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Case Report

Delayed acute subdural hematoma treated with endoscopic procedure: A case report

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ABSTRACT

Background: Delayed acute subdural hematoma (DASDH) is defined as late onset ASDH with the absence of any abnormal radiological and clinical findings at initial examination. Moreover, this entity is very rare in traumatic brain injury and its mechanism is still unclear. Recently, endoscopic surgery for ASDH has also been performed. In this case, we describe some considerations of the mechanism of DASDH and review previous literature and usefulness of endoscopic surgical procedure for ASDH.

Case Description: A 73-year-old man fell at night, and visited a former medical institution by himself. No abnormal neurological finding was detected. Head computed tomography (CT) detected no abnormal finding. He was diagnosed minor head injury and was hospitalized at midnight and discharged after brain magnetic resonance image (MRI) next day. Brain MRI also detected no abnormal findings. Three days later, he visited our hospital himself, because of the severe headache. Neurologically, he had a mild consciousness disturbance and head CT revealed left ASDH. We performed endoscopic evacuation of hematoma under local anesthesia. Then, the clot was evacuated under the endoscopic procedure through dilated burr hole and pulsatile bleeding from the cortical artery was observed, which was considered to be the source of the ASDH. The patient's consciousness disturbance was improved immediately after surgery and he discharged without neurological deficit.

Conclusion: We revealed the source of bleeding of DASDH under endoscopic procedure and described hypothesis and speculation of its cause in our case. DASDH is rare entity, so we need further experiences and more considerations.

Keywords: Bleeding source, Delayed acute subdural hematoma, Endoscopic procedure, Mechanism of bleeding

INTRODUCTION

Acute subdural hematoma (ASDH) is well known as a severe prognostic factor of head trauma that requires an emergency surgical treatment.[6,19]

We often experienced cases that have increased hematoma during the course and require additional treatment. Moreover, the standard treatment for ASDH is large craniotomy and decompressive craniectomy to prevent secondary brain damage.

Delayed ASDH (DASDH) is very rare concept that defined as late onset ASDH with the absence of any abnormal radiological and clinical findings at initial examination.[4,5] Moreover, the mechanism of DASDH is still unclear.

In this report, we detected a cause of DASDH, during endoscopic surgical procedure and describe some considerations of the mechanism of DASDH, surgical procedure, and review previous literature.

CASE REPORT

A 73-year-old man fell while walking to get to the bathroom late at night and was injured his head, and visited a former medical institution by himself.

His consciousness was clear (Glasgow Coma Scale: GCS E4V5M6) and there were no abnormal neurological findings including loss of consciousness or amnesia. Head computed tomography (CT) was performed and detected no abnormal finding [Figure 1]. He was diagnosed minor head injury and was hospitalized at midnight and discharged after brain magnetic resonance image (MRI) next day. Brain MRI also detected no abnormal findings as the previous head CT [Figure 2].

Three days later, he visited our hospital himself, because of the severe headache. Neurologically, he had a mild consciousness disturbance (GCS E4V4M6) and head CT revealed left ASDH with mass effect [Figure 3]. As ASDH existed without cerebral contusion and acute brain swelling, we performed endoscopic evacuation of hematoma under local anesthesia with dexmedetomidine. After the skin was incised, we used a perforator attachment (Integra Life Sciences, disposable perforator diameter: 14 mm, Plainsboro, New Jersey, USA) with a cordless handle to make a burr hole. After perforation, the tip was exchanged from perforator to dilator attachment which we developed (S & B Corporation, Chiba, Japan), and the burr hole was extended to 25 × 30 mm. A rigid scope with a tip angle of 0 or 30° (KARL-STORZ, Tuttlingen, Germany) clearly showed a residual dark red clot. The clot was evacuated using a suction tube and was irrigated with artificial cerebrospinal fluid (Otsuka Pharmaceutical, Tokushima, Japan). Then, the clot was evacuated under the endoscopic procedure through dilated burr hole and pulsatile bleeding from the cortical artery was observed, which was considered to be the source of the ASDH [Video 1]. No other obvious arterial or venous bleeding was observed. Hemostasis was performed using suction-monopolar coagulator (Covidien, Massachusetts, USA), [Video 1]. Postoperative CT and MRI revealed no re-bleeding and indicated the bleeding point [Figure 4]. The patient's consciousness disturbance was improved immediately after surgery. He stayed 10 days in our hospital and was discharged without neurological deficit.

