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Case Report

Management and outcome of cerebrospinal fluid leakage during anterior cervical fusion for an ossified posterior longitudinal ligament

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ABSTRACT

The rate of dural tears during anterior cervical diskectomy or corpectomy with fusion is higher in those patients with ossified posterior longitudinal ligaments (OPLL) than with those with other causes of cervical spinal stenosis. Various techniques have been described to deal with dural tears with cerebrospinal fluid (CSF) leakage in OPLL. Dural repair accompanied by a shunting technique with a lumbar subarachnoid drain is most commonly used. However, overdrainage of CSF fluid can cause further complications. Monitoring to keep the lumbar drain from overdrainage has not been described well in previous reports. In our series, 50 patients diagnosed with OPLL underwent anterior cervical surgery between July 2005 and June 2012. Dural tears with CSF leakage occurred in three patients. The dural defects were all about 1 mm in length. The dural defect was covered with a blood clot and gelfoam sponge. A closed suction drain (Hemovac) was placed as usual. After completion of the cervical surgery, a lumbar subarachnoid drain was inserted. The purpose of the lumbar drain was to shunt CSF pressure and avoid CSF leakage at the tear site. The lumbar drain rate was set at <20 mL/hour to prevent further complications. The effects of the lumbar drain were monitored and the drain rate was decreased gradually by observing the amount of cervical closed drainage, which should be minimal. The lumbar drains were used for 7 days in these three cases. There were no infections, severe headaches, or any other CSF leakage-related complications. None of the patients required reoperation for CSF leakage. Using a blood clot and gelfoam sponge to cover a dural tear site and placing a distant lumbar drain to shunt CSF pressure is an effective and successful method to treat CSF leakage in cervical operations.

1. Introduction

The incidence of dural tears and cerebrospinal fluid (CSF) fistulas after anterior cervical diskectomy or corpectomy with fusion (ACDF or ACCF) for cervical myelopathy due to various pathologies varies from 0.5% to 8.4% [1–4]. In studies concentrating exclusively on patients with ossified posterior longitudinal ligaments (OPLL), an incidence rate as high as 30% has been reported [5–8].

In addition to intraoperative dura repair techniques such as gelatin sponges, dural substitutes, and fibrin glue, the shunting procedure is also very important in managing this complication. The various reported methods include lumbar drains, lumboperitoneal and wound peritoneal shunts, and ventriculostomy [9–12]. A lumbar subarachnoid drain is most commonly used. However, overdrainage may cause further problems. Monitoring to keep the lumbar drain from overdrainage has not been described well in previous reports.

We report three cases of intraoperative CSF leakage during anterior cervical decompression and fusion (ACF) for OPLL-induced cervical myelopathy. We describe a reliable method to manage the leakage.

2. Case report

Fifty patients (41 men) with OPLL underwent ACF with or without a laminoplasty for cervical myelopathy between July 2005

Conflict of interest: none.

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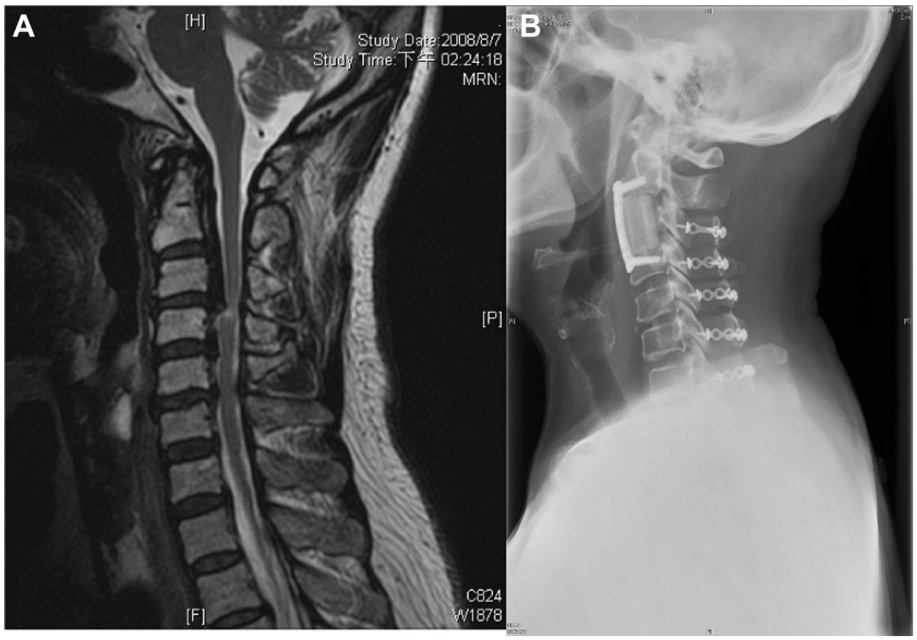

