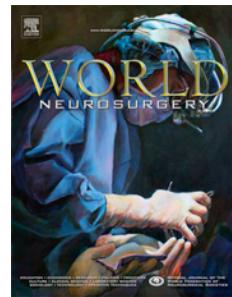


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Usefulness of embolization for iatrogenic dural arteriovenous fistula associated with recurrent chronic subdural hematoma: A case report and literature review

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Keywords: Dural arteriovenous fistula, embolization, subdural hematoma, n-butyl cyanoacrylate (NBCA)

Abbreviations: dAVF, Dural arteriovenous fistula; DSA, digital subtraction angiography; NBCA, n-butyl cyanoacrylate; MMA, middle meningeal artery; SDH, subdural hematoma

Conflicts of interest: None.

ABSTRACT

BACKGROUND: Refractory Chronic subdural hematomas due to iatrogenic dural AVF are difficult to treat. We report our experience and propose a guideline on basis of literature review for usefulness of embolization of middle meningeal artery (MMA) for the treatment of the same.

CASE DESCRIPTION: We report the case with right hemiparesis and aphasia 1 month after fall from bicycle. CT scan head showed left CSDH which was evacuated by burr hole and drainage. The post operative course was complicated by re-accumulation within short period of time. On superselective DSA of MMA iatrogenic dAVF found on left side. We successfully embolized it using NBCA following third irrigation. No re-accumulation found in post operative period till last follow up. We propose treatment protocol based on our experience and literature review.

CONCLUSION: Refractory CSDH with re-accumulation with in short interval should be subjected to DSA of MMA. Embolization of ipsilateral MMA is safe, effective and useful option for the iatrogenic dAVF treatment and for resolution of hematoma.

INTRODUCTION

Chronic subdural hematoma (CSDH) is relatively common condition in neurosurgery, especially in old age group on anticoagulants. Burr hole drainage and evacuation of hematoma is perhaps widely accepted management for symptomatic CSDH. Recurrence of CSDH has many etiologies. Iatrogenic Dural arteriovenous fistula (dAVF) is rare cause of refractory CSDH. We report our experience and propose a guideline on basis of literature review for usefulness of embolization of middle meningeal artery (MMA) for the treatment of the same.

CASE REPORT

A 82 years old female patient presented with right hemiparesis and dysarthria. She had history of minor head trauma in form of fall from bicycle before one month. She was already diagnosed case of Alzheimer's diseases on medications, apart from that no significant medical history, especially anti thrombotic drugs. On evaluation with head CT left side CSDH diagnosed (figure 1a). The CSDH measured approximately 2 cm in maximum thickness. The patient underwent burr-hole drainage of the SDH. On 1st post operative day head CT scan revealed improvement(figure 1b). The recovery was uneventful until 3 weeks postoperatively when she noted reappearance of symptoms. A head CT scan demonstrated recurrence of SDH(figure 2a). The patient was re-operated with burr hole drainage of hematoma with subdural drain placement for 48 hours. A 1st postoperative day head

CT scan showed improvement (figure 2b). The patient did well postoperatively for 1 month, then again deterioration of symptoms noted. A head CT scan revealed re-accumulation of the SDH(figure 2c). On evaluating clotting parameters like plasma thromboplastin, partial thromboplastin time, platelet count, factor VIII, fibrinogen, and fibrin-split products, were all normal. Digital subtraction angiography (DSA) was performed to rule out an occult vascular malformation leading to repeated accumulations (figure 3a). Selective left middle meningeal artery injections revealed dAVF just inferior to the burr hole with cotton wool like staining surrounding the burr hole. Because of further recurrence within the month, a third burr hole irrigation with subdural drain placement was performed. Subsequently, embolization of the MMA was scheduled.

Embolization procedure

A 6F guiding catheter was inserted from the right femoral artery and placed in the left external carotid artery. A microcatheter (Marathon, Medtronic, Minneapolis, USA) with micro guidewire (Chikai 10, Asahi intecc, Aichi, Japan) was advanced into the parietal branch of the left MMA. Subsequent angiography confirmed DSA findings of cotton wool-like staining surrounding burr hole with parietal branch of left MMA as feeder and draining veins at inferior end of the burr hole (figure 3b). Fourteen per cent NBCA (Histoacryl; B. Braun, Melsungen, Germany) was prepared with pure NBCA and lipiodol (Lipiodol Ultra-Fluide®, Guerbet, Roissy, France) in 1:6 proportion, was injected after confirmation of the negative result of a provocative test with 1% lidocaine injection.

