ELEMENTS OF HYDROTHERAPY FOR NURSES

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BY

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PREFACE TO SECOND EDITION

THE technique of the Flowing Bath and the Oxygen Bath has been added to the third part of the book. A few other alterations have been made in order to conform to general usage. For helpfulness in making these changes the author desires to thank the publishers.

The urgent need of a nurses' text-book on hydrotherapy has induced the author to attempt to meet this need. The writer has endeavored to cover the subject in only an elementary way. The principles and curative effects are discussed in such simplified language as to be readily comprehended by the average nurse. In the arrangement of the text-matter the same general plan has been followed as in the author's work "Hydrotherapy for Students and Practitioners." Details and data regarding the experimental basis and the physiologic and therapeutic effects of hydrotherapy are given in this larger work, to which are referred teachers and others desiring more complete knowledge of the subject.

The writer desires to acknowledge with thanks the help received from Drs. G. H. Heald and W. A. George in their criticism of the manuscript, and wishes to express his appreciation of the encouragement given by many others.

G. K. A.

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PART I

Physiologic Effects

CHAPTER I

The Physical Properties of Water

TO apply intelligently any curative agent it is necessary to obtain an understanding of the agent itself, its properties and usual behavior. To utilize most effectively an engine for work, its working capacity must be understood, and one must know how to control this power so as to use more or less of it, and apply it to different kinds of work as desired. The chief properties of water which are used to affect beneficially the body and aid in the recovery from disease are the following: —

1. *The ability of water to communicate and absorb large quantities of heat by contact.*
   a. Specific heat.
   b. Latent heat.

2. *The intensity of temperature impressions obtained by the use of water.*

3. *The perfect fluidity of water, rendering it efficient in applying mechanical stimuli.*

4. *Its properties as a solvent and its use in nutritive changes.*

1. COMMUNICATION AND ABSORPTION OF HEAT.— Some one has called the science of the use of water in disease hydro-thermo-therapy (hydro — water, thermo — heat, therapy — cure). This name was given because it is recognized that it is principally the *heat* or *cold* of the water which produces the results when it is applied to the body. One should therefore understand that water has great heat-conveying properties, and consequently must be used in accordance with definite principles if definite results are to be obtained from it.

HEAT MEASURES — DEGREES

The intensity of heat is measured in *degrees* by a thermometer (heat measure). All are familiar with the ordinary Fahrenheit thermometer. The freezing-point is marked as 32° above the starting-place, or *zero*, and the *boiling-point* is marked 212°. These are the freezing- and boiling-points of pure distilled water at sea-level. Although the Fahrenheit thermometer is most used in this country, and so seems simple to us, it is, in reality, more complicated than the centigrade thermometer, first used in France and now used in scientific work in nearly all countries. On this thermometer the freezing-point of water is marked 0° (zero), while the boiling-point is 100°.

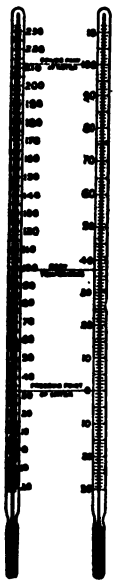


FIG. 1
Comparative Thermometer Scales.

By placing the two thermometers side by side (Fig. 1) it will be seen that the difference lies in the method of marking the scale. In the centigrade thermometer the freezing-point is marked 0°, and so becomes the starting-point of the scale. In the Fahrenheit thermometer this zero is 32° below freezing, so that the points called zero in the two scales do not correspond. There are 100° between the freezing- and boiling-points of the centigrade scale, while in the same interval on the Fahrenheit scale there are 180° (212–32). This reveals the fact that the degrees on the two thermometers are not of the same size. Those of the Fahrenheit being smaller (5-9 of a centigrade degree), there are more in the same interval.

Equivalent Readings.— To change a given reading on the centigrade scale to Fahrenheit, it is necessary to multiply by 9-5 (180-100). This gives the number of

Fahrenheit degrees above the freezing-point. Since this point on the Fahrenheit scale is 32° above zero, 32 should be added to the result to obtain the correct Fahrenheit reading. For example, find the Fahrenheit reading which corresponds to 35° C. Multiplying 35° by 9-5 gives 63° above freezing; adding 32° gives 95° F.

To obtain the correct centigrade reading of a given Fahrenheit temperature, it is only necessary to reverse the process. Take, for example, 98.6° F., the normal body temperature taken by mouth. This is 66.6° (98.6 – 32) above freezing. 66.6° multiplied by 5-9 equals 37° C. Since 0° C. is the freezing-point, this is correct centigrade reading.

Condensed Rules.— To change centigrade to Fahrenheit, multiply by 9-5, and add 32.

To change Fahrenheit to centigrade, subtract 32, and multiply by 5-9.

HEAT MEASURES — CALORIES

a. Specific Heat.— If one were to measure the depth of water in a tub and in a pail, it might be found the same in both. This does not, however, mean that there would be the same amount of water in each. The tub would contain more, and yet the water be of the same depth. This illustration may serve to make plain how a pound of water can store many times the *amount* of heat stored by a pound of any other substance, and yet the two substances — for example, water and mercury — be of the same temperature, or intensity of heat (depth in the above illustration). If a centigrade thermometer were placed in each and they should both register 1° C., the water would in cooling to 0° C give off thirty times as much heat as the same weight of mercury in cooling to 0° C. If the water should give up part of its heat to the mercury, so that its temperature (that of the water) sinks to

0° C., the temperature of the mercury would rise 30°; i. e., to 31° C. On the contrary, if the mercury should give up part of its heat, so that its temperature is reduced to 0° C., the temperature of the water would be caused to rise only 1-30 of a degree centigrade. Water, therefore, has a capacity for absorbing and storing a great amount of heat, but these large quantities of heat which it may give off or take on do not greatly change its temperature (intensity of heat).

The heat-absorbing capacity of substances is called specific heat. Water, therefore, has a high specific heat. For this reason it is taken as the standard, and the amount of heat a gram * of water absorbs or gives off in changing its temperature 1° C., is taken as the standard of thermic capacity, or specific heat, and is called a calorie. This is the small calorie, or heat unit. The large calorie is a thousand times as large, and is the amount of heat a kilogram (1,000 grams) of water absorbs or gives off in changing its temperature 1° C.

It will be seen from the preceding discussion that a large amount of heat is stored in hot water. It is this high specific heat of water that makes it especially valuable in applying heat to the body. A pound of hot water would communicate thirty times as much heat to the body as a pound of mercury at the same temperature. And conversely, a pound of cold water would take from the body thirty times as much heat as a pound of mercury; the temperature of the water or mercury in each case being changed only 1°. The hot water not only stores up a great amount of heat, but it communicates this very readily to things with which it comes in contact. Conversely, cold water very readily absorbs heat from contact with other

* A gram is the weight of a cube of water about two fifths of an inch on a side.

bodies; hence, if applied to the human body, it very quickly cools the skin, adjacent tissues, and their blood current.

b. Latent Heat.— As interesting as it may seem that water in lowering its temperature 1° C. gives off so much heat, it is more interesting to learn that water in freezing gives off nearly eighty times as much heat as in cooling 1° *before* the freezing-point. This large amount is given off without the slightest change in its temperature. If a thermometer is placed in water as it is freezing, and another on the ice after it is formed, both will register exactly the same; viz., 0° C.

One gram of ice in melting (with no change of temperature) absorbs enough heat to raise a gram of water from 0° C. to 79.2° C. Since the change of 1° in the temperature of one gram of water requires one calorie, or heat unit, raising the temperature 79.2° C. requires 79.2 calories. This number of heat units is taken on with the melting of every gram of ice, and given off with the freezing of every gram of water, and yet no change in temperature occurs. This heat that does not appear by testing with the thermometer is called hidden, or latent heat. The latent heat of the freezing of water is therefore said to be 79.2 calories.

In the boiling of one gram of water, a much greater amount of heat is made latent. The latent heat of boiling has been found to be 537 calories. When steam condenses, it gives off this heat. In this phenomenon lies the explanation of the fact that a Russian bath gives an intense heating effect. Much of the steam condenses, the water particles remaining suspended as a thick fog. The intensity of burns produced by steam is readily understood when it is kept in mind that 537 times as much heat is given off when one gram of steam condenses on the skin as when one gram of water loses 1° in temperature.

The marked cooling of the body by the ice rub and

the evaporating wet sheet pack, is due in the one case to the heat absorbed from the body by the melting of the ice, and in the other by the evaporation of the water.

The great value of water as a curative agent lies principally in its exceedingly high specific and latent heat coefficients.

2. THERMIC IMPRESSIONS.— In order for water or any other substance to communicate heat to another body, it must for some time remain in contact with that body. This long contact is not necessary to produce *impressions* of heat or cold. These are perceived instantly whenever a substance whose temperature differs from that of the skin comes in contact with it. It is not by the transfer of any large amount of heat, but because the nerves are stimulated, that sensations of heat or cold are produced. Sensations of heat arise when the substance in contact with the body has a temperature higher than that of the skin, and a sensation of cold results when the temperature of the substance is lower than that of the skin. The temperature of the skin, then, is the starting-point, or zero, of the temperature sense. This zero changes according to changes in the temperature of the surface of the body. The intensity of thermic impressions depends upon the number of degrees of *difference* between the temperature of the skin and the temperature of the water applied, rather than upon the *amount* of heat that may be transferred.

It is, of course, because water stores so much heat and gives it off so readily that it seems hotter or colder than other substances. For example, the temperature-conducting capacity of water is twenty-seven times that of air. This may be readily appreciated by stepping from an atmosphere of 75° F. into a tub of water at the same temperature. In applying water for the purpose of producing impressions of heat or cold the

temperature of the water can be easily and accurately governed. This makes water the most valuable means of applying thermic stimuli to the body.

3. MECHANICAL STIMULI.— In the cold mitten friction, the impression of cold is combined with the mechanical stimulus of friction. Both acting together produce a much greater effect than either alone. The same is true of douches and sprays. The percussion of the streams of water adds greatly to the effects produced by the heat or cold. It is because of the perfect fluidity of water that it so readily lends itself to combination with the mechanical stimuli of friction and percussion.

4. SOLVENT AND NUTRITIVE PROPERTIES.— As a solvent water is used in the shampoo, enema, etc. The beneficial results of free water-drinking are largely due to the dissolving and washing out of excreta and poisons from the system. In the physical processes of osmosis and dialysis, water is used as a solvent for various saline substances. These processes come into play in hypodermoclysis and the saline enema, as they are factors in the absorption of fluids.

In order that blood pressure may be maintained at a normal height, it is necessary that the body have plenty of fluid. Many of the waste products of the body are very sparingly soluble in water, and hence require a great deal of water to dissolve them, that they may be excreted. Some of these slightly soluble wastes are very poisonous, and cause no little disturbance when they accumulate in the body. Free water-drinking is, therefore, very necessary. Within a comparatively limited range of temperature, water exists in all three states of matter; *viz.*, solid, liquid, and gaseous. For this reason it is possible to utilize it in treatment in all these states. Unlike drugs or special appliances, water is freely accessible to all mankind, and so fills a place of wide applicability.

QUESTIONS FOR REVIEW

1. Name the four properties of water most useful in the treatment of disease.
2. What is the difference between the communicating of heat and the producing of temperature impressions?
3. What is the difference between heat degrees and heat units?
4. What is meant by heat capacity?
5. How is heat capacity measured?
6. What is the difference between specific heat and latent heat?
7. Name three different treatments in which latent heat is concerned, and explain how it is involved in each.
8. What property of water makes its application easily combined with mechanical stimuli?
9. What name is applied to water in each of the three states of matter?

CHAPTER II

Intrinsic and Reactionary Effects

WHEN the body has long remained in contact with cold substances, such as cold air and cold water, the real effects of the cold are seen. If the body becomes thoroughly chilled, its various functions are slowed or depressed. The respiration and pulse are less rapid. The circulation is slower, tactile sensation is blunted, the muscles move sluggishly and clumsily. Digestion is retarded or arrested, and after a time the temperature of the body is lowered. These are the *intrinsic* effects of cold; i. e., the effects of the *cold itself.*

While cold depresses, moderate heat stimulates life processes. For example: the warmth of the sunshine quickens the circulation, pulse-rate, and respiration. Digestion proceeds more rapidly. The muscles are quick and active. Sensations from the skin are more quickly perceived and more accurate. These results are due to the intrinsic effects of heat.

If, instead of becoming chilled, the body remains in contact with cold water or cold air for only a brief time, its activities are heightened instead of slowed or depressed. The *thermic impressions* are here the important factor, and not the transfer of heat. The body recognizes cold as a depressing agent, and so endeavors to counteract or overbalance this anticipated depressant action by increasing the vigor of the vital processes. The heart beats more rapidly and forcibly; the circulation is whipped up; the nerves tingle as with new life; respiration becomes at first rapid, then slower and deeper. The muscles are energized and have new power for work. In bringing about these changes the body is said to *react*, and this

series of alterations in body function constitutes what is known as the *reaction*. This reaction is always the opposite of the *intrinsic* effect. It may be said to be the action of the body against the agent.

We have seen that the intrinsic effect of heat is that of a stimulant. This effect is seen only when the heat is moderate, or of comparatively brief duration. If the heat is excessive, and especially if long continued, depression results. A feeling of languor and weakness is noticed. The muscles are actually less able to work. Less is accomplished. While the heart beats rapidly, its force is lessened, and the peripheral circulation may be considerably slowed. The *reaction to heat* is therefore recognized as *depressing*.

The accompanying diagram (Fig. 2) illustrates the

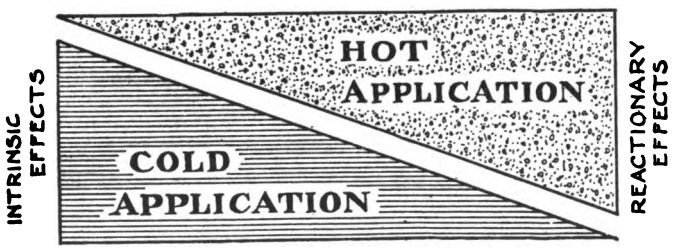


FIG. 2

Diagram illustrating the time factor in the obtaining of intrinsic and reactionary effects.

relation existing between the duration of the application and the obtaining of intrinsic and reactionary effects. The thick ends of the wedges indicate prolonged applications; the thin ends, brief applications. Intrinsic effects are shown at the left and reactions at the right. Intrinsic effects are produced by brief applications of heat or prolonged applications of cold. The reaction is most pronounced when produced by long hot applications or short cold applications.

Tonic and stimulating effects are obtained from the—

a. Intrinsic effects of heat (short).
b. Reactionary effects of cold (short).

Depressant effects are obtained from the —

a. Reactionary effects of heat (long).
b. Intrinsic effects of cold (long).

DEFINITIONS. — *a. An intrinsic effect is the result of the action of the agent itself.*

b. Reaction is made up of a series of vital changes, set in motion by the body in order to counteract or overbalance the intrinsic effect of an external agent.

Many of the most interesting and beneficial results of hydrotherapy are due to reaction. It is this arousing of the body to aid in its own recuperation and healing that characterizes natural or physiological therapy. Not so with drug-giving. Drugs are nearly always poisonous in nature, and so do not usually produce a heightening of *normal* activities, or bring about *normal* rest, but on the contrary they cause a perversion of function. The after-effect of such perverted, abnormally stimulated or repressed activities results in harm to the organism. This is especially true when the drug is given repeatedly. On the other hand, the tonic or sedative effect of natural means leaves no bad after-effect.

PHASES OF REACTION

Since the reaction consists of a series or group of changes in various functions, it must consist of several different phases. So we speak of a *thermic reaction, a circulatory reaction, and a nervous reaction.* These are but different manifestations of the one general attitude of the body toward a disturbing agent. For example, the *reaction to cold* * causes the body to produce more heat — *thermic reaction.* The skin becomes

* The term reaction unless otherwise specified refers to the reactionary effect of cold.

reddened with an increase of blood — *circulatory reaction.* The nerves tingle with new life, and there is a feeling of renewed energy for work — *nervous reaction.*

The change most apparent to the nurse is the circulatory phase of the reaction. This is the part from which she may judge of all other phases and of the completeness of the entire process of reaction.

TYPES AND DEGREES OF REACTION

In case of an *incomplete reaction*, there may be duskiness of the skin, goose-flesh, chilliness or shivering, cold feet or hands, a feeling of fulness in the head or of faintness. These are due to the internal congestion which has not been relieved or has been increased by the failure of the treatment to produce a vigorous surface circulation. These conditions should be combated immediately on their appearance, by methods pointed out below.

Sometimes it is *desirable* to *suppress the reaction.* This is often designed in the case of local applications of intense cold, such as the ice-bag. Where a function is overactive because of disease, it may be suppressed to a certain and definite limit by the prolonged use of the ice-bag, ice-cap, or cold compress frequently renewed. In this case, the usual changes produced by reaction do not appear, because the cold has been so long continued that the *intrinsic effect predominates.*

If it is desired to suppress or prevent the reaction which follows the *removal* of a prolonged cold application, a brief application of heat may be given immediately after the cold.

Repeated reactions are often beneficial where it is necessary to secure a maximum effect. This occurs with all alternating hot and cold applications. After two or three changes each succeeding reaction is less complete than the preceding, because of fatigue of the reactive powers. In order to maintain or increase

the height of reaction, the later applications must be more intense or mechanical stimuli added, such as friction or percussion.

CONDITIONS THAT INFLUENCE REACTION

AGE AND VITALITY OF PATIENT.— In the extremes of life the ability to react is quite limited. Neither infants nor aged persons bear cold treatment well. We have treated persons in advanced life who were utterly unable to react to even cool water as applied by the wet hand rub, and who invariably chilled after a cold mitten friction.

In certain diseases or states the vitality is so reduced as to render reaction extremely difficult. This is true of nearly all those diseases which produce a profound asthenia. In anemia and emaciation, the same conditions prevail. In all such cases it is necessary to thoroughly warm the body previous to the cold application, and give vigorous friction during and following the treatment. Even these means will not always insure a reaction.

EXERCISE, sufficient to warm the body, promotes reaction. This is true whether taken before or after the treatment. It quickens the circulation and brings the blood to the surface. Body heat is increased, so that the surface blood-vessels become dilated in order to increase heat elimination. Fatigue is not conducive to completeness of reaction. In case it is necessary to treat persons who are fatigued, a short hot application should be given first, quickly followed by some short but vigorous cold treatment, accompanied by friction or percussion. In case of extreme exhaustion no cold treatment at all should be given, as the reactive powers have already been taxed to their utmost.

WARMTH OF BODY.— When the body is warm, reaction appears promptly. The internal heat of the body may be ever so much, and yet reaction be impossible, if the skin is cold and clammy, pale, cyanotic, or goose-flesh in appearance. The skin should be warm, and if possible ruddy, before cold applications are used. In case it is not, some sort of hot treatment should be used first, in order to draw the blood to the skin. The air of the room in which the patient is treated should be warm, and he should remain in a warm room after treatment until reaction is complete. It may be necessary to give a hot drink in order to warm the body. More essential than all these is the warmth of the feet. It is impossible to secure full reaction or the best possible results if the feet are cold. It should therefore be a general rule that if the feet are cold, they should be warmed by a hot foot-bath or alternate hot and cold foot-bath or hot foot-pack previous to any and all treatment. In the giving of even an enema, this is necessary. After treatment, it may be necessary to provide the patient with additional covering, either in the line of bedding or clothing, in order to secure full reaction.

CHARACTER OF TREATMENT AND MODE OF APPLICATION.— In all cases where reaction is likely to be tardy, the cold treatment should be preceded by a hot treatment. In ordinary cases the hot application should exceed in duration the cold application. It should thoroughly warm the body and make the cold a welcome change. The reaction is more prompt in its appearance if extreme cold is used and accompanied by friction or percussion. The colder the water, the greater the reaction. The cold treatment should be given quickly. The treating of one part at a time favors the quick appearance of the reaction. The larger an application or the more general the surface treated, the less promptly will the reaction appear.

Friction with the dry hand or a rough towel following the drying enhances the reaction. Percussion has the same effect. The drying from sprays and general applications of water should be done as quickly and as thoroughly as possible. If moisture is left on the surface, the resulting evaporation cools the body, and reaction is delayed and less complete. The patient should be dried in a warm room near the place where the last application of water was made. To properly shape circumstances so as to favor reaction, requires much care and forethought on the part of the attendant or nurse. A little carelessness may undo much or all of the benefit which should accrue from a given treatment.

COMMON NAMES OF TEMPERATURE

Heat and cold are comparative, not absolute terms, and must needs be defined. This can not be done with accuracy, since people differ in their toleration of heat and cold. What one calls very cold may seem only cool to another. We have therefore defined the usual limits in terms of degrees as follows: —

Very hot	104° F.	and	above
Hot	100°	to	104° F.
Warm (neutral 94° to 97°)	92°	to	100° F.
Tepid	80°	to	92° F.
Cool	70°	to	80° F.
Cold	55°	to	70° F.
Very cold	32°	to	55° F.

QUESTIONS FOR REVIEW

1. What is an intrinsic effect?
2. Why does it require a comparatively long time for cold to produce its intrinsic effects?
3. What are the intrinsic effects of heat?

4. What is the *nature* of the intrinsic effects of cold? of heat?

5. Explain why and how cold causes a reaction.

6. Is it the activity of the body or the agent that is most manifest in an intrinsic effect? in a reaction?

7. What is characteristic of the manner in which natural therapy acts in healing?

8. Name the three most important phases of reaction.

9. Explain and illustrate incomplete reaction, suppressed reaction, and repeated reaction.

10. What precautions and care would you take in order to secure a good reaction?

CHAPTER III

The Office of the Skin in Hydrotherapy

THROUGH the blood-vessels and nerves of the skin and the connections they make with the nerves and blood-vessels of the internal organs, practically every part of the body may be influenced by applications to the skin surface, and by far the greater number of hydriatic applications are made to the skin surface.

The skin itself is composed of two layers. The outer, or epidermis, is designed chiefly as a protection to the delicate and sensitive structures underneath. The inner layer, dermis, or true skin, is made up of a network of connective tissue fibers containing the nerves, blood-vessels, glands, and hair-follicles. The surface of the true skin, where it lies in contact with the epidermis, is not level, but thrown into ridges made up of many knob-like projections, called papillæ. Some of these papillæ contain nerves, others contain blood-vessels.

The connective tissue of the dermis is of two kinds; viz., white fibrous and yellow elastic tissue. There are also many small muscle bundles found in the true skin. These are principally in connection with the hair-follicles. The muscles that are attached to the hairs are called *arrectores pilorum*. They consist of smooth muscle fibers, and are involuntary. The elastic tissue serves as tendons for these muscular bundles, so that when the muscle fibers contract, the elastic tissue is stretched and tense. When the muscles relax, the elastic tissue assumes its usual state of pliability.

Contractions of the hair muscles cause the hairs to stand erect, producing little elevations of the skin about each, giving rise to what is known as goose-flesh. This

condition may be brought about by cold applications or chilliness. Even extremely hot applications may cause goose-flesh. When these hair muscles contract, the skin becomes blanched. This is due to the squeezing of the blood out of the blood-vessels by the contraction of the many involuntary muscles found in the skin. The capillary blood-vessels do not possess a muscular coat, so these muscles of the skin help to perform the work for the capillaries that the muscular coat performs in the larger blood-vessels. The venules of the skin are much wider and are capable of holding much more blood than the arterioles.

The skin contains also an enormous network of lymphatic vessels, mostly capillary lymphatics. The large lymphatic vessels, or collecting trunks, have a muscular coat the same as the blood-vessels, and contain valves similar to those found in the veins.

While contraction of the blood-vessels is due chiefly to the muscular coat, yet the capillaries, which possess no muscle coat, are capable of altering their size. The endothelium, a single layer of flat cells, is the only wall they have. These cells may be observed to contract or expand. This can be seen in the thin edge of the web of a frog's foot, or in the mesentery of the intestine. The same is true of the lymphatic capillaries. Nerve-fibers are distributed to these cells as well as to the muscular coat of the larger vessels, so that all, whether large or small, blood- or lymph-vessels, are under the control of the nervous system. These nerves are known as vasomotor nerves, and are chiefly non-medulated sympathetic fibers.

THE PERIPHERAL HEART

During health the blood-vessels of the body are not of a constant unvarying size. They are in a state of continual change. They become larger — dilate; then smaller — contract. These alternate changes occur

about once every minute. As contraction occurs, the blood is forced onward. When dilatation takes place, they again fill with blood, which is sent onward by the next contraction. This *pumping action* of the blood-vessels is so powerful and is such an important factor in the circulation that the smaller vessels, as a system, have been called the *peripheral heart*, or *skin heart.* (Fig. 3.)

If the nervous control of the blood-vessels is interfered with, i. e., the vasomotor nerves are paralyzed, the blood-vessels dilate and remain dilated. This causes them to be overdistended with blood, which has only

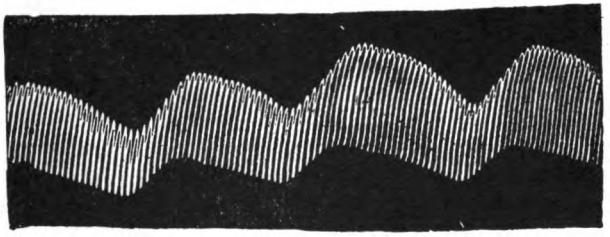


FIG. 3

Blood-pressure tracing showing pulse wave and wave due to the action of the "peripheral heart." The pulse wave is shown by the up and down strokes. The long undulations are due to the alternate dilatation and contraction of the blood-vessel itself.

the force of the heart-beat to push it along. The slower circulation which results causes the part to become dusky in color, and cold. This is what occurs in paralysis such as follows apoplexy. Somewhat the same condition, viz., a weakness or paresis of the blood-vessels, is found in neurasthenia, dyspepsia, infectious diseases, and fevers. The failure of the blood-vessels to perform their part of the work of the circulation, throws an added burden on the heart. For this reason, the heart works under much stress and at a disadvantage, but may not itself be at fault. Many cases of so-called

heart-failure are in reality failure of the vasomotor mechanism, and not primarily of the heart.

There are many ways in which the work done by the peripheral heart may be increased in efficiency or restored to normal when deranged. All sorts of applications to the skin excite contractions in the blood-vessels so that the usual rhythmic changes in size occur more rapidly or are greater in extent. Each kind of application, however, is conducive to different degrees of contraction or dilatation, and so to different end results. It is these changes occurring in the blood-vessels which constitute *ci culatory reaction.*

When cold water is applied to the skin for a brief space of time, and especially when accompanied by friction, the skin becomes reddened with an increase of bright-red blood. This is due to the vigorous pumping action of the blood- vessels. The circulation being hastened, the venous blood is rapidly replaced by fresh arterial blood. The cold and friction, through the vasomotor nerves, stimulate the blood-vessels to more rapid and extreme dilatation and contraction. This condition of the blood- vessels is known as *active dilatation*, and the resultant change in the vascularity of the part as *active or arterial hyperemia*, because arterial or freshly oxygenated blood predominates.

Hot applications produce results differing essentially from the above conditions. At first the changes appear to be much the same, since the blood-vessels are excited to greater activity. But as the hot application is prolonged, the blood-vessels tend to remain dilated, and the pumping action is lessened; whereas with the cold the blood-vessels were excited to dilate and contract vigorously. With heat, the dilatations become greater and the contractions less and less as the application is prolonged. The blood accumulates in the dilated capillaries and veins. This results first in a redness of the skin, but later in a duskiness, because the circulation is

slowed instead of hastened, venous blood predominating. The relaxed condition of the blood-vessels is known as *atonic or passive dilatation*, and the stasis of blood which results as *passive hyperemia*. When the cold application is intense, such as an ice-bag, and prolonged, a condition results which is the opposite of that produced by prolonged heat. The blood-vessels are at first stimulated to alternate dilatation and contraction, but the dilatations become less and less while the contractions increase in vigor until a state of constant vasoconstriction results, the blood-vessels being very small in size and the skin blanched from absence of blood. In this condition the reaction is *suppressed* by the prolonged and intense cold of the ice.

When the body is immersed in a bath of cool salt-water charged with carbon dioxid gas, the blood-vessels are very powerfully stimulated. Such a bath as this is known as an artificial Nauheim or effervescent bath. A defective heart, beating rapidly and working under adverse circumstances, may be so effectively assisted that its rate will decrease ten to twenty-five beats a minute, and it assume an easy, steady movement. The change for the better is often astonishing, and needs to be seen to be appreciated. One may gain something of an insight into how such a marvelous result may be brought about when it is understood that the combined cross section of the capillaries is eight hundred times that of the aorta.

Ordinarily the lymph flow from a limb is dependent upon the *movements* of that limb, whether these be brought about by active exercise or by passive movements, such as massage. This fact reveals how necessary it is that the body have exercise in order to maintain the activity of the lymphatic circulation, and the necessity of giving passive exercise by means of massage, etc., where the patient is unable to exercise for himself.

The changes in the circulation caused by heat, cold,

massage, etc., do not produce results of small account. About one thirteenth of the body weight is blood and about one fourth or one third is lymph. Almost this entire quantity of fluid is acted upon when an application of any considerable extent is made. The results may be seen all over the body as well as in the part treated, and not alone in one activity or function but in many.

THE SWEAT-GLANDS

The sweat-glands are found throughout the entire skin, and are especially numerous in the axilla, palms, and soles. The total surface of their ducts is estimated at eleven thousand square feet. Since so large a secreting surface is devoted to one single function, this function must be of considerable importance, and its derangement by unhygienic habits or surroundings a great cause of disorder in all other bodily functions.

The secretion of the sweat-glands is about ninety-eight per cent water.

The total amount of water excreted by the skin is approximately double that given off from the lungs. In health the perspiration contains very little of a poisonous nature. In disease, however, and especially where the excretory function of the kidneys is deficient, the sweat may be highly poisonous and contain some of the substances usually excreted by the kidneys. For ages it has been believed that free perspiration is beneficial in kidney disease. It has recently been definitely proved that the sweat-glands also become diseased when disease of the kidneys is of long standing.

There are many factors which influence the activity of the sweat-glands. Some of these are used for the purpose of increasing their activity, others are used to lessen perspiration when it is excessive. To insure free perspiration with an electric-light bath, it is well to give the patient water to drink before and during the

treatment. Hot drinks are very helpful and sometimes absolutely necessary in order to secure free perspiration in hot packs, vapor-baths, etc.

The use of the cold mitten friction or vinegar and salt rub followed by a talcum rub are very serviceable in checking excessive perspiration in tuberculosis, surgical shock, etc. The following are some of the conditions and measures which influence the activity of the sweat-glands: —

Measures and conditions that increase perspiration: —

1. Application of heat, as hot air, hot water, steam, light, etc.
2. Water-drinking, especially of hot water.
3. Exercise.
4. Mechanical irritation, as friction or percussion.
5. Diaphoretic drugs.

Measures and conditions that decrease perspiration: —

1. Cold applications, or chilling.
2. Excretion of large amounts of water by the kidneys or bowels.
3. Certain drugs, as atropin.
4. Local application of astringents or cooling preparations, as alcohol, vinegar, talcum powder, etc.

HEAT REGULATION BY THE SKIN

Intimately connected with the functions of the perspiratory glands, is the action of the skin in regulating the heat of the body. Body heat is controlled by heat production and heat loss, and is maintained at a constant point by a proper balance between the two. Through nerve connection the impressions made upon the skin influence the production of heat by the muscles and internal organs. The skin itself, however, takes part in heat loss only. From 70 per cent to 80 per cent of the total amount of heat lost from the body is given off from the skin. This loss occurs in two ways; viz., by the evaporation of perspiration or other moisture

from the surface and by the direct radiation of heat. When the skin is heated by a hot application, the blood-vessels are dilated and the skin congested, so that more blood being brought to the surface the body is cooled more rapidly. The hot application also increases perspiration, and its evaporation adds greatly to the loss of heat.

Opposite conditions are produced by cold air or cold water when applied to the skin. The blood-vessels are contracted and perspiration checked, both changes lessening the amount of heat lost from the surface.

The powerful influence of the cutaneous nerves in regulating heat production is seen in cases where the skin nerves are destroyed or paralyzed, as in extensive burns and drunkenness. In either case heat production is decreased, and the body unaided becomes unable to control heat loss from the skin, so that a serious result may follow.

There are three sets of nerves terminating in the skin which are of special importance in hydrotherapy. These have already been mentioned; viz., the *secretory*, *vasomotor*, and *temperature* nerves.

The secretory nerves control the activity of the sweat-glands. The vasomotor nerves govern the size and activity of the blood-vessels. The temperature nerves serve to make the connection between the skin and the internal organs and other structures through which applications to the surface reflexly influence the activity of these organs, their *blood-vessels*, *glandular activity*, and heat production. These relations reveal the aptness of the saying that the skin is the keyboard of hydrotherapy.

QUESTIONS FOR REVIEW

1. Explain the causes, how produced, and results of goose-flesh.

2. Are all blood-vessels and lymphatic vessels contractile? Which coats of the wall are capable of contraction?

3. Explain what is meant by the peripheral heart. By what is it controlled?

4. When the blood-vessels are paralyzed or weak, why does it appear that the heart is weak?

5. What is the effect of cold friction on the peripheral heart? What is the name of the condition produced, and why so called?

6. What is the effect of prolonged heat on the blood-vessels?

7. In what respect is the excretory function of the sweat-glands vicarious?

8. How would you explain the production of the cold, clammy sweat of shock? How may it be checked?

9. Explain how hot applications increase loss of heat from the skin.

10. Name the three principal sets of cutaneous nerves, and give the uses of each.

CHAPTER IV

The Circulation — Reflex Effects

DURING health the nerves exercise a continual control over the activity of the various organs and structures of the body, so that their functions are performed in a normal manner. It is possible so to stimulate these nerves as to increase the activity of a function. On the other hand, by cutting off the nerve supply, or depressing the nerves, the activity of an organ may be decreased. This is especially manifest in the blood-vessels, since changes in their size and action are very apparent. One experimenter found that ice applied to a nerve-trunk caused the blood-vessels of the pia mater of the brain to contract. Ice applied to a small skin area of the head or face, causes the same result, while warm water produces opposite conditions; viz., dilatation of the blood-vessels.

While strong stimulation of any nerve in the body may cause changes in all, or nearly all, the blood-vessels of the body, yet these changes in size are most pronounced in certain parts which have the most perfect nerve connection with the part stimulated. For example, an ice-bag applied over the stomach may cause a brief change in the size of the blood-vessels of the brain, but the pronounced and lasting changes are in the blood-vessels of the stomach. We may therefore say that for each internal organ there is one area which, when stimulated, causes the greatest change in the blood-vessels of that organ. In all, or nearly all, instances, this area of most direct nerve connection, and through which a maximum effect is obtained, is the skin surface over that organ.

The nerve impulses which influence the internal organs, are carried over definite nerve-paths. Beginning with

the skin, the stimulation produced by heat, cold, electricity, or mechanical means is conveyed to the spinal cord by sensory nerves; i. e., nerves of touch. In the spinal cord, the impulse is conveyed upward or downward to various levels by these sensory nerves, whose ends touch cells in the spinal cord which start other impulses over outgoing nerves. The impulses which are destined to influence an internal organ, pass over nerves which enter the chain of sympathetic ganglia, and so pass with the sympathetic nerves to the internal organs. These efferent (outgoing) sympathetic nerves are connected not only with the blood-vessels of the internal organs, but also with their muscles and glands. Because of these connections, every function of the body may be stimulated or depressed by influences arising in the skin. When an application to the skin affects a part through nerve connection, it is said to produce a *reflex effect. A reflex effect is, then, an indirect effect produced through nerve connection.*

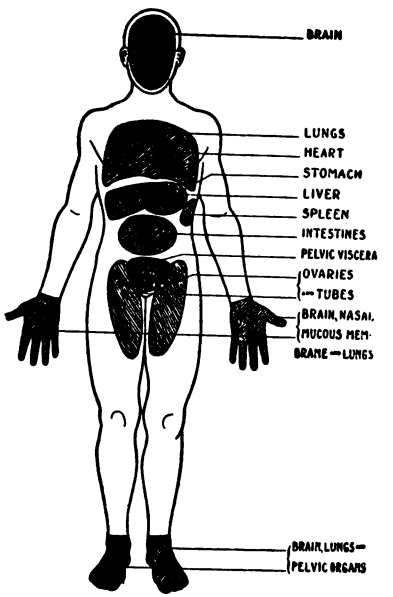


FIG. 4
Anterior Reflex Areas.

REFLEX AREAS

The following are the more important reflex areas employed in hydrotherapy (Fig. 4): —

1. The skin areas of the face, scalp, and back of the neck are reflexly related with the brain.

2. The skin of the neck is reflexly related with the pharynx and larynx.

3. The back of the neck is reflexly related with the mucous membrane of the nose.

4. The skin of the chest (front, back, and sides), dorsal region, and shoulders has reflex relations with the lungs.

5. The precordia is in very perfect reflex relation with the heart through its accelerator nerves (sympathetic).

6. The hands are reflexly related with the brain and nasal mucous membrane.

7. The skin over the lower right chest, with the liver.

8. The skin over the lower left chest, with the spleen.

9. The skin over the lower third of the sternum, with the kidneys.

10. The mid-dorsal spine (from the fifth to the seventh vertebra) is related with the stomach.

11. Lower dorsal and lumbar spine, with the kidneys and intestines.

12. The lower lumbar and sacral spine, with the pelvic organs,— uterus, ovaries, bladder, and rectum.

13. The epigastrium, with the stomach.

14. The skin of the entire abdomen, especially that of the umbilical region, is reflexly related with the intestines. The fact that the pain of colic, appendicitis, etc., is referred to the region of the umbilicus, is an evidence of a similar nervous connection.

15. The lower abdomen, including the groin, and the upper inner surfaces of the thighs, are reflexly related with the pelvic organs.

16. The skin of the feet and legs is reflexly related with the brain, lungs, and pelvic organs.

17. The breasts are reflexly related with the pelvic organs.

CLASSES OF EFFECTS

There are two general classes of effects produced by hydriatic and mechanical applications; viz., (1) stimulating and tonic, and (2) depressant and sedative. Stimulant and tonic effects are both due to an *increase* of vital activity. They are the same in *kind*, but differ in *degree*. A stimulant effect is greater than a tonic effect. The degree or intensity of the effect will be greater or less according to the intensity of the application. A very brief intense application stimulates, while one less intense and of longer duration may produce tonic effects. On the other hand, depressant and sedative effects are both due to a *decrease* of activity, but they also differ as to the extent of the decrease.

Whatever the degree of the reflex effect may be, it is in kind the same as the direct effect on the skin area treated. For example, a long continuous application of cold decreases the vital activities of the surface treated and the internal part in reflex relation with it. In general the four principal effects in the skin and internal organs are as follows: —

1. The blood-vessels are contracted, and remain so as long as the application is in place and for a variable length of time after.*
2. The nerve sensibility is decreased.
3. Glandular activity is decreased.
4. The muscles contract firmly.

The duration and intensity of the reflex effect depends upon the duration and intensity of the application. In healthy organs the vascular changes may not be excessively marked, but with congested or inflamed organs the changes are often astonishing.

* When an ice-bag is not well wrapped or remains too long, the reflex may be paralyzed.

SPECIAL REFLEX EFFECTS OF PROLONGED COLD

1. Cold applied over the trunk of an artery causes contraction of the artery and of its distal branches. Example: ice-bags applied over the carotid arteries decrease the blood going to the brain and head generally. Such an application is called a proximal application.

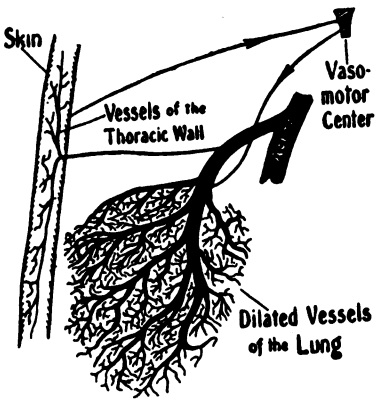


FIG. 5
Diagram showing congestion of the lungs.

2. Prolonged immersion of the hands in cold water causes contraction of the vessels of the brain and nasal mucous membrane.

3. Prolonged cold to the upper dorsal region causes contraction of the vessels of the nasal mucous membrane.

4. An ice-bag applied to the precordia slows the heart rate, increases its force, and raises arterial blood pressure.

5. An ice-bag applied over the thyroid gland (in parenchymatous goiter), decreases its vascularity and lessens its glandular activity.

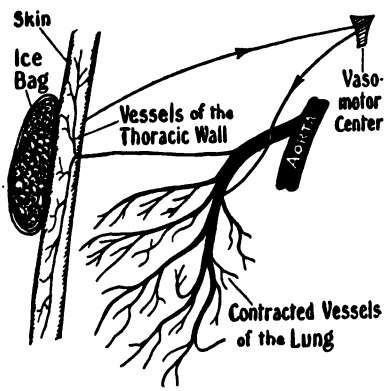


FIG. 6
Diagram showing reflex action of an ice-bag in decreasing congestion of the lungs.

6. Long cold applications to the chest, at the back, front, or sides, contract the blood-vessels of

the lungs (Figs. 5 and 6), slow respiration, and increase its depth.

7. An ice-bag to the epigastrium or mid-dorsal region causes contraction of the vessels of the stomach, and lessens gastric secretion while the application continues.

8. A long cold application to the pelvis, groin, or inner surface of the thighs, contracts the blood-vessels and muscles of the pelvic organs.

9. A long cold sitz bath causes firm contraction of the uterine muscles, thereby reducing subinvolution.

10. Long cold applications to the face, forehead, scalp, and back of the neck cause contraction of the blood-vessels of the brain.

11. An ice-bag to the lower third of the sternum or over the lower dorsal and upper lumbar region causes contraction of the blood-vessels of the kidney.

12. Ice-bags applied to the sides of the neck just below the angle of the jaw contract the blood-vessels of the pharynx.

SPECIAL REFLEX EFFECTS OF SHORT COLD

Short cold applications to a reflex area produce tonic and stimulating effects in the deep part by virtue of the reaction which soon follows: —

1. Short cold applications to the face and head stimulate mental activity.

2. A short cold application to the chest, as a cold rub, friction, or cold douche, at first increases the respiration rate. Soon it results in deeper respiration with a somewhat slowed rate.

3. A cold douche to the precordia or slapping the chest with a cold towel, increases both the heart-rate and force. After the cessation of the application, the rate decreases while the force remains increased.

4. A short very cold percussion douche to a reflex area causes active dilatation of the blood-vessels in the

related viscera,— as a short cold percussion douche to the sacrum or feet causes a dilatation of the vessels of the uterus.

5. Short cold or moderately prolonged cold applications to the breasts cause vigorous contractions of the uterus — of use in inertia uteri.

6. Short very cold applications to the abdomen, hands, or feet cause contraction of the muscles of the bladder, bowels, and uterus.

7. A short cold douche or ice-bag intermittently to the lower third of the sternum causes increased renal secretion.

8. A short very cold douche to the liver causes active dilatation of its vessels, and increases its glandular activity.

9. The reaction from a moderately prolonged cold application to the epigastrium causes increased gastric secretion.

SPECIAL REFLEX EFFECTS OF HOT APPLICATIONS

1. A very much prolonged hot application to a reflex area produces passive dilatation of the blood-vessels of the related organ.

2. Long hot applications to the precordia and to many other parts increase the heart-rate, decrease its force, and lower the blood pressure.

3. Hot, moist applications to the chest facilitate respiration and expectoration.

4. Long, moderately hot applications over the stomach after meals increase gastric secretion and hasten digestion. The same, if given before a meal, decrease gastric secretion because of the atonic reaction which ensues.

5. Prolonged hot applications to the abdomen lessen peristalsis.

6. Prolonged hot applications to the pelvis, as a fomentation, pack, or sitz bath, relax the muscles of

the bladder, rectum, and uterus, dilate their blood-vessels, and increase the menstrual flow.

