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Choroid plexectomy for the treatment of chronic infected hydrocephalus

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Abstract. Choroid plexectomy was performed for chronic infected hydrocephalus in 17 children via a direct open approach. In 16 cases, the CSF was sterilized soon after the plexectomy. In 37% of cases, the hydrocephalus was arrested without a shunt. The incidence of seizures did not increase after plexectomy. Removal of the choroid plexus was controlled by scintigraphy. Neuropsychological results were not encouraging, probably related to the long history of chronic ventricular infection. Surgical mortality was 6%. Choroid plexectomy should be considered as a possible treatment of chronic infected hydrocephalus in children.

Key words: Choroid plexectomy – Children – Chronic infected hydrocephalus.

It is now generally stated that choroid plexectomy is an operation of historic interest only and has no place in the current treatment of hydrocephalus. Our proposal is to modify this statement slightly. Choroid plexectomy is sometimes useful and effective for the treatment of patients previously treated with a shunt, complicated by chronic or recurrent infection. The choroid plexus seems to play a role in chronic infection or to serve as a focus of chronic or subacute infection. Removal of the plexus helps to control and treat intraventricular infection; in addition, choroid plexectomy is sometimes followed by cure of the hydrocephalic process itself.

Materials and methods

In our department, we have performed a plexectomy for infected hydrocephalus in 17 children, during a 15-year period. There were 10 males and 7 females ranging in age from 1.5 to 20.5 months, with an average of 9 months. Four cases had not previously been shunted. They were treated for ventriculitis during the neonatal period. The infection was resistant to antibiotics, with persistent positive growth. At the same time, hydrocephalus developed. We prefer, in these cases, to perform a plexectomy rather than use prolonged external ventricular drainage.

Thirteen cases were infants or children who had previously been treated by shunt for hydrocephalus, secondarily complicated by infection during the postoperative period. In the beginning, all cases were treated with antibiotics and external placement of the shunt. Because the infection became chronic and germs were still found in the ventricles, the external drain was changed for a new one. In spite of these treatments, infection was still present after 2 months or more in 11 cases. In 2 other cases, when infection was apparently cured according to all biological tests, a new internal shunt was inserted after removal of the external drain. Unfortunately, this new procedure failed because recurrent ventriculitis with the same germs previously found, commanding again externalization of the shunt. In order to stop this vicious circle, we decided to perform a plexectomy.

The germs were: *Staphylococcus epidermidis* (9 cases), *Pseudomonas aeruginosa* (2 cases), *Steptococcus* (2 cases), *Escherichia coli* (2 cases), and *Proteus* (1 case); associated germs were: *Proteus, Klebsiella,* and *Streptococcus* (1 case). Before surgery, the persistant character of hydrocephalus was expressed by the need for external drainage and the impossibility of closing the system.

The choroid plexuses were visualized preoperatively by isotopic scanning, using ^{99m}Tc-pertechnetate [4]. The children were prepared with an intravenous infusion of 100 mg Na-pyrophosphate and 16 mg stannous chloride in an aqueous solution 24 h before the examination. This examination showed where the plexuses were located and their size (Fig. 1 A–B). In two instances, the plexectomy had to be cancelled because the plexuses were too small or not visible at all. The same isotopic scanning was performed after surgery to control the extent of plexus resection (Fig. 2 A, B).

We used an open surgical procedure in one stage through a small right parietal bone flap, the cortical opening being located at the level of the upper parieto-occipital junction. Under direct visual control, the choroid plexus was totally removed on the ipsilateral side. Removal on the contralateral side was performed through a spontaneous or surgical opening of the septum pellucidum. Choroid plexectomy was bilateral and total in 13 cases, as indicated by the postoperative isotopic scan. It was total on one side and partial on the contralateral side in 4 cases. In 5 cases, the ventricular cavity was partially loculated by septae, or inflammatory tracts, which were resected during the approach for the plexectomy. The macroscopic aspect of the plexuses was variable: sometimes normal, sometimes showing signs of inflammation. Microscopic examination of the removed choroid plexuses showed inflammatory granuloma or signs of subacute infection in evolution located in the plexus (Figs. 3–8).

