fluid was withdrawn from the swelling in the left frontal region. In each case, the fluid on examination was sterile and microscopically consisted of amorphous debris with degenerating pus cells. Four weeks later, a serous effusion appeared in the right chest; this was aspirated, but no organisms were recovered from it.

Blood examinations revealed 4,020,000 red cells and 11,600 leucocytes per c.mm. (polymorphonuclears 55 per cent, lymphocytes 29 per cent, mononuclear cells 10 per cent and eosinophils 6 per cent), hæmoglobin 10 grammes per 100 c.cm., the sedimentation rate was 95 mm. in first hour.

At operation, the ninth rib was exposed under pentothal anæsthesia and the diseased area was resected. Material resembling ordinary pus was mopped away, and the wound was sutured after the introduction of about a drachm of pure urea. The wound healed by primary union.

Ten days later, as the swelling in the frontal region had repeatedly refilled after aspiration, and the skin was becoming unhealthy, a flap enclosing the area was turned down, an abscess penetrating the temporal fascia and muscle was opened up, and the frontal bone exposed. A ring of diseased bone was excised with a chisel. Urea was inserted and the wound was closed (*see* figure 4, plate VI). Some sloughing of the previously unhealthy skin occurred, but otherwise the wound healed by primary union. The patient continued to run a low fever, but said he felt quite well. The abscesses were never more than slightly tender. Histological examination of the removed portions of bone revealed tuberculous disease, and guinea-pig inoculation was positive for tuberculosis.

Commentary

The patient had complained of only fever and soft swellings over the chest, skull and left scapular regions. Apart from a right pleural effusion and a high sedimentation rate there was little to confirm a provisional diagnosis of tuberculous caries of the rib and skull.

Tuberculous disease of the cranial bones is very uncommon, and more usually it is either secondary to a meningeal focus or to extension from cervical vertebræ or tuberculous middle ear disease. In this case it appeared to have originated in the diplœ. The involvement of the inner and outer tables was equal in extent; the dura showed little more than irritation, and the pus had not burrowed between the bone and the dura at all. The *x*-ray appearances were suggestive though not absolutely pathognomonic of tuberculous disease, and it was therefore necessary to exclude other inflammatory bone diseases such as typhoid, and low-grade pyogenic osteitis and syphilitic disease, as well as both primary and secondary neoplastic conditions. The diagnosis was finally established by histological examination of the removed portions of diseased bone and by guinea-pig inoculation. In this case the bone disease was probably blood borne from a focus in the right lung which was recognizable neither clinically nor radiologically until an effusion developed. There was no obvious enlargement in any of the superficial lymph nodes.

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DEHYDRATION TREATED BY CONTINUOUS GASTRIC DRIP

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The problem of the dehydrated patient is a very real one, and dehydration occurs far more commonly than is realized, particularly in tropical and sub-tropical countries.

The normal daily fluid loss from the body in a temperate climate, through the lungs, skin, urine and fæces, is approximately 4½ pints. In hot countries the urine output is lower, but evaporation from the skin is greatly increased and the daily total loss is 6 pints or more. Loss of fluid from the body continues even if there is no fluid intake, approximately 2½ pints being lost daily in a temperate climate, in the absence of any intake. When fluid loss exceeds intake, tissue fluids are reduced, and this constitutes dehydration. Later, hæmoconcentration occurs, and the urine output having dropped to an amount too small to carry off all the waste products, toxæmia and delirium result.

Dehydration occurs most frequently in prolonged high fevers, persistent vomiting, and prolonged diarrhœa and allied conditions. Examination of such patients will invariably show a dry tongue and oliguria, and later, a low blood pressure and feeble pulse. These signs indicate a loss of from 6 to 9 pints or more of body fluid, for no clinical dehydration occurs before a loss of 4½ pints of tissue fluid has occurred.

The importance of dehydration receives fresh and added significance with the advent of the sulphonamide drugs, particularly sulphapyridine, sulphathiazole and sulphadiazine. These drugs are liable to be deposited in the renal tubules, renal pelvis or ureters causing anuria or hæmaturia when the secretion of urine falls below 500 c.cm. (17 fl. oz.) daily. To prevent this symptom-complex, a secretion of urine amounting to 1,500 c.cm. (50 oz.) daily is required (*M. R. C. War Memorandum, No.* 10).

