Treatment of Obstructive Lesions of the Aqueduct of Sylvius and the Fourth Ventricle by Interventriculostomy*

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The treatment of stenosis of the aqueduct of Sylvius, though rarely necessary, is still a challenge to the neurosurgeon. Among 44 autopsied cases of infantile hydrocephalus studied several years ago, I found 29.5 per cent with stenosis of the aqueduct of Sylvius. Sporadic attempts at treatment have been made and various operative measures devised, some of which are well known and some even forgotten. I shall make no attempt to review the extensive literature or discuss the relative merits of various procedures, but will simply report a group of patients with stenosis treated by interventricularostomy (3rd–4th).

In 1920, Dandy reported 2 patients, aged 1 and 5 years, in whom he dilated the aqueduct and left a portion of rubber catheter in place for 2 to 3 weeks. The older child died of pneumonia 7 weeks later but the other was reported well after 1 year. A similar procedure has been performed occasionally by others, though there do not seem to be many published cases. In 1922, Dandy stated that "strictures of the aqueduct of Sylvius recur after any attempt to restore the lumen," and proposed 3rd ventriculostomy. In 1945, Dandy stated that strictures of the aqueduct can be opened easily, but with rare exceptions they will recur. He advocated 3rd ventriculostomy by a temporal approach as the operation of choice.

In the past I have attempted to explore and catheterize the aqueduct of Sylvius in infants. It seemed to be a dangerous procedure which I discontinued. However, a few of these patients grow to adolescence or adulthood, when surgery becomes somewhat more simple.

The first patient of this group was operated upon on March 26, 1947. A plastic tube of tigon was left in the aqueduct permanently. The result was successful, and the patient has survived more than 17 years. Soon after this patient had been operated on, I visited Sweden and found that Norlén had just placed a specially-designed spiral of thin metal wire in the aqueduct of a child with a brain tumour, and 2 such cases were reported by him in 1949. Leksell had devised the method of dilating the aqueduct with a rubber catheter and introducing a specially designed spiral of tightly wound metallic wire into the aqueduct for permanent drainage. In 1949 he reported 10 cases in children and adults, 3 of whom died soon after operation. As Leksell remarked, "It is doubtful whether operative intervention is on the whole indicated in this group of extreme cases."

The purpose of the present report is to record the long-term follow-up of a small trial series of patients treated by intubation of the aqueduct of Sylvius with rubber and plastic tubing.

Case Reports

Case 1. C.S.P., a 12-year-old girl, was admitted March 17, 1947, complaining of headache, vomiting, a staggering gait, poor memory and failing vision, progressing over the last 3 months. She was never bright at school, but with the onset of headache her work deteriorated.

Examination. She was an overweight, fidgety child with a large head. There were numerous café au lait areas and blue spots (von Recklinghausen's syndrome) over the trunk. The optic discs were pale and the margins indistinct. She had horizontal and vertical nystagmus, incoordin-
nation of the extremities, unsteadiness of gait, and bilateral plantar extensor reflexes.

Roentgenograms (Fig. 1) revealed the evidence of chronic increased intracranial pressure. Ventriculography (Fig. 2a and b), March 26, 1947, showed extensive ventricular dilation with obstruction at the upper end of the aqueduct. Encephalography the same day filled the subarachnoid cisterns but failed to show the 4th ventricle. The electroencephalogram showed a persistent abnormality from all regions of the head with a disturbance of alpha rhythm by slow-wave activity. There were high-voltage sharp waves with foci of phase reversals mostly from the left and right parietal regions.

Operation. On March 26, 1947, the aqueduct of Sylvius was explored via the 4th ventricle and was found to be occluded. The aqueduct, seen at its lower end, was no larger than a pinpoint and did not appear to pass fluid. It was gently dilated with appropriately sized, round-ended probes. There was a point of slight resistance at the cephalad end. A plastic tube of tigon was inserted and left to function permanently.