The frontal branch was also embolized with 14% NBCA in a similar procedure (figure 3c).

Post procedure course

The hematoma started to decrease in size 1 week after embolization and disappeared in 3 months (figure 4). No recurrence has been observed since then.

DISCUSSION

Chronic subdural hematoma (CSDH) is relatively common condition in neurosurgery, especially in old age group on anticoagulants. The treatment comprises mainly 1 or 2 burr hole irrigation, usually with satisfactory outcome. However, in elderly patients, patients with cerebral atrophy, blood coagulation disorders, and patients on oral antiplatelet/anticoagulant drugs, resolution may not be achieved even after several rounds of surgery, and CSDH is sometimes difficult to treat.¹ There are many etiologies for the recurrence like chronic alcoholism, cerebral atrophy, hepatic dysfunction, use of oral anticoagulant drugs, hemodialysis, blood coagulation disorder, shunt surgery, post operative infection and rarely dAVF.^{1,2,3}

Trivial trauma is most common cause of CSDH in elderly patients, leading to rupture of bridging vein and accumulation of blood products mixed CSF between two layers of dura. Recurrent bleed in outer membrane capillaries thought to be cause of enlargement of CSDH. Histologically the outer membrane and dura mater have capillary like communicating vessels, which penetrate through the

dura mater and connect to MMA.⁴ These can be seen as cotton wool like staining or visualization of scattered abnormal vascular network using Superselective DSA of MMA. In refractory recurrent cases DSA shows diffuse dilatation of MMA near CSDH membrane and burr hole.^{5,6} Overall these evidences support role of embolization of the MMA for interrupting the blood supply to the outer membrane and stop recurrence of hematoma.

Iatrogenic dAVF are rarity.⁷ Anatomically two meningeal veins normally accompany the MMA and its major branches. Interestingly, the veins rather then arteries, occupy the meningeal groove in skull bone.^{7,8} Injury at this region leads to abnormal communication and eventually dAVF, producing characteristic tram tracks appearance on DSA. The same phenomenon can be demonstrated in our case as seen in figure 3b. It shows iatrogenic dAVF after burr hole placement treated successfully with embolization of ipsilateral MMA.

Embolization of the MMA is highly useful for refractory CSDH as per literature review.^{1,5,6,9,10} Tempaku et al¹⁰ showed efficacy of embolization of MMA in five patients. Hashimoto et al¹ and Mino et al⁹ also support use of embolization of MMA in refractory CSDH. The commonly used embolic materials are NBCA, polyvinyl alcohol particles, and coils with almost same therapeutic outcomes.^{1,6,10} We used NBCA due to its low recanalization rate and liquid state providing suitability for the peripheral use.

Subdural drain placement is very effective method in prevention of recurrence.¹¹ The dAVF associated recurrence is usually refractory to this as outer membrane capillaries receive high flow inputs from dAVF. Intra-operative coagulation of the membrane might be insufficient sometimes. Prevention of iatrogenic dAVF can be done by using fusion images in preoperative planning but efficacy of the method is questionable due to reconstruction artifact and anatomical variations.^{5,6}

We propose a protocol based on literature review that patients with refractory CSDH, i.e. two or more recurrences after satisfactory treatment and re accumulation with in short interval i.e. within 1 month, should be subjected to DSA of external carotid arteries. If dAVF found, embolization of ipsilateral MMA is safe, effective and beneficial treatment option.

CONCLUSION

Refractory CSDH with re accumulation with in short interval should be subjected to DSA of MMA. Embolization of ipsilateral MMA is safe, effective and useful option for the iatrogenic dAVF treatment and for resolution of hematoma.

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Figure Legends

Fig. 1. Non contrast head CT on admission (a) showing left CSDH and (b) on first post operative day.

Fig. 2. (a) CT scan after 1 month of first irrigation and (b) after second evacuation. (c) CT scan showing re-recurrence after second irrigation.