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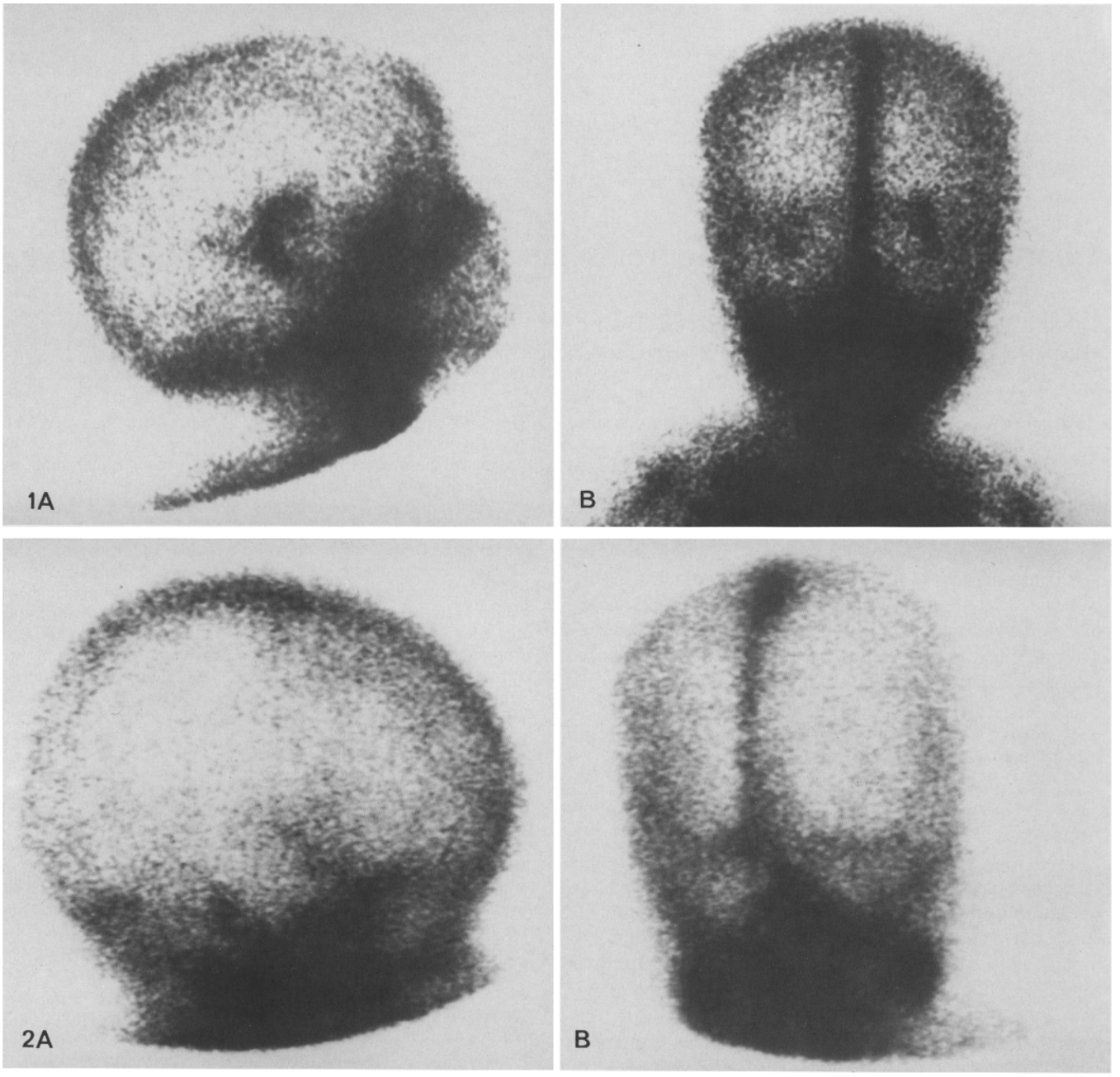


