

## PENUMBRA COIL AND STENT: AN OPTION IN LARGE ANEURYSMS OF WIDTH NECK

### *Coil Penumbra más Stent: Una opción en aneurismas grandes de cuello ancho*

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#### ABSTRACT

**Introduction:** Endovascular treatment of cerebral aneurysms is an appropriate option. In patients with wide neck can be chose embolization with coils with stent assisted or flow diverter. In complex aneurysms, endovascular treatment has incomplete occlusion rates, so alternatives are sought as the Penumbra® coil, which is a thicker coil, therefore it has a potential effect of being more efficient for packaging and more cost effective, because better packaging is achieved with fewer coils and faster.

**Clinical case:** Presents itself the case of a 48-year-old patient, a time of illness of 8 months, with a decreased visual acuity in the left eye, sporadic headache, oppressive and global type with AVS 4/10. The cerebral angiography evidenced a saccular aneurysm of the ophthalmic segment of the left internal carotid of 15.04x11.53mm, with a 9.78mm wide neck, not broken, Barami type IA. They decide to embolize with 7 Penumbra® coils with previous placement of an LVIS® stent, achieving adequate compaction and total occlusion of the aneurysm as evidenced by immediate postoperative angiography at 6-month control, yielding the patient's clinic without any complications.

**Conclusion:** Penumbra® coils are an efficient alternative and cost effective of embolization in large aneurysms, and the use of stent is an ideal aid in cases of associated wide neck.

**Keywords:** Intracranial Aneurysm, Cerebral Angiography, Stents, Embolization Therapeutic. (source: MeSH NLM)

#### RESUMEN

**Introducción:** El tratamiento endovascular de los aneurismas cerebrales rotos y no rotos es una opción adecuada. En los pacientes con cuello ancho se opta por embolización con coils asistido con stent o divisor de flujo. En los aneurismas complejos el tratamiento endovascular tiene tasas altas de oclusión incompleta, por ello se buscan alternativas como el uso del Coil Penumbra® que es un coil más grueso, por lo tanto, tiene un efecto potencial de ser más eficiente para el empaquetamiento y más costo efectivo, debido a que se logra mejor empaquetamiento con menos coils y más rápido.

**Caso Clínico:** Se presenta el caso de un paciente varón de 48 años, con un tiempo de enfermedad de 8 meses, con clínica de disminución de agudeza visual en ojo izquierdo, cefalea esporádica tipo opresiva y global con EVA 4/10, por lo que se le realiza una angiografía cerebral en la que se identifica un aneurisma sacular del segmento oftálmico de la carótida interna izquierda de 15.04x11.53mm, con cuello ancho de 9.78mm, no roto, Barami tipo IA. Se decide embolizar con 7 coils Penumbra® previa colocación de un stent LVIS®, lográndose la compactación adecuada y la oclusión total del aneurisma como se evidencia en la angiografía postoperatoria inmediata al control de 6 meses, cediendo la clínica del paciente sin complicación ninguna del procedimiento.

**Conclusión:** Los coils Penumbra® son una alternativa eficiente y costo efectiva de embolización en aneurismas grandes, y el uso de stent es una ayuda idónea en los casos de cuello ancho asociado.

**Palabras Clave:** Aneurisma Intracraneal, Angiografía cerebral, Stents, Embolización Terapéutica. (fuente: DeCS Bireme)

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**E**ndovascular treatment of ruptured and unruptured cerebral aneurysms is an appropriate option for the treatment of most patients. In aneurysms that have a well defined and narrow neck, treatment with coils is sufficient. On the other hand, when the neck is wide, other strategies

