THE USE OF HYPERTONIC SALINE IN SURGICAL PRACTICE.

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Hypertonic saline, injected intravenously in 30 per cent. solutions in amounts of 20 to 40 c.c. is a valuable remedy to the surgeon. The purpose of this note is to sketch some indications for it and to give illustrative cases.

1. **Spinal anæsthesia.** The disadvantages to be overcome with nearly all spinal anæsthetics is that of the prevention or restoration of the serious fall in blood pressure which occurs in almost every case. Dr. Joan Walker (1936), of Leicester, pointed out the great value of an intravenous injection of 40 c.c. of hypertonic saline for the restoration of blood pressure. It is given immediately an operation under a spinal anæsthetic has begun. It raises and maintains the blood pressure around normal limits. The writer's experience is in accord with Dr. Walker's statements.

2. **Post-operative spinal headache.** Since 1934 hypertonic saline has been used with consistent success for post-operative spinal headaches. The dose is 20 c.c. ; it should be given as soon as the patient complains of the cephalalgia. Delay in its administration in the hope that it will pass off or that giving tablets of A.P.C. or ephedrin orally will give relief is waste of time, and the patient continues with discomfort, some degree of mental confusion and "muddle-headedness." The injection is made promptly and repeated if necessary once or twice, but this is not often required. An ache at the back of the neck or in the occipital region is also a post-spinal ache and is treated in the same way. This point of the post-operative headache was explored further in a personal communication with Dr. Walker ; the enquiry being, was the incidence of post-operative spinal headaches less after the injection of hypertonic saline during operation than in those patients who did not have it ? The reply was decisively, "Yes." Fortunately, notes had been kept and these showed that the headaches after saline injection were 5 to 10 per cent. as against 25 per cent. in cases without it.

3. **Blood pressure falls at major operations.** At operations performed under all types of anæsthesia other than spinal, considerable falls of blood pressure have been recorded, especially towards the end of long procedures, such as resections of the stomach and colon. The hypertonic saline injection has again proved to be dependable as well as improving the patient's colour.

4. **In head injuries.** Head injuries have been treated by hypertonic saline when the following symptoms have presented :—(a) continued cerebral-irritation after four days of the injury. The hypertonic saline is repeated intravenously daily and with ultimate complete relief, but it may take a week or two.

Case I. A coroner's officer was excitable and irritable for a month after a severe fracture of the skull. With the hypertonic salines and a bromide mixture he ultimately emerged and returned to duty. Since then he has been the friend and guide of the residents at this hospital.

Case II. An army sergeant fractured his skull in a motor-cycle accident. His headache, mental confusion and a mild irritability continued for six weeks. The hypertonic injections were supplemented by postural position, that of lying for 30 to

60 minutes daily in the full Trendelenberg position. He recovered and returned to full duty. This postural remedy of the Trendelenberg position has been occasionally used in conjunction with the hypertonic injections, particularly in obstinate post-operative spinal headaches ; success has been invariable.

Case III. A patient after a head injury reported at out-patients a month after his discharge. He was complaining of tingling and weakness in his arms, pain in the back of his neck, and constant headache. He had returned to work but had given it up after a day on account of this disability and his inability to concentrate. An injection of 20 c.c. of 30 per cent. hypertonic saline gave immediate relief and started resolution of the tingling and weakness. He began work a week later.

5. **Mental confusion.** "Muddle-headedness," inability to read for long, to concentrate or fix the interest, are sometimes met after head injuries and spinal anaesthesia. Hypertonic salines will clear this.

6. **After lumbar punctures.** Over a period of years it has been the writer's experience to see a few patients complaining of persistent headache after simple lumbar punctures for routine medical diagnostic purposes. They have been referred to the surgical department when the usual remedies have failed. All those symptoms have disappeared on the injection of 20 c.c. of 30 per cent. hypertonic saline.

7. **At cerebral operations.** At intra-cranial operations the intra-cranial pressure may be so great as to cause bulging of the brain and prevent the operation proceeding. This obstruction can be overcome sometimes by an injection of hypertonic saline.

8. **For a case of post-operative encephalitis.** A man aged thirty-eight was given a low spinal anaesthetic for the radical cure of an inguinal hernia. The anaesthetic was administered by the writer. The practice of boiling the syringe, needles, ampoule of anaesthetic and the file in distilled water was followed. The technique of administration was carefully performed.

Four days after the operation he complained of indigestion. He had suffered from duodenal ulcer dyspepsia for several years ; suitable treatment and diet were prescribed. For a few days he improved, but then in the following three weeks a deterioration set in, he began to vomit, developed double vision, became completely unconscious, paralysed and incontinent of urine and faeces. A lumbar puncture showed a small increase in the number of cells in the C.S.F. His care was undertaken by physician colleagues, after a week at a joint consultation the diagnosis of encephalitis was pronounced and a hopeless prognosis given, three to four days only being estimated. Further treatment was discouraged as useless.

From then onwards a regime of daily injections of 20 c.c. of hypertonic saline was begun together with intravenous injections of T.A.B. vaccine every fifth day, beginning with 50 million and subsequent doses increasing by double, i.e., 100, 200, 400, 800. Improvement began slowly. He was occasionally conscious, then continually so. continence returned and control of his limbs. In three weeks he was discharged and two months later he returned to work.

9. **For paralytic ileus and pulmonary oedema.** Professor Flint (1939) writes that hypertonic saline has a beneficial effect on these conditions. In early post-operative gross oedema of the lungs the results have occasionally been dramatic. He has recorded

that in some patients with ileus the blood pressure is low and the relationship of the diastolic and systolic pressure seriously altered. It may be that the increase in blood pressure which follows the administration of the saline and the exchange of tissue and venous fluids which it causes contributes to the improvement. Again chlorides are always depleted in intestinal obstruction and emesis.

Difficulties. The only difficulty experienced in the use of the hypertonic saline is that of finding a vein, which is a technical item and disappears with experience and resolution. Occasionally pain has been reported from a thrombophlebitis in the vessel which has been used, but this is rare. When it is given for headache patients are warned that for 20 to 30 minutes their discomfort or other symptoms will be aggravated and then the improvement will follow. One patient said she was unable to read the paper after the operation until after her injection of saline.

Rationale. The effect of the saline is to attract fluid from the tissue spaces in order to dilute the 30 per cent. saline to normal saline strength in the blood. If this is regarded as 1 per cent. (actually it is less than this), then 20 c.c. of 30 per cent. saline is equal to 600 c.c. of 1 per cent. saline, so that the tissues must find 580 c.c. of fluid. This raises the blood pressure partly by filling the blood vessels. It also relieves congestion, especially in areas with traumatic and chronic inflammatory oedema, and by so doing the results support the supposition that it initiates resolution, especially in head injuries, for there is no space in the skull cavity for swelling. In some patients the chlorides are beneficial, whilst in others the increase in blood pressure improves the circulation and starts the process of return to normal.

Conclusion. Several uses are described for hypertonic saline 30 per cent. in doses of 20 to 40 c.c. in surgical practice, including post-operative and post-traumatic headache, low blood pressure, paralytic ileus and oedema of the lungs.

REFERENCES.

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