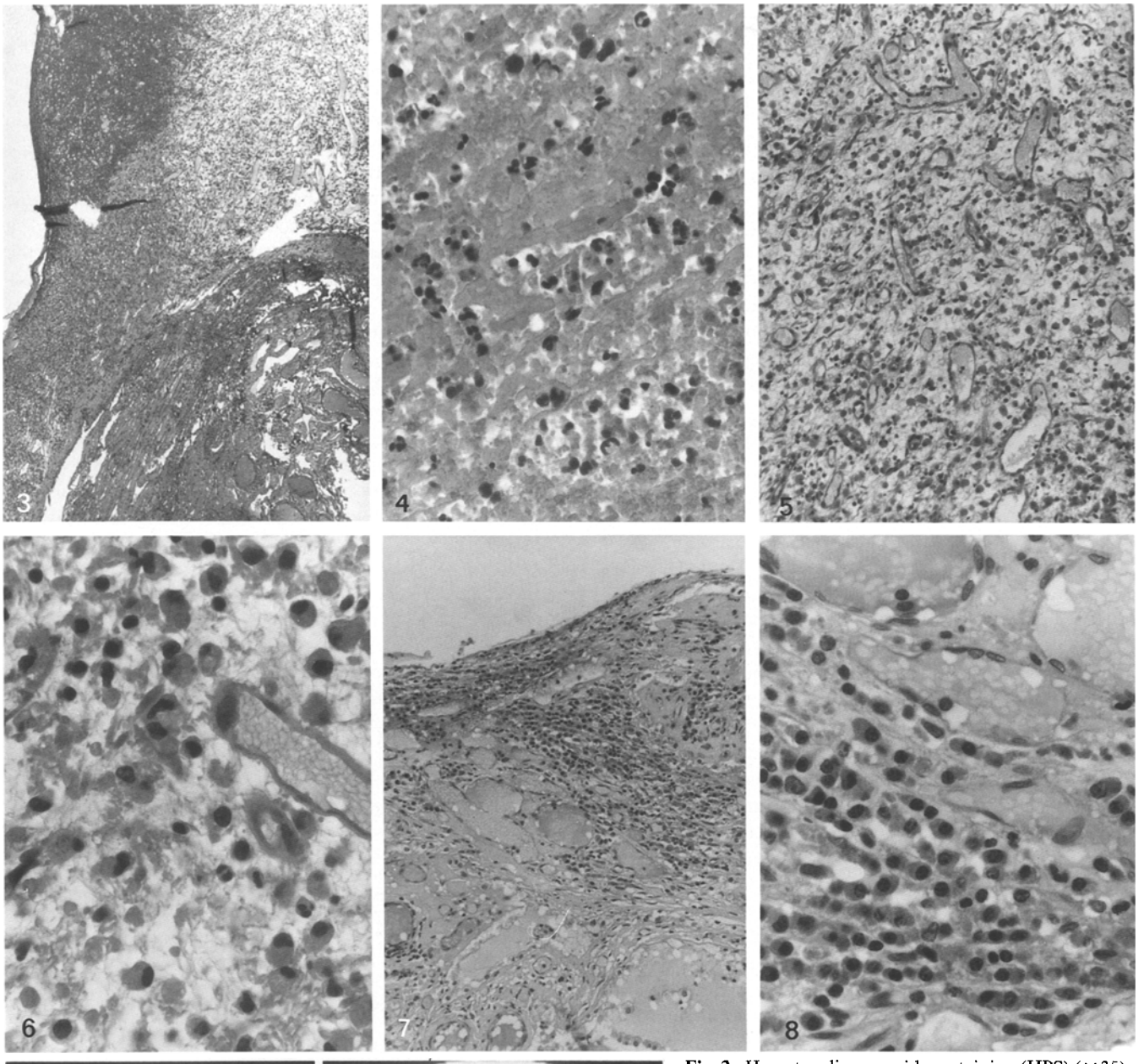
Fig. 1 A, B. Scintigraphy of the choroid plexus. **A, B** Lateral and posterior view. Note the choroid plexus before operation

Fig. 2 A, B. Scintigraphy of choroid plexus. **A, B** Lateral and posterior view after operation

Results

One infant died soon after surgery from respiratory problems and collapse; another died 2 years later (after plexectomy) of shunt failure. The shunt revision had been postponed with the parent's permission because the child was badly handicapped.

