

# A rare case of traumatic arteriovenous fistula between middle meningeal artery and sphenoparietal sinus who presented with only chronic red eye and literature review

SengFai Tang, WeiLoon Ng, Umi Kalthum Mohd Noh, Bastion Mae-Lynn Catherine, Shahizon Azura Muhamed Mukari, Hazlita Mohd Isa

Department of Ophthalmology, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia

## Abstract

Traumatic middle meningeal arteriovenous fistula with sphenoparietal sinus involvement is very rare. It is usually associated with skull fracture and intracranial hemorrhage. Ocular manifestation as sole presentation is extremely rare and only a few cases have been reported. We report a case of traumatic middle meningeal arteriovenous fistula with sphenoparietal sinus involvement 2 months after head trauma, presenting with left eye redness and dilated corkscrew episcleral vessel. CT scan showed venous out flow disturbance of the cavernous sinus with dilated ophthalmic veins. Transarterial endovascular embolisation of the fistula was done successfully; clinical and 6 months MRA resolution was noted. In conclusion, patient with traumatic middle meningeal arteriovenous fistula into the sphenoparietal sinus can present solely with subtle ocular symptoms. Transarterial endovascular embolisation is an effective procedure to close the fistula as seen in this case.

## INTRODUCTION

Traumatic middle meningeal arteriovenous (AV) fistula was initially described by Fincher in 1957.<sup>1</sup> Freckmann *et al.* reviewed cerebral angiography for 446 patients with head trauma and found that 1.8% of the patients have AV fistula of middle meningeal artery.<sup>2</sup> This fistula caused abnormal communication between middle meningeal artery and dural sinuses, leading to arterialization of dural venous drainage system. Sphenoparietal sinus involvement in the middle meningeal artery AV fistula was rare.

As mentioned, sphenoparietal sinus involvement is rare. Patients usually present with intracranial hemorrhage and significant skull damage. Ocular manifestation usually occurs together with other, serious neurological symptoms<sup>3-7</sup>, and disease presentation with ocular manifestation in isolation is extremely rare and only been reported in a few cases.<sup>8,9</sup>

## CASE REPORT

A 74 year-old lady presented with one-month history of left eye redness that persisted

despite topical antibiotic prescribed by general practitioner (Figure 1). She has history of minor head trauma one month prior to the eye redness. She slipped and bumped the left side of her head on the concrete wall. She denied loss of consciousness, only experiencing bruising and swelling of the left temporal side of her head that resolved weeks later.

Clinical examination revealed presence of dilated corkscrew episcleral conjunctival vessels at left eye (Figure 1). Visual acuity, extra ocular muscle movement, intraocular pressure, optic nerve function and fundus examination of left eye were normal. Right eye was also normal and other systemic examinations were unremarkable.

CT scan of the brain showed venous outflow disturbance in left cavernous sinus and dilated superior and inferior ophthalmic veins (Figure 2). Cerebral angiography showed AV fistula between left middle meningeal artery and left sphenoparietal sinus. The arterial blood drained from left sphenoparietal sinus into left cavernous sinus. Out flow of cavernous sinus was occluded and the blood was refluxed into superior and inferior ophthalmic veins instead of draining into

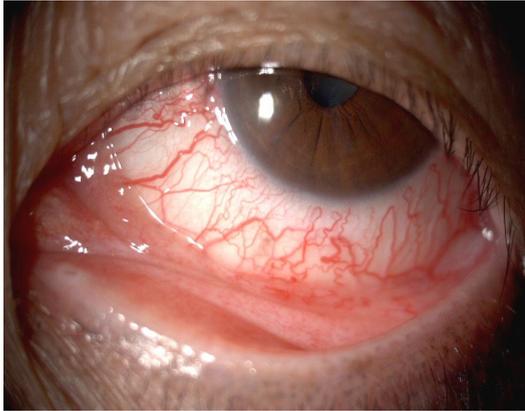


Figure 1. Photo showing corkscrew dilated and tortuous episcleral conjunctival vessel

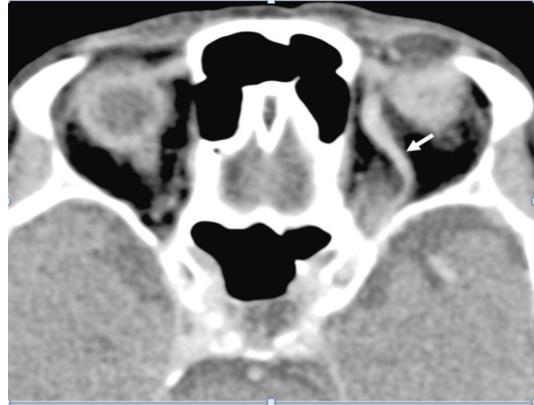


Figure 2. CT brain scan showing dilated superior ophthalmic vein (white arrow)

superior and inferior petrosal sinuses (Figure 3).

