

Treatment experience for full-thickness wound dehiscence with cerebrospinal fluid leakage following posterior primary spine surgery

Three case reports

Chen Feng, MD, Shao Qianqian, MD, Hu Jianhua, MD*, Zhao Yu, MD, Wang Yipeng, MD, Zhang Jianguo, MD, Qiu Guixing, MD

Abstract

Rationale: Full-thickness wound dehiscence with cerebrospinal fluid (CSF) leakage following posterior spine surgery is a rare but troublesome complication. In the present study, 3 clinical cases associated with this entity are reported.

Patient concerns: The first case developed incision effusion 5 days after posterior decompression and internal fixation for lumbar spinal stenosis. The second case has the same diagnosis and treatment with the first case. She developed intraoperative CSF leak and incision effusion 7 days after the surgery. The third case developed incision effusion 6 days after posterior single door laminoplasty for cervical spondylosis.

Diagnosis: All cases developed CSF leak, incision effusion and finally full-thickness wound dehiscence on the postoperative period.

Interventions: Bed rest, drainage, vacuum sealing drainage (VSD), and reoperations were applied in all of the patients. Trapezius flap transfer was applied to the third case. One lumbar patient developed deep infection and meningitis; thus, the internal fixation and bone graft were removed.

Outcomes: All of the patients received wound healing finally and were followed up for >6 months. No incision complications reoccurred, and preoperative symptoms significantly relieved.

Lessons: Several techniques can be adopted to minimize the incidence of complications and proper surgical repair is the most important. Lumbar cistern drainage and VSD are recommended. Some other available options of management will also help.

Abbreviations: BMI = body mass index, CSF = cerebrospinal fluid, LSS = lumbar spinal stenosis, OPLL = ossification of the posterior longitudinal ligament, POD = postoperative day, VSD = vacuum sealing drainage.

Keywords: CSF leakage, full-thickness wound dehiscence, posterior primary spine surgery

1. Introduction

Cerebrospinal fluid (CSF) leakage is a common and troublesome catastrophic complication after spinal surgery, with reported incidence of approximately 14% in lumbar spinal surgery and about 1% in cervical spinal surgery. Once CSF leakage occurs, patients will develop orthostatic headache and need bed rest for a

long time which will bring side effects to rehabilitation. Spinocutaneous fistula tends to occur, and risks of poor wound healing and infection increase. If full-thickness wound dehiscence occurred following the CSF leak, the treatments will be more complicated. Risks of internal fixation explosion as well as deep tissue and central nervous system infection largely increase, which maybe life-threatening in severe cases. A second or multiple operations may be needed which will prolong the time of hospitalization and increase the hospitalization expense. Although management of postoperative CSF leak was well documented in the previous literature, there are only limited data reporting full-thickness wound dehiscence. In this article, we review the cases that developed full-thickness wound dehiscence with CSF leakage following posterior primary spine surgery in our single center and discuss the risk factors and therapeutic experiences of this complication. This study was approved by the Institutional Review Board of Peking Union Medical College Hospital. Informed consent was obtained from the patient for publication of this case report.

2. Report of cases

We retrospectively analyzed cases of full-thickness wound dehiscence with CSF leakage following posterior primary spine surgery from January 1998 to June 2018. A total of 3 patients were included. We summarized the general material, major diagnostic, and therapeutic process of the 3 patients (see Tables 1 and 2 for details).

Editor: N/A.

CF and SQ equally contributed to this article.

General financial grant from the China postdoctoral science foundation (2017M610813).

The authors have no conflicts of interest to disclose.

Department of Orthopedics, Peking Union Medical College Hospital, Peking Union Medical College & Chinese Academy of Medical Sciences, Beijing, China.

* Correspondence: Hu Jianhua, Department of Orthopedics, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences/Peking Union Medical College, Beijing 100730, China (e-mail: pumch_hujianhua@163.com).

Copyright © 2019 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

Medicine (2019) 98:15(e15126)

Received: 14 February 2019 / Received in final form: 3 March 2019 / Accepted: 13 March 2019

<http://dx.doi.org/10.1097/MD.00000000000015126>

Table 1
General materials of the 3 patients.