DISCUSSION

There is an approximately 1% risk of life-threatening, intracranial hemorrhagic events that needs immediate neurosurgical operation both in adults and children of mild traumatic brain injury (mTBI).[18] Hence, accurate diagnosis and evaluation of these patients are important to reduce mortality and morbidity. DASDH is rare clinical entity, which is defined as late onset ASDH with the absence of any abnormal radiological and clinical findings at initial examination.[1,2,7,8,13,15-17]

Patients have risk factors, such as coagulation disorder, taking anticoagulants or antiplatelets, alcoholism, deranged liver function, and chronic illnesses, such as diabetes mellitus, hypertension, and underlying cardiac disease. Especially elderly patients, increasing oral antiplatelet or anticoagulation have been shown to be associated with higher risk of intracranial bleeding after head injury.

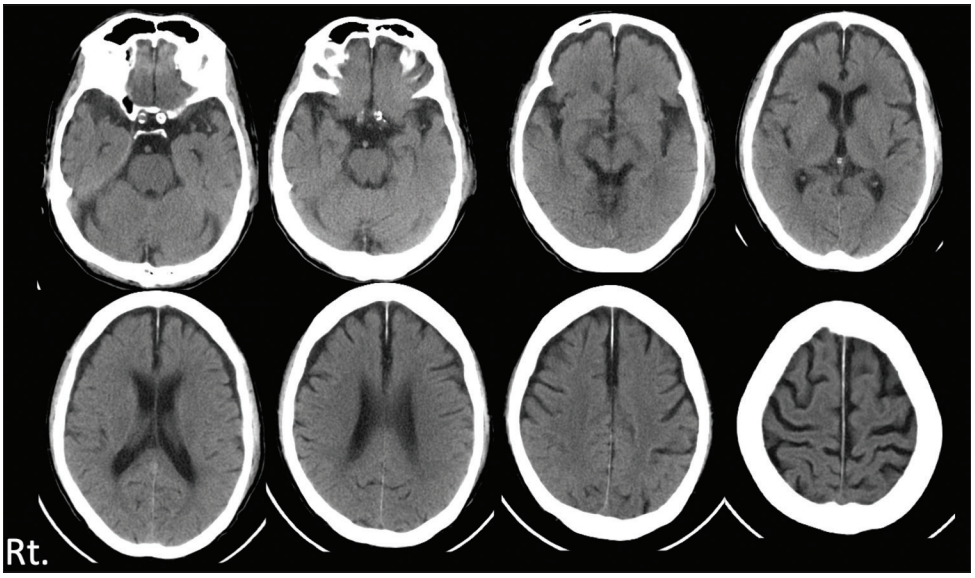

Figure 1: Initial head computed tomography revealed no hemorrhagic findings.

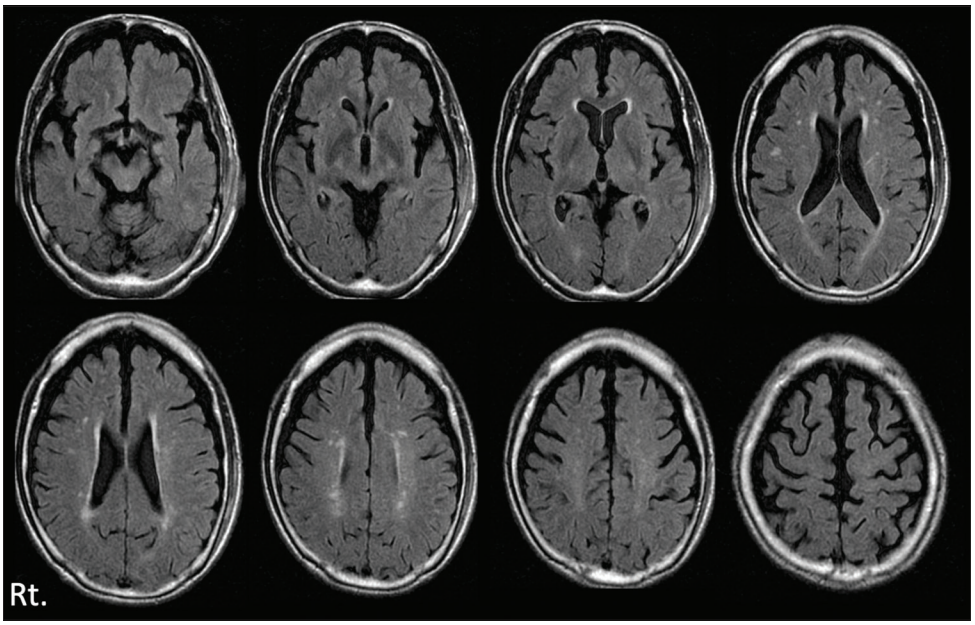

Figure 2: Brain magnetic resonance imaging (FLAIR) on day 2 after head injury, it revealed no hemorrhagic lesions including contusion.