Postoperative Course. Postoperative x-rays on March 28 showed the tube to be in place and a ventriculogram on April 8 demonstrated that oxygen passed to the 4th ventricle and the cervical subarachnoid space (Fig. 2c and d).

Postoperatively there was transient slight deviation of the eyes without diplopia. On April 9 there was no nystagmus, no extraocular paresis and no diplopia. The plantar reflexes were flexor. The patient had become bright, alert, cooperative and cheerful, and the incoordination of gait had improved. She was discharged on May 13.

In 1954 and 1957 she was reported to be symptom free and functioning as well as could be expected for a person of her ability. In follow-up letters of 1962 and 1964, 15 and 17 years postoperatively, she complained of headaches and some fainting spells. Although it is possible that the tube should be removed and replaced, the symptoms have not as yet warranted re-admission.

Case 2. T.C., a 5-year-old boy, entered the hospital, November 24, 1949, with complaints of unsteady gait and convulsions for 10 days.
Interventriculostomy in the Aqueduct of Sylvius

Examination. He had a large head with a relatively shallow posterior fossa, papilloedema, nystagmus, tremor, incoordination, unsteady gait and some generalized weakness of handgrips and muscles of shoulder and pelvic girdle.

Roentgenograms showed evidence of hydrocephalus. Ventriculography on November 25, 1949, (Fig. 3a and b) revealed a huge spherical mass lying posteriorly between the lateral ventricles. It compressed the posterior half of the 3rd ventricle and appeared to cause a block at the level of the aqueduct of Sylvius. A supplemental spinal injection of oxygen failed to visualize the aqueduct and the 4th ventricle. The lesion was considered to be a huge cyst.

First Operation. The 3rd ventricle and the cyst were explored through a right parasagittal craniotomy on November 25, 1949. The dome of the

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Fig. 2 (c) and (d). Case 1. Postoperative ventriculogram demonstrated the 4th ventricle and the cervical subarachnoid space and the tube.

Fig. 3 (a) and (b). Case 2. Preoperative ventriculogram showed negative shadow of huge cyst or diverticulum between the lateral ventricles posteriorly.
cyst was formed of transparent membrane containing veins suggesting arachnoid and velum interpositum.

On December 9, 13 days later, encephalography with a ventricular needle in place failed to prove passage of gas above the 4th ventricle. Enecephalography on December 28 showed communication between the spinal subarachnoid space and the lateral ventricles, and on January 28, 1950, showed communication between the spinal subarachnoid and the lateral and the 3rd ventricles. However, a subsequent ventriculogram (Fig. 3c and d) on January 28 showed no evidence that oxygen passed from the 3rd to the 4th ventricle. It finally became clear that the cyst was a big diverticulum. As a result of the surgical intervention it now communicated with the posterior part of the 3rd ventricle; passage of gas through the aqueduct had never occurred. In retrospect, the gas from the spinal subarachnoid space may have passed into the 3rd and lateral ventricles by way of the surgical openings in the cyst; or the cyst may have been a separate entity.

Second Operation. The posterior fossa was explored on January 28, 1950. The falx was only 1 mm. in depth and the tentorium was represented by a rim 1 to 2 cm. in width. The large cystic cavity was entered; it simulated a huge 4th ventricle but was actually the large diverticulum which now communicated with the 3rd ventricle. On further examination the foramen of Magendie was found just beneath it. A small 4th ventricle was entered, through which one could reach the aqueduct. The stenosed aqueduct was then dilated and intubated permanently with a portex tube. One month following this operation, encephalography showed free communication between the spinal subarachnoid space and the ventricular system, presumably by way of the aqueduct. Eye movements were normal. There was no nystagmus. There was some residual ataxia and tremor. The patient was bright and alert on discharge.

A follow-up letter written by the patient from Newfoundland in August, 1958, 8 years after the operation, stated that he felt fine and attended school regularly. His mother added that he was healthy and normal for his age, but was nervous and easily disturbed by noise. He did have an occasional headache, but apart from this was well and the local doctor was satisfied.

