

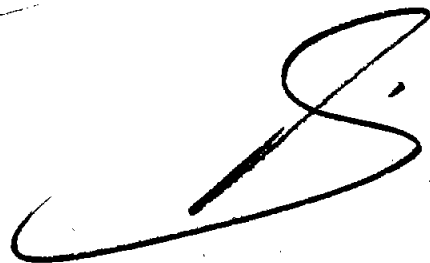
112428  
Universidad Nacional Autónoma de México

División de Estudios de Postgrado  
Instituto Nacional de Neurología y Neurocirugía  
"Manuel Velasco Suárez"

Endovascular Treatment of Transverse-Sigmoid Sinus Aneurysm  
Presenting as a Pulsatile Tinnitus

TESIS DE POSTGRADO  
Que para obtener el Título  
En la Sub-especialidad de:  
TERAPIA ENDOVASCULAR NEUROLÓGICA

Presenta:  
Dr. Luis Manuel Murillo Bonilla



México, D.F. Octubre 7, 2003



Universidad Nacional  
Autónoma de México



**UNAM – Dirección General de Bibliotecas**  
**Tesis Digitales**  
**Restricciones de uso**

**DERECHOS RESERVADOS ©**  
**PROHIBIDA SU REPRODUCCIÓN TOTAL O PARCIAL**

Todo el material contenido en esta tesis esta protegido por la Ley Federal del Derecho de Autor (LFDA) de los Estados Unidos Mexicanos (México).

El uso de imágenes, fragmentos de videos, y demás material que sea objeto de protección de los derechos de autor, será exclusivamente para fines educativos e informativos y deberá citar la fuente donde la obtuvo mencionando el autor o autores. Cualquier uso distinto como el lucro, reproducción, edición o modificación, será perseguido y sancionado por el respectivo titular de los Derechos de Autor.

INSTITUTO NACIONAL DE NEUROLOGIA Y  
NEUROCIRUGIA  
MANUEL VELASCO SUAREZ

FIRMAS



p.a.

---

Dra. Teresa Corona Vazquez  
Directora General de Enseñanza



---

Dr. Marco Antonio Zenteno Castellanos  
Jefe del Servicio de Terapia Endovascular Neurológica



INSTITUTO NACIONAL  
DE NEUROLOGIA Y  
NEUROCIRUGIA  
DIRECCION DE ENSEÑANZA



**Endovascular treatment of transverse-sigmoid sinus aneurysm presenting as pulsatile tinnitus.**

**Marco Zenteno MD\*, Luis Murillo-Bonilla MD\*, Sergio Martínez MD\*, Antonio Arauz MD\*, Carlo Pane MD\*\*, Angel Lee MD\*\*\*, Ramiro del Valle MD\*\*\*.**

**\* Department of Neuroradiology and Endovascular Therapy, Instituto Nacional de Neurología y Neurocirugía “Manuel Velasco Suárez”.**

**\*\* Department of Neuro-Otology, Instituto Nacional de Neurología y Neurocirugía “Manuel Velasco Suárez”.**

**\*\*\* Medica Sur Foundation.**

**Address correspondence to:**

**Marco Zenteno**

**Insurgentes Sur 3877, Colonia la Fama, Delegación Tlalpan. México, D.F. 14268.**

**e-mail: [luismur@avantel.net](mailto:luismur@avantel.net)**

**Phone: (52) 56063822 ext. 1022**

**Fax: (52) 55287867**

**Brief running-head title: Endovascular Treatment of venous aneurysms.**

**Key Words: Transverse-sigmoid sinus, Venous aneurysm, Pulsatile Tinnitus, Endovascular treatment.**

**ABSTRACT**

We report the case of a 38-year-old woman experienced incapacitating pulsatile tinnitus in the left ear for 6 months. Angiographic studies showed wide-neck venous aneurysm of the left transverse-sigmoid sinus. Solely stent placement across the neck results in a slight modification in the aneurysm characteristics. A second time embolization with Guglielmi detachable coils results in a 100% occlusion of the aneurysm with patency of the parent vessel, and resolution of the tinnitus.

**Key Words**

Transverse-sigmoid sinus, Venous aneurysm, Pulsatile tinnitus, Endovascular treatment.

