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## Case Report

# Stent-Assisted Coil Embolization of a Transverse-Sigmoid Sinus Diverticulum Presenting with Pulsatile Tinnitus

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## ABSTRACT

When tinnitus is pulse-synchronous, a vascular etiology is suggested. We present a case of persistent and troublesome pulsatile tinnitus caused by a transverse-sigmoid sinus diverticulum that was endovascularly treated with stent-assisted coiling. A 39-year-old woman presented with a 4-year history of progressive pulsatile tinnitus involving the right ear. Slight pulsatile bruit was heard on the right mastoid bone by auscultation. Cerebral angiography demonstrated a diverticulum of the transverse-sigmoid sinus. The procedure was performed with an 8F guiding catheter (Cordis, USA) catheterized into the right sigmoid sinus. The diverticulum was completely coiled following deployment of a 5.5 mm-50 mm Leo stent. This patient awakened without any neurological deficit and with immediate resolution of her tinnitus. This case report describes a stent-assisted coil embolization of venous sinus diverticulum, which provides immediate resolution of pulsatile tinnitus.

**KEYWORDS:** Pulsatile tinnitus, Venous sinus, Diverticulum, Stent-assisted coiling

## INTRODUCTION

One of the rare causes of the pulsatile tinnitus is diverticulum of the transverse-sigmoid sinus (2, 3). Some reports call this diverticulum as "sinus aneurysm" and these aneurysms were surgically treated in order to eliminate a possible cause of pulsatile tinnitus (1, 2, 5, 9, 14).

In this paper, we describe an endovascular approach for chronic, right-sided pulsatile tinnitus caused by a transverse-sigmoid sinus diverticulum in a 39-year-old woman. The endovascular approach was stent-assisted coil embolization.

## CASE REPORT

A 39-year-old woman presented with a 4-year history of a persistent right-sided pulsatile tinnitus. She was healthy otherwise. The bruit interfered with her daily function and severely diminished her quality of life because of her lack of sleep. Her physical examination revealed a slight pulse-synchronous, auscultated low pitch bruit at the right mastoid.

Gentle compression of the right internal jugular vein caused obliteration of the bruit and resolution of her symptoms. Otoscopic and neurological examinations were normal. Computed tomography (CT) of the head demonstrated erosion of the mastoid bone in the right transverse-sigmoid junction (Figure 1A). Magnetic resonance (MR) venogram examination demonstrated a diverticulum of the transverse-sigmoid sinus (Figure 1B). Digital subtraction angiography confirmed that finding (Figure 2A).

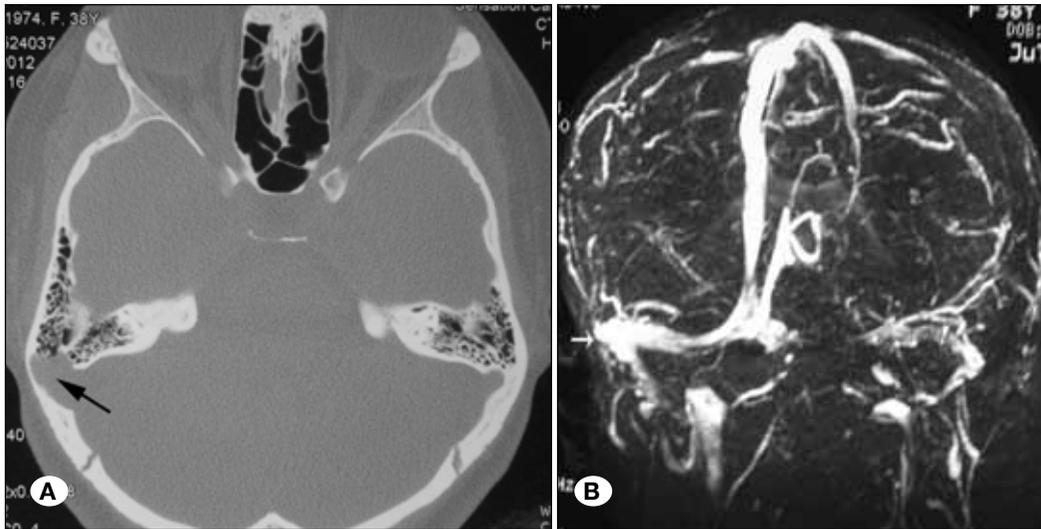
Premedication (100 mg of aspirin and 75 mg of clopidogrel per day) was initiated 3 days prior to the procedure. An endovascular procedure was performed under general anesthesia and systemic heparinization. The bolus infusion of heparin was 3000 IU followed by 1000 IU/h for anticoagulation (5).

Unilateral femoral access was done through a percutaneous femoral venous puncture and an 8-French Envoy MPD (Cordis Neurovascular, Inc.) guiding catheter was inserted into the right sigmoid sinus (5).

