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Case Report

Iatrogenic Acute Intracranial Hematoma Following Drainage Catheter Removal: A Report of 2 Cases and Literature Review

Chuan-Yuan Tao[1], Jia-Jing Wang[2], Qi Gan[1], Chao You[1]

[1]*Department of Neurosurgery, West China Hospital, Sichuan University, Sichuan, China*

[2]*Department of Neurosurgical ICU, West China Hospital, Sichuan University, Sichuan, China*

This paper describes 2 unique cases of catheter removal-induced intracranial hemorrhage (CRIH). Acute intracranial hematoma including extradural, subdural, and ventricular hemorrhage is a rare but dangerous complication during catheter removal. Its occurrence is usually iatrogenic. The clinical data of two patients of CRIH were retrospectively collected with a brief review of the phenomenon. A huge subdural hematoma was confirmed in the first case and severe ventricular hematoma in the second case immediately after removing intracranial drains. Emergent craniotomy identified the parietal branch of superficial temporal artery and choroid plexus as the separate source of bleeding. According to the literature review, only 4 cases in 2 reports were diagnosed with CRIH. CRIH should be borne in mind during the procedure of removing a catheter for drainage. The chance of CRIH may be lowered by vigilant manipulation in the processes of both catheter insertion and removal. Early detection and timely evacuation is essential for good recovery. The first case is another example of CRIH in subdural cavity. However, CRIH in ventricles may also occur as demonstrated in the second patient, which was never reported to our knowledge.

Key words: Drainage catheter – Iatrogenic – Intracranial hematoma – Postoperative complication

Insertion of a draining catheter into subgaleal, epidural, subdural spaces and sometimes surgical residual cavity is usually performed to prevent postoperative accumulation of fluid and hematoma.[1,2] External ventricular drainage (EVD) is also a common procedure to relieve acute hydrocephalus

Corresponding author: Chao You, MD, PhD, Department of Neurosurgery, West China Hospital, Sichuan University, 37 Guoxue Alley, Chengdu, Sichuan 610041, China.
Tel.: +8613402842965; Fax: +6802885422490; E-mail: tcy106@163.com

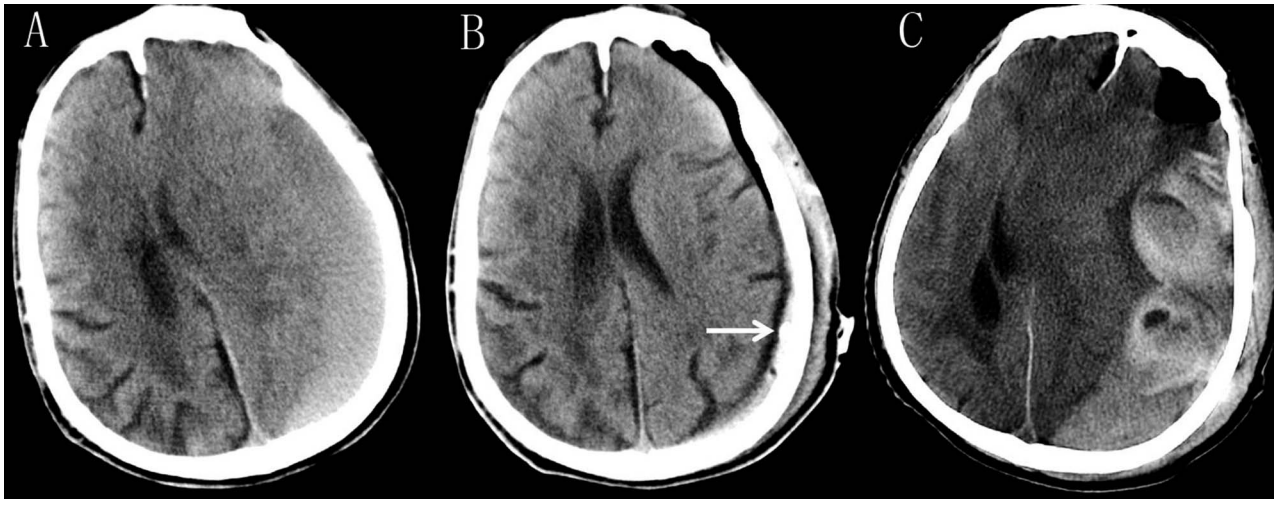

Fig. 1 (A) Axial CT imaging showing a thick subacute subdural hematoma in the left cerebral hemisphere. (B) Axial CT imaging showing the majority of the hematoma was removed after a burr hole drainage and a catheter was placed in the subdural cavity (arrow). (C) Axial CT imaging showing a massive fresh subdural hematoma with significant midline shift right after the catheter removal.

and monitor intracranial pressure.[3] In general, a catheter placement is safe with few serious complications.[3,4] However, an iatrogenic complication of acute intracranial hemorrhage induced by removal of a catheter is possible. We report on 2 patients who developed a rapid subdural hematoma and intraventricular hemorrhage immediately after removing a subdural and ventricular drain, respectively. The bleeding mechanisms were discussed according to different locations of hematoma with pertinent literature review.