## INTRODUCTION

Cerebral venous aneurysms are included in the group of venous malformations and are associated to arteriovenous malformations (AVM), but single venous aneurysms are rare.<sup>8,9,12,20</sup> Recently, Houdart reported a sigmoid sinus aneurysm associated to pulsatile tinnitus, and endovascular coil occlusion of the aneurysm was followed by resolution of the tinnitus.<sup>3</sup> Occlusion of the internal jugular vein and transverse-sigmoid sinus have been proposed to treat venous pathology, but these procedures appear to be harmful because of the risk of increasing the intracranial pressure. We report the case of a 38-year-old woman presenting with a severe pulsatile tinnitus in the left ear associated with a left transverse-sigmoid sinus aneurysm (TSSA). Solely stent placement across the neck followed by a second time embolization with Guglielmi detachable coils results in occlusion of the aneurysm, patency of the parent vessel and resolution of the tinnitus.

## CASE REPORT

A 38-year-old woman experienced intermittent pulsatile tinnitus lasting several minutes related to head movement the previous 6 months. Two months later, tinnitus became continuous and severe in intensity. On admission, vital signs, neurological examination and otoscopy were normal. Compression of the left internal jugular vein (IJV) decreased tinnitus intensity, while compression of the right increased it. These findings were in favor of a venous pathology.

A high-resolution bone window CT-scan images showed a left petrous bone eroded at transverse-sigmoid sinus (TSS), with involvement of the mastoid cells. Digital subtraction angiography (DSA) showed a venous aneurysm (8 x 6 mm, wide neck 6 mm) in the left TSS (Figure 1). Considering the wide neck of the venous aneurysm and dominance of the left transverse sinus, and because to date do not exist stents of enough diameter and flexibility to navigate in a retrograde way through the jugular vein, we chose a solely stent placement by paratorcular approach, to allow patency of the parent vessel. A burr hole done 3 cm right to the torcula allowed the placement of a 0.035" Terumo guidewire up to the left jugular vein. A guiding catheter (Arrow 8F x 25 cm) was introduced and located in the TSS proximal to the aneurysm, then a 10 x 28 wallstent was expanded across the aneurysm neck. Clopidogrel (75 mg/day) and aspirin (325 mg/ day) were initiated to avoid stent occlusion. She was symptom-free up to 4 months, then pulsatile tinnitus reappear intermittent and moderate in intensity. A new DSA showed patency of the TSS and a slight decrease in the size of the aneurysm (Figure 2).

As a result, embolization with Guglielmi detachable coils (GDC) was performed under general anesthesia and heparinization with 10,000 UI. A 6F Envoy guiding catheter was placed into the left IJV after femoral puncture, and the aneurysm was catheterized



through the stent mesh with a Tracker Excel 14 microcatheter. Totally angiographic occlusion of the aneurysm was reached with two 3D (6 x 15 and 4 x 8) and 3 soft (3 x 8) GDC. A control angiogram showed complete occlusion of the aneurysm (Figure 3). The patient was discharged on clopidogrel (75 mg/day) and AAS (325 mg/day). Follow-up visit at 6 months the patient was symptom-free, **and the control angiogram performed at that time showed an occlusion of the venous aneurysm as well as the patency of the venous sinus (Figure 4).**

## DISCUSSION

Tinnitus is considered to be chronic when it has been present for more than three months. Spontaneous tinnitus – that is, tinnitus “usually lasting longer than 5 minutes” is presented in 10% of adults, and in 0.5% tinnitus severely reduced the ability to lead a normal life. A large – scale Swedish study reported somewhat higher figures: for 2.4% of adults “tinnitus plagues me all day”.<sup>1</sup> Our patient has a chronic incapacitating pulsatile tinnitus lasting more than six month.

Causes of tinnitus can be divided into vascular or nonvascular.<sup>4</sup> Pulsatile tinnitus is believed to be consequence of transmission of sound created by turbulent blood flow, through the petrous bone to the cochlea,<sup>2</sup> and is caused by benign intracranial hypertension, glomus tumors, atherosclerotic carotid artery disease, dural AVM, carotid-cavernous fistula, AVM of the head and neck, vascular tumors of the temporal lobe,<sup>16,15,14</sup> and recently by aneurysm of the dural sigmoid sinus as proposed by Houdart.<sup>3</sup> As our knowledge this is the second report of pulsatile tinnitus produced by a TSS aneurysm. Other auditory symptoms have been associated to aneurysm, Khalil et al.<sup>5</sup> reported one case of a patient with a middle cerebral artery aneurysm presenting as isolated hyperacusis, embolization with detachable coils produced complete resolution of his symptoms.