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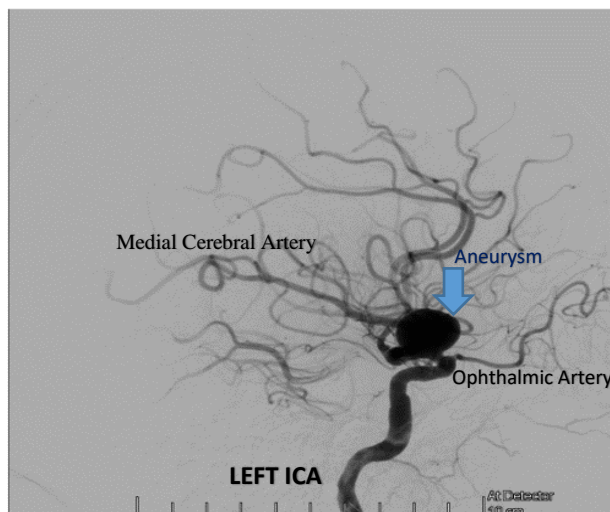
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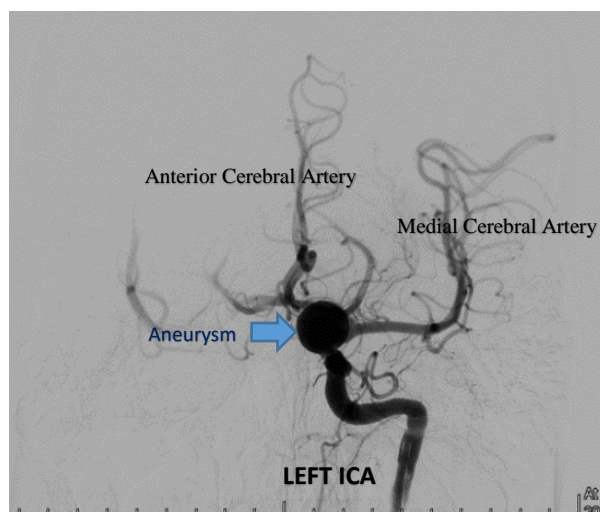
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are chosen such as the use of assisted coils with a stent or the diverter of flow. <sup>1</sup>

In some complex aneurysms, despite endovascular treatment, there are high rates of incomplete occlusion, recanalization or retreatment with microsurgical clipping,



**Fig 1.** Angiography of the left internal carotid artery (ICA) in the anteroposterior view.



**Fig 2.** Angiography of the left internal carotid artery (ICA) in the anteroposterior view.

which is why the technology of coils has changed in the last 2 decades.<sup>2</sup>

Penumbra® coils are coils thicker than conventional coils, therefore, they provide a potential effect of being more efficient in packaging and more cost effective. Being a more efficient embolization brings less time for the catheter to remain inside the vessel and less exposure to radiation, both the patient and the medical staff.<sup>3-4</sup>

Penumbra® coils have 0.020 inches of diameter and give between 178 to 400% more volume per unit length than conventional coils of 0.010 and 0.015 in. Initially they were an alternative for large aneurysms, but they can also help in small aneurysms, because better packaging is achieved with fewer coils and more quickly.<sup>3-5</sup>

We presented the successful case of the treatment of a patient with large unruptured aneurysm of the ophthalmic segment of the left internal carotid artery, which was embolized with Penumbra® coils and stent, achieving complete occlusion.

## CLINICAL CASE

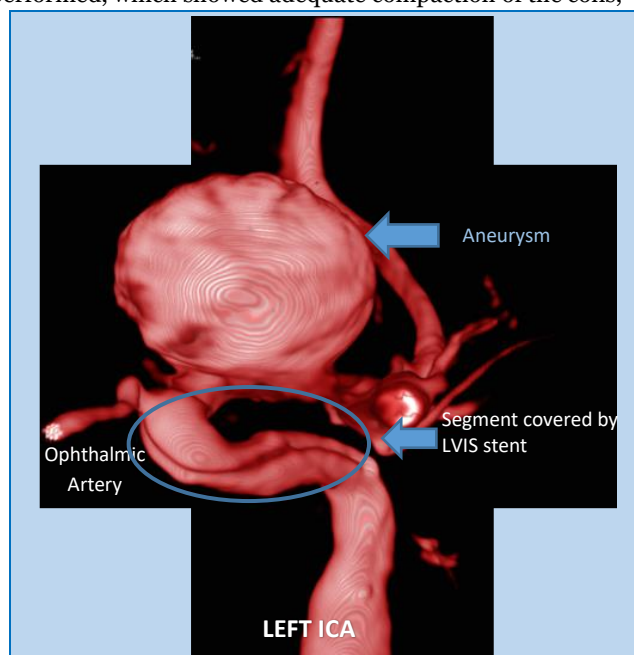
**History and examination:** 48-year-old male patient, native from Lima, with a medical history of hypothyroidism of 3 years of evolution in treatment with Levothyroxine. No surgical history, no medication allergy. The patient presented 8 months before his admission visual acuity decrease in the left eye, associated with sporadic headache type oppressive, global, with visual analogue scale (VAS) 4/10, which yielded with conventional analgesics. For this reason, he went to a private doctor, where a cerebral angio-CT was indicated that showed the presence of a unruptured saccular aneurysm with a narrow neck, in the ophthalmic segment of the left internal carotid artery (ICA), measuring 13x14x15mm.

