Respiratory Medicine Case Reports 25 (2018) 235–238

Contents lists available at ScienceDirect

Respiratory Medicine Case Reports

journal homepage: www.elsevier.com/locate/rmcr

Case report

A simple technique for thoracoscopic assisted placement of the distal limb of syringopleural shunts

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ARTICLE INFO

Keywords:
Syringomyelia
Syringopleural shunt
Thoracoscopy

ABSTRACT

Background: Syringomyelia is an unusual accumulation of fluid within the spinal cord that may be associated with significant neurologic symptoms. Surgical drainage using various techniques is often required to reduce the intraparenchymal pressure and to alleviate symptoms. Syringopleural shunting seems to produce best results.
Patients and methods: A simple technique to insert the distal limb of the syringopleural shunt into the pleural space is described in detail. The patient is placed in prone position. The syrinx is accessed from a dorsal incision and the proximal limb is inserted into the fluid cavity. The tube is tunneled through the subcutaneous space laterally and caudally. A 5mm blunt port is inserted lateral to the scapula and advanced under visual control using a 5mm 30° camera through the subcutaneous tissue and muscle and at the upper border of the 5th rib through the intercostals. With ventilation paused, the pleura is penetrated and CO2 is insufflated with a pressure of 8mm mercury. Under visual control the distal limb of the shunt is inserted at the pleural recessus and the tube is directed cranially. Positive airway pressure is applied re-expanding the lung. The trocar is removed from the pleural cavity and the skin is closed with subcuticular sutures.
Results: The shunt was successfully placed in three consecutive cases including one redo case (1 male, 1 female aged 50 and 51 years with post traumatic syrinx). Postoperative chest x-ray excluded pneumothorax and no chest tube was required. Neurologic improvement was achieved in both patients.
Conclusions: General surgeons should be familiar with this simple technique similar to laparoscopic assisted placement of distal ventriculoperitoneal shunt catheters into the abdominal cavity.

1. Introduction

Syringomyelia is characterized by an unusual accumulation of fluid within the syrinx cavities of the spine that may be associated with significant neurologic symptoms [1]. It is caused by a variety of pathologies such as malformations, tumors, infections and trauma amongst others. Primary therapy is treatment of the underlying disease; however, if this fails, diversion of the excess fluid through syringo-subarachnoid, syringo-peritoneal or syringo-pleural shunting is indicated [2]. It is still a matter of debate, which of the three shunts provides the best solution. An individualized approach depending on the patient's demographics and underlying disease should direct the treatment. In addition previous failed surgeries may need to be taken in consideration [3]. Due to the specific pressure conditions within the syringomyelia, shunting into the pleural cavity may have some advantages over the other techniques as with every breath a gentle negative pressure is created that helps drain fluid out of the fluid collection [4–6]. In contrast the pressure within the abdominal cavity is positive and is a function of multiple factors with significant volatility. Therefore, a valve similar to a ventriculoperitoneal shunt may be required, which may hinder good drainage. In addition the tubing system needs to be longer when compared to pleural shunting, which in these cases where a small diameter tube is preferably used is another factor in flow of fluid. Drainage into the subarachnoid space also has been widely used with variable success and arachnolysis has also been suggested [2,7].

When performing a syringopleural shunt, the central portion of the shunt is placed into the cyst, the subarachnoid space is closed and the tube is connected and tunneled so that the distal limb can be placed into the pleural cavity. Various techniques to access the pleural space have been suggested; however, placement under thoracoscopic guidance seems to be preferred now by most surgeons [8–10]. Similar to

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https://doi.org/10.1016/j.rmcr.2018.09.011
Received 4 August 2018; Received in revised form 13 September 2018; Accepted 13 September 2018

Table 1
Demographic and clinical data.

Gender	Age	Syrinx	underlying disorder	Previous intervention	Neurologic symptoms	distal limb	Comments	Follow up
F	51	traumatic	Motor vehicle crash: complete spinal cord injury, upper thoracic level;	Cervicothoracic decompression and fusion	Distal UE sensorimotor deficits	right chest	none	Improvement in UE sensation and strength
M	50	traumatic	Motor vehicle crash: complete spinal cord injury, lower cervical level	C6-7 Anterior cervical discectomy and fusion	Distal UE sensorimotor deficits and severe pain	right chest	Removal of system due to arachnoid leak	No change postop
M	50	As above	As above	C6-7 Anterior cervical discectomy and fusion, attempted syringopleural shunt	As above	right chest	Redo case	No progression of neurologic symptoms

ventriculoperitoneal shunts, the access to the pleural cavity should be easy and entry site should be as small as possible. We herein report a series of three consecutive syringopleural shunts with an emphasis on the technical aspects of thoracoscopic guided placement of the distal limb using a single 5mm trocar.

2. Patients and methods

Demographic and clinical data from three patients undergoing syringopleural shunting at our hospital were collected from electronic medical records. The study was approved by the ethical committee. Table 1 displays demographic and clinical data of the study population. The surgical technique is described in detail.

