

## Case Report

# Bilateral Dural Arteriovenous Fistula (DAVF) of “Breschet Sinus”. A Very Rare Cause of Subarachnoid Hemorrhage - Case Report and Review

Guilherme Cabral De Andrade<sup>1,2\*</sup> and Alexandre Leszczynski<sup>1,2</sup>

<sup>1</sup>Department of Neurointervention, CINN-Centro Integrado de Neurologia e Neurocirurgia, Brazil

<sup>2</sup>Parana Hospital, Maringá, Brazil

**\*Corresponding author**

Cabral De Andrade G, Department of Neurointervention, CINN-Centro Integrado de Neurologia e Neurocirurgia, Rua Santos Dumont N 719, Maringá, Paraná, CEP 87050-100, Brazil, Fax: 55-44-3227-7001; Tel: 55-44- 998513600; Email: g.c.andrade@hotmail.com

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- Dural Arterio Venous Fistula (DAVF)
- Sphenoparietal sinus
- Sinus of Breschet
- Subarachnoid Hemorrhage (SAH)

**Abstract**

**Object:** Dural arteriovenous fistula (DAVFs) of sphenoparietal sinus or “Breschet’s Sinus” are a very rare form of intracranial arteriovenous malformation and also very unusual cause of subarachnoid hemorrhage.

**Methods:** We present a case of 68 years old woman that presented a very rare bilateral middle fossa dural arterio venous fistula (DAVF’s) of Breschet sinus manifesting only as a subarachnoid hemorrhage (SAH) Fisher IV. Selective angiography revealed dural arterio venous shunts between the bilateral middle meningeal arteries and sphenoparietal/ Breschet sinus without supply of both internal carotid arteries.

**Results:** Successful treatment was achieved by bilateral extra cranial transarterial embolization with non-adhesive embolic liquid and total occlusion.

**Conclusion:** The Breschet sinus can be a paleontological remnant and its presentation as a dural arterio venous fistula and subarachnoid hemorrhage is something very unusual, this being the only case in the literature with bilateral and SAH presentation, however its treatment is safe and efficient by embolization with non-adhesive liquids embolics through the dural arterial approach.

**INTRODUCTION**

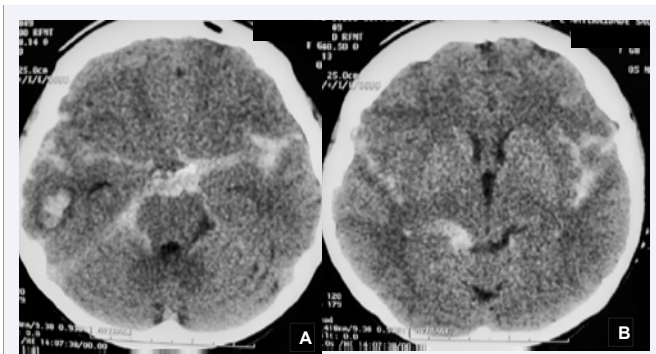
DAVFs in the region of the lesser sphenoid wing are rare lesions and there are few reports in the literature that describe the involvement of the sphenoparietal sinus. Typically, patients present with pulsatile tinnitus and chemosis with exophthalmos respectively. Other presentations include headache, cranial nerve palsy or other neurological deficits which may be related to spontaneous intracranial hemorrhage. DAVFs that drain into the sphenoparietal sinus are particularly rare and were first reported by Pakarinen in 1965 [1]. In a literature review we found only two cases of unilateral DAVF of sphenoparietal (Breschet) sinus and subarachnoid hemorrhage [2,3] however we describe a previously unreported presentation of a patient with a bilateral Breschet DAVF with SAH and successful treatment was achieved by transarterial bilateral embolization

**CASE PRESENTATION**

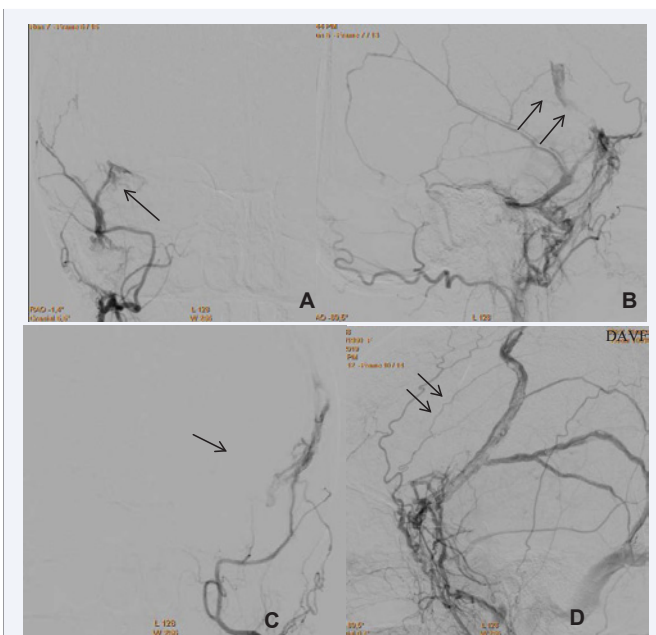
A 68 years old woman that presented an explosive and intense headache with loss of consciousness and apraxia of