Fig. 3. (a) Superselective DSA of left MMA with area of interest in red rectangle, (b) enlarging the area of interest showing cotton wool area surrounding burr hole, feeders from left MMA and point of fistula at lower border of burr hole with corresponding draining veins. (c) showing corresponding DSA after embolization of left MMA, disappearance of the dAVF.

Fig. 4. Non contrast head CT scan after 3 months of left MMA embolization with burr hole drainage

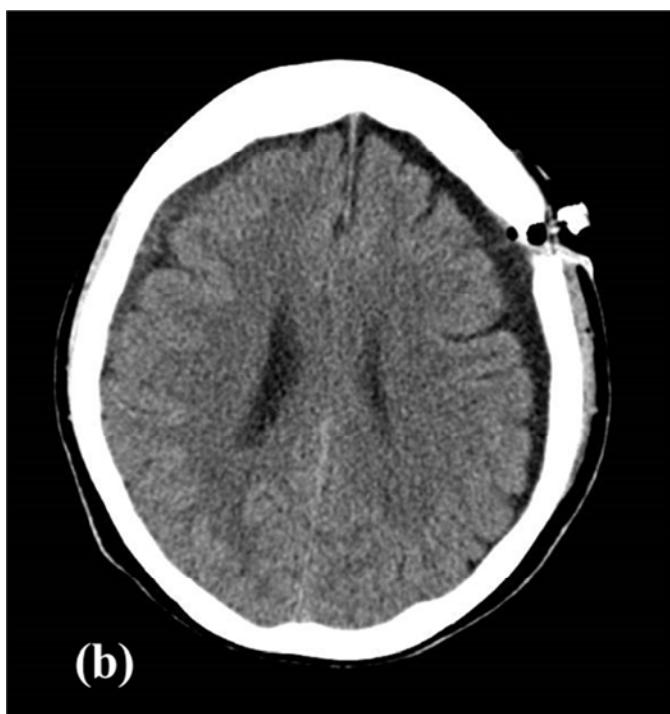
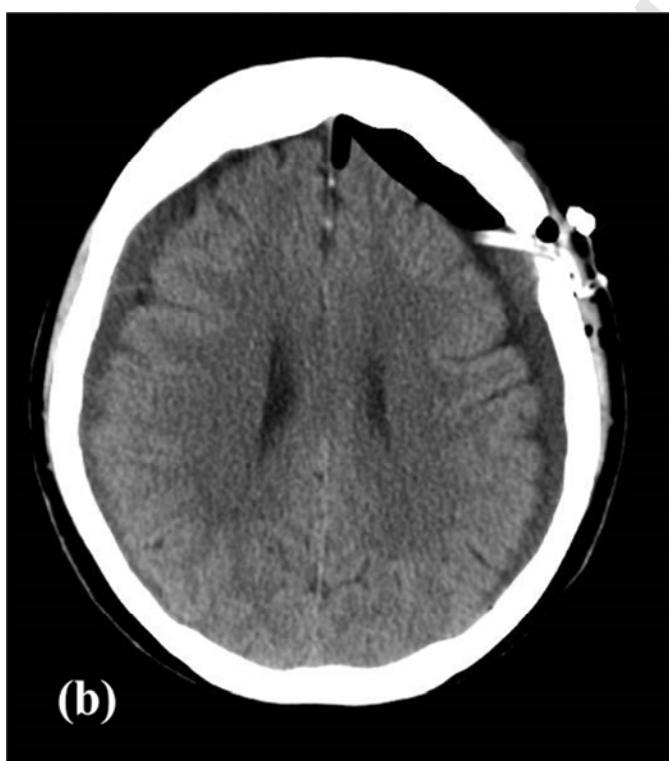
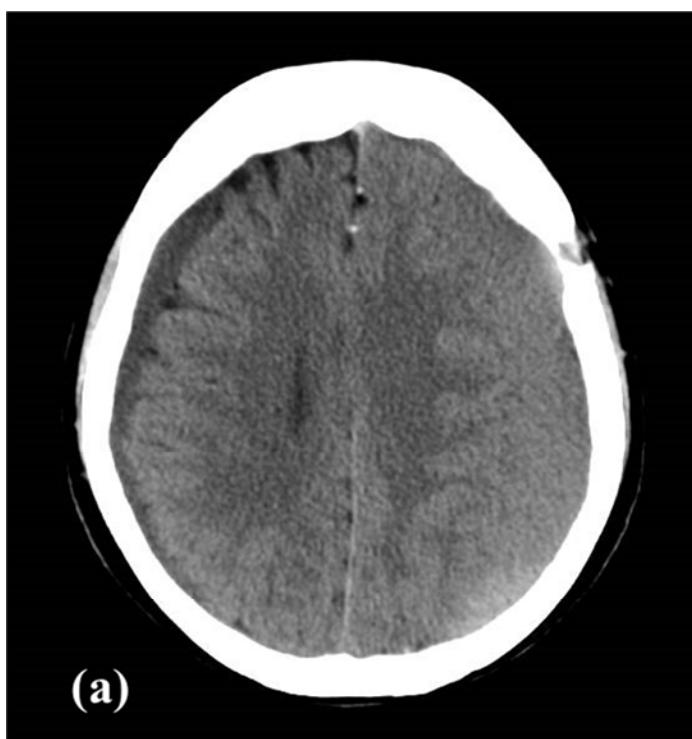


