CASE REPORT

Cerebellar hemorrhage after supratentorial burr hole drainage of a chronic subdural hematoma

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Abstract
Cerebellar hemorrhage is an unusual, but increasingly recognized complication after supratentorial surgery. Even rarer are the cases of cerebellar hemorrhage after supratentorial burr-hole drainage of a chronic subdural hematoma (CSDH). The pathophysiology of this rare complication still remains unclear. Hypertension and overdrainage of cerebrospinal fluid seem to be causative factors of postoperative cerebellar hemorrhage. The most important key to minimize this hazardous sequel is to be aware of this potential complication and its pathogenetic mechanisms. We report our case of a 43-year old man who developed cerebellar hemorrhage after burr hole trephination for supratentorial CSDH.
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Key words: burr hole drainage; cerebellar hemorrhage; chronic subdural hematoma; supratentorial surgery.

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Cerebellar hemorrhage after supratentorial surgery is the most commonly described pattern of remote intracranial hemorrhage after neurosurgical procedures[1]. Even rarer are the cases of cerebellar hemorrhage after supratentorial burr-hole drainage of a chronic subdural hematoma (CSDH)[2-7]. We report a case of a 43-year old man who developed cerebellar hemorrhage after burr hole trephination for supratentorial CSDH and discuss possible etiologic mechanisms.

Case Report

A 43-year old man was admitted to our hospital with head injury after a car accident in good neurological condition. The CT scan revealed a small right frontal subdural hematoma (SDH). Initially, he was treated conservatively, but after 4 days he developed lethargy and ataxia. The new CT scan revealed low density subdural lesions in both frontal regions compatible with chronic bifrontal subdural hematoma with slight decrease of gyral markings (Figure. 1). There was no history of arterial hypertension or hemorrhagic diathesis. Surgery was performed under general anesthesia with the patient in the supine position, without head rotation. Frontal burr holes were drilled on each side and the hematoma was slowly decompressed. His peri-operative blood pressure remained within normal range. At the end of the operation a subdural frontal closed drainage system was placed on each side. Drainage rate was controlled by gravity. The patient was restricted to bed rest in the supine position. One hour postoperatively he developed a strong headache, irritability and nausea.

The level of consciousness, however, was not impaired. The postoperative CT scan demonstrated adequate

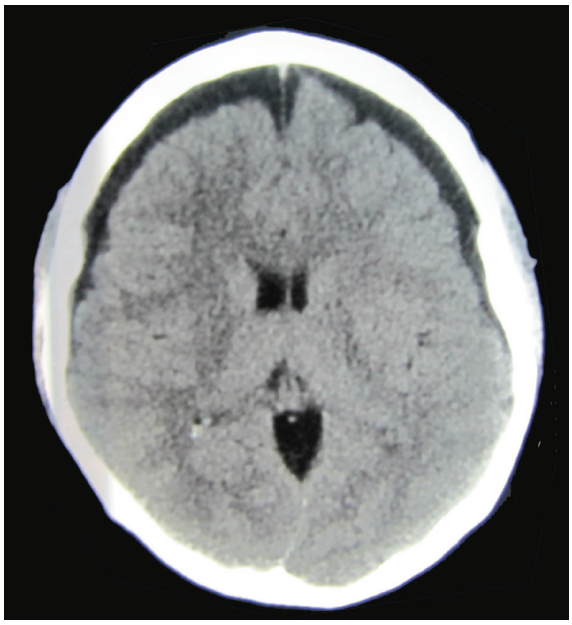

Figure 1. CT scan on 16th day after the car accident: subdural low density lesions in both frontal regions, the lesion on the left side being larger. The scan showed a decrease of gyral markings but no shifting of midline structures.

drainage of the subdural hematomas which were replaced by bifrontal pneumocephalus and additionally a new subarachnoid and intraparenchymal hemorrhage within both cerebellar hemispheres (Figure. 2). The drainage system was left for 4 days and about 300 ml of chronic subdural hematoma mixed with cerebrospinal fluid (CSF) were totally drained. The patient was treated conservatively with bed rest and hydration and improved gradually within 7 days postoperatively. The CT scan after 17 postoperative days showed complete absorption of the cerebellar hematoma and pneumocephalus. The patient was subsequently discharged without any neurologic deficits.

