Expansive duraplasty for the treatment of spinal extradural arachnoid cysts

Case report

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The authors report the case of a 25-year-old man with a thoracolumbar extradural arachnoid cyst who underwent expansive duraplasty. Symptoms, preoperative magnetic resonance imaging features, and intraoperative findings suggested the involvement of entrapment neuropathy in the manifestation of symptoms. To the authors' knowledge, this case represents the first evidence that expansive duraplasty can achieve complete resolution of the symptoms in a patient with a spinal extradural arachnoid cyst. The results indicate that duraplasty may be an alternative option in cases in which complete resection of the lesion is difficult and widening of the dural sac is necessary at surgery.

KEY WORDS • arachnoid cyst • extradural cyst • thoracolumbar spine • duraplasty

Spinal arachnoid cysts are usually located in the thoracic spine, and congenital, hereditary, idiopathic, and inflammatory causes have been proposed as their pathogenetic mechanisms.9 Surgical treatment is required when neurological symptoms develop due to cyst-induced spinal cord or nerve root compression. Although various treatment methods have been proposed, the results of surgery were sometimes unfavorable.1–13 In this report, we present the case of a patient with a large thoracolumbar arachnoid cyst consisting of multiple cavities that was successfully treated by expansive reconstruction of the dural sac.

Case Report

Presentation and History. This 25-year-old man presented with a 3-year history of pain and dysesthesia initially in the low-back region and extending gradually to the distal side of the bilateral lower extremities. Pain and dysesthesia were exaggerated when he was lying down and attenuated when standing or walking. He had undergone cardiovascular intervention for an atrial septal defect when he was 15 years of age and had experienced no other prior illness or trauma.

Examination. Neurological examination showed bilateral lower-extremity pain and dysesthesia, increasing from the proximal to the distal portions of the legs; the territory of the pain and dysesthesia was clearly not consistent with the dermatome. Neither reduced muscular strength of the legs nor increased deep tendon reflex was noted. Bowel and bladder functions were also normal.

Computerized tomography myelography revealed a large mass located posterior to the spinal cord, extending from T-12 to L-3. Pooling of contrast medium was observed in the lesion indicating the communication of this lesion with the subarachnoid space (Fig. 1A). Magnetic resonance imaging demonstrated a cystic lesion; the anterior wall of the cyst was fused with the dura. Neither a clear margin nor indentation between the lesion and the dural sac was observed (Fig. 1B). Septation was present within the cyst (Fig. 1C). Although a hyperintense lesion on T2-weighted MR imaging indicating myelomalacia was not demonstrated within the spinal cord, the cord and nerve roots were severely anteriorly displaced due to compression by the cyst (Fig. 1D). The dural sac was flattened and the CSF space had disappeared around the cord (Fig. 1D). Based on these neuroimaging findings, we diagnosed the lesion as a spinal epidural arachnoid cyst. Because the patient’s symptoms were severe and progressive, we recommended surgical treatment of this lesion.

Operation. The patient underwent surgery while in the prone position. The cyst was exposed via a T10–L3 laminectomy. The laminectomy was carefully performed to avoid injuring the posterior wall of the cyst. The wall was thick, tough, and tense. It was incised longitudinally and CSF-like fluid was released. During this process, septations were found within the cyst around L-2, which separated the cyst into two cavities (Fig. 2A). These were removed and also incised vertically and opened laterally.

Abbreviations used in this paper: CSF = cerebrospinal fluid; MR = magnetic resonance.
FIG. 1. Preoperative imaging studies.  A: Sagittal computerized tomography myelogram demonstrating a large mass extending from T-12 to L-3 posterior to the spinal cord and pooling of contrast medium within the lesion, indicating communication with the subarachnoid space.  B: Sagittal T2-weighted sagittal MR image showing no myelomalacia in the spinal cord. Neither a clear margin nor indentation between the lesion and the dural sac was observed.  C: Axial T2-weighted MR image demonstrating a septation within the cyst (arrowhead).  D: Axial T2-weighted MR image revealing anterior displacement and flattening of the dural sac and disappearance of the CSF space around the cord.