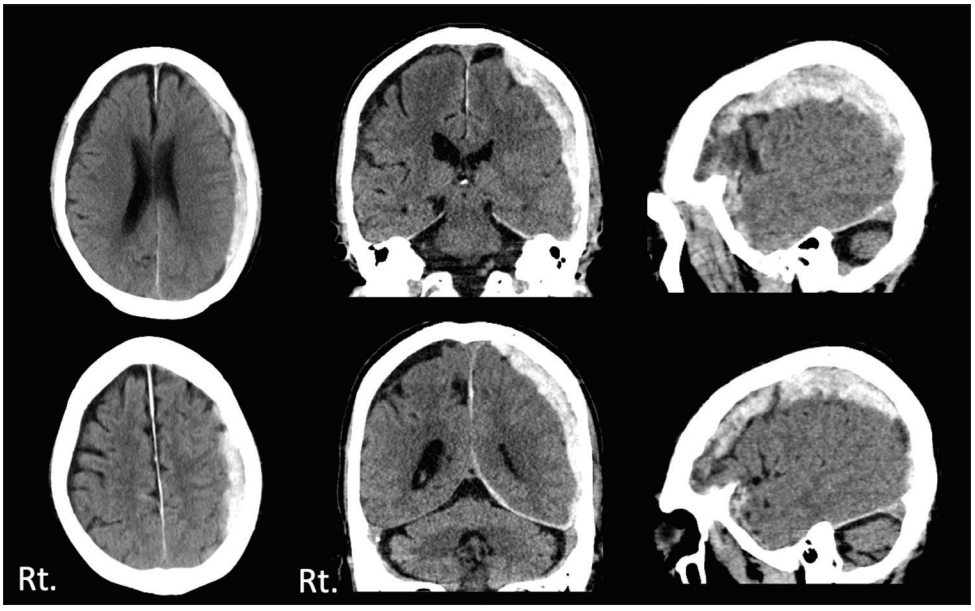

Figure 3: Head computed tomography on day 3 after head injury; it was appeared that left acute subdural hematoma with mass effect.

Especially elderly patients, increasing oral antiplatelet or anticoagulation have been shown to be associated with higher risk of intracranial bleeding after head injury.

In our review, there are 13 cases (including our case) of DASDH after posttraumatic injury [Table 1].[1,2,7,8,13,15-17] Although, the age ranged from 18 to 86 year old (median: 65 year old), nine patients (69.2%) were over 60 years old.

Moreover, these nine patients were administered antiplatelet and/or anticoagulant therapy [Table 1]. It is suggested that age, anticoagulation, and antiplatelet therapy are thought to promote late onset bleeding, such as DASDH.

In all cases were diagnosed mTBI which GCS 14–15 at the initial evaluation. And their neurological symptoms were deteriorated between 3 and 72 h in our review. When the symptoms worsen, the GCS score is 8 or less, and the prognosis is very poor [Table 1].

The mechanism of DASDH is still unclear. As described by Zervas *et al.*, the cerebral blood vessels are devoid of vasa vasorum.[21] The cerebral vessels contain a rete vasorum in the adventitia that is permeable to large proteins and is in continuity with the subarachnoid space. This substructure may be analogous to the systemic vasa vasorum and may

Table 1: Characteristics of patients with delayed acute subdural hematoma.

	Age/Sex	Antiplatelet/ anticoagulant	Initial GCS	Repeat GCS	Repeat CT from 1st CT	Intervention and outcome
Itshayek *et al.* 2006	86/M	LMWH, aspirin	15	4	3 days	Decompressive craniotomy, dead on POD6
	69/M	Warfarin	15	9	12 h	Decompressive craniotomy, dead 3months after operation
	65/W	Warfarin	15	7	24 h	Decompressive craniotomy, living
	72/W	Warfarin	15	15	24 h	Conservation, living
Matsuda *et al.*, 2008	18/M	-	15	15	2 days	Conservation, living
Engelen *et al.*, 2009	57/M	Warfarin	15	9	12 h	Decompressive craniotomy, living
Peck *et al.*, 2011	86/M	Warfarin/Aspirin	15	15	12 h	Conservation, living
Nishijima *et al.*. 2012	63/W	Warfarin	15	3	3 days	Conservation dead on hospital day 1
Borders *et al.*., 2012	19/W	-	14	4	24 h	Decompressive craniotomy, living
Arai *et al.*., 2016	63/M	Unfractionated heparin	15	3	1 h	Decompressive craniotomy, living
Shabani *et al.*. 2016	75/W	Aspirin	15	6	23 h	Decompressive craniotomy, dead POD1
Hong *et al.*., 2018	54/M	-	15	15	8 h	Removal of hematoma, living
Our case	73/M	aspirin	15	14	3 days	Endoscopic evacuation of hematoma, living