Case	Sex	Age	Medical history	Personal history	BMI, kg/m ²	Diagnoses	Surgical method	Intraoperative CSF leak (yes/no)	Treatment for intraoperative CSF leak	Time of removal of drainage tube, d	Time of developing postoperative incision effusion, d	Time of developing full-thickness wound dehiscence, d	Total Length of stay, d	Total cost (RMB)
1	Male	62	Osteoporosis, chronic vertebral compressive fracture	Smoking (9/d × 40 y)	27.7	Lumbar spinal stenosis	Posterior decompression, internal fixation and bone graft fusion (L2–S1)	No	—	4	5	8	119	218,995
2	Female	63	HTN	—	29.7	Lumbar spinal stenosis	Posterior decompression, internal fixation and bone graft fusion (L2–S1)	Yes	Gelatin sponge coverage	5	7	10	118	274,347
3	Male	58	HTN, DM	Smoking (20/d × 28 y), drinking (150 mL/d × 28 y)	24.8	Cervical spondylosis	Posterior single door laminoplasty (C3–C7)	Yes	Direct suture; gelatin sponge coverage	20	6	9	91	280,988

BMI = body mass index, DM = diabetes mellitus, HTN = hypertension.

Table 2
Major diagnostic and therapeutic process of the patients.

Case	Symptoms of CSF leak	On-bed position	Placement of lumbar cistern drainage (yes/no)	Placement of VSD (yes/no)	Times of reoperation	Infection	Prognosis
Case 1	Increased drainage, fever, incision pain	Trendelenburg	No	Yes	7	Deep infection, transient meningitis	Removal of internal fixation, debridement and full-thickness suturing, wound healing
Case 2	Clear drainage, headache, nausea, vomiting	Trendelenburg	Yes	Yes	3	Superficial infection	Keep internal fixation, deep tissue healing, superficial scar healing
Case 3	Increased clear drainage, fever, incision pain	Raise the bed head	Yes	Yes	3	Superficial infection	Keep internal fixation, repair with transfer flap, healing

2.1. Case 1

The first case is a 62-year-old male patient with the diagnosis of lumbar spinal stenosis (LSS) from L3 to L5. His medical history was not significant with the exception of osteoporosis and chronic vertebral compressive fracture (T12). Besides, he had smoked for >40 years and his body mass index (BMI) was 27.7 kg/m².

He received posterior decompression and internal fixation for long segments (L2–S1) on September 24, 2012. The surgery went smoothly and no obvious CSF leakage was detected during the operation. However, the patient complained for headache, nausea, vomiting and incision pain in the early period of postoperation. After we removed the drainage tube on postoperative day (POD) 4, he then developed incision exudates. CSF leak was highly suspected, and bed rest and activity limitation were immediately indicated. However, full-thickness wound dehiscence occurred finally on POD 8.

He received reoperation of debridement and sew on October 2, 2012. Lumbar cistern drainage was placed during the surgery to reduce CSF pressure. After the operation, bed rest and activity limitation were indicated and trendelenburg bed position was adopted. Vacuum sealing drainage (VSD) was applied later to promote wound healing. Unfortunately, the patient developed deep infection as well as symptoms of transient meningitis later. We had no choice but to perform operation to remove the internal fixation and bone graft on October 19, 2012. Since then, the patient received re-operations of debridement, sew and adjust VSD for another 3 times on 29th October 2012, 5th November 2012 and 12th November 2012. Finally, the dehiscence wound achieved healing via VSD, debridement, and dressing change. The patient discharged on January 24, 2013. He was followed up regularly and reported asymptomatic in our 1-year follow-up by telephone.

2.2. Case 2

This case is a 63-year-old female patient who referred to our hospital with the diagnosis of LSS from L2 to S1. She had a medical history of hypertension (maximum blood pressure of 180/100 mm Hg) for 1 year. Family and psychosocial history was not significant. Her BMI was 29.7 kg/m².

He received posterior decompression and internal fixation from L2 to S1 on April 17, 2015. Dural tear was detected at L2–L3 level during the decompression process. Dural tear was located at the lateral abdominal side and direct suture was not applicable. We covered the tear with gelatin sponge. However, postoperative CSF leak occurred and incision complications followed after we removed the drainage tube on POD 7. Full-thickness wound dehiscence occurred on POD 10, and we performed reoperation of debridement and sew on April 30, 2015. Bed rest and activity limitation were indicated, and trendelenburg bed position was adopted postoperatively. VSD was also applied to promote wound healing. Finally, the dehiscence wound achieved healing via VSD, debridement, and dressing change. After discharge on July 30, 2015, the patient underwent regular follow-up and recovered well 12 months later.