Transarterial endovascular embolisation of the fistula were done via approach from femoral artery. The procedure was uneventful and successful. The patient's red eye resolved. MRA brain was done 6 months later and revealed normal superior and inferior ophthalmic vein.

### DISCUSSION

This case showed a rare disease spectrum of traumatic middle meningeal arteriovenous

fistula with sphenoparietal sinus involvement was demonstrated in this case. Patient was well and only presented with corkscrew episcleral conjunctival vessel that misdiagnosed by the general practitioner as conjunctivitis.

Freckmann *et al.* classified traumatic middle meningeal arteriovenous fistula into six-type base on their route of drainage.<sup>2</sup> (I). Drainage via middle meningeal veins to pterygoid plexus; (II). Drainage via sphenoparietal sinus or similarly running meningeal vein to sagittal sinus; (III).

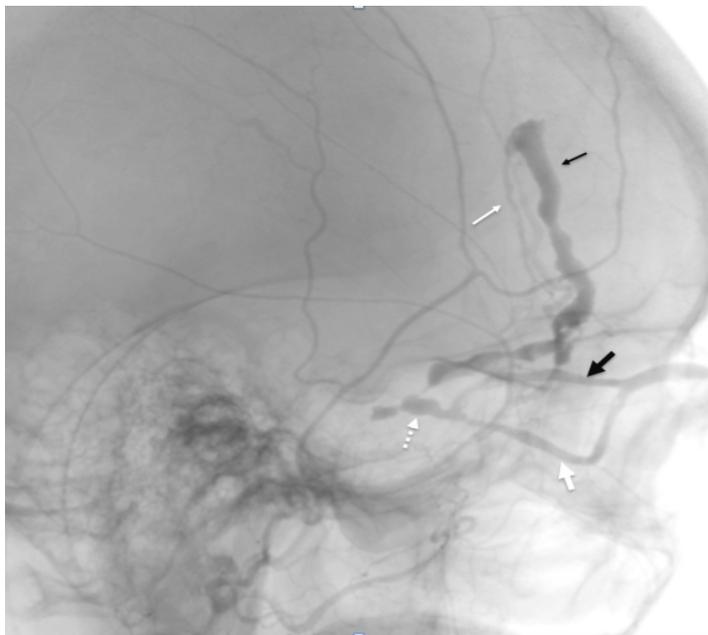


Figure 3. Lateral view of left external carotid artery in cerebral angiography. White arrow (thin) indicates middle meningeal artery. Black arrow (thin) indicate dilated and tortuous sphenoparietal sinus that drained into cavernous sinus (dotted white arrow) which showed outflow occlusion. Thick black arrow indicates dilated superior ophthalmic vein while thick white arrow indicates dilated inferior ophthalmic vein.

**Table 1: Case report of traumatic arteriovenous fistula that involved middle meningeal artery and sphenoparietal sinus**

Author/year	Age and gender	Head trauma/skull fracture	Presentation	Type (based on Freckmann et al. <sup>2</sup> )	Treatment	Outcome
Pakarinen 1965 <sup>12</sup>	25, Male	Minor trauma, no fracture	Headache, continuous pulsating bruit in the ear	Type III	External carotid artery ligation	Recovered
Freckmann 1981 <sup>2</sup>	62, Female	Sphenoid bone fracture	Subdural hematoma and intracerebral bleed	Type I + II	Surgery	Apallic syndrome
	44, Male	Parietal bone fracture	Small subdural hematoma	Type II	N/A	Recovered
Smith 1981 <sup>10</sup>	37, Male	Occipitotemporal fracture	Seizures, comatose, subdural and epidural hematoma, raised intracranial pressure and papilloedema	From sphenoparietal sinus into pterygoid plexus	Symptomatic treatment for increased intracranial pressure	Patient passed away
Unterhofer 2009 <sup>11</sup>	53, male	Temporoparietal fracture	Subdural and epidural hematoma, pulsating exophthalmos, chemosis and raised intraocular pressure	Type III	Transarterial endovascular embolization with coils	Recovered
Present case, 2015	72, female	Minor head trauma, no fracture	Corkscrew dilated vessel at conjunctiva only	Type III	Transarterial endovascular embolization with glue	Recovered

Drainage via sphenoparietal sinus to cavernous sinus; (IV). Drainage via middle meningeal veins and superior petrosal sinus to cavernous sinus/basilar plexus; (V). Drainage via diploic vein; (VI). Drainage via bridging vein to superior sagittal sinus.