Case Report

Case 1

An 80-year-old male presented with conscious disturbance and progressive hemiplegia of the right side for 1 month duration. Head computed tomography (CT) demonstrated a left-sided subacute subdural hematoma with obvious midline shift (Fig. 1A). He underwent a burr hole drainage of the hematoma. During operation, a catheter was put in the subdural space for continuous hematoma drainage and the drain was tunneled and secured to the frontal skin. On postoperative day 1, the patient was alert and could move his right extremities; CT revealed that majority of the hematoma was removed without mass effect (Fig. 1B).

Three days later, after the drainage catheter was pull out, the patient suffered massive hemorrhage from the puncture site of skin followed by persistent seizures and coma within 30 minutes and dilated pupil in 1 hour. A huge fresh subdural hematoma was observed on the repeated CT (Fig. 1C). We performed emergent hematoma evacuation via craniotomy. It was noted that bleeding origin was from the parietal branch of superficial temporal artery (STA) during operation. The patient remained comatose and died of pneumonia 1 month later.

Case 2

A 64-year-old hypertensive man manifested as sudden unconsciousness. CT revealed a right-sided thalamic hematoma rupturing into ventricles with obstructive hydrocephalus (Fig. 2A). Bilateral external ventricular drainage (EVD) was performed to facilitate the clearance of ventricular hemorrhage and relieve intracranial hypertension. During operation, a catheter with several holes on the side surface was inserted 5 centimeters in depth from dura to the frontal horn of each lateral ventricle. His conscious status recovered to normal after the procedures. Postoperative CT at day 1 exhibited no obvious change in hematoma volume (Fig. 2B). However, his condition deteriorated soon after removing the ventricular catheters without any suction 1 week later. He became unconscious again within 30 minutes. Re-hemorrhage was detected in the ventricles on the urgent CT (Fig. 2C and 2D). Hematoma was evacuated timely through the left frontal approach (Fig. 2E and 2F). An active bleeding from choroid plexus was identified during

