Open Journal of
Clinical & Medical
Case Reports

Volume 6 (2020)
Issue 7

ISSN: 2379-1039

Remote cerebellar hemorrhage after supratentorial burr hole trepanation for subdural hematoma. Valsalva maneuver, an underestimated factor?

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Abstract

Introduction: Remote cerebellar hemorrhage (RCH) after burr-hole evacuation for chronic subdural hematoma is a rare and unusual complication of minor supratentorial surgery with few reports in the literature.

The exact mechanism remains unknown. In the literature, several factors are mentioned as a probable cause of RCH. However, the increase intracranial pressure during the Valsalva maneuver as a probable factor is not currently mentioned.

Case Presentation: An 84-year-old male patient is found unconscious in the street. He's known for high blood pressure under well-conducted treatment and aspirin for secondary prevention. The CT-scan shows a bilateral chronic and subacute subdural hematoma. It is drained by two fronto-parietal trepan holes on each side. No intraoperative complications occurred. At the end of the procedure, the blood pressure increases, and the patient performs several Valsalva maneuvers during extubation. The subgaleal parietal open drainage system is mistakenly placed at the foot of the patient's bed. The patient develops major neurological symptoms. The CT-scan shows cerebellar hemorrhage. The hospitalization is prolonged allowing the patient to recover and return home.

Conclusion: Remote cerebellar hemorrhages are a relatively benign, but extremely rare, complication of supratentorial surgery. The exact pathophysiology is not clear. The postoperative increase intracranial pressure (Valsalva maneuver) associated with an increase in blood pressure, pneumocephalus and drain positioning remain as the most prominent factors in our case.

Keywords

Remote cerebellar hemorrhage; neurosurgery; burr hole

Introduction

Although hematoma at operative site is not unusual in neurosurgery, spontaneous bleeding in the posterior fossa after supratentorial procedures is extremely rare. The incidence was reported a 0.08-0.6% [1]. Park et al reported remote hemorrhage after trephinations by burr hole for drainage chronic subdural hematoma is even rarer, with an incidence of 0,14% [2] and it can locate bilaterally (53.5%) as often as unilaterally (46.5%) [3]. The typical bleeding pattern in RCH it classically occurs in the sulci of superior surface (tentorial surface) of one or both cerebellar hemispheres giving the classic radiologic sign known as the Zebra sign [4].

Case Presentation

An 84-year-old male patient was admitted to our hospital after being found on the ground unconscious. A GCS 14, confusion, facial wounds (right eyebrow and nasal crest) and frostbite on the extremities of the upper limbs was the initial clinical state of the patient. A non-contrast CT scan of the brain revealed bilateral chronic and subacute subdural hematomas, no abnormality in the posterior fossa (Figure 1).

Hypertension was the only systemic disease, which was under control with only one antihypertensive drug. Also, the patient had Aspirine for preventive treatment. The physical and laboratory examinations were unremarkable. After preoperative evaluations, the patient underwent an operation of supratentoreal burr hole drainage of chronic and acute subdural hematoma through two burr holes on each side. Surgery was performed under general anesthesia with the patient in the spine position, without head rotation. Frontal and parietal burr holes were drilled on each side and the hematoma was slowly decompressed and the cavity filled with saline solution (NaCl 0,9%).

At the end of the operation, a subgaleal parietal open system drainage without negative pressure was placed on each side and fixed to the head side of the bed at the level of the patient's head. In our institute the system is passive, and the drainage rate is controlled by gravity. The awakening was marked by a poorly controlled blood pressure reaching values of 210 mmgH, and by vomiting reflex due to the presence of the endotracheal tube causing a repeated Valsalva.

The patient was restricted to bed rest in the spine supination and he was transferred in a continuing care unit to control the blood pressure. The sugaleal drainage aided 100 ml in total within the first six postoperative hours. On the first postoperative day, we found the drains mistaken placed at the foot of the patient's bed with in total 150 ml. We decided immediately to remove the system. The clinical course was good with the patient claiming minor headache and a little dizziness. A routine non-contrast CT scan of the brain revealed a large bilateral fronto-polar and fronto-orbital pneumcephalus. No cerebellar abnormality was observed (Figure 2).

On the fourth postoperative day, the patient developed a dysarthria, headache, vomit and balance disorder. A non-contrast CT scan of the brain revealed a cerebellar hemorrhage on the left side and

appearance of blood in the left occipital horn of the lateral ventricle and pneumocephalus. An MRI was also performed, showing the same distribution of blood without a clear source of bleeding (Figure 3).

