4. Unless there are definite indications to the contrary there is seldom need to continue the flow after the third day. A good working rule is to remove the needle or cannula at the end of seventy-two hours and if necessary to reinsert it into another vein after six or twelve hours.

5. If the flow stops do not dissemble any part of the apparatus without due thought of the possibility of air embolism. Rather remove the needle or cannula, and if necessary reinsert it into another vein.

6. In some cases, especially when glucose is employed, redness and tenderness appears along the course of the vein. This is hardly ever anything more than a chemical phlebitis, which soon settles down after the flow into that vein has been discontinued.

Conclusion

A patient who is ill enough to warrant this form of therapy needs watchful care and attention. The continuous administration of saline solution intravenously does not therefore add materially to the nursing or medical attention which such a patient requires.

The advantages of this over other methods of administering saline solution are great; the rate of flow and the amount of fluid given can be regulated with mathematical precision. Like all good things the principal evil lies in its abuse, and the most obvious danger is oedema. It should be realized that it is not until about eight pints of fluid have collected in the tissues, a quantity equal to the volume of the circulating blood itself, that the sign of pitting on pressure becomes manifest. It would be a very great help if there existed some simple test which would indicate when the patient had received sufficient fluid and that more would be harmful. At the present time the only choice lies between an estimation of the plasma protein, which is far too complicated and time-consuming for general application, and the rough-and-ready method of charting the output of urine and its specific gravity in one column and the intake of all fluid in the other (see table). Providing that reasonable care

*Continuous Intravenous Saline Balance Sheet**

24 hours ending	Intake	Output
	Pints	Pints
	At 50 drops per minute	Urine { S.G. a.m. } { S.G. p.m. }
	„ 30 drops per minute	Vomit
	„ drops per minute	Normally { Faeces }
	By mouth	1½ pints { Sweating and lungs, say
	Total	Total

* Pads of these charts can be obtained from the G.U. Manufacturing Co., 28A, Devonshire Street.

is exercised the latter is enough for practical purposes. A balance sheet of fluid loss and intake should be drawn up. For loss of fluid by sweat, lungs, and normal defaecation a total of one and three-quarter pints has to be calculated. To this is added the urine output plus vomitus if necessary. From this total the maintenance dose for the next twenty-four hours can be calculated.

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CLIMATO-PHYSIOLOGICAL INVESTIGATIONS AT THE SEASHORE*

BY

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For nearly two hundred years convalescent children have been sent to the seaside, and it is generally known that this treatment is successful. When, as a physiologist, I began to study the curative power of the seashore I remembered that pharmacology had greatly increased the efficiency of drugs by modern methods of experimental study. In recent years many investigations have been made upon children at the small seaside town of Wyk on the island of Föehr, on the German side of the North Sea, where there are two large children's homes belonging to Berlin and Hamburg, and a great number of smaller homes for convalescent children under national insurance. The town built a small laboratory for us and the insurance organizations made a grant of some money. Dr. Häberlin, who has practised in Wyk for more than thirty years, and other local medical men, were associated with me in this investigation.

Physiological Effects of Climate

Medical climatology makes a true distinction between climates that are stimulating or "bracing" and those that are sheltered or "sedative." But a stimulating climate, so called, includes both the stimulus of the solar heat, which we do not feel so bracing, and the ultra-violet rays of the sun, which we do not feel at all. Obviously climatic stimuli of all kinds—of the sunshine, wind, cold air, or rolling breaking waves—operate upon the body through the skin, and it is true also that it is by means of the skin that the human body controls its temperature-regulation by changing the size of the capillaries at different external temperatures.

The observations which formed the basis of our work may be summarized as follows:

1. There is a very rapid reaction of the capillaries (Häberlin, Kestner, *et al.*, 1923), both dilating and contracting, in healthy children living at the seaside.