This patient was especially interesting because of the presence of the huge supramesencephalic cyst or diverticulum which might have been primary or secondary. The advantage of the tube was obvious. It not only overcame the primary obstruction, but prevented pressure from the cyst closing the aqueduct as a secondary phenomenon. A large cyst could also cause obstruction at the incisura tentorii; either this or the small cisterna magna might vitiate the results of a

![Fig. 3 (c) and (d). Case 2. Ventriculogram made after 3rd ventricle exploration showed positive shadow of huge diverticulum, but no 4th ventricle.](image)
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FIG. 4 (a) and (b). Case 3. Preoperative ventriculogram showed marked dilatation of the lateral and 3rd ventricles. The aqueduct of Sylvius and 4th ventricle were not visualized.

Fig. 4 (c). Case 3. Postoperative spinal pneumogram showed passage of oxygen via aqueduct of Sylvius.

Torkildsen’s procedure. A tube in the aqueduct, however, cannot be compressed to create the pressure favorable for fluid to pass through the 3 natural outlets of the 4th ventricle.

Case 3. W.S., a 36-year-old man, was admitted on July 1, 1949. He had suffered from headache, staggering, stumbling, and vague seizures for 1 year. He had had occasional convulsions in early childhood and a duodenal ulcer in 1945.

Examination. There was marked incoordination of the lower extremities and to a lesser degree of the arms. He was unable to walk with one foot before the other, and lost his balance while standing with his feet together. There was no nystagmus. X-rays of the skull showed a large head with signs of increased intracranial pressure. Preoperative electroencephalography showed a 6 per sec. generalized cerebral dysrhythmia; the results suggested a subcortical projection of cortical disturbance.

Encephalography on July 11, 1949, showed a normal 4th ventricle, but no gas passed through the aqueduct. A ventriculogram (Fig. 4a and b) revealed aqueductal stenosis with internal hydrocephalus as suggested by the encephalogram.

Operation. On July 15, 1949, the aqueduct of Sylvius was dilated, relieving a block at its upper
end. A portex tube was inserted from 4th to 3rd ventricles. The arachnoid over the cisterna magna was thick and might have made a Torkildsen procedure difficult.

Postoperative Course. The postoperative course was satisfactory. The patient was alert and cooperative, and conjugate eye movements were normal. On the following day there was 6th nerve paresis with diplopia, which cleared in 3 days. There was incoordination of gait, much as before operation. The finger pointing tests were done fairly well. An x-ray, July 27, showed the position of the tube, and on July 27 and July 28, spinal pneumography (Fig. 4c) showed the tube to be open. On August 1, 1949, a postoperative electrogram suggested a widespread cortical disturbance, greater on the right. He had an epileptic seizure on September 1, with headache and vomiting the next morning. On September 5, 1939, a combined ventricular and lumbar puncture showed no block, and the spinal fluid pressure was normal. He was discharged on a phenobarbital regime on September 10, 1949.

In 1954, 5 years later, the patient was reported by his doctor to be looking after his own farm. He was receiving an anticonvulsant, but no seizures were reported. A letter written by the patient in 1938, 9 years after interventriculostomy, stated that he continued to farm in a managerial capacity. He had had a recent gastrectomy for ulcers.

Case 4. G.M.H., a 46-year-old man, was admitted comatose January 19, 1950. For 6 years he had had headache, dizzy spells, and spells in which he either lost consciousness or didn’t know who he was. He had gained 15 lbs, in the last year.

Examination. On admission, the patient was deeply comatose and had been for 5 hours. He had bilateral papilledema with evidence of secondary optic atrophy, a questionable right facial weakness, a slight increase of right knee jerk, absent abdominal, cremasteric and corneal reflexes. A lesion of the 3rd ventricle such as a diverticulum above the mesencephalon was suspected.