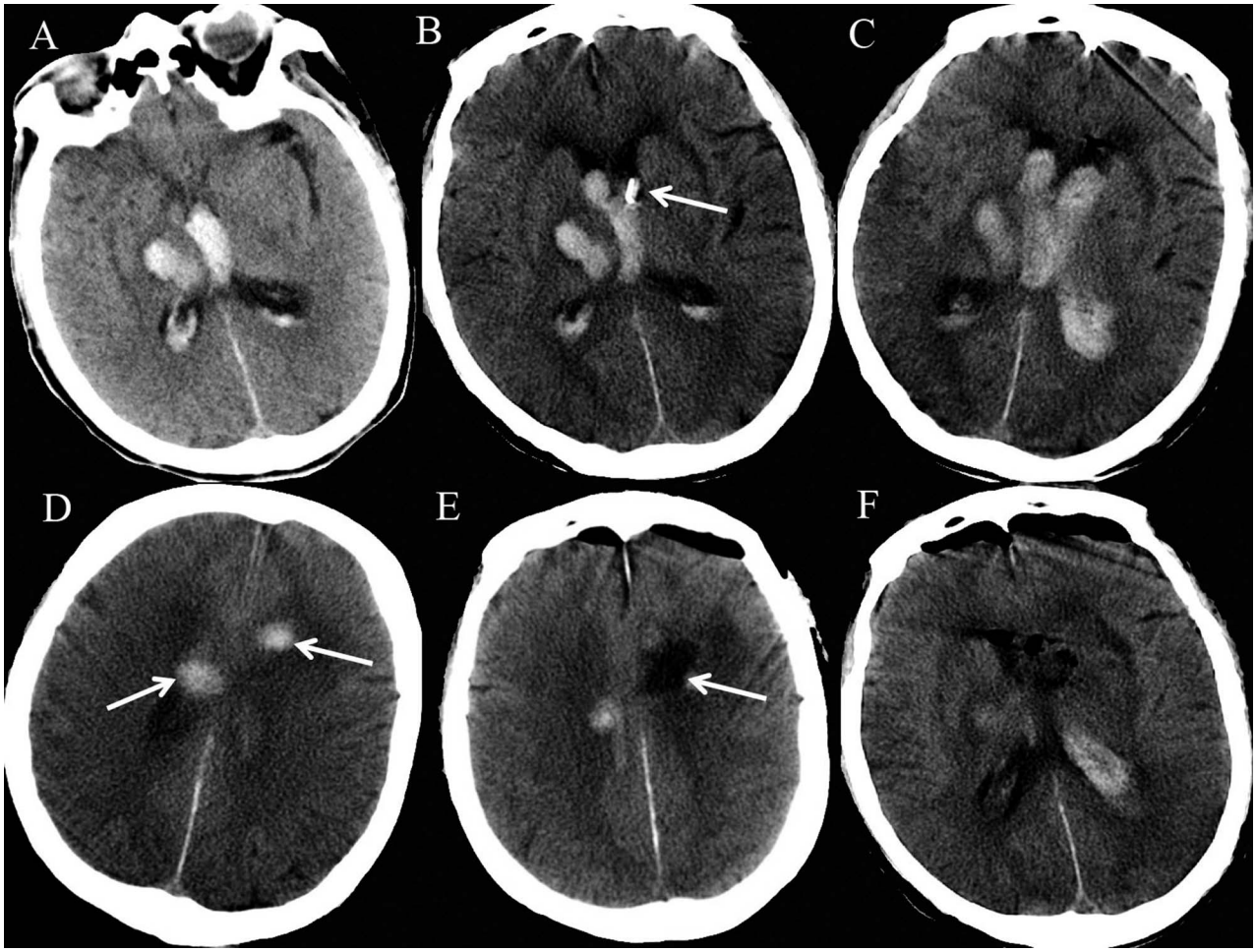

Fig. 2 (A) Axial CT imaging displaying right thalamic hematoma extending into lateral and third ventricles. (B) Axial CT imaging 1 day after EVD displaying the catheter tip was in the lateral ventricle (arrow). (C, D) Axial CT imaging displaying acute ventricular hemorrhage cast immediately after removing bilateral drains. The fresh hematoma was spreading along the trajectory tracts (arrows). (E, F) Axial CT imaging displaying a large part of the hematoma was removed via the left frontal transcortical approach (arrow).

surgery. The patient eventually died of multiple organ dysfunctions.

Discussion

Catheter removal induced hemorrhage (CRIH) is a possible postoperative complication but rarely documented in the literature; only 6 cases have been reported so far, including 2 cases in the present study.[2,5] All patients are male; with the exception of one patient, all were older than 60 years. The primary diagnosis consisted of subacute or chronic subdural hematoma in 3 cases, brain abscess, glioma, and ventricular hemorrhage secondary to thalamic hematoma in the remaining patients. Drainage catheter was placed in the subdural space in 3 patients, the subgaleal space in 2 patients and the lateral ventricle in 1 patient. Duration of drainage ranged from 18 hours to 7 days. The symptoms of CRIH involved headache, seizure, coma, and dilated pupil within 30 minutes to 2 hours. The source of bleeding identified on operation included scalp, superficial temporal artery, subdural membrane, and choroid plexus. Although all patients underwent hematoma evacuation by craniotomy, only 2 of them achieved complete recovery with 3 being dead and 1 in a vegetative state.

The mechanism of hemorrhaging is injury to artery of scalp, the underlying muscles, the subdural membrane, and choroid plexus. The primary surgery decreased the intracranial hypertension and created a potential extradural or subdural cavity. When a

drainage catheter is secured in the front of the scalp where the parietal branch of STA travels, the artery could be injured but compressed by the catheter, so bleeding into extradural/subdural cavity is temporarily stopped until the catheter is removed.[1] Meanwhile, in the setting of chronic subdural hematoma, vessels of hyperplasia in the visceral subdural membrane are possibly damaged by the catheter tip leading to subdural hematoma.[2] To our knowledge, acute intraventricular hemorrhage (IVH) caused by EVD removal has not been described previously in the literature, although the complication of immediate IVH due to choroid plexus injury is relatively common after removing a long-term ventricular catheter as a part of ventriculoperitoneal shunt device.[3] The tight adherence to choroid plexus because of initial ventricular hemorrhage may be responsible for the bleeding of our case.

To reduce the risk of hemorrhage during the removal of a drainage catheter, scalp arteries should be avoided when making the skin opening for the drain. Gentle manipulation with great care should also be exercised when removing a subdural or intraventricular catheter. Moreover, the patients should be under strict observation in the periprocedural period. Once there is much bleeding from the drain hole after removing the catheter, first, it is necessary to cut the sutures to find out whether the bleeding originates from the scalp artery or not. If a scalp artery is identified as the bleeding source, the bleeding could be stopped by prolonged press, or direct ligation after exploring the wound. However, if the bleeding is detected from intracranial cavity, simple skin hemostasis by compressing or stitching the wound is useless, sometimes even accelerates the formation of intracranial hematoma. In such circumstances, the wound should be covered by clean dressings loosely and the patient should be prepared for radiologic examination and possible reoperation without any hesitation.

CRIH should be considered in the case of rapid clinical deterioration and hemorrhage from the drain exit wound after a drainage catheter removal.[2] Urgent CT scan and following craniotomy should be performed as soon as possible, as any delay will cause unfavorable outcomes, even death.

Conclusions

CRIH is a rare but serious complication that should be considered during the procedure of removing a catheter for drainage. The chance of CRIH may be lowered by vigilant manipulation in the processes of both catheter insertion and removal. Early detection and evacuation is essential for good recovery.

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