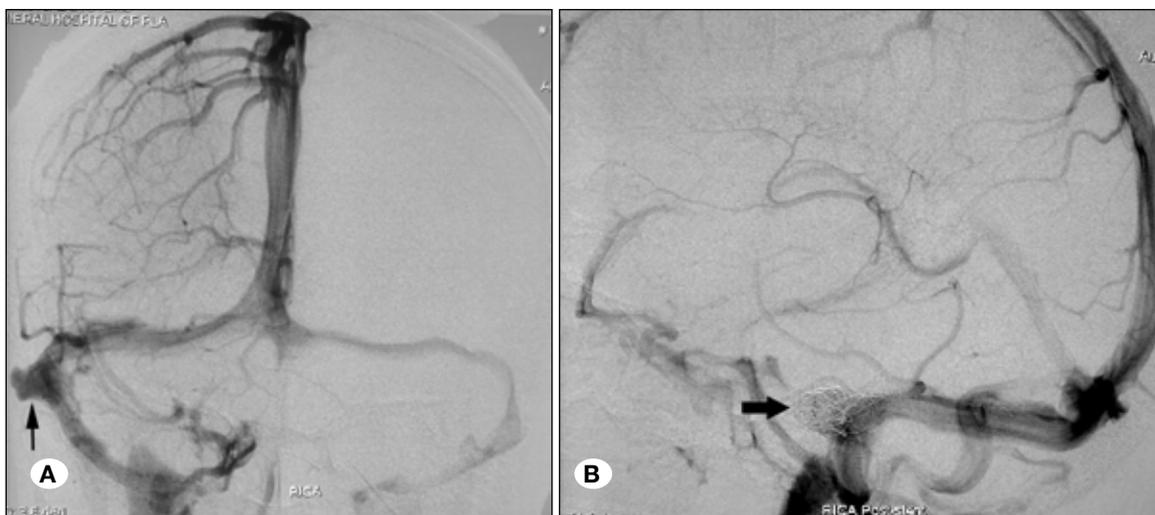


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**Figure 1:** **A)** Bone window of a non-contrast CT scan of the head demonstrating erosion of the mastoid bone (Arrow). **B)** MR venogram demonstrating a venous diverticulum in the region of the transverse-sigmoid junction (Arrow).



**Figure 2:** **A)** Digital subtraction angiogram confirmed the magnetic resonance venogram finding. (Arrow) **B)** Postoperative angiogram demonstrating obliteration of the diverticulum in the dominant right transverse-sigmoid junction (Arrow).

A coil delivery microcatheter (Renegade) was firstly introduced into the diverticulum and then a Vasco-28 (Balt, Montmorency, France) catheter was advanced over a 0.014-inch X-Celerator microguidewire (Covidien) into the normal distal transverse sinus beyond the diverticulum by 2 cm. The guidewire was then removed, and a 5.5 mm-50 mm Leo stent (Balt, Montmorency, France) was introduced into the hub of the catheter via the delivery system. Then, the stent was pushed through the microcatheter and aligned directly across the neck of the diverticulum. When proper alignment was achieved, the microcatheter was gently pulled back to unsheath the stent while gentle forward tension was maintained on the stent system to keep it in place. One must then pull the catheter and the stent back until the distal end of the stent is precisely positioned. Once the stent was fully deployed, Microplex coils (10×30, 8×30 and 6×30, Microvention, Inc., Aliso Viejo, CA) were delivered within the diverticulum through the microcatheter to obtain circulatory exclusion of the lesion (Figure 2B) (5).

After the endovascular treatment, the patient was extubated. Immediate post-embolisation examination showed no neuro-

logical deficits and immediate resolution of her symptoms. She was maintained on aspirin and clopidogrel for 1 month and aspirin (100 mg per day) for 6 months. The patient was discharged three days later without any neurologic deficit. There was no recurrence of the pulsatile tinnitus after 4 months.

## DISCUSSION

Pulsatile tinnitus of vascular origin results from turbulent flow secondary to increased volume or irregular vascular lumen (8). The vascular causes of pulsatile tinnitus are atherosclerotic carotid artery disease, idiopathic intracranial hypertension, dural arteriovenous fistulae, persistent stapedia artery and aberrant internal carotid artery (2, 6, 8, 12).

A sigmoid sinus diverticulum has been considered to be a very rare cause of pulsatile tinnitus recently and there have been a few reports about it (1-3). It is easy to differentiate the arterial causes of pulsatile tinnitus from the venous causes by gently compressing the internal jugular vein ipsilateral to the tinnitus (2, 14). This maneuver immediately improves the pulsatile tinnitus of venous origin (2, 14), as in our patient.

Diverticulum of the sigmoid sinus is a cause of pulsatile tinnitus which can be treated by endovascular or surgical approaches (2). Houdart et al. (3), Mehanna et al. (7) and Park et al. (10) described coil embolization of a narrow-necked sigmoid sinus diverticulum, with the improvement of pulsatile tinnitus. Zenteno et al. (13) and Sanchez et al. (11) also described stent-assisted coil embolization for wide-necked sigmoid diverticula, with good angiographic and clinical outcomes. Otto et al. (9) presented 5 cases of sigmoid sinus diverticulum recently and 3 of them underwent surgical reconstruction of the sigmoid sinus. The authors warned the surgeons regarding the risk of strangulation of the sinus or intraluminal thrombus of bone wax.

Gologorsky et al. recommended U-clips for complete reconstruction of the sinus, with minimal risk of thrombogenesis through a small craniectomy (2). The postoperative angiogram demonstrated obliteration of the aneurysm, with minimal obstruction in the repair site and good flow through the dominant right transverse-sigmoid junction (2).

The U-clips were originally designed for rapid vascular anastomoses in cardiac applications and repair of a venous sinus with U-clips is often limited. In addition, U-clips require less manipulation and less tension on venous sinus wall than the standard suture technique (2).

However, this surgical approach may have a risk of massive bleeding or dural injury causing increased intracranial pressure, so meticulous bone work and careful reduction of the diverticulum are needed during the operation. In our patient, the pulsatile tinnitus was an important health problem for the patient and this surgical approach was not accepted as an option.

Endovascular management for this lesion seems to have many advantages compared with conventional surgery. Like previous cases, we used a Leo stent to prevent herniation of coils. This technique is based on our extensive experience in stenting treatment of venous sinus stenosis (4).

## ■ CONCLUSION

This case report describes a stent-assisted coil embolization of transverse-sigmoid sinus diverticulum, which provides immediate resolution of pulsatile tinnitus. Pulsatile tinnitus requires a careful physical examination and evaluation with selected imaging techniques to identify the origin of the symptoms.

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