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Technical Notes & Surgical Techniques

Treatment of postoperative recurrent cerebrospinal fluid leak with pseudo-meningocele formation using temporary epidural drain

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ABSTRACT

Objective: Treatment of cerebrospinal fluid (CSF) leak with pseudo meningocele formation can be challenging; especially when attempts to repair it fail. In this paper the authors present four cases in which the problem was fixed using temporary epidural drain.
Patients and methods: Four patients were treated with this approach over the last 15 years. One patient had cranio-cervical decompression for Chiari malformation with two attempts to fix the CSF leak after the initial operation; two patients had one attempt at operative repair of the leak after the initial operation; and one patient had an attempt to repair of the leak during the initial procedure. Epidural drains were placed percutaneously under local anesthesia.
Results: Within 2–3 days the wounds were dry and flat. After one week the drains were removed. None of the patients had recurrence of the leak. There was no complication from the drain placement.
Conclusion: Placement of the epidural catheter is a simple and minimally invasive procedure that solved a complex problem in these four patients. Considering the simplicity of this procedure it is worthwhile trying it prior to considering reoperation.

1. Objectives

Spinal fluid leak is a well-recognized complication after spinal surgery [8,9,12,13]. The causes of the leak can be an inadvertent tear in the dura by a surgical instrument during surgery or from the suture line following an intra-dural procedure. Tear in the dura followed by CSF leak can also occur in a delayed fashion in an extradural operation if the dura is very thin or the margin along the laminectomy defect has a bony spicule. When the tear is detected during the initial operation it can easily repaired with suture and or a dura substitute. In addition, a sealant can be applied. In some cases, the repair fails and the patient develops a pseudo meningocele with or without an external leak.

The first line of treatment for the above-mentioned pathology is to try epidural blood patch. In a case in which there is no external leak some surgeons may opt to adopt a “wait and see” approach with the hope that the pathology with subside. In cases in which the symptoms are very severe or there is external leak, more aggressive approach is needed. Some surgeons may opt to place an intrathecal drain to divert fluid away from the leak site, to allow it to heal. Others may do an open repair with or without an intrathecal drain.

Intraoperative placement of extradural catheters in the sub fascial space has been utilized in cases of intentional durotomies, in order to prevent CSF fistula formation with positive outcomes [11]. However, there is no report on the use of this method for those who failed an attempt at repair and developed pseudo meningocele. In this paper the authors report four cases with pseudo meningocele that had failed prior attempt at repairing the leak, in whom drainage of extradural space with indwelling catheter resulted in resolution of the pathology.

2. Patients and methods

2.1. Case 1

A 45-year-old male presented with an unsteady gait secondary to Chiari I malformation. He underwent a decompression sub-occipital craniectomy with removal of the posterior arch of C1. The dura was opened, and arachnoid adhesions were lysed. A dural closure was performed with 4–0 Nurolon sutures and Dura Guard (by Synovis, St Paul, MN)) used as a patch graft to expand the subdural space. The repair was tested using the Valsalva maneuver which was negative for CSF leak. The patient had an uneventful postoperative course for the first two days. On the third day his wound was swollen and there was

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CSF leak through the skin incision. He was taken back to the operating room where the wound was resealed using DuraSeal (by Integra Plainsboro, NJ) placed along the suture line. Postoperatively, after 3 days of dry period the leak resumed. The patient was taken back to the operating room for the second reoperation. The old sealant was removed, additional sutures were put and the dural incision was covered with sealant. Three days after this operation the leak resumed with recurrence of the pseudo-meningocele.