figure 1: a and b



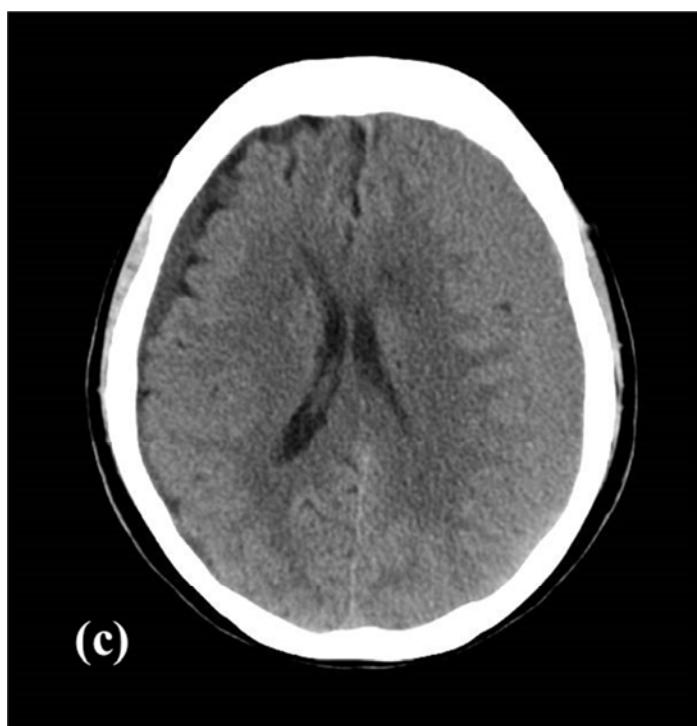
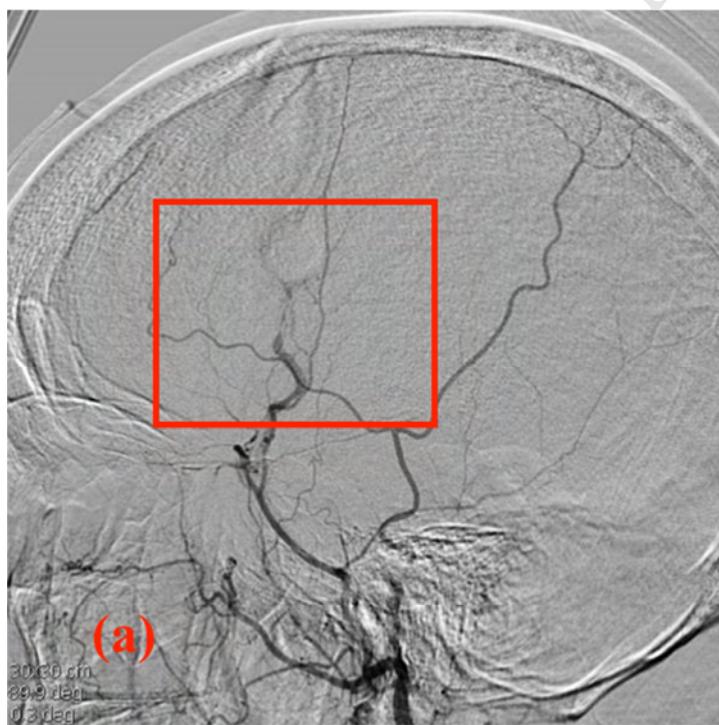
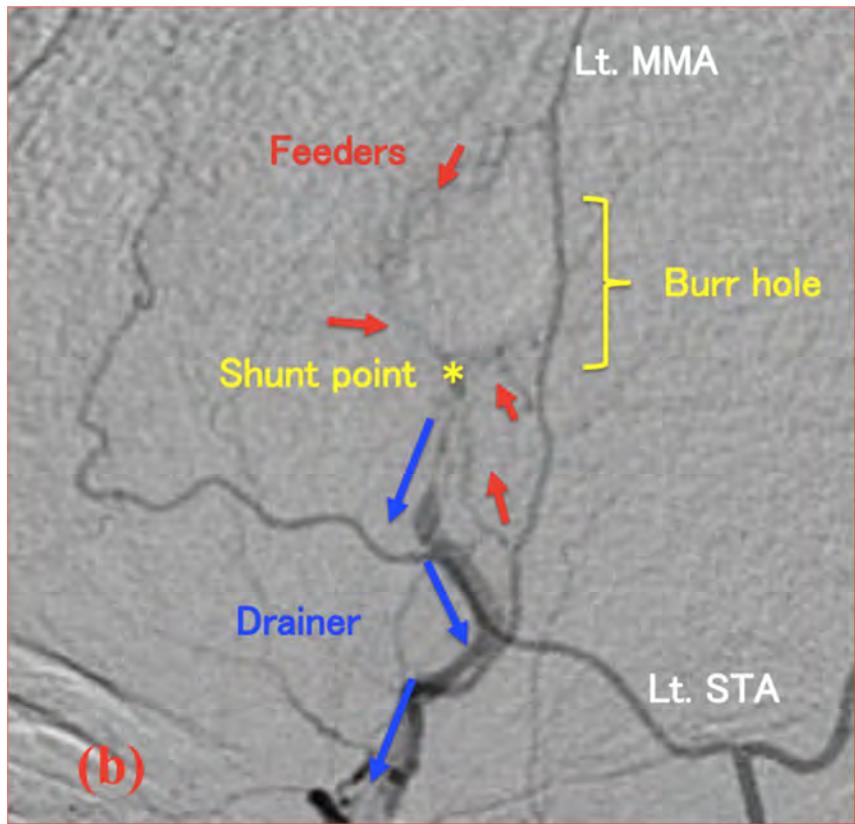