2.3. Case 3

This case is a 58-year-old male patient with the diagnosis of cervical spondylosis from C3 to C6. He had a medical history of hypertension and diabetes for >10 years. He also had a long history of smoking and drinking. His family was not significant. His BMI was 24.8 kg/m².

He received posterior single door laminoplasty from C3 to C7 on May 30, 2018. When we performed laminoplasty during the operation, the patient developed dural tear with a length of about 5 mm when we dissected adherent dura with Kerrison rongeur. We directly repaired the tear with 4-0 suture and covered it with gelatin sponge. On postoperative days, the patient complained for headache, nausea, vomiting, and incision pain. Drainage gradually increased and CSF leak was suspected. Bed rest and activity limitation were immediately indicated. Incision exudates occurred on POD 6. Although drainage was kept for a long time (20 days) to reduce the effusion, incision breakdown occurred during the postoperative period.

He then received reoperation of trapezius flap transfer as well as debridement and sew to repair the incision on July 30, 2018 (see Fig. 1 for details). After the operation, bed rest and activity limitation were indicated, and head of bed was elevated to 10 to 15 degrees. VSD, debridement, and dressing change were also applied to promote wound healing. Finally, the dehiscence wound achieved healing and the patient discharged on August 24, 2018. No incision complications occurred and preoperative symptoms significantly relieved in our 6-month follow-up at the outpatient clinic.

For the 3 patients, the total length of stay was as long as 3 to 4 months, and the mean total cost was approximately 44,000 dollars (nearly 300,000 RMB). Such troublesome complication brings great harm and burden to both patients and medical workers.

3. Discussions

CSF leakage is a common complication of spine surgeries. Proper and timely management of CSF leak is the first step to prevent incision problems. The prevalence of CSF leak has been reported to be about 1% during cervical spine surgery and approximately 14% in lumbar spinal surgery.^[1] Ossification of the posterior longitudinal ligament (OPLL) is a known risk factor for dural deficiency, resulting in CSF leaks.^[2,3] Patients with OPLL were 13.7 times more likely to develop CSF leak compared with patients without OPLL ($P=.05$). One well known and widely accepted option of management is surgical repair either by meticulous direct primary closure of the dura or augmented closure by means of fat, muscle tissue, or a fascial graft.^[4,5] The goal of surgical repair of postoperative dural tears with associated CSF leaks is to produce an adequate seal that can withstand CSF pressure during the healing period. CSF leaks are also reported to occur, whereas an electrocautery device or Kerrison rongeur was used during posterior approaches to the spine.^[1] Thus, when operating on the posterior portion of the cervical spine, surgeons should be mindful that the dura is vulnerable to injury, even during the exposure.

Full-thickness wound dehiscence means all layers of soft tissue including spine muscle and deep fascia are hiascent, which will lead to wound nonhealing and internal fixation exposure with high risk of infection. We consider that the main mechanism of full-thickness laceration is the accumulation of large amounts of CSF along the poorly sutured fascia into the subcutaneous soft tissue. How to deal the CSF leakage and difficult-heal wound is a huge challenge for both patients and doctors.

Risk factors associated with impaired wound healing leading to wound healing complications or chronic nonhealing wounds include infection, smoking, aging, malnutrition, immobilization, high BMI, diabetes, vascular disease, immunosuppressive therapy, and so on.^[6–9] The risk factors in our cases include relatively



Figure 1. Incision healing details of Case 3. (A) The patient developed full-thickness wound dehiscence with CSF leakage on POD 10; (B) a cavity with size of 6 cm \times 5 cm \times 4 cm formed in the dehiscent wound; (C) dural tear closed and deep tissue healed on POD 50 after VSD was applied; (D) trapezius flap transfer was applied to repair the incision on POD 60; (E) the wound got satisfactory healing on POD 75.

high BMI, diabetes, immobilization, and poorly dural closure as the most important factors.

Although the treatment process is difficult, we have tried many methods that had been approved in clinic practice and obtained a relatively satisfactory outcome, but there are still some debates in the application of several therapeutic techniques.