speech and GCS 14. She had no previous history of head trauma, hypotension, headache, tinnitus, or progressive neurological symptoms as well as any kind of clinical background as venous thrombosis or infectious diseases. A Computed tomography Scan (CT) showed a diffuse SAH, Fisher IV and an intraparenchymal right temporal posterior hematomia (Figure 1A,B). A diagnostic cerebral angiography was performed, with selective injection of the bilateral internal and external carotid artery using a 5F catheter. The selective angiography (DSA) of the both internal carotids was normal in the arterial and venous phase, however the selective injection (DSA) in both external carotid arteries were diagnosed bilateral dural arterio venous shunts between the middle meningeal arteries (MMAs) and an abnormal exclusively bilateral venous structure with the fistular shunt at the sphenoidal topography throughout the parietal topography “the sphenoparietal sinus” (Figure 2A-D) and 3D reconstruction images (Figure 3A,B).

The treatment was decided by a transarterial bilateral MMA approach and was performed under general anesthesia,



**Figure 1** CT Scan showed a diffuse bilateral SAH, Fisher IV and an intraparenchymal right temporal posterior hematomata.



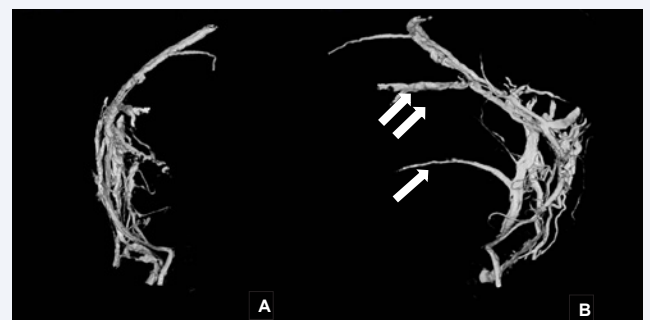
**Figure 2** A: Selective right external carotid artery AP view showed fistular point in the sphenoid projection "arrow". B: DSA right ECA lateral view and a sphenoparietal sinus DAVF "double arrows". C: Selective left external carotid artery AP view showed fistular point in the sphenoid projection "arrow". D: DSA left ECA lateral view and a sphenoparietal sinus DAVF "double arrows".

and an intravenous bolus of 5000 IU heparin was given at the beginning of the procedure. To perform embolization, a 6-French straight-guiding catheter (Guider soft tip, Boston Scientific/Target, Fremont, Calif.) was placed in the main trunk of the external carotid artery on one side after the other. The middle meningeal artery was approached under roadmap guidance with a microcatheter Sonic 1,5 F25 (Balt, Montmorency, France) was advanced over a Hybrid 0.008-inch microguidewire (Balt, Montmorency, France) in the middle meningeal artery up to the fistulous zone on one side after the other, the micro catheter lumen was flushed with dimethyl sulfoxide (DMSO) and the dead space was filled and after these were occluded by injection of liquid embolic agent SQUID 12 (Balt, Montmorency, France) in the right side there were two other dural fistular points between the posterior middle meningeal branches and the lateral

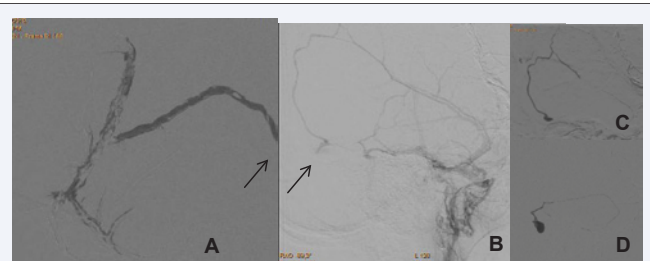
sinus also occluded with liquid embolic Squid 12 (Figure 4A-D). Immediate control angiogram showed complete DAVF exclusion without intra cranial reflux and no substracts images to show bilateral framework of DAVF occluded by Squid 12 (Figure 5A-C). Her postoperative course was uneventful and was discharged home after the vasospasm period and no other intracranial complications were observed during the following and there was complete recovery of the dispraxia of speech.

**DISCUSSION**

The sphenoparietal sinus, or Breschet’s sinus, was first described by the head of the anatomical works of the “Hotel de Dieu” in Paris, Prof “Gilbert Breschet” in 1826 in an atlas of



**Figure 3** A: Right ECA 3D reconstruction image of the DAVF in right side. B: Left ECA 3D reconstruction image of the DAVF in left side, sowed sphenoid sinus "arrow" and the peietal portion of the sphenoparietal (Breschet) sinus "double arrows".



**Figure 4** A: Left DAVF embolization with liquid embolic Squid 12. B: Right DAVF and two other DAVF points "black arrows" between the posterior middle meningeal branches and the lateral sinus besides DAVF of Breschet sinus. C and D: Right embolization of DAVF between the posterior middle meningeal branches and the lateral sinus DAVF with liquid embolic Squid 12.