During intensive observation the patient showed no neurological deterioration. The patient responded well and was transferred to a rehabilitation clinic 3 week after the operation.

At a routine follow up, non-contrast CT scan cerebral showed good postoperative conditions and in-time absorption of cerebellar haemorrhage (Figure 4), the neurological exam being unremarkable.

Discussion

Postoperative hemorrhage is one of the complications after burr-hole surgery.

Detecting the cause and real risk factors of RCH is difficult and there are many factors on the main point of debate. Many authors suggested some mechanisms to contribute to this remote cerebellar hemorrhage, including hypertension, cerebrospinal fluid overdrainage during or after surgery, occult arteriovenous malformation bleed, impared venous drainage due to extreme head rotation during patient positioning at surgery or deranged bleeding parameters [3-7].

We want to underline some factors as possible cause that we think is relevant.

The increase intracranial pressure during the Valsalva maneuver as a probable factor is not currently mentioned after supratentorial procedures. The Valsalva maneuver is described as the act of forced expiration against a closed glottis after a full inspiration. The physiological changes set into motion by this maneuver can be associated with a diverse range of neurological complications [12].

The increased intrathoracic pressure is transmitted to the venous circulation, resulting in significant increases in central venous pressure. Therefore, a retrograde venous pressure wave may also reach the vulnerable cerebral microcirculation [13]. An abrupt increase in blood pressure might origin an increased gradient between cerebrospinal fluid pressure and intravascular pressure, which can be responsible for serious neurological consequences such as fainting, rupture of intracranial aneurysms, and rebleeding following hemostasis [7,18].

Ungvari et al postulated that performing a Valsalva maneuver, may promote the development of multifocal cerebral microhemorrhages as well as trigger the emergence of larger, acutely symptomatic, intracerebral haemorrhage [10].

Carlson et al reported a case of a large cerebellar hemorrhage during trumpet playing and the Valsalva maneuver may have contributed to his risk of hemorrhage [11].

Brockmann et al reported intraoperative elevated systolic blood pressure and history of aspirin intake were found to be significant to contributing to RCH. Hypertension was noted in 33.1% of the patients with RCH [3].

The subgaleal instead than subdural placement of the drain did not have a negative impact on clinical or radiological outcome. The intention to place a subdural drain was associated with a higher rate of parenchymal injuries [14]. In our case, the open system drainage was mistaken placed at the foot of the patient's bed. Still, this has not increased the rate of drain. However, many authors described the drainage of large volumes of CSF by some mechanism in the peroperative period may lead to downward displacement cerebellum causing tearing of the superior cerebellar vein and tributaries [10]. Kelley and Johnson describe this phenomenon a "sinking brain syndrome" [11].

The open system drainage placed at the foot of the patient's bed possibly increase pneumocephalus. Yoshiba reported a substantial air reflux into cranial cavity though the drainage tube can be a predisposing factor [10].

The postoperative CT-scan revealed bifrontal pneumocephalus, which is common after brain surgery and may have played a role in the downward cerebellar displacement, which in turn may a transient kinking causing an infarct and hemorrhagic conversion [9]. Pneumocephalus can develop following Valsalva maneuver because there is egress of cerebrospinal fluid following a rise in intracranial pressure and the air is then pulled inside the cranium to equalize the intracranial pressure [17].

More than a few methods have been reported for reducing the occurrence of pneumocephalus, notably the hyperhydratation of the patient, supplemental breathing of 100% oxygen or bed rest for up to a week [16,17].

Conclusion

Even if a rare complication, it is necessary to be attentive of the possibility of cerebellar hemorrhage after supratentorial surgery, even with limited surgery such as burr hole drainage of a chronic subdural hematoma. The precise mechanism is unknown.

We advocate avoidance of Valsalva maneuver, because significant complications can occur in situations where the maneuver is vigorous or sustained, which associated with one or more factors known, can possibly promote the development of the RCH.