1. The time of removing wound drainage is still a controversial issue because there is a contradiction between adequate drainage and the risk of retrograde infection. As we all know,

Dura tear is prone to spontaneous healing with time. Some doctors may recommend to remove the drainage tube and suturing the orifice at 7 to 10 days early after the operation.^[10–12]

This may help maintain local pressure to prevent CSF from flowing out and close the tear. But obviously, this method is not applicable in cases of incision laceration. In such condition, we recommend drainage to be kept as long as possible to avoid incision effusion and further deterioration. Meanwhile, the full course prophylactic antibiotics usage to prevent retrograde and wound infection is recommended.

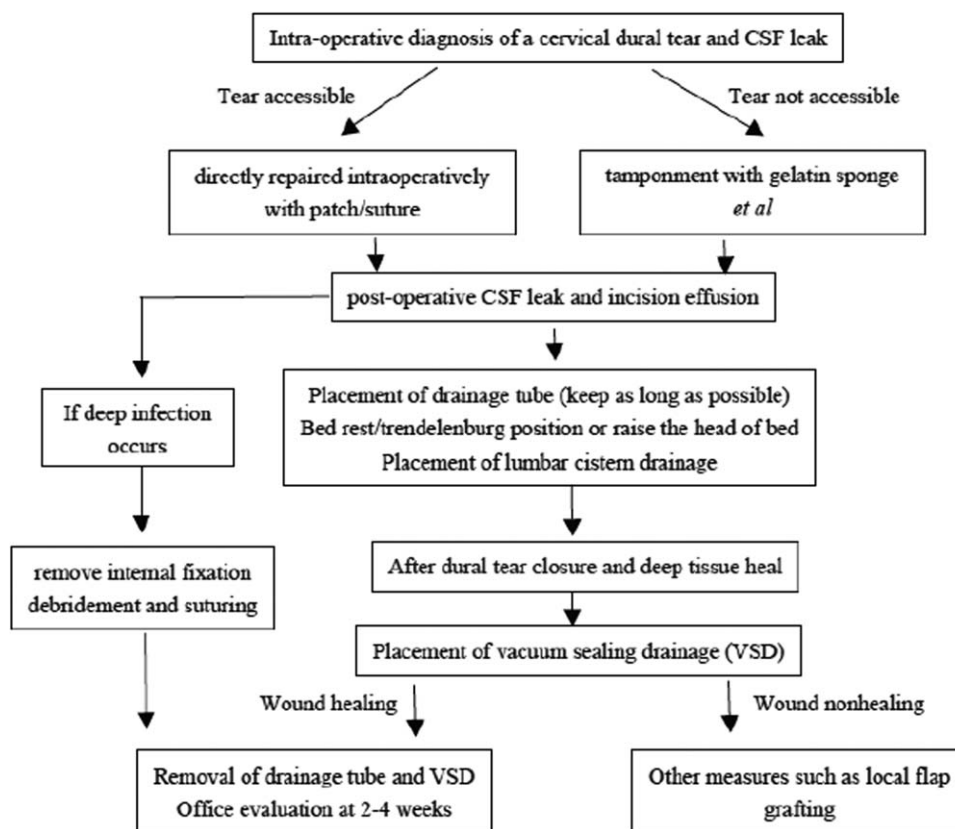


Figure 2. Algorithm for the treatment of CSF leak and wound problem.

- The use of a lumbar cistern drain in the management of spinal CSF leak has been reported earlier.^[13–15] The basic principle was to regulate the flow of CSF through the fistula and facilitate healing. We also tried to use this method in these 3 patients and achieved some results. However, headache and poor drainage occur from time to time. It seems that the effect is better in cervical case than in the lumbar ones. This may be mainly because of the displacement of the lumbar cistern drainage tube due to frequent dressing changes and puncture site near the lumbar wound incision.
- Application of VSD or not also remains controversial. Some surgeons treat VSD as contraindication of treatments of CSF leak. Early use of VSD may result in further loss of CSF and was not conducive to dural tear healing.^[16] So we applied VSD on POD 10 to 14 even at 3 weeks later when dural tear closed. VSD helped to seal the lowest layer of tissue and gradually shrink the cavity. It can improve the wound condition and prepare for final suture or other operation.

Our study is limited by small sample size. The therapeutic strategy in this review is based on single-center experience and only 3 cases are included. However, considering the extremely low incidence of the complication, we hope this article can provide some positive inspiration for clinical medical workers.