GCS: Glasgow Coma Scale, M: Man, LMWH: Low-molecular-weighted heparin, POD: Postoperative day, W: Woman

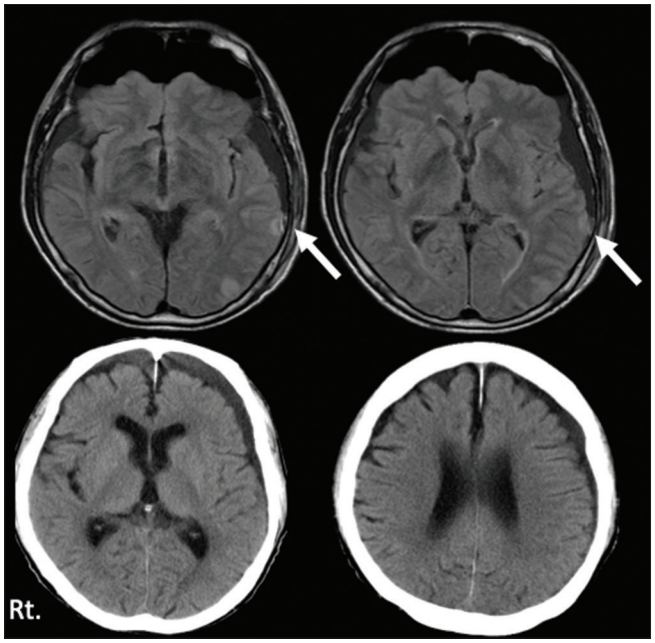

Figure 4: Postoperative images. Upper: Brain magnetic resonance imaging (FLAIR) showed hemostatic scar by monopolar coagulator (white arrow). Lower: Head computed tomography: Hematoma has been evacuated.

contribute to the nutrition of the cerebral blood vessels. It can be suggested here that injury to this rete vasorum may cause hypoxic injury to the vessel wall, leading to degeneration, and disruption of the vessel wall. The other hypothesis proposed was spontaneous vascular rupture, resulting from progressive vascular degeneration, the local metabolites causing vascular wall injury, vasoparalysis resulting from local hypoxia, and increased intracranial pressure causing venous congestion produced by Valsalva effect.

In our case, it was presumed that slight damage to the vessel wall occurred first, and then delayed disruption of the vessel occurred due to failure of rete vasorum. We speculated that the antiplatelet might have contributed to delayed bleeding. To confirm this phenomenon, we need to accumulate more cases and further evaluation. Arterial or venous bleeding as a source of ASDH is often seen in craniotomy. However, this is the first report to describe the bleeding point of DASDH and get hemostasis under endoscopic procedure.

Although, the usefulness of endoscopic surgery as a minimally invasive surgery for subdural hematoma in elderly and also young patients have been reported recently,[3,10,12,14,20] there is no report mention that the intraoperative findings of endoscopic surgery applied for DASDH.

The indication and contraindication of endoscopic surgery for SDH have been reported.[18,20] Our case was performed endoscopic surgery followed the indication of the elderly patient described Yokosuka *et al*.,[20] and Karakhan *et al*.[9]

The development of useful equipment is important. When making a burr hole as an endoscopic surgical corridor for intracranial hemorrhagic lesions, such as a subdural hematoma, it is necessary to make one with enough size. We developed a novel instrument in the form of a dilator attachment with a cordless handle, making it simple, and safe to extend a burr hole after perforation.[11]

Yokosuka created an irrigation suction cannula with a malleable nozzle to improve procedures in the subdural

space.[20] We also used malleable suction to retract the brain surface using a curved section of a suction cannula. This technique is very effective to evacuate the clot and manage hemostasis with insertion of some surgical instruments, even if mild brain swelling has occurred.[12]

Fortunately, our case had no remarkable brain swelling or massive bleeding during surgery; we were able to accomplish the endoscopic procedure with no trouble.

There are no reports that have been made regarding the source of bleeding of DASDH, and it is difficult to explain the mechanism clearly in this case, but this is the first report in which this case was clearly confirmed the source of DASDH during surgery with especially endoscopic procedure.

CONCLUSION

We report a case of DASDH and hypothesis of its pathogenesis based on findings of endoscopic surgical procedure. DASDH is rare entity, so we need further experiences and more considerations.