7. A large hot application to the trunk, as a hot trunk pack in biliary or renal colic, relaxes the muscles of the bile-ducts, gall-bladder, or ureters, and aids in relieving the pain due to spasm of these muscles.

QUESTIONS FOR REVIEW

1. In case an application to the skin produces a contraction of the blood-vessels in the skin, what will the reflex effect be?

2. Can you think of any reason why an application to the skin area over an organ produces the most marked reflex effect in that organ?

3. What kind of nerves convey the stimulus from the skin to the spinal cord? What kind of nerves carry the reflex stimulus outward from the spinal cord to the internal organs?

4. What three tissues of the internal organs are especially influenced reflexly?

5. Name four reflex effects of prolonged cold applications.

6. Define reflex effect.

7. How would you accomplish the following results *through reflex action:* slow heart rate and increase its force; stimulate flow of gastric juice; stop hemorrhage in stomach; lessen brain congestion; stop hemorrhage from lungs; lessen intestinal peristalsis, and relieve bladder spasm?

8. What is a proximal compress? What is its effect? Illustrate.

9. Make a list of eight important internal organs, together with all the skin areas reflexly related with each.

CHAPTER V

The Circulation — Hydrostatic Effects

WHEN hot or cold applications are made to a small skin area, so that it is principally the nerves that are affected, we have seen that a reflex effect is produced. In experimenting upon trephined rabbits, it was found that pieces of ice applied to a *nerve*, caused *contraction* of the blood-vessels of the pia mater, the same as if the ice were applied directly to the membrane itself. But if a large *wet compress* of the same temperature (ice-cold) were *applied to the abdomen or back of the rabbit*, the blood-vessels of the pia mater were caused to *dilate* widely, and remain so. *Warm water* applied to a *nerve* caused the pial blood-vessels to *dilate*, while a warm compress applied to the *skin of the trunk* produced a *narrowing* of the vessels in the brain. Since these results are opposite, both can not be brought about through nerve connection.

No extended reasoning is necessary to explain these opposite results. Cold causes the blood-vessels of the skin to contract, and since the cold compress covers so large an area, a great deal of the blood will be driven into the internal organs; and the internal blood-vessels being more completely filled will dilate widely and remain dilated as long as cold is in contact with the skin.

When a warm compress or fomentation is applied over a large area, the skin vessels dilate and fill with blood, thus leaving less blood to flow to the brain. The blood-vessels in the brain are in consequence narrowed to suit the decreased amount of blood sent them. In the case of a warm bath, the vessels contract still more than with a compress, since a greater amount of blood is drawn to the skin and superficial structures.

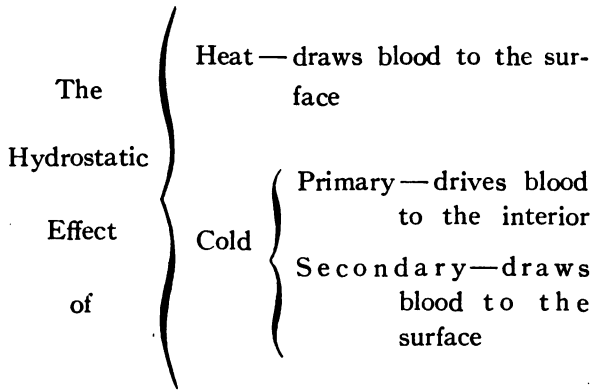
It was observed that a change took place when the cold applications were much prolonged. At first a cold compress drives the blood inward, and the blood-vessels of the pia mater dilate. After three to five minutes the vessels of the pia mater begin to contract, and finally become as narrow as with a warm compress. It will be easily surmised that after three to five minutes the cold compress "warms up," and reaction taking place, the skin becomes congested, and so less blood flows to the brain. The cold compress becomes a warm compress, and hence produces the same effect as a warm compress; viz., lessening of the blood supply to the head.

These effects are produced through the blood-vessels in a mechanical way, and not through nerve connection. The blood ebbs and flows as water would do in a system of soft rubber tubes; hence these circulatory effects are said to be hydrostatic. If the tubing of one part of the system is widened, less water will be contained in the rest of the system, and the tubes will become smaller, and vice versa.

With warm compresses the condition does not change, no matter how prolonged the application. But with cold applications a change occurs when reaction takes place, so that the second effect is the same as that of a warm application. This may be called the secondary hydrostatic effect. This secondary effect is of great importance in hydrotherapy. For example, a cold mitten friction produces a prompt reaction, bringing the blood to the surface; this lessens the blood in the internal organs, thereby reducing internal congestion.

An alternate hot and cold foot-bath or an alternate hot and cold percussion douche to the feet reduces congestion of the brain by the action of this principle. The degree of these hydrostatic effects depends upon nothing so much as the extent of surface treated, a large compress having a greater effect than a small compress, and a bath a much greater effect than either.

The accompanying outline shows the different ways in which hydrostatic effects may be produced:—



In treatments, these hydrostatic effects are used chiefly for the purposes of lessening congestions and of assisting to reduce inflammations. But if the surface of the body becomes chilled, the opposite will take place; viz., a *retrostasis*, or driving of the blood from the skin to the internal organs. Such a retrostasis is very likely to produce a congestion in some organ or increase an already existing congestion.

AREAS FOR DERIVATION

In health a warm application to the skin surface draws blood about equally from all other parts of the body, chiefly, however, from the interior. Where there are congested organs or parts, a hot application will draw proportionately more blood from the congested organ than from the other parts of the body. The decreasing of congestion is known as *depletion*, and the means of producing it as *derivation*. While large and distant areas are often used to secure derivation, yet in some cases, other areas nearer to the congested organ are more useful. The following are a few of the organs

frequently congested, together with a list of the areas used for purposes of depletion:—

1. The brain. Blood may be withdrawn from the brain by applications to the feet, legs, or the entire lower limbs; also to the spine and entire surface of the trunk.

2. Spinal cord. If spinal congestion is not extreme, large fomentations to the spine are useful; also hot applications to the feet and legs.

3. Middle ear and mastoid. Fomentations to the entire side of the head, also very hot leg-baths or hot applications to the abdomen or spine.

4. Throat and larynx. By applications to the neck, either fomentations or the heating compress.

5. Lungs. It is necessary to use applications to large areas, since the lungs may contain much blood when congested. These areas are the feet and legs, and the entire skin surface of the trunk and hips. In pleurisy it is best to use a fomentation directly over the affected area.

6. Kidneys. Where there is much congestion in the kidneys, it is necessary to use hot applications to the entire surface of the body, the head, of course, being excluded. Less intense congestion may be treated by large fomentations to the back or by the trunk-pack.

7. Liver and spleen. By hot applications to the skin surface over these organs.

8. Pelvic organs. There are two principal areas used: First, the entire skin surface of the hips and lower abdomen, as by a hot sitz bath or hot hip-pack. Second, the lower limbs, as by a hot leg-pack or leg-bath. Both areas may be treated by the hot hip- and leg-pack.

THE BALANCE IN CIRCULATORY EFFECTS

It will doubtless have occurred to the student that any thermic application to the skin must of necessity produce both a reflex and a hydrostatic effect. Since

these are opposite in nature, they must therefore conflict with each other. And although both effects are produced by the same application, one will be greater than the other and the stronger effect eventually overcome the weaker. It might seem that this conflict produces a hopeless entanglement in determining which effect will predominate, or what will in a given case be the practical result. There are definite laws which govern this balance, so that the effects may be known with certainty. These laws are as follows: The first relates to the *size of the area treated;* the second, to the *intensity of the application;* and the third, to the *location of the area.*

1. SIZE OF AREA.— (a) When an application covers a *small area*, as an ice-bag or a jet douche, the *effect is chiefly reflex*, and is concentrated upon the internal organ in reflex relation with the surface treated (Fig. 6). These applications are so small that the circulatory effect in driving blood from the skin will be slight. The resulting hydrostatic effect, therefore, being very slight and spreading out over all the rest of the body, will be of no importance.

(b) With all *large applications* the *mechanical or hydrostatic effect* soon overbalances and wipes out the reflex effect. This is true of hot leg-baths, hot packs, full tub baths, etc.

2. INTENSITY OF APPLICATION.— When small applications are of *great intensity* (very cold or very hot or with strong percussion), the tendency is also to produce a decided reflex effect with but little mechanical effect upon the blood current.

3. LOCATION OF AREA.— An application made *over the heart* always produces a *reflex effect*, no hydrostatic effect being perceptible. The same is true of an application to the head, the reflex effect nearly always being greater than the hydrostatic effect. On the contrary, applications to *the feet or legs* practically always produce

hydrostatic effects unless the applications cover a very small area. This implies that certain areas give reflex effects chiefly, while with certain other areas the mechanical effect predominates.

QUESTIONS FOR REVIEW

1. Explain hydrostatic effects. Illustrate.
2. What is the first hydrostatic effect of a cold bath? What is the secondary effect? and when will it appear?
3. What, if any, is the difference in the hydrostatic effect of a hot application and the secondary hydrostatic effect of a cold application? Is there any difference in the permanency of these effects?
4. Through what avenue are reflex effects produced? hydrostatic effects?
5. What is retrostasis? Illustrate.
6. May an application produce both a reflex and a hydrostatic effect? Illustrate.
7. How may you know which effect will predominate? What three factors enter into the governing of the balance between hydrostatic and reflex effects?
8. State these laws. Illustrate each.
9. How do you explain why an application over the heart always gives a reflex effect, while applications to the feet and legs nearly always give hydrostatic effects?

CHAPTER VI

The Circulation — Blood Pressure and Composition

BLOOD PRESSURE

IN chapter three it was pointed out that both hot applications and short cold applications cause an increase of blood in the skin. This hyperemia is, however, of a different nature in the two cases.

After hot applications, there is a venous hyperemia due to passive dilatation of the blood-vessels and slowing of the blood current. After cold applications there is an arterial hyperemia, due to active dilatation of the blood-vessels and hastening of the blood current. In the reaction to hot applications the blood-vessels lose their tone. Because of this atonic condition, the blood-vessels being dilated, there is a lowering of blood pressure and a slowing of the circulation. In the reaction to cold applications the blood-vessels retain their tone, and because of the increased pumping action, blood pressure is raised and the circulation hastened.

This maintaining of blood pressure and hastening of the circulation is of the greatest importance in the treatment of disease. The supplying of the diseased tissues with fresh arterial blood containing an abundance of oxygen and free from wastes is conducive to rapid and complete healing. Functional disturbances are often adjusted by the mere reestablishment of a perfect circulation. The proper nutrition of the tissues themselves also depends upon an active circulation.

The following are the most important laws governing the effects of thermic applications upon the blood pressure: —

1. Thermic applications, not accompanied by mechanical irritation, if given below the temperature of the skin, produce increased blood pressure with slowed pulse-rate.

2. Thermic applications above the skin temperature, after a brief rise, produce a fall in blood pressure which later rises. Hot baths above 104° F. persistently increase blood pressure and the pulse-rate.

3. Neutral baths equalize blood pressure.

COMPOSITION OF THE BLOOD

During physical inactivity, the blood-corpuscles are not evenly distributed throughout the blood of the different parts of the body. They tend to collect in greater numbers in the internal organs, especially the abdominal organs and the liver and spleen in particular. Brisk exercise, however, produces somewhat of an equalization, so that more cells are found in the peripheral blood-vessels, just as it is also conducive to a more active peripheral circulation. When the body becomes overheated, there is even a greater accumulation of the corpuscles in the internal organs than during inactivity. This is especially manifest in the case of the white cells, blood taken from the finger or ear showing fewer leucocytes than normal. They collect in the viscera. Short hot applications, however, do not produce such a decided decrease, and quite the opposite result is obtained if the hot application is followed by cold treatment. Following all sorts of cold procedures associated with mechanical stimulation and after hot baths or douches when followed by cold applications, there is a decided increase in the number of cells in the peripheral circulation. This increase often amounts to from 20 per cent to 35 per cent in the red corpuscles and from 200 per cent to 300 per cent in the white corpuscles; the hemoglobin also shows an increase of 10 per cent or more.

It is not only the activity of the peripheral blood-vessels that keeps the blood-cells evenly distributed; but the normal movements of the spleen, i. e., its alternate dilatation and contraction, are also a factor in distributing the white blood-cells evenly throughout the body. Various applications to the abdomen and over the spleen stimulate this organ to increased activity. The splenic douche, alternate hot and cold applications, and cold friction to the abdomen are especially efficient in this respect.

At the same time these changes in the cellular elements are produced by cold applications, there is also a change in the chemical reaction of the blood. Blood is normally alkaline. In fevers, infections, diseases of nutrition, etc., the alkalinity is diminished, though the blood never actually becomes acid. This change is due to the accumulation of acid waste products which partially neutralize the normal alkalinity. The reaction to cold applications increases the alkalinity of the blood, tending to restore it to normal by causing a burning up (oxidation) of the waste products. On the contrary, prolonged hot applications decrease the alkalinity of the blood unless followed by cold applications.

PRACTICAL APPLICATIONS

These changes in the composition of the blood are among the most important effects produced by hydriatic procedures. All the nutritive processes of the body, and in fact all chemical changes which take place in the tissues, depend for their proper performance upon an abundant supply of oxygen. This is carried solely by the hemoglobin of the red blood-cells. Not only do cold applications hasten the blood current, but they increase the number of red cells in active circulation. Nor is this all,— the hemoglobin is increased in amount and its oxygen-carrying capacity promoted. Such effects as these, it is impossible to produce at will

by the administration of medicines containing iron or any other "blood tonic." The immediate effects of cold applications last from one hour to two or three hours, and their repeated administration produces permanent improvement in the circulation and progressive increase in the red cells and hemoglobin until a normal condition is restored.

As beneficial as the above results may be in anemia and other impoverished conditions of the blood, it is not upon an increase in the red cells and hemoglobin that we depend in infectious diseases, but upon the work of the white corpuscles. The white blood-cells are the patrolmen and policemen of the human body. They constitute the standing army designed to repel the invasion of bacteria. It is upon their number and efficiency that the body depends for its resistance to and immunity from bacterial diseases. The white cells and other cells of the body accomplish this resistance in two ways or by a combination of these two methods: —

One is by the production of substances which *neutralize* or antidote the poisons produced by the bacteria. These substances are known as *antitoxins*. Or the cells of the body may produce substances which weaken or destroy the germs themselves. Such substances are called *bacteriolysins*, *opsonins*, etc.

Second, the white blood-cells may actually *eat up* and *digest* the bacteria, thus destroying them. This process is known as *phagocytosis*, and the cell which displays such properties is called a phagocyte.

It will then be seen that whatever agent produces an increase in the number of white cells in active circulation, and makes them more energetic, is a most powerful means of combating infectious diseases. Both these results, i. e., increasing the number of white cells and increasing their activity, are brought about by cold applications. So powerful is the stimulation of cold

that the leucocytes in the peripheral circulation may be doubled or trebled by the reaction to cold treatment. The restoration of the normal alkalinity of the blood which results from cold applications is also conducive to the better and more energetic action of the phagocytes, since their surroundings are more nearly normal. While a single cold treatment can not be expected to cause the production of more white cells, yet the frequent repetition of suitable tonic cold applications does actually stimulate the blood-forming organs to produce more cells.

Notwithstanding the many antiseptics, germicides, etc., that have been vaunted for the treatment of infectious diseases, the white blood-cell itself is the most efficient germicide known, and will always retain its high place in the defense of the body against bacterial invasion; furthermore, the agent which assists the body by augmenting its natural powers of defense, will never occupy a place secondary to purely artificial and chemical means of destroying the invaders.

QUESTIONS FOR REVIEW

1. Describe the condition known as arterial hyperemia. Is the blood pressure raised or lowered?
2. What is passive hyperemia? What is the condition of the blood-vessels in passive hyperemia?
3. State the laws governing the effects of hydriatic applications on blood pressure.
4. What is the effect of cold applications upon the distribution of the blood-corpuscles? of hot applications?
5. In what other organ besides the liver may the blood-cells accumulate?
6. Define antitoxin, bacteriolysin, opsonin, phagocyte, immunity.
7. What is the special value of cold applications in infectious diseases?

CHAPTER VII

Tissue Changes

THE performance of every function of the human body is associated with changes in the chemical structure of the tissues concerned. These changes are therefore occurring constantly. They vary in degree during activity and rest, or they are of different nature when the body is at rest than during activity. In general, these changes are classed under two heads; viz., the *building-up* or *anabolic* processes and the *breaking-down* or *catabolic* processes. Both are considered together under the general head of *metabolism*. The functions of digestion and absorption are intimately associated with the building-up processes; and the excretion of waste products, with the breaking-down processes.

In the preceding chapter mention was made of the effect upon nutrition and nutritive changes brought about by changes in the circulation which result from various thermic applications. These changes affect practically all the chemical constituents of the body. They also influence the assimilation of food elements, both as to the amount and proportion of these elements. The amount and proportion of the various waste products excreted are likewise altered.

Besides the inorganic salts, there are two general classes of substances entering into the composition of the tissues. These are the nitrogenous foodstuffs and the non-nitrogenous. For our present purpose we are not greatly concerned with the subdivisions of the non-nitrogenous elements. In the intake of nitrogenous substances, we have only to consider the amount of these substances absorbed from the alimentary tract. They are excreted by the urine in various forms, which

we shall presently consider. A small amount may be excreted with the feces, varying inversely to the efficiency of absorption. In the case of the non-nitrogenous elements, we have to consider both the amount of these elements absorbed from the alimentary tract and the amount of oxygen taken into the blood from the lungs. The reason is that when completely burned up, the waste products of non-nitrogenous metabolism are carbon dioxid (CO_2) and water (H_2O), both of which contain a large per cent by weight of oxygen. These end products are excreted from the kidneys as water and in chemical combination in the urinary solids; also from the lungs as watery vapor and carbon dioxid gas.

NITROGENOUS METABOLISM AND EXCRETION

It has been found by experiment that all sorts of cold treatments cause more complete absorption of nitrogenous foods. This is manifest by the fact that the feces contain less nitrogen. (Fig. 7.) The utilization of proteid in the body is also promoted and nitrogenous catabolism hastened as shown by the increase in the per cent of nitrogen in the urine. These effects are greatest during the days that the treatments are being conducted. They gradually subside after treatment is discontinued. During the treatment days the excretion of urea increases about 20 per cent and the excretion of uric acid about 30 per cent. At the same time the nitrogen of the feces decreases proportionately. Urea comes from the breaking down of all proteid; uric acid is derived from the nuclear proteid only, except that which is taken in with the food as such, and is in no way utilized by the body, it being merely excreted as waste. The excretion of ammonia may increase as much as 50 per cent during the bath period. In addition to the more perfect absorption and utilization

of food, it has been found that the waste products excreted are more completely oxidized (burned up). This means that there is less of those substances which may be compared to cinders,— half-burned fuel,— while the well-burned ash increases accordingly. This is manifest in a decrease of the nitrogenous extractives in the urine after the bath period, which sink as low as 1 per cent or .5 per cent of the total nitrogen excreted; whereas the

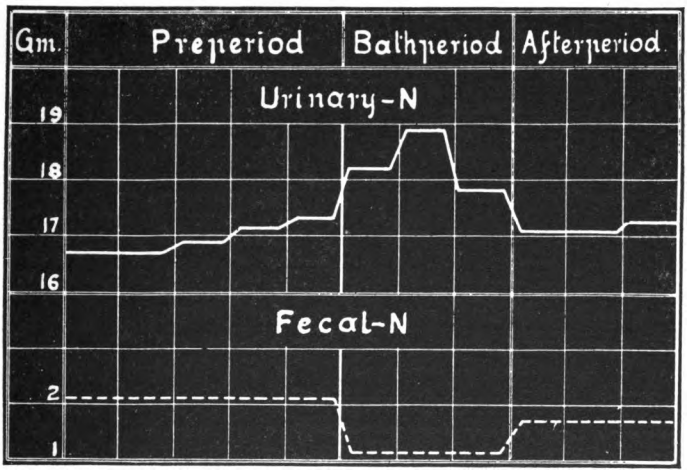


FIG. 7

Changes in urinary and fecal nitrogen as affected by cold treatment.

extractives usually make up from 3 to 4 per cent of the total nitrogen.

The phosphoric acid of the urine is also derived from proteid. Its excretion is increased from 25 per cent to 30 per cent. This increase is almost entirely in the alkaline phosphates, there being little change in the per cent of earthy phosphates in the urine.

Hot treatment also brings about nitrogen tissue changes, but these are not very decided unless the hot treatment is much prolonged, or not until after three,

four, or five hot treatments have been given. In the case of cold treatment the increased metabolism continues for a variable length of time after the bath period. With hot treatment there is a decreased excretion of nitrogen after the bath period. This would seem to indicate that while hot treatment induces greater catabolism, it does not bring about a corresponding increase in the building up of tissue, since the body does not store enough to be able to keep up the normal amount of excretion *after* the treatment. This agrees with clinical experience in the use of prolonged hot treatments, it being well known that extreme sweating baths decrease the body weight.

CARBONACEOUS METABOLISM AND EXCRETION

Since the taking in of oxygen and the excretion of carbon dioxid are so intimately connected with the chemical changes in carbohydrates and fats, it is helpful to understand the changes in respiration which are brought about by thermic and mechanical stimuli. The respiration is affected by practically every stimulus applied to the body. Thermic applications combined with mechanical stimuli, when applied directly to the chest, are so powerful in stimulating respiration that such means are among the most efficient in resuscitating the new-born infant, and as an aid in artificial respiration. The sudden application of cold to the chest, or the alternate application of heat and cold, especially when extreme, produces a quick, deep inspiration which is followed by other short, quick efforts, each of which is as suddenly interrupted. When cold applications are prolonged, the respiration becomes slower, more regular, and of greatly increased depth. The tidal air may be increased from 25 per cent to 50 per cent. Cold compresses allowed to remain until well into the heating

stage, have a similar effect, the increase gradually declining to normal.

Hot applications, after a slight initial disturbance, produce much shallower respiration, the tidal air decreasing as much as 35 per cent. At the same time the rate of respiration is increased. Hot moist applications or inhalations of steam make respiration easier. Hot dry air has an opposite effect, making respiration more difficult. This is a matter of common experience, it being a well-recognized fact that breathing seems easier at the seacoast or during a rain than it is on the desert, where the air is hot and dry. Both heat and cold increase nitrogenous metabolism, and the same is true of carbonaceous metabolism. Extreme heat or extreme cold produces an increase in the absorption of oxygen through the lungs, and an increase in the excretion of carbon dioxid.

A bath at 61° F. causes an increase of about 47 per cent in the absorption of oxygen and an increase of nearly 65 per cent in the excretion of carbon dioxid. A bath at 111° F. causes an increase in the oxygen of about 17 per cent and in the carbon dioxid of about 32 per cent. As the temperature of the bath approaches neutral, there is a gradual lessening of the increase. A neutral temperature produces no change at all. It is interesting to note that a douche at 61° F. has something more than double the effect of a bath at the same temperature. The same is true of a hot douche as compared with a hot bath. The mechanical stimulus is, of course, the cause of this doubling of the effect on metabolism. These facts reveal the importance of extreme applications combined with more or less mechanical stimuli in conditions where the absorption of oxygen is interfered with, as in lobar pneumonia and bronchopneumonia. The cold rubbing bath produces more decided results than quiet immersion, and a cold mitten friction in-

creases metabolism to a greater extent than a cold wet hand rub of the same temperature.

Such decided and beneficial changes in nutrition and the excretion of wastes as these, it is impossible to bring about by the administration of any drug known. Moreover, hydriatic applications leave no injurious after-effects (such as are invariably seen when drugs are used continuously) and they can be repeated without injury to the body or its natural power of defense. For example, quinin may decrease nitrogenous metabolism by a poisonous action to the extent of as much as 39 per cent. The coal-tar products have a similar action. They arrest or decrease oxidation, and so make their use undesirable where the body is filled with poisonous nitrogenous substances which require burning in order to be gotten rid of. One should therefore avoid the use of these drugs, utilizing the physiologic means which, when intelligently applied according to the needs of the individual case, always result beneficially.

QUESTIONS FOR REVIEW

1. What is the difference between a physical and a chemical change? Name three physical changes induced by hydriatic applications.

2. What is the effect of tonic cold applications on the absorption of food?

3. Why should cold treatments cause the waste products to be more completely burned up?

4. What is the effect of hot applications on the burning of carbon in the body? of cold applications?

5. How may the chemical effects produced by applications of cold water be enhanced? To what extent do such additions increase the intake of oxygen and the output of carbon dioxid?

CHAPTER VIII

Muscular Capacity

THE restorative effect of baths and their effects in relieving muscular fatigue are matters of common knowledge. After the fatiguing effects of severe and prolonged exertion, a warm bath relieves the fatigue and promotes normal rest and sleep by its relaxing and quieting influence. On the other hand, if a brief warm bath is followed by vigorous, general cold applications, whether by a pour or a douche of cold water, or a cold plunge bath, the body acquires new energy so that still more work may be done without injurious effects.

These facts of general knowledge have been made more definite by careful experiments with strength- and fatigue-testing machines. An instrument known as the ergograph (*ergo* — work, *graph* — writing or record) has been much used in testing the ability of a group of muscles to withstand fatigue. For example, the hand and arm are made stationary in the machine, while the forefinger or middle finger is left free for flexion and extension. A weight is attached to the finger so that it is raised by each flexive movement. Raising and lowering of the weight is kept up until the muscles are unable to contract longer; in other words, until they are fatigued. With the beginning of fatigue, the height the weight is raised declines, becoming less and less as fatigue increases.

In one experiment the middle finger was able before complete fatigue to execute work equal to 5.139 kilogrammeters (a kilogrammeter is equal to 1-75 of a horsepower). After a cold bath at 50° F. for fifteen seconds, the same muscles were able to do work equivalent to 9.126 kgm. before complete fatigue. The accompany-

ing cut (Fig. 8) shows another experiment, in which a graduated bath (96.5° to 68° F.) increased the working capacity from 3.603 kgm. to 9.349 kgm.

Even after the muscles have been fatigued by active work and are able to work but a very short time longer, the giving of cold treatment restores them to their usual capacity for work, or the working ability may even be increased over the normal. This is shown in Fig. 9, in which *a* represents the ability of the muscles before fatigue, *b* after fatigue, and *c* after fatigue followed by a cold bath.

Hot baths have the opposite effect, i. e., the mus-

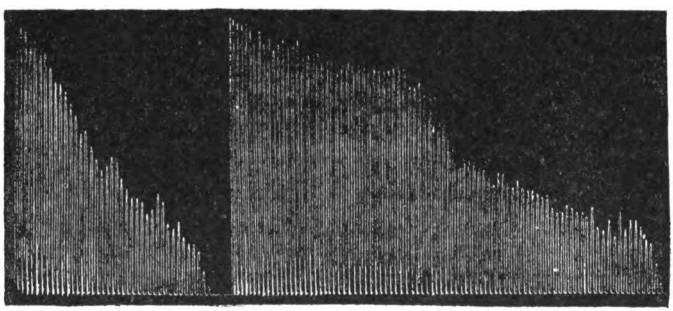


FIG. 8

Ergograms showing the effect of a graduated bath on muscular capacity: *a*, normal; *b*, after the gradually-cooled bath.

cles become more quickly fatigued and are able to do less work. On an average, various cold treatments increase the working ability about 30 per cent, and hot treatments decrease muscular capacity to the same extent. When, however, a hot douche is given, the working capacity is increased, but to a less extent than with cold treatment. The mechanical stimulus of the percussion is responsible for this difference between a hot bath and a hot douche. For this reason the alternate hot and cold percussion douche is a most efficient means of relieving muscular fatigue. For this purpose

the hot should be of brief duration, just sufficiently long to prepare the body for the cold.

All alternate hot and cold applications have the same effect in varying degree, according to the nature of each treatment. General cold treatments, such as the cold mitten friction, cold towel rub, wet sheet rub, cold shallow bath, pail pour, cold percussion douche, and even the salt glow, are most powerful means of stimulating the muscles to renewed activity. Since the causes of fatigue are removed, this stimulation is, in fact, a real tonic effect, and not simply a deadening of the sense of fatigue, such as follows the use of tea or coffee. The quickened circulation carries away the fatigue poisons, while the taking of tea or coffee only adds to them, for such caffein is.

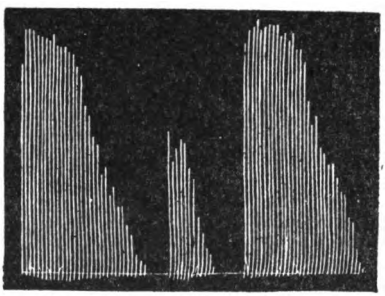


FIG. 9

Ergograms showing the effect of a cold bath on fatigued muscles: *a*, before fatigue; *b*, after fatigue; *c*, after fatigue followed by a cold bath.

Mechanical effects alone, such as massage, also raise the working capacity of the muscles, but to a less degree than hydriatic procedures. Cold applications should be properly graduated to suit the needs and reactive ability of each individual case.

These beneficial effects can not be produced by any of the medicinal stimulants usually considered to possess the power of increasing working capacity. The effects of strychnin are irregular and transient. It is a whip only, and in no sense a real tonic, since it does not tend to restore to a normal condition.

On the other hand, those drugs which are used to give relief from fatigue, such as the coal-tar products,

bromides, caffein, etc., do not promote normal rest, but only deaden the nerve-centers so that there is not a true appreciation of the worn-out condition of the body. For this reason, the body when under the influence of tea or coffee (caffein) goes on working when it should rest, and hence to its own damage. A warm bath, however, gives no such false sense of energy, but is conducive to the perfect relaxation and quiet which normal rest and sleep require in order that the powers of the body may be recuperated.

QUESTIONS FOR REVIEW

1. Considering the effect of cold treatments on metabolism, can you tell why they increase muscular capacity?
2. Name some treatments that increase the ability for work.
3. What measures are conducive to relaxation and rest?
4. In what sense may tea and coffee be considered narcotics? In what way may they be looked upon as stimulants?
5. In what way do strychnin and tonic hydriatic applications differ in their stimulating effects?
6. Why is it best to take a cold bath in the morning and a warm bath at night?
7. Can you tell why a meat-eater is more easily and quickly fatigued than a vegetarian?

CHAPTER IX

Body Heat

HEAT PRODUCTION

THE breaking down of foodstuffs and their oxidation in the body, sets free energy. This energy appears in the form of heat and work. The greater part is manifest as heat, nearly nine tenths of the total body energy taking this form.

Bodily exercise is one of the chief sources of heat. The heat produced in this way originates in the muscles during their activity. However, the muscles produce some heat when they are not the seat of visible contractions. In the resting body they still produce heat by virtue of metabolic changes which are occurring constantly. If the nerve supply to a muscle is cut off, it ceases to produce heat.

The liver is the second most important source of body heat. It is the largest and most active gland of the body. With the exception of the fats, nearly all the food absorbed passes through the liver to be in some way acted upon before it is utilized by the body. As a consequence of this activity, the blood coming from the liver has a higher temperature than that of any other part of the body.

Since life depends upon chemical changes, the body is constantly producing heat, and as constantly communicating it to surrounding objects. When an animal is exposed to cold, its body produces more heat, in order to counterbalance the effects of its environment; and so its temperature remains the same. If the animal has its nerves paralyzed by certain drugs, and is then exposed to cold, it fails to do this, and its temperature sinks. In other words, it behaves like a frog or other cold-blooded animal, whose temperature

rises and falls with its surroundings. Since paralysis of the nerves interferes with the production of heat, this function must therefore be under the control of the nervous system. The exposure to cold stimulates the nerves, which in turn excite greater metabolic activities in the body, and so more heat is produced. The lungs take in more oxygen, and more carbon dioxid is produced as a result of the heightened chemical activities. These processes are a part of the general *reaction* of the body to external agents. This phase of the reaction has already been alluded to as the *thermic reaction*.

HEAT LOSS

Since life processes must of necessity produce heat, it is necessary that there be provision whereby some of this heat may be eliminated in order that the body temperature be not unduly high. The loss of heat from the body occurs in three ways: —

1. There is a small amount, not over 3 per cent, of heat lost with the excretions of the body. This is of little practical importance.

2. The expired air, which has been warmed by the body, carries with it a certain amount of heat. The expired air contains more moisture than the inspired air. The evaporation of this moisture also causes a loss of heat from the body. The loss in these two ways has been variously estimated at from 10 per cent to 20 per cent.

3. The most important method of heat loss is by the skin. This is of chief importance for two reasons: First, because the *greatest amount* of heat loss occurs in this way, from 75 per cent to 85 per cent of the total amount of heat eliminated from the body, being eliminated by the skin; second, because the loss of heat from the skin can be regulated by clothing, suitable applications, etc., and hence is susceptible of very efficient control for therapeutic purposes.

Heat loss by the skin occurs in two ways; viz., by the ***radiation*** of heat and by the ***evaporation*** of sweat. By radiation is meant the giving off of heat as a stove does. It warms objects about it, especially the air. The place of the warmed air is taken by other cold air, and so a current is produced. This latter method of cooling is spoken of as ***convection.***

The evaporation of sweat occurs at all temperatures, but is greatest when the surrounding air is warm. In fact, these two methods of cooling the body — radiation and evaporation — both vary with the temperature of the air, so that in cold air, radiation is increased while evaporation is decreased; and vice versa, when the air is warm, radiation is decreased and evaporation increased.

With every gram of water that evaporates from the skin, 537 calories of heat are absorbed, most of this heat being taken from the body. A hot application, such as a fomentation, when applied to the body, causes an increased flow of blood to the skin. As soon as the fomentation is removed, contact with the air cools the skin and its blood current. The hastening of the blood flow through the skin therefore greatly cools the body. The evaporation of moisture from the body after a hot application, also causes heat to be lost. For this reason the skin surface should be wiped dry after a fomentation, in order to prevent undue loss of heat and consequent chilling.

The blood supply to the skin may also be increased and the blood flow hastened by dry friction, or by an application of cold water combined with friction, as in the cold mitten friction. While this treatment lessens perspiration and so ***decreases heat loss by evaporation,*** it produces an increase of blood in the skin and so ***increases heat loss by radiation.***

We have noted that cold applied to the body stimulates heat production, while it also causes an increase

in the heat loss. The colder the application, the greater is the production of heat resulting. In the case of baths, it has been estimated that for every fall of 1° C., there is an increase in metabolism amounting to 2 per cent or 3 per cent, and a consequent increase in the heat produced. Just the opposite set of conditions result from hot applications. During the application there is of necessity a certain amount of heat absorbed by the body. But the after-effect or reaction to the heat results in lessening heat production, in order to balance this absorption of heat. This decreased heat production is the thermic part of the *atonic reaction*, which results from hot applications. However, with very hot applications, there is, during the application, an increase in the heat produced.

SUMMARY

HEAT PRODUCTION.— The following are some of the conditions and measures that increase heat production:—

1. Vital activities; such as,—
   a. Glandular activity.
   b. Muscular activity.
   c. Digestive activity.
   d. Mental activity.
2. External conditions:—
   a. Reaction to cold applications, either long or short.
   b. Low atmospheric temperatures.
   c. High atmospheric temperatures.

The following conditions and measures decrease heat production:—

1. Fasting.
2. Sleep and rest.
3. Reaction to short hot applications.

HEAT ELIMINATION.— The following conditions increase heat elimination. The agents or the means

by which these conditions are produced are listed as subordinates.

1. Dilated surface vessels and rapid circulation: —
   a. Heat.
   b. Short cold (reaction).
   c. Friction (reaction).
   d. Weak chemical irritants.
   e. Exercise.
2. Increased perspiration (by evaporation of water): —
   a. Heat.
   b. Friction.
   c. Exercise.
   d. Water-drinking.
3. Increased rate of respiration.

Conditions that decrease heat elimination: —

1. Contracted surface vessels and slowed circulation (as in goose-flesh).
2. Decrease of perspiration (lessened evaporation).
3. Slowing of respiration.
4. Very high atmospheric temperatures.
5. Oiling of the skin.

More or less prolonged applications of cold, whether cold water or cold air, abstract heat from the body by conduction; but they tend to make the body resist this effect; that is, it attempts to counteract heat elimination. In a cold bath of fifteen minutes' duration two thirds of the total heat loss occurs during the first five minutes. This is because the body is at first unprepared to resist the abstraction of heat. The following applications, while they cause the body to make attempts at decreased heat elimination, do, by contact, abstract heat: —

1. Cold baths.
2. Cold enemata.
3. Cold-water drinking.
4. Breathing cold air.

QUESTIONS FOR REVIEW

1. What are the sources of body heat? Ultimately all heat is derived from what processes?
2. What are the two chief thermogenic tissues of the body?
3. What is a cold-blooded animal? Name some such animals. What is a warm-blooded animal?
4. Why is the skin the most important organ of heat elimination?
5. Define radiation; convection; and illustrate each.
6. By what means may excessive perspiration be checked?
7. To what extent does the evaporation of moisture from the skin cool the body?
8. What is the effect of cold applications on heat production? on heat elimination?
9. What effect have hot applications on heat production? on heat elimination?
10. From memory summarize the means of increasing and decreasing heat production and heat elimination.

PART II

Therapeutics

INTRODUCTION

Disease is a disordered state of the body in which one or more functions cease to be performed in a normal manner. Disease is due to transgression of the laws of life.

Therapeutics is the science and art of healing. Permanent healing is dependent upon continual compliance with the laws of life.

The rational treatment of disease rests upon three essentials: —

1. *The removal of the cause.*
2. *The treatment of the existing conditions.*
3. *The relief of such symptoms as by their severity in turn become causes.*

The intelligent application of these basic principles constitutes *rational medicine.*

Usually the natural means most appropriate in the treatment of a given disease, accomplishes all three of the desired results.

In the case of drug therapy, a different medicine is usually necessary for each condition or symptom, since it rarely accomplishes more than one desirable result, and this usually at the expense of other and more important results.

CHAPTER X

Fever and Antipyretic Effects

THAT condition of the body in which there is a more or less marked rise of temperature above the normal, is known as fever.

CAUSES OF FEVER

When waste products or poisons of an unusual character accumulate in the system, the body attempts, by oxidation, to burn up and get rid of them. This heightened oxidation greatly increases the amount of heat produced in the body. At the same time many of these poisons so irritate the vasomotor nerves as to cause contraction of the surface blood-vessels, and thus by driving the blood inward, produce chilliness and partially prevent heat elimination. Either of these factors — increased heat production or decreased heat elimination — will cause a rise of temperature. It will thus be seen that the fever is the result of a protective effort, an attempt on the part of the body to cope with the poisons. But, as is usual in disease, an effort at protection is often accompanied by disordered action, or the body may be unable alone to accomplish the desired results.

SOURCE OF FEVER POISONS

The poisons that give rise to fever are of various origin. Practically, there is but one source that need be considered here. Nearly all fevers are due to poisons produced by the growth of bacteria. These poisons may be introduced from without, or originate from the growth of bacteria within the body itself or upon some of its surfaces. The poisons of bacterial origin are called *bacterial toxins*. They are nitrogenous compounds and highly poisonous.

MANIFESTATIONS OF FEVER

The following group of symptoms, when taken together, are characteristic of fever. Not all these symptoms may be present in any given case. They may also vary according to the cause of the fever and the stage of the disease. These manifestations are: —

1. Various nervous disturbances, such as malaise, headache, backache, insomnia, delirium, etc.
2. Chilliness.
3. A hot, dry skin, or cold, clammy skin.
4. Increased pulse-rate and tension.
5. Excessive thirst.
6. Loss of appetite, foul breath, coated tongue.
7. Constipation or diarrhea.
8. Urine scanty, highly colored, with an increase of solids.

Nearly all these symptoms are due directly to the infection or bacterial poisons, and not to the rise of temperature. The damage to the body and its organs comes almost wholly from the crowding of the system with toxins, not from the abnormal temperature. Unless very high or much prolonged, there is little to be feared from the fever itself. The fever is not the cause of the disturbance, but the result. The rise of temperature is, as already stated, due to the burning of the toxins.

RATIONALE OF TREATMENT

It is necessary in some way to rid the body of these poisons. Oxidation is one of the ways in which this may be done. To stop the oxidation of poisons is therefore, an irrational thing. The burning should be encouraged, not hindered. The only precaution to be taken is that the additional heat produced shall be rapidly eliminated. The idea that the reduction of temperature is the chief or sole object in the treatment of fevers, has become very firmly fixed in the minds

of the majority of people. And even in the use of hydrotherapy, many suppose that the temperature itself is the thing to be attacked.

The principal object in the treatment of fevers is the same as in all other diseases; viz., the removal of the cause: —

First, since the poisons are produced by bacteria, it is necessary to increase the germ-destroying power of the body cells, especially of the white blood-cells.

Second, increase the oxidation and hasten the elimination of these toxins.

Third, conserve and assist the powers of the body, such as the heart action, circulation, digestion, etc., during the course of the fever.

Fourth, mitigate the distressing symptoms, especially the nervous symptoms.

Lastly, prevent the undue accumulation of heat within the body.

All of these results can be accomplished by cold baths and other hydriatic applications, properly applied and graded to suit the needs of each case. As has been pointed out in the first part of this book, the cold bath increases phagocytosis, so meeting the first requirement, the destruction of the bacteria. Cold treatment also increases oxidation, thus meeting the second need,— that of burning up the toxins. At the same time contact with the cold water conveys away the heat produced, and so keeps the temperature within safe limits. Hydriatic applications stimulate the circulation, aid the heart, favor digestion, and increase absorption. In this way the vital powers are sustained until the cause can be completely removed. Nothing so relieves the nervous system, allays headache and delirium, and prevents insomnia in fever as the cold bath. This it does by hastening the elimination of poisons by the kidneys, skin, and lungs, so that the sources of nerve irritation are markedly lessened.

It has been shown that the so-called heart-failure of infectious fevers is due to paralysis of the vasomotors and consequent failure of the peripheral heart rather than of the central heart. This paralysis is caused by the bacterial toxins acting upon the vasomotor center. Unless the paralysis is unusually extreme, the blood-vessels may still be stimulated by heat, cold, and friction; and so the failure in the circulation be remedied. The burning up of poisons and their more rapid elimination after cold treatment also directly remove the cause of vascular paralysis. Such a group of favorable effects it is impossible to attain by medicinal means. If a drug seems to act beneficially in one way, it is nearly always accompanied by one or more (and usually more) deleterious effects. We shall now briefly consider these effects.

HOW DRUGS LESSEN FEVER

1. *Aconite.*— The forcible action of the heart, together with high blood pressure, helps to keep up the excessive production of heat. Aconite has what is termed a "collapse action" upon the heart and circulation. It greatly decreases the force of the heart-beat and dilates the blood-vessels. It is highly dangerous in long-continued weakening fevers, or where there is cardiac weakness or actual heart-disease.

2. *Alcohol.*— This drug causes an atonic or paretic dilatation of the capillaries. This favors loss of heat from the skin. At the same time the internal blood-vessels are dilated, thus increasing the danger from the already existing internal congestion. The heart action is depressed. Oxidation is delayed, thus allowing the poisons to accumulate in the body. The phagocytic power of the white blood-cell is greatly reduced or entirely checked. It is impossible for the body to maintain or acquire immunity to infections while alcohol is being taken.

3. The Coal-Tar Antipyretics.— Acetanilid, phenacetin, and antipyrin lower fever by checking oxidation, especially of nitrogenous substances. It is these latter wastes that are so highly toxic. The result is, therefore, just the opposite of what should be accomplished. These drugs are powerful heart depressants, and are liable to produce sudden death. The oxygen-carrying power of the red blood-cells is lessened by the breaking up of these cells and the altering of the hemoglobin. The activity of the white cells is arrested, and phagocytosis suppressed. In whatever way these drugs are viewed, their use in fever is entirely irrational. They render the body less able to resist infection.

