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Case Report

A case of traumatic acute interhemispheric subdural hematoma due to injured dural branch of anterior cerebral artery

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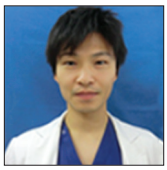

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Received : 05 March 2022
Accepted : 27 July 2022
Published : 12 August 2022

DOI
10.25259/SNI_232_2022

Quick Response Code:

ABSTRACT

Background: The precise causes of traumatic acute interhemispheric subdural hematoma (AISDH) are unclear in most cases, and there are few cases, where the sources of bleeding are directly confirmed intraoperatively. We report a rare case of traumatic AISDH, in which a damaged dural branch of anterior cerebral artery (ACA) to the cerebral falx was identified as the cause of bleeding during hematoma removal.

Case Description: A 61-year-old man with a history of craniotomy for the left putaminal hemorrhage at the age of 50 fell from a bed, bruised his head, and lost consciousness. Computed tomography of the head showed AISDH of 2.5cm in thickness, which was removed through a parietal parasagittal craniotomy under the microscope. Intraoperatively, the bleeding source was revealed to be a damaged dural branch from ACA to the cerebral falx. There was no rebleeding during his stay in our hospital.

Conclusion: In this case, intraoperative findings revealed that the cause of bleeding was a damage to the dural branch of ACA. A vascular study is mandatory to rule out a vascular malformation in similar cases.

Keywords: Acute interhemispheric subdural hematoma, Dural arteriovenous fistula, Dural branch of anterior cerebral artery, Falcine sinus, Falx syndrome

INTRODUCTION

Traumatic acute interhemispheric subdural hematoma (AISDH) rarely causes neurological deficits, requiring surgery.[1,3,4,5,7,8,9] A rupture of the bridging vein, anterior cerebral artery (ACA), its branches, and cerebral contusion have been reported as a possible cause of AISDH.[9] However, the precise causes of the hematoma formation are often unknown: the sources of bleeding cannot be directly confirmed during surgery in most cases. The authors report a rare case of traumatic AISDH, in which the cause of bleeding was identified to be a damage to the dural branch of ACA to the cerebral falx during surgery for hematoma removal.

CASE PRESENTATION

A 61-year-old man fell from a bed in a facility, bruised his head, and lost consciousness, being brought to our hospital. The patient had a history of craniotomy for the left putaminal

hemorrhage at the age of 50, which caused permanent motor aphasia and right hemiparesis (manual muscle test [MMT], 2/5). On admission, the patient was comatose associated with the left hemiplegia and was found to have a subcutaneous hematoma and abrasion on his right forehead. He had neither disorders of coagulation nor consumption of alcohol or anticoagulants. Computed tomography (CT) of the head showed AISDH of 2.5 cm in thickness and thin bilateral convexity subdural hematomas [Figure 1]. Because he was comatose and had left hemiplegia, hematoma removal through a parietal parasagittal craniotomy was performed under the microscope. Intraoperatively, there was neither brain contusion nor a rupture of the bridging vein found [Figure 2a]. As the hematoma was removed, arterial bleeding was seen arising from a branch of ACA [Figure 2b]. The vessel was torn and the other end was found to be continuous with the cerebral falx, from which arterial bleeding was also observed [Figure 2c]. Both ends of the vessel were very close together and coagulated to stop bleeding [Figure 2d]: thus, it was determined that the damage to the dural branch from ACA to the cerebral falx was the cause of the hemorrhage. Postoperative CT demonstrated that the AISDH was near totally removed [Figure 3]. His altered sensorium and left hemiplegia improved mildly, but the patient remained bedridden and quadriparetic. Therefore, further vascular examinations were not performed. There was no recurrent bleeding during his stay in our hospital. He was transferred to a long-term hospital with modified Rankin Scale 5 with motor aphasia and right hemiparesis (MMT, 2/5), which were sequelae that he had before the trauma, and left hemiparesis (MMT, 3/5) on the 44th postoperative day.