Declaration of patient consent

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

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Arai N, Nakamura A, Tabuse M, Miyazaki H. Delayed acute subdural hematoma associated with percutaneous coronary intervention. J Cranniofac Surg 2016;27:514-6.
2. Bordes J, Goutorbe P, Lacroix G, Prunet B, Asencio Y, Kaiser E. A case of massive delayed acute subdural hematoma. J Emerg Med 2012;42:459-60.
3. Codd PJ, Venteicher AS, Agarwalla PK, Kahle KT, Jho DH. Endoscopic burr hole evacuation of an acute subdural hematoma. J Clin Neurosci 2013;20:1751-3.
4. Diaz FG, Yock DH, Larson D, Rockswold GL. Early diagnosis of delayed posttraumatic intracerebral hematomas. J Neurosurg 1979;50:217-23.
5. Engelen M, Nederkoorn PJ, Smits M, Van De Beek D. Delayed life-threatening subdural hematoma after minor head injury in a patient with severe coagulopathy: A case report. Cases J 2009;2:7587.
6. Haselsberger K, Pucher R, Auer LM. Prognosis after acute subdural or epidural haemorrhage. Acta Neurochir (Wien) 1998;90:111-6.
7. Hong SO, Kang DS, Kong MH, Jang SY, Kim JH, Song KY. Development of delayed acute subdural hematoma after mild traumatic brain injury: A case report. Korean J Neurotrauma 2018;14:24-7.
8. Itshayek E, Rosenthal G, Fraifeld S, Perez-Sanchez X, Cohen JE, Spektor S. Delayed posttraumatic acute subdural hematoma in elderly patients on anticoagulation. Neurosurgery 2006;58:851-6.
9. Karakhan VB, Khodnevich AA. Endoscopic surgery of traumatic intracranial haemorrhages. Acta Neurochir Suppl 1994;61:84-91.
10. Kon H, Saito A, Uchida H, Inoue M, Sasaki T, Nishijima M. Endoscopic surgery for traumatic acute subdural hematoma. Case Rep Neurol 2013;5:208-13.
11. Kuge A, Kondo R, Sato S, Mitobe Y, Saito S, Sonoda Y. Novel burr hole dilator for endoscopic surgery for intracranial hemorrhagic lesion: Technical note. World Neurosurg 2019;128:295-8.
12. Kuge A, Tsuchiya D, Watanabe S, Sato M, Kinjo T. Endoscopic hematoma evacuation for acute subdural hematoma in a young patient: A case report. Acute Med Surg 2017;4:451-3.
13. Matsuda W, Sugimoto K, Sato N, Watanabe T, Fujimoto A, Matsumura A. Delayed onset of posttraumatic acute subdural hematoma after mild head injury with normal computed tomography: A case report and brief review. J Trauma 2008;65:461-3.
14. Miki K, Yoshioka T, Hirata Y, Enomoto T, Takagi T, Tsugu H, *et al*. Surgical outcome of acute and subacute subdural hematoma with endoscopic surgery. No Shinkei Geka 2016;44:455-62.
15. Nishijima DK, Offerman SR, Ballard DW, Vinson DR, Chettipally UK, Rauchwerger AS, *et al*. Immediate and delayed traumatic intracranial hemorrhage in patients with head trauma and preinjury warfarin or clopidogrel use. Ann Emerg Med 2012;59:460-8.
16. Peck KA, Sise CB, Shackford SR, Sise MJ, Calvo RY, Sak DI, *et al*. Delayed intracranial hemorrhage after blunt trauma: Are patients on preinjury anticoagulants and prescription antiplatelet agents at risk? J Trauma 2011;71:600-4.
17. Shabani S, Nguyen HS, Doan N, Baisden JL. Case report and review of literature of delayed acute subdural hematoma. World Neurosurg 2016;96:66-71.
18. Vos PE, Alekseenko Y, Battistin L, Ehler E, Gerstenbrand F, Muresanu DF, *et al*. Mild traumatic brain injury. Eur J Neurol 2012;19:191-8.
19. Wilberger JE, Harris M, Diamond DL. Acute subdural hematoma: Morbidity, mortality, and operative timing. J. Neurosurg 1991;74:212-8.
20. Yokosuka K, Uno M, Matsumura K, Takai H, Hagino H, Matsushita N, *et al*. Endoscopic hematoma evacuation for acute and subacute subdural hematoma in elderly patients. J. Neurosurg 2015;123:1065-9.
21. Zervas NT, Liszczak TM, Mayberg MR, Black PM. Cerebrospinal fluid may nourish cerebral vessels through pathways in the adventitia that may be analogous to systemic vasa vasorum. J Neurosurg 1982;56:475-81.

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