4. Quinin.— The action of quinin is very similar to that of the coal-tar products. It may decrease nitrogenous metabolism more than one third. If found in the blood in a strength greater than eight parts in one hundred thousand, phagocytosis is completely stopped. Ten grains in the blood of a person weighing one hundred thirty pounds, would be equal to nearly twice the poisonous dose for the phagocytes. It also causes breaking up of the red cells, with hemoglobin in the urine if used in large amounts or used continuously.

It will be readily seen that the slight benefit to be derived from these drugs is at the expense of more important and indispensable results. Either the heart and circulation are endangered, their efficiency lessened, or the bodily resistance to bacteria is decreased or checked, or both effects may be produced by a single drug.

EFFECTS OF VARIOUS HYDRIATIC ANTIPYRETICS

Having already considered the essential effects of hydrotherapy in fever, the effects produced by different hydriatic applications should be noted, and the conditions in which each is most appropriate. The follow-

ing simple classification shows the general type of applications used, together with the essential effect of each: —

1. Applications of cold.

a. Prolonged — direct antipyretic by abstracting more heat than is produced.

b. Short — stimulate heat production as much or more than they increase heat loss.

2. Applications of heat.

a. Prolonged — antipyretic by increasing heat elimination through profuse sweating.

b. Short — prepares the body for cold applications.

The *cold rubbing bath* may be taken as a type of *long cold applications*. It causes a decided increase in heat production. The oxidation of poisons and wastes is greatly heightened, and their elimination hastened. At the same time continuous contact with the cold water causes a greater amount of heat to be conveyed from the body than the extra heat produced during the bath, so that the temperature is lowered. This is brought about by the rubbing which keeps the blood in the skin. If reaction fails, heat elimination is checked, and the bath ceases to be beneficial. Long cold applications are indicated in long-continued weakening fevers, such as typhoid, typhus, and in hyperpyrexia.

The *cold mitten friction* may be used as a type of the *short cold applications*. It stimulates the circulation, increases blood pressure, and augments heat production. But the contact of the cold water with the body is of too brief duration to provide for much heat elimination. Consequently, the temperature may remain the same, fall slightly or rise slightly. The cold mitten friction is indicated in such short fevers as colds, grippe, etc., or when the skin is cold, for the purpose of warming the skin and thus reducing internal congestion.

Any *sweating treatment* will serve to illustrate the ef-

fects of *long hot applications*. By producing free perspiration the elimination of heat is greatly increased. The temperature is first raised and then lowered as the sweating becomes well established. In fevers where heat production is greatly increased it is, however, impossible to lower the temperature by the use of sweating measures alone. They may, however, be used in colds, grippe, coryza, etc.

Fomentations and *hot packs* of brief duration are often used to prepare the body for cold treatment by promoting the ability to react. Used in this way, they are examples of the use of *short hot applications* in fever.

INDICATIONS FOR HYDRIATIC TREATMENTS OF DIFFERING EFFECTS

Fever is produced whenever heat production is greater than heat elimination. Both may be increased and still fever result, if the heat elimination is not increased proportionately with the heat production. Both may be decreased, but if the heat elimination is decreased more than the heat production, fever will likewise result; or heat production may be increased and heat elimination decreased, thus producing a very high temperature. There are certain symptoms and signs which indicate that the fever is due largely to overproduction of heat; while there are other signs which reveal that the rise of temperature is due more largely to decidedly decreased heat elimination.

Where greatly increased heat production is the chief factor, it would be irrational to use a treatment such as the cold mitten friction, since it does not provide for conveying off the extra heat it causes to be produced.

Where heat elimination is decidedly decreased, it would be unreasonable to use a long cold application, at least at first, since reaction would be difficult or impossible to secure.

The following signs indicate a great increase in heat production as the chief cause of the fever: —

1. Full pulse and flushed face.
2. A hot, dry skin.
3. A warm, moist skin.

A cold mitten friction would be inappropriate in the above conditions, since it has no tendency to lower blood pressure. It stimulates heat production, but the contact with the cold water is of too brief duration to abstract much heat from the body. A hot treatment should not be used, since heat abstraction is desired.

The following symptoms show a decided decrease in heat elimination: —

1. Cold skin, whether dry or moist and clammy.
2. Cyanosis.
3. Goose-flesh.
4. Chilly sensations.
5. Shivering.

When these conditions prevail, cold applications should not be used, since they would increase the difficulty. Even the cold mitten friction may do harm unless preceded by a vigorous hot application to draw the blood to the surface and warm the skin.

In general, long cold applications should be used where the skin is hot and dry. Hot applications should be used where the skin is cold, cyanotic, or clammy, and continued until this condition is overcome. The accompanying outline shows briefly the principles and methods involved in the treatment of fevers: —

FEVERS AND THEIR TREATMENT

a. SYMPTOM GROUP.— Full pulse, flushed face, hot dry skin.

CHIEF CONDITION PRESENT.— Great increase in heat production.

INDICATIONS.— Increase heat loss by long contact with cold.

TREATMENT.— Long cold applications.

b. SYMPTOM GROUP.— Cold skin, wet or dry, cyanosis, goose-flesh, chilly sensations, shivering.

CHIEF CONDITION PRESENT.— Decided decrease in heat elimination.

INDICATIONS.— Warm the skin, combat internal congestion.

TREATMENT.— Hot applications until the blood is brought back to skin.

The following hot and cold treatments when properly selected to meet the needs of the particular case under treatment, and the varying degrees of fever, are useful in febrile diseases,— the cold treatments when the first set of symptoms are present and the hot treatments when the second set of symptoms prevail: —

Cold applications useful in fever: —

1. Brand bath.
2. Graduated bath with friction.
3. Tepid or cool bath.
4. Evaporating wet sheet pack.
5. Cold sponging.
6. Cold to head and neck.
7. Ice-bag or cold compress to heart.
8. Cold compress.
9. Cold rectal irrigation or enema.
10. Cold-water drinking.
11. Fresh cold air in the sick-room.

Hot applications useful in fever or preparatory to cold treatment: —

1. Hot blanket pack.
2. Hot bath (very short) or repeated hot sponging.
3. Hot evaporating sheet.
4. Fomentations to abdomen.
5. Fomentations to spine.
6. Hot-water drinking.
7. Cold mitten friction (reaction simulates a hot application).

QUESTIONS FOR REVIEW

1. Tell how fever is brought about.
2. How are the poisons best gotten rid of?
3. What are the two most important considerations in the treatment of fevers?
4. Show how completely hydrotherapy meets the needs of a fever case.
5. Explain in simple language why antipyretic drugs are both useless and harmful.
6. Reproduce from memory the chart on fevers and their treatment.
7. Give the principles involved in the treatment of the circulatory failure that occurs in fevers.
8. Explain the effects of long cold applications, short cold applications with friction, and sweating treatments on heat production and heat loss in fevers.
9. What symptoms show that fever is due chiefly to increased heat production? What symptoms show that it is due more largely to decreased heat elimination?

CHAPTER XI

The Treatment of Fevers

TYPHOID FEVER

TYPHOID fever is one of those diseases in which the body is aroused to form antitoxins and other antibodies which serve the purpose of protection. It requires some days before these are present in appreciable amount, and several weeks before they are sufficient to overcome the infection. The chief object in the treatment of typhoid fever is not the reduction of the temperature,* but the sustaining of the vital resistance, heart action, circulation, elimination, etc., until such time as the cellular tissues can produce a sufficient amount of these protective substances successfully to combat the toxins and bacteria, and until the cells themselves are able thus assisted to overcome the infection.

To obtain the best results the treatment should begin within the first five days of the illness. If treatment is begun after the first week, the control of the disease is rendered much more difficult. It is even stated by some that none need die of typhoid fever if the proper hydriatic treatment is instituted at once at the onset. Vigorous treatment at the start certainly can not be too strongly urged. Practically all patients would be able to react to vigorous cold baths if this plan were instituted at the beginning. Should the patient come under observation later than this, or after a week or

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*The temperature, however, serves as a guide, and when a hydriatic régime is intelligently followed, it, together with other symptoms, does become a fairly accurate *guide* to the condition of the patient. When antipyretic drugs are used, the temperature in no way runs parallel with the patient's condition. It may be within safe limits while the patient is in a most serious condition.

ten days, it will usually be necessary to modify considerably the severity of the treatment, or apply other forms of hydrotherapy than the cold immersion bath and other severe cold treatments. If treatment can be instituted at the beginning, so that an ideal plan may be followed, the following system will be found most serviceable: —

As soon as the temperature reaches 102.5° or 103° F., a cold immersion bath should be given. For this purpose either a stationary or a portable tub may be used. The portable tubs are much more convenient. There are two general types of portable tubs in use. These are the tub on wheels (Fig. 10), and the bed bath.

The Burr portable bed bath* (Fig. 11) entails the least amount of moving of the patient. When this is used, the tub is filled with water after it has been arranged about the patient. In case a stationary tub or one on wheels is used, the tub should be filled first and the patient lifted in afterward. The temperature of the water should not be below 70° nor over 85° F.† The amount should be sufficient to cover well the chest of the patient. The patient may be made comfortable by means of a hammock made by stretching a strong sheet across the tub and fastening the edges underneath. The head should rest on an air-pillow, or be made comfortable in some other way.

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* It consists of a folding frame and a rubber sheet of sufficient size to form a bed within the frame, come up over the sides and fasten on the outer side of the rails of the frame. The rubber sheet is first spread out on the mattress, and the patient lifted on to it. The sides of the sheet are now turned over the patient, while the frame is placed so as to rest on the mattress. A hard mattress should be used in order to provide against sinking of the bath at one or more places. The edges of the rubber cloth are now drawn over the upper rails and fastened to the lower rails on the outer side by means of suitable tapes passed through the eyelets or hooks in the edge of the rubber sheet. The bath is now ready to receive the water. This may be supplied through a hose from a faucet or by means of a pail.

† The strict Brand bath is given at 65° to 70°, and lasts fifteen minutes.

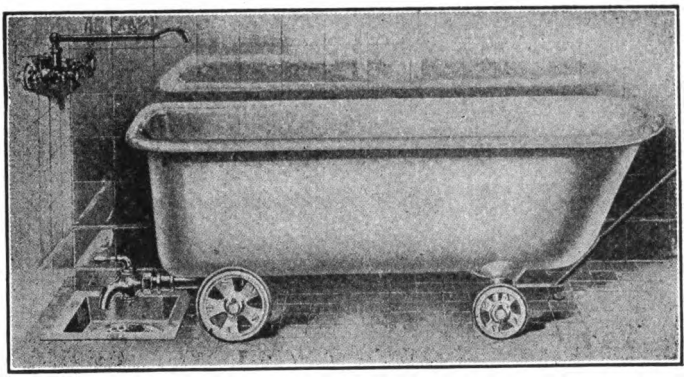


Fig. 10

PORTABLE BATH-TUB ON WHEELS

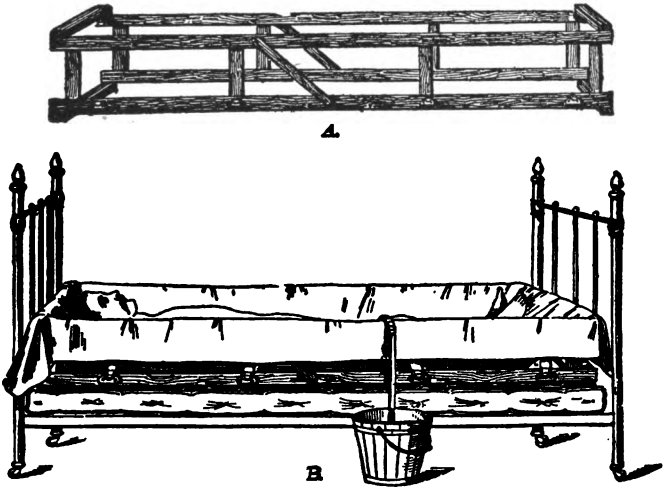


FIG 11

BURR BED-BATH.

Before the first bath, a thorough evacuation of the bowels should be secured. Immediately before entering the bath the patient's head, including the face, scalp (hair clipped short), and neck, is to be bathed in ice-water, and a cold compress applied so as to cover the neck, forehead, and scalp. A properly arranged rubber coil may be used for this purpose. The water passing through the coil should be ice-water or very cold water. This preliminary cooling of the head is necessary in order to prevent undue retrostasis of blood to the brain on the first contact of the body with the cold water.

In no case should a patient with cold feet or cyanotic skin be "tubbed." The preparation of a patient in this condition will be considered later. The patient should now be lifted into the tub. This will require two nurses. He should not be allowed to assist himself. Rubbing of the skin surface should be begun at once. This must be done vigorously and continuously; it also will require both nurses. After three or four minutes, when the skin glow is well secured, the cold compresses to the head should be renewed. The use of the ice-water coil over a wet towel makes this renewal unnecessary, and enables the nurses to devote their entire time to the securing and maintaining of the cutaneous reaction.

At the end of eight or ten minutes, the temperature should be taken. If the patient reacts well, the bath should last fifteen minutes or even longer. Should the reaction fail and chilling occur, the patient must be removed at once. On removal from the bath, the patient may be received in a dry blanket with a dry sheet next the body, and covered with other blankets. The sheet may be removed as soon as the skin is dried and the patient thoroughly warmed. The temperature should be taken on removal from the bath and at the end of twenty minutes after removal.

During the first week the baths will not produce marked lowering of the temperature, or the temperature may remain practically the same.* Tubbing should be repeated not oftener than every three or four hours, or as often as the temperature reaches 103° F. The cold compress or ice-coil to the head should be continued with little or no interruption.

Should it be desired or seem advisable to employ a less heroic treatment,— for example, where treatment is begun in the second week of the disease or in case of a feeble patient of poor reactive ability,— the graduated bath of Ziemssen may be chosen. With this form of bath the time must be prolonged to from thirty minutes to one hour, depending upon the rate at which the temperature of the water is reduced. Although the vigor of the cutaneous stimulation is less with the graduated bath than with the strict cold bath, the temperature of the patient may be just as effectively reduced by the longer stay in water at a higher temperature as by a shorter stay in colder water.

While full immersion baths are the most efficient in the treatment of typhoid fever, yet other methods are very serviceable where circumstances prevent the use of tubs, or when for any reason, moving the patient is deemed inadvisable.

The *wet sheet pack* may be applied. To avoid removing it for renewal, cold water from a watering-pot should be sprinkled over the sheet. The rate of evaporation may be controlled by the dry blanket coverings which are used. It may be hastened by fanning or the use of an electric fan placed at the head of the bed. Partial wet sheet packs may be used in the same way. Large towels may also be used for similar purposes.

Cold compresses are simply small wet packs. The

*Should a decided lowering of the temperature occur after each of the first few baths, say, 2° or more, the probabilities are that the disease is not typhoid fever.

cold compress to the abdomen, to prove effective in reducing temperature, must be changed very frequently; if thin, every three or four minutes; if very thick and wrung from ice-water, every ten or fifteen minutes. Each renewal is accompanied by a slight shock, which prevents the complete relaxation necessary for the needed rest the patient should have. To obviate this the *Winternitz coil* placed over one thickness of toweling may be used. As cold water or ice-water courses through the coil, the compress is kept cold and at a constant temperature. This procedure is much more grateful to the patient and also more effective.

If it is desired to apply a *heating compress* to the abdomen, the cold compress, with the coil removed, may be left on for twenty or thirty minutes. This aids in restoring the reactive power of the skin where the cold coil has been used for some time. A single *fomentation* may be used for the same purpose, thus consuming less time in the heating, and allowing almost continuous use of the cold coil.

The *Winternitz coil* to the head is probably more effective, since it acts upon the thermogenic centers in addition to direct cooling of the blood current.

The *cold affusion* is a very efficient means of reducing fever. It may be applied with the Burr bath, or with a rubber sheet arranged so as to carry off the water. The cold affusion to the head, in case of cerebral symptoms, acts very effectively and promptly.

Cold sponging may be used. It is not a very decidedly antipyretic measure where the temperature is 103° or over. *Hot sponging* may be helpful if there is a slight tendency to chilliness.

The *ice rub* is used by some. A flat piece of ice wrapped in one thickness of linen is used for the rub. It may be applied to the spine only, or the entire skin surface may be gone over, with the exception of the abdomen.

The *cold enema* or *cold rectal irrigation* is a very prompt means of lowering the temperature. When very cold water is used, it is not devoid of danger, as it may cause retrostasis of blood to the upper abdomen or chest. For this reason it should never be used where lung complications exist. However, in uncomplicated typhoid fever, if used at a temperature of 70° to 85° and continued from thirty to forty-five minutes, it is a very grateful and efficient means of controlling the fever. A fomentation, or spine bag filled with hot water, may be applied to the spine at the same time, to allay any sensation of chilliness.

The *ice-bag* or cold coil should be applied over the heart if the pulse becomes weak or too rapid. It should remain from twenty to thirty minutes or longer, according to the indications.

THE USE OF HOT TREATMENT

One occasionally meets with cases presenting a cold cyanotic skin surface or with a cold clammy skin. This condition may be quite constant or be produced only by the use of cold applications. When these conditions are present, it is necessary to thoroughly warm the skin, bringing the blood to the surface and thus reducing the internal congestion. For this purpose the graduated bath may be used if the chilliness is not overly marked. The bath should begin at a temperature about three degrees below the mouth temperature, and continue until the chilliness is overcome. The temperature of the bath may then be gradually lowered to 90° or 85°, the patient being rubbed constantly to maintain an active cutaneous circulation. In case the patient really does not react to any form of generalized cold treatment, the prolonged (forty to fifty minutes) use of the hot evaporating sponge may give just the desired results in allaying the chilliness and at the same time reducing the temperature. It should be remembered that the evaporation of every

gram of water absorbs 537 calories of heat, so that where the hot sponging is continued for a half-hour or longer, an enormous amount of heat may be abstracted from the body. The atonic reactionary effect upon heat production, which follows the use of prolonged hot applications, will prevent the temperature from rising rapidly after treatment by hot sponging.

Where the cyanosis is more extreme, as in case of a cold, clammy perspiration, it will be necessary to use a hot foot-bath, aided by large fomentations to various parts of the body, or a hot hip- and leg-pack, or even a short full blanket pack. The head should be kept cool during all this time, and if necessary an ice-bag applied to the heart. The pack, or fomentations, should continue just long enough to overcome the chilliness and bring the blood to the surface. In some cases the cold mitten friction may be used immediately after the hot applications. It should not be used if the temperature is 103° or over, but may be used if the temperature is less than this. The cold towel rub following hot applications is an excellent means of reducing the fever. The towel may be dipped several times, if necessary. Much more heat is abstracted from the body by the cold towel rub than by the cold mitten friction.

THERAPEUTIC EFFECTS OF THE COLD BATH

The ill effects of the typhoid toxins fall most heavily upon the *nervous system*, the *circulation*, and the *kidneys*. It is these organs and their functions that are especially deranged and liable to the most damage.

The nervous symptoms of typhoid fever are almost wholly due to the accumulation of unusual poisons within the body. The restlessness, headache, insomnia, delirium, stupor, etc., are all the result of irritation produced by the toxins together with the congestion of the nerve-centers and brain. We have already seen

that cold baths* increase the oxidation of wastes. The poisons, being more completely oxidized, lose their toxicity, and are also more rapidly eliminated by the kidneys. The cold water is a direct tonic to the nerve-cells. The dull, listless appearance and restlessness give way to a brightening of the mental powers. Stupor or insomnia is replaced by quiet and refreshing slumber. The beneficial effects of hydrotherapy are hardly more marked in anything than in the betterment of the nervous manifestations of typhoid fever.

The *heart and circulation* show great embarrassment in the severer grades of fever. The pulse is rapid and very weak. The tonic and stimulating effects of the cold water on the heart and circulation are due largely to its effect upon the peripheral heart. The central control of the vasomotor nerves is impaired along with other nerve functions. But the blood-vessels may be stimulated *reflexly* by applications to the skin. The toning up of the blood-vessels reacts upon the heart by relieving it of the extra burden. Consequently, it is enabled to beat more slowly and forcibly, and hence more effectively. Strychnin should not be used, as it only increases the embarrassment of the heart, the pulse becoming weaker and more rapid under its continued use. Being an irritant to the spinal cord, it also increases the irritability of the nervous system.

The *kidneys* are frequently the seat of an acute inflammation (acute Bright's disease or nephritis) in typhoid fever. These organs are overworked, the seat of a constant irritation because of the great volume of toxins which must of necessity pass through them. The urine is very highly toxic in typhoid fever. This only tends to increase the local kidney congestion, which is a part of the general internal congestion.

* The term "cold bath" is frequently used in this chapter to designate all forms of treatment with cold water.

Nephritis is much less common when cold baths are used. The drinking of plenty of water in small quantities at frequent intervals is of great assistance to the kidneys by diluting the urine. The use of cold rectal irrigation or the cold enema also has the advantage that it greatly increases the amount of urine, and consequently hastens the elimination of poisons. In case of great urgency where the urine is very scanty, or suppression of the urine occurs, the saline enema may be used either by intermittent or continuous proctoclysis.

The elimination of poisons by the kidneys is much greater after a cold bath than before, and this continues throughout the febrile period if hydrotherapy is used, while the elimination of poisons during convalescence is greatly decreased by the previous use of the cold bath.

The cold bath should not be used in the following complications: pneumonia, pleurisy, hemorrhage, and perforation. It may be used to some extent in nephritis. The graduated bath is the best here. Otherwise the pneumonia, pleurisy, and nephritis of typhoid fever should be treated as these diseases are treated when occurring alone.

In either hemorrhage or perforation, the patient should be kept at absolute rest. No general cold applications should be made, as they cause retrostasis of blood, thus increasing the hemorrhage. The extremities should be kept warm, all cold applications being removed until the temperature returns to normal. If it is desired to apply cold to the abdomen for the purpose of reflexly assisting in checking hemorrhage, it is best to apply the cold coil over a thickness of toweling, and use cold water at 50° to 65° for passing through the coil. After recovery from a hemorrhage, the temperature may be controlled by affusions, the cold towel rub, cold sponge, etc. Needless to say the abdomen should be avoided in giving any cold rub.

Tympanites is greatly reduced by the cold bath, and

is almost unknown where cold enemata and cold abdominal compresses are used. Of local measures, the almost continuous use of the cold coil, interrupted every hour by a fomentation, will give good results. The asafetida or turpentine enema should be used if the tympanites is extreme.

Without hydrotherapy, the mortality of typhoid fever varies from 20 per cent to 40 per cent. Under all forms of hydrotherapy the mortality is not over 7½ per cent. With the cold-bath system, if treatment is begun within the first week, the mortality may be reduced to between 1 per cent and 4 per cent.

QUESTIONS FOR REVIEW

1. What are the principal things to be accomplished in the treatment of typhoid fever?
2. What is the object of constant rubbing in the administration of the cold bath?
3. In the use of cold baths what would indicate that the fever is not typhoid?
4. In what way does an ice-bag to the head operate in the reduction of fever?
5. Under what circumstances should hot treatment be used in typhoid?
6. Explain in full the physiologic effects of the cold bath on the circulation, kidneys, and nervous system.
7. What precautions should be taken in hemorrhage and perforation?
8. Tell how you would treat typhoid fever in a home where no bath-tub is available.

CHAPTER XII

The Treatment of Fevers

(Continued)

MALARIA

FROM the standpoint of hydriatic treatment, malaria may be divided into two general types; viz., acute malaria and chronic malaria. While fully acknowledging the decided effects of quinin in malarial fevers in general, yet it must also be admitted that it comes far short of an ideal or unfailing therapeutic agent. In chronic malaria especially, it not only very often fails to cure, but may be the direct cause of failure or of death. Nor is it always successful in acute malaria. The reason seems to be that the malarial parasite becomes accustomed to the drug, while the body never does. The white cells are crippled or their activity wholly arrested by the quinin, thus destroying the body's natural defense. For this reason quinin should *never* be administered as a preventive.

The beneficial effects of hydrotherapy lie very largely in the stimulation of the phagocytes to accomplish the destruction of the malarial parasite. This, as we have already seen, is best brought about by cold water applied with friction or percussion. In the second place the beneficial effects of cold water are due to its action upon the blood-vessels. Two hours previous to the chill the surface vessels begin to contract until at the time of the chill they are in a state of extreme vasoconstriction; the skin is pale, the blood having been driven inward. This contraction of the blood-vessels is prevented by stimulating them to vigorous action (alternate dilatation and contraction), thus drawing the blood to the surface and preventing the excessive internal congestion.

If the hydriatic treatment of malaria is to succeed, it must be most carefully applied. The cold treatment must be suited to the reactive ability of the patient, and yet given most energetically. The last item can not be too strongly emphasized. An application given in a half-hearted manner will fail utterly. The use of much hot treatment, and especially of sweating treatment, will also cause failure.

The following program of treatment has been most uniformly successful. The case should first, if possible, be diagnosed by microscopic examination of the blood. The treatment should be begun at once. The part of the treatment which is of the most importance is that which just precedes the chill. This should begin from six to eight hours before the expected paroxysm. The first treatment had best be given cautiously until the reactive capacity of the patient has been ascertained. The bowels should be unloaded by an enema; the feet warmed by a short hot foot-bath followed by rubbing with cold water, then dried quickly. Next apply a fomentation to the spine or abdomen. It is usually best to use only one or two. Now, if the skin is warm and the patient feels warm, a vigorous cold mitten friction, with ice-water, should be given. Lose no time in drying the parts. On completion of the treatment the skin should be well reddened all over. If the patient can not react, then a reaction must be *compelled* by keeping the feet or legs in hot water and by applying a fomentation to the spine or abdomen while the cold mitten friction is being administered. In an hour or an hour and a half, give a cold percussion douche to the spine, legs, and feet. This treatment should be begun by a vigorous hot and cold percussion douche to the feet, the rest of the body being kept warm while this is applied. If the reaction is likely to be tardy, the patient may stand in hot water while the cold douche is given. The main part of the treatment, the cold

percussion douche, now follows. A *very short* hot douche may be given before the cold percussion douche. From three to five changes should be made. This cold douche treatment must be applied by one skilled in hydrotherapeutic technique. It should produce a decided reaction and the patient feel warm. Dry quickly by vigorous rubbing and percussion. After resting for another hour and a half, if the first two treatments have produced decided reaction, next administer a cold shallow bath. The temperature should be suited to the reactive ability of the patient, and may be from 60° to 85° F. The water should be about five or six inches deep in the tub. While the patient sits, two attendants rub the limbs and hips. Then the water is dashed up on the back, shoulders, and chest, and the rubbing continued. This is done two or three times. The patient now lies down, and the entire body is gone over with the rubbing. By this time the skin should be in a decided glow and the body red all over. Dry quickly as before. For further treatment a selection may be made from these three or some modification of them. They should be repeated about every two hours until the expected chill is well past. On the alternating days when no chill is anticipated, two or three general tonic treatments should be administered. The diet should be light but nutritious and the bowels kept open; the special program should be repeated on the next day on which a chill would regularly appear. The general tonic treatment would better be kept up for a week at least.

The cold treatments equalize the circulation, driving the stagnant leucocytes out of the spleen and other internal organs, whither they have been driven by the malarial poison and the resulting chill. Quinin has the same effect as the malaria toxin, causing the white cells to leave the outer blood-vessels and collect in the internal organs. This condition can not be combated by

sweating treatment, since, as we have already seen, it only encourages the stagnation of the white cells in the spleen and liver.

Cold treatment, when intelligently applied, and suited to the reactive ability of the patient, has been most successful. In chronic malaria a similar plan, or some modification of it, should be followed. Hydrotherapy is *always* to be preferred to quinin in *chronic malaria*, and may be used instead of quinin in acute cases.

MEASLES

Although measles is not a particularly serious infection, the patient may be made much more comfortable by hydriatic measures, and the liability to bronchopneumonia lessened by sustaining the vital resistance and preventing undue internal congestion. This latter is indeed the first object to be sought. The appearance of the eruption on the fourth day is accompanied by a decrease in the internal congestion and marked by a fall in the temperature. The fact that these events occur at the same time has led to the idea that a faint eruption is indicative of a severe illness or of bad results. To relieve this congestion some hot, sweating treatments should be given as soon as the fever makes its appearance. This is, of course, before a positive diagnosis can be made, since the eruption comes three or four days later. The sweating may be aided by the use of some hot drink. The head should be kept cool by cold compresses. In children where the skin is hot and dry, the wet sheet pack prolonged to the sweating stage will accomplish the desired result. The evaporating pack is also useful in reducing the fever later in the disease.

Some recommend the use of the warm half-bath, cold water being poured over the chest and shoulders at the close of the treatment. Friction should not be used in measles, because of the irritability of the skin.

The occurrence of bronchopneumonia as a complication of measles, demands most careful attention and vigorous treatment. In general the same plan may be followed as for this condition occurring alone. In order to lessen the tendency to pneumonia, it is necessary to use some form of treatment wh ch, without friction, will produce a decided cutaneous reaction. Short hot tub baths followed by sudden cold affusions admirably accomplish this result. The cold treatments also increase the depth of respiration, and so favor proper oxygenation of the blood. In older children a hot moist application to the chest interrupted by a sudden cold application, very materially aids in the expulsion of mucus.

SCARLET FEVER

Scarlatina is a much more serious affection than measles, and should be treated accordingly. It is especially necessary to sustain the circulation, to maintain general vital resistance, and to promote elimination. The first treatment should be a hot, sweating treatment. If the rash has not already appeared, or begun to appear, it will usually be brought out by this initial hot treatment. After the rash has appeared and the internal congestion been reduced, some form of cold treatment should be given. If the hot treatment has been a tub bath, the temperature may be gradually lowered to a comfortable tolerance. If a pack has been used, it may be followed by an evaporating wet sheet pack. These antipyretic treatments, such as the graduated bath, evaporating wet sheet pack, cold sponging, cold towel rub, cold affusions, etc., should be repeated sufficiently often to prevent the temperature from going much above 103° F. Extreme cold baths should not be used. The head should be kept cool, and the pulse-rate controlled by an ice-bag over the heart. For the sore throat or tonsillitis, fomentations, followed

by the heating throat compress, may be used. The patient should drink plenty of water, since the kidneys are especially liable to congestion.

If nephritis appears before the fever has declined to normal, the vigor of the cold treatments should be modified. Fomentations may be used to promote reactive ability. These should be applied the entire length of the spine or across the lower back only. A hot foot-bath should precede this, and a cold affusion, sponging, or wet sheet pack follow it.

Should the nephritis occur after the temperature of the patient has reached normal, it may be treated by the usual sweating measures. To maintain the general vitality, the cold mitten friction may now be used provided desquamation has begun. If endocarditis appears, the same plan should be followed as outlined for this condition in another chapter.

INFLUENZA

There are three general forms of grippe; viz., the respiratory, the digestive, and the nervous. Of these the respiratory form is most common. It is not a long weakening fever like typhoid, but is of shorter duration, and is accompanied by high temperature and high blood pressure for a brief time only. It is not, therefore, necessary to use prolonged cold applications.

The treatment as usually carried out consists of some active sweating measure, followed by a moderately vigorous cold treatment according to the reactive ability of the patient. In one previously well and strong and accustomed to cold bathing a hot and cold percussion douche may produce a beneficial result. The sweating treatment would best be a hot leg-bath accompanied by fomentations to the spine or neck and chest with cold to the head, or head and neck. This more effectually reduces the internal congestion than a simple sweat produced by hot air or steam. During

the hot treatment, the patient should drink one or more glasses of hot lemonade or other hot beverage. After sweating is well begun, cold water may be taken. The hot drink aids sweating because of the added heat. It also increases kidney activity, and so favors elimination. Care must be exercised that the patient does not faint while in the hot leg-bath. If the patient is inclined to faint easily, a hot foot-bath may be used with the patient reclining. If the pulse is very rapid, an ice-bag should be applied over the heart. When the treatment is given in a home, it may be concluded by a cold mitten friction, given by treating a single part at a time, drying and quickly recovering with a dry blanket. In a well-equipped treatment-room the sweating should be followed by a graduated spray. This should begin at 106° or 108° F., and the temperature raised gradually to the limit of tolerance. This is then maintained for a short time, and slowly lowered to between 95° and 90° F. It should not go lower than this; continue it for about two minutes. During the entire procedure the head should be kept cool by an ice compress. If desired, a hot and cold percussion douche to the feet may be used before the graduated spray. This makes the derivation more permanent, and helps to prevent fainting during the hot spray. The patient is now quickly dried, and should, if possible, sleep for some hours. Gentle perspiration during this time is an advantage. The succeeding treatments should consist of fomentations to the spine or abdomen, hot and cold to the spine, hot foot- and leg-baths, the cold mitten friction, hot and cold sprays, the salt glow, etc. The extreme sweating should not be repeated.

Needless to say a thorough enema should be given before the first treatment, and the bowels kept active afterward.

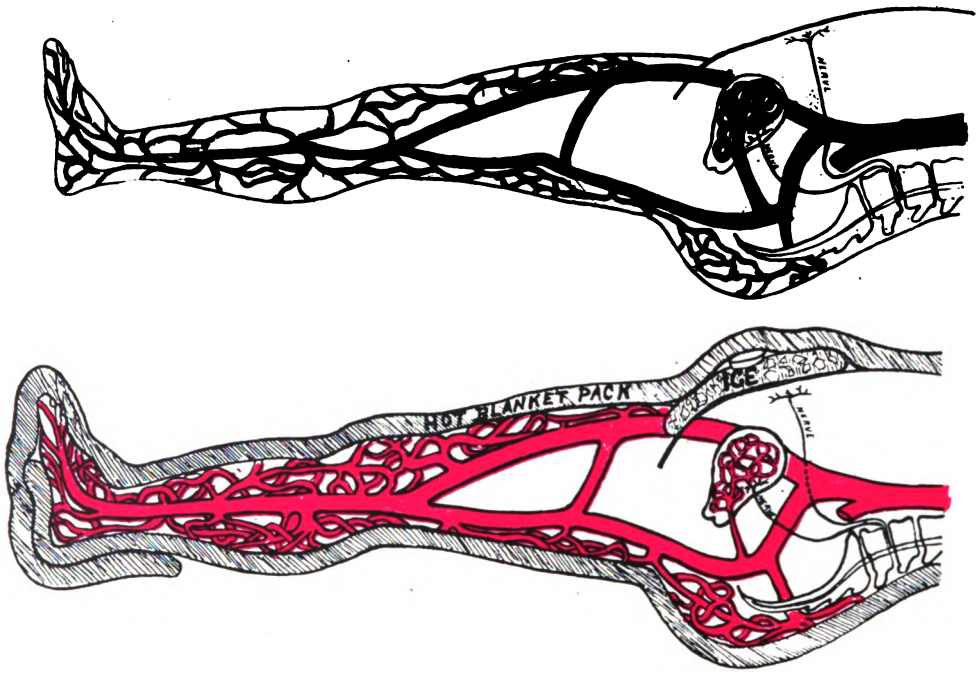
Headache may be relieved by the ice-cap or cold compress; also by alternate hot and cold to the head, in

case the cold has settled largely in the upper respiratory passages and nasal mucous membrane.

Sore throat should be treated by fomentations and the heating compress; cough, by fomentations to the chest, followed by the moist or the dry chest-pack. Pain in the back may be relieved by fomentations to the spine, and pain in the legs by a leg-pack followed by a vigorous cold mitten friction. Free water-drinking should be encouraged. A short fast will aid in rapid recovery.

QUESTIONS FOR REVIEW

1. Explain the mechanism of protection in malaria.
2. Explain the philosophy of hydriatic treatment in malaria.
3. Why use hot treatment at the first of measles and scarlet fever?
4. Why not use a cold tub bath in measles or scarlet fever? What may be used instead?
5. Give in detail the treatment of scarlet fever.
6. In what way should the treatment of influenza differ from typhoid fever, and why?



Congestion of the uterus relieved by hydrostatic effect of a hot pack, and the reflex effect of an ice-bag.

CHAPTER XIII

Inflammation and Antiphlogistic Effects

DERIVATION

DERIVATION consists in decreasing the amount of blood in some organ or part by increasing the amount of blood in some other part of the body. It is of practical importance in the treatment of congestions and inflammations, especially in the acute stage, or during the first few hours of the inflammatory process.

The most effectual method of securing derivation is by the use of some large hot application to a part more or less distant from the congested part, together with a small very cold application directly over the congested organ. The hot application dilates the surface blood-vessels, and so draws blood from all other parts of the body, but especially from the congested part. The cold application, either directly or reflexly, causes contraction of the blood-vessels in the congested organ, and so aids in decreasing the amount of blood in that organ. These effects may be termed "push" and "pull" effects. The hot draws the blood away, constituting the pull effect; the cold drives the blood away, constituting the push effect. (Plate I.)

The following are a few of the more important derivative treatments used for the conditions mentioned, and should in most cases be applied early in the disease, i. e., in the acute stage:—

1. Appendicitis — Hot hip- and leg-pack, with the ice-bag over the appendix.

2. Acute salpingitis or other pelvic infection — Hot hip- and leg-pack or full blanket pack with ice-bag to pelvis anteriorly.

3. Meningitis — Hot leg-pack only, with ice-cravat, ice-cap to head, and ice-bag to base of brain and upper spine.

4. Cerebral congestion — Hot foot- or leg-bath, with ice-cravat, ice-cap or cold compress to entire face and scalp.

5. Pneumonia (lobar) — Hot leg-bath, hip- and leg-pack or full hot blanket pack with cracked-ice compress over lobe affected.

In order to maintain the derivation that has been secured, it is necessary to conclude the hot treatment by giving a cold mitten friction to the same parts. While a *hot hip- and leg-pack* produces a *passive congestion* in the feet and legs, that for the time being relieves the internal congestion, the *cold friction* produces an *active congestion* of the limbs which is much more permanent.

DERIVATION BY HOT ALONE

In some conditions, especially where the congestion is not extensive, a large hot application applied directly over the congested part, draws sufficient blood to the surface to relieve the internal congestion. This is true in pleurisy, where local cold would only increase the congestion, and consequently the pain. The fomentations divert the blood from the inflamed pleura to the surface. A very small inflammation in some superficial part, may for a short time be treated by cold alone.

FLUXION

By *fluxion* is meant the extreme hastening of the circulation in a single part. In applying hot and cold applications to secure derivation they are applied to different parts at the *same time*. If the hot and cold are applied *alternately* to the same part, the result is fluxion. Any alternate hot and cold application produces fluxion by stimulating the blood-vessels to active dilatation and contraction. So-called revulsive treatments have the same effect. Fluxion effects are especially indicated in chronic congestion and in the chronic

stage of inflammations. The effect of alternate hot and cold applications is directly opposite to the effect of constricting bands, suction-cups, etc., used in the Bier hyperemia treatment. The former hastens the circulation; the latter delays it.

INFLAMMATION

The *five classic symptoms* of an *inflammation* are *redness, swelling, heat, pain,* and *loss of function.* Inflammatory conditions are said to pass through two stages — an acute and a chronic stage. While most inflammations are caused by bacteria and their poisons, there are other causes, such as burning, bruising, caustics, chemicals, etc.

In the acute stage the inflamed part is bright red in color, and swollen from the excessive amount of blood and watery exudate. The circulation is rapid, the pain is throbbing in character, due to the increased tension on the nerves with each pulsation. The blood stream and inflamed tissues are full of white cells, which tend to accumulate in the tissue and remain there.

In the chronic stage the circulation is slowed, the blood having accumulated in the veins. The tissues have thickened from beginning organization of the exudate. There are fewer white cells in the blood and tissues than necessary to accomplish prompt healing. The inflamed part is the seat of a more or less constant dull pain.

In the intermediate stages the condition passes gradually from that in the acute stage to that in the chronic stage.

TREATMENT

Since so many inflammations are due to bacteria, it is necessary, in planning any treatment, to provide for combating the infection as well as for the relief of the effects produced by the bacteria.

By considering the conditions in the *acute stage* it will be seen that treatment should be directed toward decreasing the congestion, and at the same time increasing the activity and efficiency of the phagocytes. This is best accomplished by *derivation*, and ideally by the use of heat to a more or less distant part with ice over the part itself. The combined applications decrease the congestion while the cold stimulates the activity of the phagocytes.

In the *chronic stage* an almost opposite set of conditions is present. The circulation is slowed, and the inflamed organ is full of impure venous blood, while there is a scarcity of leucocytes. To remedy this condition it is necessary to employ treatment having a *fluxion effect.* Alternate applications of extreme heat and cold change the venous congestion to an arterial congestion, and increased numbers of leucocytes are brought to the part. The increased rapidity of the circulation also hastens the absorption of the exudate.

In beginning the treatment of an inflammation, hot applications should be intense and produce decided derivation. The cold application over the part should continue while the hot application is in place. It may then be replaced by a cold compress which is allowed to heat up, or be continued by using an ice-bag, according to the nature and location of the inflammation. As the condition passes from the acute toward the chronic stage, less cold and more heat should be used over the part. At first the heating compress is sufficient; later a fomentation should be applied for a brief time. When the chronic stage is reached, the applications of heat and cold should alternate. If there are bacteria in the inflamed tissue, massage or rubbing should not be used. On the other hand, if the condition is a simple chronic congestion, or the bacteria have disappeared from the inflamed tissue, massage effects, such as kneading and friction, will be of decided advantage.

It will be seen from the discussion, that the use of constricting bands to produce venous congestion as a means of treating chronic inflammations, in no way meets the conditions. It is entirely irrational. The rational plan in chronic inflammation is to *increase* the rapidity of the circulation, not decrease it.

The following outline shows, in a condensed form, the conditions present in acute and chronic stages of inflammation, together with the objects to be sought by treatment and the result which appropriate treatment should produce.

ACUTE STAGE OF INFLAMMATION

CONDITIONS PRESENT

1. Arterial congestion
2. Watery exudate
3. Many leucocytes tending to stagnate
4. Pain severe and throbbing
5. Bright-red color

INDICATIONS FOR TREATMENT

1. Decrease congestion
2. Prevent exudation
3. Stimulate leucocytes
4. Relieve pain

TREATMENT SHOULD PRODUCE

Derivation

(Reducing of congestion)

CHRONIC STAGE OF INFLAMMATION

CONDITIONS PRESENT

1. Passive congestion
2. Thickening of exudate
3. Scarcity of leucocytes
4. Pain less severe and dull
5. Dark red, dusky, or bluish color

INDICATIONS FOR TREATMENT

1. Stimulate circulation
2. Cause absorption of exudate
3. Stimulate leucocytosis

TREATMENT SHOULD PRODUCE

Fluxion

(Increasing rapidity of circulation)

The use of proper treatment in the acute stage may prevent suppuration. But if the white cells accumulate in the inflamed part, being overcome by the bacteria, pus will be formed. After pus has formed, treatment will be of little avail; the abscess should be opened. After draining the abscess, fluxion treatment will cause the inflamed tissues to return more quickly to the normal state. After the formation of an abscess, either hot or cold treatment only very temporarily relieves the pain, or not at all. This non-relief of pain is often an evidence of abscess formation.

QUESTIONS FOR REVIEW

1. Define derivation, fluxion, and inflammation.
2. Does the term revulsion mean derivation or fluxion?
3. Describe the conditions present in acute and chronic inflammation.
4. Explain the philosophy of treatment for the chronic stage of inflammation.
5. What is Bier's passive hyperemia treatment? Why is it irrational?
6. Outline the chief points in the principles governing antiphlogistic effects as given in the chart.
7. Explain the effects of a hot hip- and leg-pack with ice-bag to the pelvis as used in pelvic inflammations. In what stage should it be used?

CHAPTER XIV

The Treatment of Inflammations

CONJUNCTIVITIS AND OTHER INFLAMMATIONS OF THE EYE

USE small cold compresses made of four to six thicknesses of gauze. These should be wrung from ice-water, renewed frequently and continued a long time, hours if necessary. The compress may occasionally be wrung from hot water and applied for a short time to make the cold more acceptable. To produce derivation, a fomentation may be applied to the side of the face, or a small piece of ice wrapped in gauze and laid over the eye itself and a fomentation applied over all. Cold compresses should be renewed about every two minutes. In the acute stage the cold should be almost continuous. In the chronic stage, heat and cold should alternate, the heat being applied for a shorter time than the cold.

