Nuances in Localization and Surgical Treatment of Syringomyelia Associated with Fenestrated and Webbed Intradural Spinal Arachnoid Cyst: A Retrospective Analysis

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■ INTRODUCTION: **Intradural spinal arachnoid cysts (SACs) are among many etiologies for syringomyelia. Consequentially, neurologic symptoms arise such as pain, gait disturbance, and bladder dysfunction. Identification of SAC on magnetic resonance imaging (MRI) can be challenging, as SACs can be fenestrated or in the form of fine webs.**

■ METHODS: **Imaging and clinical data for 7 patients who underwent surgical treatment for SAC associated with syringomyelia were reviewed. All previous publications of this pathology were reviewed via MEDLINE search.**

■ RESULTS: **Seven patients with a mean age 59 years were found to have a SAC causing syringomyelia. Intraoperative exploration confirmed SAC appearances of fine webs or a fluid-filled loculation impinging on the spinal cord. Common presentations were back pain, gait disturbance, and bladder incontinence. Diagnosis was made by MRI, although in 3 cases, the SAC was not identified on the initial review. Computed tomography myelogram was performed in one case due to the enlarged syringomyelia and lack of obvious spinal cord compression. Thoracic laminectomy/laminoplasty was performed for all patients, centered at the level of a subtle indentation of the cord; the syringomyelia proper was not directly addressed. Postoperatively, all patients had complete resolution of their symptoms with MRI demonstrating resolution of the syringomyelia.**

■ CONCLUSIONS: **Careful evaluation of the MRI can demonstrate subtle indentation of the cord at the caudal or cephalad end of the syringomyelia and may obviate the need for additional imaging. Meticulous arachnoid dissection and establishment of good CSF flow is sufficient for resolution of the syringomyelia, averting the need for more aggressive procedures.**

BACKGROUND

Syringomyelia is the pathologic development of a longitudinal fluid collection (syringomyelia) that forms within the spinal cord.[1] It is a pathologic state with many different etiologies, all with the common pathophysiology of altered normal cerebrospinal fluid (CSF) dynamics.[2] The typical presentation of syringomyelia is the loss of pain and temperature, diminished reflexes, and lower extremity spasticity, especially affecting the crossing fibers of the spinothalamic tract in the ventral white commissure.[1] Spinal arachnoid cysts (SACs) have been described in several case series as being associated with syringomyelia.[2-15] Their presence in the spinal canal is thought to result in altered CSF flow dynamics, which in turn causes an abnormal local pressure increase to be transmitted into the spinal cord central canal, ultimately leading to dilatation.[16-18] SACs, filled with CSF fluid, are most commonly congenital or occur secondary to trauma, postoperative scarring, or inflammation.[18] Magnetic resonance imaging (MRI) of the spine often shows a CSF-intensity focal mass causing indentation of the spinal cord into its dorsal surface.[13,17] SACs can easily be missed on a cursory radiologic review as some can be thin walled, fenestrated, and blended into normal surrounding CSF. They may not present as an obvious pathologic entity with evident spinal cord deformation. We present a series of patients who were treated surgically for their syringomyelia that was found to be associated with

Key words
- Arachnoid cyst
- Arachnoid web
- Intradural cyst
- Spinal cyst
- Syringohydromyelia
- Syringomyelia
- Syrinx

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
CT: Computed tomography
SAC: Spinal arachnoid cyst

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fenestrated, fine-webbed SACs, some of which were not initially identified on preoperative MRI. In this series we attempt to describe nuances and challenges with their presentation, imaging findings, and surgical management.

MATERIALS AND METHODS

Electronic records of 7 consecutive patients were retrospectively reviewed. All patients underwent surgical intervention for a syringomyelia by surgeons at Baylor College of Medicine affiliate hospitals between 2011 and 2013. Preoperative and postoperative imaging and clinical history were reviewed. Data gathered include clinical presentation, demographic data, preoperative and postoperative imaging, and outcome. A MEDLINE literature search was performed using the key words "arachnoid cyst," "arachnoid web," "syrinx," "syringomyelia," "hydromyelia," and "syringohydromyelia." Cases in the pediatric population or in patients with spinal dysraphism or syndromic causes of syringomyelia were excluded.