**Figure 5** No substracts images to show bilateral framework of DAVF occluded by liquid embolic Squid 12 A: Right DAVF lateral view B: AP view C: Left DAVF lateral view.

the venous system [4]. Breschet seems to have combined the parietal portion of the anterior branch of the middle meningeal veins with a dural sinus located under the lesser sphenoid wing, to create a single continuous venous entity that he named the sphenoparietal sinus. Some years after, another anatomist described the sphenoparietal sinus as a “sinus found within the limits of the anterior and medial portions of the base of the skull, which occupies a transversally oriented gutter that runs inward into the cavernous sinus. This sinus receives several branches from the skull bones, the dura mater, and the diploic vein of the temporal bone” [2] and it was being described as classic definition of the sphenoparietal sinus, which then came to be known as the “sinus of Breschet” [5]. This eponym has been forgotten for many years and the existence of this is still questioned. Some anatomic and papers in the 20<sup>th</sup> century became more complex and somewhat confusing [6-10]. In this recent study [9] the author showed no direct relationship between the superficial middle cerebral vein and the middle meningeal veins. We found relatively few publications in the medical literature regarding the sphenoparietal sinus, and even fewer with respect to its detailed anatomy.

In two most recent publications anatomic study, they concluded that the sphenoparietal sinus corresponds to the artificial combination of two venous structures, the parietal portion of the anterior branch of the middle meningeal veins and a dural channel located under the lesser sphenoid wing, the sinus of the lesser sphenoid wing and consider the middle meningeal veins (parietal) and their connections as simply tributaries to the sphenoparietal sinus [11,12]. In other findings the dural venous sinus, often located inferior to the lesser wing of the sphenoid bone (sphenoparietal sinus), had no identifiable connections to the middle meningeal veins [13]. Its diameter was first measured with 3mm at its medial end and that its position is often marked by a groove on the sphenoid bone [14]. Perhaps the term “sinus of the lesser sphenoid wing” does, indeed, portray more accurately the “sphenoparietal” sinus [15]. The presence of a deep parietal groove in the parietal bone parallel to the coronal suture from the tip of the lesser wing of the sphenoid to a point just behind the bregma are often found in the bone lodging great cauliflower-like masses of pacchionian bodies, was first described as caused by venous sinuses, and not by the middle meningeal artery [16]. In the embryological human venous development, there is no direct or indirect relationship between the middle meningeal veins and the sphenoid sinus, however there is an indirect relationship between them and the cavernous sinus through the petrous squamous sinus which can disappear or usually declines in size [17]. However publications in human paleontology, describe an involution of this dural sinus, less frequent in Neanderthals and very rare in modern humans, considering a paleontological remnant.

In paleoanthropology, based on fossil evidence, the sphenoparietal sinuses are considered to be imprints of enlarged anterior middle meningeal veins behind the coronal suture and the dural venous sinuses are frequently accompanied by arachnoid foveae that are imprints of the arachnoid granulations (Pacchionian bodies) and these are small convexities of variable size, which are situated in close proximity to the venous sinuses, middle meningeal vessels, and diploic veins and the groove left

behind the coronal suture by the middle meningeal veins (the sphenoparietal sinus according to some anthropologists) has been described as a characteristic feature in some populations [16]. The sphenoparietal sinus is discussed frequently and actually refers to the great anterior meningeal vein which leaves a deep and wide sulcus close behind the coronal suture, where it connects large sagittal lacunae in the upper vault with the cavernous sinuses on the cranial base [18] These sinus it isn't frequent in anatomically modern humans just 14% whereas it is almost always present in Neanderthals. The different vascular arrangements of the venous sinuses are also hypothesized to be associated with functional adaptations and selection associated with body posture and bipedal evolution in Australopithecus [13].

A selective angiographic catheterization of the internal carotid artery may miss this pathology. Therefore, investigation should include a selective angiographic catheterization of the external carotids arteries when bone damage after head injury involves the lateral skull base and a fistula is suspected on clinical grounds or SAH. DAVF treatments include microsurgical and endovascular intervention and stereotactic radiosurgery. Introduction of a non-adhesive liquid embolic agent has significantly increased the efficiency of endovascular treatment. Our patient had a very rare type of DAVF located in the bilateral sphenoparietal sinus and relationship only the bilateral external carotids arteries and she had any kind of symptoms before the onset of hemorrhage

## CONCLUSION

Breschet's sinus appears to be a paleontological remnant and is rarely found in homo sapiens, as well as its association with DAVF and SAH. In the angiographic diagnosis, supraselective examination of the both external carotid arteries is essential. In our case presented, it was still more rare due to its bilateral nature, had no similar case in the literature. The treatment performed and chosen is the endovascular treatment by arterial dural approach and occlusion the use of non-adhesive liquids embolics allows the achievement of complete occlusion of the fistula and the sinus.

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