Middle meningeal vein was most commonly involved in traumatic middle meningeal arteriovenous fistula cases whereas sphenoparietal sinus involvement is rare.<sup>10</sup> Only a few cases have been reported and these are listed and compared in Table 1.<sup>2,10-12</sup>

Concurrent out flow occlusion of left cavernous sinus was seen in this case. It leads to reflux of blood to the superior and inferior ophthalmic vein that contributes to the ocular sign of corkscrew episcleral vessel. Our finding of thrombosis of the cavernous sinus may be caused by the abnormal blood flow from the fistula as a consequence of Virchow's triad. However, our patient did not present with significant cavernous sinus syndrome.

Spontaneous resolution of traumatic middle meningeal arteriovenous fistula by thrombosis has been well reported.<sup>13-16</sup> However, this was unpredictable and carries an unacceptable risk of intracranial hemorrhage. Transarterial endovascular embolization of the fistula was done by using glue in this case. It was uneventful and successful. Patient's ocular symptom was resolved. MRA brain 6 months later showed normal superior and inferior ophthalmic vein.

In conclusion, patient with traumatic middle meningeal arteriovenous fistula into sphenoparietal sinus can rarely present with only ocular symptoms. Transarterial endovascular embolisation of middle meningeal arteriovenous fistula is a safe and effective procedure, as demonstrated in this case.

## REFERENCES

1. Fincher EF. Arteriovenous fistula between the middle meningeal artery and the great petrosal sinus: case report. *Ann Surg* 1951; 133(6):886-8.
2. Freckmann N, Sartor K, Hermann HD. Traumatic arteriovenous fistulae of the middle meningeal artery and the neighbouring veins or dural sinuses. *Acta Neurochir* 1981;55(3-4):273-81.
3. Nayil K, Ramzan A, Makhdoomi R, *et al.* Incidental traumatic pseudoaneurysm of the middle meningeal artery: case report and literature review. *Turk Neurosurg* 2012; 22(2):239-41.
4. Takeuchi S, Takasato Y, Masaoka H, *et al.* A case of traumatic middle meningeal arteriovenous fistula on the side of the head opposite to the injured side. *No Shinkei Geka* 2009; 37(10):983-6
5. Jung HK, Young JK. Traumatic pseudoaneurysm of the middle meningeal artery with an arteriovenous fistula on a non fracture site. *Interventional Neuroradiology* 2014; 20:352-6.
6. Alex B, John S, In SP, Mark P. Percutaneous embolization of the arteriovenous fistula of the external carotid artery. *AJNR* 1986; 7:937-42.
7. Hiroaki M, Takanori M, Hiroto K, *et al.* Traumatic aneurysm of the middle meningeal artery presenting with traumatic middle meningeal arteriovenous fistula: case report. *J Neuroendovascular Therapy* 2015; 9(2)
8. Ishii M, Suzuki S, Iwabuchi T. Dural arteriovenous malformation with false aneurysm and exophthalmos. A successfully treated case. *Acta Neurochir* 1978; 43(1-2):101-10.
9. Lv XL, Li YX, Jiang CH. Traumatic middle meningeal artery and fistula formation with the cavernous sinus and a review of the literature on the endovascular management of the traumatic carotid carvenous fistulas. InTech.ISBN:978-953-51-1178-8
10. James ES, Joe E, Harry CP, Luther B. Traumatic Ateriovenous fistula between the middle meningeal artery and the sphenoparietal sinus: A case report and review of the world literature. *J Nati Med Assoc* 1981; 73(3):274-8.
11. Unterhofer C, Chemelli A, Waldenberger P, Baucer R, Ortler M. Traumatic fistula between the middle meningeal artery and the sphenoparietal sinus. *Acta Neurochir* 2009; 151(10):1301-4.
12. Pakarinen S. Arteriovenous fistula between the middle meningeal artery and the sphenoparietal sinus. A case report. *J Neurosurgery* 1965;23:438-9.
13. Satoh T, Sakurai M, Yamamoto Y, Asari S. Spontaneous closure of a traumatic middle meningeal arterio-venous fistula. *Neuroradiology* 1983; 25(2):105-9.
14. Luciani A, Houdart E, Mounayer C, Saint Maurice JP, Merland JJ. Spontaneous closure of the dural arteriovenous fistulas: report of three cases and review of the literature. *Am J Neuroradiol* 2001; 22(5):992-6.
15. Srinivasan A, Lesiuk H, Goyal M. Spontaneous resolution of posttraumatic middle meningeal artery pseudoaneurysm. *Am J Neuroradiol* 2006; 27(4):882-3.
16. Moriya M, Itokawa H, Fujimoto M, *et al.* Spontaneous closure of the dural arteriovenous fistula after performing diagnostic angiography. *No Shinkei Geka* 2007; 35(1):65-70.