Patients were initially presented to the clinic and thoroughly evaluated. MRI of the affected area of the spine was obtained. After careful evaluation of the imaging studies and the severity of their symptoms, surgery was offered as a therapeutic measure. Surgical intervention included laminectomy/laminoplasty with resection of the SAC in all cases, which warranted resolution of symptoms and radiologic abnormality in the spinal cord.

Preoperative Evaluation

All patients were initially seen in the outpatient setting after being referred to the neurosurgical clinic. Their workup included a detailed history and physical examination, determination of ambulatory status, and MRI (Table 1). Other causes of syringomyelia, including tethered cord, Chiari malformation, and other mass lesions were excluded from this series.

Radiographic Imaging

All patients had preoperative MRIs, and 1 patient underwent an additional imaging study, a computed tomography (CT) myelogram (Patient 7, Table 2), due to his large syringomyelia and uncertainty of the presence of the SAC. The size or levels spanned by the syringomyelia were recorded. Radiologists' official reports, as well as original images, were reviewed to assess for any spinal cord deformity. Any mention of causative lesions in the final report were noted.

Surgery

After careful evaluation in the clinic, patients were offered surgical intervention, in the form of a laminectomy/laminoplasty and planned resection of any underlying lesion. Surgery was tailored toward treatment of the SAC and not the syringomyelia, with the laminectomy/laminoplasty planned at the level of the SAC and not the syringomyelia. The levels were identified by the surgeons with intensive review of the spinal MR imaging, looking for any subtle indentations of the spinal cord. Upon careful review, subtle indentation can be found either cephalad or caudal to the SAC. Thoracic laminectomy was then carried out via a standard midline exposure according to the location of the presumed SAC. Intraoperative ultrasound was then used before dural opening to discern the changes between the normal arachnoid and SAC. Further laminectomy was performed if the real-time imaging demonstrated indentation of the cord and lack of rhythmic pulsation of the CSF around the spinal cord. The operating microscope was used for all intradural microdissection. Webbed, small-multilobulated, and thickened SAC that was adhered to the dura and pia was clearly identifiable. Surgery was carried out to resect the SAC completely and restore normal CSF flow proximally and distally to the SAC (Table 1). Meticulous dissection was performed with the intention of minimizing the introduction of blood products into the intradural space. Upon completion of the resection, dural closure was performed primarily with 5-0 Prolene sutures. Reconstruction of the posterior elements was performed whenever possible. The patients were kept flat in bed for 24 hours postoperatively, followed by head elevation at 30 degrees for 24 hours, and mobilized out of bed on postoperative day 3. There were no immediate complications from the surgeries in any patients.

RESULTS

A summary of the 7 patients included in this series is summarized in Table 1. Six patients were male, and 1 was female. Patients ranged from 40–83 years old, with a mean age of 59 years. All arachnoid cysts were noted to be in the thoracic spine, between T4 and T11. Associated syringomyelias were localized either cephalad or caudad to the SAC ranging from C1–T11. In 57% of patients, the syringomyelia was "focal" and spanned <2 vertebral levels. The remaining patients had a syringomyelia extending 3–4 levels (14%) or >4 levels (29%). The largest syringomyelia in the series extended from C1-T11. In most cases the SAC was noted to border the syringomyelia at the rostral (Figure 1) or caudal (Figure 3) end. One patient (Table 1, Patient 2) had 2 separate SACs that were at and below the level of the syringomyelia. Syringomyelia diameter ranged from 6 mm–17 mm. Out of 7 patients, SAC was not mentioned in the initial imaging report for 3 patients.

The presenting complaint was primarily gait imbalance (71%), with some patients also suffering from back pain (43%), loss of pain and temperature sensation at the level of the syringomyelia (28%), and bladder dysfunction (28%). Following resection, and by their 3 months' follow-up visit, 57% of patients had their gait returned to normal and 43% with significant improvement. Two patients presented with preoperative incontinence as well. Postoperatively, 1 had complete resolution and the other had considerable improvement and very sporadic episodes of incontinence (see Table 1). All patients, overall, showed significant and noticeable benefit from surgery in all aspects of their symptoms and imaging (Figures 2, 4).

Laminoplasty was performed in 2 cases (29%), and laminectomy was performed in 5 cases (71%). No syringomyelias were fenestrated, and syringo-subarachnoid shunts were not placed. The main purpose of the surgery was to address the underlying etiology, which was the SAC that was impeding normal CSF flow.

CASE EXAMPLE

A 40-year-old male was referred for symptoms of low back pain and progressive difficulty walking and frequent falls. On