FIG. 2. Intraoperative and pathological findings.  A: Intraoperative photograph obtained around L-2 after opening the dorsal wall, showing the presence of a septum within the cyst.  B: Intraoperative photograph around T-12 demonstrating an oval dural defect at the off-midline portion (asterisk) on the discolored and flattened dura, and tight adhesion of ventral and lateral walls to the dura.  C: Intraoperative photograph around L-1 obtained after opening the dura, revealing the cord and nerve roots relieved from entrapment. The dura was tightly anchored to the lateral wall.  D: Photomicrograph showing that the wall of the cyst consisted of hypertrophic loose connective tissue with some calcification.
with the posterior wall. At the bottom of the cavity, a thin anterior wall was observed, and this adhered to the dura (Fig. 3A). The dura was discolored and flattened as a result of long-term compression. An oval dural defect with a smooth margin was seen at the off-midline portion around T-12 (Fig. 2B). Because the anterior and lateral walls of the cyst tightly adhered to the dura, we believed that complete resection of the cyst would be difficult without creating a large dural defect. The flattening of the dura and the shortened diameter of the dural sac suggested the involvement of entrapment neuropathy in the production of symptoms. Therefore, expansive reconstruction of the dural sac was planned to relieve this entrapment. The posterior wall of the dura was incised longitudinally, together with the anterior wall of the cyst, and opened (Fig. 2C). The cord and nerve roots were examined and decompressed. Because reconstruction of the dura with artificial materials posed the potential risk of postoperative CSF leakage, we reconstructed the dural sac using the thickened posterior wall as follows. First, the dura was tightly anchored to the lateral wall of the cyst with 6-0 nylon suture so as to avoid recurrent collection of CSF between them (Figs. 2C and 3B). Thereafter, the posterior wall was resealed with the same suture to provide an expanded dural sac with a single lumen (Fig. 3B). The wound was closed in a watertight fashion.

Postoperative Course. The patient experienced marked reduction of pain and dysesthesia as well as improved gait function soon after surgery. He remained symptom free 8 months after surgery. At the 8-month follow-up examination, MR imaging demonstrated no recurrence of the lesion and the presence of an expanded dural sac without subcutaneous CSF collection. Resolution of anterior displacement and flattening of the spinal cord and nerve roots was also observed (Figs. 4A and 3B). Histopathological evaluation showed that the wall of the cyst consisted of loose connective tissues with some calcification and no columnar cell lines, features consistent with the diagnosis of extradural arachnoid cyst (Fig. 3D).

Discussion

Several surgical methods for spinal epidural arachnoid cysts have been proposed. 1–13 Although cystoperitoneal shunt therapy, 1 a simple cyst puncture, 10 or an epidural blood patch 3 have been undertaken in some cases, complete resection of the cyst and tight closure of the fistula are generally thought to be the gold standard of surgical treatment. 2,4–5,9,11–13 When complete resection is difficult because the cyst is tightly adherent to the neural tissue or the dura, or because of intraoperative bleeding from a well-developed epidural venous plexus, partial resection of the cyst and closure of the fistula have been recommended. 2,4,8,13 It has been reported that a small part of the remaining cyst wall does not promote recurrence. 12,13 Although symptoms have been improved after surgical treatment in most cases, complete recovery has been seen in only a few cases. 2,4,8,9,13 Preoperative myelomalacia or marked spinal cord atrophy, and long duration of symptoms have been implicated as being predictive of poor surgical outcome. 4,8 There have, however, been cases in which complete recovery was not achieved by surgery even when such findings were absent. 5,7,11,12 This fact suggests that there are populations of patients in whom simple cyst removal is not enough to allow for complete relief of their symptoms.
In our patient, pain and dysesthesia were increasing from the proximal to the distal portions of both legs, and the territory was not consistent with the dermatome of the nerve roots. Intraoperatively we observed that the dura was discolored and flattened, and a preoperative MR imaging study had not demonstrated the presence of myelomalacia. Based on these findings, we speculated that the symptoms were due not to radiculopathy but to entrapment neuropathy. Expansive duraplasty led to complete resolution of symptoms in our patient. If the surgery had been performed using biological graft material such as muscular fascia, a separate incision would have been required. The use of artificial dural substrate, moreover, would be associated with the risk of postoperative CSF leakage.

In conclusion, our case represents the first published evidence that expansive duraplasty can lead to the complete resolution of symptoms due to spinal extradural arachnoid cysts. This procedure can be seen as an alternative option when complete resection of the lesion is difficult and widening of the dural sac is necessary intraoperatively.

References
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