

Noncompletely Occlusive Net-Assisted Remodeling Technique in Coiling of Wide-Necked Cerebral Saccular Aneurysms

Dejan Daskalov*, Lazar Kostovski, Petar Janevski and Nikola Stamenkovski

Interventional Radiology Department, University Institute of Radiology, Skopje, North Macedonia

***Corresponding Author:** Dejan Daskalov, Interventional Radiology Department, University Institute of Radiology, Skopje, North Macedonia.

Received: June 19, 2024; **Published:** July 04, 2024

Abstract

Introduction: Cerebral saccular aneurysms represent pathological dilations or bulges of the arteries in the brain due to weakening of the muscular layer of the vessel wall. The approach or technique of endovascular intervention varies depending on the dimensions of the aneurysm neck.

Aims: To present a case of one of the newer endovascular techniques for treating wide-necked cerebral aneurysms that offers a good cost-benefit ratio for patients and rapid post-therapy recovery.

Case Report: A 60-year-old woman presented with severe pulsating pain behind the left eye persisting for a long period and ptosis of the left eyelid. A CT scan of the brain revealed an oval hyperdense extra-axial lesion. The patient was referred for puncture angiography using the Seldinger technique, where a large aneurysm with a wide neck in the ophthalmic segment of the left ICA was diagnosed. Endovascular treatment was approached using a noncompletely occlusive net-assisted remodeling and coiling technique, whereby the aneurysm was completely excluded from circulation.

Conclusion: The noncompletely occlusive net-assisted remodeling technique in coiling of wide-necked cerebral aneurysms offers optimal results for successfully resolving the aneurysmal dilation.

Keywords: *Endovascular Treatment of Aneurysm; Aneurysm; Brain CT; Coiling; Noncompletely Occlusive Net-Assisted Remodeling Technique*

Introduction

A cerebral aneurysm is a pathological dilation or ballooning of a blood vessel in the brain, an abnormal expansion, in the wall of intracranial blood vessels. The most common are saccular (berry) aneurysms, located at the branching points of arteries, predominantly in the Willis' circle at the base of the brain. Rupture of the blood vessel often results in subarachnoid hemorrhage (SAH) or intracranial hemorrhages.

The role of endovascular procedures represents a complete diagnostic and therapeutic revolution in the diagnosis and treatment of cerebral aneurysms, both in their early detection and in fully managing this condition. A particular challenge for endovascular treatment are aneurysms with a wide neck. There are several endovascular techniques for treating wide-necked aneurysms, such as stent-assisted

coiling, balloon-assisted coiling, flow-diverter placement, WEB device placement, and noncompletely occlusive net-assisted remodeling and coiling.

The noncompletely occlusive net-assisted remodeling technique combines the benefits of mechanical support with the precision of coil embolization. The technique involves placing a net across the aneurysm neck, providing a scaffold that prevents coil migration into the parent vessel and ensures dense packing of the aneurysm sac. This approach offers several advantages:

1. **Enhanced stability:** The net provides a stable framework that helps maintain the position of the coils within the aneurysm sac, reducing the risk of coil migration and ensuring a more durable occlusion.
2. **Improved occlusion rates:** By facilitating dense packing of the aneurysm sac, this technique increases the likelihood of complete occlusion, reducing the risk of aneurysm recurrence.
3. **Preservation of parent vessel patency:** The nonocclusive nature of the net allows for the maintenance of blood flow in the parent artery, which is crucial for preventing ischemic complications.
4. **Minimized risk of thromboembolic events:** Unlike stent-assisted techniques, the temporary nature of the net placement reduces the need for prolonged antiplatelet therapy, which can mitigate the risk of thromboembolic events [1,2].

Case Report

A 60-year-old female patient presented with severe pain behind the left eye persisting for a long period and ptosis of the left eyelid. She had been using analgesics, but the pain did not subside. A CT scan on axial sections revealed an oval hyperdense extra-axial lesion supraclinoid left about 12 mm.

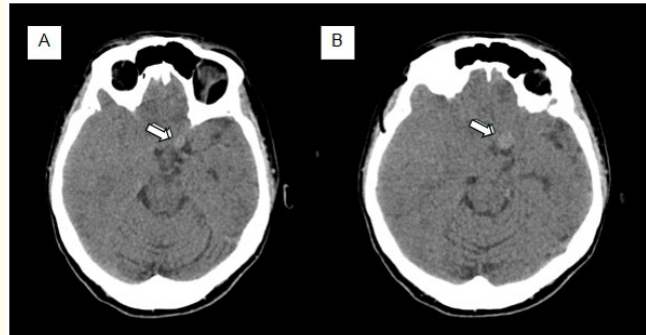


Figure 1: CT axial shows hyperdense extra-axial lesion supraclinoid left (A, B - arrow).

The patient was referred for additional diagnostic puncture angiography where a large aneurysm with a wide neck from the left internal carotid artery (ICA) in the ophthalmic segment was visualized.