2.1.1. Procedure

A 14-gauge 4 in. angiocath was then percutaneously placed into the pseudo-meningocele fluid space. The procedure was done at the bed side. Area around the wound was disinfected. The entry point was at the most dependent part of the meningocele. After free CSF was visible the metal cannula was removed. The sheath was anchored to the skin with 3–0 silk suture and the distal end was connected to a drainage bag using a connecting tubing. The drainage bag was always at a lower level (5–6 cm) than the catheter entry point. The patient was allowed to ambulate. Within 4 days the wound was dry and flat. In the first 2 days the drainage was 50–60 ml/day. Over drainage problem was not encountered. On the seventh day the tubing connecting the catheter to the drainage bag was clamped for 24 h to make sure the wound stayed dry and flat. The catheter was then removed, and the drain entry wound was closed in a figure-of-eight fashion using 3–0 prolene suture. The patient was on antibiotic while the catheter was in place.

2.1.2. Results

At six months follow up there was no evidence of a recurrence of the pathology. No images are available for this patient because the patient was treated 15 years ago. The patient had no complications from the procedure.

2.2. Procedure for the next 3 cases

In the next three cases we followed the same protocol for epidural drainage as in case 1; with the exception that 10 French C2 drain catheters were used and were inserted using CT guidance so as to place them close to the dura (Fig. 2b), and the patients were kept on bed rest for 3–4 days. The volume of the drained fluid in the four patients averaged about 50–60 ml/day for the first three to four days. It then tapered down slowly to 3–4 ml/day just prior to removal of the drain. All patients were received antibiotics during the period they had the drain.

2.3. Case 2

A 56-year-old woman presented with four years of right lower back pain radiating to her right foot secondary to right lateral recess stenosis at L5-S1. She underwent a decompressive hemilaminectomy and foraminotomy. Four days post-surgery she developed intussusception requiring diagnostic laparoscopy with reduction of intussuscepted proximal small bowel. At this time, she also developed a headache which was likely the first presentation of her CSF leak. Epidural blood patch was tried to treat her headache without success. On day 28 post-surgery she presented with wound swelling and drainage of clear fluid from the skin incision. CT scans (Fig. 1) showed a large fluid collection in the epidural space that extended to the subcutaneous tissue. She underwent an open surgical repair procedure. A tear in the dura was identified. However, the dura was parchment paper-like; preventing the tear from being sutured. The dura was covered with DuraGen (by Integra, Plainsboro, NJ) and DuraSeal. Then, Valsalva maneuver was performed. This was negative for a leak. Patient was kept on bed rest for four days and then ambulated. This resulted in recurrence of the leak. Epidural drainage protocol was then initiated. Fig. 1b shows the catheter in place on a X-ray image.

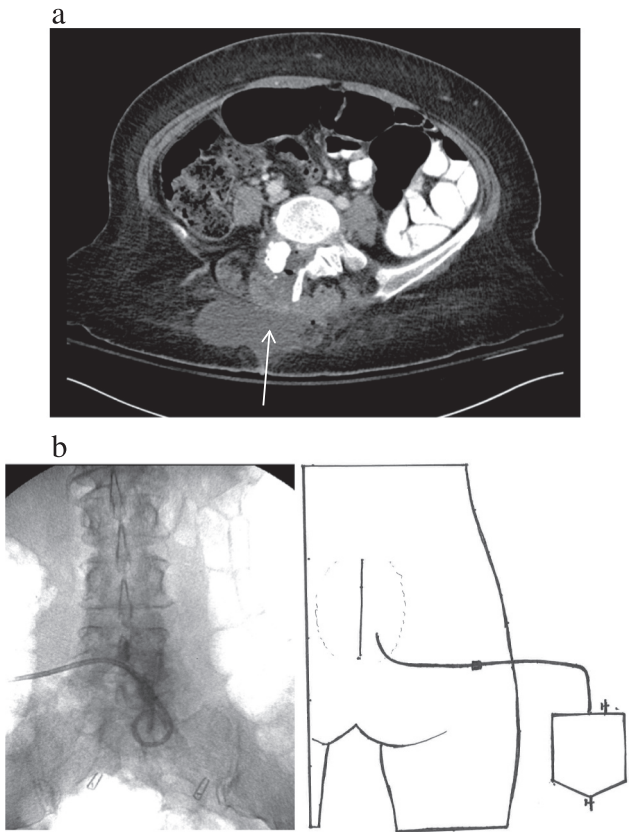

Fig. 1. a: Axial CT image. Arrow highlights fluid collection. b.