Results in chronic infection were very good. In 16 patients who underwent surgery, the CSF has always been sterilized soon after plexectomy. Antibiotics were given postoperatively for an average of 15 days (from 6 days to 6 weeks). In all the cases, hydrocephalus was so modified after surgery that it was possible to remove the preoperative external drainage. Removal of the external drainage was performed from a few days to 2 weeks after plexectomy when the CSF was clear of blood, after a temporary clamping of the drain had indicated that this was feasible. Six children (37%) had definitively stabilized hydrocephalus and no longer needed shunting or drainage (Fig. 9A, B). All others (10 cases) needed a new shunt from 3 weeks to 6 months later. In 5 cases, the course of hydrocephalus was slowed, more the result of normal pressure hydrocephalus than the previous, active, hypertensive hydrocephalus.



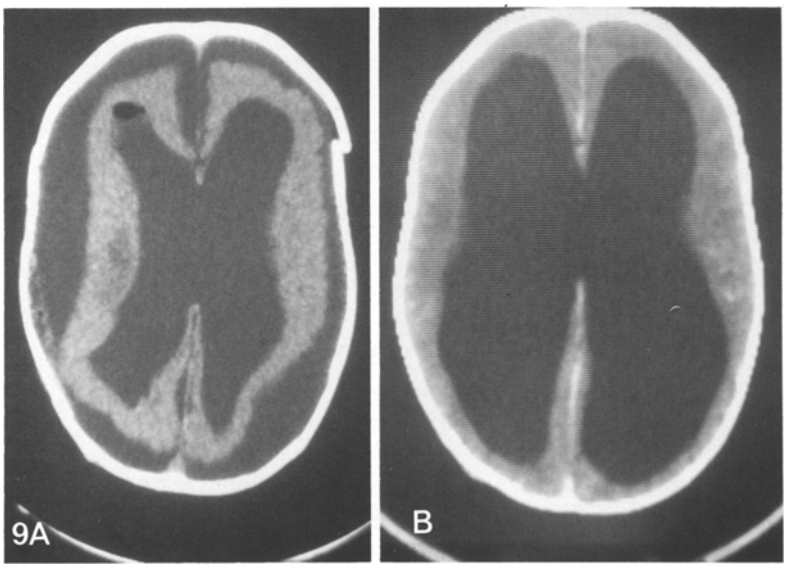


Fig. 3. Hematoxylin-peroxidase staining (HPS) (×35). General view of the infected choroid plexus. *Top left,* acute evolutive inflammation; *top right,* underlying subacute inflammation (nonspecific granulomatous inflammation); *bottom right,* congestive choroid plexus axis

Fig. 4. HPS (×158). Detail of the acute superficial inflammatory focal point (note the abundant granulocytic and pyocytic infiltration)

Fig. 5. HSP (×99). Detail of the subjacent subacute reaction (note the rich neovascular component)

Fig. 6. HPS (×158). Note subacute lymphoplasmohistiocytic and granulocytic infiltration

Fig. 7. HPS (×99). General view of the choroid plexus. Some epithelial cells can be seen at the bottom right. There are signs of subacute persistant inflammatory reaction within the choroid plexus axis

Fig. 8. HPS (×158). Detail of the previous figure. Note the subacute inflammatory reaction represented essentially by plasmocytic infiltration

Fig. 9. **A** CT scan before and **B** after plexectomy

No preoperative neuropsychological analysis was available. Postoperative neuropsychological analysis was performed in 15 patients: 8 were seriously handicapped, with an IQ below 60 and no schooling possible; 5 were psychologically retarded, with an IQ below 80 and specialized schooling required; only 2 had an IQ above 80 and could manage, with slight difficulties, a normal school program. Seven children had recurrent epileptic attacks before the plexectomy, 2 only showed spikes on the EEG without seizures, and 6 had no epileptic anomalies. After the plexectomy, 4 patients have seizures, 3 have spike anomalies on EEG, and 8 have no epileptic seizures or EEG anomalies. It is worth noting that among 7 children with preoperative convulsions, 3 had no epilepsy after surgery. In contrast, of 6 children without preoperative seizures, one developed epilepsy later on.