Cerebral venous aneurysm are included in the group of venous angiomas and are associated to AVM, but few cases of single venous aneurysm are reported in the literature.<sup>8,9,12,20</sup> It could be incidental or be associated with subarachnoid hemorrhage and seizures.<sup>9,20</sup> It is difficult to propose a harmless intervention in patients with sinus aneurysm because lack of evidence. Occlusion of the IJV had been described,<sup>6</sup> but it carries a risk of increasing the intracranial pressure and definitively suppresses one of the two brain-draining veins with so little evidence of clinical benefit, in our patient the left TSS was

dominant, so this approach was not considered. **We did not consider other surgical techniques like aneurysmorrhaphy because of the risk of injury of a dominant sinus, and because a combination of minimal invasive techniques (burr hole and endovascular approach) was deemed to be safer and more suitable for the radical treatment of the aneurysm.**

Successful resolution of pulsatile tinnitus has been obtain with endovascular therapy in the treatment of TSS dural AVM. Shownkeen et.al.<sup>15</sup> report three cases of pulsatile tinnitus due to TSS dural AVM treated with occlusion of the TSS with detachable balloon and Guglielmi detachable coils following arterial feeder embolization with histoacryl. The problem is that this procedure carries the same risk of occlusion of the IJV. Houdart, et.al.<sup>3</sup> reported successful resolution of pulsatile tinnitus with embolization of the aneurysm sac with detachable coils preserving the TSS.

In our case of wide-neck aneurysm, embolization of the aneurysm with detachable coils was considered technically difficult because of the possibility of coil herniation into the parent vessel lumen, and regrowth/recanalization of the aneurysms.<sup>10,18</sup> The management of those aneurysms are technically challenging, there are reports with the ballon-assist or neck-remodeling technique as an adjunctive method devised for the endovascular coil embolization of aneurysm characterized by a wide neck or unfavorable geometric features, providing a safe means of improving the efficacy of endovascular treatment.<sup>10,7</sup> Recently Phatouros et.al.,<sup>11</sup> and Sekhon et.al.<sup>13</sup> reported the stent-supported coil embolization technique with good outcomes. With the results of some experimental studies using lonely stent placement,<sup>19,17</sup> we are using this technique as a protocol in cases of wide-neck giant incidental arterial aneurysms and aneurysms of the basilar artery with Good outcomes and prospective follow-up, these cases will be reported in another article.

Because of the experience in our Center with wide neck arterial aneurysm, and because to date do not exist stents to navigate up to the jugular vein, we decided solely stent placement by paratorcular approach resulting in improving of the patient's symptoms. However, few months later, symptoms worse again, and control angiography shows slight modification in the aneurysm characteristics. **We used a long stent because there is no evidence that the amount of metal placed in a vein favors thrombosis, and we think that occlusion is more related to venous architecture itself.** Finally, we decided embolization with GDC as a second approach, resulting in 100% occlusion of the aneurysm preserving the dominant TSS. In the 6 month follow-up visit the patient is asymptomatic.

In conclusion, TSS aneurysm should be a differential diagnosis in pulsatile tinnitus work up. Detachable coil embolization is a successful procedure to treat well-circumscribed venous aneurysm. Stent-supported coil embolization technique could be helpful in wide neck venous aneurysm to allow occlusion of the aneurysm and to avoid complications related to the occlusion of the dominant sinus. However, we need more evidence to support lonely stent placement or stent-supported coil embolization for the treatment of wide-neck venous aneurysm.