Roentgenograms showed a decalcified sella turcica, suggesting chronic increased pressure. A ventriculogram (Fig. 5a) demonstrated stenosis of the aqueduct of Sylvius with ballooning of the suprapineal recess toward the posterior fossa; in brief, a small replica of the huge cystic diverticulum seen in Case 2. An encephalogram (Fig. 5b) on the same day showed a small 4th ventricle and a blocked aqueduct of Sylvius.

Operation. On January 27, 1950, the stenosed aqueduct was explored and a portex tube gently inserted.

Postoperative course. The patient continued to be listless. Active movement produced dizziness and nausea. He was able to walk with some ataxia. There was no definite weakness or incoordination, no nystagmus and no diplopia. There was an increased intake and output of water for a few days. A postoperative pneumoencephalogram (Fig. 5c) on February 18 showed that the tube was patent for oxygen.

A follow-up in 1952 stated that the patient had

Fig. 5. Case 4. (a) Preoperative ventriculogram with posterior diverticulum from 3rd ventricle. (b) Superimposed encephalogram, made the same day, with oxygen in the 4th ventricle.
been riding a bicycle 1 mile, 4 times a day, to work. In March, 1953, he reported no recurrence of blackouts. He was working 7 hours a day as a caretaker and walked 6 miles a day to work. His optic discs were normal. In 1956, 1958 and 1961 the patient was reported to be well and working as usual as a supervisor of janitors. In 1961, x-rays showed re-osseification of the dorsum sellae, indicating normal intracranial pressure. There was evidence of Paget's disease of the skull. The tube had slipped caudally 10 mm, but it had given no trouble. He had one fainting spell in 1963 but was reported quite well in 1964, his 14th postoperative year.

Case 5. R.C., a 46-year-old woman, was brought by her family who described abnormal untidiness and unsanitary habits for 1 year. On 2 occasions she had felt faint and had fallen.

Examination. On admission, July 21, 1948, she was unconcerned, disoriented and felt that she was well. She had divergent strabismus, accentuated left knee jerk, absent left and right abdominal reflexes, and bilateral plantar extension. There were psychotic behavioral abnormalities. A brain tumour was suspected.

Ventriculography on July 28 revealed a mid-aqueductal block with hydrocephalus. Encephalography on July 30 showed a normal 4th ventricle with a block of the aqueduct of Sylvius.

Operation. On August 2, 1948, a portion of a rubber catheter was placed in the stenosed aqueduct.

Postoperative Course. The patient continued to be psychotic and was placed in an institution. Her general status was unchanged. She died in 1951, and autopsy showed the catheter to be open. There was no tumour. Some chronic arachnoiditis was present. The tube apparently was working.

Case 6. B.K., an 11-year-old girl, was admitted after 1 year of headaches and vomiting. During the same time she had developed blurred vision, staggering gait, irritability, poor memory and unsatisfactory 3rd grade school work.

Examination. Examination on admission, May 8, 1953, revealed lack of attention, slight disorientation in time, and poor cooperation. There was blurring of the optic discs, diminished power in the right arm, a hyperactive right ankle jerk, a right positive Chaddock's reflex, unsteadiness of gait even with a wide base, and a tendency to fall backwards. The diagnosis of an expanding lesion of the posterior fossa, probably in the anterior vermis, was considered.

Preoperative electroencephalography on May 12 showed bilaterally synchronous paroxysmal high voltage 2–2.5/sec. activity.

Examination on May 13 showed indistinct optic discs, occasional transitory rapid nystagmus, a hyperactive right knee jerk, a right plantar extensor reflex, incoordination and some degree of retropulsion.

Roentgenograms on May 11 showed separated coronal sutures, pressure markings, and decalcification of the dorsum sella. A ventriculogram (Fig. 6a and b) on May 15 showed an obstructed aqueduct, suggesting either a stenosis of the aqueduct or a lesion in the posterior fossa.

Operation. On May 15, 1953, through a suboccipital exposure, a portion of rubber catheter was inserted through the stenosed aqueduct after failure to get a portex tube satisfactorily in place. Free flow of fluid from the 3rd to the 4th ventricle through the tube was observed.

