THE WHIRLPOOL BATH.

BY

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"EAU COURANTE" had been, for some time before its introduction into this country, extensively employed in France for the treatment of stiff joints, contractures and other conditions resulting from injuries sustained by soldiers during the present war. The treatment, as carried out at the Grand Palais, was investigated by Dr. Fortescue Fox on behalf of a committee of the Balneological Section of the Royal Society of Medicine. His recommendation that the whirlpool bath should be introduced into military hospitals was adopted by the committee and brought to the notice of the military authorities.

The first baths made in this country were copied from the French model, in which the hot and cold water supplies are led into a mixing chamber whence the water, at the required temperature, passes into the bath through a number of jets. After rushing round the bath, the water flows out through an opening near the top. The whirlpool is thus produced by a constant stream of rapidly flowing water. To obtain a satisfactory whirlpool, a pressure of at least 50 ft. is required and the consumption of water is very considerable. To obviate these disadvantages, a bath has recently been devised in which the whirlpool is produced by an electrically driven turbine, placed under a grating at the bottom of the bath. A small quantity of hot water is admitted from time to time, in order to maintain the temperature, whilst a corresponding amount is allowed to flow out through the waste pipe. A very small quantity of water is thus required and, if necessary, the bath may be filled from cans. An apparatus is fitted by means of which compressed air can be forced through the water, which is thus caused to bubble violently, an addition which should prove of particular value in neuritis.*

All the leg baths at present in use are cylinders in which immersion above the middle of the thigh is impossible. At my suggestion, Messrs. Shanks and Co. (81, New Bond Street) are making a motor bath fitted with a seat which can be moved up or down and adjusted to any angle to accommodate any form of stiff hip. If the knee only requires treatment, the seat is fixed above the level of the water, and the uninjured leg can be kept dry. If the hip-joint is to be treated, the seat is lowered and fixed at the appropriate angle, but both limbs are necessarily immersed.

The following notes are based upon experience gained in the Physical Treatment Department of the Red Cross Auxiliary Hospitals for Officers, Brighton. The baths are of the French type and were presented by H.R.H. the Princess Royal. They have been in use for over four months, during which time more than sixty cases have been treated.

The period of immersion is usually twenty minutes; the temperature should be as high as can be comfortably borne—in most cases from 110° F. to 120° F. Before the limb is immersed the bath is filled with water at about 100° F. and the temperature is gradually raised to the limit of endurance. It will frequently be found that the higher ranges of temperature, 110° F. to 120° F., cannot be borne at first, but, as a rule, after one or two treatments, tolerance is acquired. It is necessary to proceed very cautiously when treating cases in which nerves have been injured and there are areas of anaesthesia or partial anaesthesia. The skin supplied by the injured nerves is frequently in a very atrophic condition, and scalding of these areas may take place without the patient having complained of any discomfort in the normal portions of the limb. Very shortly after the limb has been immersed in the bath the skin becomes flushed, pain is relieved and a feeling of comfort is experienced. The tissues become more supple and movements can be made which previously were painful or impossible. After the bath the limb is found to be in a condition of considerable hyperaemia.

* Motor baths, with the compressed air attachment, have been installed at the Physical Clinic for Wounded and Disabled Soldiers, 126, Great Portland Street, W.

The skin is red and feels hot, and it is probable that the internal temperature of the limb also is temporarily raised. There is usually a slight increase in bulk, varying in the case of the thigh from one-half to one-third of an inch in circumference. The tissues are soft and relaxed, and will bear manipulations which before the bath would have been too painful.

In a large majority of cases the whirlpool bath is used as a preparation for subsequent massage and manipulation. In the Red Cross Auxiliary Hospitals for Officers at Brighton, radiant heat was formerly used for this purpose. When the whirlpool baths have been installed they were substituted for the radiant heat in every possible case, so that the views of masseurs and patients who had had experience of both methods of treatment could be obtained. The opinions expressed were unanimously in favour of the baths. The masseurs said that the tissues and joints were more easily manipulated, and the patients that the manipulations were less painful. Subsequent experience has confirmed the correctness of these early observations. Adhesions are frequently and almost painlessly broken down, and function seems to be restored more rapidly. Some members of my staff have found that, when there is great tenderness, they can employ deeper massage and obtain more movement while the limb is still in the bath than if they wait till afterwards. But the whirlpool is not only a thermal bath; in virtue of the lavage and elastic pressure produced by the rapidly moving water, it must be regarded as an efficient form of gentle massage. In cases in which the use of hand massage is contraindicated by the danger of disturbing the barriers erected by nature against the spread of infection, the whirlpool bath is of considerable value. An increased flow of blood is induced by its thermal qualities, whilst resolution and removal of inflammatory products is facilitated by the massage of the rapidly moving water.