4. Conclusions

Full-thickness wound dehiscence with CSF leakage following posterior spine surgery is a rare but troublesome complication that will significantly increase reoperation rate, length of stay, and total cost. We proposed experience and therapeutic algorithm based on

a thorough literature review and our own experience (see Fig. 2). Several techniques can be adopted to minimize the incidence of CSF leak and incision complications, such as careful operation during the surgery, timely detection of dural tear, primary dural closure, and meticulous closure of deep fascia. Reasonable and timely application of techniques, such as lumbar cistern drainage and VSD, will promote incision healing. Other available options of management, such as infection control, dressing change, debridement and suturing, and local flap grafting, will also help.

Author contributions

FC, QQS, and JHH looked after the patients, and YZ, GXQ, and YPW collected the data. All authors contributed to the report. Written consent to publication was obtained.

Data curation: Chen Feng, Wang Yipeng.

Formal analysis: Shao Qianqian.

Investigation: Shao Qianqian, Zhao Yu.

Supervision: Jianhua Hu, Qiu Guixing.

Writing – original draft: Zhang Jianguo.

References

- David Hannallah , Joon Lee , Mustafa Khan , et al. Cerebrospinal fluid leaks following cervical spine surgery. *J Bone Joint Surg Am* 2008;90: 1101–5.
- Du YQ, Duan WR, Chen Z, et al. Risk factors and management of dural defects in anterior surgery for cervical ossification of the posterior longitudinal ligament. *World Neurosurg* 2018;111:e527–38.
- Epstein NE. Cervical surgery for ossification of the posterior longitudinal ligament: one spine surgeon's perspective. *Surg Neurol Int* 2014;5(Suppl. 3):S88–92.

- [4] Guerin P, El Fegoun AB, Obeid I, et al. Incidental durotomy during spine surgery: incidence, management and complications. A retrospective review. *Injury* 2012;43:397–401.
- [5] Hughes SA, Ozgur BM, German M, et al. Prolonged Jackson-Pratt drainage in the management of lumbar cerebrospinal fluid leaks. *Surg Neurol* 2006;65:410–4.
- [6] Orr JW, Taylor PT. Wound healing. In: *Complications in Gynecological Surgery: Prevention, Recognition, and Management*. Philadelphia, PA: JB Lippincott; 2018:p. 167.
- [7] Li R, Ni M, Zhao J, et al. A modified strategy using barbed sutures for wound closure in total joint arthroplasty: a prospective, randomized, double-blind, self-controlled clinical trial. *Med Sci Monit* 2018;24:8401–7.
- [8] Armstrong DG, Lavery LA, Harkless LB. Validation of a diabetic wound classification system. The contribution of depth, infection, and ischemia to risk of amputation. *Diabetes Care* 1998;21:855.
- [9] Morbach S, Furchert H, Gröblichhoff U, et al. Long-term prognosis of diabetic foot patients and their limbs: amputation and death over the course of a decade. *Diabetes Care* 2012;35:2021.
- [10] Fang Z, Jia YT, Tian R, et al. Subfascial drainage for management of cerebrospinal fluid leakage after posterior spine surgery—a prospective study based on Poiseuille’s law. *Chin J Traumatol* 2016;19:35e38.
- [11] Cho JY, Chan CK, Lee SH, et al. Management of cerebrospinal fluid leakage after anterior decompression for ossification of posterior longitudinal ligament in the thoracic spine: the utilization of a volume-controlled pseudomeningocele. *J Spinal Disord Tech* 2012;25: E93eE102.
- [12] Hannallah D, Lee J, Khan M, et al. Cerebrospinal fluid leaks following cervical spine surgery. *J Bone Joint Surg Am* 2008;90: 1101–5.
- [13] Hasegawa H, Shin M, Kondo K, et al. Reconstruction of dural defects in endoscopic transnasal approaches for intradural lesions using multilayered fascia with a pressure-control spinal drainage system. *World Neurosurg* 2018;114:e1316–24.
- [14] Barbanti Bròdano G, Serchi E, Babbi L, et al. Is lumbar drainage of postoperative cerebrospinal fluid fistula after spine surgery effective? *J Neurosurg Sci* 2014;58:23–7.
- [15] Tosun B, Ilbay K, Kim MS, et al. Management of persistent cerebrospinal fluid leakage following thoraco-lumbar surgery. *Asian Spine J* 2012;6: 157e162.
- [16] Lei Y, Liu L, Du SH, et al. The use of a skin-stretching device combined with vacuum sealing drainage for closure of a large skin defect: a case report. *J Med Case Rep* 2018;12:264.