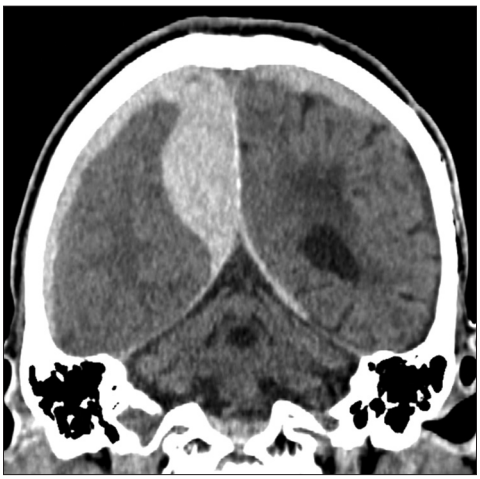

Figure 1: Coronal image of computed tomography (CT) on admission. CT shows acute interhemispheric subdural hematoma (AISDH) of 2.5 cm in the maximum thickness and thin bilateral convexity subdural hematoma.

DISCUSSION

Traumatic AISDH is not a rare condition. Elderly people with enlarged subdural space due to cerebral atrophy, excessive alcohol consumption, anticoagulant medication, and coagulopathy were reported to be risk factors for AISDH.[1,4] Léveillé *et al.*[5] reported that AISDH was found in 420 (35.5%) of 1182 cases of traumatic acute subdural hematoma. However, most of the cases consisted of only a small subdural hematoma in the interhemispheric fissure, which arose secondarily from other traumatic injuries such as acute subdural hematoma in the convexity, subarachnoid

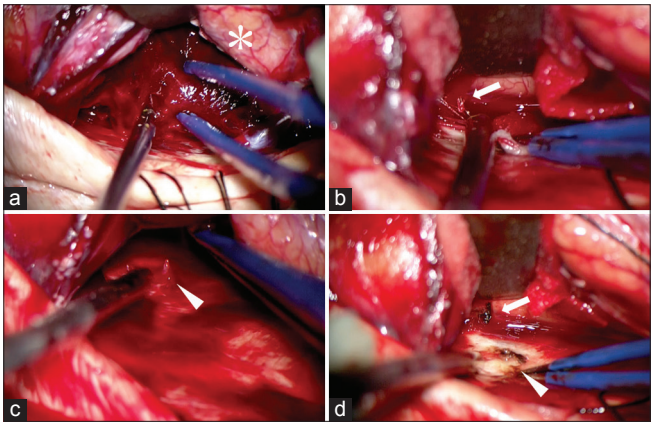

Figure 2: Intraoperative findings during removal of AISDH. Intraoperative findings show that there is neither brain contusion nor a rupture of the bridging vein (a). *Brain. As the hematoma is removed, arterial bleeding (*arrow*) is found from a branch of anterior cerebral artery (ACA) (b). The vessel is torn and the other end is found to be continuous with the cerebral falx from which arterial bleeding (*arrowhead)* is also observed (c). Both ends of the vessel are very close together and are coagulated to stop bleeding (torn ends of the ACA branch: *arrow*, brain side; *arrowhead*, falx side) (d).

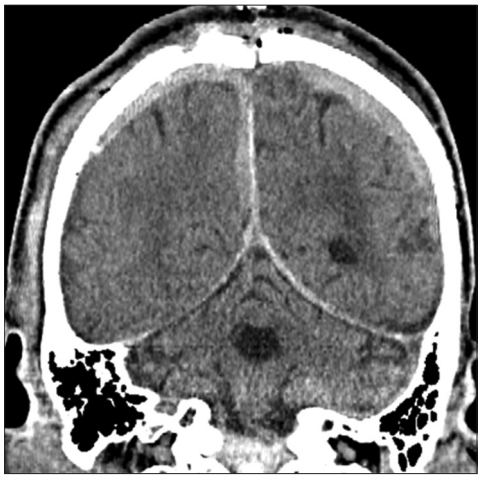

Figure 3: Coronal image of postoperative CT. AISDH is near totally removed.

hemorrhage, and cerebral contusion, and needed no surgery.[5] Wang *et al.*[9] also reported that surgery was infrequently required for AISDH and that surgical cases of AISDH were identified in only 21 (0.3%) out of 6840 cases of traumatic brain injury. In the present operative case of AISDH, subdural hematoma was found not only in the interhemispheric fissure but also in the convexity. Considering the distribution of the hematoma and the source of bleeding, it was thought that the hematoma originated from the interhemispheric fissure and spread to the convexity in our case.