A cerebral panangiography was performed that showed an unruptured saccular aneurysm in the ophthalmic segment of the left internal carotid artery of 15.04x11.53mm, with a 9.78mm wide neck, Barami Type IA. The patency of the

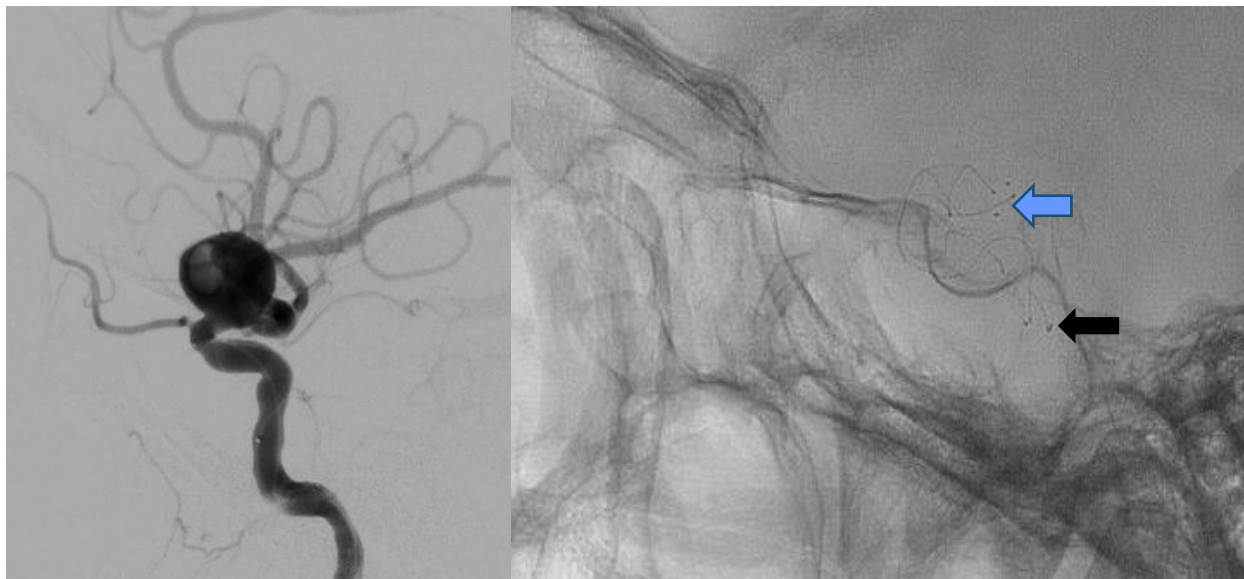
right anterior communicating and right posterior communicating arteries was evidenced, as can be seen in figures N ° 1 and N ° 2.

**Treatment:** It was decided to embolize the aneurysm using a Stent and coils. First a 5.5x27mm LVIS® stent was placed, which was placed below the carotid bifurcation, being equidistant from the neck of the aneurysm, which was completely covered. However, it was found that the filling of the aneurysm persisted, as seen in Figure 3 of a 3D angiogram of the left internal carotid artery. Also, the LVIS® stent path can be seen in Figure 4.

Then it was decided to embolize with 7 Penumbra 400 Complex Soft® coils: 16mmx60cm, 14mmx50cm, 13mmx48cm, 10mmx30cm, 9mmx35cm, 7mmx20cm and 4mmx12cm. After that, a control angiography was performed, which showed adequate compaction of the coils,



**Fig 3.** Angiography of Left Internal Carotid Artery (ICA) in 3D showing the aneurysm and the area occupied by the stent.



**Fig 4.** On the right, angiography of the left Internal Carotid Artery is observed in the lateral projection, compared to the fluoroscopic view in the left lateral projection, where the proximal end (black arrow) and distal end (celestial arrow) of the Stent can be seen LVIS®.

without evidence of aneurysm or residual neck, with a Raymond Roy I treatment degree. The evolution of the compaction can be evidenced from Figure N° 5 to the Figure N° 10

**Evolution:** The patient evolved favorably in the postoperative period without presenting complications, being discharged on the 3rd day. Six months after coil embolization, the patient was in good general condition, with a Glasgow Coma Scale of 15 points, no meningeal signs, no motor deficit, photoreactive pupils and preserved cranial nerves, asymptomatic. It was decided to perform a control angiography, where the total exclusion of the aneurysm was confirmed, with preservation of adjacent vascular structures dictating the discharge and cure of the patient. In Figure N° 11, 3D angiography of the left internal carotid artery with compaction of the coils can be seen.