The methods formerly used for the active treatment of dehydration were, in addition to encouraging the intake of fluids by mouth when possible, subcutaneous injection of saline, and the giving of fluids by rectum. Both these methods still have their uses, but both have given place to other methods. Subcutaneous injections of saline are particularly useful for infants, but

are quite inadequate for the really dehydrated patient. In devitalized tissues, their continued use may lead to abscess formation despite meticulous care in regard to asepsis. A better but similar method is continuous intramuscular saline (Bailey, 1942). Rectal salines are given by slow drip, or intermittently. Murphy advocated the giving of rectal salines by slow absorption from fluid in a can not more than one foot above the rectum and connected with the latter by a wide-bore tube so that bowel gases could freely escape. He taught that large quantities of fluid could be absorbed by this means. The method is excellent in all but practice. Sooner or later, and sooner rather than later, the method comes to grief in a soiled bed and is never popular with the nursing staff.

In 1934, Bailey and Carnow popularized in England the practice, already adopted in Canada, of giving salines by continuous intravenous drip. The following ten years have seen an enormous use of intravenous salines, until now, Bailey himself says that vigilance is required in order to curtail its use (Bailey, 1944). There is no doubt about its being a life-saving procedure, but it is not without its disadvantages and dangers. It is well known that the circulation has frequently been overloaded, and pulmonary œdema and death have occurred. Patients have been drowned, as it were, in their own fluids. The infusion fluids have to be very carefully prepared and sterilized, using pyrogen-free water.

Recently, use has been made of the bone marrow for saline infusion (Bailey, 1944), particularly in children (Gimson, 1944). The method is open to criticism that bone infection may possibly occur with devastating effects. It is however a practice which will increase.

The purpose of this article is to commend the advantages of giving fluids by continuous gastric drip, or œsophageal drip. Nasal feeding has been long employed, and continuous gastric drip is an elaboration of nasal feeding. Nasal feeding has been used intermittently for the administration of nutriments. The procedure now to be described is the giving of fluids continuously by drip.

Apparatus.—The apparatus used includes a glass receptacle for fluid, tubing with controlling clamp, glass drop counter as used for intravenous infusion, and a Ryle's tube. Experience has shown that a Ryle's tube is preferable to the shorter catheter employed for nasal feeding, though the latter may be used.

Technique.—The nostril is cleaned and the Ryle's tube, having been previously dipped in water or smeared with lubricant, is gently introduced. There is usually transient discomfort as the tube passes the region of the larynx. At this stage the patient, if able to be sufficiently cooperative, is given a sip of water to drink and the tube is advanced during the act of swallowing. This effectively prevents the tube entering the larynx. Alternatively the patient is told to breathe slowly and deeply and the tube is advanced during expiration. There is no suggestion of trouble at this stage in the drowsy or unconscious. When the tube has been introduced as far as the first or second mark, it is attached to the forehead by adhesive tape, and connected to the drip apparatus. It is advisable to wait for a few moments before beginning to administer fluids in order that the patient may become accustomed to the tube.

The rate of flow for continuous use is 40 to 60 drops per minute, which is equivalent to 6 to 9 pints per day, but strict accuracy in this is not required. Fluids given by continuous drip is tolerated better than larger quantities intermittently. At the beginning, if dehydration is marked, 90 drops per minute is satisfactory and easily tolerated. Sufficient is given to maintain an excretion of about 50 fl. oz. of urine daily, as this is the only way by which one knows that the intake is adequate.

A variety of fluids may be used but, as salt is lost with all the body excretions, the best fluid to use is one containing salt. Half a teaspoonful of salt dissolved in one pint of water, or glucose water, is satisfactory. In certain conditions, sodium bicarbonate solution, one drachm to the pint is useful. Where feeding is required, citrated milk may be used. In addition, any medicines which have to be given orally may be added to the receptacle.

The advantages of this method over others of combating dehydration are many. Fluid is absorbed in a natural manner from the stomach. This may not be said of fluids introduced by intravenous, subcutaneous or bone marrow routes. There is consequently no necessity for sterile fluids to be used; ordinary, clean, potable water is the basis. The technique is simple and does not always require the presence of a doctor, but may be carried out by a nurse. Once it is started it does not require the same degree of expert attention as is required in intravenous infusion. This is of importance when the staff is not fully trained, or is small. Should the giving receptacle become empty no harm is done and there is no canula or needle to become blocked thereby. There is a much greater range of rate with which the fluid may be given with safety than is the case with intravenous fluids. There is much less effort involved than when fluids by mouth are urged upon an unwilling patient; many patients with the best of intentions find it difficult to drink the large quantities of fluids required to maintain an adequate diuresis. There is no risk of sepsis or of pulmonary œdema. The intake by mouth may be augmented as the patient feels inclined. Experience and theory indicate that it is far better to give fluids continuously by drip, than larger quantities intermittently as in ordinary nasal feeding. Distention of the stomach, a sense of fullness and nausea are entirely avoided and ultimately a much greater quantity is absorbed. It is not suggested that there is no discomfort, but it can be tolerated

for days and is less irksome than intravenous salines continued for a similar period. It is easy and so is likely to be given early.

