Subarachnoid-subarachnoid bypass for spinal adhesive arachnoiditis

Case report

TOSHIYA TACHIBANA, M.D., PH.D., TOKUHIDE MORIYAMA, M.D., PH.D., KEISHI MARUO, M.D., PH.D., SHINICHI INOUE, M.D., PH.D., FUMIHIRO ARIZUMI, M.D., AND SHINICHI YOSHIYA, M.D., PH.D.

Department of Orthopaedic Surgery, Hyogo College of Medicine, Nishinomiya, Hyogo, Japan

The authors report a case of adhesive arachnoiditis (AA) and arachnoid cyst successfully treated by subarachnoid to subarachnoid bypass (S-S bypass). Arachnoid cysts or syringes sometimes compress the spinal cord and cause compressive myelopathy that requires surgical treatment. However, surgical treatment for AA is challenging. A 57-year-old woman developed leg pain and gait disturbance. A dorsal arachnoid cyst compressed the spinal cord at T7–9, the spinal cord was swollen, and a small syrinx was present at T9–10. An S-S bypass was performed from T6–7 to T11–12. The patient’s gait disturbance resolved immediately after surgery. Two years later, a small arachnoid cyst developed. However, there was no neurological deterioration. The myelopathy associated with thoracic spinal AA, subarachnoid cyst, and syrinx improved after S-S bypass.

Key Words • adhesive arachnoiditis • arachnoid cyst • syrinx • subarachnoid to subarachnoid bypass

Adhesive arachnoiditis (AA) can cause blockage of CSF circulation and secondary subdural arachnoid cysts or syringes. Subdural arachnoid cysts or syringes sometimes compress the spinal cord and cause compressive myelopathy that requires surgical treatment. However, surgical treatment for AA is challenging. We encountered a case of AA and a subdural arachnoid cyst that we successfully treated by subarachnoid to subarachnoid bypass (S-S bypass).

Case Report

History and Presentation. A 57-year-old woman developed leg pain and gait disturbance 3 months before visiting our clinic. She had been treated surgically for lumbar disc herniation at age 19. Neurological examination during the first visit to our clinic revealed hypesthesia of the lower right extremity below L-4 and of the lower left extremity below S-1, reinforcement of the bilateral patellar and Achilles tendon reflexes, bilateral ankle clonus, slight motor weakness of the bilateral iliopsoas, and spastic gait. The Japanese Orthopaedic Association (JOA) score for cervical myelopathy, with the exception of upper-extremity components, was 8/11 points.

Imaging. Magnetic resonance imaging of the thoracic spine showed that the spinal cord was shifted ventrally and flattened at T7–9; it was also swollen with a syrinx at T10–11 (Fig. 1). A myelogram showed contrast medium pooled at T9–10 (Fig. 2A). A CT myelogram revealed that the spinal cord was shifted ventrally and flattened at T7–9 and was also swollen with a small syrinx at T10–11 (Fig. 2B). The lesion was diagnosed as a ventral focal spinal AA at the T9–10 level caused by accumulation of CSF. A dorsal subdural arachnoid cyst (pseudocyst) and syringomyelia had developed secondary to myelopathy.

Operation and Postoperative Course. We intended to create an S-S bypass connecting the intact subarachnoid spaces at the T6–7 and T11–12 levels. This necessitated a laminectomy at T7–11, which was followed by opening of the dura mater at T7–9 and T11–12. The outer and inner layers of the dura were opened separately in preparation for suturing of a shunt tube. The dorsal subdural arachnoid cyst was extruded after opening the dura at T7–9.
The cyst was opened at the dorsal side and was found to be a pseudocyst because it did not have a wall located at the cranial side. We did not open the dura at the T-10 spinal level because lower-leg muscle flexion occurred when touching the dura here. The S-S bypass was performed from T6–7 to T11–12. A 3.3-mm-inner-diameter shunt tube was placed in the subarachnoid space from T6–7 to T11–12, and the tube was fixed by suturing between the outer and inner layers of the dura (Fig. 3). The patient’s gait disturbance resolved immediately after the operation. Three months later, MRI revealed that the arachnoid cyst and syrinx had disappeared and the spinal cord had expanded dorsally (Fig. 4). Two years after surgery, a very small subdural arachnoid cyst developed (Fig. 5). However, there was no neurological deterioration. The JOA score improved to 10.5/11 points.