## DISCUSSION

Milburn et al found in their study that the use of coil Penumbra® reduced by 25% the number of coils used compared to the use of Orbit® or Galaxy® coils, with equal occlusion and complication rates which were acceptable. It even found a 67% reduction in costs when using Penumbra® coils. <sup>6</sup>

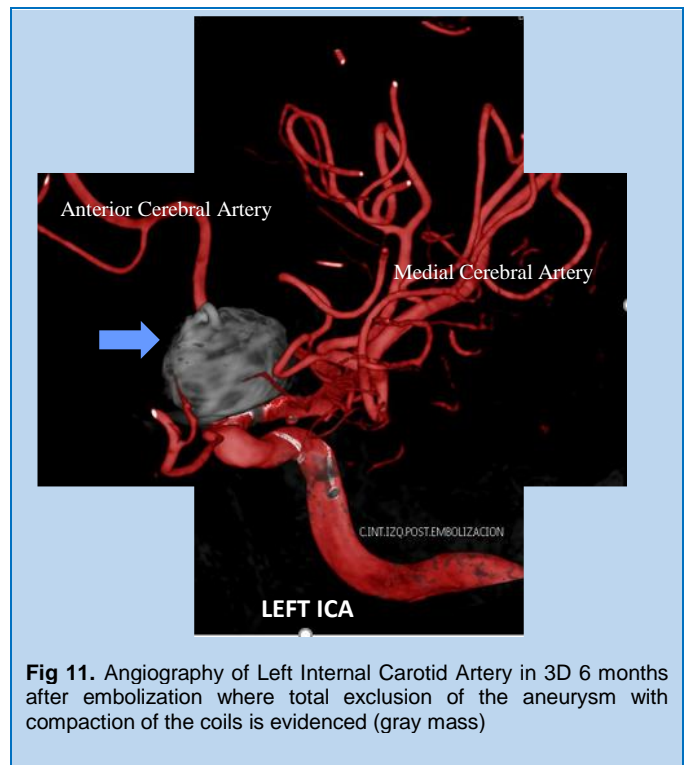
Stapleton et al found that better packing was achieved, greater initial degree of aneurysmal occlusion with a lower rate of recanalization and retreatment when using Penumbra® coils. <sup>2</sup>

Given the cost of using the flow diversifier, which in our institution is difficult to acquire, we consider that the treatment of this aneurysm can receive the benefit of the Penumbra® coil assisted with a stent because the aneurysm had a wide neck. In this way, excellent results could be obtained in the patient, as demonstrated in the immediate postoperative angiography and in the 6 months after the procedure with total exclusion of the aneurysm, without sequelae and without presenting symptoms.

## CONCLUSION

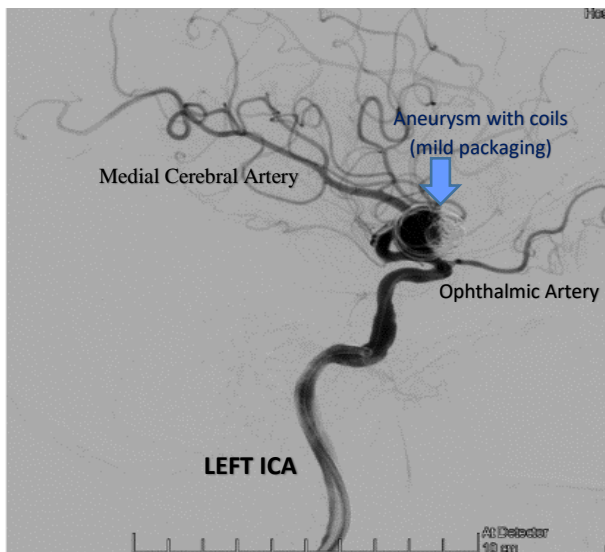
Penumbra® coils are an efficient and cost-effective alternative to embolization in large aneurysms, with adequate packing and occlusion and with a low rate of complications.

The concomitant use of stent is of great help to avoid the protrusion and migration of coils in a patient with wide neck aneurysm.

