

Remote cerebellar haemorrhage after lumbar spine surgery: case report

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Abstract Remote cerebellar haemorrhage (RCH) is a well-described complication of supratentorial surgical procedures with an incidence ranging between 0.2 and 4.9 %, but is a rare complication of spinal surgery. We report a case of RCH in a 65-year-old woman who showed sudden mental deterioration 48 h after lumbar spinal surgery, which was complicated by incidental dural tearing with minimal CSF loss. Brain CT scan revealed hypodense areas compatible with acute infarction involving mostly the left cerebellar hemisphere. No cerebral bleeding was observed. MRI was also performed revealing small cerebellar areas of acute infarction mainly relating the vermis and the left postero-inferior cerebellar hemisphere with haemorrhagic transformation and mass effect in the posterior fossa producing acute hydrocephalus. Haematoma removal was initially attempted by means of a suboccipital craniotomy. An external ventricular derivation was placed in a second procedure 24 h later due to the persistence of ventricular dilatation. At discharge the patient was only showing a slight dysmetria with the fine motor skills of hands and fingers. All cases of RCH after spinal surgery reported in the literature are invariably associated to iatrogenic dural tearing; although CSF loss seems to play the key role in the pathogenesis of this rare complication, the exact pathophysiology of this condition still remains undetermined.

Keywords Cerebellum · Remote cerebellar haemorrhage · Postoperative complication · Dural tear · Spinal surgery

Introduction

Although most of spinal surgery complications are implant related or postoperative wound infections, neurologic complications such as nerve root lesion, epidural haematoma, epidural abscess or dural tearing are not infrequent. Dural tearing during spinal surgery has a reported incidence ranging from 3.5 to 17.4 % [1]. However, remote cerebellar haemorrhage (RCH), which develops distant to the site of surgery, after spinal surgery is a rare complication with a reported incidence of 0.08 % [2–5]. Interestingly, all the cases reported in the literature are invariably related to intraoperative unintended durotomy and cerebrospinal fluid (CSF) leakage [3, 5, 6]. Although loss of CSF seems to play the key role in the pathogenesis of this complication, the exact pathophysiology of this condition still remains undetermined [7]. Some authors suggest that RCH can occur due to cerebellar downward sag resulting from CSF leakage that might injury the cephalic bridging cerebellar veins leading to haemorrhagic venous infarction [3, 8]. We report a further case in which RCH occurred after spinal surgery complicated with dural tearing, review the literature, and discuss possible causative factors for this probably underreported complication of spinal surgery.

Case report

A 65-year-old woman with an otherwise unremarkable past medical history was taken to surgery after failure of conservative management for low back pain and neurogenic

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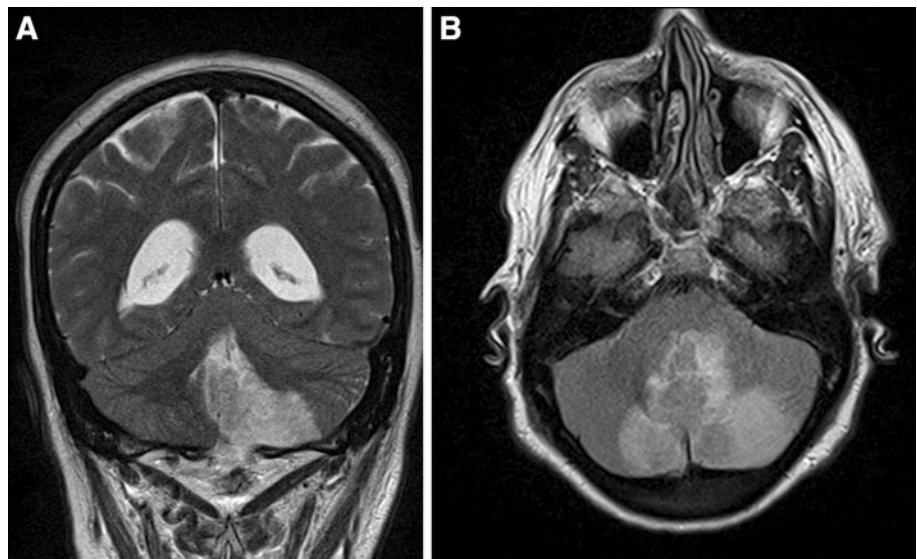
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Fig. 1 Preoperative brain CT: hypodensity in the cerebellar hemisphere, left more than right, a finding compatible with acute ischemic infarct and beginning acute hydrocephalus

claudication secondary to lumbar spinal canal stenosis. The patient underwent instrumented postero-lateral fusion and decompression from L2 to L5 with additional transforaminal interbody fusion at L3–4 and at L4–5. During the procedure accidental dural tearing with minimal CSF leakage occurred. The dural tear was immediately sutured in watertight fashion and a subfascial drain with negative pressure was placed at the end of the procedure. The patient immediate postoperative course was uneventful. No clear or serous fluids were observed in the drainages suggesting that a possible CSF leakage had occurred postoperatively. However, 48 h postoperatively the patient experienced a sudden change in her neurological status and presented with slurred language, somnolence and temporo-spatial disorientation, with Glasgow Coma Scale 13.