2.3.1. Results

The patient was discharged eight days later with dry and flat wound; which showed no recurrence at 6 months follow-up. The patient had no complication from the procedure.

2.4. Case 3

A 53-year-old male underwent a lumbar decompressive laminectomy at an outside facility. Ten days following his procedure, he presented with headaches and low back pain, and a CSF leak from the incision site. The original surgeon repaired the leak through open surgery and discharged the patient in stable condition three days after the repair. He presented to us twenty-two days following the initial surgery due to constant headaches and drainage from his incision site requiring frequent dressing changes. CT scans (Fig. 2A) showed a large fluid collection in the epidural space that extended to the subcutaneous tissue. Epidural drainage protocol was initiated (Fig. 2B).

2.4.1. Results

The patient was discharged eight days later with dry and flat wound. At three months follow-up he was asymptomatic, and his wound was dry and flat. The patient had no complications from the procedure.

2.5. Case 4

A 55-year-male presented with pain radiating into left leg with weak dorsiflexion. MRI show lateral recess stenosis at L5-S1 level on the left side. A laminectomy at L5 and decompression of the left lateral recess was performed. There was CSF leak upon removal of the ligamentum flavum. The dura had shredded appearance with several small leaking spots. It was covered with DuraGen and DuraSeal. Valsalva maneuver was negative for leak. Patient was kept on bed rest for three days and

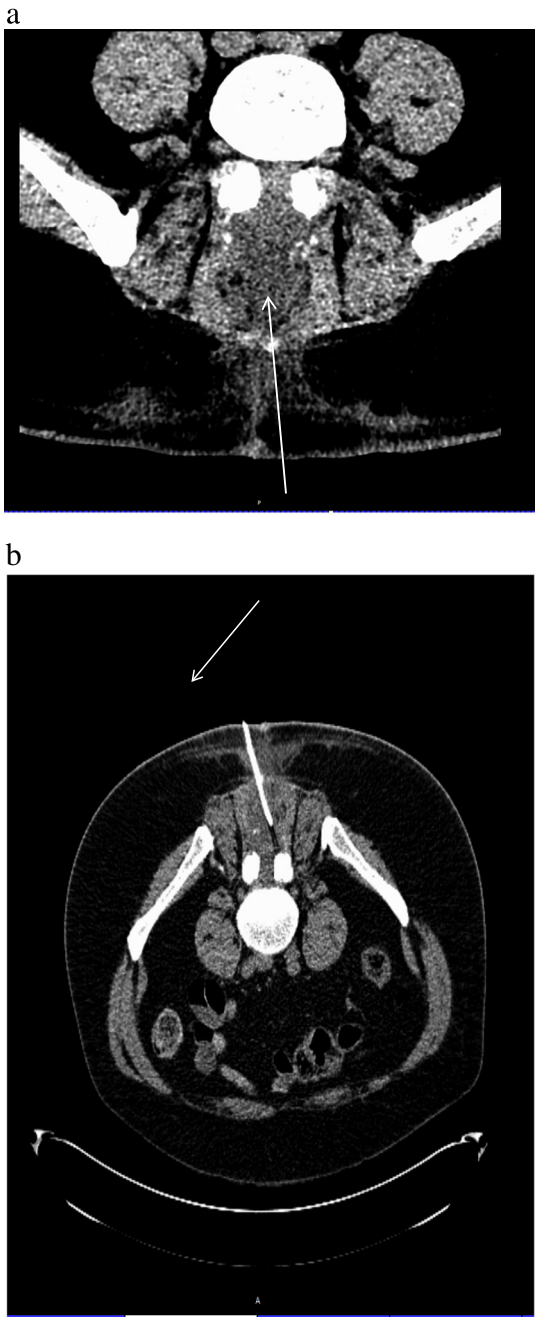

Fig. 2. A: Axial CT image. Arrow shows fluid filled space.
B: Axial CT image. Arrow shows catheter in the fluid filled space.

then ambulated. He had no motor weakness and the wound was dry and flat. He was sent home. Seven days later he was readmitted with severe back pain, headache and nausea. His wound was bulging and CT scan (Fig. 3) showed large fluid collection in the epidural space that extended to the subcutaneous tissue. Epidural drainage protocol was initiated. This resulted in good resolution of the CSF leak without further complication.

