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Treatment of selected syringomyelias with syringo-pleural shunt: The experience with a consecutive 26 cases

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ABSTRACT

Summary of background data: It is well established that syringomyelia can cause neurological symptoms and deficit by accumulation of fluid within syrinx cavities that lead to internal compression within the spinal cord. When other intervention treating the underlying etiology failed to yield any improvement, the next option would be a procedure to divert the fluid from the syrinx cavity, such as syringo-subarachnoid, syringo-peritoneal or syringo-pleural shunting. The indications and long term efficacy of these direct shunting procedures are still questionable and controversial.
Objective: To investigate the clinical indication, outcome and complication of syringe-pleural shunt (SPS) as an alternative for treatment of syringomyelia.
Study design: We reported a retrospective 26 cases of syringomyelia were found to have indication for a diversion procedure. SPS was offered. Patients' symptoms, mJOA score, and MRI were collected to evaluate the change of the syringomyelia and prognosis of the patients. 2-tailed wilcoxon signed-rank test was used to perform the statistical analysis of the mJOA scores.
Methods: All 26 patients underwent SPS. The clinical information was collected, the mean follow-up time was 27.4 months, 2-tailed wilcoxon signed-rank test was used to perform the statistical analysis of the mJOA scores. The key surgical technique, outcome and complications of SPS were reported in detail.
Results: No mortality and severe complications occurred. Postoperative MRIs revealed near-complete resolution of syrinx in 14 patients, significant shrinkage of syrinx in 10 patients, no obvious reduction or unchanged in remaining 2 patient. Postoperatively, the symptoms improved in 24 cases (92.3%). Statistical analysis of the mJOA scores showed a statistical significance ($P < 0.001$) between the preoperative group and the 2-week postoperative group. No further significant improvement between 2 weeks to the final follow up at 27 months.
Conclusion: Collapse or remarkable shrinkage of the syrinx by SPS could ameliorate or at least stabilize the symptoms for the patient. We recommend small laminectomy and a less than 3mm myelotomy either at PML or DREZ. The SPS procedure can be an effective and relatively long-lived treatment for the idiopathic syringomyelia and those that failed other options.

Abbreviations: CSF, cerebrospinal fluid; MRI, magnetic resonance imaging; SPS, syringopleural shunting; mJOA, modified Japanese Orthopaedic Association; DREZ, dorsal root entry zone; PML, posterior midline.

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1. Introduction

Syringomyelia, as a simple or complex phenomenon, can be either a primary or a secondary condition associated with other pathologies, such as Chiari malformation, basilar invagination posttraumatic, postoperative subarachnoid adhesion, spinal cord tethering, intramedullary tumors, or scoliosis [1]. The etiology of syringomyelia is often multifactorial and thus should be evaluated carefully and managed by a variety of strategies [2]. It is generally assumed that the accumulation of fluid within syrinx cavities can cause worsening neurologic symptoms or deficits by progressive internal compression of the neural elements within the spinal cord. Thus, when all other surgical options aimed at treating the underlying etiology are exhausted, the remaining surgical treatment should target at the reduction of the size of syrinx or the collapse of the cystic cavity to ameliorate or at least to halt the deterioration of the symptoms [1,3–5].

The advancement in understanding of the pathophysiological mechanism of syringomyelia has suggested that restoration of cerebrospinal fluid (CSF) flow dynamics is the ultimate goal for surgical intervention and this can be achieved by decompression, reconstruction of spinal subarachnoid space, or diversion of the intra-syrinx cerebrospinal fluid [6]. Among the various effective surgical treatments, the posterior fossa decompression surgery for Chiari malformations, detethering the tethered spinal cord, or release of the subarachnoid adhesion of the spinal cord at the previous surgical site or posttraumatic vertebral level mainly aim at restoration of the CSF flow dynamics [1,3,4,6]. However, once these surgical interventions failed to lead to any improvement, the direct fluid diversion of the syrinx are recommended to reduce the size of syrinx and prevent further accumulation of CSF inside the cord. The options include syringo-subarachnoid [7–9], syringo-peritoneal [10–12], or syringo-pleural shunting [2,13–15]. Reports of these shunting procedures are few in the literature. Even though some authors have reported sustained improvement following direct CSF shunting from the syrinx cavity, unfortunately, the indications and efficacy of the different shunting procedures are still questionable and controversial [5,13].

During the past 4 years, we have treated about 160 cases of syringomyelia-related patients. After individualized analysis and evaluation of each patient by clinical physical examination and MRI, we have selected syringo-pleural shunting as a treatment of 26 cases of syringomyelia. The indications, technique points, clinical results, and patients' prognosis are reported and discussed as follows.