**Discussion**

The etiology of AA in this patient could not be clarified. She had undergone lumbar spine surgery 38 years previously and might have undergone myelography in which a lipid contrast medium was used before the surgery. This could have subsequently induced arachnoiditis. Several options for treatment of AA have been reported in the literature. Alternative treatment options other than S-S bypass include neurolysis, microlysis, and shunt procedures. However, their results are not satisfactory. Shikata et al. reported on intradural neurolysis after extradural decompression or microlysis for AA.8 The percentage of cases in which good results were obtained by nonmicroscopic lysis and microlysis was only 54.8% in their series. Klekamp et al.5 reviewed the surgical results of 78 patients with syringomyelia associated with AA. Clinical stabilization was accomplished in 83% of patients with focal arachnoid scarring who underwent microsurgical dissection of the arachnoid scar and decompression of the subarachnoid space with a fascia lata graft, whereas clinical stabilization was accomplished in only 17% of the patients with extensive arachnoid scarring over multiple spinal levels who underwent the same procedures.5 Morisako et al.6 reported on microsurgical arachnoidolysis performed in 4 patients with symptomatic syringomyelia or myelomalacia caused by focal
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AA. Postoperatively, neurological function in 3 patients showed modest or minor improvement, and neurological function in 1 patient remained unchanged. The authors emphasized that microsurgical arachnoidolysis is technically demanding.6 Syringosubarachnoid shunts and syringoperitoneal shunts have a high rate of symptom recurrence, and Klekamp et al. found that symptom recurrence rate was 92% for patients with focal arachnoid scarring and 100% for patients with extensive arachnoid scarring.5

Fig. 3. Intraoperative photographs showing S-S bypass procedure performed from T6–7 to T11–12. A: Laminectomy was performed from T-7 to T-11, the dura was opened, and the arachnoid cyst was subsequently opened at T7–9. B: A 3.3-mm-inner-diameter shunt tube was placed in the subarachnoid space from T6–7 to T11–12. C: The tube was fixed by suturing it between the outer and inner layers of the dura at T-8 and T11–12.

Fig. 4. MRI 3 months after surgery shows disappearance of the arachnoid cyst and syrinx and dorsal expansion of the spinal cord.

Fig. 5. MRI 2 years after surgery shows the spinal cord displaced ventrally by a small arachnoid cyst. However, the shunt is still working.
The S-S bypass procedure was introduced by Ohta et al.\textsuperscript{7} These authors reported that there was no recurrence of syringomyelia in 16 patients receiving S-S bypass for syringomyelia associated with AA. S-S bypass may be a direct treatment for blockage of CSF circulation, which may contribute to syrinx- or subdural arachnoid cyst-associated AA without arachnoidolysis. S-S bypass may also be a safer technique because it creates a bypass for CSF circulation using a shunt tube from the intact cranial subarachnoid space to the intact caudal subarachnoid space without touching the arachnoid adhesion or the spinal cord, which might be damaged. The adoption of this surgical approach may afford another advantage by preventing scar formation in the subarachnoid region following the surgery. The S-S bypass procedure has an advantage over shunt procedures such as syringosubarachnoid shunt and syringoperitoneal shunt because a tube with a diameter of 3.0–4.0 mm can be used. The use of a larger-diameter tube would reduce the risk of postoperative tube occlusion, which is a complication that impairs the effectiveness of surgery in these procedures. S-S bypass is also the most effective treatment for blockage of CSF circulation in an electrical circuit model that simulates the dynamics of the CSF in the spine.\textsuperscript{3}

Conclusions

The S-S bypass procedure proved successful in a 57-year-old woman who presented with thoracic spinal AA, subarachnoid cyst, and myelopathy. Her gait disturbance improved immediately after S-S bypass and was maintained for 2 years.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper. Author contributions to the study and manuscript preparation include the following. Conception and design: Tachibana.

References


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