Fig. 1. Case 1, a 65-year-old woman with an OPLL with severe stenosis of C2-4, had a C3-7 laminoplasty and C3 ACCF. (A) Preoperative magnetic resonance imaging. (B) Plain radiograph 1 month postoperatively.

and June 2012. Three patients had CSF leakage, during anterior surgery.

Case 1 (a 65-year-old woman) received a C3-7 laminoplasty and C3 ACCF with a struct allogenous graft and an anterior cervical plate (Fig. 1). Case 2 (a 70-year-old man) received a C3-7 laminoplasty and C3-4 ACDF with a cage (PEEK, Tuttlingen, Germany) filled with autogenous bone graft and an anterior cervical plate (Fig. 2). Case 3 (a 65-year-old man) received a C3-4 and C5-6 ACDF with a cage (PEEK, Aesculap) filled with autogenous bone graft (Fig. 3). The dural tear occurred when parts of the posterior longitudinal ligament were difficult to remove because of severe adhesion to the dura, resulting in CSF leakage. The dural defects were all about 1 mm in length. The dural defect was repaired with a blood clot and an adequate sized gelfoam sponge.

A closed suction drain (Hemovac, Zimmer, Cowpens, SC, USA) was inserted before wound closure. A lumbar subarachnoid drain was placed after cervical surgery under the same general anesthesia, using a Perifix epidural catheter (Braun B, Melsungen, Germany) placed percutaneously with a 16-gauge Perican Touhy needle. The skin entry site of the lumbar drain was covered with a transparent waterproof dressing and the drain was connected to a 500 mL bag with tubing set to establish a closed drainage system (Fig. 4). The transparent dressing aided daily inspection of the lumbar drain site. During the first 3 postoperative days CSF was drained from the lumbar drainage system at a rate between 10 mL/hour and 20 mL/hour. Usually, the cervical blood drainage decreased to $<$10 mL/day during this period. The CSF drainage rate was decreased gradually every 8 hours on postoperative days (PODs) 4 and 5, according to the cervical drainage amount, which should be minimal. The patients were placed on bed rest with the head elevated 30° during this period. The lumbar drain was closed on POD 6. If the cervical wound