When nerves in the vicinity of a wound have been slightly injured but not destroyed, treatment is apt to be extremely difficult. The application of heat frequently increases the pain, whilst massage, which may be urgently needed for the preservation of the utility of the limb, is rendered impossible by the pain it causes. In these cases, the whirlpool bath at a "neutral" temperature acts not only as a substitute for hand massage, but also relieves the pain to a remarkable extent.

The pain in the missing hand or foot, so frequently felt after amputation, is rapidly allayed by the whirlpool bath. The effect of the bath seems to be increased if one of the jets is allowed to play directly on the tissues covering the nerve which is apparently at fault.

The use of the whirlpool bath as a preliminary to the breaking down of adhesions under anaesthesia is of doubtful value. Owing to the hyperaemic condition of the tissues, the advantage gained by the decreased amount of force required seems to be more than counterbalanced by the increased bruising which ensues.

So far as my information goes, the whirlpool has not yet been employed in the treatment of recent wounds, but it seems probable that its use in this connexion would be valuable, especially when a large sloughing area could be exposed to the action of the water. Owing to the difficulty of cleansing the turbine bath, it would be necessary to use an apparatus of the French type.

The following cases may be of interest as illustrating the foregoing remarks. Except when otherwise noted, the angles are calculated from the position of full extension, the axis of the upper bone entering into the joint and an imaginary line produced past the joint, in continuation of the axis, forming the diameter of a circle of which the joint is the centre—for example, 10 degrees of flexion at the knee-joint means that the tibia, forming a radius of the imaginary half circle, makes an angle of 10 degrees with the imaginary line passing through the knee-joint.

1 and 2. *Fractures of Femur*.—Fracture of left femur (December 2nd, 1915) 2 in. below great trochanter. Admitted July 4th, 1916; much periarticular swelling of knee-joint, a little fluid in joint, flexion 10 degrees. Whirlpool bath and massage. August 26th: Very little periarticular swelling, still a little fluid in the joint, flexion 90 degrees. G. S. W. Fracture right femur, upper third. Admitted July 29th, 1916. Wound healed, flexion of knee 20 degrees. Whirlpool bath and massage. September 1st: Flexion 113 degrees.

3. *Shell Wound*.—Left foot; very septic. Admitted July 14th, 1916. Wounds healed, much swelling of foot and ankle, foot in toe-pointed position. Range of movement at ankle 15 degrees.

No movement at interphalangeal or metatarso-phalangeal joints. Whirlpool bath and massage. September 1st: Swelling much decreased, all interphalangeal and metatarso-phalangeal joints move well. Range of movement at ankle 23 degrees.

4. *Fracture of Humerus*.—G. S. W. Comminuted fracture lower end of left humerus. Admitted August 9th, 1916. Wound healed, union firm, pronation and supination weak and incomplete, elbow can neither be fully extended nor fully flexed. Range of movement 30 degrees. Whirlpool, massage. September 1st: Pronation and supination complete and fairly strong. Range of movement at elbow-joint 70 degrees.

5. *Septic arthritis* of the knee; incisions. Admitted July 7th, 1916. Much periarticular thickening, fluid in joint, flexion 60 degrees. August 8th: No fluid in joint, very little periarticular thickening, flexion 120 degrees.

6. *Traumatic arthritis*, right knee. Admitted March 28th, 1916. Much periarticular swelling. X ray: "Lining" of cartilage; no bony change. Can bear no weight on knee; walks with crutches; no movement at knee-joint. Radiant heat and massage. May 25th: Very little improvement; still on crutches. Whirlpool bath and massage. July 15th: No swelling of knee; walks well with stick. Flexion at knee-joint 90 degrees.

7. *Amputation*, right arm. Admitted May 20th, 1916. Tenderness of stump; much pain in missing hand. Whirlpool bath. June 14th: No tenderness of stump; no pain in missing hand.

8. *Wound of axilla*, bruising of brachial nerves. Admitted June 13th, 1916. Much neuritic pain, referred chiefly to fingers. Partial anaesthesia, dorsum of thumb and index finger and radial side of hand and wrist. No power of extension of fingers. Elbow flexed at right angle; no power of extension beyond this point. Paralysis of supinator longus and extensors of wrists. Radiant heat followed by massage, or either alone, caused increased pain. July 3rd: Whirlpool bath at temperature of 99° F. Immediate alleviation of pain; tolerance to gentle hand massage after six treatments. August 8th: Very little pain; sensation returning; some power of flexion of fingers; supinator longus recovering; extension of wrist weak but complete. Extension of elbow to 50 degrees.

RELIEF STAINING FOR BACTERIA AND SPIROCHAETES.

