CONTINUOUS CEREBROSPINAL FLUID DRAINAGE BY INDWELLING SPINAL CATHETER

BY

G. VOURC'H
Hôpital Foch, Suresnes, Seine, France

SUMMARY

A technique is described of cerebrospinal fluid drainage utilizing an indwelling spinal catheter. This allows continuous drainage and reduction of pressure and brain volume in neurosurgical operations and in conditions such as traumatic cerebrospinal fluid leak and hydrocephalus. Indications, contraindications and results are described.

The reduction of brain tension, during neurosurgical operations, has been achieved in many ways. The aim is to provide the surgeon with adequate operative conditions; it is well known that cerebral oedema may impair the surgeon's work and may induce excessive brain trauma, especially when the tumour is deep within the brain substance. Hyperventilation, ganglion-blocking agents, hypothermia and urea infusions, have all been used with success to reduce brain volume.

It has been known for many years that lumbar puncture, and cerebrospinal fluid withdrawal during the operation can reduce brain volume by emptying the ventricles, just as does ventricular tapping itself. However, in most cases, the position of the patient on the table makes lumbar puncture difficult. The danger of trauma, fracture or dislodging of the needle, is such that the method has not been widely accepted, though it has many advantages: by purely physical means, controllable and reversible, it is possible to withdraw enough cerebrospinal fluid to reduce the tension of the brain appreciably.

It was thought that the Tuohy technique of continuous spinal analgesia by insertion of a plastic catheter within the spinal canal could be applied to these cases (Vourc'h and Rougerie; 1960).

TECHNIQUE

Lumbar puncture is performed as usual (with the patient seated, or in the lateral position), using the Tuohy needle. If the patient is conscious and co-operative, this is carried out using local analgesia; if he is agitated, or if he is a child, it is better carried out under general anaesthesia.

Spinal puncture itself is simple; two types of needles are available: No. 16 or 17. The size of the plastic catheter will be determined according to the needle used, and it should be ascertained, before starting, that it will fit into the needle selected. The bevel is directed headward and the catheter is inserted so that a length of about 5 cm lies beyond the tip of the needle; this must be measured before insertion, since there are no marks on most catheters.

The end of the catheter is then connected either to a fine needle and a syringe (capacity 50 to 100 ml) or introduced into a sterile container such as a previously emptied saline bottle. A large-bore needle is inserted through the rubber cap and the catheter is introduced through the needle, which is then withdrawn; the rubber squeezes the catheter, without obstructing it, ensuring an airtight seal. Another needle, with a cottonwool filter, provides an exit for air, while keeping the set sterile. We have used, with good results, a special type of connection to provide an airtight seal between catheter and syringe: the plastic tube is inserted through a thin hole in a steel connection; a flame is then applied to it; the plastic melts, and provides a perfect seal for the second steel connection which is then screwed into the first one. The advantage of that system is that there is no reduction in the inside bore of the tubing, such as would result from the catheterization of the plastic tube with a finer (hypodermic) needle, a method which would lead to a considerable increase in resistance.
A special catheter has been used which has three features:
(a) It can be autoclaved, whereas most plastic catheters must be sterilized by boiling, which may damage them, or by insertion into an antiseptic solution.
(b) It has the needle mounting already fixed.
(c) It is made of radio-opaque material and can therefore be located by X-ray.

RESULTS

During operation.
This technique provides the surgeon with excellent operating conditions. The brain literally shrinks, so that the dura must be stitched up as soon as the bone flap has been removed. Deep structures can be exposed without trauma. At the end of the operation, cerebrospinal fluid can be re-injected to fill the ventricles as long as the cisternae have not been opened, in which case the surgeon can inject the Ringer solution within the ventricles.

For cerebrospinal fluid leaks.
The results have been most impressive in the management of this condition. It is well known that fistulae take long to heal and may lead to infection and meningitis. If the wound could be kept dry it would heal spontaneously but the cerebrospinal fluid pressure keeps it open. By tapping it, and reducing the pressure at the site of the leak (which involves adequate posture of the patient, the leak being left higher than the catheter), we have always been able to treat our cases successfully.

Leaks in the cephalic region are particularly easy to deal with, since the lumbar catheter drains most of the cerebrospinal fluid when the patient is seated. The amount of tilt and the height of the bottle allow a constant control of the amount of fluid withdrawn.

In cases of leaks in the spinal region, the treatment is not so easy, for obvious reasons. However, we were able to treat a leak in the dorsal region, following laminectomy for tumour of the cord, which had been irradiated by mistake. The wound did not heal, and there was considerable cerebrospinal fluid loss, sufficient to soak the dressings and bed sheets. By insertion of a catheter through the occipital region, and the use of an adequate Trendelenburg position the wound healed within 15 days, without infection.

