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Pediatric neuroendoscopy in Chile

Analysis of the first 100 cases

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Abstract The personal series of the first 100 cases of neuroendoscopy performed at the Pediatric Neurosurgery Service of the Institute of Neurosurgery Alfonso Asenjo in Santiago-Chile is presented. The patients were the first to undergo endoscopic operations for different types of hydrocephalus and their ages ranged from newborn up to15 years. Their clinical records, surgical protocols, radiologic results, videos and follow-up are reviewed. A mortality of 2% and a morbidity of 7% were found in this group, hemorrhage, ventriculitis and CSF leakage being the main problems. Success was achieved in more than 75% of cases in the whole series. If we only consider the group of III ventriculostomies performed in noncommunicating hydrocephalus, our success rate rises to 90%. Follow-up ranges from 30 months in the first case to 2 months in the last case considered. All patients were operated on by the author using a rigid Gaab scope with 5.8 mm OD coupled to a Codman light source and a microcamera. Surgical technique was always the same using a right precoronal burr hole. Prophylaxis with vancomycin was indicated in all cases. General, partial and specific results are presented and allow the conclusion that this is an excellent procedure when it is well indicated. It means a great saving in shunts and treatments and has become an alternative to shunts in all neurosurgical units.

Key words Neuroendoscopy · III Ventriculostomy · Hydrocephalus · Shunts

Introduction

Neuroendoscopy is a surgical technique that was created in 1920 by a urologist, who succeeded in coagulating the choroid plexus of a hydrocephalic child using a cystoscope. Nevertheless, it was Dandy who incorporated it as a new treatment technique. With the development of shunts in 1949, neuroendoscopy was soon supplanted and it was not until 1970, with the discovery of light transmission through solid rod lenses and later through flexible fiberoptics, that neuroendoscopy was reapplied and new and current endoscopic techniques were defined [4].

In Chile, efforts were made in the past, but an endoscopic program could never be formally developed. In 1995, the Institute of Neurosurgery was given a complete set of equipment for neuroendoscopy, and this was the starting point for development of the technique. To date more than 250 patients, adults and children, have been operated on using this minimally invasive procedure, allowing us to gain useful initial experience.

Patients and methods

Data on the first 100 children aged between 1 day of life and 15 years operated on in the Pediatric Neurosurgical Service of the Institute of Neurosurgery, Santiago, Chile, were extensively analyzed.

All available neuroradiological material relating to the patients were reviewed, including clinical history, pre- and postoperative notes and later follow-up records, and also the operation video. The time between August 1995 and February 1998 (30 months), was regarded as the follow-up period.

Data were handled in a prospective way in a database created with the Excel program (Office 95 Microsoft).

The instrumentation used was the Gaab Neuroendoscopic System with a rigid endoscope (OD 5.8 mm), which includes biopsy and grasping forceps, biopsy needles and scissors. Monopolar and bipolar electrodes, Fogarty balloon catheters and double-chamber balloons were some of the tools used for the procedures. A Codman microcamera and light source plus a Sony color TV monitor and a video processor made up the imaging set [15].

The basic surgical technique was essentially the same in all patients, with adaptation of the instruments for each case. All operations were performed under general anesthesia with the patient in dorsal decubitus with a slight head elevation. A right precoronal burr hole was the usual access route, but according to age and indication other entry sites were used [5].

Vancomycin was the antibiotic indicated for prophylaxis during the operation and the following 24 h. Plastic aprons for the surgeons and plastic covers for the patient were also used to build up a watertight wall. Shaving was partial or total, and the head was washed with antiseptic solution at least four times. All procedures were tape recorded for later revision and for teaching purposes.

Radiological preoperative examination, CT scans, or MRI were performed for all patients in the whole series, and some underwent CSF circulation studies. Postoperative control with early CT scan was done, and repeated at 3, 6 and 12 months of follow-up.

Results

A total of 100 procedures were performed on 100 pediatric patients aged from 1 day to 15 years (Fig. 1).