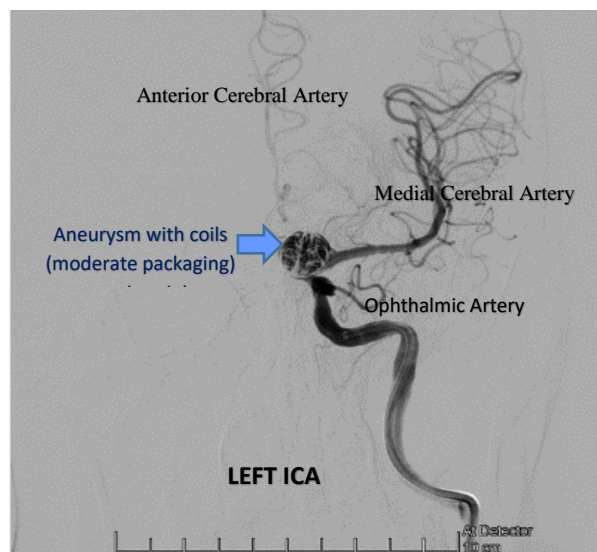


**Fig 11.** Angiography of Left Internal Carotid Artery in 3D 6 months after embolization where total exclusion of the aneurysm with compaction of the coils is evidenced (gray mass)

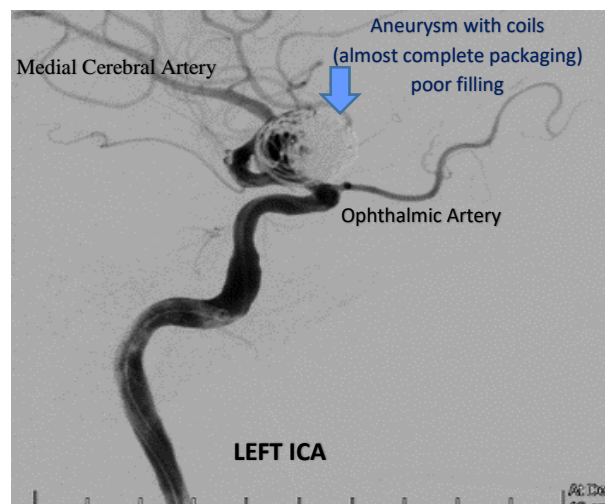




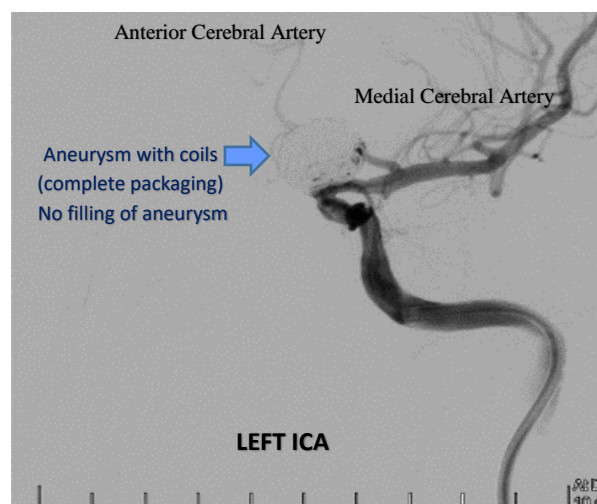
**Fig 5.** Angiography of left Internal Carotid Artery (ICA) in lateral projection after the placement of the first coil.



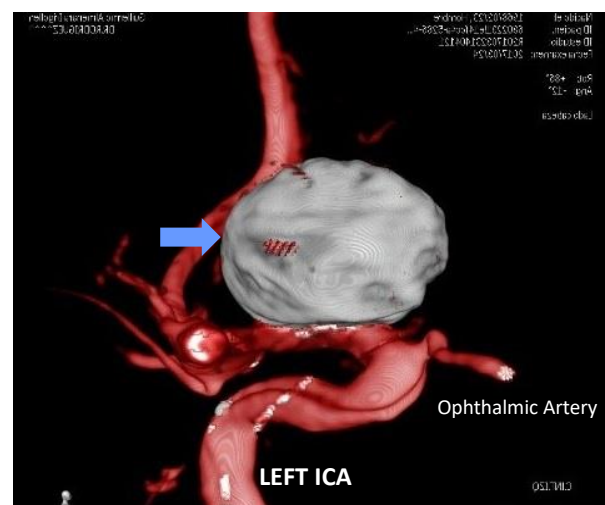
**Fig 6.** Angiography of left Internal Carotid Artery (ICA) in anteroposterior projection after the placement of 3 coils.



