Remote Cerebellar Hemorrhage after Thoracic Spinal Surgery with Moderate CSF Loss: A Case Report and Review of the Literature

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Abstract
Remote Cerebellar Hemorrhage (RCH) is an infrequent but serious complication after spinal surgery, and the exact pathogenetic mechanism is unknown. We described a 46-year-old woman underwent surgery for an intradural and extramedullary tumor at T3/4 level while the dura mater was opened intraoperatively with moderate Cerebrospinal Fluid (CSF) leakage. The patient complained of a severe headache and quickly got into unconsciousness a few hours after surgery. The immediate cranial Computed Tomography (CT) showed hemorrhage in the left cerebellar hemisphere. The patient was treated conservatively, and the repeat CT showed the hemorrhage sites was remarkably smaller. Finally, the patient had an acceptable recovery after rehabilitation therapy. Excessive CSF leakage is thought to be a leading cause of RCH. Early diagnosis is particularly important for the management of RCH after spinal surgery.

Keywords: Cerebrospinal fluid leak; Complication; Remote Cerebellar Hemorrhage; Spinal surgery

Introduction
Remote Cerebellar Hemorrhage (RCH) was occasionally found distant from the surgical site after cranial operation and can be a life-threatening complication according to the location of bleeding [1]. RCH has also been found following spinal surgery, but it is much more rare and unpredictable [2].

Since the first report of RCH as the complication of a spinal operation in 1981, there has been a growing attention to RCH following spinal surgery [3]. Although the etiological factors and pathophysiology mechanism have not been well described, intraoperative or postoperative excessive loss of Cerebrospinal Fluid (CSF) seems to be involved in all the cases [4-6]. We report a case of RCH after a thoracic spinal surgery with moderate CSF leakage as a severe complication.

Case Presentation
A 46-year-old woman presented weakness and numbness in both of her legs. Investigation revealed an intradural and extramedullary tumor at T3/4 level. She was operated in prone position via a posterior approach. The surgery involved T3-4 laminectomies and tumor resection. The dura mater was opened intraoperatively, and was sutured in watertight fashion after removal of the tumor. Approximately 150 ml CSF escaped before the dura was closed. A hemovac drain was placed in the epidural space.

When the patient awoke from anesthesia, her neurological function was the same as that before operation and her blood pressure was normal. 24 hr after surgery, she complained of headache and vomiting. She was suspected to have low intracranial pressure syndrome due to the CSF leakage. A painkiller was prescribed for her and her headache was released. In the first 24 hr after surgery, 180 ml of CSF and blood were removed via the hemovac drain. However, 38 hr after surgery, the patient developed a severe headache and quickly got into unconsciousness with elevated blood pressure of 170/105 mmHg. An immediate cranial Computed Tomography (CT) showed hemorrhage in the left cerebellar hemisphere. A total of 250 ml of CSF and blood were removed via the hemovac drain after surgery in 38 hrs.

The endotracheal intubation and mechanical ventilation was used since the patient’s oxygen saturation began to decrease, and she was managed conservatively with dehydration, cerebral
protection, and anti-infection and nerve nutrition when the hemovac drain was put in intermittent clamping. The patient recovered consciousness in the next morning and her left limb muscle strength appeared to decline. Repeat CT at 72 hr and 5 days after surgery showed no enlargement of the hemorrhage sites. Ten days after surgery, the patient received extubation and a repeat CT showed the hemorrhage sites was remarkably smaller. The patient’s left limb muscle strength increased but was still weaker than that before surgery. Then the patient received rehabilitation therapy 3 months after surgery, her left limb muscle strength gradually recovered to normal and the CT angiography scan showed that there were no intracranial vascular malformations. However, the patient still suffered from dizziness and ataxia 2 years after the surgery.

Discussion

Hemorrhage after cranial or spinal surgery can occur in the intracerebral, cerebellar, epidural or subdural compartments [7-9]. RCH is intracranial hemorrhage localized in the cerebellum and it is an infrequent complication following spinal surgery since only a few cases have been reported. Chadduck first described RCH after a spinal operation in 1981 [3], which occurred following a cervical laminectomy with the dura widely opened. Most recently, Sen et al. reported a case of RCH following lumbar spinal surgery [10].

Several possible pathological mechanisms have been proposed for RCH, such as sex, blood coagulation, transient hypertensive peaks, intracranial vascular malformation, and patient’s intraoperative position, but none have been accepted as the major factor. Marquardt et al. pointed out that, except for sex, none of the mentioned factors were involved in spontaneous cerebellar hemorrhage [11]. Konya et al. reviewed ten cases of RCH following spinal surgery and found no relationship between RCH and age, sex, pathology operated, or type of interventions performed [12].