Figures

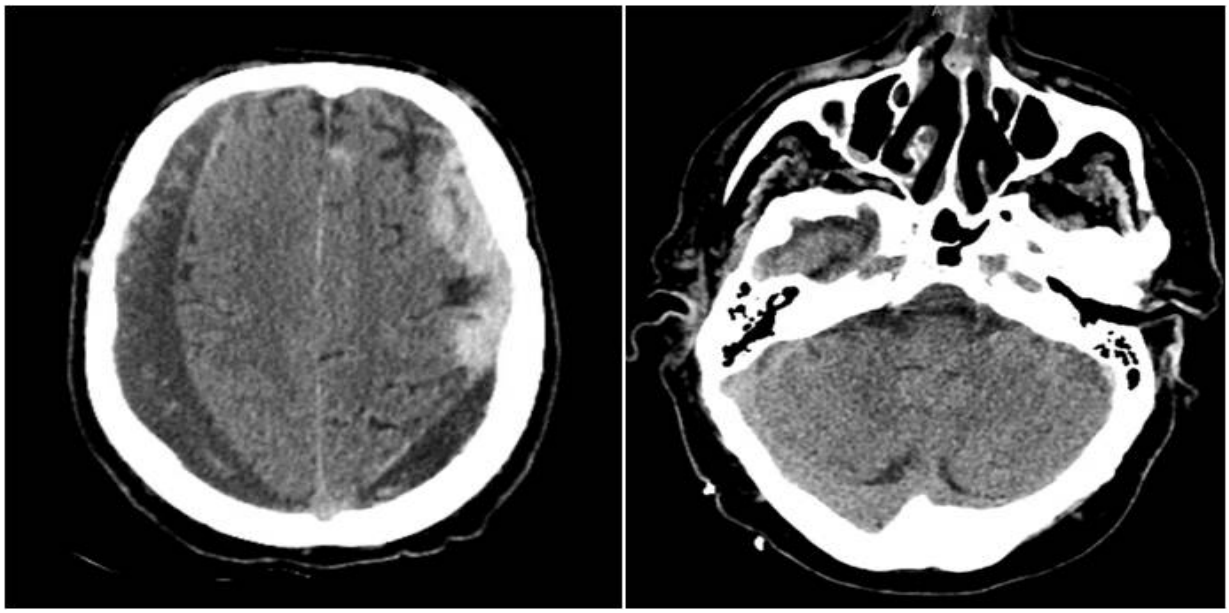

Figure 1: Preoperative axial non-contrast computed tomography scan showing a subdural hematomas of the two convexities of chronic gait with acute component this day measuring 18 mm. No engagement.
Foci of subarachnoid hemorrhage in left upper frontal furrows.
No cerebellar abnormality.