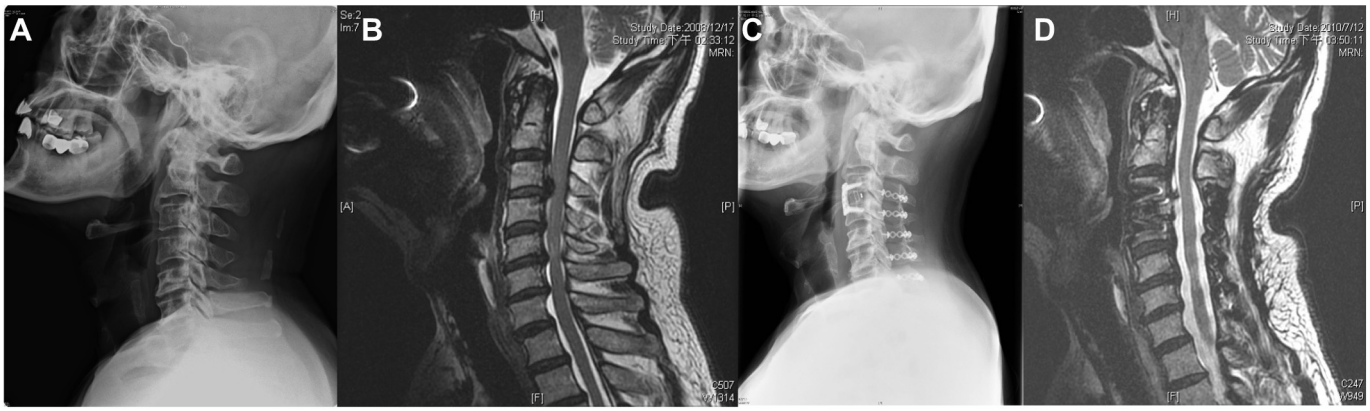

Fig. 2. Case 2, a 70-year-old man with OPLL with a C3/4 hard ruptured disc, had a C3-7 laminoplasty and C3/4 ACDF. (A) Preoperative plain radiograph. (B) Preoperative magnetic resonance imaging. (C) Plain radiograph 1 month postoperatively. (D) Magnetic resonance imaging 6 months postoperatively.

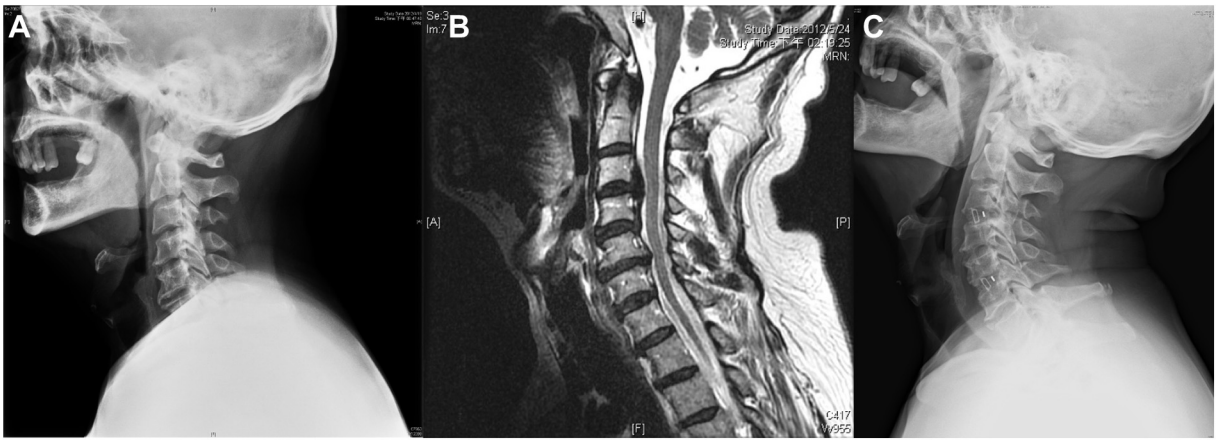

Fig. 3. Case 3, a 65-year-old man with OPLL with C3/4 and C5/6 stenosis, had a C3/4 and C5/6 ACDF. (A) Preoperative plain radiograph. (B) Preoperative magnetic resonance imaging. (C) Plain radiography 1 month postoperatively.

drainage was minimal, both the wound drain and lumbar drain were removed on POD 7. Both drains were removed smoothly in these three patients. They started a rehabilitation program on POD 7.

The hospital course was smooth and the three patients tolerated the shunting procedure well. None of them had developed meningitis, CSF leakage from the wound or formation of a pseudomeningocele by the POD 6 to POD 8. None of them developed symptoms of a pseudomeningocele during follow-op in the outpatient department. Follow-up cervical spine plain radiographs revealed no prevertebral swelling, ruling out an occult pseudomeningocele. Further cervical magnetic resonance imaging in Case 2 revealed absence of a pseudomeningocele with good decompression of the spinal cord (Fig. 2).

3. Discussion

CSF leakage after anterior cervical spinal surgery can be bothersome, leading to a pseudomeningocele, respiratory obstruction, cutaneous CSF fistula, or meningitis [11–14]. In the literature, the incidence of CSF leakage after anterior cervical fusion surgery for OPLL ranges from 5.7% to 31.8% [15–17]. Our incidence of 6% CSF leakage is favorable compared with rates reported in the literature.

Primary suture closure of the dura in the cervical region can be very difficult. Repair techniques employed include gelatin sponges, patch grafts, fibrin glue, and CSF diversion. Despite these techniques, the incidence of fistula and pseudomeningocele formation remains high (4.6–22.7%) [2,17]. In all reported cases, these fistulas ultimately required some form of temporary or permanent CSF diversion.