2.1. Surgical technique

The patient is placed in the prone position after intubation and initiation of general anesthesia and fluoroscopy imaging is utilized to localize the area of interest. A small midline incision is made over the appropriate region and exposure of the spinous processes and lamina is achieved. A small laminectomy is then completed to expose a small segment of the spinal cord. The intraoperative microscope is utilized at this point to complete the insertion of the proximal catheter. This is accomplished by making a small durotomy in the midline followed by a small puncture in the midline where the spinal cord is thinnest, usually overlying the area of the largest syrinx dilation. The puncture site is just large enough to pass the small catheter into the syrinx cavity. Intraoperative ultrasound can also be used to assist with localizing the syrinx and placing the catheter within it. It is made sure that all of the catheter perforations are placed within the syrinx and do not extend into the subarachnoid space to avoid CSF shunting. The durotomy is closed in a watertight fashion and the proximal catheter is secured at multiple sites. The catheter is tunneled towards the desired entry site into the pleural space.

A 5mm skin incision is made lateral to the scapula above the 5th intercostals space. A needle is advanced on the 6th rib and inserted into the pleural cavity above the rib guiding direction for the trocar. An optical 5mm trocar is advanced slowly through the subcutaneous fat under guidance of a 30° camera. The thoracic fascia and muscle layer are penetrated and the trocar is advanced through the intercostal muscles just above the rib. At this point breathing is held and the trocar is carefully pushed through the pleura (Fig. 1a). The camera and core are pulled back and the trocar is gently advanced and the tip is secured in the pleural space. The camera is inserted and CO_2 is slowly insufflated until the lung is appropriately collapsed to achieve good visualization. Shallow breaths are given. The catheter insertion needle is advanced under visual control into the pleural space 2–3 intercostal spaces lower than the trocar at the upper border of the rib. A guide wire is advanced (Fig. 1b) and then the catheter is inserted into the pleural space using a sheath (Fig. 1c) and advanced so the tip is placed at the apex (Fig. 1d). CO_2 is released and ventilation is restarted until the lung is expanded. The trocar is pulled back and positive airway pressure is applied to expel remnant CO_2. The camera is removed. The skin is closed with a subcuticular suture. The patient is admitted and a chest x-ray is ordered. An MRI of the spine without contrast is performed the next day to evaluate the surgical site and catheter position within the syrinx cavity.

3. Results

Table 1 shows clinical data. Postoperative chest x-ray was negative for a pneumothorax in all cases and no chest tube was required. One patient with previous surgery of the syringomyelia required two surgeries. In both cases the shunt was successfully placed, however, during the first surgery there was shunting of CSF from the subarachnoid space through the myelotomy site into the proximal catheter in the syrinx