While most of cases are asymptomatic and the prognosis is good, AISDH may cause falx syndrome such as contralateral hemiplegia with lower limb dominance, monoplegia of the contralateral lower limb, altered sensorium, gait disturbance, seizure/convulsion, and aphasia.[1,8,9] Tonetti *et al.*[8] reported these symptoms in 0.4% (25/9868) of all head trauma patients, with a poor prognosis and a mortality rate of 24–36%. Although surgical indications for AISDH have not been clearly defined, Wang *et al.*[9] considered the surgery for the following indications: (1) the progression of clinical symptoms and signs, especially exacerbation of lower extremity weakness; (2) paralysis of both lower extremities; (3) persistent increased intracranial pressure >30 mmHg; and (4) the hematoma volume >40 ml and/or the hematoma thickness >15 mm. In the present case, CT on admission showed 25 mm thick AISDH and the patient suffered from the left hemiplegia and impaired consciousness. Thus, he underwent emergency removal of the hematoma, resulting in persistent left hemiparesis, but improved altered sensorium.

As causes of AISDH, an injury to the cortical branch of ACA by cerebral falx, bridging vein injury, and cerebral contusion were reported: however, the source of bleeding was rarely found by surgery or imaging studies, and most were of unknown cause.[9] Wang *et al.*[9] reported 21 cases of AISDH, in which the cause of bleeding was surgically identified: (1) ACA branch injuries (ten cases, 47%); (2) vein injuries in the interhemispheric fissure (12 cases, 57%); (3) cerebral contusion along the interhemispheric fissure (six cases, 29%); and (4) bridging vein injuries around the superior sagittal sinus (one case, 5%).[9] In eight of the 21 cases, multiple causes were found: injuries of both ACA branch and veins in the interhemispheric fissure in seven cases (33%), and both cerebral contusion and bridging vein injuries in one case (5%).[9] Based on the intraoperative findings, the source of bleeding in the present case was determined to be an injury to the dural branch of ACA.

The cerebral falx is fed by the anterior falcine artery, which runs from the end of the anterior ethmoidal artery through the canalis orbitocranialis into the anterior cranial fossa, and then from the cerebral falx attachment at the tip of crista galli through the dura mater of the cerebral falx along the endocranial plate. Although the anterior falcine artery rarely branches off from the ophthalmic artery to the cerebral falx, there are no reports of ACA branching into the cerebral falx, except under special conditions such as the coexistence of dural arteriovenous fistulas (dAVFs) and meningiomas. It was reported that physiological arteriovenous shunts in the dura mater might become apparent under the influence of changes in intracranial pressure after surgery, leading to the development of an arteriovenous fistula.[2,6] The falcine sinus connecting the superior and inferior sagittal sinuses may be left behind during fetal life, and the dAVF in which the falcine sinus becomes a drainer is a falcine sinus dAVF.[10,11] In the present case, because a branch of ACA appeared to have flowed into the cerebral falx, it is the possibility that a dAVF such as a falcine sinus dAVF preexisted the AISDH: the craniotomy to remove the left putaminal hemorrhage might have caused changes in venous and intracranial pressure and have contributed to the development of the dAVF. In addition to underlying vascular malformation like a dAVF, other possible causes for the AISDH in our case are as follows: (1) A bridging vein might rupture during the fall to form AISDH, and the expansion of the AISDH could have stretched the ACA branch between the brain and the falx, resulting in its rupture, although no bridging vein injuries were found intraoperatively; and (2) the ACA branch could have iatrogenically ruptured during removal of the hematoma in the interhemispheric fissure, although hematoma removal was performed under the microscope to identify the source of bleeding and to avoid vascular injuries in this case. Surgery for AISDH should be done with the aid of an operating microscope, because the interhemispheric fissure is narrow, deep, and densely packed with arteries and veins. However, this case suggests that it is better to perform a vascular study to identify any underlying vascular malformation as the cause of bleeding before surgery if possible.

CONCLUSION

In the present case, intraoperative findings revealed that the cause of bleeding was a damaged dural branch of ACA. It was thought that a dAVF could have been formed after craniotomy or that the patient could have had a falcine sinus dAVF, although no vascular study was performed to identify it. Further, accumulation of similar cases is desirable.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Nakajima H, Tsuchiya T, Shimizu S, Suzuki H. A case of traumatic acute interhemispheric subdural hematoma due to injured dural branch of anterior cerebral artery. Surg Neurol Int 2022;13:355.