Technical Note & Surgical Technique

Contralateral development of acute subdural hematoma (SDH) immediately following a burr-hole craniostomy for chronic SDH

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1. Introduction

Chronic subdural hematoma (CSDH) is a very common entity of intracranial hemorrhages especially among the elderly [1]. Burr-hole craniostomy with closed-system drainage is widely utilized for CSDH, although no surgical technique of choice has reached the universal consensus. Various postoperative complications following burr-hole craniostomy have been discussed, including seizure, subdural empyema, intracerebral hemorrhage, etc. [2–3]. A total of four cases of contralateral development of acute SDH (ASDH) following a craniostomy for CSDH have been reported so far, but none of them occurred immediately after the surgery without concurrent hemorrhage. Hereby, we report the first case described in the literature where a mere ASDH developed in the contralateral hemisphere immediately after the burr-hole trephination for CSDH.

2. Case

An 84 year old male presented with moderate pancephalic headache that had lasted for three days. He had slipped and fallen hitting his head to the ground about one month before the visit. He had previously been healthy and his routine coagulation tests were normal. The initial brain computed tomography (CT) delineated CSDH in the right fronto-temporo-parietal region with the maximal thickness of 15 mm as well as minimal (6 mm) subdural hygroma in the left fronto-temporal region (Fig. 1A). A standard burr-hole trephination was performed under general anesthesia. Upon the opening of the dura, dark yellowish yet clear fluid was drained and a 12-French catheter was subdurally inserted. A total of 30 cm³ of clear fluid was drained until an immediate postoperative CT was taken, which was less than an hour after the surgery. The postoperative CT showed not only almost the same amount of CSDH on the right side, but also a new collection of acute hemorrhage in the left subdural space (Fig. 1B). The maximal thickness of the ASDH (11 mm) was greater than the previously measured subdural hygroma (6 mm), and yet no midline shift was seen. Neither deterioration of consciousness nor focal neurologic deficit was observed. Another CT on the
second postoperative day revealed near complete evacuation of CSDH on the right side as well as substantial resorption of ASDH on the left side (Fig. 1C). The patient was discharged without sequelae.

3. Discussion

Contralateral development of intracranial hemorrhages after surgical evacuation of initial hematoma is rare but not unprecedented [4–5]. By 2013, nine contralateral ASDH cases after initial craniotomy or craniectomy for ASDH had been reported; three of them were dead and the remaining six suffered moderate to severe disability [6]. Moon et al. reported a contralateral ASDH after removal of calcified CSDH in 2007, in which a craniotomy instead of burr-hole craniectomy preceded the complication [7]. Four cases of contralateral ASDH following a burr-hole craniotomy have been reported so far; one case where development of bilateral ASDH was detected on the date of the initial surgery [8], one with contralateral ASDH concurrent with intracerebral hemorrhage [9], and two cases of mere contralateral ASDH that occurred one and three days after the surgery, respectively [10–11]. Our present case is the first one described in the literature where a mere ASDH contralaterally developed on the same day of the initial burr-hole craniostomy for CSDH. Pathophysiology of this complication lacks sufficient investigation mainly due to the scarcity of cases. Several assumptions, however, could be borrowed from other adjacent entities.

3.1. Altered Cerebral Blood Flow (CBF) and fragile vessels

According to researches concerning CBF in CSDH patients, reduction of CBF was observed not only in the adjacent cortex, but also in the deeper structures including thalamus or even the contralateral hemisphere [12–13]. Several authors who reported postoperative intracerebral hematomas occurring remote from the initial craniotomy or craniectomy attributed their complication to possible sudden increase in CBF following the initial surgery [9,14–15]. Long term decrease of CBF might have contributed to fragile vessels, which may lead to intracerebral hemorrhage when CBF is restored during or after the evacuation. The thickness of bridging vein in subdural space remarkably vary and it can be as thin as 10μm, whereas that of vessels in subarachnoid space is fairly constant (50–200μm) [16]. One can assume that sudden increase of CBF in these fragile and thin bridging veins may be the cause of our present complication.

3.2. Systemic hyperactive fibrinolysis in CSDH patients

Kawakami et al. reported increased fibrinolytic activity in 19 patients, either from their chronic subdural hematoma or from venous blood [17]. Another study by Yamashita et al. investigated coagulation and fibrinolysis in 88 elderly patients (>65) who had experienced minor head injury, using 7 parameters including fibrinopeptide A, fibrinopeptide B, systemic blood and Aα plasmin inhibitor, plasmin-α2 plasmin inhibitor complex, fibrinogen, D-dimer, antithrombin-III in hematoma contents [18]. 61 of 88 patients were with CSDH and the remaining 27 were not. As anticipated, fibrinolysis in hematoma contents was increased and the majority of patients showed hyperfibrinolytic activity in their venous blood as well whether or not they had subdural hematoma. Although our present patient yielded normal results in his routine coagulation test, it is probable that his fibrinolysis had been hyper-activated prior to the surgery, which might have affected the development of a new hematoma.

3.3. Spinal Cerebrospinal Fluid (CSF) leak induced CSDH

CSDH has been addressed to as a rare complication of lumbar puncture, spontaneous intracranial hypotension, neurosurgical shunting procedures, spinal anesthesia, etc., which are related to CSF outflow [19–20]. In these studies, spinal outflow of CSF was suspected to cause sagging of brain that can lead to a tear of congested bridging veins [20]. According to another research concerning CSF leak and CSDH, seven (25.9%) of 27 patients with CSDH possessed CSF fistula proven by CT/MRI or myelography, while one and four patients had previous medication history of warfarin and aspirin, respectively [19]. Based on the premise that CSF outflow can be a predisposition to SDH, drain of yellowish yet clear fluid in our case during the first postoperative hour may account for the development of contralateral ASDH. It is probable that the clear fluid was not solely chronic hematoma, but a mixture of it with CSF that had entered into subdural space through torn arachnoid layer. Despite relatively small amount (30 cm3) of CSF mixed fluid drained, it may be sufficient to disrupt the homeostasis in CSF containing structures.

4. Conclusion

Burr hole craniostomy for CSDH, albeit a simple procedure, can be associated with various postoperative complications. Pathophysiology of each complication has not been fully elucidated, whereupon, excessive or too fast drain of CSDH must be avoided in order not to encounter any unexpected complications.

References