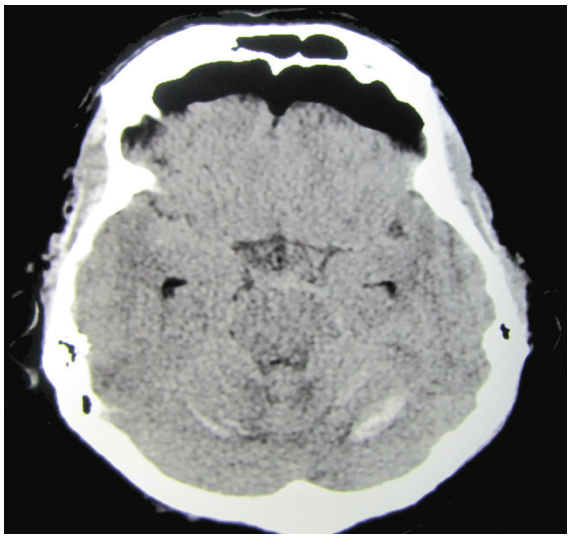

Figure 2. Postoperative CT scan: bifrontal pneumocephalus and hemorrhage within both cerebellar hemispheres, the lesion on the left side being larger.

Discussion

Remote cerebellar hemorrhage (RCH) is a very rare complication of supratentorial surgery, with a reported incidence of 0,08%[1]. RCH after burr hole trephinations for CSDH is even rarer, with an incidence of 0,14%[2].

Pathogenesis of RCH after burr hole drainage of CSDH

The precise mechanism of cerebellar hemorrhage

Table 1: Patient characteristics with cerebellar hemorrhage after burr hole evacuation of chronic subdural hematoma.

Nr (Ref)	Age/Sex	Coexisting fators	Symptoms on admission	Diagnosis	Surgery			Postop symptoms	Estimated amount of CSF lost	Postop BP	Postop CT scan	Treatment	Outcome
					Operating position	Periop BP	Drainage system						
1 (2)	74/F	Anticoagulant agent, Hypertension under medication	R-hemiparesis, expressive dysphasia for 3 days	L-CSDH	Patient supine, with head rotation 45 degrees to the contralateral side	Normal	Yes	None	100 ml during surgery	-	5th day: R-cerebellar hemorrhage	Conservative	Complete recovery
2 (3)	49/F	None	Headaches for 14 days and gait disorder	Chronic bifrontal SDH	Patient supine, without head rotation	Normal	Yes	6 h postop.: headache, slurred speech, R- sided ataxia	20ml in 4 h	-	Hemorrhage within the upper vermis cerebelli and R-cerebellar follia, compression of 4th ventricle	External ventricular drainage	Complete recovery
3 (3)	73/M	Anticoagulation factor, Hepatic dysfunction (HCV)	Impaired consciousness, L-hemiparesis	R- CSDH	-	-	Yes	80 h postop.: nausea, vomiting,GCS 10/15	40ml in 6 h	-	Hemorrhage within the upper vermis cerebelli and both cerebellar follia, compression of 4th ventricle	External ventricular drainage	Progressive recovery
4 (4)	53/F	Diabetes mellitus for 3 years	R-leg weakness for 7 days	Chronic bifrontal SDH	Patient supine, without head rotation	Normal	Yes	Strong headache, dizziness, nausea and vomiting	100 ml on R-side, 120 ml on L-side		L-cerebellar hemorrhage	Conservative	Complete recovery
5 (5)	86/M	None	Headache, drowsiness, mild quadriparesis	Chronic bifronto-temporal SDH	-	-	Yes	4th day: consciousness deteriorated	1st day: 100 ml from each side. From the 2nd day: 300 ml/day L-side, 10 ml/ day R-side	Normal	L-cerebellar hemorrhage	-	-
6 (5)	75/M	None	Headache for 6 weeks	Bifronto-temporal CSDH	-	-	Yes	5th day: deterioration of consiousness	360ml R-side, 40 ml L-side in 4 days		R-cerebellar hemorrhage	-	-
7 (6)	79/M	Anticoagulation factor	3-day drowsiness, confusion, decreased mobility, GSC 9/15	R- CSDH	-	The patient was treated 3 times with burr hole evacuation for recurrent CSDH. A subdural drain was left at the end of third surgery		1st surgery: GCS 9/15, 2nd: no motor or eye-opening responses, 3rd: spontaneous eye-opening, localising to pain			Hemorrhages within both cerebellar follia, frontal and parietal ICH	Conservative	Died
8 (7)	59/M	Hypertension	Headache, drowsiness	Bilateral CSDH	Patient supine with intra-operative rotation of the head to the left and to the right	Normal	Yes	4th day: consciousness deteriorated	1150 ml CSF were drained from both drains in 3 days	Elevation of blood pressure 2nd-3rd post-oper night	4th day: L-cerebellar hemorrhage, obstruction of 4th ventricle	External ventricular drainage	Complete recovery
Our case	43/M	None	Lethargy, drowsiness, headache, ataxia for 12 days	Chronic bifrontal SDH	Patient supine, without head rotation	Normal	Yes	Headache, dizziness, irritability, nausea 1 h postop	300 ml in 4 days	Normal	Bifrontal pneumocephalus, hemorrhage within both cerebellar follia	Conservative	Complete recovery