Etiology was mainly noncommunicating hydrocephalus (49% of cases), which was secondary to aqueduct stenosis in 28 children and to posterior fossa tumors in 21 cases. Loculated hydrocephalus, arachnoidal cysts, meningomyeloceles, intracranial hemorrhage, brain tumors and other diseases were the etiological conditions in the rest of the 100 cases studied (Table 1).

The operations done were mainly III ventriculostomies (66%), fenestrations (18%), septostomies (3%) and others (Table 2). Minor bleeding made the operations more difficult, but were not serious enough to justify abandoning them. Anatomical variations made some operations take longer. Ventricular drainages were used to control major hemorrhages. In 84% of the cases the operation was performed successfully (Table 3).

Table 1 Etiology

Aqueductal stenosis	29
Posterior fossa tumors	21
Loculated hydrocephalus	12
Arachnoidal cysts	10
Meningomyelocele	6
Intracranial hemorrhage	5
Brain tumors	5
Intraventricular cysts	4
Other	8

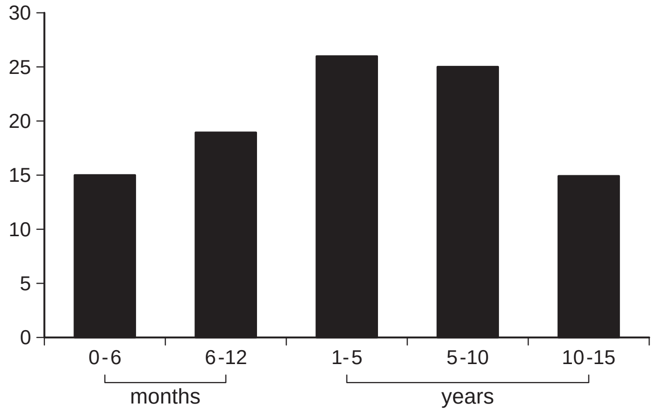

Fig. 1 Age distribution

Table 2 Operations

III Ventriculostomy	66
Fenestration	18
Septostomy	3
Coagulation choroidal plexus	2
Other (biopsies, catheters, tumors)	11

Table 3 Technical difficulties

Ependymal perforation	1
Major hemorrhage	4
Anatomical variations	5
Minor bleeding	6
No difficulties	84

Postoperative evolution was uneventful in 79% of the patients, and only in 21% were there some complications, ventriculitis being the most frequent, with an incidence of 12%. Cerebrospinal fluid leakage appeared in 5 patients, and ventricular hemorrhage happened in 4 cases. There were no complications in 79% of the series.

Analysis of the method's efficiency

Procedures were considered successful if the patient did not need other interventions throughout the follow-up period to deal with intracranial hypertension. When any other method had to be used to treat the hypertensive syndrome, the procedure was considered to be a failure.

On these terms, this series has an overall success rate of 83% and a 17% failure rate. When only infants – between 1 day of life and 6 months old – are considered, this group represents 15% of the entire series and there were complications in 47%, ventriculitis being the most frequent problem that heavily influenced the outcome.

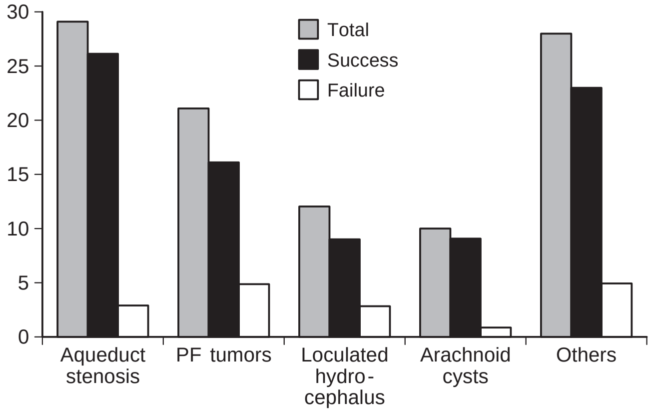

Fig. 2 Efficiency and etiology (*PF* posterior fossa)