Postoperative Course. There was no disturbance of ocular movement. The plantar reflexes had returned to normal, and the patient had no complaints.

On May 28 a postoperative electrogram confirmed the preoperative impression of a continuously abnormal electroencephalogram with bilaterally synchronous 2/sec. waves in the posterior regions of the head, consistent with a lesion of the brain stem.

On discharge, June 10, 1953, the patient was greatly improved mentally. Vision and gait had improved. There was still some squint and equivocal right plantar response.

Because of the suspicion of tumor, the patient was given a course of deep x-ray therapy from June 3 to July 30, 1953, with a tumor dose of 5,576r. On August 13, 1953, the cranial nerves
balance, position sense and knee jerks were normal.

By February, 1954, there had been great improvement in school work. She was near the top of the class in regular work, taking piano lessons, dramatics, and gymnastics (except for acrobatics). She was able to skate, dive, turn somersaults, and play volleyball. Reports in 1954, and 1956, revealed no abnormal residual symptoms or signs, and the patient was attending school regularly.

Roentgenograms (Fig. 6c) of November 5, 1954, showed the tube to be in good position; recalcification of the dorsum sella had occurred. An electrogram of November 5, 1954, indicated very striking improvement with normal electrical activity generally, and only minimal irregularities which would be consistent with minor abnormalities of the brain stem.

In 1958 she attended college and was very happy. Her marks were high. She was on the Student Council and President of her class. She played the piano, typed well, and danced a lot. Her mother felt that in spite of all this, her balance might be impaired on quick turns. The optic discs remained normal. She was married in 1963, 10 years postoperatively which would seem to be a good test for a reluctant aqueduct.

Case 7. P.E.B., a 35-year-old man, was admitted in November, 1954, because of headaches and defective memory over the past 2 years. He showed papilledema, left-sided exophthalmos, diplopia, slight weakness of the left hand and foot, and incoordination of gait. He had moderate

Fig. 6 (a) and (b). Case 6. Preoperative ventriculogram showed block at aqueduct of Sylvius.

Fig. 6 (c). Case 6. Postoperative x-rays showed position of tube and recalcification of sella turcica.
arterial hypertension. He had been operated on for a "spina bifida" 20 years before.

Skull films showed signs of increased intracranial pressure. A ventriculogram (Fig. 7a and b), November 17, 1954, revealed internal hydrocephalus with obstruction of the aqueduct of Sylvius.

**Operation.** On November 17, 1954, a suboccipital exploration was carried out. No tumor was seen; the aqueduct was dilated and intubated with a portex tube in the manner described.

**Postoperative Course.** Postoperative roentgenograms on November 22 and December 8, and an encephalogram on Dec. 14, 1954 (Fig. 7c), showed the tube to be well positioned and functioning freely; there appeared to be less internal hydrocephalus.

The patient improved gradually. On the first day there was a divergent strabismus, which cleared to a moderate diplopia as before the operation. The unsteadiness of gait with retropulsion improved and the papilledema receded. The patient was discharged considerably improved.

Examination 1 year later in December, 1955, showed that the patient was working full-time at his old job as an engineering designer. He had little, if any, nystagmus. There was a very slight diplopia on gaze to the extreme left, due to minimal weakness of the left 6th nerve. There...
was a slight oscillation of the left eye, due to poor fixation. He had had no headache since his operation. The patient complained of fatigue, but he also had suffered from arterial hypertension. A tumor was still considered a possibility.

Examination in November, 1957, indicated that he was well and active. The blood pressure was 140/80. The optic discs were normal and the eyes were more steady. He had little, if any, incoordination in the arms, and the gait was quite normal. He had slight unsteadiness when walking with one foot before the other, and was under medical treatment for arterial hypertension.

Yearly follow-ups showed a recession of signs and when last seen in October, 1964, 10 years postoperatively, he was considered practically normal.