Discussion

Choroid plexectomy was introduced by Dandy [1, 2] in 1918 as a means for decreasing the production of CSF within the ventricular system. Extirpation of the choroid plexus was performed in four patients in a two-stage operation. Three of four cases first reported by Dandy died following collapse of the brain. Sachs [7] in 1942 and Davidoff [3] in 1948 also reported a high mortality (near 50%). In 1932, Dandy, followed by Putnam [6] and Scarff [8], introduced a technique of endoscopic coagulation in order to decrease the danger of the procedure. Scarff reported first a mortality of 15%, and then of 5%. The surgical mortality in our series was 6%. We were successful in controlling hydrocephalus in only 37% of the cases. This result was a plus, because surgery was not performed primarily for this purpose. Total bilateral plexectomy provides a better chance of arresting hydrocephalus: of 6 cases, 4 had total bilateral plexectomy and 2 partial removal on the side opposite the surgical approach. If we add the 5 cases where active hydrocephalus was transformed into a normal pressure hydrocephalus to the 6 cases completely cured, we observe that for 68% of our patients the hydrocephalus was modified favorably, results that are comparable to the 60% success rate of earlier authors where no information regarding the postoperative ventricular size and psychomotor results was available [5]. The neuropychological results were not good in our series, probably a result of the long history of chronic ventricular infection suffered by all patients. We did not observe a late decrease in psychomotor results, particularly among children without a shunt. This fact correlated with the stable size of their ventricles, and, it is important to assert that in these cases, hydrocephalus was really arrested.

Critics of plexectomy stress the high incidence of seizures after surgery. We have not had this experience: 7 children had seizures before surgery compared to 4 after surgery. Thus, in our opinion, the surgical procedure does not increase the incidence of convulsive disorders. Probably the main cause of seizures is chronic infection.

The main point stressed here is the possibility to treat chronic ventricular infection. We prefer to perform a resection of the plexus by an open surgical approach, rather than coagulation by an endoscopic technique to be sure to remove the inflammatory part of the plexus. Choroid plexectomy probably helped to control chronic infection through two mechanisms: the removal of a reservoir for germs (the pathological findings of the removed plexus revealed the chronic character of infection); resection of the plexus decreases the production of CSF. It is well known that without foreign bodies in the ventricular cavity, infection is more easily and more rapidly controlled. Whatever the explanation, choroid plexectomy is a reasonable alternative in the treatment of chronic or recurrent ventricular infection complicating a shunt for hydrocephalus in children. In addition to the treatment of infection, choroid plexectomy is effective in the treatment of hydrocephalus in at least one-third of cases.

References

1. Dandy WE (1918) Extirpation of the choroid plexus of the lateral ventricles in communicating hydrocephalus. Ann Surg 68:659–679
2. Dandy WE (1945) Diagnosis and treatment of strictures of the aqueduct of Sylvius (causing hydrocephalus). Arch Surg 51: 1–14
3. Davidoff LM (1948) Hydrocephalus, and hydrocephalus with meningocele. Their treatment by choroid plexectomy. Surg Clin North Am 28:416–420
4. De Tovar G, Panneciere C, Akerman M, Perez R (1975) La scintigraphie des plexus choroides (plexographie choroidienne). Nouv Presse Med 4:2399–2400
5. Milhorat TH (1972) Hydrocephalus and the cerebrospinal fluid, vol I. William & Wilkins, Baltimore
6. Putnam TJ, Ask-Upmark E (1934) Microscopic observation on the living choroid plexus and ependyma of the cat. Arch Neurol Psychiatry 32:72
7. Sachs E (1942) Hydrocephalus: analysis of ninety-eight cases. Mt Sinai J Med (NY) 9:767–781
8. Scarff JE (1970) The treatment of nonobstructive (communicating) hydrocephalus by endoscopic cauterization of the choroid plexuses. J Neurosurg 33: 1–12

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Editorial comment

Karl H. Hovind, Editor

Any attempt at shunting chronic infected hydrocephalus is doomed to fail due to the shunt plugging as a result of a relatively high presence of protein and cells. Until re-