followed by ligation of the common carotid and of the axillary arteries at later dates. The patient lived until 1933, and a full account of the case will be found in the *Lancet* for April 14th, 1934.

In his paper of January, 1922, Ballance mentions five other cases from recent literature with three recoveries, and one death from hemiplegia and one from haemorrhage at operation.

Reid⁴ reports that in 124 cases of aneurysm of various arteries admitted to Johns Hopkins Hospital, only three were true cases of innominate aneurysm, and, of these, two were operated upon. One patient died at operation, apparently from traction on the aorta, which would seem to be very dangerous. In one the innominate artery was tied and later the carotid, with improvement. The operation was performed by Halsted, and the patient lived six months, dying of pneumonia.

Other Records

Juckelson⁵ records a case in a man aged 30, following a punctured wound in the neck; he was treated by ligation of the innominate and extirpation of a portion of the sac, and was well five and a half years after the operation. Buchser⁶ gives a pathological report with a clinical history of an innominate aneurysm which perforated the trachea. His article includes a full bibliography of the German literature. Baldwin⁷ describes a case (1910) in which he ligatured the subclavian and the common carotid arteries in a woman aged 52, with an aneurysm of the innominate. She recovered completely and lived for eighteen years. The case is remarkable, since it has been generally held that in the case of innominate aneurysm distal ligation is not successful.

Lessnoi⁸ records a case of traumatic aneurysm of the right common carotid artery in a man of 35, treated by ligation of the innominate, with recovery. In the same article he describes eight other cases of traumatic aneurysm, so that the incidence in this region is obviously rare. Flint⁹ gives details of a case (1927) of a traumatic aneurysm of the innominate artery in a man of 37, following on a bullet wound received in 1918. Rapid growth of the aneurysm began in December, 1926, eight years after the injury, accompanied by severe dyspnoea and dysphagia. Proximal ligation of the innominate artery was carried out a month after the onset of symptoms, and this was followed by the opening up of a leaking aneurysmal sac, the turning out of the clot, and the suture of the open mouth of the subclavian artery. The patient made a good recovery. Cabot¹⁰ reports a case in which he ligatured the common carotid artery for an innominate aneurysm, but death occurred from pneumonia. McCarthy¹¹ discusses, at considerable length, the treatment of aneurysms by distal arterio-venous anastomosis, describing one successful case in which an aneurysm of the innominate was cured by anastomosis to the internal jugular vein.

Conclusions

It will be seen that ligation of the innominate artery for aneurysm is a well-established surgical procedure, in which the risks of the operation are entirely justifiable in view of the gravity of the condition. Technically the operation may be easy of achievement, or the difficulties from adhesions may render it impossible. Apart from the risk of haemorrhage at the time of operation, the two chief dangers to be feared are interference with the cerebral circulation and interference with the circulation in the arm. The latter does not appear to be as serious as might be imagined, probably because during the existence of the aneurysm a wide collateral circulation has opened up. The danger to the brain, however, must always remain a serious one, and there would seem to be

no means of discovering the extent of the risk in any particular case.

I am convinced that the method adopted, of operating under local anaesthesia and of applying tentative ligatures to the arteries, is a sound one. General anaesthesia involves a disturbance to the circulation, which cannot be anything but inimical to the interests of the patient, while it precludes entirely the very important information, which a conscious patient can give, as to the effects of occluding the circulation of a large vessel.

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HYPERTONIC RECTAL SALINE FOR INTRACRANIAL INJURY IN THE NEWBORN

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J. N. Cruickshank, in his study¹ of 800 cases of death in the newborn, wrote: "The present writer believes that increased intracranial pressure is a factor of first importance in the production of a large proportion of cases of neo-natal death." Modern investigations have shown how intracranial pressure can be reduced by the introduction of hypertonic salt solutions intravenously or into the alimentary canal. The present communication is an account of the practical application of these experimental findings in an effort to save a certain number of newborn babies who would otherwise die.

It is generally agreed that, as a result of the birth process, the contents of the baby's skull may exhibit haemorrhage (gross or microscopical), oedema and congestion, or contusion. Cruickshank's studies throw doubt upon the supposed frequency of small areas of haemorrhage, and, in his view, haemorrhage into the substance of the brain does not occur, except in unusual circumstances. He believes that the clinical effects often attributed to haemorrhage are due really to congestion and oedema, leading to anoxaemia of the medullary centres. In the post-mortem records of Cruickshank's monograph, oedema of the brain and meninges was a very constant finding, especially in those cases marked in life by respiratory failure. It is not maintained that hypertonic rectal saline can do anything for those cases in which meningeal or cerebral haemorrhage has occurred, but in view of Cruickshank's findings as regards the latter alternative I believe it should always be used, even if the clinical diagnosis between oedema and haemorrhage cannot be made.

Pathology of Increased Intracranial Pressure

The clinical features of this condition in the newborn may be briefly sketched against the pathogenic background referred to above.

The labour has usually been somewhat difficult, with a prolonged second stage. Occipito-posterior presentations,

forceps deliveries, and other departures from normal have frequently occurred. Premature babies, despite the smaller size of the skull, are well known to be more liable to intracranial complications. The baby may exhibit respiratory difficulties from the onset, but more usually, in the cases I have treated successfully, the condition following delivery has been fairly good, and the symptoms have developed gradually in the first two or three days of life. A refusal to feed, with deepening somnolence, often alternating with periods of restlessness and crying, is usually the first manifestation. Recurrent vomiting may occur, the fontanelle is found to be bulging, and frequent twitchings of the facial muscles and limbs are observed. Failure of respiration with attacks of cyanosis is a very constant feature.