2. Methods

2.1. Patients' information

From 2008 to 2013, the author performed syringo-pleural shunting (SPS) in 26 of 160 patients with syringomyelia. Male 16 cases, female 10 cases, age from 18 to 61 years, mean: 41.5 years. All these patients underwent preoperative workup and were evaluated by physical examination and imaging study with MRI. When the previous operation aimed at treating the potential underlining etiology failed or any other possible canal/arachnoid space reconstruction surgery was not feasible, the SPS procedure was selected (as last resort) for the direct CSF diversion from the syrinx cavity.

This series included Chiari I syringomyelia (failure of previous posterior fossa decompression surgery) 7 cases, posttraumatic or postoperative adhesion 6 cases, syringomyelia was found during the scoliosis work up in 5 cases, post meningitis 5 cases, and idiopathic (no evidence of obvious causes) 3 cases. The patient's main symptoms were in accordance with classic syringomyelia neurological patterns, such as pain or numbness, sensory loss, and weakness.

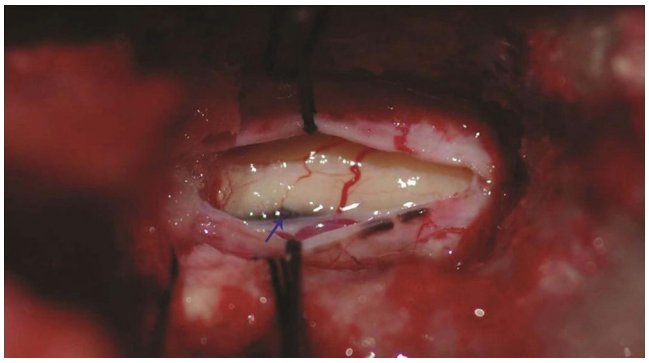

Fig. 1. After duratomy, we normally detect the surface of the spinal cord under the surgical microscope, sometimes we could find that there is only an arachnoid membrane covered on the posterior midline (Blue Arrow), or on the DREZ, then the myelotomy was made at this thinnest zone to minimize the effect on spinal cord matters. Otherwise, we would like to choose the posterior midline for the myelotomy, which is 3 mm in length. (For interpretation of reference to color in this figure legend, the reader is referred to the web version of this article.)

2.2. Syringo-pleural shunting technique

The syringo-pleural shunting device utilized is the 2-piece CSF-lumbo peritoneal T-tube shunt unit (Medtronic PS Medical), 0.7-mm inner diameter, and 1.5-mm outer diameter. The proximal end (Syrinx side) is a T-tube with a length of 8 cm and 57 holes spiral configuration. The distal tubing has multiple perforations at the end, which is positioned in the pleural space (Fig. 1).

Patients are all placed in left lateral recumbent position, according to the preoperative MRI evaluation; an upper or mid-thoracic midline incision was made at the level of the shunting site of the obvious syrinx cavity. Routinely, for the syrinx involving the entire cord, a T1–T2 or T2–T3 level is chosen for the myelotomy and shunt tube entry site, while in cases of segmental syrinx, the segment with the largest syrinx cavity and thinnest wall was chosen.

In early three cases of this series, a single-level complete laminectomy was made at the shunting site. For the following 23 cases, a modified bilateral partial hemilaminectomy was performed and only portion of the spinous process and medial inferior lamina bilaterally was removed to minimize the structure loss of the posterior elements of spinal column [16]. After opening the dura and exposing the dorsal surface of the spinal cord, we identified the area of the thinnest wall of the syrinx for myelotomy (Fig. 1) under the magnification of a surgical microscope. Myelotomy was performed at midline [17] in 16 cases, while Dorsal root entry zone (DREZ) was chosen for myelotomy [8] in the rest 10 cases. The two short ends of the T-tube were trimmed to 8–15 mm in length, and carefully inserted into the syrinx cavity via a 2–3 mm myelotomy entrance (Fig. 2). The dura was sutured to watertight degree. The catheter was connected to the distal tubing and secured to the spinous process through the fixture clip, which is included in the T-tube unit (Medtronic PS Medical). Then, the distal tubing was tunneled to a separate right-side sub-axillar paramedian incision, which was usually made at the eighth-ninth intercostal space and right above the superior margin of the ninth rib. The distal end of the catheter was then fed through a stab incision into the pleural space and the length of the catheter within pleural space was about 12 cm.