Fig. 2 Preoperative brain MRI (a axial T2, b coronal T2): acute cerebellar infarct in the vermis, in the left posterior–inferior cerebellar hemisphere, less in the right hemisphere, with haemorrhagic transformation and mass effect with compression in the posterior fossa and acute hydrocephalus



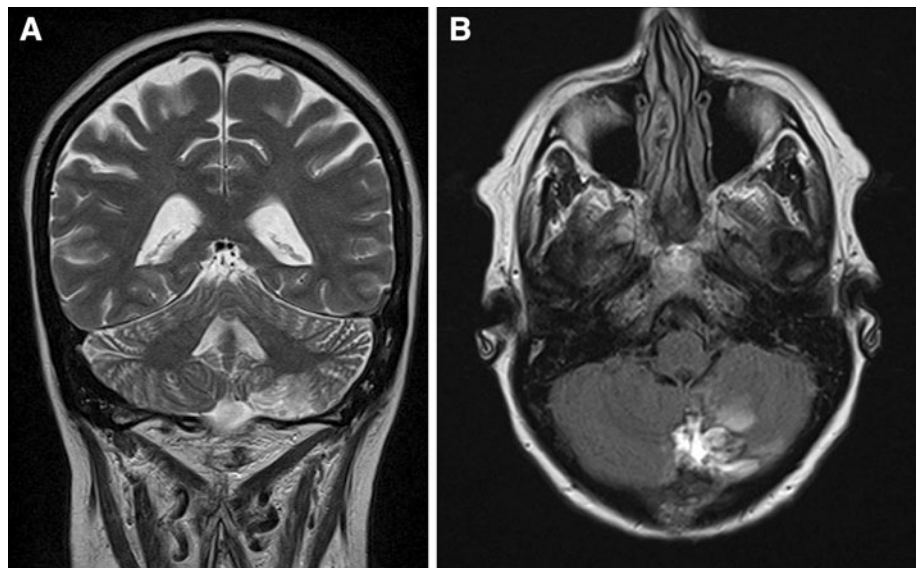
A brain CT scan (Fig. 1) was immediately performed revealing hypodensity in the cerebellar hemispheres, left more than right, suggesting an acute ischemic infarct and early signs of acute hydrocephalus. A brain MRI (Fig. 2) showed acute cerebellar infarct in the vermis and in the left posterior–inferior cerebellar hemisphere with minor involvement of the right hemisphere. Haemorrhagic transformation and mass effect with compression in the posterior fossa and acute hydrocephalus were also present. An angio-MR was also performed resulting negative for AVM. No other intracerebral lesions were documented. Laboratory studies, including platelet count, prothrombin time, and partial thromboplastin time, were within normal ranges. Due to the findings and the clinical evolution it was decided to perform a suboccipital craniectomy to achieve haematoma removal and cerebellar decompression. 24 h later it was necessary to place an external ventricular derivation (EVD) due to the persistence of hydrocephalus, confirmed in a postoperative brain CT. A brain MRI (Fig. 3) predischarge showed a regression of the haemorrhage and a normalisation in the width of the ventricular system.

When the patient was finally discharged from the ICU, 11 days after the operation, she was showing dysidiadochokinesia and a dysmetria in both hands and fingers, and a central vertigo. At hospital discharge the patient's neurological physical examination was normal except for slight dysmetria with the fine motor skills of hands and fingers and transitory subjective vertigo.

Discussion

Most of spontaneous perioperative intracranial haemorrhages are related to diverse causes such as use of anticoagulants, high arterial blood pressure or intracranial vascular

Fig. 3 Brain MRI predischarge (a axial T2, b coronal T2): status following osteoplastic suboccipital craniotomy and evacuation of cerebellar haematoma on both sides, left more than links



abnormalities. However, some reports have established that loss of CSF after dural tearing might be another important factor in the pathogenesis of intracranial haemorrhage during or after spine surgery [3, 5, 9]. Dural tearing is a well-known complication of spinal surgery, with a reported incidence ranging from 3.5 to 17.4 % [1], being associated to many different conditions such as pseudomeningocele, CSF fistula formation, meningitis, arachnoiditis, postural headache, nerve root or brainstem herniation, cerebellar dysfunction, or intracranial haemorrhage in different locations [7]. First described by Chaddock in 1981 [10], RCH after spinal surgery has been sporadically reported in the English literature especially in the last years. All the cases reported were invariably associated to accidental, noticed or unnoticed, intraoperative dural tearing and CSF leak showing neurological symptoms between immediate postoperative and 72 h after surgery [8].