Nr: Number, Ref: Reference, M: man, F: female, R: right, L: left, Periop: perioperative, BP: blood pressure, Postop: postoperative, CSF: cerebrospinal fluid, CSDH: chronic subdural hematoma, SDH: subdural hematoma, "-": data were not available

following supratentorial burr hole drainage of CSDH is uncertain, but is suspected to be multifactorial. Firstly, a history of previous hypertension and transient hypertensive peaks during the recovery period have been considered to be important factors[1,8]. This idea is based on the fact that arterial hypertension is the most common cause of spontaneous cerebellar hemorrhage. However, only two out of nine patients (22%), reported in the literature (including ours), had a history of hypertension and in one out of them the preoperative blood pressure was consistently normal with antihypertensive drugs. Moreover all patients had perioperative normal blood pressure and only in two cases an elevation of blood pressure was reported postoperatively (Table 1). In our case, blood pressure remained within normal range perioperatively and postoperatively. Another major cause of spontaneous cerebellar hemorrhages is disturbed blood coagulation, which has been considered as well to be a relevant predisposing factor for postoperative cerebellar hemorrhages[9]. According to our literature review, only 3 out of 9 patients (33%) had disturbed blood coagulation. Another proposed mechanism for the development of RCH is that expansion of CSF spaces after surgical removal of CSDH increases mobility of the intracranial structures. Moreover, CSF overdrainage may lead to a downward displacement of the cerebellum. These above mentioned mechanisms may cause stretching and possible tearing of the superior vermian veins leading to RCH[8]. Furthermore, continuous CSF drainage, intraoperatively as well as postoperatively, could even increase the transtentorial pressure gradient leading to rupture of the small supracerebellar veins and capillary bed with venous bleeding as a consequence[1]. A massive air reflux into the cranial cavity through the drainage tube may pose an additional risk[8]. In our case, the postoperative CT-scan revealed bifrontal pneumocephalus which could be a predisposing factor.

Intra-operative positioning of the patient consists a matter of debate concerning this rare complication. It has been suggested that a head turn in combination with flexion or hyperextension of the neck will cause an obstruction of the venous flow, especially of the ipsilateral jugular vein[1]. Nevertheless, the majority of patients, who underwent burr hole drainage, were positioned supine without any rotation of the head at all during surgery and in only two cases[2,7], the patients were positioned with head rotation during surgery.

Treatment and prognosis

According to our review, in all cases the hematoma was treated conservatively until it was absorbed. However, in three out of seven cases an external ventricular drainage was administrated in order to relieve postoperative obstructive hydrocephalus syndrome due to the compression of the fourth ventricle from the cerebellar hemorrhage. Furthermore, the prognosis for 8 out of 9 patients with RCH after burr hole evacuation of chronic subdural hematoma was excellent, except one patient died after three burr hole evacuations for recurrent CSDH.

The mechanism of RCH in our case

In our case, a large amount of CSF was drained through the subdural drainage system (300 ml) and this progressive but massive loss of CSF may have caused downward displacement of the cerebellum spaces or increased mobility of the intracranial structures due to CSF expansion. Finally, the ingress of the air into the cranial cavity may have played an accessory role in the downward displacement of the cerebellum which in turn may have stretched the superior vermian veins and their tributaries, causing RCH. Taking into account all the above, we consider that cerebellar hemorrhage was a postoperative complication of burr hole drainage.

Conclusion

Although a rare complication, it is essential to be aware of the potential development of cerebellar hematoma after supratentorial surgery, even after minimally invasive surgery, such as drainage of a chronic subdural hematoma through burr holes. In order to prevent this complication, we suggest very slow drainage of CSDH during surgical evacuation but also low or no negative pressure in postoperative drainage systems and close neurosurgical examination.

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Conflict of interest: The authors declare that they have no conflict of interest.