figure 2 : a, b, c,





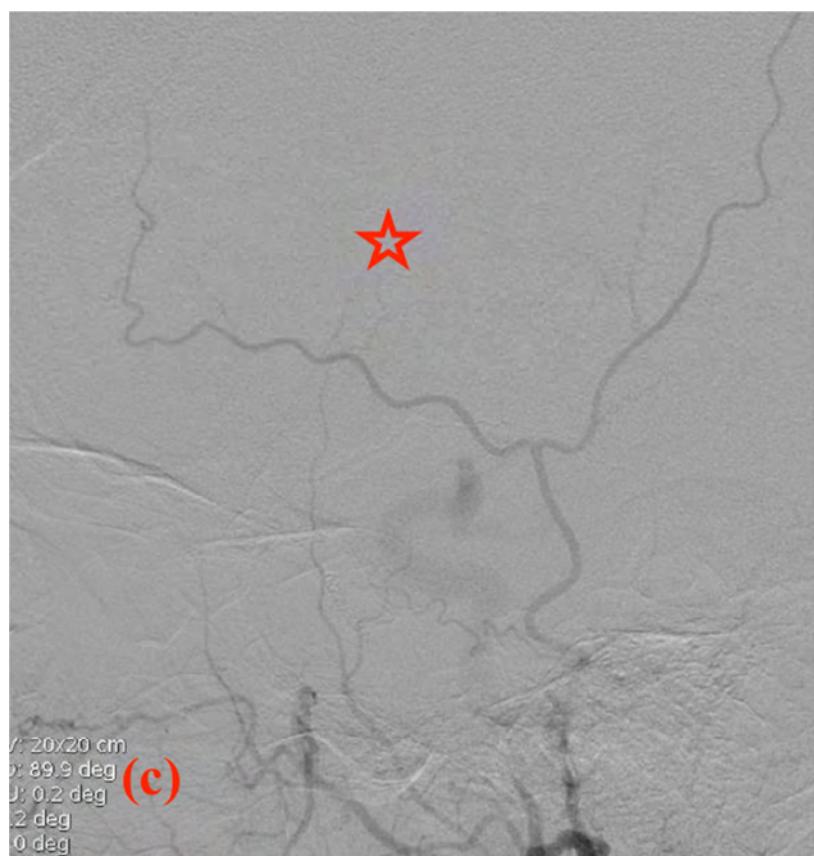


figure 3: a ,b , c

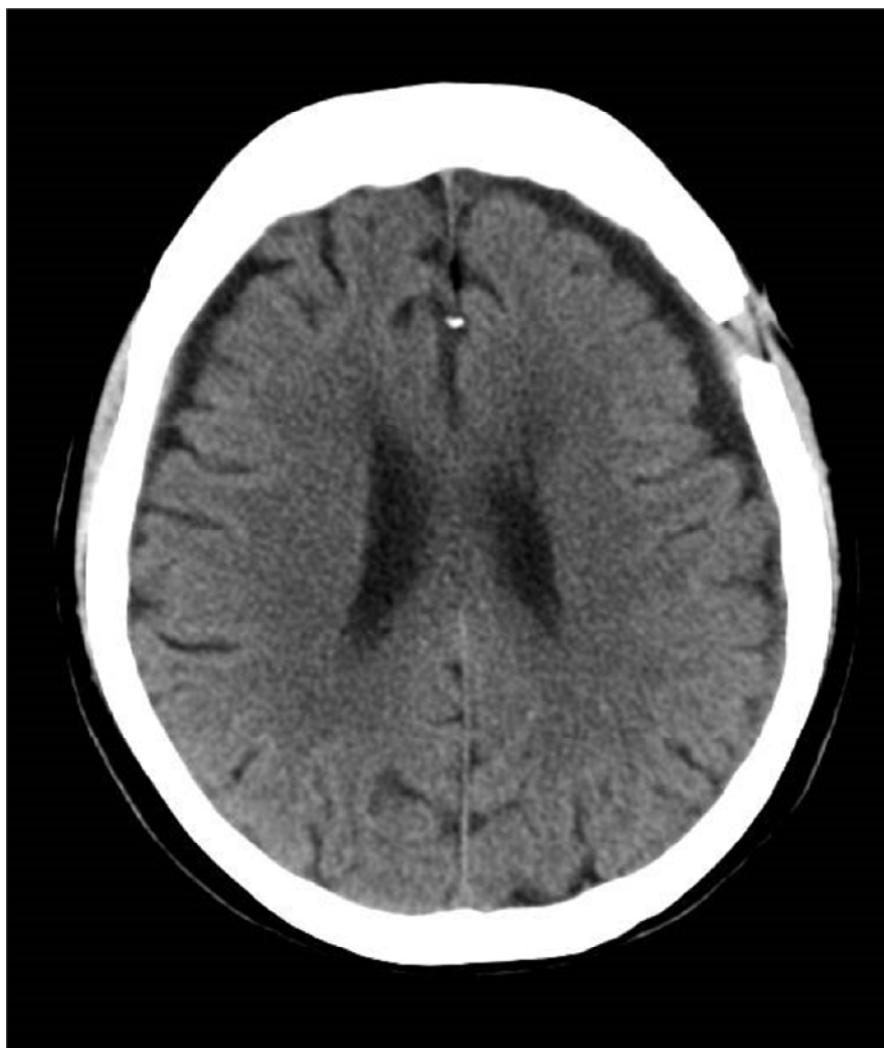


figure 4

HIGHLIGHT

- Refractory CSDH due to iatrogenic dural AVF are difficult to treat.
- Refractory CSDH with re-accumulation with in short interval should be subjected to DSA of MMA.
- Embolization of ipsilateral MMA is safe, effective and useful option for the iatrogenic dAVF treatment.