Because this procedure had proved successful in adult cases, it was felt that it might be safe to try the procedure in an infant should a very typical and urgent case arise. The following proved to be a case of this sort.

Case 8. P. McW., a 7½-month-old girl, was admitted in November, 1954, with hydrocephalus and a bulging fontanelle.

Examination. Roentgenograms showed evidence of an acute rise in intracranial pressure. A ventriculogram (Fig. 8a) and an encephalogram (Fig. 8b) on November 12 demonstrated a block at the aqueduct of Sylvius.

First Operation. On November 16 the aqueduct was explored through a suboccipital exposure and stenosis was found. A portex tube was gently introduced and left in place. The pressure was relieved at once.

Postoperative Course. Within a few days, however, the pressure rose; this was thought to be caused either by improper placement of the upper end of the tube or subarachnoid insufficiency. On November 30, a ventriculogram (Fig. 8c) suggested that the upper end of the tube was curved posteriorly and blocked against the posterior wall of the 3rd ventricle.

Second Operation. Re-exploration on December 2, 1954, revealed that the tube was working. Nevertheless, it was removed.

On December 10, a ventriculogram (Fig. 8d) showed the aqueduct to be open. On December 15 an encephalogram again showed communication. Although the ventriculogram and the pneumoencephalogram showed the aqueduct to be open, there remained some doubt from an x-ray point of view as to whether fluid was circulating over the hemispheres. However, the fontanelle remained soft, the baby was alert, and there was no enlargement of the head between admission and discharge. The fontanelle was soft and depressed when she was discharged February 3, 1955. The head was 51 cm., and there was no neurological deficit.

A letter from the mother dated August 9, 1958, stated that the baby's condition was "just perfect. She began to walk at 14 months. Her head is a little larger than normal but has not grown out
of size since the operation. She has not been ill. Sometimes if she becomes excited, her eyes will cross; otherwise, there is nothing wrong. Visitors find her very well, compared to the many cases of hydrocephalus which they know of in this area."

This then is an instance of aqueductal stenosis in infancy treated by surgical dilatation and temporary intubation of the aqueduct with successful arrest of the hydrocephalus.

Case 9. J.G., an 11-year-old boy, was admitted on September 12, 1950, with a 1-year history of staggering gait and petit mal seizures

Examination. He had bilateral papilloedema, general incoordination of the upper and lower extremities, and walked with a wide base. There was weakness of the right 6th nerve, and hyperactive deep reflexes. On September 15, 1950, an encephalogram and a ventriculogram showed hydrocephalus with a block of the aqueduct of Sylvius.

Operation. On September 15, 1950, the 4th ventricle and aqueduct were explored, and the aqueduct was intubated with a portex tube.

Postoperative Course. Two hours after the operation, the patient developed a sudden irregular respiration with gradual dilation of the pupils. An intratracheal tube improved this condition, but the difficulty recurred within 3 hours. The operative site was reopened at once and revealed a massive epidural haematoma with compression of the brain stem. He died on September 16, 1950.

Autopsy verified the large epidural hematoma with cerebral edema. The portex tube was in place. The original area of stenosis was found halfway along the aqueduct of Sylvius. This was an operative mortality due to epidural hematoma. It is likely that this was facilitated by the sudden lowering of intracranial pressure.

Case 10. D.T., a 5-week-old girl, was admitted on February 2, 1951, because of progressive hydrocephalus, first noted 2 weeks before when a cervical meningocele was removed at a different hospital.

Examination. There was a transverse operative scar which had to be crossed by our own incision. A ventriculogram on February 8 and encephalograms on February 15 and 22 revealed hydrocephalus with obstruction at the aqueduct of Sylvius, just below the floor of the 3rd ventricle.

Operation. On February 22 the aqueduct was explored and dilated by probing alone, establishing continuity between the 3rd and the 4th ventricles. There also seemed to be an extra false membrane covering structures in the posterior fossa.