2. In pale, weakly, and undernourished children, damaged by town life and sent by health officers or doctors to the seashore, the same reactions occur, but they are slower and weaker. We found that these children, not protected by immediate reactions, lose many calories, and that the temperature of the body falls considerably after the shortest sea-baths, even in August, and even whilst merely playing on the seashore. Such children cannot at first tolerate sea-bathing, but during the cure the capillaries gradually recover their normal "gymnastic" function. The circulatory reactions improve week by week, and the same children who felt "terribly cold" and cried at their first bath could play later on in the open air without clothing, even in stormy weather. The time and completeness, or otherwise, of the reaction can be determined and measured, and these measurements are very helpful in checking the degree of exposure and the recovery of health. This behaviour of the cutaneous circulation explains an observation of Curschmann. He found that healthy young men, mostly students, had the same systolic blood pressure after sea-bathing as before, but that in patients with contracted blood vessels (arterial hypertonus) the blood pressure was lowered after a sea-bath. For this reason he called the seashore "the paradise of the hypertonic."

* Abstract of a lecture given to the Kensington Branch of the British Medical Association, October 16, 1936.

† The reference to Dr. Carl Häberlin's address, reported in the *British Medical Journal*, August 22, 1931 (p. 331).

3. Respiratory reactions. It is a familiar fact that putting the feet in cold water is answered by deep breathing. The cool air and the continual breezes of the seashore deepen the respiration and change the form of the chest (Häberlin and Krauel, 1933).

4. It has been demonstrated that exposure to bright sunshine raises the content of haemoglobin in under-nourished anaemic children (Häberlin, Kestner, *et al.*, 1923, and Häberlin and Krauel, 1933). When we began our investigation the children had dinner at midday and rested or slept after dinner for two or three hours. The best hours of the day, therefore, were spent indoors, and play on the seashore was only possible in fair weather. At that time we found a striking parallelism between the duration of sunshine and content of haemoglobin (Häberlin, Kestner, *et al.*, 1923). We then altered the scheme of daily life in the convalescent homes, and so arranged it that children could spend the time out of doors, even on days with only brief intervals of sunshine. The weather changes often and suddenly on this island. At the present time the children play out of doors for hours, even in winter, and for half an hour, twice daily, without clothing. This they do with enjoyment even in the snow. When we repeated our previous determinations we could not find any relation between sunshine and haemoglobin.

It is one of the important practical results of these investigations that all these homes are now open throughout the year. The doctors in charge now consider that the best results are obtained during the winter (Häberlin, 1928). These observations agree with the experience at Berck-sur-Mer. It is evident, therefore, that ultra-violet rays cannot be the one and only active factor in the sea climate. Häberlin found the proportion of ultra-violet rays in summer and winter as 330 to 1.

5. The stimuli of the seashore increase human metabolism. The astonishing extent of this increase, both at marine and Alpine stations, and indeed as produced merely by exposure of the body to the open air, has been demonstrated by Sir Leonard Hill. We studied the effects of exposing children and adults to the sun and air and found that the oxygen consumption was higher in the sunshine than in the shade (5-1.1). A rise could be observed if we exposed only the face and hands, but it was higher if the rays of the sun could touch the whole body. Artificial light, so rich in ultra-violet rays, does not produce the same reaction. This effect of the sun-bath is, however, at once lost if the body becomes heated, for the processes of oxidation (for example, in the liver) are diminished by heat. Thus is explained one of the principal advantages of the seashore as compared with other health resorts—namely, the great stimulation of metabolism—for the incessant movement in the atmosphere has great cooling power and prevents disturbance of this stimulation by neutralizing the effects of solar heat.

6. An increasing metabolism is the best criterion of a stimulating climate, both in the Alps and on the seashore. It is always connected in children with a retention of nitrogen. During the summer and winter we have had boys aged 6 to 8 under our care. Before arriving at Wyk they spent ten or fourteen days in the clinic of the University Hospital in Hamburg on a diet containing calories, proteins, vitamins enough for maintenance, and they excreted in urine and faeces about the same quantity of nitrogen as they obtained in their food. These children were then brought to one of the convalescent homes in Wyk, accompanied by the same nurse, and were put on exactly the same diet. We found that the excretion of nitrogen was lowered from the third to the last day of a month, so that a daily retention of 0.6 to 1 gramme of