**REFERENCES**

1. Axelsson A, Ringdahl A. Tinnitus – a study of its prevalence and characteristics. *Br J Audiol* 1989;23:53-62.
2. Emery DJ, Ferguson RD, Williams JS. Pulsatile tinnitus cured by angioplasty and stenting of petrous carotid artery stenosis. *Arch Otolaryngol Head Neck Surg* 1998;124:460-1.
3. Houdart E, Chapot R, Merland JJ. Aneurysm of a dural sigmoid sinus: A novel vascular cause of pulsatile tinnitus. *Ann Neurol* 2000;48:669-71.
4. Jackson P. Tinnitus in the elderly. In: Hinchcliffe R, ed. *Hearing and balance in the elderly*. Edinburgh: Churchill Livingstone, 1983.
5. Khalil S, Ogunyemi L, Osborne J. Middle cerebral artery aneurysm presenting as isolated hyperacusis. *J Laryngol Otol* 2002;116:376-8.
6. Lambert PR, Cantrell RW. Objective tinnitus associated with abnormal mastoid emissary vein. *Am J Otolaryngol* 1986;7:204-7.
7. Malek AM, Halbach VV, Phatouros CC, et al. Balloon-assist Technique for Endovascular Coil Embolization of Geometrically Difficult Intracranial Aneurysms. *Neurosurgery* 2000;46:1397-1407.
8. McCormick WF. The pathology of vascular (“arteriovenous”) malformations. *J Neurosurg* 1966;24:807-16.
9. Meyer JD, Baghai P, Latchaw RE. Cerebral varix and probable venous angiomas: an unusual isolated anomaly. *Am J Neuroradiol* 1983;4:85-7.
10. Nelson PK, Levy DI. Balloon – assisted coil embolization of wide – neck aneurysms of the internal carotid artery: medium – term angiographic and clinical follow – up in 22 patients. *Am J Neuroradiol* 2001;22:19-26.

11. Phatouros CC, Sasaki TYJ, Higashida RT, et al. Stent-supported coil embolization: The treatment of fusiform and wide-neck aneurysms and pseudoaneurysms. *Neurosurgery* 2000;47:107-15.
12. Sarwar M, McCormick WF. Intracerebral venous angiomas. *Arch Neurol* 1978;35:323-5.
13. Sekhon LHS, Morgan MK, Sorby W, Grinnell V. Combined endovascular stent implantation and endovascular coil placement for the treatment of a wide – necked vertebral artery aneurysm: Technical case report. *Neurosurgery* 1998;43:380-3.
14. Shah SB, Lalwani AK, Dowd CF. Transverse/Sigmoid sinus dural arteriovenous fistulas presenting as pulsatile tinnitus. *Laryngoscope* 1999;109:54-8.
15. Shownkeen H, Yoo K, Leonetti J, Origitano TC. Endovascular treatment of transverse – sigmoid sinus dural arteriovenous malformations presenting as pulsatile tinnitus. *Skull Base: An Interdisciplinary Approach* 2001;11:13-23.
16. Sismains A, Stamm MA, Sobel M. Objective tinnitus in patients with atherosclerotic carotid artery disease. *Am J Otol* 1994;15:404-7.
17. Soula P, d'Othee BJ, Otal P, et al. Macroporous polyester-covered stent in an experimental abdominal aortic aneurysm model. *J Endovasc Ther* 2001;8:390-400.
18. Tong FC, Cloft HJ, Dion JE. Endovascular treatment of intracranial aneurysms with Guglielmi detachable coils: emphasis on new techniques. *J Clin Neurosci* 2000;7:244-53.
19. Turjman F, Acevedo G, Massoud TF, et al. An experimental study of the treatment of aneurysms using and intravascular prosthesis. *J Neuroradiol* 1997;24:205-11.
20. Tyson GW, Jane JA, Strachan WE. Intracerebral hemorrhage due to ruptured venous aneurysm. *J Neurosurg* 1978;49:739-43.

Figure 1. Left, bone window CT-scan shows eroded left petrous bone with involvement of the mastoid cells (Black arrow). Right, venous phase angiogram shows a left transverse-sigmoid sinus aneurysm (White arrow).



Figure 2. Left, first DSA shows post-stent angiogram (Black arrow). Right, control DSA shows slight reduction in the size of aneurysm (White arrow).





Figure 3. Left, X-ray image shows stent and coils localizations (Black arrow). Right, final venous phase angiogram shows occlusion of the aneurysm and patency of the left TSS (white arrow).



Figure 4. Six month follow-up venous phase angiogram shows occlusion of the aneurysm (black arrow) and patency of the left TSS (White arrow).