Postoperative Course. On March 1, there de-
developed a staphylococcic infection of the wound at the junction with the former incision, and on March 8 there were areas of consolidation in the lungs. The patient died on March 12, 1951, probably due to generalized infection; autopsy showed hydrocephalus, encephalomalacia, purulent meningitis, pulmonary emboli, and wound infection.

**Discussion**

We have reported 10 cases of congenital stenosis of the aqueduct of Sylvius treated by 3rd–4th interventriculostomy. These came to operation at ages ranging from 5 weeks to 46 years.

The operative mortality rate was 20 per cent. In 1 instance, however, fatal postoperative infection was probably caused by crossing a recent operative scar, and this was only a probing operation. There were 9 cases of stenosis of the aqueduct, in 8 of which a tube was left in permanently; in the remaining case the tube was removed at the end of 16 days. One of these 9 died postoperatively from epidural hemorrhage, probably as a result of the acute drop in intracranial pressure. Thus the mortality for those 9 actually intubated was 11.1 per cent.

In no case of stenosis did a tube fail to function when properly placed. Apparently the contour of the floor of the aqueduct and 4th ventricle plus the tight fit induced by the stenosis keep the tube from shifting position and allows it to clear the floor of the 3rd and 4th ventricles.

Of those 8 patients who survived, including the one from whom the tube was removed after 2 weeks, all but 1 (Case 5) are still living, are well rehabilitated and have no obvious difficulty with the tube. Case 5 died from other causes after 2½ years. Furthermore, there has been recession of symptoms in all patients. Two more patients with permanent tubes have had a successful outcome, although they are not included in this report. Their inclusion would lower the mortality to 9 per cent.

It is of interest that Case 1 showed evidence of von Recklinghausen's syndrome. This association has been observed by others: Laurence,7 Paine and McKissock,10 and Pennybacker.12 Cases 7 and 10 were associated with a spina bifida. It is also of some interest that Case 7 had suffered from arterial hypertension, which improved gradually over the years after interventriculostomy and medication. Epilepsy of some category had occurred preoperatively in Cases 2 and 3. In Cases 4 and 6 there were lapses of consciousness and changes in personality.

We have pointed out elsewhere11 that the small diverticulum in Case 4, and possibly the large closed cyst or diverticulum in Case 2, seem to arise as posterior extensions of the 3rd ventricle, rather than as lateral diverticuli from the thin posteromedial wall of the lateral ventricles, as described by Sweet13 and Childe and McNaughton1, although this is also possible.

The relative value of this procedure rather than that of Torkildsen14–16 must be considered in each case. Interventriculostomy does avoid the necessity of perforation of the ipsilateral hemisphere and further chronic intraventricular damage by the placing and permanent settling of the Torkildsen tube. It is also probably a more effective procedure than a Torkildsen's shunt in special instances for reasons already given.

It has some advantages in certain cases of suspected tumor, as in Cases 6 and 7, in which the opportunity for direct inspection and possible biopsy is an advantage; it can also be used in certain cases of tumor of the mesencephalon and 4th ventricle, in which removal or inspection may be combined with interventriculostomy, and in which the cerebrospinal fluid flow may be maintained in spite of tumor growth around the tube.

**Summary**

1. That plastic tubes can be safely left in place in the aqueduct of Sylvius is clear. The tubes used were rubber catheter, tigon and portex. Polyethylene is too rigid for insertion. Silicone should be suitable. Gentle introduction is essential.

2. Patients with stenosis of the aqueduct of Sylvius may grow to adult life before symptoms become disturbing. They can be cured by 3rd–4th interventriculostomy.

3. In no case did a tube fail to function when properly placed. When feasible, interventriculostomy appears to be a permanent and physiological type of procedure which also provides for exploration to rule out other abnormalities.

This is, of course, a dangerous procedure.
There seems however to be a place in the repertoire of neurosurgery for both simple dilatation and temporary or permanent intubation of the aqueduct of Silvius.

References


6. Ingebriotsen, R. Cited by Torkildsen.16