nitrogen could be observed, equivalent to 400 to 600 grammes of new living tissue. Physiology does not show any considerable storage of proteins in the body; retention of nitrogen must signify the building of new tissues and growth. The sea climate, therefore, enables the human body to grow and build up tissues on the same diet which in a good hospital, where the children spend a good part of the day in the garden and play and live in the same way as by the sea, does not allow retention of nitrogen. During a further period spent by these children in Hamburg no retention could be observed. In another group of boys, who lived in the hospital as far as possible in the same way as on the seashore, and who were exposed daily to artificial ultra-violet rays, there was also no retention.

7. This retention of nitrogen is in full accordance with Häberlin's determinations of the body weight of groups of children who lived for ten months of the year in a city and for two months at Wyk-on-Foehr. Body weight and haemoglobin went up at the seashore and dropped or did not increase when they were in the city. The whole life-history of these children looks on the charts like a staircase. The circumference of arms and legs increased by growth of the muscles; the circumference of the abdomen decreased (Häberlin, Kestner, *et al.*, 1923, and Hering, 1925).

8. A further important influence of the seashore is increased gastric secretion, observed at Wyk by Maria Braun. In both adults and children she found the hydrochloric acid and total acidity figures after the usual test meals higher than in Hamburg. The increased appetite of people during their stay by the sea or on board steamers is probably connected with the rise of gastric secretion, but it is not easy to give a physiological explanation of this rise of acidity as in the case of the fall of blood pressure by the improved reaction of the capillaries. My investigation could not be finished, so no explanations can be offered.

Conclusion

Most of our investigations are made on children—pale, weak, convalescent children. It seems to be a rule that healthy, vigorous persons have very slight reactions to differences in climate. They are not greatly disturbed by changes of environment. A full measure of adaptability is a symptom of perfect health. That may be the reason why many climatologists studying the influence of climates on themselves or on their friends and comrades have found surprisingly minute reactions.

The stimuli of the seashore are sun, air, water, winds, and waves. We do not at present know any others. These stimuli exist only in the open air; not in the room of a hotel or a convalescent home. This enables the medical man to control the dose. Undoubtedly the complex must be different in different health resorts, and even in different parts of the same health resort. Modern biology tells us that every living being elects the stimuli of its environment according to its ability to be influenced by them. The living man is the instrument for investigations in medical climatology. It appears that two climates can be very different for the meteorologist and nevertheless have the same influence upon our patients.

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Clinical Memoranda

A Sporadic Case of Encephalitis Lethargica

In the island of Jersey the condition of encephalitis lethargica is almost unknown. This case presented unusual difficulty of diagnosis, which prevented its early recognition, as will be easily appreciated from the report; there seems, however, no reasonable doubt as to its correctness.

CASE RECORD

A female, aged 33, first came under observation in 1930, when she had a large pyonephrosis on the right side. Nephrectomy was performed, with uninterrupted recovery; on examination the tumour revealed only fibrous tissue and pus, no renal substance remaining. The patient complained of some frequency of micturition, particularly nocturnal, after the operation.

In 1931 the frequency of micturition called for treatment because the patient had to rise from nine to twelve times a night. No marked physical signs were apparent; the urine was acid, with a trace of albumin and some pus cells; bacilli of the *coli* group were present. Hexamine was given, with some improvement.

In 1934 frequency of micturition, which had never completely disappeared, again became very troublesome; and as it resisted medical treatment and bladder lavage she elected to go to London, and was admitted to the Westminster Hospital under the care of Mr. Arthur Evans. Cystoscopy revealed some ulceration of the bladder and cystitis; the left urethral orifice was enlarged and the bladder capacity small. Intravenous pyelography showed normal filling of the renal pelvis and ureter, and no sign of stone. Hexamine was administered and bladder washes with silver nitrate and oxycyanide of mercury given, but the urine remained as reported above. The patient was placed on a ketonic diet without any marked result. Treatment with the *B. acidophilus* was likewise unattended with improvement, and the patient returned to her home.