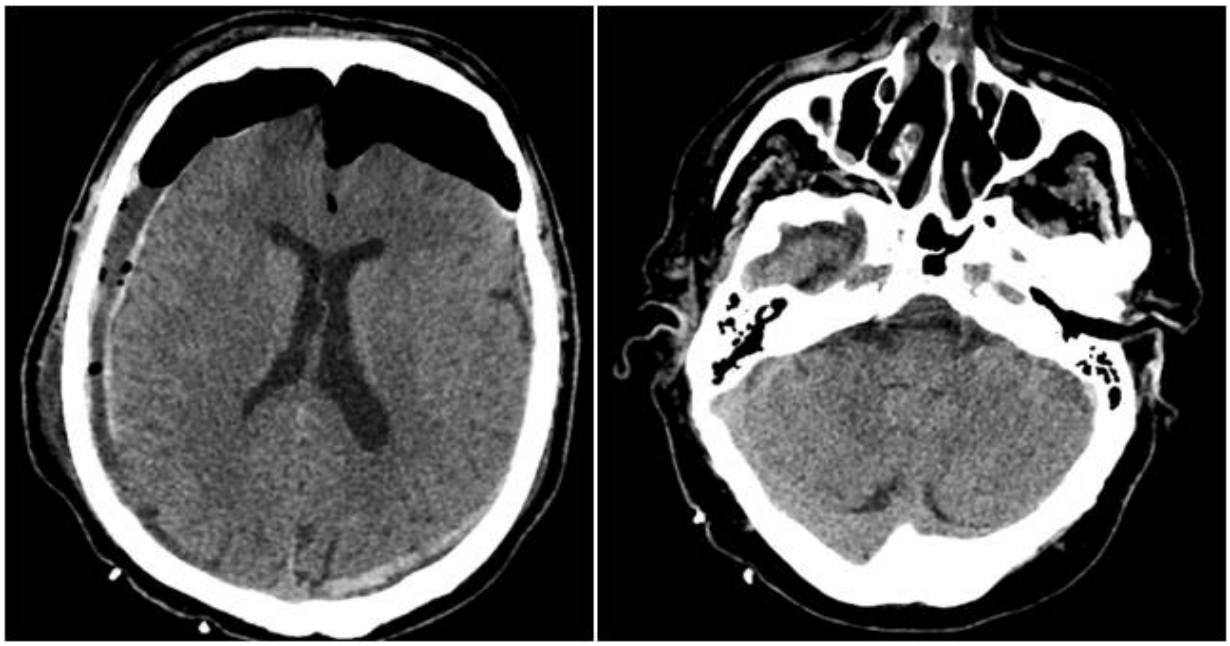

Figure 2: Axial and coronal non-contrast computed tomography scan of the brain after the fall of its height.
Regression of chronic subdural hematomas with acute component at posterior frontal and parietal right. However, appearance of a large bilateral fronto-polar and fronto-orbital pneumcephalus (reaching in their largest diameter 23 mm) and some pneumocranium bubbles at the level of the Sylvian valleys of the two sides.
No cerebellar abnormality was observed.

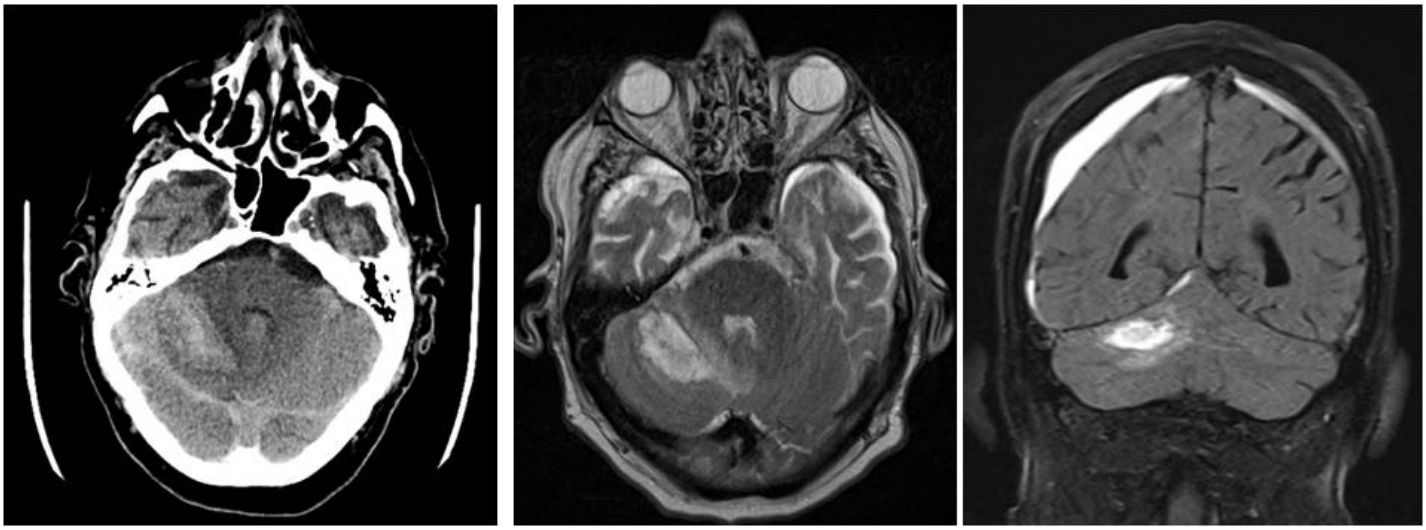

Figure 3: Postoperative axial non-contrast computed tomography scan and axial and coronal brain magnetic resonance imaging revealing Chronic subdural hematomas predominate on the right, extending to the tent of the cerebellum on the right and the tent of the brain on the left with a discrete mass effect on the cortex and the right lateral ventricle without deviation of the median line or hydrocephalus.
Hemisphere cerebellar hemorrhage compatible in context with cerebellar hemorrhage

Figure 4: Right cerebellar hemispheric hypodensity in relation to the normal course of intraparenchymal hemorrhage.

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Manuscript Information: Received: November 22, 2019; Accepted: April 08, 2020; Published: April 15, 2020

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Citation: Leite Arada D, Huscher K. Remote cerebellar hemorrhage after supratentorial burr hole trepanation for subdural hematoma. Valsalva maneuver, an underestimated factor?. Open J Clin Med Case Rep. 2020; 1651.