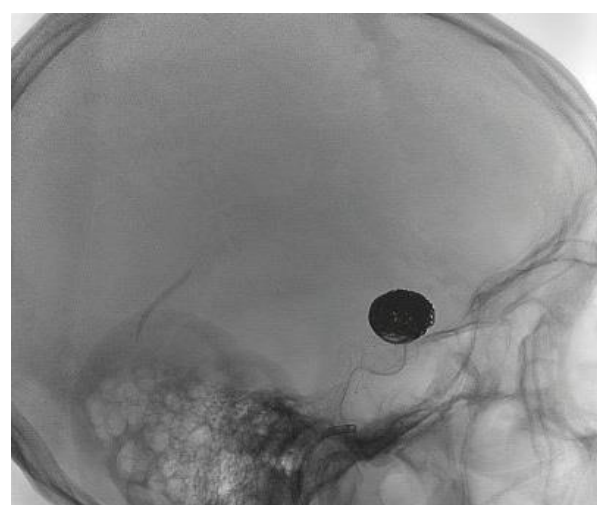
**Fig 7.** Angiography of left Internal Carotid Artery (ICA) in lateral projection after the placement of 5 coils.



**Fig 8.** Angiography of left Internal Carotid Artery (ICA) in anteroposterior projection after the placement of 7 coils.



**Fig 9.** Angiography of left Internal Carotid Artery (ICA) in 3D after embolization with 7 coils (gray mass in the image). The total occlusion of the aneurysm is evident (arrow)



**Fig 10.** Fluoroscopic view in lateral projection where it is possible to demonstrate the mass of compacted coils (arrow).

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## Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

## Author Contributions

*Conception and design:* All the authors. *Drafting the article:* Vargas. *Critically revising the article:* Rodriguez R. *Reviewed submitted version of manuscript:* Vargas. *Approved the final version of the manuscript on behalf of all authors:* Vargas.

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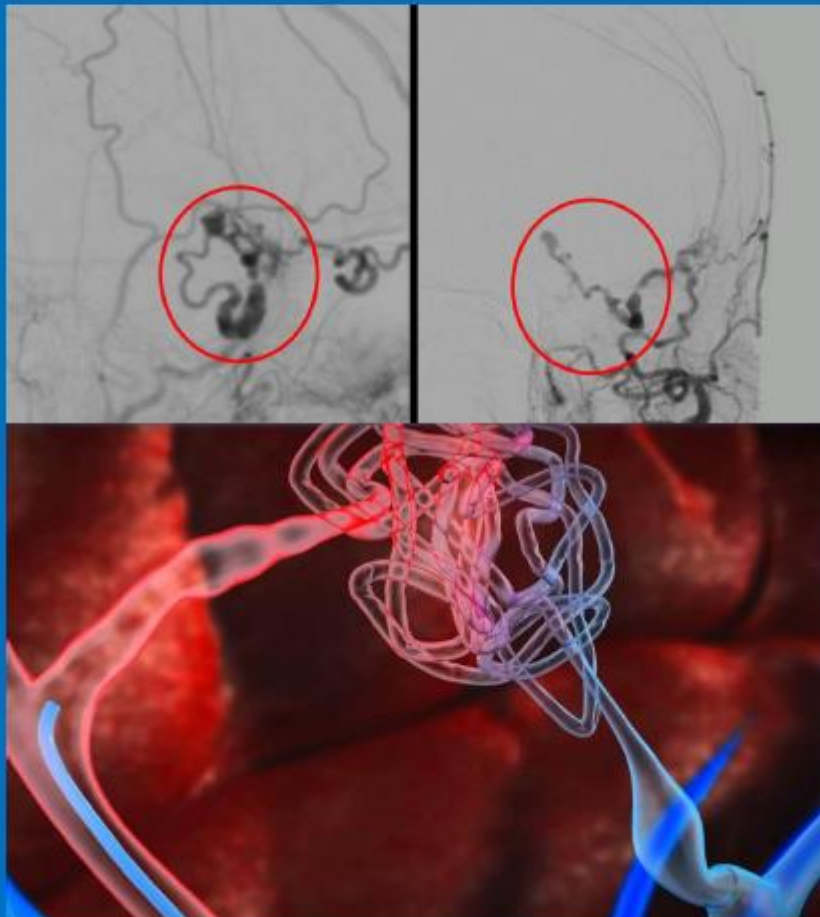
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