She was then given intravenous injections of cytotropin 5 c.cm. every other day, ten injections in all, with marked benefit, nocturnal frequency being reduced to three times in the night. Treatment was discontinued, and the patient remained in this state for about two years.

On October 5, 1936, the patient again presented herself, this time complaining of headache and drowsiness. Examination revealed no physical signs, and the condition was regarded as uraemic. No pyrexia was present; she was placed on a suitable diet and given diuretics; she continued to work in her home. October 10: drowsiness and headache increasing, patient liable to go to sleep anywhere and at any time; she also complained of blurring of vision—examination of the optic disks revealed nothing. Urea concentration test gave a negative result, and the blood urea was found to be 41.5 mg. per 100 c.cm. This, of course, upset the diagnosis of uraemia.

The patient continued to get gradually worse. An examination of the cerebro-spinal fluid gave 0.02 per cent. protein, cells, mainly lymphocytes, 1 per c.mm., and a few red blood cells. On October 31 she took to her bed with increasing

lethargy and somnolence. The temperature, which had been irregularly subnormal, suddenly rose for a few hours to 103° F., only to fall and remain at its previous level. Further careful examination showed no physical signs other than very doubtful bilateral Babinski plantar reflexes. She now exhibited a change of character; from being a very reserved and shy woman she showed a tendency to indecent conversation and exposure.

November 11: muscles of deglutition becoming paralysed; progressive difficulty in swallowing solids; incontinence developing largely because "she cannot be bothered." November 15: severe haemorrhage occurred from the vagina, and persisted for about forty-eight hours. November 16: patient became comatose. November 17: death supervened in the state of coma.

COMMENTARY

The outstanding features of this case were: (1) headache, which was persistent and mainly frontal; (2) lethargy, which was at first associated with somnolence and later with insomnia; (3) dimness of vision; (4) complete absence of physical signs.

The difficulty of diagnosis was in the main due to her previous renal history. Unfortunately permission for a post-mortem examination could not be obtained.

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Haemolytic Streptococcal Meningitis Treated with Prontosil: Recovery

I believe the following case of streptococcal meningitis successfully treated with prontosil is worthy of record.

CASE REPORT

A boy, aged 9 years, was admitted to hospital on October 6, 1936, with the signs of acute meningitis. The child had marked neck rigidity and a positive Kernig's sign, and was complaining of pain in his back. On admission his temperature was 101.8°, pulse 128, respirations 28. The child was very thin and looked neglected. The history was that he had not been well for two weeks, and had a discharging ear. Lumbar puncture was performed; the cerebro-spinal fluid was clear but under a pressure of 220 mm. C.S.F. No abnormalities were found in the cerebro-spinal fluid except for a slight reduction in the chlorides to 680 mg. The physical signs increased, the pyrexia persisted, and lumbar puncture was repeated three days later. The fluid was now turbid and under increased pressure. Mulford's polyvalent anti-meningococcal serum was given intrathecally and intravenously. The cerebro-spinal fluid was sent to the Birmingham University laboratory for examination, and beta-haemolytic streptococci were reported in pure culture.

Anti-meningococcal serum was repeated intravenously the next day, with no reduction of temperature. On having the report of the presence of streptococci, prontosil was administered on October 13; 10 c.cm. was given intramuscularly daily and two tablets by the mouth three times a day. After thirty-six hours of treatment with prontosil the temperature became normal. Lumbar puncture performed on October 16 and 20 yielded thick pus, and beta-haemolytic streptococci were again reported in pure culture. Three doses of 20 c.cm. of anti-scarlatinal serum were also given intravenously, but not until after the temperature had returned to normal. Prontosil was continued for eight days. The patient continued to improve, and by November 5 there was no head retraction, but Kernig's sign was still positive. A week later the child appeared perfectly normal and had no Kernig's sign. By the end of November the child was up and has remained perfectly well.

I am indebted to Mr. E. S. Clayton, M.D., F.R.C.S.Ed., medical superintendent of the hospital, for permission to record this case.

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