2.5.1. Results

The patient was discharged on day eight. At four-month follow-up his wound was dry and flat, he was asymptomatic except for low back pain, and he had good motor function. MRI (Fig. 3b) showed small localized fluid collection posterior to the spinal canal without outward tracking of the fluid.

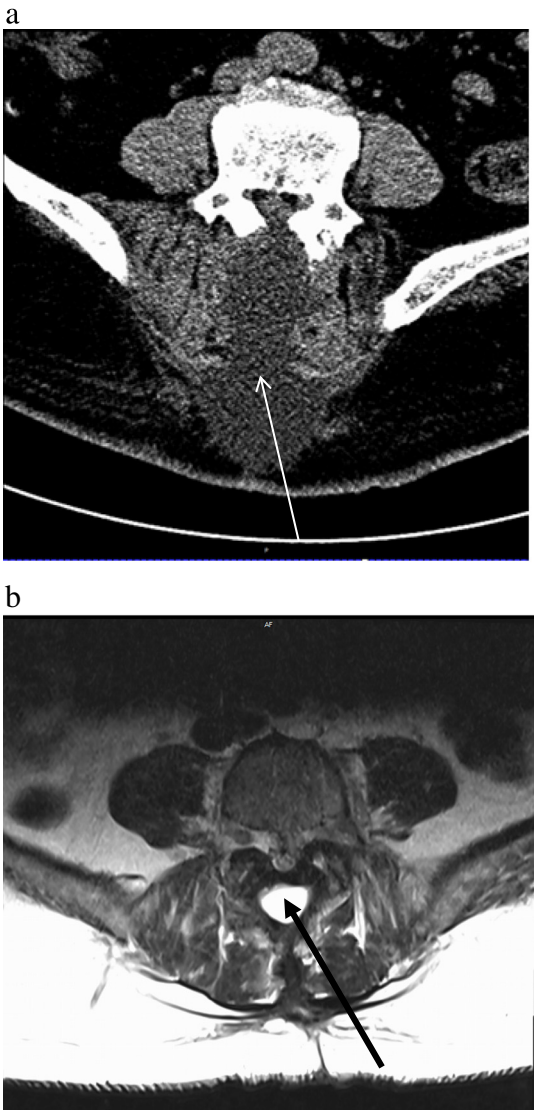

Fig. 3. a: The arrow shows large fluid collection in the epidural space that extends to the Subcutaneous tissue.
b shows small localized fluid collection posterior to the spinal canal without outward tracking of the fluid.

3. Discussion

Recurrence leak after the first attempt to fix a CSF leak and formation of pseudo-meningocele, with or without external leak, is very frustrating for the patient and surgeon. In the absence of external leak and significant symptoms some surgeons may try a “wait-and-see” approach; because CSF leaks can spontaneously resolve in approximately 80–95% of cases [6].

Epidural blood patches are frequently used to treat headaches secondary to lumbar puncture-induced CSF leaks, with success rates as high as 95% [3]. This is performed under imaging guidance by injecting blood into the epidural space between the ligamentum flavum and the dura [3]. If CT imaging is used as the form of guidance, the extent of the CSF leak can be evaluated and aspirated prior to the placement of the blood patch [4]. The proposed mechanism is that the clotted blood adheres to the dura, resolving the leak and allowing for CSF pressures to normalize [3]. The procedure has certain risks. If the blood is accidentally injected into the subdural space, aseptic meningitis or arachnoiditis may occur [4]. There can be local complications including subdural hematomas and radicular pain from mass effect of blood in the

subdural space [7]. As with any invasive procedure there is a risk of infection as well.