Table 4 Results of III ventriculostomy[a]

Functional	76%
Not functional	24%

[a] Follow-up period September 1995 to May 1998

Table 5 Failures of III ventriculostomy

Difficult anatomy	1
Previous ventriculitis	1
Intraoperative bleeding	6
Postoperative ventriculitis	4
Undetermined	4
Total	16

The analysis of efficiency according to etiology (Fig. 2) shows that the best results are achieved in the treatment of hydrocephalus caused by aqueduct stenosis or posterior fossa tumors, with a success rate of 90%, and the worst are obtained in the meningomyelocele group and compartmental hydrocephalus. This corroborates the international experience of poor results in infants and patients with hydrocephalus of other types than noncommunicating. This issue is currently under discussion [2].

The group of patients treated with III ventriculostomies (TVC) shows the best results. It is also the group in which we have seen the neurological improvement of the patients most clearly. We performed 66 III ventriculostomies – 29 in aqueduct stenosis, 21 in posterior fossa tumors and 16 in other etiologies (meningomyeloceles, compartmental hydrocephalus, suprasellar cysts, etc.) Follow-up was planned to evaluate short- and long-term outcomes, follow-up having extended to 28 months in the first cases.

Long-term success was achieved in 50 patients (76%), with the ventriculostomy still being functional to date, while the ventriculostomy became nonfunctional in 16 cases (24%) (Table 4). Failures may be explained by intraoperative bleeding and postoperative ventriculitis, which can block the subarachnoid spaces (Table 5).

Discussion

Over the last few years, neuroendoscopy has found the place that it could have occupied earlier if better instruments had been available or had shunts not appeared. Current experience throughout the world shows that this treatment is a good alternative to the use of shunts in many cases of brain disease, and particularly in obstructive hydrocephalus [2, 5, 6, 9, 10, 12].

The rate of shunt dysfunction is around 30%; the infection rate is 5–8% per year and neurological deficits are observed in 7% of shunt users [3]. It seems clear that shunts have not solved the hydrocephalus problem, but they have become a complex solution, making the patient dependent on a silicon prosthesis that will probably fail in the long run. High costs, morbidity and complications have led pediatric neurosurgeons to have recourse to neuroendoscopy.

In 1995 at the A. Asenjo Institute of Neurosurgery in Santiago, Chile, we started a neuroendoscopic team for children and adults. To date we have treated more than 250 patients. Our results do not differ much from those recorded in other international series [2, 7, 8]. In the pediatric series we obtained good results in 83% of the patients. Our postoperative infection rate is still running too high (12%), and it has become a challenge to bring it down to 5% [1, 5, 12]

Mortality was 2%, and both infants concerned died of postoperative ventriculitis. The younger, a newborn with aqueductal stenosis, was infected with a *Clostridium* and the other, a 2-month-old infant with posthemorrhagic hydrocephalus and congenital cardiac malformation, developed a *Staphylococcus aureus* ventriculitis.

We are currently using a new and thinner scope (4.2 mm OD), and our plans are to couple it with stereotaxis for tumor biopsies. We have also been treating some very symptomatic slit ventricle syndromes and monitoring dilatation of ventricles through the exteriorized proximal catheter. When a proper dilation of the III ventricle is reached we perform ventriculostomy. We have been using the scope to “look around the corner” in other operations and have also performed flexible neuroendoscopy for syringomyelia [9, 10, 11, 13, 16].

Conclusion

At our Institute, neuroendoscopy has proven to be a worthwhile procedure as an alternative to shunting in selected patients, especially children with noncommunicating hydrocephalus. This has meant a significant saving in shunt expenses, since the rate of complications has been lower, allowing the hospital stay to be considerably shortened. Our results are similar to those obtained in other centers, and our goal is to achieve a morbidity rate no higher than 3% with no mortality [7, 8]

Our final conclusion is that neuroendoscopy is a valuable method that should be developed in all neurosurgical units, especially pediatric units, since it provides a much better outcome for our small patients [9, 14]

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