ERYSIPELAS

Use an ice-bag which will well cover the inflamed part. Keep it on almost continuously throughout the disease, since the advancing border is always in the acute stage. In case the erysipelas wanders over other parts of the body than the head, face, or neck, extreme hot and cold applications may be applied alternately.

INFLAMMATION IN THE MIDDLE EAR

The pain of otitis media may be relieved by hot foot- or leg-baths and by fomentations to the side of the head over the ear. The patient must be careful after such treatment that he does not take an added cold. The treatment of otitis media should be under

the immediate care of a physician, as other measures than hydrotherapy are necessary.

ACUTE MASTOIDITIS

Before abscess formation or where the inflammation is limited to the periosteum, the ice-bag or Leiter coil may be used. This is especially beneficial in infants and children. To relieve the pain it is usually necessary to use a fomentation over the ear and side of the head. After pus forms, the ice-bag only increases the pain. In this case a very hot leg-bath together with an ice-bag to the neck on the same side of the head and a large fomentation over the ear and side of the head will give the greatest relief. When pus has formed, the case should be operated on as promptly as possible.

SIMPLE PHARYNGITIS (SORE THROAT)

Apply a large fomentation to the throat and upper chest, coming well up under the jaw and back to the ears. This should be preceded or accompanied by a hot foot-bath. These applications prolonged to sweating will be beneficial. In case this is done, cold compresses should be applied to the head and face. An electric-light bath or Russian bath may be given after the hot foot-bath and fomentations. If only the hot foot-bath and throat fomentations are used, the treatment should be concluded by a cold mitten friction and a heating compress applied to the throat to remain overnight. A hot and cold spray may be used or a hot and cold douche at the conclusion of the sweating treatment. Revulsive compresses to the throat should be applied two or three times a day. An antiseptic gargle should be used frequently.

ACUTE TONSILLITIS

The same general plan should be followed as for sore throat, except that all applications are to be more in-

tense. After a thorough enema, a vigorous sweat should be given; cold compresses or ice-bags must at the same time be applied to the head, and to the heart also if necessary. The tonic treatments should be more vigorous and given from two to four times a day. The cold mitten friction is ideal as a tonic in tonsillitis. Local treatments to the throat, such as fomentations and revulsive compresses, should be followed by a heating compress, which is left in place until the next treatment. Antiseptic gargles should also be used.

ACUTE BLOOD-POISONING — SEPTICEMIA

So-called blood-poisoning is frequently due to slight scratches, cuts, etc., which become infected. The treatment must be vigorous and be begun early, as fatal results may follow very quickly. The sign of immediate danger lies in the appearance of red lines extending upward from the infected part, as up along the inner side of the arm toward the axilla.

If the infected part is a hand or a foot, provide two pails deep enough so that the part may be completely immersed in water. Fill one pail with the hottest water that can be borne, and add hot water as the toleration increases. The other pail is filled with ice-water containing chunks of ice. The infected part is now immersed in the hot water for one and one-half to two minutes, then in the cold water for fifteen to thirty seconds. It is returned to the hot water for about two minutes, and again plunged into the ice-water for fifteen to thirty seconds. These changes should be kept up for a half-hour or longer. If desired, disinfectants may be added, but these must be very dilute. This alternate hot and cold immersion should be repeated from once to three or four times a day, according to the seriousness of the infection. Where it is not possible to immerse a part, the alternate hot and cold pour or low pressure spray may be employed.

Cases treated in this way will heal much more rapidly than when antiseptics alone are used. While cases treated by poultices, antiseptic dressings, etc., will require from a week to several weeks for healing, when treated in the manner described above, they will require but a few days or a week. The benefit is derived from the production of an arterial hyperemia and a decided local leucocytosis together with the stimulation of phagocytosis.

LOBAR PNEUMONIA

In order that pneumonia may be produced, it is necessary that two causes act at the same time. In the presence of a pulmonary congestion and the germ of pneumonia, the disease will nearly always appear. Either cause acting alone is incapable of producing the disease. The lung condition in pneumonia passes through three stages. The first stage consists of an intense congestion of the lung tissue. In the second stage there is an exudation of blood into the air-sacs, so that one or more lobes become consolidated. In the third stage, this exudate becomes softened and is absorbed. The crisis — a sudden fall in temperature — marks the beginning of the third stage. Strictly speaking, pneumonia does not exist until the second stage has begun. The pulmonary congestion may be checked if taken very early. This, however, is not often possible. After the formation of the exudate the disease can not be checked; it must run its course. To relieve as far as possible the pulmonary congestion should be the first object of treatment. To accomplish this give some strong derivative treatment, such as a hot leg-bath with fomentations to the chest or spine; at the same time the patient should drink some hot liquid so as to promote sweating. This must be free, and continue until the skin is well filled with blood. During the sweating treatment keep cold on the head and also over

the heart if necessary. A full hot blanket pack may be given for the same purpose. With either treatment a cracked-ice compress should be applied over the affected lobe. This should not be placed until the patient has been thoroughly warmed. It reflexly contracts the vessels of the lung, while the hot leg-bath or hot pack draws the blood away by congesting the limbs and skin. The sweating also aids the derivation. At the conclusion of the treatment, i. e., when all chilliness has been overcome and the pain partially or entirely relieved, the skin having been well filled with blood, give a cold mitten friction, uncovering one part at a time, and recovering with dry flannel before proceeding with another part.

While effective derivation is to be maintained throughout the disease by the use of hot foot-baths, etc., yet the sweating treatments should not be repeated. In the treatment of pneumonia there are three main objects to be attained. These are made manifest by the condition of the patient and the methods nature takes to combat the infection. The blood does not obtain the usual amount of oxygen, and so the tissues are poorly supplied. The heart works under added pressure and at a great disadvantage, because the consolidated lung offers so much resistance to the blood stream passing through it. There is an enormous production of white blood-cells in those cases where the system is able to offer much resistance to the infection.

The three objects of treatment are therefore as follows: First, increase the oxygenation of the blood; second, sustain the heart and circulation; third, stimulate phagocytosis.

All three of these results are obtained by the use of cold frictions, affusions, etc., and alternate hot and cold applications. The heart action and respiration may be stimulated by using the revulsive compress to the front of the chest or over the affected lobe. The changes should be sudden and extreme. The fomenta-

tion increases the ease of respiration, and therefore its depth. The cold, when suddenly applied after the hot, compels a deep inspiration, and greatly increases the amount of oxygen absorbed by the blood. The cold mitten friction should be given at least twice a day. Its special purpose is the relief of the heart by stimulating the peripheral circulation. The hot foot-bath should be given as frequently as necessary. A moist (heating) chest-pack may be applied between other treatments. In very vigorous patients a cold application, such as an ice compress, may be kept on the chest almost continuously, the reactive ability being renewed by an occasional fomentation, say every thirty minutes to every hour or even longer.

The supplying of plenty of fresh cold air is of the greatest importance. This one thing alone will do more than all the other means combined in reducing the mortality in pneumonia. Keep the patient warm by added bedding and the use of hot-water bottles. The windows should be opened wide and a constant supply of cold air kept up. Better still if the bed may be placed on an open veranda or a screen porch. If the patient is kept warm, no ill effects need be feared.

For pain in the chest use a series of three or four very hot fomentations. To relieve the cough and stimulate expectoration, use large fomentations, or for the latter, the revulsive compress. The heating hest-pack is beneficial for the same purpose. Inhalations of steam, either plain or medicated, are also useful. Plenty of water should be taken in order to hasten the elimination of poisons by the kidneys. Free water-drinking also helps to loosen the exudate and increase expectoration. The bowels should be kept open by warm enemas given daily throughout the disease. A cathartic may be administered at the beginning.

Quinin is very commonly used in pneumonia, yet nothing could be more harmful. It destroys nature's

defense by preventing the activity of the white blood-cells in destroying bacteria. It prolongs convalescence and delays the clearing up of the lung and the absorption of the exudate. If given in excessive amounts, there may be no crisis, the fever continuing until it gradually reaches normal. Delayed healing in pneumonia is often due to quinin.

Alcohol is another drug that has been very popular in the treatment of pneumonia. Reasoning from the effect of the drug as one of the predisposing causes of pneumonia, its use in treatment does indeed seem irrational, and so it is. Alcohol causes a partial paralysis of the blood-vessels, thus making the circulation unstable and increasing the danger from congestions. It also destroys the body's natural defense in the function of phagocytosis. Alcohol likewise limits the power of the blood to carry oxygen and lessens the ability of the tissues to use it. In all fevers through lack of sufficient oxygen, the body is loaded with unburned poisons, and alcohol only increases the difficulty.

BRONCHOPNEUMONIA

This disease occurs chiefly in children and the aged. Under two years pneumonia is practically always of this type. Bronchopneumonia is in reality a severe bronchitis involving the smaller bronchial tubes and the lung tissue immediately surrounding these.

The treatment is conducted upon much the same principles as in lobar pneumonia. To increase the respiratory functions is the chief object of treatment. First, overcome all chilliness by the use of a full hot bath or hot foot-bath with fomentations to the chest. If the tub bath is used, the child should, while sitting, receive one or two cold affusions to the chest and shoulders. This may be done by pouring from a large dipper water at 75° or 80° to 90° F. The temperature should

be governed by the age and vitality of the child. In infants, employ moist heat to the chest with dry heat to the feet and legs. After the child has been well warmed, or after the sweating begins, immediately place it in a wet sheet pack wrung from water at 80° to 85° F. Cover all with a dry blanket, placing a hot-water bottle at the feet. Leave the child in the pack until sweating has been reestablished. It may be allowed to sleep in the pack. This it will usually do as soon as the heating stage is reached. It may be taken out with a wet hand rub, or dried immediately and wrapped in a flannel blanket. The moist chest-pack, reenforced by a small hot-water bottle, will greatly ease respiration and facilitate expectoration. Extreme temperatures should not be used with infants. Mustard packs are sometimes beneficial as a reaction is produced without the application of much heat.

PLEURISY

The treatment given here is for the dry and serous forms only. The treatment of pleurisy is quite different from that for pneumonia. In the latter, cold applications are used early, and may be considerably prolonged. In pleurisy, cold is not permissible until the later stages, and even then should be of very brief duration.

On the first indications of pleurisy, the patient should be given a hot foot-bath, followed by several very hot fomentations to the chest directly over the painful area. These latter should be thick and large, and must be applied under the arm from sternum to spine while the patient lies on the opposite side. Continue until the pain is relieved. This may require from three to five fomentations. With persons in good flesh, the moist chest-pack may be applied immediately after the fomentations; use no cold at all. In thin persons, or those of low vitality, apply the dry chest-pack. In

either case it is well to reenforce it with a hot-water bottle laid against the chest outside the pack. The next treatment may consist of a hot foot-bath with fomentations to the chest, and concluded by a cold mitten friction, avoiding the chest. If the pain has been relieved, in the third treatment a revulsive compress to the chest may be used. From this on it is well to use the hot foot-bath, fomentations to the chest, and cold mitten friction in the forenoon, with the revulsive compress to the chest in the afternoon. After a week, if decided improvement is manifest, the alternate spray douche to the chest may be employed. The percussion douche should never be used. It may cause a return of the fluid or increase the water already in the chest. Never use the ice-bag to the chest in pleurisy. It delays absorption of the fluid, increases the pain, and very much prolongs the illness.

RHEUMATIC FEVER

Acute inflammatory rheumatism is an infectious disease affecting chiefly the synovial membranes and other joint tissues. It is also prone to attack the pleura and especially the lining membrane of the heart — the endocardium.

The objects to be attained in the treatment of rheumatic fever are: (1) The reduction of the inflammation in the joints; (2) the prevention of endocarditis and other complications; (3) the relief of the pain.

Local measures are used to treat the inflammation and relieve the pain. For this purpose hot applications are most commonly used. Among these are the fomentation, heating compress, stupe, medicated compress, hot air bath, and the radiant heat. These local measures should be applied to two or three joints at a time, and repeated at least twice a day. The hot applications must be extreme and of fairly long duration, in order to accomplish the best results.

The use of medicated compresses and packs between treatments is also of service. The gauze of the compress may be dipped in dilute solutions of pain-relieving medicines, or these may be rubbed on the joint. Oil of wintergreen is very commonly employed for this purpose. The natural oil of wintergreen given internally is effective in relieving the pain. It has no bad effects. The patient's general vitality should be kept up by the use of the cold mitten friction given twice daily. In many cases the use of hot applications fails of the best results. The use of extreme, continuous cold to the joints may be more successful. To apply this, cover the joint with a large, thick dry flannel cloth. Outside of this flannel, pack cracked ice or snow. Ice-bags may be used for the same purpose. Cover all with two or three thicknesses of flannel. Leave these ice packs in place for thirty minutes to an hour or more, until the part becomes almost numb. Care should be taken that actual freezing does not occur. The body should be kept warm by hot-water bottles, bricks, etc. The hot foot-bath may also be used.

When the cold has done away with the tenderness, the pack should be removed and the joint rubbed with snow or the dry hand until it is red and a thorough reaction secured. The ice-pack may now be replaced, or the treatment repeated after an interval of several hours. The inflammation runs a shorter course when extreme cold applications are used. Also use the cold mitten friction, hot and cold to the spine, and the ice-bag to the heart. The patient should take much water, and an occasional sweating treatment will be beneficial, say two or even three times a week.

Endocarditis.— To prevent inflammation of the heart valves, the patient must be kept at absolute rest. After the fever has subsided, the getting up should be very gradual, and no exertion allowed for some weeks. A physician should examine into the condition of the

heart at very frequent intervals, as it may be necessary for the patient to return to bed.

Throughout the disease use the ice-bag to the heart for a considerable period of time. Wrap it well in flannel, and leave it on for twenty to thirty minutes or more. Warm the skin and replace the ice-bag. The cold mitten friction is especially helpful in relieving the heart strain and in reducing the pulse-rate. The revulsive compress to the limbs may also be used.

MENINGITIS

In acute cerebrospinal meningitis, there are two main objects to be accomplished by hydrotherapy: First, the reduction of the cerebral congestion and relief of the cerebral symptoms; second, relaxation of muscular rigidity. In addition to the hydrotherapy, Flexner's serum should be given. It has resulted in saving seventy-five per cent of cases where it has been used.

To reduce the congestion of the brain and meninges, apply a large ice-cap or ice-helmet to the head. The ice-water coil may be used instead. Put another ice-bag at the base of the brain, and if it seems necessary, use a spinal ice-bag along the cervical spine. These should be kept on almost continuously. The limbs may be kept warm by the hot foot-bath, hot-water bottles, etc. A hot leg-pack or fomentations to the abdomen will aid in reducing the brain congestion. Do not apply heat to the spine. A cold pour to the head is very effective in lessening the delirium. It may be continued as long as twenty to thirty minutes.

Where there is much rigidity and backward bowing of the body, place the patient in a full warm bath at 98° to 100° F. Continue this from fifteen minutes to an hour. If the temperature of the patient is above 102° F., place an ice-bag at the base of the brain, or an ice-coil to the head. These warm baths are also useful in relieving the rigidity in tubercular meningitis.

APPENDICITIS

This is a surgical disease, and should be surgically treated. A safe recovery from an acute attack should not be depended upon as permanent, whether this has been secured by hydrotherapy or other medical treatment. For temporary relief, while waiting to operate, or to tide the patient over to the interval, hydrotherapy offers the safest and surest conduct and the best chances for immediate recovery.

Apply a hot hip- and leg-pack. After this has been placed, insert an ice-bag under the upper edge of the blanket just over the appendix. The principles of derivation which this treatment secures have been explained under this heading in the previous chapter. The pain is effectually relieved in those cases where rupture or abscess formation has not taken place. At the end of twenty or thirty minutes remove the pack, and give a cold mitten friction to all parts covered by the pack except the abdomen. Repeat the pack as often as necessary. Precede the treatment by a thorough warm enema. Cathartics should not be given. They may cause rupture of the appendix, or spread infection by stimulating peristalsis. In the chronic stage the greatest relief is obtained by fomentations to the abdomen or by the hot sitz bath.

PELVIC INFLAMMATIONS

This designation is meant to include such inflammations as puerperal sepsis, inflammation of the tubes or ovaries, pelvic cellulitis and peritonitis. While the prognosis, surgical treatment, and some local applications differ with the different parts involved, yet the hydriatic management is much the same in all. Hydrotherapy is useful in all these conditions, whether as an adjunct to the surgical treatment or as the main dependence. The patient should first be given a very hot

vaginal irrigation, either plain or disinfectant according to the condition. Following this the treatment is conducted upon the same principles as in appendicitis. Apply a hot hip- and leg-pack with an ice-bag to the groin, suprapubic region, or skin surface nearest over the inflamed organ. Continue twenty to thirty minutes; remove the pack and give a cold mitten friction. This treatment should be given two or three times a day, according to the necessities of the case. After the acute inflammation subsides, use the fomentation, revulsive compress, or other alternate hot and cold applications. The alternate hot and cold vaginal irrigation may be used in the chronic stage. It is, however, usually best to give a hot vaginal irrigation followed by the hot half-bath concluded by a cold pail pour to the hips. The revulsive sitz bath gives nearly the same effect. The sitz bath in its various forms is, perhaps, the best means of treating chronic pelvic inflammations. At first the temperature of the cold should not be too low. It may gradually be lowered until in the later treatments, very cold water is used. The alternate hot and cold percussion douche to the sacrum, feet, and legs is also an effective means of treating chronic pelvic congestions and inflammations. General tonic treatments should form a part of the régime for these cases.

QUESTIONS FOR REVIEW

1. Give in full the treatment of acute blood-poisoning of a hand.
2. What are the three main objects to be sought in the treatment of pneumonia?
3. Can pneumonia be aborted? Give reason for your answer.
4. What is more essential than hydrotherapy in the treatment of pneumonia?

5. Why not use alcohol and quinin in pneumonia?
6. Why do you use fomentations in acute pleurisy instead of the ice-bag?
7. What special precautions are to be taken in cases of acute articular rheumatism?
8 How may you relieve the pain of appendicitis without morphin?

CHAPTER XV

Stimulants and Tonics

THE terms stimulant and tonic are both applied to agents that increase vital activities. They do not, however, produce the same effects upon the body. It is commonly believed that stimulants are necessary in order to produce tonic effects. Nothing could be further from the truth. The following quotation from Sir William Broadbent very accurately defines the effect of a stimulant: "A falsehood that dies hard is the idea that stimulants, of whatever kind, actually give strength, and are necessary for the maintenance of health and vigor. Such is not the case, and the well-worn comparison, that they are the whip and spur and not the corn and grass, is strictly accurate. Anything accomplished under the influence of stimulants is done at the expense of blood and tissue, and, if frequently repeated, at the expense of the constitution."

While a stimulant calls forth energy that it is unable to replace, a tonic causes the body not only to expend energy, but also to build up its tissue, and therefore to store energy for future use. A stimulant gives a false idea of the ability for work. A tonic makes the body better able to perform its usual work. True tonics must of necessity exert their influence in a natural way. Drug stimulants never possess a natural action, and there is no such thing as a drug tonic. There are, however, physiologic stimulants. Their chief action is to arouse the body to unusual activity. They are all extreme measures, and are used chiefly in emergencies or where activities have become so deadened that strong means are necessary to arouse them. The hydriatic tonics are milder in their action. They heighten body functions within normal limits, and their after-effect is to cause an increase in the building-up processes,

HYDRIATIC TONICS

Tonic effects are derived mostly from cold applications or from alternate hot and cold applications. It has been shown how these increase the rapidity of the circulation, heighten muscular activity and nerve sensibility, increase heat production, etc. In the treatment of most diseases it is necessary to begin with mild measures, increasing the vigor of the treatment as the patient acquires reactive capacity. The following list of tonic measures is given in the order of their severity: —

1. Wet hand rub
2. Cold mitten friction.
3. Cold towel rub.
4. Salt glow.
5. Pail pour.
6. Cold douche.
7. Wet sheet rub.
8. Dripping sheet rub.
9. Shallow bath.
10. Cold plunge.

Tonic measures of one kind or another are used in practically all diseases. In some, however, special attention should be given to the securing of tonic effects. A few of these are listed below: —

1. Anemia.
2. Neurasthenia.
3. Hysteria.
4. Dyspepsia.
5. Insomnia.
6. Chronic articular rheumatism.
7. Organic heart-disease.
8. Obesity with fatty heart.
9. Diabetes.
10. Flaccid paralyses.

ANEMIA

In the treatment of anemia, remove as far as possible all known causes. One of the chief factors, if not the only one, in many cases, is defective digestion with intestinal putrefaction. In anemia there is not only a deficiency of iron in the blood, but also a general impoverishment of the tissues. The body is not supplied with the proper nutriment. Without an improvement in digestion and assimilation any form of treatment will fail. The food may be ample and organic iron abundant, but all to no avail if the system does not appropriate it. Artificial preparations of iron nearly always derange the digestion, and so defeat the very purpose for which they are given. Nor are these at all necessary since ordinary foods contain sufficient iron to amply supply the needs of the system for blood-making. The iron contained in vegetable foods is in the best possible form for assimilation. The iron of the yolk of eggs is especially useful, as it is so readily changed into hemoglobin. Fruits and green vegetables all contain organic iron, spinach as high as thirty-eight milligrams to one hundred grams of dry substance.

Therefore all that is necessary in the line of diet is to supply these natural foods which are rich in organic iron. Besides this, special treatments must be directed toward an improvement of digestion and assimilation. This is discussed under dyspepsia, and will not be taken up here.

General tonic treatment for the purpose of improving the circulation, the general nutrition, and especially as a stimulant to the blood-making organs, is indicated in all forms of anemia from whatever cause. A carefully graded system of tonic measures is necessary. In the extreme grade of anemia the mildest hydriatic tonics should be used first. It may be that the patient can react to nothing more vigorous than a wet hand rub

preceded by one or more fomentations. A hot foot-bath with fomentations to the abdomen or spine may be used. The hot treatments should not be prolonged, as anemic patients do not bear sweating treatments well. Later the cold mitten friction should be given, and when the patient has acquired ability to react well to this, the salt glow may be used. A mild hot and cold to the spine may be well borne at first, later being made more vigorous. The other tonic treatments may be given in their order. Progress should be made slowly. After the patient becomes able to react to a general spray, more rapid advancement may be made.

Full sun-baths are especially beneficial as the sunlight stimulates the production of red cells. Fresh cool or cold air is another physiologic means of decided advantage. It stimulates respiration and circulation and acts as a general tonic. The natural surroundings of the woods, fields, or mountains, where these requisites are best obtained, is also conducive to mental improvement, acting as an antidote to the blues and other neurasthenic symptoms. These, when combined with a simple natural diet and tonic hydrotherapy, offer the best conditions for the relief of anemia.

NEURASTHENIA

The forms of neurasthenia are almost as numerous as the patients afflicted with this disorder. The condition is rarely the result of a single cause. Usually several causes operate at the same time. Prominent among these are worry, business or social cares, indigestion, autointoxication, insufficient exercise, and lack of outdoor life, together with nerve shocks of various kinds. While all causes should be removed by placing the patient under the most natural surroundings, yet the special causes in each case require special attention. The condition of the patient is a mixture of general nerve and brain exhaustion with autointoxication, vaso-

motor derangement, and an unbalanced circulation. All these conditions require tonic treatment, while the nerve exhaustion may also require sedative measures depending upon its degree and particular nervous manifestations. A deranged digestion practically always accompanies neurasthenia and may be a direct cause.

In beginning the treatment of neurasthenia, employ those hydriatic means which may be least objectionable to the patient, and which produce no shock. After confidence has been established, proceed with the milder tonic measures, as the cold mitten friction, hot and cold to the spine, etc. Special attention should be given to the circulation in the extremities. For cold feet employ the alternate hot and cold foot-bath or the alternate hot and cold percussion douche to the feet. The loss of tone in the abdominal sympathetics and vasomotors may be treated by the graduated or cold sitz bath. In less vigorous patients, a hot foot-bath should be given and accompanied by continuous cold to the abdomen and head. The cold application to the abdomen is best accomplished by the use of the Winternitz coil. Continue this combination for fifteen to thirty minutes, and finish with a cold mitten friction. This treatment should not begin nearer than two and one-half hours after a meal. More acute abdominal distress may be relieved by fomentations. The cold treatments, such as the cold sitz and cold Winternitz coil, to the abdomen reduce the blood supply to the abdominal and pelvic viscera, and help to restore the irritated nerves of these parts to their normal tone. Sinusoidal electricity to the abdomen also stimulates the vasomotors and aids in the relief of venous congestion.

The patient should be encouraged to drink water freely between meals. An occasional electric-light bath aids the elimination, and helps to keep the skin in an active condition. Besides the particular attention given to the diet and measures calculated to aid digestion, the

liver should receive its share of special treatment. It is the organ which more than any other is responsible for the destruction of poisons. When it is overworked or inactive, these poisons accumulate and affect especially the nervous system. In order to decrease liver congestion and stimulate its circulation and activity, extreme measures are necessary. The revulsive compress and alternate hot and cold douche applied to the liver area are best calculated to produce decided results. Use also deep vibratory massage and sinusoidal electricity to the right upper abdomen, liver area, and lower dorsal spine. For the sedative treatment of neurasthenia see Sedative Effects.

DIABETES MELLITUS

Diabetes is a condition in which the system is unable to store or fully utilize the carbohydrate element of an ordinary diet. Diabetes may be due to disease of the pancreas or the liver. These are the principal organs at fault. Because the system is not able to completely oxidize the sugar, it is excreted in the urine as dextrose. To reduce the amount of starch and sugar of the diet to a minimum, only partly meets the needs in this condition. The body requires a stimulus to its oxidizing powers. This it is impossible to accomplish by other means than physiologic therapy. It has already been shown that cold applications combined with friction or percussion greatly increase the oxidation of carbohydrates. This is especially true of such treatments as the cold mitten friction and the cold percussion douche.

The tonic measures used in diabetes must be very carefully graduated to suit the needs of each case. Often only the mildest measures can be used at first. Short, hot applications, such as the fomentation, local electric light, hot foot-bath, etc., may be followed by the wet hand rub or cold mitten friction. Massage also aids in stimulating oxidative changes. It hastens

the circulation and increases the capacity of the muscles to utilize sugar.

Tonic hydrotherapy and massage, together with regulation of the diet, attention to general hygiene, outdoor life, and judicious exercise, will result in the greatest possible good.

VALVULAR HEART-DISEASE

While there are many different types of valvular heart-disease, yet the conditions requiring treatment are very much the same in all. Because of a leakage or a contracted valve orifice, the heart must expend more than the usual amount of energy in order to accomplish the usual amount of work. Therefore, its reserve supply of energy is not sufficient to meet emergencies. Running or other brisk exercise calls for the expenditure of more power than it possesses; but under ordinary circumstances it is able to perform its usual work, and still compensate for the leakage. A heart in this condition is said to be in the stage of compensation. On the other hand, when the ordinary work of the circulation is more than the diseased heart can perform efficiently, the condition is known as broken compensation. In the stage of broken compensation, there are such symptoms as edema of the feet and legs, palpitation, rapid pulse, labored breathing, cyanosis, etc. The heart compensates for the extra amount of work required of it by increasing the thickness of its muscular walls. In order that this extra growth of muscle may occur, the heart must have sufficient rest, as it is only in the period of rest that the tissue can be increased in amount or repaired. It will be seen from this that the heart must in some way be given more rest and permanently assisted to perform its work. There are three important ways of physiologically bringing about these results: —

1. By rest — physical and mental.

2. Ice-bag to the heart.

3. By measures which stimulate the peripheral heart.

1. REST.— This is of first importance. Absolute physical and mental rest must be observed in the stage of broken compensation. Physical rest may be secured by rest in bed or the use of a wheel-chair according to the gravity of the case. When the body is at rest, it requires less food and oxygen and consequently a less rapid circulation. Rest should be continued until slow walking does not materially increase the pulse-rate.

2. ICE-BAG TO THE HEART.— When a prolonged cold application is made over the heart, the heart-rate is decreased, the force increased, and the period of relaxation lengthened. This is a true tonic effect and can not be produced by any drug known. The effect of digitalis more nearly approaches the effect of the ice-bag than any other drug. But by contracting the blood-vessels, digitalis increases the work required of the heart, and by its cumulative poisonous action it increases the heart-rate and decreases its force, and may produce an irregularity of the beat. This the ice-bag does not do, and it may be used day after day. The ice-bag should be wrapped in flannel and left on from twenty to forty minutes. Its application should be repeated as often as necessary to maintain the proper pulse-rate.

3. MEASURES WHICH STIMULATE THE PERIPHERAL HEART.— The student should by this time be familiar with the normal activity of the blood-vessels. In Chapter III it was seen that the blood-vessels by their alternate contraction and dilatation perform no small part of the work of the circulation. It was also noted that both the rate and degree of dilatation and contraction may be increased by proper means. Chief among these vasomotor tonics are cold water and friction or percussion. The marked help thus given the heart by these means has to be seen to be appreciated. They often

cause the pulse-rate to decrease from ten to twenty-five beats in the course of a single treatment, and quiet, regular breathing takes the place of dyspnea.

a. Massage is the mildest of the vasomotor tonics. The friction and kneading movements hasten the venous circulation mechanically and stimulate the arterioles. Mechanical vibration is also a vasomotor stimulant.

b. Hydriatic Vasomotor Tonics.— Among these procedures the cold mitten friction occupies first place, since it possesses the greatest range of adaptability. It never overstimulates and may be used in the acute stage of endocarditis. The vigor of the application may be varied by changes in the temperature of the water used, by the degree of filling of the mitt, and by the amount of friction used. The ice-bag should be applied at the same time.

Of other hydriatic vasomotor tonics some deserve special mention. These are, the salt glow, hot and cold to the spine, hot and cold douche to the spine, legs, and feet, the alternate hot and cold foot- or leg-bath. Of special help when the limbs are cold or the circulation decidedly sluggish, is the brief application of a fomentation followed by a brisk cold mitten friction, these applications to be given to the limbs, spine, etc., in rapid succession.

c. Nauheim or Effervescent Bath.— This hydriatic and chemical vasomotor tonic is so widely used as to deserve separate mention. Its usefulness is limited to the chronic stage of endocarditis, and because of its cumulative action and liability to overstimulate the heart, it should be used with caution. Nevertheless it is a powerful agent for good, and its value has not been fully appreciated. For the method of giving the Nauheim bath see Technique. A course of eight to twelve treatments is all that should be given at one time. Two or three treatments a week for three or four weeks is suffi-

cient to obtain the maximum of good. Each treatment should last from five to twelve minutes. A large ice-bag should be placed over the heart while the patient is in the bath. Many advise that the patient rest for at least an hour after each bath.

d. Resistant Movements.— This is commonly known as the Schott treatment, and is combined with the use of the Nauheim bath. The treatment consists of alternate flexion and extension, abduction and adduction, etc., of various parts of the body against resistance. It is best performed by the assistance of a nurse who resists each movement. At first the series of movements should be of brief duration and with only slight resistance; later the duration of the treatment may be lengthened and the degree of the resistance increased. The procedure should never cause shortness of breath, rapid pulse, or fatigue. The Schott treatment can be used only in the stage of compensation.

e. Œrtel Method.— This consists of graduated walking and climbing exercises, and naturally follows the Schott treatment. At first the walking should be on a level, then up slight grades, and later up steeper grades. It should be used only after a fair degree of compensation has been secured. All exercises must be done slowly, and never carried to the point of increasing materially the pulse-rate.

In addition to these special methods, nothing is of greater importance than careful regulation of the diet and attention to outdoor life, especially as regards fresh air and sunshine. The diet is all-important, since gaseous dyspepsia may undo all that can be accomplished by otherwise the most skilled treatment.

CONTRAINDICATIONS

Excitant or extreme stimulating measures should not be used in organic heart-disease. The wet sheet rub, cold shallow bath, plunge bath, etc., must not be given

in this disease. The electric-light bath and other sweating treatments are usually contraindicated. If used at all, they must be very brief and in selected cases only. An ice-bag to the heart and cold compresses to the head and neck must be applied at the same time.

COMPLICATIONS

Edema.— All the measures calculated to restore compensation will aid in the relief of dropsy. Of local measures, the alternate hot and cold foot- or leg-bath is most efficacious. The water should fully cover the edematous parts. Follow by a thorough centripetal friction to the same parts. The alternate hot and cold spray douche to the feet and legs may also be used. These measures should be repeated daily or oftener.

Congestion of the Liver.— The application to the liver area of the revulsive compress or alternate hot and cold spray douche, will aid in decreasing venous congestion in the liver. A large fomentation with an ice-bag under the center, may be applied over the liver for the same purpose.

Acute Edema of the Lungs.— This is partly a result of acute engorgement of the heart and lungs due to some nervous shock or chilling. The philosophy of the treatment lies in as quickly as possible reestablishing the circulatory balance by drawing the blood to the surface. Place the patient's feet in hot water. To the spine apply a fomentation, and when the surface is well reddened, immediately follow it with a brisk cold mitten friction. Dry quickly with a Turkish towel, rubbing until a decided glow is produced. Treat the arms and legs in the same manner. As soon as the fomentation is applied to the spine, place an ice-bag over the heart. This entire procedure may need to be repeated in thirty or forty minutes. The moist sounds in the chest should clear up in a very short time if the treatment has been effective.

SURGICAL SHOCK

It has been shown that the low blood pressure and heart embarrassment in surgical shock are due to over-excitation or exhaustion of the vasomotor center. The condition in its results upon the circulation is very similar to the state of the vasomotors in infectious diseases. It is quite distinct from the condition known as collapse, which is due principally to hemorrhage. Of course, wherever there has been much loss of blood, it should be replaced by warm saline solution. This may be given by enema or by hypodermoclysis. Even in shock it is an excellent plan to give six or eight ounces of warm saline solution by rectum, as it stimulates the vasomotors and helps to stop further fall in blood pressure.

In the condition of surgical shock, the patient requires most prompt and vigorous treatment. It will require at least two persons properly to administer the treatment. One should give attention to the chest and arms, the other to the lower limbs. Quickly apply to the legs and feet well-wrapped fomentations, or give a hot foot-bath. Great care should be taken that the patient is not burned. As soon as the parts have been well warmed, which should require from three to five minutes, administer, with vigorous friction and very cold water, a cold mitten friction, rapidly dry the part, and finish with dry friction. Proceed quickly to another part, and repeat the procedures; i. e., the brief application of a fomentation, quickly followed by a cold mitten friction. This should be done until the entire body is covered. At the same time another nurse should give quickly alternating applications of heat and cold to the anterior surface of the chest by means of very brief applications of a fomentation and the ice rub.

These measures will result in prompt response of the blood-vessels and heart. Blood pressure will rise

quickly, and respiration become deeper and more regular. It has been repeatedly demonstrated by the best surgeons and physiologists that strychnin and other supposed heart stimulants are valueless in the treatment of surgical shock. With a patient in the condition of surgical shock the giving of strychnin only intensifies the shock, and the vasomotors become still further exhausted.

QUESTIONS FOR REVIEW

1. Distinguish between stimulant and tonic.
2. What are the chief indications in the treatment of anemia?
3. Explain the ways in which the nervous system is restored to a healthy tone.
4. What are the special effects of cold applications and of sinusoidal electricity to the abdomen in neurasthenia?
5. What form of treatment should be used in diabetes, and why?
6. Outline a daily program for the treatment of organic heart-disease in the stage of compensation; in the stage of broken compensation with dropsy of the legs.
7. Which should receive the greater amount of attention in the treatment of heart-disease, the heart or the blood-vessels? Why?
8. Name all the measures that stimulate the peripheral heart.
9. Give principles of treatment and methods used in treating surgical shock.

CHAPTER XVI

Sedative Effects

A SEDATIVE effect is the opposite of a stimulating effect. One lessens, the other increases vital activity. While the quieting of any overactive function may be called sedation, we prefer to limit the term to the action of nerve sedatives. The measures and effects to be discussed here are therefore such as bring about the relief of irritation, nervousness, convulsions, etc., and that are conducive to relaxation and rest.

In order effectually to restore any perverted function to normal, it is necessary to remove the cause of the perversion. When nervousness, insomnia, etc., are due to irritation of the nerve-centers by the poisons of autointoxication, the source of such poisons must be sought out and the proper treatment applied. Indigestion and constipation require special attention. The diet must be regulated so that the system may be free from poisons. Worry, anxiety, and close and prolonged application to business, or overindulgence in social duties, are causes which must be removed. When such causes as the above are removed, direct nerve sedatives may then be relied upon to produce satisfactory results.

The principal nerve sedatives may be classified as follows: —

1. General Sedatives: —
   a. Pure sedatives.
   b. Tonic sedatives.
2. Local Sedatives: —
   a. For relief of pain.
   b. For relief of paresthesias.

General sedatives comprise the milder hydriatic means. They are mostly neutral or warm applications. Local

sedatives are extreme measures, since pain and abnormal sensations can not be relieved by mild means.

GENERAL SEDATIVES

1. PURE SEDATIVES.

a. Neutral or warm bath 94° – 98° F.

b. Neutral wet sheet pack.

c. Warm or hot shower, spray, douche, or affusion.

d. Sponging — cool, tepid, or warm.

e. Heating compresses, as moist abdominal girdle, throat compress, moist chest-pack, etc.

f. Fomentations, especially to spine and abdomen.

The following sedatives are directed toward decreasing the congestion of nerve-centers: —

a. Hot foot-bath with cold to the head.

b. Cold sitz bath.

c. Cold-water coil to abdomen or head.

d. Alternate hot and cold foot-bath or percussion douche to the feet.

In nearly all these sedative treatments the derivation is all-important. The brain and other nerve-centers, being relieved of congestion, are less irritable, and this together with the relaxing effect produces an effective sedation. Even the two procedures more closely approaching a neutral temperature, the neutral bath and the wet pack, cause a decided decrease in the amount of blood in the brain. This is the normal condition essential for sleep. The cold sitz bath decreases the amount of blood in the abdomen and pelvis, and thereby lessens the irritability of the sympathetic nerves in these regions. Purely sedative measures are indicated in —

a. Neurasthenia.

b. Insomnia.

c. Hysteria.

d. Mania.

e. Chorea.

f. Rigid (spastic) spinal paralyses.

g. Epilepsy.

2. TONIC SEDATIVES.— Normal rest and sleep are the natural results of normal fatigue. We sleep because we are tired by the work of the day, and nature demands relaxation. The sleep following a day of labor outdoors is sound and refreshing. Those persons whose occupation is of a sedative nature are liable to nervousness and insomnia because of insufficient physical exercise. In such cases tonic measures are conducive to rest and sleep because of the fatigue which they produce. The following treatments are useful as tonic sedatives:—

a. Hot and cold to the spine.

b. Cold mitten friction.

c. Hot and cold spray, shower, or douche.

d. Neutral Faradic tub.

e. Massage.

f. Rapid Faradic current.

The two chief indications are the *insomnia* of neurasthenia and chronic *invalidism*.

LOCAL SEDATIVES

1. RELIEF OF PAIN.— In order to relieve pain, extreme measures are necessary. The treatment to be employed will depend largely upon the cause of the pain. Heat has a special pain-relieving action, and a hot application, in order effectually to relieve pain, must be as hot as can be borne by the patient.

The following treatments are useful:—

a. Very hot fomentations.

b. Hot immersion, as foot-bath, sitz bath, etc.

c. Hot pack, local or full blanket pack.

d. Hot enema.

e. Extreme cold, as ice-bag, ice compress, use of ice-water or cracked ice by mouth.

f. Cold immersion, as of hand or foot, sitz bath, etc.

g. Derivation.

The indications are numerous: —

a. Pain of deep-seated inflammation.
b. Pain of superficial inflammation.
c. Gastric ulcer.
d. Rectal ulcer.
e. Hemorrhoids.
f. Toxic neuralgia.
g. Inflammatory neuralgia.
h. Tenesmus — rectal or vesical.
i. Dysmenorrhea.
j. Colic — renal, biliary, intestinal.
k. Burns.
l. Sprains, bruises, etc.
m. Fractures.

2. RELIEF OF PARESTHESIAS (abnormal sensations, such as burning, smarting, itching, crawling sensations).— The following treatments are useful: —

a. Ice-bag.
b. Immersion in cold water or ice-water.
c. Very hot sponging.
d. Stupes.
e. Weak chemical irritants, as neutral saline bath, bicarbonate of soda bath, saline sponging, alcohol rub, witch-hazel rub, menthol compress.
f. Short sweating bath followed by tub shampoo and cool bath.

The indications are not numerous —

a. Pruritus from various causes.
b. Hives and heat rashes.
c. Formication.
d. Numbness and tingling.
e. Burning and smarting.

INSOMNIA

While there are many conditions in which insomnia may be present, yet it is the insomnia of neurasthenia

that demands special attention. The insomnia and many other nervous manifestations are due to a combination of nerve exhaustion and nerve irritability. With these causes there is usually present a congestion of the nerve-centers. Sleep comes as a natural result of normal fatigue, and in some cases all that is necessary in treatment is to produce this normal fatigue. This may be brought about by proper exercise, aided by tonic measures as outlined under tonic sedatives. Such treatment should be administered late in the evening.

Where the nerves are unusually irritable, directly sedative means are necessary. Best among the pure sedatives are the neutral bath and neutral wet sheet pack. All parts of the body should be warm before either of these treatments is given. It is well to make the neutral bath warm enough to secure a full relaxation. A temperature of 96° or 97° F. also aids in reducing the congestion of the brain and spinal cord, which is such a constant accompaniment of insomnia.

In some patients the wet sheet pack is much more efficient. To regulate the covering so as to maintain a neutral temperature requires almost constant attention. But when once well applied, a patient may spend the entire night in a wet sheet pack, so effective is it in promoting quiet, restful sleep.

The after-effects of a physiologic hypnotic are very different from those produced by drug sedatives. Medicinal hypnotics deaden the sensibility of the nerve-centers without in any way removing the causes of insomnia or so shaping conditions that natural sleep may result. With physiologic means the patient feels refreshed the next day, whereas after sleep produced by drugs, drowsiness, irritability, or headache is likely to follow. Some hydriatic means aim solely at the brain congestion. Among these treatments are those already enumerated. The alternate hot and cold foot-bath or hot and cold

douche to the feet, together with cold to the head and neck, are excellent means of relieving congestion of the brain. The cold sitz and cold coil to the abdomen, together with the hot foot-bath, are effective measures in decreasing irritability of the abdominal and pelvic sympathetics by decreasing the blood supply to the organs of these regions. In mild cases of insomnia there is nothing more successful than the application of two or three fomentations to the spine.

CHOREA

There are a number of choreiform diseases which may be treated upon the principles outlined for common chorea. From the first, rest in bed with freedom from all excitement is necessary. Sedative means will need to be repeated once or twice daily. The neutral bath is most effective. Make the patient comfortable by means of a sheet arranged in the tub as a hammock, and continue the bath from twenty minutes to an hour. Other means are usually best reserved until improvement becomes manifest. After a week or ten days, the neutral bath may be alternated with the wet hand rub, tepid sponging, and tepid affusions to the spine. After convalescence is well established, tonic measures should be used. These must be mild at first, but later, after the choreal movements have nearly ceased, may be quite vigorous. Outdoor life in the country is of great benefit, and it, together with dietetic regulation and hydrotherapy, will produce the greatest possible good.

SPASTIC PARALYSES

A spastic paralysis is one in which there is a state of constant muscular rigidity. This is due to the overaction of the reflex nerve-centers because control from the brain has been cut off. In the chronic stage of such conditions, it is necessary to apply sedative means.

That which has given the best results in these conditions is the prolonged neutral bath. The patient may be allowed to remain in the bath from one to four hours. It produces a relaxation and lessening of the rigidity. Fomentations to the spine will likewise aid in securing relaxation. Light massage and the wet hand rub may also be used.