I believe that the problem here to be solved differs in no essential from that presented by head injuries in adults and older children. In the same way, a rising intracranial pressure threatens life, and the investigations largely inspired by Cushing in relation to intracranial surgery have an important application in the neo-natal period. Two out of the many contributions on the subject of hypertonic salt solutions and the lowering of intracranial pressure may be briefly summarized to illustrate the experimental justification for the methods of treatment here indicated.

Foley and Putnam² quote Cushing to the effect that people with headaches often secure relief by thorough intestinal evacuation, especially when this is accomplished by salines. In their experiments the introduction of a 30 per cent. sodium chloride solution into the rectum in animals produced a steady and great drop in the pressure of the cerebro-spinal fluid, the systemic blood pressure remaining unaffected. Even with a 10 per cent. solution they recorded a notable fall in the pressure of the cerebro-spinal fluid, which was maintained for some hours. About 35 c.cm. were used for a cat, and retained in the rectum as long as possible. Cushing and Foley³ point out that while reduction in intracranial pressure can be produced by the intravenous injection of hypertonic saline, this is to a certain extent undesirable because of effects upon the pulse, respiration, and blood pressure. (From the point of view of practical midwifery, intravenous injections for the newborn present gross difficulties.) They found that even small doses (5 c.cm.) of a 2 per cent. sodium chloride solution into the alimentary canal of the cat below the stomach (that is, duodenum or rectum) produce a definite effect in lowering the intracranial pressure, and they obtained confirmation of the effects of hypertonic salt solutions in patients with brain tumours after operations for decompression.

Dandy⁴ and Jefferson⁵ have criticized the use of hypertonic salt solutions in the treatment of head injuries, but it is agreed by the latter that, properly used, this method of treatment has its place. The term "dehydration" is possibly responsible for criticism in reference to such solutions, and, certainly in the newborn, any attempt at producing dehydration is to be strongly deprecated. It might be urged that more prompt results may be obtained by the use of lumbar puncture, but the method to be described here is much easier of application, is less disturbing to the infant, and can be repeated as often as is required without any difficulty, while offering less risk of further damage to the brain.

Observations with the Method

The present method has been evolved over a period of nearly twelve months, and about twenty babies in hospital and private practice have been treated, mostly with highly successful results. I have not attempted to compare mortality rates for this and other methods of treatment, because, fundamentally, it is difficult to decide whether babies who survive would have died had they not been so treated. I can only record that obstetricians, resident officers, midwives, and nurses have been impressed with the results. A bulging fontanelle becoming normal, a comatose baby coming out of coma and taking feeds normally, and the cessation of twitching and of cyanotic attacks are some of the effects which have been observed.

Technique

The method now in use consists of the introduction of two to three ounces of 10 per cent. saline into the rectum of the newborn babe, as soon as any of the symptoms mentioned above appear.* The nurse is instructed to do this slowly, with the baby in the cot and with the minimum of disturbance, and to hold the buttocks together to get as long a retention as possible. Strong solutions are very quickly returned, and weaker solutions are not so effective, although an early case treated with only 2 per cent. saline made such a good recovery that it afforded encouragement to proceed with the method. The injections can be repeated at four-hourly or longer intervals, according to the improvement obtained. The method is wholly free from harm, and can be carried out by nurses undertaking domiciliary midwifery. "Ten times normal saline" is a convenient way of describing the strength of the solution used (ten teaspoonfuls of salt to the pint of water, or one teaspoonful in two ounces to make only the required quantity).

Other ancillary forms of treatment must not be neglected. As with head injuries in later life, absolute rest is of fundamental importance. Such babies must not be lifted out of bed for any purpose. Feeding must be carried out with breast milk expressed from the mother (or from other sources, if possible, in the early days). If the baby cannot suck, spoon-feeding may be tried, or, if this fails, an oesophageal tube. Small doses of chloral are valuable (1/2 grain) if any restlessness or twitching is present. Five per cent. carbon dioxide in oxygen through a nasal catheter is of great value for failure of respiration, and if there is the slightest suggestion of intracranial haemorrhage (indicated by the rapid onset of symptoms shortly after delivery) I believe it is sound to withdraw 10 c.cm. of blood from the mother and inject this intramuscularly into the baby.

In some instances a certain amount of spasticity is found to be present in the first few weeks after recovery. I was at first depressed by this, thinking that the method was possibly saving a certain number of infants who would have been better spared from a life of paralysis and imbecility. Longer experience has indicated that stiffness of the muscles usually wears off by 3 months of age. I do not think the method can possibly influence the survival of cases with structural damage to the brain. On the other hand, since oedema and congestion of the brain are temporary conditions which will disappear in the course of a few days if only the infant's life can be preserved, the use of hypertonic saline appears to offer a chance of reducing the risks of increased intracranial pressure which Cruickshank, on the basis of his wide pathological experience, believes to be of such great importance in the problem of neo-natal death.

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* Since this was written it has been decided to use the method prophylactically. A baby after a difficult delivery is given a hypertonic saline almost immediately.

The National Physical Laboratory has issued a new edition of its pamphlet "Tests on Volumetric Glassware." No fundamental changes have been made from the preceding edition, but several points have been dealt with in more detail—for example, the testing of burette tops and permissible schemes of subdivision of scales on graduated glassware. Copies of the pamphlet may be obtained free of charge on application to the Director, National Physical Laboratory, Teddington, Middlesex.