Hydrocephalus.
Some newborn children with hydrocephalus can be treated by cerebrospinal fluid drainage into the right auricle. For technical reasons, however, the operation cannot be performed until the child has achieved a certain stature. To prevent the extension of the condition, the technique has been used in a 3-month-old child (the catheter having been withdrawn by a nurse by mistake, on two occasions). The result on the brain volume was satisfactory; in fact, the drainage bottle having been kept too low, there was excessive depression of the fontanelle. However, the child died before operation could be performed, with hyperthermia. No organism could be identified in the cerebrospinal fluid.

INDICATIONS

During operation.
Cerebrospinal fluid drainage is indicated particularly during operations in the frontal region and on deep structures. Although other techniques usually provide adequate surgical conditions they have certain limitations and contraindications. The anaesthetist must decide which of these techniques is best suited for the individual case. It is felt that neither the induction of arterial hypotension nor the use of intravenous urea is suitable, for example, in very ill patients or in children. Hyperventilation deprives the anaesthetist of one of the most important signs by which to assess the patient's condition, namely, respiration. Although all techniques have been used it is believed that cerebrospinal fluid drainage achieves the same result at a lower cost.

Cerebrospinal fluid leaks.
Cerebrospinal fluid leak is probably the best indication for the use of the technique which enables excellent results to be achieved. Drainage may have to be carried out for some days under strictly sterile conditions. Attention should be paid to fluid balance (the amount of water and electrolytes withdrawn being replaced on a weight-for-weight basis). Excessive cerebrospinal fluid withdrawn must be avoided because this leads to headache, nausea and vomiting, in which case the height of the draining bottle must be adjusted.
The management of hydrocephaly in small children by this means has not yet been assessed on a large enough scale and definite conclusions cannot be drawn. However, it has been shown that a catheter can be inserted, using the Tuohy needle, in very small children.

CONTRAINDICATIONS
Posterior fossa tumours, with coning and cerebral hypertension, are obvious contraindications to the employment of this technique. Local infection can be put in the same class, just as it is a contra-indication to lumbar puncture.

FAILURES
These can occur for purely mechanical reasons. Examples are: lumbar punctures being impossible for anatomical reasons; occlusion of the catheter by a nerve root (in which case withdrawal will restore patency); kinking of the catheter; leaks due to puncture.

REFERENCE

SOMMAIRE
L’auteur décrit une technique de drainage du liquide cérébro-spinal à l’aide d’un drain spinal laissé en place. On peut ainsi maintenir un drainage continu et réduire pression et volume du LCR dans le cerveau au cours des interventions de neuro-chirurgie et dans les traumatismes ayant provoqué soit l’écoulement excessif du LCR soit un hydrocéphale. L’auteur décrit indications, contre-indications et résultats.

ZUSAMMENFASSUNG

BOOK REVIEW


This small volume, as Dr. Hunter states in his preface, is directed towards the junior anaesthetist, house surgeon, or house physician who may be called upon to institute artificial ventilation. The author’s aim has been to provide them with an elementary guide and reference and in this he has largely been successful. The chapters cover the general principles involved, the means of instituting artificial ventilation, the clinical monitoring and the nursing care of the patients, and finally there is a brief description of the conditions in which respirator treatment may be necessary.

With the increasing employment of such therapy, this book is timely and, as it is well set out and liberally illustrated, it should prove an asset to the junior hospital staff. Thus it is unfortunate that, in the interests of economy, the binding is such that it will obviously not withstand the recurrent “thumbing” that this book will promote and deserve.

It is indeed a pity that the author has not devoted more space to “mouth to mouth” ventilation, and such directions as are given are rather awkwardly expressed —“the air in the lungs of anyone present will serve as the gas for inflating the patient and the muscles of expiration as a means of delivering it under pressure”

—that the young reader may have difficulty in obtaining a clear picture of this life-saving method. This is all the more so because considerable space is devoted to the description and illustration of cuirass respirators which are so rarely employed today.

Greater prominence should have been given to instructions regarding the prevention of general infection which can occur so readily in patients undergoing respirator therapy, and the value of organized and regular physiotherapy receives rather too scant attention.

With the increasing realization that intravenous administration of fluids to patients receiving prolonged artificial ventilation is fraught with difficulties and very real dangers, it is believed that something more than just the mention of thrombophlebitis is required.

The reviewer also feels that a page setting out clear instructions on a procedure to be adopted in an emergency occurring during respirator therapy (such as sudden mechanical failure of the respirator), and stressing the need to have an alternative means of inflation of the lungs always on hand, would be most valuable to junior staff faced with this problem.

In general, the text as it stands is clearly expressed, the advice given is sound, there are sufficient relevant references for those students wishing to read the original work, and for a book of this size the index is unusually complete.

Douglas Joseph