Endovascular treatment was approached using a noncompletely occlusive net-assisted remodeling and coiling technique. A retrograde puncture was performed via the Seldinger technique on the right a. femoralis communis, followed by catheterization of the left ICA, where a guiding catheter was placed. Through the guiding catheter, a non-occlusive support net was placed along the artery covering

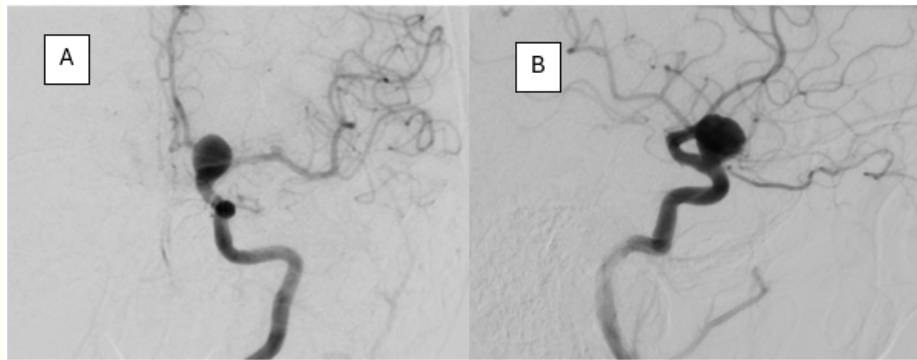


Figure 2: Digital subtraction angiography of saccular aneurysm in the ophthalmic segment of the left ICA, anteroposterior projection (A), lateral projection (B).

the aneurysm neck and a microcatheter into the aneurysm sac, through which the aneurysm was embolized with coils and its neck was remodeled. At the end of the intervention, the non-occlusive support net was removed, and the aneurysm was completely excluded from circulation. During the intervention, 5000 IU of heparin was administered intravenously.

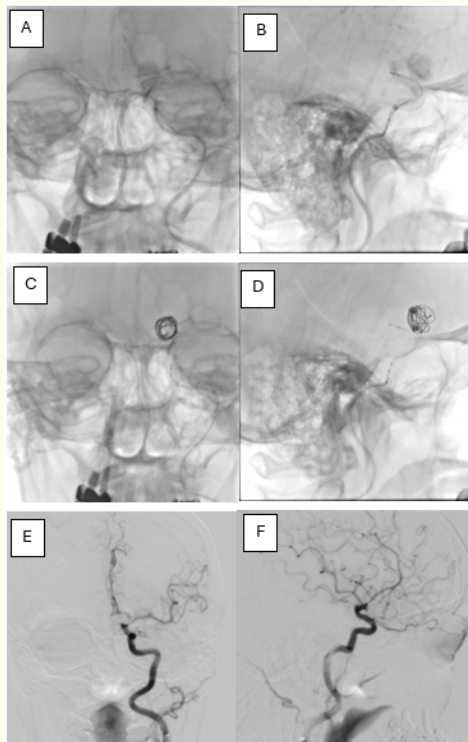


Figure 3: Placement of non-occlusive net (A, B), partial coiling of the sac (C, D), completely embolized aneurysm with neck covering (E, F).

Discussion

The management of wide-necked cerebral saccular aneurysms presents a significant challenge in the field of neurointervention due to the complexity of maintaining stable coil placement while preserving the patency of the parent artery. Traditional methods, such as simple coiling, often prove inadequate for such aneurysms due to the increased risk of coil migration and incomplete occlusion. To address these challenges, more advanced techniques like stent-assisted coiling, balloon-assisted coiling, flow diversion, WEB device placement, and the noncompletely occlusive net-assisted remodeling technique have been developed [1-5].

Our case presented demonstrates the successful application of this technique in a 60-year-old female with a wide-necked aneurysm of the ophthalmic segment of the left internal carotid artery (ICA). The patient's symptoms, including severe pulsating pain behind the left eye and proptosis of the left eyelid, prompted imaging studies that revealed the presence of the aneurysm:

- 1. Diagnostic imaging:** The initial CT scan provided crucial information about the lesion's location and size. Subsequent puncture angiography via the Seldinger technique confirmed the diagnosis and detailed the aneurysm's characteristics, which guided the endovascular treatment approach [6].
- 2. Endovascular procedure:** The procedure involved retrograde puncture and catheterization of the left ICA. A nonocclusive support net was placed across the aneurysm neck, followed by coil embolization. The net provided the necessary support for dense coil packing, and upon completion, the net was removed, leaving the aneurysm completely excluded from the circulation [7].
- 3. Outcome:** The patient tolerated the procedure well, with no immediate complications. The post-intervention imaging confirmed the successful exclusion of the aneurysm from the circulation, indicating a favorable outcome.

Comparative techniques

Techniques that can be used in this type of aneurysm have their own advantages and disadvantages and should be selected for each patient. While stent-assisted and balloon-assisted coiling are also effective for treating wide-necked aneurysms, each has its limitations. Stent-assisted coiling requires the permanent implantation of a stent, necessitating long-term antiplatelet therapy to prevent in-stent thrombosis [8]. Balloon-assisted coiling provides temporary support during coil placement but can be technically challenging and carries the risk of balloon rupture [9]. Flow diverters and WEB devices are other alternatives but come with their own sets of complexities and risks, such as delayed aneurysm occlusion and device-related complications [10,11]. The noncompletely occlusive net-assisted remodeling technique, by contrast, offers a balance of safety and efficacy, minimizing the need for permanent implants and reducing the procedural risks.

The evolution of endovascular techniques continues to enhance the management of complex aneurysms. Ongoing advancements in device technology, imaging modalities, and procedural techniques are likely to further improve outcomes for patients with wide-necked cerebral aneurysms. Future studies comparing long-term outcomes of different techniques will be crucial in refining treatment algorithms and ensuring optimal patient care [12,13].

Conclusion

The noncompletely occlusive net-assisted remodeling technique for coiling wide-necked cerebral aneurysms demonstrates promising results in terms of safety, efficacy, and patient outcomes. By providing stable coil placement and preserving parent vessel patency, this technique represents a valuable addition to the endovascular treatment arsenal, offering a viable solution for the challenging anatomy of wide-necked aneurysms.

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Volume 7 Issue 8 August 2024

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