EXOPHTHALMIC GOITER

Exophthalmic goiter (parenchymatous goiter) is due to enlargement and hyperactivity of the secreting part of the thyroid gland. When enlarged, the gland produces an excessive amount of secretion which by its overstimulation of the nerves causes the nervous symptoms peculiar to this disease. There are nervousness, restlessness, insomnia, tremor, rapid pulse, and usually moist flushed skin. The thyroid gland may pulsate because of excessive blood supply. The hydriatic management of exophthalmic goiter is much like that of organic heart-disease. In fact, rest, quiet, vasomotor tonics, etc., are applied in much the same manner as in heart-disease.

To lessen the blood supply to the gland and decrease its activity, apply the ice-bag for twenty to thirty minutes. It may then be removed and applied over the heart for about the same length of time, and then reapplied over the goiter. These alternations may be continued for one to two hours or longer as indicated and repeated two or three times a day. At least once, and in some cases twice, a day a cold mitten friction should be given. This tones up the blood-vessels, and so prevents the excessive perspiration; at the same time it helps to decrease the pulse-rate. The patient must be kept free from all mental excitement and worry. Absolute physical rest is necessary until the pulse-rate is nearly normal. Sedative measures may be indicated in some cases. The neutral bath, if used, should be

at a lower temperature than that given for the insomnia of neurasthenia. Cold feet should be treated by the alternate hot and cold foot-bath or alternate douche. Careful attention to rest and quiet with proper adaptation of the hydriatic means will produce the greatest good which can accrue from medical treatment.

MANIA

Maniacal conditions may be due to a variety of causes, which need not be considered here. In the curable cases autointoxication is a prominent contributing factor. Sudden and severe nerve strain acting upon a weakened nervous system, may give rise to mania. The quieting of the brain-centers in mania is always a difficult task. The full warm tub bath and the full neutral pack are almost specifics in this condition. The pack, besides offering a sedative temperature and producing derivation, serves to restrain the patient at the same time. The patient may be snugly wrapped in a sheet and placed in a neutral bath lasting from one to several hours. The marked quieting effect of both these measures has to be seen to be appreciated.

As intervals of quiet begin to appear, both tonic and eliminative procedures should be used. The hot tub bath or hot leg-bath with fomentations and other sweating treatments is useful. The head should be kept cool by the ice-cap or frequently changed cold compresses. Of tonic measures nothing quite equals the spray or shower. At first a shower graduated from warm to cool had best be given. Later the alternate hot and cold shower is of decided advantage. The cold mitten friction may be used before other more exciting means are suitable. Moderately hot fomentations to spine and the hot foot-bath are also calculated to produce sedation when the symptoms have somewhat abated.

EPILEPSY

A variety of measures are indicated in epilepsy. Congestion of the brain and spinal cord should be guarded against by hot foot-baths, cold to head and neck, fomentations to the lower spine, alternate douche to the feet, etc. Of the tonic measures which should be used selection may be made from the cold mitten friction, salt glow, cold towel rub, hot and cold to the spine, etc. A short electric-light bath, followed by a graduated shower, aids elimination, and combines both tonic and sedative effects. The neutral bath or pack may be used at night or during those periods when irritability or restlessness becomes manifest. In the general program of treatment for epilepsy a mild tonic treatment should be given in the forenoon and a sedative treatment, such as the neutral bath or massage, in the afternoon or evening.

TREATMENT FOR VARIOUS PAINFUL CONDITIONS

INFLAMMATIONS

The pain accompanying inflammation in internal organs and parts is best relieved by the derivative treatment outlined in a previous chapter. In most cases this consists of collateral heat with an ice-bag to the reflex area over the organ. In pleurisy, heat alone should be used. An ice-bag over the part increases the pain. The pain of an abscess does not readily respond to any treatment. It should be opened as early as possible.

In superficial inflammations either continuous very cold applications or alternate hot and cold immersion is most effective. These applications prevent the excessive swelling of the inflamed part, and so relieve the tension on the nerves.

GASTRIC ULCER

The pain of ulcer of the stomach is due largely to the irritation produced by the movements and spasm of the muscular wall. To relieve this the movements may be decreased and the organ relaxed by the application of fomentations, the hot trunk pack, or the moist abdominal girdle. It may be well to give cracked ice by mouth to decrease gastric irritability and aid in preventing hemorrhage.

RECTAL ULCER AND HEMORRHOIDS

The hot enema and especially the hot sitz bath are efficient in relieving the pain of rectal ulcer. The starch enema may also be used. In hemorrhoids cold is best calculated to relieve the pain, since it causes firm contraction of the dilated veins. For this purpose use prolonged applications of the cold sitz bath or ice-bag to the perineum. The alternate hot and cold perineal spray is also effective. Repeat the treatment daily or twice a day.

NEURALGIA

Very hot applications, such as the fomentation, hot-water bottle, hot douche, etc., usually give the greatest relief. Some neuralgias yield best to the régime of treatments outlined for inflammations, i. e., cold applications at first, with alternate hot and cold applications later, as the acute symptoms begin to subside. In the treatment of any neuralgia, general tonic treatment should not be neglected.

TENESMUS OF RECTUM OR BLADDER

Wherever the mucous membrane of a hollow organ is inflamed, the irritation causes spasm of the muscular walls. To relax this, hot applications are necessary. No cold at all should be used. For either rectal or bladder spasm, use fomentations to the lower abdomen, the hot enema, and the hot sitz bath.

DYSMENORRHEA

The most common cause of dysmenorrhea is a sharp anteflexion of the uterus, or taking cold. To relieve the congestion or swelling, so allowing the blood free exit, some derivative treatment, such as a hot foot- or leg-bath, the hot hip- and leg-pack, or hot sitz bath, should be given. A fomentation to the lower abdomen may be sufficient to afford relief. The hot enema and the hot vaginal douche may be given first. Continue the hot applications until relief is afforded. If much prolonged, use cold to the head and neck.

COLIC OF GALL-STONE OR KIDNEY-STONE AND INTESTINAL COLIC

In treating the first two conditions, resort to an opiate may be necessary. Less will have to be given, and it may be dispensed with in some cases, if large very hot applications are used. A hot trunk-pack or the full hot blanket pack is the best to use. These must be applied very quickly while the heat is still almost unbearable, or little good will result. Apply a hot-water bottle outside as soon as the heat of the pack becomes tolerable. Keep the head cool by cold compresses.

In intestinal colic, thoroughly cleanse the bowel by hot enemata and a simple cathartic. Next apply fomentations to the abdomen, repeating until the pain is relieved. The starch enema may aid in decreasing the colic of diarrhea.

QUESTIONS FOR REVIEW

1. Classify sedative effects.
2. What do you understand by a tonic sedative?
3. In what conditions is a tonic sedative indicated?
4. Nearly all physiologic sedatives have what effect in common?
5. Outline the treatment for insomnia, chorea.

6. How does the neutral or tepid bath act in mania?
7. Why not use a cold application to relieve the pain of inflammation in a hollow muscular organ?
8. How is the pain of a deep-seated inflammation best relieved?
9. In what way should exophthalmic goiter be treated like valvular heart-disease? Why?

CHAPTER XVII

Expectorant Effects

INFLUENCES brought to bear upon the respiratory tract so as to affect beneficially the flow and raising of mucous secretions are said to have an expectorant effect.

Other effects, such as easing the respiration, decreasing the cough and pain, also result from these same influences. When one "takes cold," contracts acute bronchitis or simple croup, there are two or three conditions which follow each other in a definite order. At first there is a dry cough, breathing is difficult, and there is no sputum raised. Next there is a more severe cough, possibly with some pain, and a very little thick tenacious mucus is raised. The sputum then becomes thinner and more abundant. It is raised with less effort, and the cough is said to have loosened.

The first two stages may last some hours or even days. The last stage marks the beginning of recovery. By appropriate treatment it is possible to hasten these changes, and mitigate the symptoms of cough, pain, and difficult breathing. In order to increase the fluidity of the secretions in the first stage and relieve the symptoms mentioned above, some form of hot moist application should be used. These may be fomentations to the chest and throat, inhalations of steam, hot-water drinking, the heating chest- or throat-pack, or some general sweating measure. The moist heat causes a more abundant and a more fluid secretion; it makes breathing easier and lessens the pain. These hot moist applications should be continued until the symptoms have been considerably relieved. Mild tonic measures such as the wet hand rub, cold mitten friction, etc.' may then be used. With vigorous persons the alter'

nate spray or alternate hot and cold douche may be employed. In the later stages alternate applications may be given with but very little preliminary heat. In selecting a sweating treatment, care should be taken that the heat is accompanied by moisture. For this reason the Russian bath is frequently used, while the electric-light bath, unless preceded by fomentations to the chest and a hot foot-bath, is less beneficial.

In a *simple cold*, first give a general sweating treatment, such as a hot foot- or leg-bath with fomentations to the chest and neck; accompany the treatment by hot-water drinking. Hot lemonade may be substituted for the hot water. It has the advantage of being a more active kidney stimulant. When the patient is perspiring freely, give a mild cold treatment, such as the wet hand rub, cold mitten friction, or graduated shower, according to the patient's vitality. He may then be put to bed with a heating chest-pack or heating throat compress or both, and allowed to perspire gently for some time. This should be followed the next day or after some hours by a series of three fomentations to the chest or spine and a cold mitten friction. As the expectoration becomes freer and more fluid, increase the proportion of tonic treatment by giving hot and cold to the chest or spine and the alternate spray or douche. The salt glow and pail pour may now be used. In a cold in the head (coryza) there is nothing more efficient than alternate hot and cold to the head. This, however, requires close attention to detail and careful following of the technique of this procedure.

In diphtheritic croup, of course antitoxin should be given promptly. Hydrotherapy will, however, serve many useful purposes in both real (diphtheritic) croup and simple croup. Apply a hot moist application to the chest and another to the feet. Wrap the child in a warm blanket, and continue the hot applications until a free perspiration is secured. The moist heat to the chest

is of prime importance. When sweating is well begun, the cough should lessen, breathing become easier, and the child presently fall asleep. It is often beneficial to administer steam by inhalation. This may be either plain or medicated. There are special "croup kettles" designed for this purpose; they may, however, be improvised at home. After all such treatment the child must be kept warm and away from cold drafts. The treatment needs to be repeated several times. As soon as possible the wet hand rub or cold mitten friction should be given. At first the chest must be avoided, but later may be included. After all sweating treatment the patient is, of course, more susceptible to colds; hence the necessity for some form of cold tonic treatment to restore the circulatory balance, and aid the nervous system in regaining its control of the blood-vessels and circulation generally.

QUESTIONS FOR REVIEW

1. State the changes occurring in catarrhal inflammations from the acute to the chronic stage.
2. How is each stage best treated?
3. Give outline of treatment for simple croup.
4. What precautions are to be taken in the use of hot treatment in colds, grippe, etc.?
5. What is a "cold"?

CHAPTER XVIII

Diaphoretic Effects

ANY means or measure used to produce sweating is said to have a diaphoretic or sudorific effect. There is a great variety of measures which induce general perspiration. To accomplish sweating, it is necessary that much heat be communicated to the body, or that an unusual amount of heat be generated within the body itself. The principal diaphoretic treatments are listed below: —

1. Electric-light bath (general or local).
2. Sun-bath.
3. Turkish bath.
4. Superheated air-bath (250° – 350° F.).
5. Russian bath or vapor-bath.
6. Full hot tub bath.
7. Hot blanket pack.
8. Dry pack.
9. Electrothermal pack.
10. Heating wet sheet pack.
11. Hot leg- or foot-bath.
12. Hot sitz or half-bath.
13. Fomentations to the spine.
14. Hot-water drinking.

Each measure has its own special advantages for certain conditions. The local hot applications have a wide range of usefulness, while the general and more extreme measures are much more limited in their adaptability. For some purposes tonic cold applications should immediately follow a general sweating treatment, but for other purposes little or no cold should be given afterward.

There are a number of important physiological effects produced by diaphoretic measures. Variations in the

mode of applying the treatment will enable the physician or nurse greatly to increase the special effect desired in any particular case. The more important effects are as follows: —

1. Increase perspiration (water chiefly).
2. Increase catabolic changes (spoliative or reducing).
3. Increase elimination of toxins through the skin and indirectly through the kidneys.
4. Improve the nutrition of the skin and of all its structures.
5. Relieve internal congestion.
6. Prepare the patient for cold treatment.

While nearly all ambulatory patients should be given an occasional sweating treatment, say at least once a week, there are a number of conditions that require excessive diaphoresis. Among these are certain diseases of the kidney in which it is sought to increase indirectly kidney activity by inducing general perspiration. Such diseases will be considered in the chapter on diuretic effects. Of other conditions benefited by sudorific measures, three only will be considered; viz., obesity, chronic rheumatism, and internal congestions.

OBESITY

Patients with marked obesity are usually also the subjects of muscular weakness, so that it is not enough merely to reduce the weight, but the general strength must be improved. To accomplish this latter object, there is nothing so efficient as frequent sweats accompanied by general tonic treatment. The strength may be markedly improved in a very short time, but the loss in weight will be only nominal. In order materially to reduce the weight, it is necessary to use extreme sweating measures frequently repeated and without the use of tonic measures. It will be remembered that both heat and cold tend to cause an increased breaking down

of tissue, but that extreme heat has no tendency to stimulate the building-up processes. For this reason the sweating treatments should be used alone, i. e., with little or no cold following, if it is desired to reduce the weight to any great extent. Of no less importance and usually of greater consequence in the treatment of obesity, is reduction in the amount of food taken.

To produce excessive perspiration in obesity, the following measures are available: Russian bath, Turkish bath, electric-light bath, full blanket pack, electrothermal pack and sweating wet sheet pack. Hot tub baths and the hot mud baths possess no advantages over other sudorific means. Active exercise and heavy massage or vibration should accompany the hydriatic treatment of obesity. Where a fatty heart accompanies a generalized fatty degeneration, the case should, in almost every respect, be treated as one of organic heart-disease, and placed at rest with vasomotor tonics.

RHEUMATISM

Chronic rheumatism of the uric-acid type is not a simple disease due to a single cause; hence treatment must consider all contributing factors. Without reduction in the amount of proteid food, elimination from the diet of purin-containing foods, and careful attention to autointoxication, all other treatment will fail of producing any decided result. The diet must contain no meat, dry legumes, or tea and coffee, as these articles contain purins, and therefore contribute to the formation of uric acid. The total proteid should not exceed thirty-five to forty grams per day.

The popular treatment of chronic rheumatism consists of extreme, prolonged, and frequently repeated diaphoretic measures. This is the usual treatment given rheumatic patients at hot springs. There are only a few rheumatic patients that receive great benefit by such a program. These are the obese rheumatics,

and even with them it is often carried too far. The usual sweating treatments, such as the hot tub bath, Russian bath, electric-light or Turkish bath, should be combined with tonic treatment and massage. The alternate sprays and douches are excellent for this purpose. Local hot applications to the painful joints may be followed by the alternate hot and cold spray douche to the same parts. Heating compresses, whether plain or medicated, are of benefit. They may be applied between other treatments. Free water-drinking should be encouraged by making a definite program for water-drinking.

With emaciated rheumatic patients the local hot applications are sufficient. These should be followed by a mild tonic measure, such as the cold mitten friction, applied solely to the muscular portions of the body, avoiding entirely the painful joints. An occasional alternate hot and cold to the spine should be given. This or plain fomentations to the spine are helpful in the insomnia and general nervousness of rheumatic cases. In real gout only hot applications can be applied to the foot during the paroxysm. In some much-reduced patients it is best for a time to use only general massage, together with attention to the diet, constipation, etc.

INTERNAL CONGESTIONS

Acute and chronic visceral congestions occur in a large number of diseases. Such congestions can not exist while the body is under the influence of a vigorous diaphoretic. The congestion and increased activity of the skin caused by sweating prevents stagnation of the blood in the internal organs. In nearly all chronic diseases of the liver, stomach, intestines, and kidneys, a sweating treatment once or twice a week is indicated. Follow this by a vigorous tonic so as to cause the blood to be retained in the skin as long as possible.

Again in acute inflammations diaphoretic measures are often indicated at the beginning in order to prevent undue internal congestion. Such is the case in grippe, pulmonary congestions, pleurisy, acute Bright's disease, scarlet fever, and measles. The treatment of these conditions has been considered elsewhere.

QUESTIONS FOR REVIEW

1. What precautions are to be taken in administering hot treatment?
2. Name the special effects of diaphoretic measures.
3. What class of rheumatic patients may be given frequent sweating treatments?
4. What is of more importance than hydrotherapy in the treatment of chronic articular rheumatism?
5. In what way are internal congestions benefited by diaphoresis?

CHAPTER XIX

Diuretic Effects

DIURESIS is a term which in its broadest sense is used to designate an increase in the efficiency of kidney excretion. As the term is ordinarily used, it means an increase in the amount of the urine.

That condition of kidney activity which is of greatest benefit to the body in disease is an increase in the amount of the urinary solids excreted, especially of poisonous substances whose retention within the body is the source of disturbance. It has already been mentioned that there is a close relation existing between the activity of the skin and that of the kidneys. In the treatment of disease increase in the solid constituents of the urine brought about by sweating measures is of special value. Sweating lessens the stagnation of the blood in the kidneys (and all other congested internal organs). This hastening of the flow of blood through the kidneys causes them to act more efficiently, and they therefore excrete a greater amount of urine. Other measures than sweating treatments reflexly and mechanically influence the circulation and glandular activity of the kidneys.

The following are the principal diuretic measures which are useful in kidney inactivity and kindred conditions: —

1. Full hot blanket pack.
2. Electric-light bath.
3. Russian and other vapor-baths.
4. Full warm tub bath.
5. Water-drinking (especially when combined with other treatments).
6. Cold (or hot and cold) douche to lower sternum and lumbar spine.

7. Heating trunk-pack.
8. Fomentations to lumbar spine.

These diuretic measures are especially useful in —

1. Bright's disease, acute or chronic.
2. Uremia, eclampsia, etc.
3. Ether and post-operative nephritis.
4. Ptomain-poisoning.
5. Poisoning by lead, turpentine, alcohol, etc.

BRIGHT'S DISEASE

In the treatment of Bright's disease there are other considerations than those just discussed. In mild cases of acute Bright's disease the kidney may be restored to nearly its normal structure. But in many cases of acute and in chronic nephritis the changes in structure are permanent. Therefore hydrotherapy aims only at correcting, as far as possible, the functional defects due to the changes in structure. The kidney is an organ of necessarily constant activity, and in disease this activity must increase rather than decrease. Therefore, when the kidney is inflamed, the best that can be done is to lighten as much as possible the work demanded of it, and decrease the sources of irritation; i. e., the amount of poisonous wastes which must pass through it. There are two ways in which to accomplish these results: First, by more complete burning up (oxidation) of wastes, thus lessening the toxicity of the urine; second, by diluting the urine, thus rendering its excretion less difficult and less irritating to the inflamed kidney tissues. In order to decrease nitrogenous and acid waste a low proteid diet and a diet free from uric acid (purin) must be adopted. This means a vegetarian diet, rich in fruit and fresh vegetables, and having sufficient cereals, eggs, and milk to provide for the nutritive requirements of the body. Digestive disturbances and constipation should receive proper attention, in order to lessen the formation and absorption of toxins.

As has already been shown, hydriatic applications cause a much more complete oxidation of nitrogenous substances, as well as an increase in the amount excreted. This latter result is especially prominent after the full warm bath at 95° to 100° F. It causes an increase in the elimination of nitrogen, salines, and water even in the presence of dropsy.

It has been shown that edema (dropsy) is largely due to the inactivity of the illy nourished cells of the blood-vessel walls. Alternate hot and cold applications greatly improve the circulation, and hence the nutrition of the tissues generally, including the blood-vessel walls. The alternate hot and cold leg-bath may be used for edema of the feet and legs. In chronic Bright's disease with dropsy, it is one of the most efficient measures available. Warm and sweating baths are also effective in the same condition. Free water-drinking aids in the elimination of wastes and salt. There is no evidence that free water-drinking is harmful where the amount of urine is less than normal. It does not tend to increase dropsy. In dropsy it is well to withhold salt from the diet for a time.

ACUTE BRIGHT'S DISEASE.— In acute kidney inflammation (nephritis), nothing has proved of greater value than sweating treatment. The congestion of the skin relieves the kidney congestion. The sweating also relieves the kidney of part of its work as an excretory organ, and the heat causes an increased oxidation of nitrogenous wastes. The patient should be given one or two sweating treatments daily accompanied by free water-drinking and the use of lemonade and oranges. For sweating purposes the hot foot-bath with fomentations to the abdomen or spine may be used; also the hot trunk-pack or in extreme cases the full hot blanket pack. During the treatment the head should be kept cool by compresses or the ice-bag. Finish with a tepid sponge. In milder cases a brisk cold mitten friction

may be given at the close. The hot-air bath or vapor-bath may be given in place of other sweating measures. On the completion of a sweating treatment after the sponge or friction has been given, the patient should be placed between warm dry blankets, and continue to perspire gently for some time.

CHRONIC BRIGHT'S DISEASE.— A greater variety of hydriatic measures may be used in chronic nephritis. A warm dry climate should be selected. Light work outdoors is a decided advantage. The perspiration occasioned by it is even more beneficial than that produced by artificial heat. All forms of hot baths may be used, and these should be concluded by tonic treatment of mild and medium grade, such as the cold mitten friction, graduated or alternate shower, douche, pail pour, salt glow, etc. Sweating treatment should be given about three times a week. Alternate hot and cold applications to the spine, kidney region, and feet, are helpful in stimulating the renal circulation. The full warm bath is highly recommended by some in both acute and chronic nephritis.

Where chronic nephritis is accompanied by arteriosclerosis (hard arteries), extreme measures are to be avoided. The milder sweating and tonic treatments should be used in such cases.

Medicinal diuretics can not be recommended since they are, without exception, the source of added irritation to the kidney. The natural fruit acids are the only diuretics other than water which do not irritate the kidney cells.

UREMIA AND ECLAMPSIA

Both uremia and eclampsia have one condition in common; viz., a toxemia due to the accumulation of nitrogenous wastes in blood and body tissues. In the majority of cases both the liver and kidney are responsible for this accumulation of toxins. In many

cases there is an added congestion, edema, or increased pressure within the kidneys. As in all other nitrogenous toxemias a highly proteid diet and especially a meat diet are predisposing factors. In eclampsia there is the exciting cause — pregnancy and a nervous temperament. In spite of the very best treatment, it is often necessary to empty the uterus to avert a fatal issue.

In the management of chronic uremia of pregnancy with a tendency to faulty elimination, it is necessary to reduce the amount of proteid in the diet and forbid both tea and coffee.

Mild sweating treatment accompanied by tonic measures should be given two or three times a week. The patient should take water freely and frequently. Special attention should be given to the digestion, liver activity, and regularity of the bowel movements. Local hot and alternate hot and cold applications to the abdomen and liver may be given on alternate days. In case albumin appears in the urine or the urea decreases greatly, the patient should be under constant treatment.

In the treatment of the acute attack, diaphoretic measures have proved more helpful than any other means. The full hot blanket pack is that most commonly administered for this purpose. Water should be taken freely before and during the pack. Saline solutions may be given by hypodermoclysis or by enema. This alone has been sufficient in many cases. It should cause diuresis in a very short time. The saline enema is best given by the Murphy method or a half pint of hot saline solution at a time.

The full hot bath is recommended by some. During all hot treatments it is necessary to keep the head cool by ice to the head and neck. If it is necessary to much prolong the pack, an ice-bag may be placed over the heart. In case there is not prompt response to the sweating treatment, it may be well to administer a rub-

bing wet sheet pack with a cold pour, continuing the friction after each pour until the body is thoroughly warmed.

QUESTIONS FOR REVIEW

1. Explain the relation between the functions of the kidneys and skin.
2. What measure should accompany all diuretic procedures? Why?
3. In what ways may the work of the kidneys be lessened in Bright's disease?
4. Tell how to treat edema of the legs.
5. What one measure is used most in acute nephritis?
6. What would you do for a patient in eclampsia before the physician arrives?

CHAPTER XX

Peptogenic Effects

THE term "peptogenic" as here used includes all those effects upon the digestive organs and functions which cause an increase in digestive activity. All tonic treatments increase the muscular and glandular activity of the stomach and intestines and the glandular activity of the liver and other digestive glands. However, in addition to general tonic treatment special attention should be given to the digestive organs themselves. The following list of treatments are among those which are most useful for this purpose:—

1. Hot and heating trunk-pack (Winternitz pack).
2. Hot trunk-pack.
3. Fomentations to abdomen.
4. Revulsive compress to the abdomen.
5. Hot and cold to the spine.
6. Hot and cold douche to abdomen, liver, or spine.
7. The moist abdominal girdle.
8. Hot-water bottle over stomach after meals.
9. Ice-bag over the stomach or cold-water drinking before a meal.

Each treatment has its special adaptability. Some are used in mild cases, others in more rebellious conditions. They are given above in the approximate order of their efficiency. When properly selected to meet the needs of the individual case, these treatments are indicated in the following conditions:—

1. All forms of atonic indigestion.
2. Chronic congestion of the liver.
3. Anemia of the liver.

ATONIC DYSPEPSIA

Under this head we include such diseases and conditions as deficiency of hydrochloric acid, gastric dila-

tation and prolapse, deficient gastric motility, biliousness, and starchy indigestion. In one way or another these are all manifestations of a decreased activity.

While each type of dyspepsia requires some special measures, yet the treatment of all should follow about the same general program of hydrotherapy. In the main this is as follows: Half an hour before the meal the patient should be instructed to take half a glass of cold water or even ice-water. An ice-bag over the stomach for ten minutes, beginning thirty or forty minutes before the meal, serves the same purpose. The reaction to this cold application comes on about the time food is taken, and so increases the flow of the digestive juices and stimulates the gastric muscles. Following the meal apply some form of hot application, such as the hot-water bottle, hot coil, or the fomentation. These hot applications should continue from twenty minutes to nearly an hour. In very rebellious cases the Winternitz or hot and heating trunk-pack will be found an almost never-failing remedy. It is also indicated in persistent vomiting. It may be applied directly after the meal or just before the meal, and left on from one to three hours; conclude with a cold mitten friction.

In the general run of cases, about two or three hours after the meal apply a treatment consisting of the hot foot-bath, revulsive compress to the abdomen, or hot and cold to the spine, together with a cold mitten friction or cold towel rub. The hot and cold douche to the spine, liver, legs, and feet is also an excellent measure. The moist abdominal girdle applied overnight may aid in some cases. It should be dry by morning.

In addition to hydriatic treatment, proper attention should be given to diet, exercise, rest, outdoor life, etc. Both massage and sinusoidal electricity, especially to the abdomen and spine, are of the greatest help in these cases of atonic indigestion. In case of a markedly dilated stomach, the drinking of much water at one

time is a detriment. This is also true of the common practise of washing out the stomach with warm or hot water. It only increases the dilatation unless concluded with cold water, intragastric electricity, or some other special measure. In general prolapse of the abdominal organs, the cold rubbing sitz bath is an excellent measure, also the cold or alternate hot and cold douche.

HYPERACIDITY

This is said to be the first stage in the history of a chronic indigestion. Only a few cases, however, are so extreme as to require special treatment. The hyperactivity, increase of acid, and general nervous symptoms require both local and general sedative treatments. The treatment is the opposite of that outlined for atonic dyspepsia. Use the hot-water bottle or a hot drink before the meal and the ice-bag after the meal. At night apply the protected girdle. Use the neutral bath and neutral pack instead of tonic treatments. Omit all meat, condiments, and pastry from the diet. Give no food that contains a large amount of proteid. Oils, either free or emulsified, as olive-oil, cream, and unsalted butter, are of decided benefit in decreasing the secretion of acid.

QUESTIONS FOR REVIEW

1. Outline a general program for atonic dyspepsia.
2. What special treatment should be given in a case of gastric dilatation? in general prolapse of the abdominal organs?
3. How would you treat a case of persistent vomiting due to gastric indigestion?
4. Of what value are the following in atonic dyspepsia — outdoor exercise, employment, cold-water drinking, hot-water drinking, a rubbing foot-bath?
5. How should a case of hyperacidity be treated? Upon what principles is this treatment founded?

PART III

Technique

Technique

CLASSIFICATION OF PROCEDURES

BECAUSE of similarity in technique and for convenience of description, the procedures of hydrotherapy have been classified under the following heads: —

1. LOCAL APPLICATIONS OF HEAT.— These include localized applications of heat to such areas as the abdomen, spine, chest, or a joint. Examples: the fomentation, hot-water bottle, radiant heat.

2. LOCAL APPLICATIONS OF COLD.— These are circumscribed applications of cold to such areas as those mentioned above. Examples: ice-bag, cold-water coil.

3. HEATING COMPRESSES.— A heating compress is a local application of moist heat made by applying next to the skin a cloth wrung from cold water, and so covered with flannel or an impervious covering as to cause an accumulation of body heat. Examples: moist chest-pack, moist abdominal girdle, heating compress to throat.

4. POULTICES.— A poultice is an application of moist heat made by means of a semisolid mixture of various substances, and applied to the body while hot. Examples: flaxseed, clay and glycerin, charcoal.

5. TONIC FRICTIONS.— A tonic friction is an application of cold water so combined with friction as to produce stimulating or tonic effects. Examples: cold mitten friction, wet sheet rub.

6. SPONGING.— Sponging or ablution consists in the application of a liquid by means of a sponge, a cloth, or the bare hand, in which the chief effect is derived from the liquid applied. Examples: cold water sponging, alcohol rub, soap wash.

7. RUBS AND FRICTIONS.— These are procedures in which the chief effect is derived from friction with the bare hands. Examples: centripetal friction, oil rub.

8. BATHS.— Under this heading are included various local and general procedures in which the body is immersed in water, light, heated air, or vapor. Examples: tub bath, foot-bath, electric-light or Russian baths.

9. SHAMPOOS.— The term shampoo applies to local or general cleansing measures by means of soap and water. (It is sometimes applied to massage.) Examples: Swedish shampoo, Turkish shampoo.

10. PACKS.— A pack is a procedure in which a considerable portion of the body is enveloped in wet sheets or blankets for therapeutic purposes. Examples: Hot blanket pack, hot hip-and-leg pack, wet sheet pack.

11. SPRAYS AND DOUCHES.— A spray or douche consists in the projection of one or more streams of water against the body. Examples: shower-bath, needle spray, pail pour, hot and cold douche.

12. ENEMATA.— An enema is an injection of fluid into the lower bowel. Examples: warm enema, rectal irrigation, coloclyster, oil enema, starch enema.

13. VAGINAL DOUCHES.— A vaginal douche consists in the flushing or irrigating of the vaginal cavity with a fluid. Examples: hot vaginal irrigation, disinfectant douches, styptic douche.

REMEDIAL PROPERTIES OF WATER

The terms listed below are commonly used to designate the various physiologic or therapeutic effects of water. The definitions given should be studied thoroughly and memorized:—

1. TONIC.— A tonic effect is one in which vital activities are increased so as to restore the body to a

normal tone or condition. The nutrition, circulation, and other body functions are promoted.

2. PURE STIMULANT.— A stimulant arouses the body to unusual activities. It may be compared to a whip, and is used chiefly in emergencies. Like a tonic it increases vital activities, but to a much greater degree. Between a pure stimulant and a tonic there are various gradations which might be designated as mild stimulant, extreme tonic, etc.

3. SEDATIVE.— A sedative or calmative agent is one which lessens vital activity and is conducive to relaxation and rest.

4. ANTISPASMODIC.— The relaxing of spasm or relieving of convulsions.

5. DEPRESSANT.— A depressant effect is one in which heightened or normal body activities are decreased to a marked degree. Such an effect is desirable only where a function is greatly overactive.

6. ANODYNE.— An anodyne effect refers to the relief of pain.

7. SPOLIATIVE.— A spoliative treatment is one which increases the oxidation and breaking down (catabolism) of tissue; tending to reduce weight.

8. DIAPHORESIS.— The production of sweating. An agent that produces sweating is said to have a diaphoretic or sudorific effect.

9. DIURESIS.— Increasing the excretion of urine.

10. ELIMINATIVE.— An eliminative effect consists in promoting and hastening excretion from the kidneys (diuresis), skin (diaphoresis), and lungs.

11. DERIVATIVE.— Derivation is the drawing of blood or lymph from one part of the body by increasing the amount in another part. The term *depletion* is also applied to this process, but refers particularly to the result produced.

12. FLUXION.— Fluxion consists in greatly increasing the rapidity of the blood current in a particular part. It is the production of active or arterial hyperemia.

13. ANTIPYRETIC.— The lowering of body temperature in fever.

14. REFRIGERANT.— Relieving of thirst and restoring the alkalinity of the blood by such means as free water-drinking and the use of fruit-juices.

15. REVULSIVE.— A term used to designate a treatment consisting of a single prolonged application of heat followed by a single very brief application of cold. This meaning is not strictly adhered to, as the term is also used where three applications of such proportionate duration are made.

16. ALTERNATE.— The expression "alternate hot and cold" is used in this text to describe treatments in which the duration of the cold application is from one fourth to one half that of the heat (in a few cases equal to it) and in which three or more changes from heat to cold are made.

LOCAL APPLICATIONS OF HEAT

FOMENTATIONS

(FO.)

A fomentation is a local application of moist heat by means of cloths wrung from hot water.

1. *Articles Necessary.*— In well-equipped treatment-rooms the fomentation tank should be so arranged that the water from which the fomentations are to be wrung, can be heated by a coil of live steam. When properly arranged, the escape of steam from this coil into the water will be noiseless, and cause the water to boil more vigorously than over a fire. A wringer with extra long rollers should be clamped to the side or end of the tank, and a table placed immediately beyond the wringer, on which the fomentations may be wrapped.

If treatment is given at the patient's residence, a boiler or pail of hot water may be used. In an institution it is rarely necessary to carry a pail of hot water to the patient's room, as the fomentations will be hotter if prepared in the treatment-rooms and packed in a pail in the manner described below. The nurse should also be provided with a set of six fomentation cloths, two Turkish towels for drying the patient, one large cotton sheet for covering the patient, a bowl of cold water or ice-water, and one or two hand towels. An oilcloth and extra sheets and towels will be necessary to protect the bedding. If the treatment is to be given in a patient's room, provide a grass mat on which the pail of fomentations or hot water may be placed. If the pail is placed on a carpet, a newspaper will be sufficient. It should not be used over varnish.

2. *The Patient.*— All clothing should be removed. If the clothing is not removed, then bare a longer area than the part to be treated, and thoroughly protect the clothing by thick Turkish towels. See that the feet are warm, and kept so during treatment. If they are cold, a hot foot-bath should be given. It is more effective than hot-water bottles.

In giving fomentations to a bed patient great care should be exercised to avoid steaming the bedding, as a patient may easily take cold because of bed linen left damp after treatment. Protect the bedding underneath the patient by oilcloth, sheets, and towels, as necessary. After applying a fomentation, cover it with a dry fomentation cloth to protect the bedding.

3. *The Fomentation.*— Prepare a set of four or six fomentation cloths, thirty to thirty-six inches square. Four of these may be cut from a single blanket. The material should be half wool. Three cloths are necessary for one fomentation where they are to be very hot — one for the dry covering, and two to be wrung from boil-

ing water for the inside wet part. Where less heat is required, one inside cloth may be sufficient. Two such fomentations are necessary for the best results.

Spread out on the table the cloth for the dry covering. Fold together in three thicknesses so as to make a long narrow piece, the cloth or cloths to be used inside; holding the strip by one end, immerse in the boiling water. When thoroughly saturated with the boiling water, pass it quickly through the wringer, and after further folding or readjusting to the proper shape and size for the part to be treated, fold it quickly inside the dry fomentation cloth. It is now ready for use. By again doubling together the surface of the fomentation to be applied to the patient, it can be carried with less loss of heat. The fomentation should be large enough to cover a much larger area than the part affected.

Where it is necessary to wring the fomentation by hand, partially twist the long folded piece while it is held doubled together with one hand holding each end. Both ends are now grasped in one hand, and the fomentation dipped into the boiling water. When it is ready to wring, twist tightly, handling the fomentation cloth by the dry ends. Next, pull the ends apart. The water is thus squeezed out. The twisting and pulling may be repeated as necessary for thorough wringing of the cloth. By releasing one end while holding up the cloth by the other it may be quickly untwisted and at once wrapped in the dry covering.

Where it is necessary to give the treatment in the patient's room, a set of three fomentations may be packed in a papier-mâché pail in such a way as to preserve their heat for a half-hour or even longer. First, line the pail with large, dry fomentation cloths. Prepare each fomentation as usual and pack in tightly, or, better still, wring by hand the inside cloths, leaving them twisted as tightly as possible, and pack closely

in the lined pail. A hot-water bottle may be placed in the bottom of the pail if thought necessary, and another over the wet cloths. The necessary number of dry fomentation cloths may be packed into the top of the pail, and the fomentations made up in the room as needed.

4. *Procedure.*— The fomentation should lie closely in contact with the skin, and be renewed in three or four minutes; or in case of pain, as soon as it becomes comfortable. If unbearably hot, rub the part with the hand under the fomentation, or remove the moisture by firm rubbing once or twice with a Turkish towel wrapped about the hand. The fomentations may be applied over a towel in order to temper the heat.

To renew the fomentation, prepare another similar one, and apply immediately after removing the moisture occasioned by the first. Never apply another fomentation until this is done, as the water on the skin makes it more difficult to endure the heat of the newly prepared fomentation. The second fomentation should be ready to apply before the first is removed.

Unless otherwise indicated or ordered, three successive applications are made. In all cases, however, they should be continued until the desired effect is obtained. After the last one, the part should be immediately cooled by a wet hand rub, cold compress, or rub with the cold wet towel. Dry thoroughly and cover at once to prevent chilling. In some cases of pain, the part should be dried without the cold applications. All changes should be made quickly, and the part treated should never be left uncovered.

5. *Precautions.*— In cases of unconsciousness, paralyzed sensation, diabetes, dropsy, under anesthesia or after operations, great care must be taken to avoid burning. The degree of each application should be tested by the back of the hand or face before being applied to the patient. In fomentations to the face

or other sensitive part, apply gauze next the skin. In case of general perspiration, a general cold friction, wet hand rub, wet towel rub, or alcohol rub should be given.

Sensitive surfaces, especially bony prominences, such as the ilia, costal arches, clavicles, or scapula, may need to be protected by extra coverings of flannel or Turkish towel.

Where the patient is liable to cerebral congestion, and always in case of fever, apply cold compresses to the head, and also to the neck if needed. The same should be done where two or more applications of heat are made at the same time, or general perspiration is induced. In case of heart-disease, usually in fever, and with rapid pulse from any cause, place an ice-bag over the heart.

In order to relieve pain, the fomentation must be very hot, as hot as can be borne, and renewed as soon as it becomes comfortable. In some cases of pain the cold application at the close should be omitted, the part being dried and immediately covered with flannel.

For sanitary reasons it is desirable that each patient furnish his own fomentation cloths. However, persons with communicable diseases should not be admitted to a general treatment-room.

6. *Effects.*— The fomentation is used to relieve pain, produce derivation, as a preparation for cold treatment, and for stimulating or sedative effects, according to the temperature and mode of application. Its first effect is that of a vital stimulant; unless followed by a cold application the reaction is atonic. A brief application is stimulating; prolonged applications are sedative or depressing. For sedative effects the heat should be moderate and the application more prolonged before renewal. These points should be observed in applying fomentations to the spine for insomnia.

HOT GAUZE COMPRESS

(H. Comp.)

This is used when it is desired to apply moist heat to such sensitive parts as the eye, a wound, or infected part where the cloth must be disinfected or discarded after being used.

Several thicknesses of gauze, cheese-cloth, or ordinary cotton cloth of appropriate size and shape, are wrung from boiling water and applied in the same way as a fomentation. Because the compress is usually small and unprotected, it cools quickly, and for this reason must be more frequently renewed; nor does cotton hold heat as long as wool. From ten to fifteen minutes will usually suffice to obtain the desired result. The treatment should be concluded in a manner similar to the fomentation.

STUPES

A stupe consists in the application of a medicament by means of a fomentation. When gauze compresses are used, the disinfectant or medicament may be put into the hot water from which the compress is wrung. In case of a large fomentation with flannel cloths, the medicament may be applied by compresses placed under the fomentation. Turpentine, mustard, menthol, etc., may be used in this way. However, the desired hyperemia and depletion can usually be obtained in a more cleanly manner by a plain fomentation, and without the danger of a blister. A stupe does not require such close attention or frequent renewal as the fomentation. It is doubtless for this reason that it is so much used in hospitals.

In preparing the gauze or muslin for a mustard fomentation, use one teaspoonful of mustard to a cup of hot water. Spread out this mustard compress on the surface to be treated and cover with an ordinary fomentation.

REVULSIVE COMPRESS
(Rev. Comp.)

This is given in the same manner as the fomentation, with the addition of a cold compress after each application of heat. A hand towel is wrung from cold water or ice-water, according to the ability of the patient to react. This is spread out over the surface immediately on the removal of the fomentation, allowed to remain a few seconds, then turned over, and allowed to remain about thirty seconds. The skin is now dried, and the next fomentation applied. Three changes of hot and three of cold are usually employed.

The revulsive compress is a mild stimulant and tonic measure; it also produces mild fluxion in the part treated.

ALTERNATE HOT AND COLD TO SPINE
(H. & C. Sp.)

Fomentations are given in the same manner as for the revulsive compress. After each a smooth piece of ice is quickly rubbed back and forth over the part, making from three to five or more to-and-fro movements. The part is then dried and another fomentation applied. In making these hot and cold applications, the next fomentation should be ready before the ice is applied.

Alternate hot and cold applications may be made to other parts in the same manner.

Alternate hot and cold to the spine is a vigorous stimulant and tonic measure, and is useful in a great variety of conditions.

ALTERNATE HOT AND COLD TO HEAD
(H. & C. Hd.)

1. *Articles Necessary.*— Two compresses of three to five thicknesses of gauze or cheese-cloth about twelve inches square.

Two ice-bags filled with finely chopped ice and covered with cheese-cloth.

A spine bag partly filled with hot water and covered with a fomentation cloth or towel.

A bowl of ice-water and a pail of boiling water.

2. *Procedure.*— Place the spine bag crosswise of the cervical spine, bringing it well up under back of head and neck.

Lightly wring cheese-cloth from ice-water and apply to face, covering top of head and ears. Press down firmly over forehead and temporal arteries; renew every minute.

After three minutes replace spine bag by two cloth-covered ice-bags, and the cold compress to face by another wrung quite dry from hot water; the latter should be renewed every minute. In another three minutes replace the first applications of spine bag to the back of the neck and cold compress to the face. Continue these alternations for three complete sets of hot and cold. Cool all the parts by wiping off with a cold compress, and dry thoroughly, especially the hair.

3. *Effect.*— These alternating hot and cold applications stimulate the cerebral circulation, and the treatment is, therefore, indicated in headache due to anemia of the brain, also in passive congestion and in a cold in the head. Any *alternating* hot and cold application produces *fluxion.*

SIMULTANEOUS HOT AND COLD TO HEAD

(Simul. H. & C. Hd.)

Place an ice-bag to the base of the brain and another ice-bag, or better, ice-cap, to the vertex after moistening the hair so that the cold will penetrate. Also place ice-bags or ice compresses over the carotids. Now apply a fomentation to the face, covering the ears and forehead. Gauze or cheese-cloth should be used under the fomentation when applied to the face. The nose should not be covered by the fomentation, as it is uncomfortable when so done, and it is better for the patient to breathe cooler air.

This treatment is very effective in reducing cerebral congestion and relieving congestive headache. It is well to conclude the treatment by an alternate hot and cold percussion douche to the feet, cold cervical and cephalic compresses being kept on during the douche.

Simultaneous applications of heat and cold so given that the cold application is placed over a reflex area of, or the large artery supplying, the deep part, produce *depletion*.