According to the literature it seems that RCH can occur after any type of spinal surgery in which CSF leak has occurred during or after surgery, regardless of age, sex, pathology [8] or perioperative patient position [11]. Although there is no agreement on the pathological mechanisms for RCH, most authors seem to agree on two facts: RCH has a venous origin and is a result of intraoperative or postoperative loss of CSF [3, 12]. The venous origin of RCH [11, 13] can be supported by the evidence that, while arterial bleeding tends to be unilateral, RCH is bilateral, and that the bleeding is generally located in the upper vermis and cerebellar sulci, where the cerebellar draining veins are located [12]. Regarding the intraoperative or postoperative loss of CSF as a potential cause of RCH, all cases of RCH after spinal surgery reported are related to CSF leak. Several authors suggest that a rapid leak of a large amount of CSF would lead to caudal sagging of cerebellum [11].

The ‘cerebellar sag’ can cause venous occlusion or arterial infarction, which can be followed by reperfusion haemorrhage or venous bleeding secondary to increased venous pressure [11]. Most authors agree in the fact that a rapid leak of a large amount of CSF may be required for cerebellar haemorrhage to occur. Although this might be right, in our opinion this is controversial due to the fact that in most of the reports the amount of CSF leak was not measured, and RCH with minor CSF loss (as in our case) after lumbar drainage has been reported in two patients [13].

Brain computed tomography (CT) or magnetic resonance image (MRI) allows an immediate diagnosis of this complication. According to Brockmann [14] RCH has characteristic image findings consistent with bleeding of venous origin located in the upper aspect of the vermis and folia bilaterally, and shows a curvilinear configuration alternating hyperdense (blood) and hypodense (cerebellum) stripes. These findings seen on MRI or CT are described as the ‘Zebra sign’. Zebra-pattern haemorrhage seems to be typical in a postoperative loss of CSF, which should always be considered on presentation of this bleeding pattern [15].

RCH can be asymptomatic being detected incidentally on radiological examinations. When symptomatic the clinical presentation may vary from dizziness, minor headache or symptoms not typical for a cerebellar lesion [3, 5, 6, 16], to a cerebellar or brainstem dysfunction, and even death in some cases depending on the size of the haemorrhage [17]. Small bleedings are managed conservatively and followed with serial imaging and usually they have good outcomes; while larger RCH has a greater risk of acute obstructive hydrocephalus and brainstem compression, and requires immediate surgical decompression [4, 8]. Compression of fourth ventricle and subsequent non-communicating hydrocephalus should be managed with CSF diversion

procedures [8]. Large bleedings still show favourable outcomes with complete recovery or mild remaining neurological symptoms in more than 50 % of all cases, while death can occur in 10–15 % of cases [18].

Like all the cases of RCH after spinal surgery reported previously in the literature, our case presented perioperative incidental dural tearing and consequent leak of CSF, although in our case CSF loss was minimal and the tear was immediately repaired with no postoperative CSF leakage. According to the literature, the authors believe that dural tearing and the consequent CSF loss must be responsible for the development of RCH in our patient. About 30 cases of RCH after spinal surgery have been reported to date, and all of them related to dural tearing with CSF loss. Considering that the reported incidence of incidental dural tear during spinal surgery is quite significant (between 3.5 and 17.4 %) [1] and the large number of spine surgeries performed worldwide every year, it seems reasonable to think that there are much more cases of RCH than those actually reported probably because most cases consist of small bleedings that course asymptomatic. Probably these cases are not detected because postoperative cranial CT is not routinely performed after spinal surgery [9]. Usually most of the RCH cases consist in small bleedings coursing sub-clinically, and only a very small number of cases, where dural tearing and CSF loss occurred, become symptomatic. Whether we need further investigation to stabilise if the symptomatic cases are exclusively due to CSF loss or due to other unidentified causative agents.

Conclusions

RCH is a rare, and probably underreported, complication of spinal surgery associated to intraoperative dural rupture with CSF loss during or after surgery. The real incidence of this event is not known because imaging of the brain is usually performed in symptomatic patients, and asymptomatic bleedings may occur more often than expected. Although showing generally a favourable outcome, RCH is a potentially life-threatening complication that must be kept in mind in any patient with a declining neurological status or even in those with minor headache or not typical symptoms of a cerebellar or cerebral lesion, after spine surgery associated with CSF loss. In these situations, brain CT or MRI should be achieved, and if a diagnosis of RCH is confirmed, a surgical treatment should be immediately performed in order to improve the patient outcome.

Conflict of interest The authors have no conflicts of interest to declare.

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