The limitations are also obvious, and it is by no means suggested that it should replace intravenous infusion entirely; but where the method is applicable, it is far preferable, as the natural process of absorption is followed and when given early in sulphonamide therapy removes the risk of anuria and hæmaturia. The main limitation in a case where it is otherwise considered applicable, is vomiting. On the other hand, once the tube is introduced, vomiting, which was previously present, may cease. Vomiting is frequently induced by the act of swallowing, and does not occur when fluid is introduced by drip. This point is well brought out by the following example :—

The patient, a man aged 25, was received in a mildly dehydrated condition, suffering from blackwater fever. Notes which accompanied him stated that throughout the day he had vomited all that he had taken. As the Ryle's tube was being introduced he vomited bile stained vomit, but the tube was introduced without difficulty. From this time onwards no vomiting occurred and in the next 24 hours nine pints of bicarbonate of soda solution were given effecting an adequate diuresis and cure of the condition.

The following are types of patients on whom the method has been used with success. The very ill who are undergoing treatment with sulphapyridine or sulphathiazole. In some of these, no matter what efforts were made to enforce an adequate intake of the fluids by mouth, the excretion of urine frequently amounted to no more than 12 oz. in 24 hours. Often an intake of 8 pints daily is required to produce an excretion of 50 oz. of urine. Gastric drip has proved an invaluable method of giving fluid to cases of cerebral malaria who have not responded readily to intravenous quinine and who are drowsy for a considerable period. Alkalies may be given to such patients by this route. In blackwater fever, as in the case mentioned above, it is the only method by which large quantities of bicarbonate of soda solution may be given easily. In high and prolonged fevers where classical dehydration with dry tongue, oliguria, low blood pressure and feeble pulse are most frequently seen, it is of inestimable value. It has also been used post-operatively when the need for fluid was obvious and great. There is a wide scope of usefulness in post-operative and surgical work for fluids given by this method. Finally, in severe enteric and allied conditions when adequate nutrition cannot be maintained by ordinary feeding, milk may be introduced by this way as a nutrient fluid.

Summary

The frequence of dehydration in hot climates and its special importance following the introduction of sulphonamide therapy has been stressed. The features of dehydration and the methods in vogue for the treatment of this condition have been briefly reviewed. A method of treating dehydration by continuous gastric drip, using a Ryle's tube, has been described and its many advantages enumerated. Some commendation of the method may be inferred by the enthusiasm shown by the nursing staff, and I have been encouraged to report the use of this procedure by noting its spontaneous use by fellow medical officers.

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REPORT ON AN EPIDEMIC OF SCRUB TYPHUS (K FORM) TREATED AT A GENERAL HOSPITAL IN BURMA*

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DURING September, 1941, 107 cases of this disease were received in a hospital. These patients started coming in from the 2nd; there was one on that day and one again on the 7th; the number increased to 3 on the 9th and from the 11th patients came in increasing numbers up to the 20th; on the 21st there were only 3 and on the 25th only one, and the admissions ceased.

Out of these 107 cases, 105 were from one unit camping in a rural area; out of the five companies of this unit, one company escaped the disease excepting for five members who were doing duty with the other companies. Two other cases were from another camp about 13 miles from the affected one and belonged to different units, but these men had visited the affected area.

Signs and symptoms.—Fever, headache and slow pulse were present in all cases, and the tongue thickly coated with brownish fur was usually a prominent feature. The fever lasted for more than 18 days in 19, between 13 and 18 days in 60, and for less than 13 days in 28. The fever usually came down by lysis. In some cases after coming to normal it became intermittent for a few days.

In 88 cases, there was enlargement of lymph glands with or without tenderness. The enlargement was general in some cases and in a group of glands in some cases; in the latter, it was usually the group associated with the area of the necrotic patch.

Pains all over the body, a 'mousy' smell and drowsiness were found in about 60 cases.

A macular rash was seen in 30 cases, and a papular rash in 8. The rash usually appeared

* Paper rearranged by the editor.