HOT-WATER BOTTLES

These should be partly filled with hot water (never boiling water) and wrapped in cloth, preferably flannel or a Turkish towel. Great care should be taken in applying them to patients with paralysis and during and after operations, that burns do not result. The safety of the hot-water bottle may be tested by holding it against the cheek. When not in use, the bottle should be hung bottom end up with the stopper out. It should never be left doubled sharply upon itself, as it is likely to crack at the fold.

Fomentations may be reenforced or prolonged by the use of hot-water bottles, or the bag may be wrapped in a moist cloth covered over by a dry one, to give the effects of a mild fomentation.

WINTERNITZ COIL

This consists of a matted coil of rubber tubing about ten or eleven inches in diameter, through which a stream of hot water is caused to flow. A dry blanket is placed on the treatment table, and over this is placed a doubled sheet, wrung from cold water or ice-water, so that it may be wrapped about the trunk. The patient lies down on the wet sheet, and one end is wrapped tightly about the chest and abdomen. The coil is now placed on the abdomen over the wet sheet, and the other

end of the sheet wrapped around the trunk over the coil. The dry blanket is folded over and about the patient. A small stream of hot water at 135° flows slowly through the coil from the center outward. The treatment is continued from thirty to forty minutes, or even three hours in cases of very slow and defective digestion. It is concluded by a cold mitten friction. A hot-water bottle may be used in place of the coli. (See Hot and Heating Trunk Pack.)

The coil may be used for cold water in the same manner as the Leiter coil. In fact, the cold coil is much more frequently used and for a greater number of purposes than the hot coil.

RADIANT HEAT

(Rad. Heat)

The radiant heat is a local application of heat by means of electric lights arranged in a reflecting metal case. From one to twelve or more such lights may be arranged in a single case, and the case so constructed as to fit to any part of the body. An instrument with one light is perhaps the most useful. An oblong case containing three lights is a convenient means of applying heat to the spine. A case in the shape of a half-cylinder and containing six or more lights may be made for the feet and legs.

In applying the radiant heat, the body should be protected from the edge of the case by towels or fomentation cloths. The amount of heat may be regulated by the number of lights or the distance from the skin. Leave in place for ten to twenty minutes, or until the desired results are obtained. Cover the part well after drying perspiration, or use a cold wet towel. The local electric light is a convenient means of applying heat to the feet, knees, and other joints. It may also be used over bandages where it is not desirable to remove these.

LOCAL APPLICATIONS OF COLD

COLD COMPRESS

(C. Comp.)

A cold compress is a local application of cold by means of a cloth wrung from cold water. Hand towels or ordinary cotton cloths may be used. These should be folded to the desired size, and wrung from cold water or ice-water. The wringing should be just sufficient to prevent dripping. They will be colder if taken immediately from a block of ice. As a continuous cold application, the compress must be very frequently renewed, always before it is warmed to any great extent. The thicker the compress, the less frequently will it require renewal. A set of two compresses should be used, and renewed at intervals of from one to five minutes, depending on the thickness of the compress and the result to be obtained. Cold compresses may be applied to the head, neck, over the heart or lungs, to the abdomen, spine, etc. When applied to the head, they should be pressed down firmly on the surface being treated, especially over the forehead and the temporal arteries. The pillow should be protected by rubber cloth covered by a towel. When applied to the abdomen in typhoid fever, the bedding and patient's garments should be protected by Turkish towels. Unless very thick, and always when left longer than three to five minutes, the nature of the application changes, and becomes a heating compress.

When applied over a large artery, it decreases the amount of blood in the part beyond the application. Such an application is called a *proximal compress*. Examples of this are found in such applications as a cold compress to the neck, over the femoral artery, at the bend of the elbow, etc. Ice-bags are also used for the same purpose.

ICE PACK

(Ice Pk.)

An ice pack is used where a large, continuous, and very cold application is desired. Spread cracked ice over a thick Turkish towel, folding one end and the edges over this so as to retain the ice. Apply next to the skin or over a single layer of flannel. This may be used over the heart, also over a consolidated lung area in pneumonia. In the latter case, it should never be applied until after the hot packs used in this disease have warmed the body sufficiently to prevent chilling. It should occasionally be interrupted by applying a fomentation. This helps to preserve the desired reflex effect.

Snow may be used in place of the pounded ice. In applying an ice pack to a joint, first wrap the part in flannel so as to prevent actual freezing, then pack the snow or pounded ice closely against the flannel, forming a layer about one inch thick, retaining it in place by a larger flannel cloth wrapped about all and pinned together.

Ice packs should be interrupted often enough to prevent freezing, and either the part rubbed with snow or a fomentation applied to renew the local reaction.

ICE CRAVAT

The ice cravat or collar is made in the same way as the ice pack, the towel being filled with ice and folded so as to be about three inches wide and encircle the neck. If the towel is wrung from ice-water, it must be more frequently renewed than when cracked ice is used.

An ice cravat may also be made by using two narrow spinal ice-bags. These should be filled with pounded ice and wrapped in a linen or cotton cloth.

The effect is that of a proximal application. The carotid arteries and their distal branches are contracted, also the vertebral arteries. Thus the blood supply to

the brain and head generally is very much lessened. The ice collar is frequently used in fever, in congestive headache, in acute epidemic meningitis, etc. It should also be used in sunstroke, and whenever prolonged sweating treatments are given, as in eclampsia and uremia.

ICE-BAG AND ICE-CAP

(Ice Bg.)

Ice-bags are made in various shapes and sizes. The best ice-bags are made of pure gum rubber, and are usually elliptical in shape. They may be obtained in almost any size desired. The spinal ice-bag is about three inches wide by seven to nine or ten long.

Ice-caps are usually round or elliptical and provided with a screw cap; some are also made with loops for holding them in place. Cloth-covered ice-bags offer no advantage; they usually leak after being used a few times, and are also unsanitary. The bag or cap should be filled with finely cracked or pounded ice, never with large chunks. In the case of the ice-bag, the neck should be doubled down, then folded several times across this, and tied with tape about one-fourth inch wide. Thread or fine twine should not be used, as it cuts the rubber. When applying the bag, wrap it in a towel or one thickness of flannel. The skin should not be severely chilled. The bag should be removed often enough to prevent this, the part rubbed briskly with the hand until warmed, or a fomentation applied for a short time.

COLD-WATER COIL

(C. Coil)

The rubber coil (Winternitz coil) is the most convenient means of applying a local application of cold. Matted coils, ten or eleven inches in diameter, may be purchased, or a coil may be made of ordinary rubber tubing and held together by adhesive tapes. The inflow should

enter at the center of the coil. The rate of flow may be very conveniently controlled by tying a knot in the outflow tube just above where it dips into the receiving pail. This knot may be loose or tight as desired for rapid or slow flowing of the cold water through the coil. The reservoir should be about two feet above the level of the coil, and may be a large can with an outlet at the bottom, or an ordinary pail may be used and the outflow secured by siphonage.

The coil should always be applied over a cold compress, and covered with a dry flannel cloth or dry fomentation cloth. In applying it to the head, the coil may be molded into the shape of a cap, and held in place by light bandages or folded towels. Always wet the hair before placing the coil.

The Leiter coil is not used as much as the rubber coil. It is a small flat coil of flexible metal tubing, through which a stream of cold water or ice-water passes. It may be molded tc fit any part, and is often used over the mastoid. The principle is the same as that of the Winternitz coil.

HEATING COMPRESSES

A heating compress is a cold compress so covered that warming up soon occurs. The effect is, therefore, that of a mild application of moist heat.

A heating pack or compress consists of an application of heat to the body by means of three or four thicknesses of gauze or one of linen or cotton cloth wrung from cold water and so perfectly covered with dry flannel or mackintosh and flannel as to prevent the circulation of air and cause an accumulation of body heat. In case warming does not occur promptly, it should be aided by hot-water bottles or the radiant heat. It is usually left in place for several hours between other treatments, or overnight. If left on overnight it should

be dry by morning unless an impervious covering, such as a mackintosh or oiled silk, is used. On removal of the compress, the part should be rubbed with cold water.

According to the extent and location of the surface involved, the nature and thickness of the coverings, the temperature and the amount of water left in the wet cloth, and the duration of the application, it may have the following effects; viz., tonic, sedative, derivative, or sweating.

If the pack dries out before being removed, it will have a mild derivative and a mild sedative or tonic effect, according to the part to which it is applied and the condition in which it is used. If the coverings prevent drying, the result will be that of a stronger derivative because of the local sweating. It also causes relaxation of the muscles and vasodilatation of the vessels in immediate or reflex relation with the surface treated.

MOIST CHEST-PACK

(Ch. Pk.)

Any sort of jacket which combines the above requisites for a heating compress with ease and neatness of application and accuracy of fit, will answer the purpose of a chest-pack.

The roller, square, and fitted chest-packs are examples of these:—

1. ROLLER CHEST-PACK.— The inside piece consists of two to five thicknesses of gauze eight to ten inches wide and about six or eight feet in length. One thickness of thin linen may be used. The outside piece of flannel is a little wider than the gauze and somewhat longer. The gauze or linen is loosely rolled in bandage form, and wrung nearly dry from cold water. While standing in front of the patient, the end is applied under one arm, more handily the right, then carried diagonally

across the front of the chest and over the left shoulder, then obliquely across the back, under the right arm, and directly across the front of the chest, under the left arm, across the back, and over the right shoulder, and fastened under the transverse front piece. The bandage must be snugly applied at all places, but not so tight as to restrict the movements of the chest. The flannel is now applied in the same order, care being taken that the wet piece is well covered, and then securely fastened with safety-pins. The pack should be comfortable and feel warm in a very short time.

2. SQUARE CHEST-PACK.— Both parts of the pack are of an oblong form, wide enough to reach from the top of the shoulder to the lower ribs, and long enough to give a double thickness in front. The ends of the bandage are slit into two strips, one third and two thirds, respectively, of the total width, and each one third of the length. The outer flannel part should be about two inches wider, and of the same length, and slit in the same fashion. The flannel part should be spread out on the treatment table and the linen over it after being wrung from cold water. The patient now lies back on this. The narrow strips are brought up over the shoulder and across the chest. The top of the wider strips should fit under the axilla and be brought across the chest. The flannel should now be applied in the same manner and at all loose places be drawn tight or folded in, and the whole fastened with safety-pins.

3. FITTED CHEST-PACK.— From flannel cut a front and a back piece in much the same shape as for a vest, making the necessary curved cuts about the arms and neck. The front piece should be the larger, so as to come back under the arms and lap over the back piece; also on each side of the neck, a strip four inches wide should be made long enough to overlap the back piece.

An inside piece of the same shape should be cut from

gauze or thin linen. This inside piece should be about one and one-half inches narrower at all edges, so that when covered by the flannel, it will not be exposed at any place, but be covered at least one inch beyond its edge.

After applying, see that it fits snugly and is well pinned with safety-pins, so as to prevent the entrance of air at any place along the edges.

Various other forms may be improvised to meet the needs of the home not provided with the more perfect requisites. To retain the moisture and so give greater sweating effects, the cloth may be covered with machintosh, gossamer cloth, or oiled silk of the same size and shape.

4. PARTIAL CHEST-PACK.— It is often desirable to apply the moist cloth to only a portion of the chest. The gauze or linen may be cut to any desired shape and size and applied to the proper area under the square or rolled flannel pack. The chest being covered principally by dry flannel, this form approaches in effect the dry pack.

DRY CHEST-PACK

(Dry Ch. Pk.)

With the dry chest-pack only the flannel is used of either the roller, square, or fitted style. It should usually be applied over a thin undergarment. The dry chest-pack is desirable in thin persons, the aged, and those having insufficient body heat to warm up the wet pack. It is often difficult, not to say impossible, in the case of a thin person, to pin the wet pack so tightly as to prevent the air from circulating under the edges of the pack, and yet loose enough to be comfortable and not restrict the breathing. In many cases a chamois vest may be worn over a thin undergarment to produce the effects of a dry pack.

Chest-packs are of much benefit in pleurisy, colds,

influenza of the respiratory type, during convalescence from pneumonia, in asthma, whooping-cough, croup, etc. Under the pack, the skin should be warm and gently perspiring. The choice of a dry or moist pack will depend upon the vitality of the patient and the result to be obtained.

MOIST ABDOMINAL BANDAGE

(M. A. B.)

The moist abdominal girdle is one of the most useful of the heating compresses. The inside part of the girdle consists of one thickness of linen or three or four of gauze, eight or nine inches wide and a little more than one and one-half times the circumference of the body. The outer flannel girdle should be about twelve inches wide and of the same length. The dry flannel is placed across the table, and the gauze, wrung nearly dry from cold water, placed over it. The patient now lies back on the bandage so that the lower edge will be below the iliac crests. Each end of the wet linen or gauze is pulled tightly across the abdomen and tucked under the opposite side. Both ends of the flannel are now folded tightly over these and securely fastened with safety-pins. Darts may be taken on each side by means of safety-pins in the same manner as in pinning a bandage after an abdominal operation. The flannel piece should project one and one-half or two inches beyond the wet gauze or linen. Where it is difficult for the patient to warm up the bandage, it may be moistened only over the abdomen.

The moisture may be retained by a bandage of oiled silk or mackintosh of the same width as the linen, and applied between it and the flannel. This is spoken of as a protected girdle.

The sweating underneath will be more profuse than without the impervious covering. Since the moisture is retained, it will not be dry by morning. The pro-

tected girdle is indicated in hyperacidity, and where it is desirable to produce considerable relaxation.

The ordinary moist abdominal bandage is useful in nearly all forms of atonic indigestion, in neurasthenia, anemia of the liver, insomnia, catarrhal jaundice, constipation, etc. In these conditions it is usually worn only at night.

HEATING THROAT COMPRESS

Four to six thicknesses of cheese-cloth or two or three of ordinary cotton cloth about three inches wide and long enough to encircle the neck twice are used inside. The outside consists of two thicknesses of flannel not less than four inches wide. This compress being small, considerable water may be left in it and still be found dry by morning. The neck should be rubbed with cold water immediately after removing the compress in the morning. The "cold cloth around the neck" is a very common household remedy for sore throat, hoarseness, tonsillitis, etc. It is indeed a very efficient measure; its usefulness can hardly be overestimated. The heating throat compress is indicated in pharyngitis, acute laryngitis, tonsillitis, quinsy, and in inflammation of the Eustachian tube. It is also useful in clergyman's sore throat. In tonsillitis, quinsy, and inflammation of the Eustachian tube, the compress should extend upward about the lower part of the ear, and may be held in place by a bandage over the top of the head.

HEATING JOINT COMPRESS

Heating compresses may be applied to the foot, ankle, knee, hand, wrist, etc. Rarely more than two thicknesses of gauze are used. It is often necessary to use cotton for a covering to obtain close application to the skin surface. This may be held in place by a three-inch roller bandage or a broad flannel cloth. A dry pack may be made of cotton or soft flannel alone.

In certain cases the joints may be rubbed with a medicated solution before being covered, or the gauze dipped in it. Alkaline or anodyne solutions are very frequently used in this way in cases of rheumatism. In rheumatic fever the joints may be rubbed with synthetic oil of wintergreen before the heating compress is applied. It helps to relieve the pain, and by its action as a counter-irritant, the heating and circulatory effects are enhanced.

MEDICATED COMPRESSES

Besides rubbing the parts with medicaments, such as turpentine, camphorated oil, oil of wintergreen, etc., before applying the heating compress or pack, the gauze may be wrung from various solutions, uch as an alcoholic solution of menthol, mustard water, watery solution of bicarbonate of soda, saltpeter, etc. When counter-irritant drugs are used, the effect of the heating compress is intensified. It is usually not desirable to produce a blister. For this reason the use of coal-oil and turpentine should be discouraged. Not only may they produce blisters, but being inflammable, they are also dangerous.

POULTICES

Poultices are very popular substitutes for the heating compress, and have a similar effect. They consist of a mixture of various substances, having the consistency of mush, and must be applied hot to produce the desired result. Flaxseed, onions, etc., are commonly used. The preparation may be applied directly to the skin or spread on a cloth and bound tightly to the part. They are often disagreeable, not to say uncleanly.

Probably the most useful poultice is that consisting of *white clay and glycerin*, sold under various names. It is applied hot about one quarter to one half an inch thick and covered with cotton and a bandage.

The results are partly due to the heat and partly to the water-absorbing (hygroscopic) properties of the glycerin.

The *charcoal* poultice is especially valuable in foul, sloughing ulcers or wounds. It may be prepared of charcoal alone or by adding equal parts of flaxseed meal and powdered charcoal to boiling water until the resulting mixture is the consistency of mush. This is evenly spread on a cloth and applied to the part, or directly on the part, and covered with a muslin cloth, and some impervious cloth, as oiled silk.

TONIC FRICTIONS

A tonic friction is an application of cold water so combined with friction as to produce decided thermic and circulatory reaction. The effects are briefly described as stimulant and tonic. These have been discussed in detail in the chapter on Stimulants and Tonics, q. v.

Given in the order of their severity, the tonic frictions are as follows: Wet hand rub, cold mitten friction, cold towel rub, wet sheet rub, and dripping sheet rub. To these may be added the ice rub and salt glow. While the latter is not particularly an application of cold, the friction gives tonic results similar to the others, and the procedure is not far different. The ice rub may be used for stimulant or tonic purposes, but it is more frequently used as an antipyretic.

COLD MITTEN FRICTION

(C. M. F. or Cmf.)

1. *Articles Required.*—A bowl or pail of cold water at 50° or 60° F. or ice-water, a sheet, three Turkish towels, two friction mitts made of such coarse material as woolen moreen, and compresses for the head and neck.

2. *Procedure.*— The patient should be warmly covered and the feet warm; if not, give hot foot-bath. Bare one part of the body at a time. Do not expose any part longer than necessary; dry quickly and thoroughly and recover at once with warm, dry covering. Before beginning the regular part of the treatment bathe the patient's face and neck with cold water or apply cold compresses to the head and neck. This is especially necessary in treating patients with valvular heart-disease. In this condition an ice-bag should be placed over the heart before beginning the treatment. In other conditions it is not usually necessary.

Beginning with the right arm, place one towel under the arm and another around the shoulder to protect the table and patient. With the mitts on the hands, dip them into cold water and shake or squeeze out the excess of water. While the patient holds the arm vertically, rub the arm and hand with rapid to-and-fro friction movements until it is in a glow. Quickly remove mitts, dropping them into the bowl, and cover the entire arm with one of the Turkish towels, having the patient hold the upper corners by closing the hand on them. Dry by friction outside the towel, and then rub with the towel until the arm is thoroughly dry and well reddened. Treat the left arm in the same manner.

Now covering the rest of the body, bare the chest and abdomen. Tuck a Turkish towel snugly under each side along the trunk and over the arms. Rub the chest with the mitten dipped in cold water in a manner similar to the arms, then cover the entire chest with one of the towels, and have the patient catch the two upper corners as they lie next to the shoulders. Rub briskly with downward strokes over the towel. Then wrapping the towel neatly about the right hand, again rub the entire surface, around shoulders, and down the sides, so as to dry all parts that have been wet.

Cover chest and expose the right leg and thigh. Flex

the leg and place a Turkish towel under. Place another towel around the upper thigh at the groin. Begin the friction with the leg and foot; dip the mitts again for the thigh. Treat in like manner the left leg and thigh.

Have patient turn over and lie on a pillow placed under the chest. Treat the back in the same manner as the front of the trunk. To dry, cover the entire back with a Turkish towel, and have patient hold the upper end the same as for the chest; rub with downward strokes over the towel, then wrap the towel about the hand, and rub the surface again until horoughly dry. Some prefer to begin the treatment with the chest in cases of heart-disease.

To vary the severity and tonic effects, the temperature of the water may be changed; more may be left in the mitts or the mitts dipped two or three times in treating each part, or the friction given more vigorously.

WET HAND RUB

(W. H. R. or Whr.)

The same order and general procedure is followed as for the cold mitten friction. One part at a time is bared, rubbed with the hand dipped in cold water, followed by percussion, then dried, finishing with brisk rubbing with the dry towel and the hands. Dipping from two to four or more times increases the tonic effect.

COLD TOWEL RUB

(C. T. R. or Ctr.)

In giving the cold towel rub a plain hand towel is used instead of the mitts employed for the cold mitten friction. The same order is followed as in the two previous treatments, beginning with the arms, then the chest and abdomen, legs, and last the back.

The arm is held vertically with the palm toward

the feet. The towel is dipped in cold water and wrung lightly, quickly unfolded and wrapped lengthwise around the arm, turning the upper corners into the palm to be grasped by the hand of the patient. The part is then rubbed with to-and-fro movements outside the towel. Percussion may also be given to insure a greater reaction. The towel is now removed, and the arm dried as after the cold mitten friction.

When the chest and abdomen are treated, the wet towel is spread out over the entire surface, and the patient grasps the upper corners next the shoulders and holds tightly while the nurse rubs with downward strokes outside the towel. The other parts are treated in a similar manner.

It should be remembered that the cold towel rub takes more heat from the body than the cold mitten friction, and it therefore requires greater reactive ability on the part of the patient. Because it does abstract considerable heat from the body, it is often used in fever as an antipyretic measure. By dipping the towel twice or more for a single part, its antipyretic effects are increased.

WET SHEET RUB

(W. Sh. R.)

1. *Requisites.*— Two sheets, two towels, a tub containing hot water for the feet, a pail of water at 60° to 70° F. Other temperatures may be used when indicated.

2. *Procedure.*— The patient should be warm to begin with. Apply a cold compress to the head. The patient now stands in the tub of hot water. A sheet is wrung from cold water so that it will not drip. Quickly wrap the sheet about the patient as follows: —

The patient holds up both arms. The upper left-hand corner of the sheet is placed under the patient's right arm; the patient then lowers the right arm, thus

holding the corner of the sheet in place. Pass the sheet quickly across the front of the body and under the left arm, which is lowered. The sheet should then be carried across the back, behind and up over the right shoulder, then across the chest and around the neck over the left shoulder, tucking the corner under the edge of the sheet behind. Now tuck the sheet between the patient's legs; it is thus brought into close contact with every portion of the skin. Rub vigorously and give percussion over the sheet, covering the whole surface as quickly as possible until the sheet is thoroughly warmed. The patient is not to be rubbed *with* the sheet, but *over* the sheet. Two attendants are necessary to give the best results. Dry with a sheet and towels.

The wet sheet rub is a very vigorous tonic measure. It should not be used until the patient is able to react to the cold towel rub, the pail pour, and the cold percussion douche.

DRIPPING SHEET RUB

(Drip. Sh. R.)

For the dripping sheet rub prepare three pails of cold water at about 70°, 65°, 60° F., respectively. Proceed as with the wet sheet rub, using the water at 70° from which to wring the sheet. After the sheet and patient are warmed by rubbing and percussion, without removing the sheet pour over the shoulders the second pail of water, again rubbing vigorously until warm. Use the third pail in like manner. Dry as after the wet sheet rub.

ICE RUB

The order of parts treated and the procedure in an ice rub are substantially the same as in the wet hand rub and cold mitten friction. In giving the ice rub, however, it is necessary to more thoroughly protect the bed or treatment table by covering with oilcloth and towels. Turkish towels should be tucked closely

about each part so as to absorb the water as it runs off the skin. The cake of ice to be used may be held in the hand, or better yet, wrapped in one or two thicknesses of gauze.

The ice rub is not much used for general tonic purposes, but more frequently as an antipyretic. When used for this purpose, each part should be rubbed for some time and then dried without friction or percussion with the hands. Its prolonged application to the spine is more decidedly antipyretic than the same length of application elsewhere. When given in typhoid fever, the abdomen should be avoided. Cold compresses should be applied to the head and neck and also to the heart, if necessary.

SALT GLOW
(Sgl.)

Prepare about two pounds of coarse salt wet with cold water. The treatment should be given in a "wet room" or in a bath-tub. The patient stands in a tub of hot water. While standing at the side of the patient begin with the arm. Wet the entire skin surface of the shoulder, arm, and hand with hot water from the foot-tub. This is done by dipping the water with the hands. Next apply the wet salt, spreading it evenly over the skin; now with one hand on each side of the arm, rub vigorously with to-and-fro movements, until the skin is in a glow. Stepping behind the patient to the opposite side, proceed in the same manner with the other arm.

Retain the last position to treat the front and back of the trunk. With one hand in front and one behind, wet the skin surface with hot water from the foot-tub. Now spread the salt as before, and rub the entire skin surface of the chest, abdomen, shoulders, back, and buttocks. Stepping behind the patient, with one hand under each arm, continue rubbing with the salt, treating the sides of the chest, abdomen, and the hips.

Next proceed with the legs in like manner. For each limb have the patient put one foot on a low stool so as to bring the thigh about horizontal. Wet with water as before and rub the thigh, leg, and foot with the wet salt.

Finish the treatment by thoroughly washing off the salt. This may be done by a pail pour, shower, or general spray. Dry the patient with sheets, towels, and fanning with a dry sheet, as from any general wet treatment.

If for any reason the patient ought not to stand so long, he may be seated on a low stool while the salt glow is given. Proceed as follows: —

The patient sits on a stool, with the feet in hot water. Beginning with the feet and legs, apply the water and then the salt, rubbing briskly with short strokes, the hands being on either side of the part treated. Next treat each arm separately; then the chest, abdomen, and back should be rubbed with the wet salt, the attendant standing at the side of the patient with one hand rubbing the chest and the other rubbing the back. The patient should stand while the buttocks and thighs are treated. Wash off the salt and dry as directed above.

The salt glow is a vigorous circulatory stimulant. Since no great amount of cold water is applied to the body, it does not require as great reactive ability as the wet sheet rub or cold douche.

SPONGING

Sponging consists in the application of a liquid by means of a sponge, a cloth, or the bare hand, in which the chief effect is derived from the liquid that is applied. The term ablution is also applied to sponging.

PLAIN WATER SPONGING
(Spg.)

1. HOT SPONGE (H. SPG.).— Hot sponging has a sedative effect because of the slightly atonic reaction which ensues. It is also used to reduce fever where chilliness exists. When prolonged to forty to fifty minutes, the temperature does not rise as rapidly after he treatment as it does following a cold sponge

A large, soft sea sponge may be used, a soft cotton cloth, a wash-cloth of Turkish toweling, or several thicknesses of cheese-cloth. The water should be as hot as can be borne. Bare one part at a time, and treat in the following order: the arms, chest, abdomen, legs, thighs, and back. The cloth or sponge should be dipped several times for each part. Dry thoroughly.

2. TEPID SPONGE (TEPID SPG.).— The tepid sponge has an effect similar to that of the neutral bath; i. e., it is sedative. It may also be used to reduce fever, but is not as effective as either the hot or the cold sponge.

3. COOL OR COLD SPONGE (C. SPG.).— Cold sponging is much used in the treatment of fever where the skin is hot and there is no tendency to chilliness. Each part should be gone over several times. The temperature of the water and the duration of the treatment should be governed by the effect to be produced.

SALINE SPONGE
(Sal. Spg.)

About four ounces of common salt are dissolved in a basin or bowl of tepid water. The bare hand is dipped in the salt water, and each part rubbed lightly.

The saline sponge has a mild tonic effect. Because of the salt it stimulates the vasomotors to a greater extent than plain water.

ALKALINE SPONGE

(Alk. Spg.)

Use about two ounces of bicarbonate of soda to a small basin of hot or cool water according to the case. Apply with the bare hand, a soft cloth, or a sponge. The alkaline sponge is useful in itching, smarting, and other abnormal sensations. It is usually applied only to the part affected.

VINEGAR AND SALT RUB

The vinegar and salt rub is very useful in checking the excessive perspiration or night sweats of phthisis.

Prepare a half pint of equal parts of vinegar and water, to which add one or two tablespoonfuls of salt. Apply with the bare hand, drying lightly afterward.

The application should be thorough to the parts that perspire the most; other parts may be gone over less thoroughly.

ALCOHOL RUB

(Alc. R.)

The alcohol rub is frequently used following a sweating treatment instead of the cold friction or spray. Its purpose is, of course, the prevention of taking cold. Use one part of alcohol to one part of water (proof-spirit, fifty per cent). Dip the hands in the alcohol and rub each part, dipping the second time if needed. No drying with the towel is necessary.

WITCH-HAZEL RUB

(Wzr.)

The witch-hazel rub has about the same effect as the alcohol rub. It is sedative and a mild astringent. The same procedure is used as for the alcohol rub.

MENTHOL RUB

(Menth. R.)

The application of menthol to the skin gives a sensation of cold. The effect is similar to that of the alcohol rub or cold sponging. Use one ounce of menthol liniment (menthol cryst. 1 oz., alcohol 1 pint) to three or four ounces of water.

SOAP WASH

The soap wash is used for cleansing the skin in the case of bed patients. Using a bowl of water at 102° F. with soap and wash cloth, go over each part separately. With another bowl of water at 75° to 85° F. and another cloth, remove the soapy water and dry thoroughly with a Turkish towel. Each part is gone over with the soapy water followed by rinsing with plain cool water and then dried before the next part is treated.

RUBS AND FRICTIONS

These terms are applied to procedures in which the chief effect is derived from friction with the bare hands.

CENTRIPETAL FRICTION

(C. F. or cf.)

The centripetal friction consists principally of friction strokes from the periphery toward the center. It is designed to hasten the circulation, especially in the superficial veins.

GENERAL ORDER OF MOVEMENTS:—

1. Light to-and-fro friction — once.
2. Apply lubricant — twice.
3. Centripetal friction — three times.
4. Percussion — twice.
5. Stroking (centrifugal) — three times.

Arms

1. Beginning at the finger-tips, give light, quick, to-and-fro friction to the shoulder, being sure to cover thoroughly the whole surface. Let the hands glide back as in stroking the arm.

2. Apply lubricant with long strokes from finger-tips to shoulder, returning with four rotary sweeps. Give twice.

3. Friction.

Hand.

a. Heavy centripetal stroking to back of hand, three times.

b. Palm of hand same as back of hand, beginning at finger-tips. Finish with double rotary movement in palm. Give three times.

Arm and forearm.

a. Empty blood-vessels by heavy, even stroking from wrist to elbow. The patient's elbow rests on the table. With one hand on each side and using hands alternately, give three movements with each.

b. Empty blood-vessels from elbow to shoulder, sweeping well over shoulder. With hands in the same position and alternating as for forearm, give three movements with each.

4. Percussion. With one hand on each side of the arm, which is held up by the patient, and with hands working together, give percussion from shoulder to fingers and return. Give twice. Place the patient's arm on the table at his side, give percussion down and up to external surface as far as hand.

5. Stroking — three times.

Legs

1. Leg flexed and foot flexed. Placing one hand on the sole, the other on the dorsum of the foot, give light, quick, to-and-fro friction transverse of foot. Then

placing the foot flat, continue with rapid strokes to the sides of the foot, the leg, and front of the thigh. Glide hands to knee; quick strokes to back of thigh; glide to toes.

2. Apply lubricant with long strokes to back of leg and front of thigh, coming down to knee with three rotary sweeps, then long strokes to back of thigh, down with three rotary sweeps from knee to ankle. Give twice.

3. Friction.

Foot (leg extended).

a. Dorsum with one hand — three times.

b. Each side with one hand, opposite hand supporting foot; come well up back of ankle — three times.

c. Sole with palm of hand — three times.

d. Rotary strokes to heel — three times.

Leg and thigh (leg flexed).

a. Calf — empty blood-vessels by heavy, even stroking. Hands following each other alternately — three times with each hand.

b. Empty blood-vessels under knee, hands alternating — three times with each.

c. With one hand on knee to support leg, give heavy stroking to front of leg, beginning at toes — three times.

d. Rotary to knee, hands working together — three times.

e. Empty blood-vessels of thigh, beginning with posterior surface, hands working together — three times.

f. Anterior thigh — three times.

4. Percussion. With one hand on each side give percussion from hip to ankle, down and up — give twice.

5. Stroking — three times.

Chest and Abdomen

1. Making the hands work together, stroke the neck downward three times and give rotary movements as follows: Three above the clavicle and to shoulder; six from below clavicle to level of elbow (i. e., nine down each side), returning up over median part of abdomen and chest. Give once or twice.

2. Apply lubricant with long strokes up center, four rotary sweeps down sides, covering whole surface thoroughly. Give twice.

3. Friction.

a. Empty blood-vessels of neck and shoulders by stroking from back of ears downward to chest and shoulders — three times.

b. Give strokes from shoulders to median line over the pectorals — three times.

c. Using the thumb and thenar surface, give heavy stroking outward from median line over ribs and abdomen — about six times, advancing toward the pubes.

d. Stroking from umbilicus outward and downward toward middle of Poupart's ligament — three times.

4. Percussion up and down left side, the same on right side, give twice.

5. Stroking — three times.

Back

1. Light friction with the full hand down spine, hands alternating — three times each. To-and-fro friction, beginning well up on neck, covering shoulders, back, and hips. Give three times.

2. Apply lubricant with long strokes up spine, four rotary sweeps down sides — twice.

3. Friction.

a. Heavy friction with full hand down spine — hands alternating each three times.

b. Heavy rotary, full sweep to shoulders — three times.

c. From shoulders down, across arms stroking toward spine, following ribs — six times.

d. Lower back, heavy friction upward over buttocks toward spine — three times. Upward on hips — three times. Outward, using thumb and thenar surface over crest of ilium — three times.

4. Percussion up and down on left side, same on right side. Give twice.

5. Stroking.

a. Full sweeps covering back — three times.

b. Slow strokes with full hand down spine — six times.

OIL RUB

(O. R.)

The oil rub softens the skin and is frequently used as a protective after sweating treatments. It may be given in the same manner as the centripetal friction, omitting procedure number one, lightf riction, and procedure number four, percussion. If desired, the following abbreviated method may be used, always omitting the percussion after hot treatments.

GENERAL ORDER:—

1. Apply lubricant.
2. Rotary friction.
3. Percussion.
4. Stroking (centrifugal).

Arms

1. Apply lubricant, beginning at hands with a long stroke, go over the arm up to the shoulder — three times.

2. Beginning at hand, apply long stroke up to shoulder, returning with alternate rotary movements, three each to shoulder, arm, elbow, forearm, wrist, and hand— three times.

3. Percussion up and down twice on external surface. Give same on inner surface. Six percussion strokes to the hand.

4. Finish with long strokes from shoulder to finger-tips — three times.

Legs

1. Beginning at foot, apply lubricant with long strokes up to hip with both hands, covering the entire surface — three times.

2. Apply long strokes from foot to knee, returning with alternate rotary movements, three each to knee, calf, ankle, and foot — twice. Return to hip with long stroke. With hands on anterior surface of thigh, from hip to knee, give eight or ten rapid, alternate, rotary friction movements. Give the same on the posterior surface of the thigh — three times. Continue with rotary friction from knee down as at first — once.

3. Percussion same as arm.

4. Long stroking movement from hip to toes — three times.

Chest and Abdomen

1. Lubricate, with hands working together, begin at median line below, going lightly up the median line and down the sides — three times.

2. Hands working together, stroke the neck downward three times, then give rotary movements three each, above clavicle, to shoulder below clavicle, nine down each side, nine up over median part of abdomen and chest — three times.

3. Have patient take and hold a deep breath. Beginning well over at lower left side, give percussion up that side to top of shoulder, down on same side of median line, up on right side of median line to top of shoulder, and down the right side — twice.

4. Stroking — movement same as in lubricating — three times.

Back

Procedure the same as for the chest. Finish with six long, gentle, downward strokes to spine.

TALCUM RUB

(Talc. R.)

The talcum rub is useful where oil is objectionable, as in warm weather, or where there is a tendency to too free perspiration after treatment. It dries rather than softens the skin. It is also useful in hives, and should be given after a prolonged cool bath. The procedure is the same as with the oil rub.

DRY FRICTION

(D. F.)

The procedure for dry friction or the dry hand rub (d. h. r.) is the same as for the oil rub except that no lubricant is used. If given briskly with vigorous to-and-fro friction and followed by percussion, the effect is to quicken the circulation in the skin and warm the surface. The treatment also stimulates heat production.

Slow, heavy friction without percussion, as to spine, forehead, etc., is sedative.

BATHS

Various procedures more or less similar and commonly called baths are included under this head.

I. Partial Immersion Baths

HAND-AND-ARM BATH

The hand and arm may be immersed in neutral, hot, or cold water, or the two latter alternately. For this purpose employ a foot-tub (better one of elliptical shape) with sufficient water to immerse the hand and forearm to the elbow, or including the elbow. Very

deep pails may be used. When hot water is used, it should be as hot as can be borne. Immersion of the hands in cold water is useful in controlling epistaxis.

To give hot and cold immersion to an infected hand or arm (blood-poisoning) employ two pails or tubs,—one of the hottest water that can be borne, and the other of ice-water with a block of ice in it. To the cold water may be added one-fourth or one-half dram of crystals of permanganate of potassium, and to the hot water about five times this quantity of oxalic acid. Immerse the hand and arm in hot water for one and one-half to two minutes, then in the cold for fifteen to thirty seconds. Continue these alternations for twenty-five minutes to an hour, finishing with the cold. Hot water should be added to the tub as fast as can be borne. The procedure should be repeated from one to four times daily as indicated. Other parts of the body, as the foot, may be treated in a similar manner. Massage is strictly contraindicated in infected conditions.

FOOT-BATH

(Ft. B.)

The foot-bath is one of the most useful measures in hydrotherapy. Its chief use is as a preliminary or adjunct to other treatment. It may be given with the patient lying or sitting, and is sometimes given with the patient standing. Large pails may be used, but more conveniently tubs of an elliptical shape about sixteen inches long and eight to ten inches deep.

If the foot-bath is given in bed or on a treatment table, protect the bedding or table coverings with an oilcloth. Protect the patient with a blanket or sheet, covering the knees and the foot-tub. Tuck this covering about the limbs and foot-tub so as to prevent the circulation of air. When the feet are taken out of the water, dry them thoroughly, especially between

the toes, and immediately cover well with dry coverings or put on slippers.

1. HOT FOOT-BATH (H. FT. B.).— The water should rise above the ankles. The bath may be at a temperature of about 105° F., and should be gradually increased as fast as can be borne to a maximum of about 120° F. It may be continued from five minutes to half an hour. At the close the feet should receive a pour or dash of cold water and be thoroughly dried.

It is often necessary to use the cold head compress if the bath is very hot, continued for a long time, or if given with the patient sitting up, and in all cases where there is a tendency to faintness.

Effects.— The hot foot-bath is an efficient means of securing a derivative effect. It draws blood from all other parts, especially those that are congested. The cold pour or douche given at the close helps to maintain the blood in the feet. It is sometimes desirable to use a *mustard foot-bath*, in which case add three or four tablespoonfuls of mustard to the water.

2. COLD FOOT-BATH (C. FT. B.).— The water should be from two to four inches deep at a temperature of 45° to 60° F. The feet should be previously warmed and during the bath rubbed with the hands or one foot by the other. Duration, one to five minutes.

Effects.— The shallow cold foot-bath causes reflex contraction of the blood-vessels of the brain, pelvic organs, and liver; also contraction of the muscles of the uterus, bladder, stomach, and intestines. The cold foot-bath should not be given during the menstrual period or in case of acute pulmonary, abdominal, or pelvic inflammation.

3. ALTERNATE HOT AND COLD FOOT-BATH (H. & C. FT. B.).— Use two tubs of water deep enough to well cover the ankles, one as hot as can be borne (temperature gradually raised), and the other at 45° F.

Immerse the feet in the hot water for two minutes and in the cold fifteen to thirty seconds. Continue alternations for ten to fifteen minutes, wiping from the cold.

Effects.— The alternate hot and cold foot-bath produces powerful fluxion effects in the feet. For this reason the derivation secured by its use is very decided and enduring. It is especially useful in congestive headache, in which case it is well to apply a cold compress to the head or head and neck at the same time. It is also useful in treating infections of the foot, Charcot's joint at the ankle, tuberculosis of the ankle or bones of the foot, and in gangrene to hasten the production of the line of demarkation.

LEG-BATH

(Lg. B.)

For the leg-bath a tub should be provided deep enough to immerse the legs to the knees. If used in the treatment-room the tub should be fitted with an outlet at the base so as to obviate the necessity of tipping the tub over to empty it. It should be placed near or against the wall so that it may be filled from a hot and a cold wall faucet by two short rubber hose. Also provide a stool an inch or two highe than the tub.

The patient should be covered with a sheet or blanket and, if the room is not warm enough, a large fomentation cloth or Turkish towel placed over the knees. If necessary, place a doubled fomentation cloth under the knees over the rim of the tub.

1. HOT LEG-BATH (H. LG. B.).— Begin with the water at 103° F., and increase the temperature as rapidly as can be borne. Use cold cephalic and cervical compresses (or ice-bags), renewing before they become warm. In case the leg-bath is combined with other hot treatment, as fomentations to the spine, it may be necessary to use an ice-bag over the heart, especially

if the treatment is continued to profuse perspiration. The treatment should be continued in a given case until the desired effect is produced. This may require from five to thirty minutes, according to conditions and the particular effect desired. Finish with a cold dash to the legs.

Effects.— The hot leg-bath is a much more powerful derivative measure than the hot foot-bath and is one of the best treatments that can be used for this purpose. When combined with fomentations to the spine or chest, and especially when the patient drinks some hot liquid at the same time, very profuse perspiration is produced. If used in the home, such a sweating treatment should be concluded by a cold mitten friction, or, if given in the treatment-room, by a graduated or alternate hot and cold shower and spray. The pail pour is also sometimes used for the same purpose.

2. ALTERNATE HOT AND COLD LEG-BATH (H. & C. LG. B.).— The procedure is the same as with the alternate foot-bath. It is necessary to apply a cold compress to the head and often an ice-bag to the heart.

Effects.— The alternate hot and cold leg-bath produces most powerful fluxion in the legs and feet. It is especially useful in treating edema of these parts whether due to heart or kidney disease. After two or three treatments have been given, pieces of ice should be added to the cold water. The treatment may be followed by heavy centripetal friction to the feet and legs.

SITZ BATH

(Z.)

For the sitz bath a porcelain sitz tub with special inlet and outlet is the most satisfactory; one of metal or an ordinary wash-tub may be used. In addition there should be a foot-tub for immersion of the feet

in hot water. Also a pail of cold water with a hand towel for keeping the head cool.

Protect the patient from contact with the tub by towels or fomentation cloths placed behind the back and under the knees. Cover the patient with a blanket or sheet. The temperature of the foot-bath should be at least two or three degrees above that of the sitz bath.

1. COLD SITZ BATH (C. Z.).— Sufficient water should be used to cover the hips and come up on the abdomen. Temperature — 55° to 75° F. Foot-bath — 105° to 110° F. Time — one to eight minutes. Rub the hips to promote reaction. Friction mitts may be used. If desired, the water may be flowing. It adds somewhat to the effect.

Effects.— If of brief duration — two to four minutes — it greatly stimulates the pelvic circulation and the musculature of the bowels, bladder, and uterus. When given with very cold water (55° to 65° F.) and vigorous friction (cold rubbing sitz bath) these effects are intensified. The cold rubbing sitz bath is very useful in constipation, in subinvolution, and in hastening the absorption of residual thickening after pelvic inflammations.

2. PROLONGED COLD SITZ BATH (C. Z.).— Temperature — 70° to 85° F. Time — fifteen to forty minutes. Foot-bath — 105° to 110° F. This may be begun at a higher temperature and very gradually lowered to the desired point (graduated sitz bath). It should not at any time cause chilliness, and rubbing is not desirable. If necessary to give a sensation of warmth, a fomentation or wrapped spinal hot-water bottle may be applied to the spine.

Effects.— The prolonged cold sitz bath causes extreme and lasting contraction of the pelvic blood-vessels and of the muscular wall of the uterus. It is therefore very useful in subinvolution.

3. NEUTRAL SITZ BATH (NEUT. Z.).— Temperature — 92° to 97° F. Foot-bath — 102° to 106° F. Apply cool compress to the head. Time — twenty minutes to one or two hours. Effect — sedative.