Historically many surgeons have employed the practice of an open revision surgery using direct suture repair to close the dural tear [6]. This is done using a 4–0, 5–0 or 6–0 suture using a continuous or figure-of-eight technique. If successful, this will offer a watertight closure [6]. A synthetic, absorbable polyethylene glycol (PEG) hydrogel sealant has been used to augment the suture repair by providing additional support. Studies have shown a higher success rate of obtaining a watertight seal intraoperatively [14].

A graft can also be placed to seal the tear, and the use of fat grafts, muscle grafts, synthetic grafts, expanded polytetra- fluoroethylene, Gelfoam, silastic grafts, and autologous fascial grafts have all been employed [10]. Autologous grafts often require separate harvesting but local fat and muscle grafts are able to be obtained and placed when suturing small defects [10]. DuraGen is a collagen matrix graft that has been utilized to seal dural tears and is done by placing then a 1-inch by 1-inch matrix over the defect followed by a fibrin glue, and a 1-inch by 3-inch matrix that covers the length of the laminectomy [10].

Subarachnoid catheters are used to treat CSF leaks following dural tears based on fluid flow mechanism and the theory that the CSF will preferentially drain through the catheter, decreasing subarachnoid CSF pressure allowing the dura to naturally heal [5]. The use of subarachnoid catheter has an 85–94% success rate [6]. However, the use of the catheters requires four to seven days of bed rest and drainage [4]. The overall complication rate of this technique is 44% with the most serious complications including over drainage, pneumocephalus, and meningitis [1]. The introduction of a foreign object directly into the subarachnoid space places the patient at a risk for infection, and there is a risk of infection of 10% with each drain placement including discitis, meningitis and wound site infection [4]. Insertion of the needle into the subarachnoid space may cause root irritation resulting in pain with leg movement.

Many surgeons believe that postoperative CSF leaks should not be treated with a subcutaneous drain due to the potential for perpetuation of a leakage [6]. However, there have been prior studies with successful outcomes of subfascial drains placed intraoperatively for known durotomies; or in addition to strong fascial repair. Intraoperatively placed subfascial epidural drains have not been found to be associated with CSF fistula or subdural hematoma formation [11]. Previous studies have found this method to be a safe and efficacious method of treatment [11].

The method of placing an epidural drain to treat postoperative pseudo-meningocele was implemented in the first case, because, open surgeries failed. The procedure was successful with resolution of the pseudo meningocele without adverse sequelae. This led the authors to apply the technique of epidural drain placement to treat recurrent CSF leaks in three other patients. The authors theorize that epidural drain keeps the epidural space dry. This enables proper adherence of the dura substitute to the dura to seal the defect.

There are multiple advantages of using the technique described in this paper to treat postoperative CSF leak. Because it is a percutaneous procedure it can be done under local anesthetic with minimal discomfort to the patient. Furthermore, any form of open revision surgery requires that the patient undergo another operation placing them at increased risk of infection or complications from general anesthesia. With each spinal surgery, there has been found to be a 2% risk of infection [2] Due to this inherent risk, it is beneficial to patients to minimize invasive surgeries and seek alternatives to treat post-operative pseudo-meningocele. Placement of epidural drain, therefore is a good option; because it is a simple and minimally invasive procedure that even be performed at the bed-side. Likely complication from this method include: infection, over-drainage of fluid, persistence of pseudomeningocle and formation of fistula along the catheter tract. Fortunately, we did not encounter any complication.

4. Conclusion

Placement of the epidural catheter is a simple and minimally invasive procedure that solved a complex problem in these four patients with post-operative pseudo meningocele formation. There was no complication in this small series. Considering the simplicity of this procedure it is worthwhile trying it prior to considering reoperation.

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