Now more and more authors have reached an agreement that massive CSF leakage during or after operation, usually over 600 ml, may be involved in the occurrence of RCH [13-15]. Since the excessive loss of CSF, Spinal Fluid Pressure (SFP) drops, inducing intracranial hypotension. CT and Magnetic Resonance Image (MRI) done after CSF removal in diagnostic lumbar puncture have showed caudal displacement of the brain, with decrease in ventricular size, sagging cerebellar tonsillar and dilated veins [16]. Cerebellar sag, a result of CSF leakage, has been supposed to cause stretching and occlusion of the superior cerebellar veins, which seems to be the most possible pathogenetic mechanism that can explain all the bleedings in relevant cases. In our case, the patient had no history of hypertension and did not develop this problem preoperatively or postoperatively while there was only a transient elevated blood pressure when she got into...
unconsciousness, and no arteriovenous malformation was apparent on CT angiography. The most important feature of our case that shared with previous cases was opening of the dura and consequent loss of CSF. However, the total intraoperative and postoperative CSF leakage was less than 400 ml, which was only a moderate loss and also might be the reason for the RCH, depending on the patient’s situation.

According to the ten cases reviewed by Konya et al. [12], alarming symptoms such as severe headache, neurological deficits, and decreased level of consciousness related to RCH were exhibited in all the patients, when the consciousness levels ranged from a state of awake, anxious, and agitated to comatose state. Sen et al. reported a usual case of cerebellar mutism caused by RCH following lumbar spinal surgery [10]. The common feature of all the cases was the significant CSF loss ahead of the onset of clinical symptoms. The patient in our case had a headache after operation but was not taken seriously. About 14 hr later, she developed into unconsciousness state quickly after a severe headache. Then brain CT was performed, which should have been obtained earlier retrospectively. Besides that, the patient also presented decline of muscle strength in her left limb. Therefore, if any case with CSF leakage following spine surgery exhibits unexplained deterioration of consciousness or delayed emergence, RCH should be suspected. However, symptoms such as headache and nausea in postoperative period may be attributed to low intracranial pressure syndrome, and they are not so specific to indicate brain CT and suggest RCH. Our suggestion is that more attention should be paid to the patient with CSF leakage after spinal surgery and the volume of CSF loss should be controlled by putting the hemovac drain in intermittent occlusion when the patient presents symptoms of headache and nausea. Once the patient exhibits unrelied severe headache or unexplained deterioration of consciousness, an immediate brain CT or MRI should be performed.

Hempelmann et al. reported 3 cases of RCH as a complication of spinal surgery with minor or untypical symptoms [17], and they pointed out the real incidence of RCH due to intended or unintended CSF loss during spinal operations might be higher than suggested because imaging of the brain was usually exclusively performed in symptomatic patients.

The pattern of RCH following spinal surgery is commonly unilateral when bilateral hemorrhage also occurred in some cases [18,19]. The brain CT scan in our case demonstrated the bleeding in superior part of the left cerebellum, indicating a characteristic pattern of RCH which is discrete from an arterial bleeding and a similarity to the reported cases.

Most cases of RCH can be treated conservatively by means of immediate removal of subfacial drain, complete bed rest and if necessary, external ventricular drainage. However, surgical decompression may be required when large hematomas cause significant mass effect in the posterior fossa. According to the ten previously reported cases of RCH reviewed by Konya et al. [12], four were treated medically with anti-edema drugs, analgesics and bed rest while the other six were managed both surgically and medically. He also pointed out that treatment for RCH depended on the patient’s neurological status as well as nature of the lesion. Our patient was treated conservatively and the hemovac drain was put in intermittent clamping with close monitoring. The endotrachéal intubation and mechanical ventilation was used because of the decrease of the patient’s oxygen saturation. As the patient recovered consciousness a few hours later and repeat CT had showed no enlargement of the hemorrhage sites, conservative treatment was continued and finally the patient reached an acceptable outcome.

In summary, RCH is a rare but life threatening complication after spinal surgery. Based on the experience of RCH to date, all the cases, including our current case, feature CSF loss due to intraoperative opening of the dura. It is important to consider the possibility of RCH in any patient exhibiting cerebellar symptoms, even a late sudden headache when considerable volume of CSF has been lost. Even the CSF loss is moderate, like our case, severe RCH is also possible and should be taken into consideration. It is necessary to be aware of this potential complication and such patients should receive immediate neuro radiological examination since early diagnosis is particularly important for treatment. Small hematomas due to RCH can be managed conservatively and monitored closely with serial imaging, but larger lesions causing significant mass effect should be treated surgically [20,21].

**References**