4. VERY HOT SITZ BATH (H. Z.).— Begin at a temperature of about 100° F. and rapidly increase to 106° to 115° F. Foot-bath — 110° to 120° F.; it should be kept at least 2° hotter than the temperature of the sitz bath. Keep the head cool by cold cephalic and cervical compresses. Duration — three to eight minutes. At the close cool the bath to neutral for one to three minutes. If sweating has been produced, pour cold water over the shoulders and chest. The hot sitz bath is used to relieve dysmenorrhea and pelvic pain from various other causes.

5. REVULSIVE SITZ BATH (REV. Z.).— Begin at a temperature of 100° F. and increase rapidly to 106° to 115° F. Foot-bath — 110° to 120° F. Keep the head cool by cold cephalic and cervical compresses. Duration — three to eight minutes. Finish by a cold pail pour to the hips; temperature of the water — 55° to 65° F.

Effects.— The revulsive sitz produces a fluxion effect in the surface and deep blood-vessels. It is one of the most useful measures in treating chronic inflammatory conditions of the pelvic viscera; such as, various forms of salpingitis, ovaritis, cellulitis.

HOT HALF-BATH

(H. 1-2 B.)

The hot half-bath is given in a full-length bath-tub. Fill the tub with water at 100° to 102° F. and deep enough to reach the patient's navel when the patient is sitting. The patient now sits down in the tub with the shoulders covered by a sheet and the head kept cool by a cold wet towel. It is usually best to apply

this just before the patient enters the bath. The temperature of the bath is gradually raised to 108° or 110° F., and continued for three to eight minutes. If necessary, an ice-bag should be used over the heart. Conclude the treatment by a cold pail pour to the hips.

The effects and uses are the same as those of the revulsive sitz. This treatment must not be confused with the shallow bath, which is given with cold water, and is a tonic measure.

II. Full Immersion Baths

The tub used for general or full immersion baths should be long enough so that the body may be completely immersed,— a 6-foot tub for men, in many cases a 5½-foot tub is long enough for women. The head should rest on an air pillow or small invalid ring, and for emaciated patients, a folded sheet placed under the nates. In a hot bath, the head must be kept cool by a cold compress. In the case of full-tub baths it is especially necessary that the temperature of the water be tested by means of a thermometer. In ordering tub baths, the desired temperature should be specified on the prescription.

PLAIN TUB BATHS

1. Hot Tub Bath (H. B. or H. Tub).— Temperature — 100° to 106° F. Time — two to twenty minutes. Give cold water to drink freely. Keep the head cool. If necessary, apply an ice-bag to the heart and the back of the neck. It is usually best to begin the bath at about 98°, gradually raising the temperature to the desired point. The treatment may be finished by cooling the bath, or by a cold pour or shower given immediately after rising from the bath.

Effect.— The effect varies according to the temperature and duration of the bath. If much prolonged or the temperature very high, profuse sweating is pro-

duced. The hot tub bath may be used as a preparation for cold treatment. A warm bath at 100° to 102° F. is very effective in relieving opisthotonos in tubercular meningitis, and is also beneficial in other diseases associated with spasticity of the muscles.

2. NEUTRAL BATH (NEUT. B.).— Temperature — 94° to 97° F. Time — fifteen minutes to three or four hours; usually twenty to thirty minutes. Wet the forehead and face in cool water. Cool the bath 2° or 3° just at the close. Dry the patient with a sheet directly from the bath. Use no percussion or unnecessary rubbing as this destroys the sedative effect.

Effects.— The neutral bath is given for sedative purposes. To accomplish this it must exert a relaxing effect, and so equalize the circulation as to reduce the amount of blood in the brain and spinal cord. Its temperature will therefore vary with the condition of the patient, especially as regards the skin temperature. The season of the year must also be taken into account. For these reasons it may frequently be necessary to employ the upper limit of the neutral temperatures or raise the bath to 98° or even 99°. The air of the bath-room should be warm, and if the bath is much prolonged, stretch a sheet over the tub. The cooling of the water 2° or 3° just at the close is usually necessary to prevent the slight sensation of chilliness which is likely to be produced by contact with the air on emerging from the bath. When used for insomnia, it should be given just previous to retiring.

3. CONTINUOUS FLOWING BATH.— This requires a special tub six feet long, which is provided with a large outflow and a large overflow vent near the top. The inflow may consist of one large opening at the head of the tub or of several small openings along the sides. The water is supplied directly from a mixing chamber which is fitted with a thermometer. A continuous supply of hot water at a constant temperature and pressure must be

assured, also of cold water. The water is regulated to the desired temperature in the mixing chamber before it is turned into the tub. The usual temperature is 98° F. When the tub is full and overflowing, the quantity is reduced to a gentle stream. The patient rests on a canvas hammock which swings from the rim of the tub; he is protected by a canvas cover, and provided with a rubber air pillow. An ice turban should be placed upon his head, and he should be given cold water plentifully to drink. It is well to keep a bath thermometer in the tub and consult it frequently, not relying wholly upon the thermometer in the mixing chamber.

As this bath is used chiefly in maniacal cases, the patient must be watched constantly. Very excited or violent patients should be wrapped in a sheet or blanket pack, which must be securely pinned about them, before placing them in the tub. The duration of the bath depends upon the degree of sedative effect obtained. It may last for hours or days. In the latter case the patient must be removed once or twice in the twenty-four hours, the bowels given proper attention, and the skin anointed with oil to prevent too great maceration. The continuous flowing bath is perhaps the most useful treatment in excited cases of insanity. It, together with the wet sheet pack, has revolutionized the treatment of mania.

4. Cold Bath (C. B. or C. Tub).— Temperature — 55° to 90° F. Time — a plunge only, to twenty or more minutes, depending on the temperature and effect desired. It is necessary to employ rubbing constantly or at frequent intervals. The patient's face should be bathed in cold water before entering the bath, and it is imperative that the skin be warm before the bath is given.

Effects.— When given to a patient with a normal temperature and lasting for a few seconds or minutes only, the effect is that of a stimulant and tonic. The *cold rubbing bath*, at a temperature of 75° to 90° F., is better than the strict Brand for many typhoid patients.

5. BRAND BATH.— As advised by Brand for the treatment of typhoid fever the procedure is as follows: — Temperature — 65° to 70° F. Bathe the face and head in cold water or ice-water. Lift the patient into the bath. He should be rubbed constantly to keep the blood in the skin. If chilling can not be prevented by vigorous rubbing, the patient must be removed from the bath. Time — fifteen minutes. Repeat when the temperature reaches 102.5° or 103° F. Effect — antipyretic.

6. GRADUATED BATH (GRAD. B.).— The graduated bath is as efficient in lowering febrile temperature when much prolonged and is less objectionable to the patient than the Brand bath. As the bath is frequently used in typhoid, the patient should be made comfortable by an air-pillow and hammock, made by tying a sheet across the tub, fastening the corners and sides underneath. Temperature — begin at 98° or above, depending on the height of the fever, i. e., from 3° to 5° lower than the mouth temperature. The skin must be warm to begin with. Apply cold compresses to the head. Gradually reduce the temperature of the bath to about 85° F.; when below 90° F. or if the patient feels chilly or shows goose-flesh, he should be rubbed constantly to keep the blood in the skin, and so prevent or overcome chilling. A spine bag filled with hot water may be laid along the spine for the same purpose. Both pulse and temperature should be closely watched during the bath.

7. COLD SHALLOW BATH (C. S. B.).— Fill the tub four to six inches deep with water at 65° to 75° F. The patient's feet should be warm before entering, and the head kept cool by cold wet towels. The patient sits down in the cold water and rubs the arms, legs, and chest vigorously while the attendant rubs the hips and back. Cold water dipped from the tub is dashed over the shoulders and back, and these parts

are again rubbed. The patient now lies down in the bath and rubs the chest and abdomen, while the attendant rubs the legs. This procedure may be repeated once or twice if desired.

The entire treatment should last from two to four minutes, and on emerging from the bath, the skin surface should be in a decided glow, otherwise the proper effect has not been obtained. The cold shallow bath is one of the most vigorous tonic measures employed in hydrotherapy.

HYDRO-ELECTRIC BATHS

In giving the hydro-electric or electrothermal bath a neutral temperature is usually employed. The patient is completely immersed in the water with the head on an air-pillow, and kept cool by a cold wet towel. The electrodes should hang from the side of the tub, so they may be placed in any desired position along the sides or at the feet of the patient. The treatment is begun with one electrode at the feet and the other near the arm on the opposite side. The electricity is turned on to comfortable tolerance. Time — five to twenty minutes. After half the time has expired, the electrodes should be reversed, the one at the foot of the tub being brought up along the arm of same side, and the other near the opposite arm, being placed at the foot on the same side. These directions do not apply to the galvanic bath.

Precautions.— To avoid shock there should be no current passing when the patient steps in or out. Be sure all appliances are in good order before the patient enters the bath. Keep all parts of the generator, switches, rheostat, etc., absolutely dry and clean. Do not handle the switches or the rheostat with wet hands.

Do not start or stop the motor generator or turn the current on or off while the rheostat is turned on. After the patient enters the bath, the current switch is turned on and the motor or generator started; next

gradually increase the current by turning the rheostat. Before the patient leaves the bath turn off the current by reversing these steps, i. e., first gradually lessen the current by turning down the rheostat, then stop the generator and turn off the switch.

1. FARADIC TUB BATH (NEUT. FARAD.).— The induction coil used should be large enough to amply supply any current strength needed and the interrupter so arranged as to give both slow and rapid interruptions.

Effects.— Slow or medium faradic for five or six minutes is stimulating and tonic. It is beneficial in flaccid paralysis and in general atonic conditions of the muscular system. Rapid faradic, given with less current strength and continued for twelve or fifteen minutes, is sedative. The faradic tub bath is less satisfactory than sinusoidal, as the alternations of the current are sharp and therefore less agreeable to the patient.

2. SINUSOIDAL TUB BATH (NEUT. SINU.).— For the production of a sinusoidal current the sinusoidal dynamo devised by Kellogg is the most satisfactory. The slow sinusoidal current gives a maximum muscular contraction with a minimum of unpleasantness. The contraction of the muscles is vigorous and painless.

Effects.— The slow sinusoidal for five or six minutes is stimulating and tonic. Rapid sinusoidal for a longer time is sedative. The slow sinusoidal is useful in all forms of flaccid paralysis, atrophied muscles, weak abdominal muscles, splanchnoptosis, etc. It is much more agreeable to the patient and more efficient than faradic electricity, and for these reasons should replace the faradic wherever possible.

3. GALVANIC TUB BATH (NEUT. GALV.).— Unless given from a battery of cells or a small dynamo not connected with a lighting system, galvanic electricity is dangerous. Even then burns may result if carelessly used. Moreover the effects usually sought from the

galvanic tub bath may be obtained in other ways without risk to the patient.

Precautions.— In the use of the galvanic tub bath all the precautions mentioned above should be carefully observed. The current must never be turned on before the patient enters, and always be turned off before he steps from the bath. If this is not done a severe shock may be occasioned as the patient places one foot in the bath with the other on a wet floor, thus making a grounding contact through a cement floor, or worse yet, through some metal pipe near by.

Always ascertain the polarity before the electrodes are placed. To do this, place the electrodes in water an inch or two apart and turn the current on. The bubbles formed at the negative pole are larger and more numerous than those formed at the positive pole. Place the positive pole at the head of the tub and the negative at the foot. Be sure that they do not come in contact with the skin at any point. Sinusoidal and the secondary faradic are alternating currents, and there can therefore be no distinction as to polarity.

Effects.— The positive pole is a vasoconstrictor, the negative pole a vasodilator. For this reason the positive pole decreases congestion, the negative pole increases it. The positive pole has a sedative effect, the negative pole a stimulant or irritant effect. These are the reasons for placing the positive pole at the head and the negative pole at the feet of the patient. As a neutral temperature is used, the total effect is decidedly sedative. All forms of the electric tub bath are disagreeable to some persons.

The bath should last from ten to fifteen minutes and from twenty to thirty-five milliamperes be used. The amperage should not be high enough to produce an unpleasant sensation. If there are saline substances dissolved in the bath, the amperage will run much

higher before the same effects are produced as with ordinary water. With thin subjects a comparatively low amperage must be used; with subjects in good flesh or overweight a stronger current may be employed.

MEDICATED BATHS

A tub bath may be altered by the addition of various medicaments. Such baths are not of great practical importance except in a very limited number of skin diseases.

1. SALINE BATH (SAL. B.).— Add from three to five pounds of common salt to the tub of water at 90° to 94° F. Time — ten to twenty minutes. The addition of salt adds to the tonic effect through stimulation of the peripheral circulation so that the water may be a few degrees cooler than an ordinary neutral bath. The effect is similar to a bath in sea-water.

2. ALKALINE BATH (ALK. B.).— Add one-half to one pound of bicarbonate of soda to the tub of water at a neutral temperature. One-fourth pound of carbonate of soda may be used. Time — ten to twenty minutes. Effects — relieves cutaneous irritation, itching, etc. Useful in certain skin diseases, as eczema.

NAUHEIM BATH

The effervescent or artificial Nauheim bath is one in which the water is charged with saline substances and carbon dioxid gas. Many different formulas are used to prepare such a bath. To produce the carbon dioxid gas in the bath, it is necessary that an acid come in contact with an alkaline carbonate, setting free the carbon dioxid; or salines may be dissolved in the water and the carbon dioxid added from a generator. Various proprietary mixtures prepared in cake are offered for use.

In using these, dissolve the sodium chlorid and sodium bicarbonate in forty or fifty gallons of water. The bottom of the tub is then covered with rubber sheeting. On this rubber sheeting place the acid cakes. In about three minutes, when effervescence is well under way, the patient should lie down in the bath.

A very complete and satisfactory formula is the following:—

Sodium carbonate (sal soda)	1½ lbs.
Sodium bicarbonate (baking soda)	½ lb.
Calcium chlorid	3 lbs.
Sodium chlorid (common salt)	2 lbs.
Sodium bisulphate	1 lb.

After mixing the first four, dissolve in a few inches of warm water in the bottom of the bath-tub. When thoroughly dissolved, fill the tub with water at the desired temperature. The sodium bisulphate, which is the acid part of the formula, should be granular or pounded fine and dissolved separately in a wooden or paper pail containing hot water. As it may require some time for this to dissolve, it should be prepared before the bath is to be given. When thoroughly dissolved, pour into the tub and quickly mix with the rest of the water. The bath is now ready for use. The amounts of the saline ingredients may be gradually increased for the succeeding baths of a course.

Three fourths of a pound of commercial hydrochloric acid may be used in place of the sodium bisulphate. This should be mixed with two or three times its volume of water, and after the salts are all dissolved and the tub filled with water at the desired temperature, the bottle containing the acid should be opened under wa er. It may be moved about to hasten the diffusion of the acid into the water of the bath.

The following is a simpler and less expensive formula:—

Sodium chlorid	3 to 8	lbs.
Sodium bicarbonate	¾ to 1½	lbs.
Sodium bisulphate (commerical)	1	lb.

The temperature of the bath should range from 85° to 92° F. The lower temperatures should be used for the later baths of a series. The duration of the bath should at first be from five to eight minutes. The time may then be gradually extended to fifteen or even twenty minutes. A cold compress should be applied to the head and an ice-bag to the heart. The patient should not be rubbed during the bath. About three baths a week may be taken for three or four weeks. Not over twenty baths should constitute a course.

Effects and Therapeutic Use.— The effects of the bath are due to the cutaneous stimulation of the vasomotors produced by the carbon dioxid and salines dissolved in the water. The peripheral heart is stimulated, and the cutaneous circulation greatly hastened. The heart beats slower and with greater ease. In normal individuals there may be a fall of ten or fifteen beats in the pulse-rate following a single bath, while in case of a very rapid pulse the decrease may reach as high as twenty-five to forty beats per minute. Examination of the heart after the bath in cases of a valvular lesion or cardiac dilatation shows a stronger, steadier beat; the rhythm becomes regular, the sounds clearer, and certain murmurs may disappear entirely. The pulse becomes full and blood pressure rises 20 or 30 mm. The area of dulness of an enlarged, dilated heart is often lessened one-half inch or more all around its border. Both the systole and the diastole are lengthened.

The Nauheim bath also stimulates metabolism, and hastens the elimination of gouty toxins. It exerts a beneficial effect upon nutrition, and is therefore of much use in diseases of metabolism.

If a course of baths is continued too long, over-stimulation results, passive dilatation of the blood-vessels occurs, the heart beats with less force, the rhythm is disturbed, and there will be palpitation. This may be guarded against by keeping the duration of the bath well within fifteen minutes, stopping short of the maximum number of baths that may be used in one course, and by using the ice-bag over the heart during the treatment.

OXYGEN BATH—O_2 B

This bath is similar in effect and technique to the Nauheim bath. It was introduced by Sarason, of Berlin, in 1904. Instead of carbon dioxid, the bath water is charged with oxygen gas. To produce this, requires the action of a catalizer upon an oxygen-containing chemical. Oxygen generators are also used for the same purpose, but are not regarded as so efficient because of the larger size of the bubbles. It is the oxygen that is dissolved in the water which produces the results, rather than that which collects as bubbles producing effervescence.

The standard method of preparing the oxygen bath is as follows: Fill the tub with sufficient water at 95° to 98° F. to cover the patient to his neck. Dissolve in this 300 grams of sodium perborate ($Na\ BO_3$) by sprinkling uniformly over the surface of the water. Next add the catalizer, 15 grams of manganese borate ($Mn_3(BO_3)_2$), by the same procedure. The patient gets into the water in one or two minutes after the catalizer has been put in. The liberation of oxygen continues for fifteen to

twenty minutes. The patient should remain as quiet as possible, moving the limbs only occasionally. The sensation is that of an agreeable tickling and prickling about the spine, shoulders, and limbs. At the end of twenty minutes remove the patient and dry with as little disturbance as possible. If a brownish sediment remains in the tub, it may be easily rinsed off, if this is done immediately after the bath.

The baths may be administered on alternate days or for four or five days a week, a course consisting of twenty to thirty baths. The effects are similar to those of the carbon dioxid bath in the production of a powerful stimulation of the peripheral blood-vessels. The oxygen bath, however, differs essentially in the following points: Instead of the redness of the skin produced by the carbon dioxid bath, there is either no change or the skin is paler, the peripheral diversion of blood occurring into the skeletal muscles rather than the skin. A lowering of blood pressure occurs after the oxygen bath, instead of a rise, as after the carbon dioxid bath. For this reason it is indicated in cases of high blood pressure and in cardiac and renal diseases associated with increased vascular tension.

It is also a powerful sedative to the nervous system, and is therefore a most efficient measure in the treatment of insomnia, also in asthma, neurasthenia, and various paresthesias. Because of the tendency to paleness of the skin, it is an advantage to precede the bath by some heating procedure, such as a hot foot-bath, fomentations to the spine, or a short electric-light bath. For the same reasons the bath is administered at higher temperatures than the carbon dioxid bath. For sedative purposes the bath should be administered in the afternoon or early evening, or at least an hour before retiring. In cases of hypertension, reductions in blood pressure of from 15 to 35 mm. Hg. have been reported.

III. Miscellaneous

RUSSIAN BATH

The Russian bath consists in the immersion of the body in hot vapor. The steam, as it is turned into the Russian-room, partially condenses, and hangs suspended as a thick fog. For every gram of steam that thus condenses, 537 calories of heat are liberated. This fact accounts for the intense heating effect obtained by the use of this form of hot treatment.

For the Russian bath provide a steam-tight room with a marble slab. A sliding window should be so arranged at the end of the slab that the patient's head may be outside of the steam room. The steam should enter below the slab, so as not to strike the patient directly, and be controlled by a valve near the sliding window, so that the attendant may regulate the amount of steam; at the same time keep the head cool by frequently changed cold compresses to the head and neck.

Procedure.— Move the bowels by an enema, and give a preliminary hot foot-bath. Have the patient drink water before and frequently during the bath. This is necessary in order to provide for the profuse perspiration that the treatment should induce. See that the slab is warm; if not, pour over it several pails of hot water. Warm the room to about 100° F., and cover the slab with a folded sheet.

The patient is now assisted onto the table, and lies on the back, with the head on an air-pillow just outside the opening. The window is lowered, and a towel wrung from ice-water is placed about the neck, or hung across the lower end of the window and tucked around the neck. Another cold compress is applied to the head and covers the temporal arteries. A third cold compress should be applied to the precordia. In some cases it will be necessary to use an ice-bag over the heart.

Next turn on the steam, gradually raising the temperature of the room to 115° or 120° F. A small amount of steam should be constantly escaping to maintain the temperature. Change the compresses to the head and neck frequently. The patient should be closely watched during the entire time of the treatment. The bath should last from ten to thirty minutes. Just before the patient rises from the slab, renew the ice compress to the head. Finish the treatment with a graduated or alternate spray or shower, or better still, a shampoo and graduated shower. The spray or shower should be in the Russian room or only a few steps from it.

Effects.— The effects of vigorous sweating measures have been considered elsewhere. The "washing out" effect is, perhaps, the greatest, and the thoroughness of this depends very largely upon the water taken before and during the treatment. Sweating measures greatly increase catabolism, especially of carbohydrates and fats. The products of nitrogenous metabolism show more complete oxidation.

The Russian bath is of great service in obesity, chronic rheumatism with obesity, gout, Bright's disease, auto-intoxications, chronic alcoholism, and in arteriosclerosis unless extreme. It is contraindicated in diabetes, valvular heart-disease, all diseases associated with emaciation, and in extreme arteriosclerosis.

CABINET VAPOR-BATH

The principle involved in the cabinet vapor-bath is the same as that of the Russian bath. Various waterproof cabinets are offered for sale. They are useful in a home where more elaborate facilities can not be provided. An alcohol stove heats water in a basin under or near the stool provided for the patient. This is continued until the cabinet is full of vapor, when it is ready to enter. The patient sits on the stool with the head outside the cabinet. The duration of the treat-

ment should depend upon the rapidity of vaporization and upon the effect desired. The preliminaries, procedure, and precautions to be taken are the same as in the Russian bath. Conclude the treatment with a shampoo, cold towel rub, graduated shower, or other cold application.

TURKISH BATH

The Turkish bath consists in the immersion of the body in hot air. The Russian-room may be used for this purpose, and conveniently heated by steam coils. The patient is treated in the same manner as in the Russian bath. The head and neck should be kept cool by cold compresses, and, if necessary, an ice-bag applied over the heart. The temperature of the room should be gradually raised from 120° to about 170° F. The bath may last from fifteen to forty-five minutes. Perspiration is often somewhat delayed, in which case brisk friction to the skin may hasten its appearance. If perspiration is much delayed, the patient is likely to behave badly in the hot-air bath, and for this reason should be closely watched until free perspiration is established. Owing to the difficulty with which some patients react to dry hot air, the applicability of the Turkish bath is somewhat more limited than that of the Russian bath.

SUPERHEATED AIR BATH

In the superheated air bath the temperature reaches 250° to 350° F. Special metal cabinets for the entire body or various parts may be purchased. The body or part to be treated should be thoroughly wrapped in Turkish toweling, and should not rest on any part of the cabinet likely to become hot enough to burn. By means of a gasoline or other burner, the temperature of the air in the cabinet is gradually raised to 250° or 350° F. These burners are placed just below the cabinet; over them are fitted inverted funnels with a short,

wide stem leading directly into the cabinet. The entering hot air should be spread by means of an asbestos shield so that it will not directly strike the skin surface. The patient's pulse and general condition must be watched very closely in giving a full hot-air bath. An ice-bag should be kept on the heart and ice compresses on the head and neck. These precautions are not so necessary where only a single part, such as the knee or foot and ankle, is being treated. The treatment may be concluded by an alcohol or witch-hazel rub. Great care must be exercised that the patient does not take cold afterward.

The Turkish toweling with which he body or limb is wrapped quickly absorbs the perspiration, thus preventing its collecting on the skin in drops. Should it collect in drops, burning is more likely to result.

Effects.— The superheated air bath is a much more vigorous measure than the Turkish bath. It is of special advantage in articular rheumatism, whether occurring in acute rheumatic fever, chronic gouty rheumatism, or in specific arthritis. Where one or two joints are being treated, the application should continue from twenty minutes to an hour after the temperature has reached 300° to 350° F. When the part is taken out, a momentary dash of cold water may be given, or the part cleansed from perspiration and a heating compress applied.

ELECTRIC-LIGHT BATH
(E. L. B.)

In giving the electric-light bath, special upright or reclining cabinets fitted with mirrors and incandescent lights are used.

The feet should be warmed beforehand, or with the upright cabinet a hot foot-bath should be used. Cover the stool with a folded Turkish towel. Turn on the desired number of lights; when the cabinet is warmed, have the patient enter. Then close the cabinet, and

apply a cold wet towel to the head and neck. Renew this frequently. If there is a tendency to faintness or rapid pulse, use an ice-bag to the heart as well. If a horizontal cabinet is used, cover the table with a folded sheet. Warm the cabinet, and place a rubber pillow for the patient's head. The patient then lies down and is rolled into the cabinet, or the top is lowered, according to the style of cabinet used The patient's head should be kept cool by cold compresses. There is less tendency to fainting with the horizontal than with the upright cabinet.

The patient must be watched very carefully and constantly in order to guard against fainting. On leaving the cabinet, a blanket or sheet should be thrown about the patient if it is necessary to go more than a few steps for the next part of the treatment. Finish with a spray or shampoo and spray. Where only general tonic effects are desired, the electric-light bath should last from three to five or six minutes; for profuse sweating and eliminative effects, continue it from ten to eighteen or twenty minutes.

The air of the cabinet is not warmed to the same extent as the skin of the patient, since the heat is in the form of *radiant* energy. In this particular the electric-light bath differs essentially from the Russian or Turkish bath, and from the effect produced by hot applications applied directly to the skin. This means that the heat of the electric light is not communicated to the body by direct conduction or by convection, but by the absorption of the rays of radiant energy, as they are retarded and stopped by the skin and subcutaneous tissues.

On the other hand, for strong derivative effects, the electric-light bath is unsatisfactory. For derivative purposes the heat must be brought in actual contact with the skin by applying the heated substance directly to the skin. For this reason, stronger derivative effects are secured by partial or full hot baths and hot packs.

SHAMPOOS

SWEDISH SHAMPOO

(Ssh.)

For giving the Swedish or slab shampoo, provide a pail of water at 103° to 105° F. on a stool of convenient height near the head of the slab, also a shampoo brush and a half bar of soap. If the slab is not kept warm by being in a warm room, pour over it two or three pails of hot water. Cover the slab with a doubled sheet, and assist the patient onto the slab, placing the head on an air-pillow. Quickly lather an arm by dipping the brush and soap in the pail of hot water and rubbing together over the part. With brisk short movements go over the part thoroughly, using as much friction as is comfortably borne. Do the same with the chest, abdomen, and legs.

Next assist the patient to turn over on the slab, by putting one arm under the neck and grasping the opposite shoulder, and the other arm under the near leg and grasping the opposite knee. Treat the back, hips, and the backs of the legs in the same manner as the front of the body. Pour the remaining water in the pail over the patient to rinse off the soap-suds. Follow the shampoo by a warm and cold shower, spray, or pail pour.

TUB SHAMPOO

(Tub Sh.)

Fill a bath-tub with water at 98° F. The patient may sit on a wooden stool in the tub, or, if likely to chill, he should lie down in the tub with the water deep enough to cover the chest. If given with the patient sitting on a stool, begin with the arms, back, chest, and abdomen, then the legs. If given with the patient immersed, raise one part at a time above the water and proceed

as usual, having the patient sit for the back and chest. Finish by complete immersion in the tub, followed by a cold pail pour or shower.

TURKISH SHAMPOO

(Tur. Sh.)

The Turkish shampoo is given after sweating baths, such as the Turkish, Russian, or electric-light bath. The shampoo proper is preceded by manipulations and heavy friction to loosen the outer epidermis (so-called dead skin). It is the most thorough cleansing measure used.

a. Articles Necessary.— Two pails of water at 90° F., one at 100° to 105° F., a luffa or shampoo brush, soap, two Turkish toweling mitts, two sheets and towels. In treating women, the hair should be protected by a rubber cap.

b. Procedure.— If the sweating bath has not been taken in the shampoo-room, it must be well heated and the slab warmed by pails of hot water poured over it. Cover with a doubled sheet, and assist the patient onto the slab. Place an air-pillow under the head.

Manual Rubbing.— Wet the face with water at 90° F. With the hands, dash water over every part separately, using long strokes and quickly covering the body. Beginning with the neck, about the ears, hair, forehead, over the nose and chin, rub until the dead skin is thoroughly loosened. Wash off the loosened epidermis, dipping the hands frequently. For the chest and abdomen, after applying the water, use transverse wringing and reenforced rubbing, covering each part several times. Then wash off with water. For the arms use spiral friction and wringing. For the legs, the same; with the thumbs, rub well about the ankles, soles of feet, knees, etc. Turn the patient and proceed with the back in the same manner as with the chest, also

the thighs and legs. Wash off the entire surface with water.

Friction Mitt.— Dip the mitt in the second pail of water at 90° F., and beginning with the back and backs of thighs and legs, go over each part twice, rubbing all thoroughly. Then turn the patient and treat the chest, abdomen, arms, and legs in the same manner. Wash off with the rest of the pail of water at 90° F.

Shampoo.— Treat each part as in the Swedish shampoo, using hands, a luffa or bath brush, and the pail of water at 105° F.

Finish with prolonged tepid or cool shower or spray, and at the close a short cold spray. Dry thoroughly with sheets and towels. The patient should be careful not to take cold afterward.

PACKS

Packs are procedures in which a considerable portion of the body is enveloped in wet sheets or blankets for therapeutic purposes.

I. Hot Blanket Packs

The hot blanket pack is a procedure in which hot blankets are used to communicate heat to the body.

FULL HOT BLANKET PACK
(H. B. P.)

a. Articles Necessary.— Two double blankets or one single and one double blanket; one hot-water bottle and three spine bags half filled with hot water at 160° F., a bowl or pail of ice-water with compresses for the head, neck, and heart; two Turkish towels; a tumbler, a drinking tube, and a pitcher of hot water for drinking.

b. Preliminaries.— Move the bowels by enema, give a hot foot-bath, and have the patient drink hot water.

c. Procedure.— Spread a double blanket on the treatment table or bed. Adjust a cold compress to the patient's head while his feet are still in the hot foot-bath. Fold the single blanket or another double blanket (the latter holds the heat longer) lengthwise in convenient width for passing through a wringer or wringing by hand. Wring from boiling water, quickly unfold and spread out over the dry blanket on the table.

Assist the patient to lie on the hot blanket, or with a bed patient lift onto the blanket. As quickly as possible or as rapidly as can be borne, envelop the entire body except the head in the hot blanket. Place one spine bag between the legs with one thickness of dry blanket between it and the moist blanket, and the hot-water bottle at the feet. The other spine bags should be placed along the sides of the trunk in the same way as the one to the legs. Tuck both wet and dry blankets in well, especially at the feet and about the shoulders and neck, so as to exclude the air. See that the wet blanket comes in contact with the body over its entire surface, so that no air spaces will be left.

Place cold compresses about the head and neck and protect the chin from the hot blanket by a soft dry towel. Renew the compresses before they are warmed to any extent.

For general sweating effects a dry blanket may be placed between the patient and the wet blanket, but for strong derivative effects the wet blanket should come in immediate contact with the skin.

The patient should perspire in a short time. If perspiration does not begin in about ten minutes, give hot water to drink or a hot foot-bath, or both. In giving the hot foot-bath the blankets should fall loosely about the tub so as to prevent the circulation of air.

Continue the pack for twenty to thirty minutes, i. e., until it ceases to have a heating effect. For tonic effects, five to ten minutes. Take the patient out by

a cold mitten friction or a cold towel rub, removing the blanket from one part at a time and covering with a dry blanket or bedding immediately after. It is usually most convenient to begin with the arms, then the chest and abdomen, legs last, giving the cold friction to the back after the wet blanket has been entirely removed.

d. Precautions.— Too much water left in the pack makes it feel very hot at first, but it cools more rapidly than when wrung nearly dry. For this reason the pack should be wrung as dry as possible.

If the hot-water bags are too near the patient (not sufficiently covered), there is danger of burns resulting. If complaint is made, they should at once be covered more thoroughly.

In some cases it is necessary to use a cold compress or an ice-bag to the heart.

General free perspiration should be induced by the pack. Long-continued heat without perspiration results in harm.

In giving packs in case of paralyzed sensation, unconsciousness, under or soon after anesthesia, in diabetics, dropsy, and the insane, it is safer if a thickness of dry blanket intervene between the patient and the wet blanket. Hot-water bottles should be more thoroughly covered and the water used in them should be at a lower temperature than ordinary.

e. Effects.— The hot blanket pack is a vigorous sweating measure. It also produces decided derivation. Any sweating treatment decreases internal congestion, but this action is much more marked when the wet blanket is placed next the skin. Where the congestion is not localized in some particular part, but consists of a general internal congestion, a general sweating treatment is usually sufficient for its relief. This is the case in the first stage of many fevers, in colds, grippe, etc.

DRY BLANKET PACK
(D. B. P.)

Sweating may be produced by enveloping the body in a dry woolen blanket, and using hot-water bottles in the same way as with a wet pack. The same preliminaries should be observed, especially the giving of the hot foot-bath before. It is quite essential that the patient take a considerable quantity of a hot drink during the treatment. Hot lemonade is ideal, as it favors both diaphoresis and diuresis. The sweating may be as profuse as with the wet pack, but the derivation is less efficient. Since no wet blanket is used, the patient may be first wrapped in a dry sheet and then in the dry blanket. The perspiration will be absorbed by the sheet, and so in a short time, the effect will somewhat approach that of the sweating wet sheet pack.

HOT TRUNK PACK
(H. Tr. Pk.)

The method of applying the hot trunk pack is the same as with the full blanket pack. The wet blanket should include the pelvis but exclude the arms, reaching up to the axilla. The outside dry blanket should include the whole body, but be used only for protection; it should not be wrapped tightly about the patient. It is usually best to apply a large dry fomentation cloth between the patient and the wet blanket. Place a hot-water bottle over the abdomen between the folds of the dry blanket, and spine bags on either side of the trunk. A hot foot-bath should begin before and continue during the pack. Time — twenty to thirty minutes. If given for the relief of the pain of any form of colic, omit the cold friction at the close.

The hot trunk pack has the same general effect as the hot blanket pack. Since it covers less surface the

derivative effects are less. It is especially useful in digestive disturbances and in relieving the pain of renal and biliary colic, also in intestinal colic.

REVULSIVE TRUNK PACK
(Rev. Tr. Pk.)

The revulsive trunk pack consists of a hot trunk pack given as directed above and followed by a wet sheet trunk pack. Only this one change from heat to cold is made. The sheet is wrung from water at about 60° F., and applied to the trunk after removing the wet flannel blanket. The method is described under the heading of wet sheet packs.

The hot blanket should be removed while it is still hot, and the wet sheet applied at once in much the same manner as for the revulsive compress. The wet sheet trunk pack should remain in place until the heating stage is reached, when it may be removed and a cold mitten friction or alternate hot and cold spray douche given to the parts covered by the pack, finishing with the same to the feet. If desired, the wet sheet trunk pack may be made a hot and heating trunk pack by inserting a hot-water coil or a hot-water bottle over the stomach.

The revulsive trunk pack is used for tonic purposes, also in chronic congestions of the liver and the other digestive organs.

HOT PELVIC PACK
(H. Pelv. Pk.)

The hot pelvic pack is applied in the same manner as the hot trunk pack. It should come well above the crests of the ilia and include nearly half of the thighs. It is useful in the relief of pelvic pain from dysmenorrhea, cystitis, proctitis, etc. Its effects do not greatly differ from those of the hot sitz bath or large, very hot fomentations to the pelvis, both of which treatments are much easier to apply.

REVULSIVE PELVIC PACK
(Rev. Pelv. Pk.)

This treatment is applied in the same way as the revulsive trunk pack. The cold pack should be prolonged to the heating stage. The effects are somewhat similar to those of the revulsive sitz and hot half-bath. It is useful in chronic congestions and chronic inflammations of the pelvic organs.

HOT HIP-AND-LEG PACK
(H. Hp. & Lg. Pk.)

The hip-and-leg pack should include the feet, legs, thighs, and pelvis, reaching slightly above the crests of the ilia. A hot-water bottle should be placed at the feet within the folds of the dry blanket and a spine bag between the legs. Time — twenty to forty minutes. Taking one limb out at a time, finish with a cold mitten friction, to retain the blood in the limbs, thus maintaining the derivation secured by the hot pack.

Effects.— The hot hip-and-leg pack is one of the most efficient derivative measures used in hydrotherapy; it is indicated in a large number of conditions, and is especially useful in depleting acutely inflamed organs when combined with the use of an ice-bag over the congested part. (See Hot Packs With Ice-Bags.)

HOT LEG PACK
(H. Lg. Pk.)

The hot leg pack should include the feet, legs, knees, and half or more of the thighs. Hot-water bottles are used the same as above. Conclude the treatment in the same way.

The leg pack is somewhat less effective than the hip-and-leg pack. It is used for the same purposes, and is convenient where it is undesirable to move the

pelvis in giving treatment. A large fomentation may be used over the anterior surface and sides of the pelvis at the same time, so as to cover nearly as much surface as the hip-and-leg pack.

HOT PACKS WITH ICE-BAGS

Hot packs combined with the use of ice-bags, or the ice-water coil are the most powerful and efficient derivative measures known to hydrotherapy. They are especially useful in reducing internal congestions, reducing or aborting local inflammation of deep parts and relieving the pain incident to the inflammatory process. For these purposes they are used only in the acute stage of the inflammatory process. The effects have been fully discussed in the consideration of inflammation and antiphlogistic effects, q. v.

The hot pack depletes the congested part by *drawing* the blood away to establish a collateral hyperemia (pull effect), while the ice-bag *drives* the blood away by reflexly stimulating prolonged and extreme contraction of the deep vessels of the inflamed part (push effect). (Plate I.) The cold mitten friction given at the close causes retention of the blood in the skin by changing the passive hyperemia to an active arterial hyperemia.

These treatments are sometimes spoken of as hot and cold packs, but this designation may cause confusion with the alternate hot and cold pack in which a cold (heating) wet sheet pack follows the hot blanket pack.

Ice-bags may be used with the full pack or with any of the partial packs. The following combinations are useful in the acute stages of the diseases indicated:—

APPENDICITIS — Hot hip-and-leg pack, with ice-bag to the appendiceal region.

PERITONITIS — Hot hip-and-leg pack, or leg pack only, with an ice compress or ice-cap to abdomen.

PUERPERAL INFECTIONS AND ACUTE SALPINGITIS — Full hot blanket pack, or hip-and-leg pack, with ice to pelvis (suprapubic region).

PNEUMONIA — Hip-and-leg pack or full blanket pack with cracked ice compress over lobe affected.

MENINGITIS — Hot leg pack, with ice cravat, ice-cap, and ice-bag to base of brain and upper spine.

MASTOIDITIS — Hot hip-and-leg pack or full blanket pack with ice cravat or ice-bag over the carotid artery, ice-cap to head, and fomentations to mastoid.

ALVEOLAR ABSCESS — Same as mastoiditis, except give fomentations to the jaw.

RENAL CONGESTION — Hot trunk pack or full blanket pack with ice-bag to lower third of sternum.

Other combinations will suggest themselves to the resourceful mind.

ELECTROTHERMAL PACK

(Elec. Pk.)

The electrothermal pack consists of a specially prepared blanket containing flexible resistance wire. If it is to be used dry, the body or part to be treated should be wrapped in a dry sheet or thin flannel blanket, and then in the electric blanket, and the electricity turned on. The amount of heat and consequent effect may be governed by the strength of the current. If to be used wet, wrap the patient in a sheet wrung nearly dry from cold or tepid water, and then in the electric blanket. The treatment is concluded by a cold mitten friction, spray, or douche.

Effects.— While the heat is not as intense with the electric blanket as with a blanket wrung from boiling water, it is a gradually increasing heat, and so more desirable for some purposes. It is useful for general sweating effects, and for this purpose may be used with or without the wet sheet. The dry pack may be used

where mild continuous heat is desired, as after an operation. In this case it should usually be applied only to the legs or the pelvis and legs. A Turkish towel should be placed so as to form a pad under the heels, and then folded over the toes. All bony prominences should be similarly covered. The electric blanket may be used to reenforce other packs, and so increase or prolong the effects.

The electric blanket should not be folded sharply at any place, as the wires are likely to be broken.

II. Wet Sheet Packs

A wet sheet pack is a procedure in which the body is wrapped in a wet sheet, outside of which is a dry blanket covering designed to regulate the evaporation.

FULL WET SHEET PACK

(W. S. P.)

a. Articles Necessary.— Two blankets, a sheet, a large hand towel, a Turkish towel, a pail of water at 60° to 70° F., a hot-water bottle.

b. Preliminaries.— The feet and entire body must be warm before the pack is applied. Chilliness, cold skin, or cyanosis are contraindications. In case the skin is not warm, it is necessary to give a hot blanket pack or some other general hot treatment. The head should be cooled by cold compresses before entering the pack.

c. Procedure.— Place a double blanket lengthwise of the treatment table, with the edge opposite the attendant hanging farther over the edge of the table than the near edge. The upper end should be about eight inches from the head of the table, and cover the lower third of the pillow. Wring the sheet as dry as possible from cold water and spread out upon the blanket, so that its upper end will be a little below the upper end of the blanket. The patient then lies down upon the wet

sheet with the shoulders three or four inches below the upper edge. Both arms should be raised, while one side of the sheet is quickly wrapped around the body, drawing it tightly in contact at all places and tucking the edge under the opposite side Below the hips the sheet is wrapped around the leg of the same side. The arms are then lowered, and the opposite side of the sheet drawn tightly over the body and tucked in. The sheet is folded over the shoulders and across the neck. The narrower edge of the blanket is drawn tightly around the body and tucked in along the side. The wider edge is disposed of in a similar manner, pulling it tightly to bring all parts in close contact and the extra amount wrapped entirely around the patient. The foot end is doubled under the feet. A Turkish towel is placed about the neck to protect the face and neck from contact with the blanket, and more perfectly to exclude the air. An additional blanket may be laid over the patient and tucked in along the sides and about the feet, or two blankets may be placed on the table at first.

d. Precautions.— The wet sheet must come in close contact with the body at all points. The dry blanket must effectually prevent the entrance of air, otherwise chilling will result. "Warming up" should occur promptly. The feet must be kept warm during the entire treatment. It is permissible to place a hot-water bottle to the feet to hasten reaction in case this is delayed.

e. Stages.— According to the degree of warming the pack undergoes, it passes through four stages; viz.,— *cooling or evaporating, neutral, heating and sweating.* It is often desirable to prolong the effect of one stage so that this effect may predominate. Accordingly, the treatment is varied as follows:—

1. COOLING OR EVAPORATING WET SHEET PACK (EVAP. W. S. P.).— This is the first stage of the pack

before the sheet has been warmed to the temperature of the body. It requires from five to twelve minutes to accomplish this. If at the end of this time the sheet is removed and another applied, the effect is intensified, or the blanket may be folded back and cold water sprinkled on the patient over the wet sheet. In the case of vigorous patients the dry coverings may be omitted entirely, considerable water left in the sheet, and the patient fanned to hasten evaporation, more water being sprinkled on the sheet as soon as it is warmed slightly.

Effects.— The evaporating wet sheet pack is a powerful antipyretic measure. It is useful in typhoid fevers, and in other continued fevers where repeated antipyresis is necessary. It is usually best not to remove the pack for renewal, but sprinkle on more cold water. As in the use of the cold tub bath in typhoid fever, rubbing is necessary if the water is very cold or the sheet sprinkled frequently. This is known as the *rubbing wet sheet pack.* Percussion should not be used. The greater the amount of water applied to the body, the stronger are the antipyretic effects, and consequently the quicker is the temperature of the patient reduced.