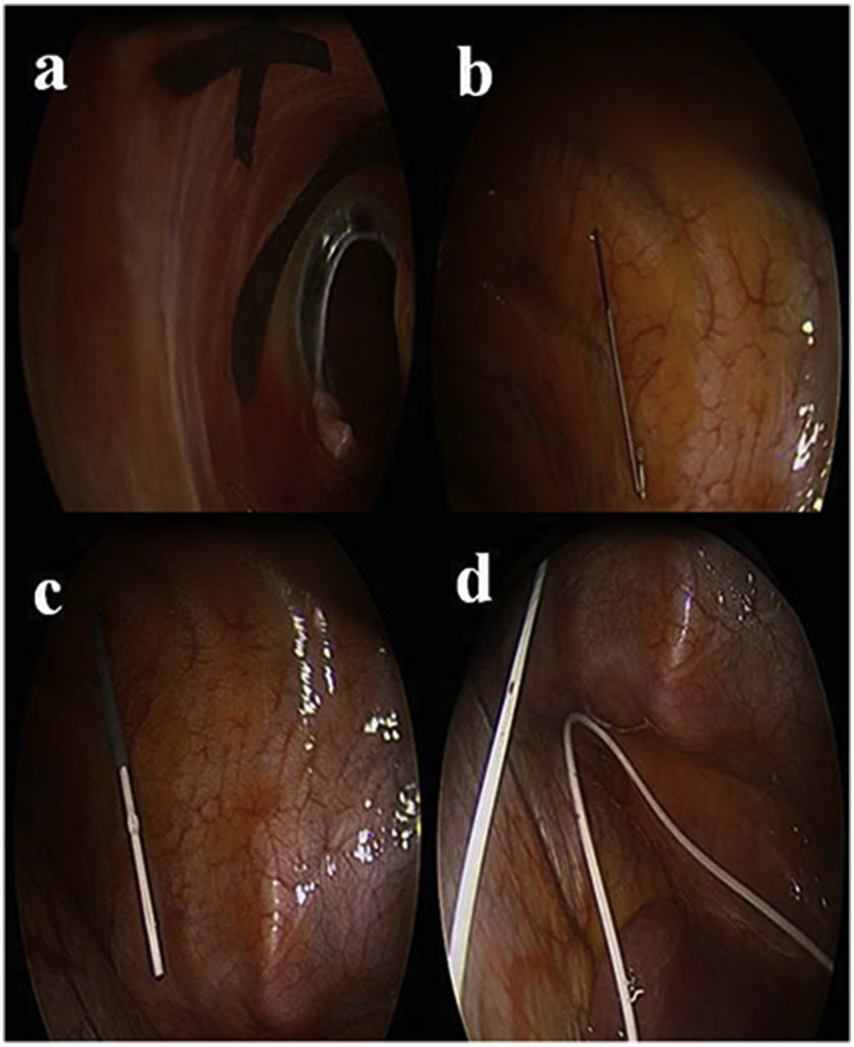

Fig. 1. Intraoperative findings. a The trocar is advanced under visual control into the pleural cavity. b The guidewire is advanced into the chest. c The distal limb is advanced through the sheath. d The tube is directed towards the apex.

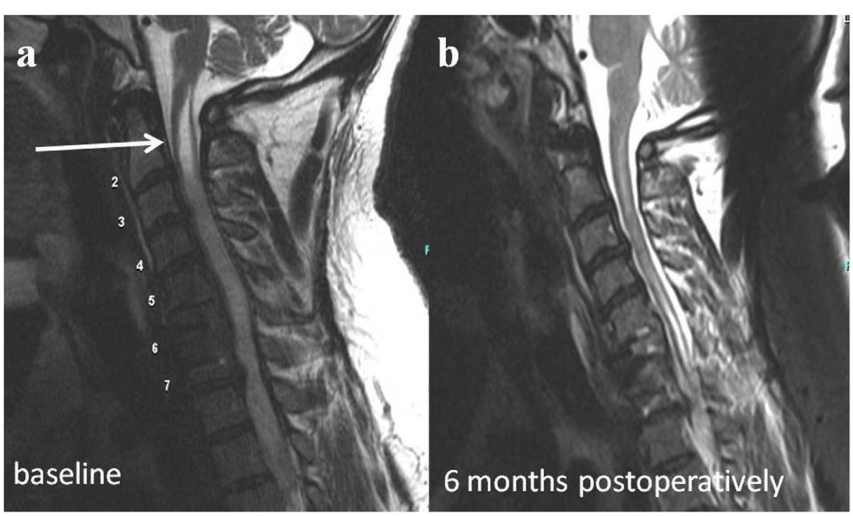

Fig. 2. MRI. a preoperative MRI: large syrinx (arrow). b follow up MRI at 6 months: resolution of the syrinx.

cavity. This was corrected by making the myelotomy site smaller and advancing the fenestrated portion of the catheter deeper into the syrinx cavity. One patient had immediate improvement in her symptoms, in the other disease progression was stopped. MRI showed resolution of the pathology in both patients (Fig. 2a and b). Long term results were favorable. One regained full motor function in both hands but remains to have numbness in one arm but has no more pain; the other has motor and sensory improvement but is still wheel chair bound; however, he is able to transfer himself. His chronic pain has also improved.

4. Discussion

We herein report a series of syringopleural shunts done by an experienced neurosurgeon with help by a general surgeon with training in minimal invasive surgery. A standardized technique for the thoracic portion of the procedure was developed that avoids the need to reposition the patient or the use of double lumen intubation. This can be done in an efficient manner using only one 5mm incision without the need for placement of a chest tube.

Syringopleural shunting seems to be the preferred technique to treat the rare condition of syringomyelia if the underlying disorder cannot be successfully managed. Multiple series of patients and reviews have shown long term superiority of the technique when used in the right patient population [3–5,8,10]. Using thoracoscopy and placing the tube into the pleural cavity under visual control adds in our opinion safety to the procedure avoiding accidental lung injury or unfavorable placement of the distal shunt limb. Traditionally, the pleural cavity is accessed in an open fashion using digital examination of the entrance area followed by insertion of an open trocar into the pleural cavity. We suggest usage of a 5mm blunt optical port to access the pleural space under visual control while the anesthetist holds ventilation for 30–45 seconds. Once the lung is visualized, CO2 is gently insufflated with a low pressure of 5–8 mm Hg. This is enough to partially collapse the lung, while the other lung can be ventilated. Placing the distal portion of the shunt tube into the pleural cavity takes no longer than few minutes and the tube can be easily directed into the apex using the 30° scope. In addition, flow of syrinx fluid can be visualized confirming shunt patency and continuity. The last step is reexpanding of the lung with positive airway pressure and release of the CO2 pneumothorax. The 5mm port can be removed and no chest tube is necessary.

Surgeons with training in minimal invasive surgery should be comfortable to perform this step of the procedure.

Statement

There are no conflicts of interest and no disclosures to be reported. The contents of the article have not been published previously and the article is not under review at another journal. Parts of the article were presented at the Austrian Surgical Association meeting 2018.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rmcr.2018.09.011.

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