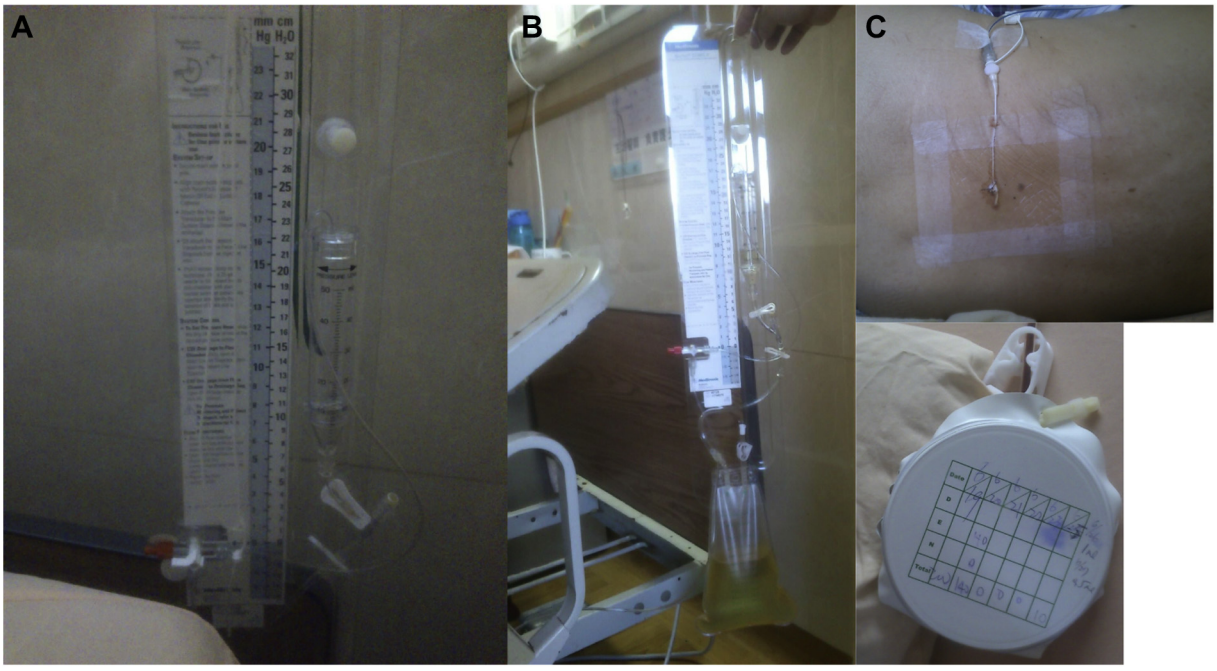

Fig. 4. (A, B) Closed lumbar drainage system and (C) wound drainage bag (Hemovac).

A shunting technique with a lumbar drain provides a safe and effective way to divert CSF. It is suggested that the drainage amount be set between 10 and 20 mL/hour. Overdrainage involves a risk of spinal headaches (60%), hydrocephalus, infections such as meningitis (2.5%), discitis (5%), and wound infection (2.5%), transient nerve root irritation, and, rarely but potentially fatally, subdural hemorrhage [9,12,18,19]. However, monitoring to avoid overdrainage has not been described well in previous reports. We controlled our drainage rate depending on two factors: (1) intensive observation of the patient's postoperative symptoms; and (2) minimization of closed wound drainage. The latter is thought to be an effective and economical method to prevent fistula and pseudomeningocele formation.

The risk of deep vein thrombosis because of immobilization in patients with lumbar drains has been well documented in the literature [20–23]. Our three patients received a bedside rehabilitation program during the drainage period to minimize this risk.

Intraoperative CSF leakage is inevitable in patients undergoing anterior cervical fusion for OPLL, with or without laminoplasty. In addition to dura repair with a blood clot and a piece of gelfoam sponge, we treated this complication successfully with a lumbar closed drain shunting system. We controlled the lumbar drain rate by monitoring the amount of wound drainage and the patient's daily symptoms to prevent fistula or pseudomeningocele formation. A bedside rehabilitation program was also done as tolerated by the patients. The three patients recovered well without further complications.

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