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By the ordinary methods we seek to colour bacteria in films to make them the more evident on a colourless background. The excess of light that meets the eye dulls our perception of the germs, and probably often causes us to lose sight of the most minute. Instead of staining the micro-organisms, we may leave them colourless and brilliant in a coloured and less transparent background. This is done, for example, in the Indian-ink method and in Harrison's collargol method of demonstrating spirochaetes. I have devised a rapid and simple process to obtain a uniform blue field from which the unstained organisms stand out in sharp relief. The depth of colour may be varied from a pale grey to a deep blue-black, being rather deeper immediately around the edge of the organism. The whole process occupies only a few moments.

A small drop of a 2 per cent. aqueous solution of Congo red is placed on a slide, and a very small quantity of the bacterial culture, or of the exudate to be examined, is rubbed into it with the platinum wire; the drop is then spread out into a tolerably thick film either with the wire or by means of another glass slide. The film, an opaque blood red, is allowed to dry; the slide is then washed over with a 1 per cent. solution of HCl in absolute alcohol and dried in the air, or with blotting paper, although the latter is apt to tear the film. The film is then ready for examination with the oil immersion lens. It is possible to apply the process to a film which has been already spread and fixed on the slide, by spreading the Congo red gently over it, drying, and treating with acid, as described above.

Under the $\frac{1}{2}$ in. lens the background may show an extremely fine stippling, but as a rule it will be quite uniform. Either natural or artificial light may be used, but it needs to be fairly strong, especially if a thick part of the film has to be examined.

Broth and salt solutions do not form a satisfactory mixture with the Congo red, and emulsions in these fluids ought first to be thrown down in the centrifuge. Serous exudates mix readily and evenly with the dye. Blood is not so satisfactory, but, except for osmotic changes in the

red cells, useful preparations of the blood fluid, and its cellular contents may be made; the films should be spread quite thinly. Urinary deposits and faecal material may both be examined by this method; in one faecal specimen I examined, large numbers of spirochaetes of various types were present. This same material examined with the dark background condenser gave a much less satisfactory picture on account of the relatively large amount of amorphous substance, and motile bacteria crowding the field. Spirochaetes as a rule show up fairly sharply, though they have not the brilliancy that the dark background condenser gives them, and of course one has not here the opportunity of observing them in motion. Bacteria vary somewhat in their relation to the dye; mostly they are clear, sharp, and quite transparent, but a certain number of them will take up the dye and appear as ill defined, bluish-black bodies: this I have noticed chiefly in old cultures of Gram-negative organisms. Some cocci show a dark central spot, and in the case of many of the *coli*-typhoid type of bacilli a similar round dark spot is seen toward each pole, or more often a dark rod-shaped area running down the centre of the bacillus. Somewhat similar appearances may be seen with Indian-ink preparations; it is impossible to say whether they represent nuclear bodies or some irregularities of external contour which have caught and held the dye. Many bacilli show a dark central portion with colourless poles, giving the appearance that the poles, either by being club-shaped, or by being bent up, had risen above the surface of the film whilst the centre part remained buried in it.

The apparent size of an organism viewed through an opaque film naturally depends on the thickness of the film—that is to say, on whether the film is sufficiently thick to more than cover the greatest diameter of the organism. Seen through an opaque film an organism usually seems much larger than it appears in a stained preparation. It was pointed out to me by Dr. Hort that in cases of septicaemia the presence of bacteria can be easily demonstrated, even when they are only present in relatively small numbers, by taking a quantity of the infected blood in distilled water and then throwing down in the centrifuge. When the deposit is examined in a Congo red film the amorphous substances blend with the background and the bacteria are easily seen. The process is far simpler than the examination of a stained film would be in such a case. He has also used Congo-red films for the demonstration in filtrates of very minute micro-organisms near the limits of vision, films stained by ordinary methods entirely failing to reveal their presence. In work of this nature it is, of course, necessary to be certain that the distilled water used in making up the reagent is quite bacterium-free, and a control film should be prepared to show the absence of bacteria.

In conclusion, it may be claimed for this method that it has certain definite advantages over other relief staining methods, in that it can be freshly made up with bacterium-free water; and that it gives a clean and even background, which has very little tendency to form cracks and fissures. I have not been able to test its value in photomicrography, but where a clear sharp outline of the organism is required I should judge it could be used with the best of results.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

CONCURRENT MEASLES AND CHICKEN-POX.

I AM not aware of any instances of cases of this character. Certainly I have not met any such during a professional life of over forty years. My patients were two boys and two girls.

Jim commenced with an attack of measles February 1st.

John developed chicken-pox February 6th and measles February 10th, both rash and spots being well out together.

Peggy began with measles February 18th and developed chicken-pox March 3rd.

Ermin developed chicken-pox and measles February 25th, practically simultaneously.

John, Peggy, and Ermin were very distinctly ill.

John had been exposed at school to chicken-pox and Jim to measles.

London, W.

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