If desirable, the sheet may be wrung from hot water, the coverings being omitted. This is spoken of as a *hot evaporating sheet.* It is useful where slight chilliness exists. This treatment is not only antipyretic but also lessens heat production because of the initial heat and the consequent atonic reaction.

2. NEUTRAL WET SHEET PACK (NEUT. W. S. P.).— The neutral stage begins when the temperature of the pack reaches or slightly exceeds the temperature of the skin; viz., about 94° F. It may be prolonged by removing all but one or two dry coverings after the warming up has well begun. This allows sufficient evaporation to prevent the accumulation of heat above the

temperature of the body. The protection must be uniform, and the entrance and circulation of air prevented.

Effects.— The effects of the neutral wet sheet pack have been considered under the treatment of insomnia. A neutral temperature is secured the same as in the neutral bath. The marked sedative effects of the neutral pack are due more to the derivation secured than to the neutral temperature. In normal sleep there is a lessening of the amount of blood in the brain and a local decrease of blood pressure. The neutral pack brings about these changes, and so aids in inducing relaxation and sleep.

If the pack is removed before sleep is produced, uncover one part at a time, drying thoroughly and wrapping it in a warm dry sheet; or entirely remove the pack, and immediately wrap the patient in a warmed sheet, finishing the drying as quickly as possible.

If the pack is removed after the patient has slept, conclude the treatment by a wet hand rub or cold mitten friction according to the degree of tonic effect desired.

The neutral wet sheet pack is also of use in the delirium of fevers, in mania, epilepsy, chorea, infantile convulsions, etc.

3. Heating Wet Sheet Pack (Heat. W. S. P.).— The heating stage begins when the warming of the pack raises the skin temperature slightly above its usual degree; it ends at the beginning of general perspiration which marks the establishment of a full reaction. For tonic effects the pack should continue about twenty minutes. When the stage of a pack is not prescribed, this treatment is intended.

Effects.— Tonic and heating effects are secured by it. These may be prolonged by applying cold water to the head and neck continuously, so as to check extreme sweating. The chief effect of the heating wet sheet

pack is the production of derivation. The reaction and heating up of the skin caused by the accumulation of body heat congest the skin, and so lessen the amount of blood in the internal organs.

The heating pack possesses quite a range of usefulness in securing mild tonic and derivative effects.

4. ELIMINATIVE OR SWEATING WET SHEET PACK (SWEAT. W. S. P.).— The production of general perspiration marks the beginning of the sweating stage. The sweating may be increased or prolonged by additional coverings, hot-water bottles placed within the folds of the dry blanket, or the drinking of hot water or lemonade at intervals. The cold compresses on the head should not be very cold nor renewed too frequently, as this depresses the thermogenic centers and prevents sweating.

Effects.— The sweating wet sheet pack is a very valuable eliminative and spoliative measure. It is one of the most useful means in the treatment of the transient fevers of infants and children, in capillary bronchitis, colds, and grippe.

For spoliative purposes it is useful in obesity and obese rheumatics.

HALF-PACK OR HEATING TRUNK PACK

(1-2 Pk.)

The heating trunk pack is given in the same manner as the heating wet sheet pack, except that it includes the trunk and hips only, the arms and legs being excluded. A full blanket should be spread out on the treatment table, and over this placed a sheet wrung from water at 60° F. and folded to the proper width to include the trunk and hips. The patient lies on the wet sheet, and it is drawn tightly about the body. The dry blanket is next folded over so as to bring the wet sheet in close contact with the skin surface. A moder-

ately hot foot-bath is given at the same time and continued during the treatment. The dry blanket should be laid loosely over the limbs. The pack and the patient should not be so thoroughly covered as to produce general perspiration. It is well to have a dry sheet or towels intervene between the blanke and the patient at all places not covered by the wet pack. For this purpose a dry sheet may be spread out on the dry blanket before the wet sheet is placed for the trunk. The treatment should last about twenty or twenty-five minutes and be concluded with a cold mitten friction or an alternate spray douche to the parts covered by the pack and to the feet and legs.

The effects, though less pronounced, are in general the same as those of the hot and heating trunk pack, q. v.

HOT AND HEATING TRUNK PACK

(H. & Heat. Tr. Pk.)

This treatment is the same as that previously described under the Winternitz coil.

A single blanket is placed crosswise of the treatment table or bed so that the upper edge may reach well up under the arms. A sheet doubled (in case of feeble patients a single thickness) to a width which will reach from the axilla to below the hips is wrung from cold water and placed over the blanket. The patient lies down on this, and while both arms are raised, one end of the wet sheet is pulled tightly across and around the trunk. Over the epigastric and umbilical regions outside of the sheet, place a three-quart hot-water bottle half filled with water at 135° to 140° F. Wrap the other end of the sheet about the trunk over the hot-water bottle, and cover snugly with a dry blanket, folding over one end at a time. A Winternitz coil or an electric pad may be used in place of the hot-water bottle. Continue the treatment from forty minutes to two hours. General sweating should not be pro-

duced. It may be begun half an hour before the meal. Take the patient out with a cold mitten friction or an alternate spray douche to the abdomen and spine.

Effects.— The hot and heating trunk pack is the *most efficient* hydrotherapeutic measure for the treatment of *digestive disturbances*. It promotes gastric secretion and gastric digestion. Liver activity and intestinal digestion proceed more normally. Excessive peristalsis and vomiting are checked, and in decreased gastric motility, stomach movements are hastened. Because of more perfect digestion and more normal peristalsis, gas formation is markedly decreased or entirely checked.

The hot and heating trunk pack is indicated in persistent vomiting, dyspepsia, flatulence, splanchnic neurasthenia, chronic congestion of the liver, and in anemia of the liver.

In cases of almost complete arrest of gastric digestion or in persistent vomiting, the pack should be applied about twenty minutes before the meal, and continued for two or three hours. A cold mitten friction should be given at the close. The feet should be warmed by a hot foot-bath before the treatment, and kept warm during the treatment. The hot foot-bath may be continued while the treatment lasts, if this is not over thirty minutes; otherwise it is well to dry the feet, and wrap them in dry flannel, so that the patient may rest more perfectly. For further details of the uses and effects, see treatment of atonic dyspepsia.

HEATING PELVIC PACK

(Heat. Pelv. Pk.)

On the treatment table spread a blanket as for a full pack. Next fold a single blanket to form a square, and then diagonally to form a triangle. Arrange this on the large blanket so that the base is upward and the apex downward where it may be folded about the pelvis

when the patient reclines. Over this place a sheet similarly folded and wrung nearly dry from water at 60° F. The patient then reclines, and with legs flexed and knees separated, the apex of the wet sheet is brought into close contact with the perineum and spread over the abdomen. With legs extended, each lateral angle of the wet sheet is drawn down tightly across the hips, lower abdomen, and upper thigh. The triangular piece of dry flannel is then applied in the same manner, and the patient covered with the large blanket. Continue the pack twenty or thirty minutes.

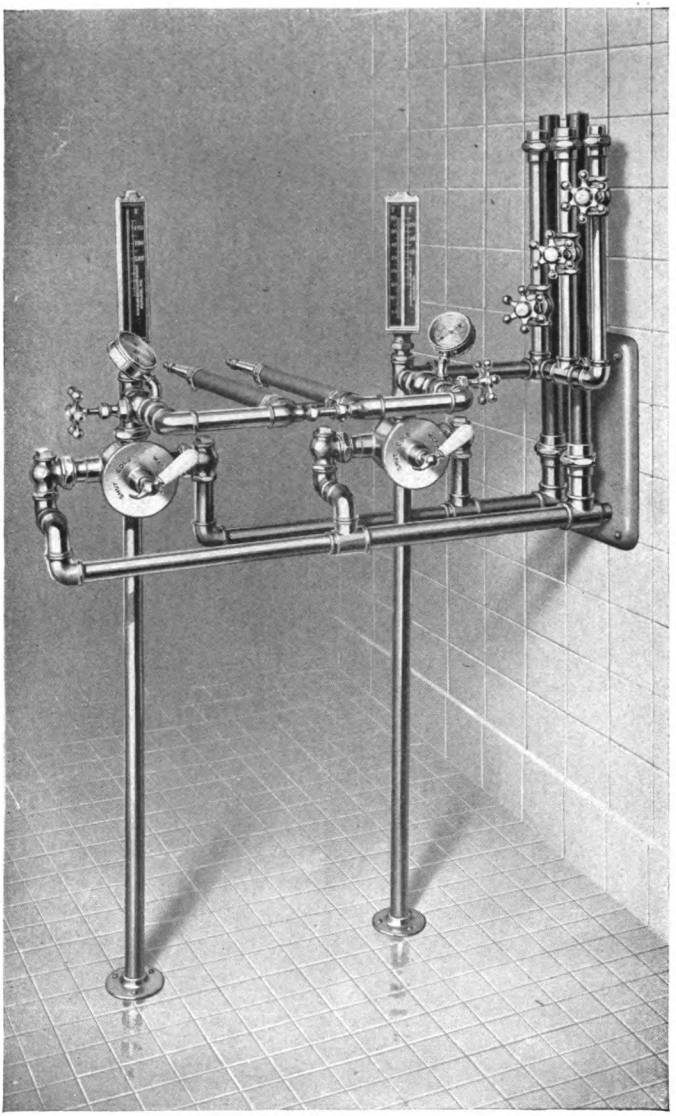
SPRAYS AND DOUCHES

A spray or douche consists in the projection of one or more columns of water against the body. Many different appliances are used in giving these treatments. They possess such a wide range of adaptability that almost any desired effect may be produced by them. For this reason the nurse should become thoroughly proficient in the use of the spray and douche controller. The water-supply to the controller should come directly from a hot and a cold water-tank by pipes entirely independent of all other fixtures, and no other faucets or fixtures should be attached to these mains. The most perfectly constructed controller will fail to give satisfactory results unless this rule is observed.

SHOWER-BATH

(Sh.)

A shower- or rain-bath consists in the projection of water in many fine streams falling upon the patient. In the shower-bath gravitation is the principal force utilized; the effect, however, is often enhanced by added pressure. The perforated disc from which the water descends should be about six inches in diameter and from ten to sixteen inches above the patient's head.



Hoffmann & Billings Mfg. Co., Milwaukee, Wis.

NIEDECKEN HYDROTHERAPEUTIC CONTROLLER

There should be sufficient force to cause the water to flow rapidly. The room should be very small and protected from drafts. See that the patient's feet are warm before entering the shower. If the wetting of the hair is objectionable, as with women, protect by a rubber or mackintosh cap. Turn on the shower and adjust to the proper temperature before the patient enters.

In making sudden changes in temperature see that the vents or discharging outlets are opened during the change, otherwise difficulty will be experienced in securing an instantaneous change, or the hot water, because of added pressure, may crowd out the cold.

1. HOT SHOWER (H. SH.).— Begin the hot shower at 100° to 105° F., and gradually raise the temperature to from 110° to 115° F., or slightly above. Time — thirty seconds to two minutes. It is used chiefly as a preparation for he cold shower or douche. It may be necessary to use a cold compress to the head during the hot shower. If only a hot shower is prescribed, cool rapidly to 90° or 85° F., and dry quickly with sheet and towels, finishing by fanning the patient with a dry sheet.

2. COLD OR COOL SHOWER (C. SH.).— The cold shower is usually preceded by a hot shower. When the patient has been warmed, lower the temperature rapidly from hot to the limit of tolerance or reactive ability of the patient. Cool — 70° to 90° F. Cold — 55° to 70° F. At first, before the patient becomes accustomed to the shower, the upper limits should be utilized, and in each succeeding treatment the temperature lowered by 1° or 2° daily and the time prolonged to from one-half to three or more minutes. Effects — tonic.

3. NEUTRAL SHOWER (NEUT. SH.).— In giving a neutral shower, begin with the water at 100° F., and very gradually lower it to 97° to 94° F. The treatment should last from three to five minutes. The patient

should be dried quickly without percussion or unnecessary friction. Effects — sedative.

4. GRADUATED SHOWER (GRAD. SH.).— After a prolonged or vigorous sweating bath, it is desirable to lower the temperature of the shower slowly for gradual cooling and to abstract as much heat from the body as possible without producing a decided thermic reaction. Apply a cold compress to the head before the patient leaves the hot bath. Begin at 108° to 110° F., quickly raising the temperature to 115° or 118° F. Maintain this until the patient feels well warmed and is ready to welcome the cold. Gradually lower the temperature to between 80° and 90° F. Time — two to six minutes. Dry as quickly as possible with sheets and towels, and see that the patient is not exposed to cold air or drafts for at least an hour afterward.

5. REVULSIVE SHOWER (REV. SH.).— Begin the shower at 105° to 108° F. and gradually raise the temperature to from 110° to 115° F. or slightly above; continue at this point for one or two minutes. When the patient has been thoroughly warmed, turn the mixer quickly to cold at a temperature of 60° to 85°. After five to ten seconds turn the mixer back to the former temperature for one or two minutes. Three complete changes from hot to cold are made. After the last cold, dry quickly with sheets and towels as usual.

Effects.— The revulsive shower has a mild tonic and stimulant effect. The patient should become accustomed to it before taking the alternate hot and cold shower. The change from one to the other may be made gradually by lengthening the duration of the cold with each succeeding treatment.

6. ALTERNATE HOT AND COLD SHOWER (H. & C. SH.). — To obtain the best results the changes should be abrupt from hot to cold. As the water must traverse about fifteen feet of pipe before it reaches the patient,

an absolutely instantaneous change is impossible. Begin with the hot at a temperature of 106° to 110° F., raising the temperature quickly to the limit of tolerance, and continue it about one minute; then turn the mixer valve quickly to cold and continue fifteen to thirty seconds. Reverse again to hot for about one minute and follow this by a second cold, and so on for three complete changes of hot and cold, finishing with the cold, and drying as usual.

Effects.— The alternate hot and cold shower is a vigorous tonic and stimulant. It should not be ventured upon without considerable preliminary training by milder measures. Some find it more agreeable than the spray, and easier to react to.

SPRAYS

(Spr.)

A spray bath consists in the simultaneous projection of water against all parts of the body by horizontal jets surrounding the patient. For this purpose may be used four upright pipes arranged in a square each being fitted with four rosettes. The upper row of rosettes should be provided with a ball joint so as to accommodate the shower to both short and tall patients. The effects and uses of the spray are the same as those of the shower except that the application is slightly more general and hence more vigorous. The treatments are given in the same manner as the shower.

DOUCHES

(D.)

The douche is a local application consisting of a single or multiple column of water directed against some part of the body. It is certainly one of the most use-

ful of all hydrotherapeutic measures. The effect of almost every other form of treatment commonly given to ambulatory patients may be approached and usually exceeded by the douche in the hands of one skilled in its application.

The necessary attachments are not numerous. These should consist of a straight nozzle, with or without a center needle for breaking and spreading the jet; a spray nozzle, like the sprinkler of a watering-pot, except that the perforated disk should have a nearly flat face; a fan douche nozzle, a movable flat piece attached to the straight nozzle will answer the same purpose; a stool with an open seat and attached up-shot spray douche for administering the perineal douche.

The jet nozzle is used whenever percussion effects are desired. The pressure may be increased by opening the valve wide, or by turning into the nozzle compressed air from a separate tube. Where a percussion douche (Perc. D.) is ordered, the jet is understood. Both cold and percussion produce a decided thermic reaction, and increase the vigor and permanency of the circulatory reaction. The spray douche is useful where percussion is not desirable. The jet douche may be "broken" by placing the finger so as to interfere with the stream. It then resembles the spray douche in effect. The effects in general vary according to the mass, pressure, and temperature of the column of water striking the body.

The cerebral circulation will be steadied and better general and local results obtained if all applications of the douche begin and end with the feet. The patient should dip his hands in cold water and bathe his face before the douche is applied. In applying the douche some definite plan should be learned and systematically followed, making changes when necessary for the particular case and condition in hand. In order to guard against burning, always keep the index finger of the

hand holding the douche in contact with the stream of water as it emerges from the nozzle. This should be done with the most perfect of appliances, and even when no trouble at all is anticipated. Keep a steady hand, apply the douche accurately to the part to be treated, and have the thermometers under constant observation.

The following are the general directions for douches of different temperatures. In giving these any form of nozzle may be used and any portion of the body treated.

1. HOT DOUCHE (H. D.).— Where the hot douche alone is used, it is given for a relatively long time, two to five minutes, at a temperature of 105° to 125° F., and followed by a very brief application of cold, five to fifteen seconds, temperature 60° to 90° F. This is supposed to be just long enough to remove from the skin the heat communicated by the hot douche. The principle is identical with that of the revulsive douche except that in the latter, three or more changes are employed, while here only one is given.

Effects.— The hot douche produces dilatation of the cutaneous vessels, and so where applied to a considerable area, effective derivation is secured. Where applied to a small area, the dilatation of the vessels in the deep part through a reflex channel may equal or exceed the hydrostatic effect. Percussion intensifies the reflex effect.

The hot douche is used for the relief of pain, irritation, neuralgia, sciatica, etc. In these cases percussion is undesirable. The effect of the combination of a hot with a cold douche is given below.

2. NEUTRAL DOUCHE (NEUT. D.).— Temperature — 94° to 97° F. Time — three to six minutes. The broken jet or spray douche is used since sedative effects are sought. The neutral spray douche is especially beneficial when given to the spine. No force should be used, and the patient should sit on a stool with the back to the operator.

3. COLD DOUCHE (C. D.).— Temperature — 55° to 70° F. The cold douche is seldom given alone, but when not preceded by hot, the percussion jet should be used. Given in this way, vigorous fluxion is produced in the part treated, with a corresponding derivation from other parts.

4. REVULSIVE DOUCHE (REV. D.).— Three or more abrupt changes from hot to cold. Temperature of the hot — 112° to 115° F. Time — thirty seconds to two minutes. Temperature of the cold — 55° to 70° F. Time — five to ten seconds. Unless given with high pressure (percussion) the reaction is chiefly circulatory. Percussion is not usually desirable with the revulsive douche.

Effects.— It will be noted that the duration of the cold is exceedingly brief as compared with the duration of the hot. In this item lies the difference between the revulsive and the alternate hot and cold douche. The effect of the revulsive douche is chiefly circulatory and greater in the surface blood-vessels than in the deep part; i. e., the reflex effect is not prominent. The surface effect is that of fluxion, and if a sufficient surface is covered by the treatment, a hydrostatic (derivative) effect upon other parts is produced.

The revulsive spray douche is especially applicable to the chest, abdomen, and over the liver and spleen, also to the spine, pelvis, and perineum.

5. ALTERNATE HOT AND COLD DOUCHE (H. & C. D.).— The method of giving the alternate douche is the same as for the revulsive douche except that the cold application is of greater duration, being from one-third the duration of the hot to equal with it, so that where the hot is given for one minute, the cold should last twenty seconds to one minute, depending upon the reactive powers of the patient. Percussion (H. & C. Perc. D.) adds much to the vigor and permanency of the reaction.

Effects.— The alternate hot and cold douche produces vigorous fluxion in the surface treated. When percussion is used, the reflex effects become prominent, especially if the douche is applied to only one or two parts of the body. As a general treatment, for example, the alternate hot and cold percussion douche to the spine and legs, powerful tonic and stimulant effects are produced. The alternate percussion douche to the feet and legs is a most efficient derivative measure, especially when preceded by the hot leg-bath. The extreme fluxion it induces in the feet and legs produces a decided and enduring derivation.

The following list of treatments, which may be given by means of the spray and douche apparatus, will help to show the technique and something of the principles involved in the effects desired.

As a General Tonic — H. & C. Perc. D. to spine, legs, and feet.

To Produce Reaction in One Unaccustomed to Cold — H. Sh. or Spr. with C. Perc. D. to spine and legs at same time.

To Relieve Congestive Headache — H. & C. Perc. D. to feet with C. Comp. to head.

Congestion of the Liver — Rev. D. (Perc. or Spr.) over hepatic area.

Sciatica — Prolonged H. D. over sciatic nerve.

Varicose Ulcers — H. & C. Spr. D. to legs, six to ten changes.

Hypochlorhydria — Rev. D. to epigastrium and mid-dorsal spine.

Lumbago — H. & C. Perc. D. to lower back.

Locomotor Ataxia and Other Flaccid Paralyses — Rev. or Alt. D. to spine.

Spastic Spinal Paralysis — Prolonged Neut. Spray D. to spine.

CHOREA — Neut. D., Sh., or Spr.

RENAL CONGESTION (CHRONIC) — H. & C. Perc. D. to lower third of sternum and over kidneys at back.

CHRONIC PELVIC CONGESTIONS — C. D. to lumbar and sacral regions.

AMENORRHEA — Short C. Perc. D. to feet.

SPECIFIC URETHRITIS, PRURITIS ANI, CHRONIC PROSTATITIS, ETC.— Rev. Spr. D. to perineum (called also "up spray").

CHRONIC PLEURISY, UNRESOLVED PNEUMONIA, ETC. — H. & C. Spr. D. to chest over area affected (use no force) followed by H. & C. Perc. D. to feet and legs.

AFFUSIONS

An affusion is the pouring of water from a convenient receptacle over the entire body or a portion thereof. Since the perfection of spray and douche apparatus, the affusion has fallen into disuse in institutions equipped with such appliances. However the pour has certain advantages which are not outweighed by the greater convenience of more complicated appliances. The flow of a considerable volume of water over a part has a somewhat different effect from a douche. Since it may be used in any home, it has a wide range of usefulness.

1. PAIL POUR OR GENERAL AFFUSION (P. P.).— The patient should be warm beforehand. If given in a bath-tub he may sit, or if given while standing, the feet should be in a tub of hot water; in either case apply a cold cephalic compress. Prepare three pails of water at different temperatures, according to the effect desired. These should be poured over the shoulders, using the warmest first. For a mild tonic employ pails of water at 100°, 90°, and 85° or 80° F., respectively. If the patient has just come from a warm bath of some sort, a lower temperature may be used for the first pail and

the others correspondingly lower, or only two pails used. In succeeding treatments lower the degree of the applications until water at 50° to 60° is used for the third pail. Rub the patient vigorously after the last pail, and dry as from spray or shower. The pail pour is conveniently used after the tub or slab shampoo, salt glow, etc. A cold pail pour to the hips is given after the hot half-bath and the hot sitz bath for revulsive effects.

2. LOCAL AFFUSIONS.— These may be designated according to the part treated and the temperature of the application. A hot affusion relieves pain. The circulatory excitation soon gives way to a tonic reaction. A neutral affusion, especially to the spine, is sedative. A cold affusion, if short, is stimulating and tonic; if prolonged, it reduces congestion and inflammation, stimulating phagocytosis. A long cold pour to the head is strongly antipyretic. The alternate hot and cold pour is a powerful stimulant and tonic, producing fluxion in the part treated, with derivation from other parts. It produces a decided local leucocytosis and stimulates phagocytosis. Because of these effects it is a very useful measure in treating an infected part where it is impossible or undesirable to completely immerse the part in water; as in the case of boils or carbuncles about the trunk or thighs.

In giving an affusion to the spine, the patient may sit on the edge of a bath-tub or on a stool in the tub. In giving a pour to the arm, hand, foot, etc., the part may be held over a small tub while the water is poured from a pail or large pitcher. To treat the head by a pour the patient should lie on a cot with head resting over the end and a tub underneath. In giving local affusions the water should fall a distance of three or four inches to one or two feet according to the part treated and effects desired.

ENEMATA

An enema is an injection of fluid into the rectum.

GENERAL DIRECTIONS:—

a. Articles Necessary.— An enema can with a capacity of one-half to two gallons, or a fountain syringe or combination bag.

Five or six feet of rubber tubing with cut-off.

A glass or hard rubber enema tube.

A disinfectant solution for the enema tube. One to three per cent lysol acts both as a disinfectant and a soap for cleansing. A water thermometer. Toilet paper.

If given in the room, there should be in addition a standard or hook for suspending the enema can, a bed-pan, slop-jar, and several newspapers.

In the treatment-room shelves or hooks are most convenient for holding the can; they should be so arranged that the elevation of the enema can may be varied from two and one-half feet to four feet above the patient.

b. Procedure.— Fill the enema can with from two to six quarts of water at the proper temperature (test with a thermometer).

The patient should be warm, especially the feet. All clothing not removed should be loose.

Position of patient — dorsal, sitting, right Sims, or knee-chest.

Release the cut-off and allow the water to run until the stream is at the same temperature as the water in the can. Close cut-off and lubricate the enema tube, being careful to wash it beforehand, removing the disinfectant solution.

The patient should insert the tube unless very ill or unable to do so. Instruct the patient to take as much water as possible. To make it easier to do this,

stop the flow by pinching the tube two or three times during the taking of the enema. Close cut-off and remove the tube. If possible, the patient should retain the water a few minutes before discharging.

Repeat until a thorough bowel movement is secured or other desired result is obtained.

I. Plain Water Enemata

RECTAL INJECTION OR ENEMA

(E. or En.)

In the ordinary enema the desired amount of fluid is injected, allowed to remain a short time, and then passed. The procedure is different from rectal irrigation, in which there is a continuous inflow and outflow of fluid.

1. Hot Enema (H. En.).— The temperature of the hot enema should vary from 103° to 110° F., according to the condition of the patient and the result desired. It is useful in relieving irritation, the pain of inflammation in the rectum or prostate and pain of hemorrhoids. It also aids in expelling gas, and helps to check diarrhea by decreasing rectal tenesmus. It may be used as a preliminary measure in the treatment of dysmenorrhea. The hot enema is also used to warm and stimulate the body in shock.

2. Warm Enema (En.).— The ordinary enema for cleansing purposes should be given at a temperature of 95° to 100° F. Where it has to be repeated frequently, it is better to use tepid water, i. e., 80° to 92° F., to avoid as far as possible the relaxing effect of warm water.

3. Cold Enema (C. En.).— In giving the cool or cold enema the temperature of the water may vary from 55° to 80° F. Up to about 70° F. it may be regarded as cold, and from 70° to 80° F. as cool. The

cold enema is a powerful stimulant to bowel movements, and should be more generally used for this purpose in place of the warm enema. For this reason it is useful in overcoming the enema or cathartic habits. If retained ten or fifteen minutes or frequently repeated is is useful in shrinking hemorrhoids. It may also be used in fever, but for this purpose prolonged rectal irrigation is much more convenient and effective.

GRADUATED ENEMA

(Grad. E.)

The graduated enema is not a single treatment but a series of treatments. It is used to overcome the enema or cathartic habits. As usually given, it extends over a period of ten to twelve days. It should be preceded on two or three successive days by thorough coloclysters of water at 90° to 100° F., to remove accumulated feces.

The series of enemata is begun with a large amount of tepid water, and finished with a small amount of cold water, one enema being given daily.

1st day	4½	pints	at	94° F.	6th day	2	pints	at	74° F.
2d "	4	"	"	90° F.	7th "	1½	"	"	70° F.
3d "	3½	"	"	86° F.	8th "	1	"	"	66° F.
4th "	3	"	"	82° F.	9th "	½	"	"	62° F.
5th "	2½	"	"	78° F.	10th "	¼	"	"	58° F.

The above program is suggestive only; the variations in the amount and temperature of the water should be made to suit the needs of the case. The entire series with the exception of the temperatures above 80° F., may need to be repeated. Cold enemata should not be given during the menses.

Effects.— After prolonged use of cathartics, the muscular part of the intestinal wall becomes relaxed and atonic because of overstimulation. The response to drug and chemical excitants is worn out, and it is necessary that

the atony be overcome by some more physiologic means. The restorative effect of cold upon muscular tissue and muscular capacity has been discussed in detail in Chapter VIII. Repeated use of the warm or hot enema also causes relaxation with stretching and distention of the wall of the rectum and lower sigmoid flexure.

The contact with the cold water introduced into the bowel is an effective means of combating this atony and distention. The gradual reduction in the temperature makes it possible to bring about a response even after the atony has existed for some time. Both this treatment and alternate hot and cold rectal irrigation are very efficient in the treatment of atonic constipation. They may be advantageously combined with the use of slow intrarectal and abdominal sinusoidal electricity, abdominal massage, and spinal nerve stimulation.

RECTAL IRRIGATION

(Rec. Irrig.)

In giving rectal irrigation a special tube is used which is provided with an inlet and a return flow, so that the fluid passes into the rectum, bathing the mucous membrane, and returns through the outlet. These are made of hard rubber or metal. The patient should be in the dorsal or Sims position. The enema can should be eighteen inches to two feet above the patient. The outflow tube should be lengthened by attaching to it a piece of rubber tubing so as to carry the outflow into the toilet fixture or, if given to a bed patient, into a jar placed at the side of the bed.

1. HOT RECTAL IRRIGATION (H. REC. IRRIG.).—When the water used is at a temperature of 102° to 105° or 106° F., the treatment produces decided effects in the relief of pain and rectal tenesmus. It may also be used with great benefit in cases of chronic cystitis with frequent and painful urination.

2. COLD RECTAL IRRIGATION (C. REC. IRRIG.).— Cold rectal irrigation is a very useful antipyretic measure. For this purpose the water should not be very cold, but from about 70° to 80° F., and the treatment continued about forty-five minutes at a time.

Cold irrigation is also useful in stimulating bowel movement, but for this purpose it possesses no advantage over the cold enema.

3. ALTERNATE HOT AND COLD RECTAL IRRIGATION (ALT. H. & C. REC. IRRIG.).— In giving alternate hot and cold irrigation, it is necessary to use two enema cans with tubing connected by a Y-tube, so that the alternations may be controlled. The hot should be allowed to run from one-half to two minutes and the cold from fifteen to thirty seconds. From five to twelve or more complete changes may be made in a single treatment. The greater the extremes of temperature, the greater will be the effect. It is possible to use a plain enema tube, injecting but a small amount and allowing the water to pass out through the enema tube after each injection.

This treatment is a most efficient measure in the relief of chronic inflammations of the pelvic organs, especially of the bladder, prostate, posterior urethra, and rectum. It is also one of the most effective means of combating chronic atonic constipation.

COLOCLYSTER

(Ccl.)

In a coloclyster the fluid is introduced into the colon.

When the coloclyster is used to produce thorough cleansing of the large bowel, four to six pints of water or saline solution at a temperature of 100° to 104° F., are used for each injection. An ordinary enema, and if necessary a soap-suds enema, is first used to cleanse the lower bowel. Have the patient take the knee-

chest or right Sims position. Use an ordinary enema tube, but if results are not obtained, it may be necessary to use the high bowel catheter (colon tube). As the water enters, rub along the colon up the left side, across the abdomen and down on the right side so as to fill well the large bowel. As much water as possible should be injected, but this should be done slowly. Remove the enema or colon tube and, as the water is expelled, reverse the movements along the colon to favor complete emptying. It may be necessary to repeat the procedure.

Effects.— The coloclyster is used to produce a full complete evacuation of the bowels, and for cleansing the large bowel in cases where an ordinary enema does not produce the desired results. It is also used to remove fecal impaction. When some medicament or antiseptic is introduced, it may be used to disinfect the large intestine or to destroy parasites, as the ameba coli. (See Quinin Enema, also Quassia Enema.)

II. Medicated Enemata

SALINE ENEMA

(Sal. En.)

For whatever purpose the saline enema is used, it should be preceded by a thorough cleansing enema, unless the bowel has already been cleared of feces.

1. Saline Enema to Be Retained and Absorbed.— The absorption of saline fluid from the rectum is useful in hemorrhage, surgical shock, and pelvic and abdominal abscesses after drainage has been instituted. To be absorbed most rapidly, the sodium chlorid solution should be isotonic with blood serum or slightly hypotonic. A physiologic salt solution is so called because it is isotonic with blood serum.

Intermittent Proctoclysis.— One-half pint of physiologic salt solution (0.95 per cent) at a temperature of 100° to

105° F., is given slowly or by high bowel catheter. To make this, use one level teaspoonful (4.5 grams or less) of salt to the pint of water. For a hypotonic solution (more rapid absorption) use a little less salt. After this has been absorbed, another one-half pint may be given. If this amount is not readily retained, use four or five ounces only.

Continuous Proctoclysis.— Murphy Method.* The fluid should be administered through a fountain syringe to which is attached a three-eighths-inch rubber hose with a hard rubber or glass vaginal douche tip with multiple openings. This tube should be flexed almost to right angles, three inches from its tip. A straight tube must not be used, as the tip produces pressure on the posterior wall of the rectum when the patient is in the Fowler position. The tube is inserted into the rectum to the flexion angle, and secured in place by adhesive strips, binding it to the side of the thigh so that it can not come out; the rubber tubing is passed under the bedding to the head or foot of the bed, to which the fountain is attached.

Two or three inches from the fountain syringe interpose a Y-tube, and to the upper limb attach a piece of rubber hose of the same size as the outlet tube. Fasten the free end of this to the top of the fountain syringe, so that what returns through it will fall into the container. When flatus is voided, the gas passes more readily through the upper tube than directly into the fountain syringe. This reduces the pressure at such times, and so aids in preventing expulsion of the fluid onto the linen.

The fountain syringe should be suspended from six to fourteen inches above the level of the buttocks and raised or lowered to just overbalance hydrostatically the intra-abdominal pressure; i. e., it must be just high

*Slightly modified from the original description by J. B. Murphy.

enough to require from forty to sixty minutes for one and one-half pints to flow in, the usual quantity given every two hours. *The flow must be controlled by gravity alone, and never by a forceps or constriction on the tube,* so that when the patient endeavors to void flatus or strain, the fluid can rapidly flow back into the can, otherwise it will be discharged in the bed. *It is this ease of flow to and from the bowel that insures against overdistention and expulsion onto the linen.* The fountain would better be a glass or graded can, so that the flow can be estimated. The temperature of the water in the fountain can be maintained at 100° by encasement in hot-water bags. The fountain is refilled every two hours with one and one-half to two pints of solution. Instead of the usual solution, a teaspoonful of calcium chlorid may be added to the pint of saline solution. The tube should not be removed from the rectum after each emptying of the syringe, but may be left in place for two or three days if necessary.

2. SALINE ENEMA TO CAUSE EXOSMOSIS, acting like a saline cathartic. Used to produce exosmosis, the enema is designed for thorough cleansing of the mucous membrane, and is of inestimable value in chronic mucous colitis.

To produce exosmosis, i. e., draw water from the tissues into the bowel, the solution must be hypertonic, i. e., of greater concentration than blood serum. Three pints of warm or hot water are used, containing about two teaspoonfuls of salt or one-fourth teaspoonful of Epsom salts added to a physiologic salt solution. The enema should be introduced into the colon by high bowel catheter, or its flow into the colon aided by the knee-chest position. Let it be retained fifteen to twenty minutes or longer. If retained much over half an hour, some fluid will be absorbed. The treatment should always be preceded by an ordinary enema to remove feces.

SOAP-SUDS ENEMA

(S. S. En.)

Prepare two or three pints of warm soap-suds solution, made by scraping Castile or Ivory soap and mixing thoroughly in water at about 100° F. Follow by a plain enema to remove the soap-suds.

Effects.— The soap-suds enema facilitates evacuation of the bowels, and should be used where the plain enema fails to produce results.

OIL ENEMA

(Oil En.)

In administering the oil enema, use the colon tube with a small enema can, giving one and one-half to three or four ounces of warmed cottonseed or other vegetable oil. It should be retained from two to ten or twelve hours or overnight. Pass it the next morning, and follow by soap-suds and plain enemata.

Effects.— The oil enema is used to remove hardened or impacted feces. It has a soothing, relaxing effect, and is therefore used to overcome spastic constipation, as of chronic lead poisoning.

When given two or three days after an operation for hemorrhoids, it softens and loosens the clot, so that it passes without causing pain or starting fresh bleeding.

HONEY OR MOLASSES ENEMA

Give one-half to one pint of a warmed solution consisting of two parts of soap-suds and one of molasses by high bowel catheter.

Effects.— The honey or molasses enema has a purging effect similar to that of the hypertonic saline enema. It aids in removing the mucous casts and mucous accumulations of chronic colitis.

It may also be used in fecal impaction and obstipation.

ASAFETIDA ENEMA

To one pint of warm water add four ounces of an emulsion of asafetida, prepared by agitating one-half dram of asafetida powder in four ounces of water; or add one ounce of tincture of asafetida to a pint of warm water. Give as an ordinary enema. It is used to expel flatus.

TURPENTINE ENEMA

To a pint of soap-suds solution add ten to twenty drops of oil of turpentine. Follow by a plain enema. The turpentine enema is given in the same way and for the same purpose as the asafetida enema. Its action is somewhat more vigorous. It should not be used where there is kidney irritation or Bright's disease.

GLYCERIN AND EPSOM SALTS ENEMA

The glycerin and Epsom salts enema is a vigorous purgative. It is used in cases of fecal impaction and obstinate constipation (obstipation).

Just before using, prepare a mixture consisting of two ounces of magnesium sulphate, two ounces of glycerin, and sufficient warm water (about two ounces) to make it pass readily through the colon tube.

First, cleanse the lower bowel from feces and then inject the mixture by high bowel catheter, using gentle pressure with a rubber bulb if necessary. Considerable patience and persistence may be necessary to secure results.

STARCH ENEMA

The warm starch enema is given to relieve irritation and check diarrhea. Make a thin paste of starch in one or two ounces of cold water. Add hot water enough to make from four ounces to one pint of solution. Inject slowly after giving a hot cleansing enema. The sedative effect may be made greater and pain relieved by adding five to twenty drops of laudanum.

ASTRINGENT ENEMA

An astringent mixture is useful in controlling or checking diarrhea and dysentery, also in inflammation of the rectum. The bowel should be cleansed by a plain enema of warm or hot water before the astringent is injected. Usually from four to eight ounces is all that is desirable. Either of the following formulas may be used: —

a. A heaping tablespoonful of tannin to one pint of water at 100° F.

b. An ounce of glycero of tannin to one pint of water at 100° F.

QUASSIA ENEMA

The quassia enema is used to destroy and remove thread or pinworms (Oxyuris vermicularis). Prepare an infusion of quassia by pouring over one and one-half drams of finely rasped quassia wood, twenty ounces of warm water; let it stand twenty to thirty minutes and strain. Use a plain cleansing enema first; then cleanse the colon thoroughly with warm water containing a teaspoonful of borax to the pint. Now inject into the colon (coloclyster) a half to a pint of the infusion of quassia; retain as long as possible. A 1 to 10,000 bichlorid solution may be used instead of the quassia. It should not be retained very long.

QUININ ENEMA

The quinin enema is used for amebic dysentery. After thorough cleansing of the bowel by low enema and colon flushing, inject by high bowel catheter, from two to four or more pints of a warmed solution of quinin, 1 to 1000 or 2500. Large and frequently repeated coloclysters of cold water may be used. Quinin kills the amebæ. Cold water paralyzes them for a time. Position of patient — hips elevated.

VAGINAL DOUCHES OR IRRIGATION

A vaginal douche consists in the flushing or irrigating of the vaginal cavity by a fluid.

GENERAL DIRECTIONS:—

a. Articles Necessary in the Treatment-Room.— Douche table, fountain syringe or douche can with a capacity of one to two gallons, five or six feet of rubber tubing, douche tube of glass or hard rubber, lubricant, disinfectant, sheets, and napkins. Additional need in private room,— standard or hooks for douche can, a douche pan, slop-jar, and rubber sheeting or papers.

b. Procedure.— Preparation of the douche. Fill the can with from two to four quarts of water at the prescribed temperature, and place it from three to four feet above the patient. Always use a thermometer in preparing vaginal douches.

Preparation of patient: If the clothing is not removed, protect thoroughly. Always cover the patient with a sheet. Lubricate the tube with vaselin or soap. Release the cut-off, and allow the water to run a few seconds. Instruct the patient to insert the tube, unless helpless.

Position of patient — dorsal, with hips raised and thighs and legs flexed.

I. PLAIN VAGINAL IRRIGATION

VAGINAL IRRIGATION FOR ORDINARY USE

1. HOT VAGINAL IRRIGATION (V. I.).— This is used for cleansing purposes. Two to four quarts of water are employed at a temperature of 105° to 115° F. Finish with a pint of water at 70° F.

In the treatment of pelvic inflammations, the hot vaginal douche is usually given as a preliminary to the use of the sitz bath, hot half-bath, or the hip-and-leg pack.

2. VERY HOT VAGINAL IRRIGATION (H. V. I.).— The very hot vaginal irrigation is designed for the relief of pain or to check hemorrhage. Two to four quarts of water are used at a temperature of 110° to 125° F.

3. ALTERNATE HOT AND COLD VAGINAL IRRIGATION (H. & C. V. I.).— Alternate hot and cold vaginal irrigation is given for tonic and stimulating effects. It is also useful in chronic pelvic inflammations. Use two cans with a Y-tube connection. Put four quarts of water in one can at a temperature of 110° to 120° F., and two quarts of water in the other at a temperature of 70° F.

Give the hot fifteen to twenty seconds and the cold five to ten seconds. Continue the alternations for five to ten minutes, beginning with hot and finishing with cold.

VAGINAL IRRIGATION DURING PREGNANCY

During pregnancy certain precautions must be observed. The pressure of the water must not be too great, i. e., the douche can must not be placed too high. Very cold water or extremely hot water should not be used. It is positively necessary that the openings in the bulb of the douche tube be lateral and not directly on the end. During pregnancy vaginal irrigation is given chiefly for cleansing, for the treatment of leucorrhea, and for the relief of irritation. Use two to four quarts of water at a temperature of 98° to 105° F. Hang the douche can twelve to eighteen inches above the hips.

II. DISINFECTANT AND MEDICATED DOUCHES

SOAP-SUDS VAGINAL IRRIGATION

(S. S. V. I.)

Use two quarts of soap-suds solution prepared from laundry soap or green soap solution, at a temperature of 105° to 110° F. Wrap the tube in cheese-cloth

and swab the vagina carefully, but thoroughly, while the water is flowing. Follow by plain vaginal irrigation, then give a permanganate or bichloride douche.

The soap-suds vaginal irrigation is used to prepare patients for surgical operations or for special cleansing and disinfectant purposes.

PERMANGANATE OF POTASSIUM VAGINAL IRRIGATION

(P. V. I.)

To one quart of water add two drams (two teaspoonfuls) of a saturated solution of potassium permanganate — (1 to 2000). Temperature — 110° to 120° F. Precede by a plain vaginal irrigation. Oxalic acid (sat. sol.) will remove the stain.

The permanganate douche is used as a deodorant and disinfectant in the treatment of vaginal inflammations, leucorrhea, etc., also as a disinfectant preparatory to operation.

BICHLORID OF MERCURY VAGINAL IRRIGATION

(Bichlor. V. I.)

Use one dram (a teaspoonful) of a saturated solution of bichlorid of mercury to one or two quarts of water — (1 to 4000 or 8000). Temperature — 110° to 115° F.

Always precede by plain vaginal irrigation, so as to remove all mucus and other secretions. If this is not done, the disinfectant properties of the bichlorid are lessened by its combination with albuminous substances.

CARBOLIC ACID VAGINAL IRRIGATION

(Carb. V. I.)

Use one-half ounce of a five-per-cent solution to one quart of water. Temperature — 110° to 115° F. Be sure that the solution is thoroughly mixed with the water, otherwise a carbolic acid burn may result. Always have alcohol at hand in giving this douche.

CREOLIN OR LYSOL VAGINAL IRRIGATION

Use a one- or two-per-cent solution of either lysol or creolin in water at a temperature of 110° to 120° F. These disinfectants are much used after confinement where puerperal infection has occurred, or in case of a suspicious odor to the lochia.

ACETIC ACID OR VINEGAR VAGINAL IRRIGATION

The acetic acid douche is used to check hemorrhage. Use one quart of boiled vinegar to one quart of water, or one ounce of glacial acetic acid to one quart of water. Temperature — 115° to 120° F.

ALUM VAGINAL IRRIGATION

(Alum V. I.)

The alum douche is also used to check hemorrhage or prolonged menses. Add one pint of a saturate solution of alum to one pint of water. In extreme cases the sat. sol. may be used. Temperature — 115° to 120° F. Precede by plain hot vaginal irrigation.

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