ISSN 1220-8841 (Print)
ISSN 2344-4959 (Online)

ROMANIAN
NEUROSURGERY

Vol. XXXV | No. 2 June 2021

The stent-assisted coil-jailing technique for very small intracranial aneurysm treatment

A. Chiriac,
N. Dobrin,
Georgiana Ion,
Z. Faiyad,
I. Poeata

DOI: 10.33962/roneuro-2021-023

Romanian Neurosurgery (2021) XXXV (2): pp. 148-151
DOI: 10.33962/roneuro-2021-023
www.journals.lapub.co.uk/index.php/roneurosurgery

The stent-assisted coil-jailing technique for very small intracranial aneurysm treatment

A. Chiriac[1,2], N. Dobrin[2], Georgiana Ion[2], Z. Faiyad[2], I. Poeata[1]

[1] "Grigore T. Popa" University of Medicine and Pharmacy, Iasi, ROMANIA
[2] "Prof. Dr N. Oblu" Clinic Emergency Hospital, Iasi, ROMANIA

ABSTRACT

The stent-assisted coil-jailing technique was initially introduced as an effective and secure method in the treatment of large wide-necked intracranial aneurysms. Later on, this technique has proved its efficiency in the safety and optimal treatment of very small aneurysms. In this article, we will present the successful treatment of a very small middle cerebral artery aneurysm using the stent-assisted coil-jailing technique and review the current trends in this type of treatment.

Keywords
very small aneurysm, stent-assisted coil-jailing technique

INTRODUCTION

With the advances in endovascular technologies, endovascular coil embolization of ruptured cerebral aneurysms has become the first efficient treatment option. Nevertheless, endovascular coiling of very small aneurysms remain controversial. Most of these particular vascular lesions are conformational characterized by a small dome and large-neck. The technical difficulties are represented by the high risk of procedure-related rupture and coil migration due to a very limited aneurysm volumes and structural restriction of embolization coils. Stent-assisted coil-jailing technique is a very popular endovascular method that could be feasible and effective for such structural complicated aneurysms. However, the technique should be used carefully and above all, its usage must be safe and lead to good clinical results with regard to aneurysm occlusion. In this report, we describe a successfully treated very small middle cerebral artery aneurysm using the stent-assisted coil-jailing technique in order to provide a more comprehensive view of this challenging endovascular treatment and eventually to offer helpful clinical information for the management of such cases [8].

CASE PRESENTATION

A 50-year-old woman presented with a sudden-onset headache for which she addressed the emergency department at a local hospital. A

Corresponding author:
A. Chiriac

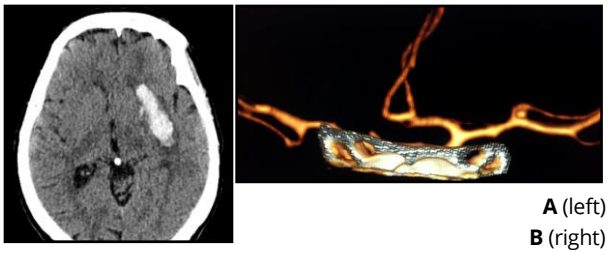
"Prof. Dr N. Oblu" Clinic Emergency Hospital, Iasi, Romania

chiriac_a@hotmail.com

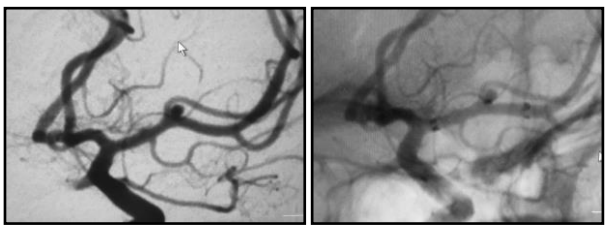
ISSN online 2344-4959
© Romanian Society of Neurosurgery

First published
June 2021 by
London Academic Publishing
www.lapub.co.uk

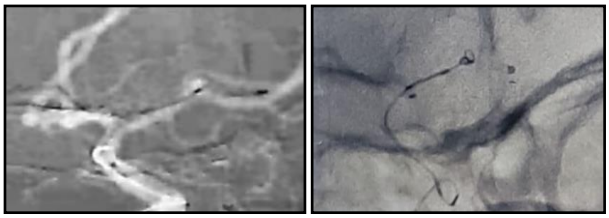
head CT-scan investigation was performed immediately and showed a lenticular hematoma and mild subarachnoid haemorrhage in the left Sylvian fissure. Due to the suspicion of an aneurysmal cerebral hemorrhage, the patient was immediately transferred to our hospital for further diagnosis and treatment. At admission she was confused and with right hemiparesis. Her past medical history included hypertension with no regular treatment. The brain CT angiography raised the suspicion of an aneurysmal dilatation on M1 segment of left middle cerebral artery. A subsequent subtraction catheter cerebral angiography confirmed a very small aneurysm at the origin of left Charcot artery. Due to the very small dimension of the aneurysm (2.3 mm × 2.0 mm) and relatively large neck a stent-assisted coil-jailing technique was proposed for the occlusion of the lesion.



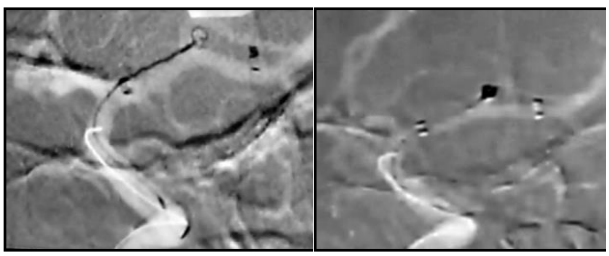
A (left)
B (right)



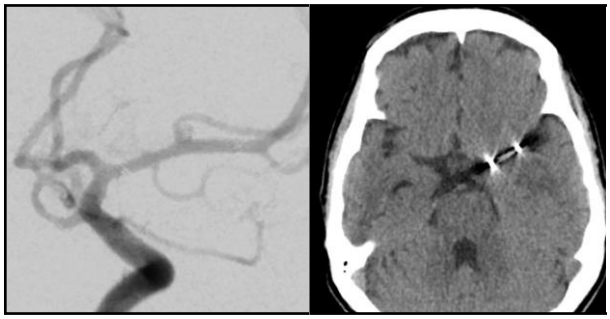
C **D**



E **F**



G **H**



I **J**

K

Figure 1. A, B – Diagnostic cerebral CT and Angio-CT images; **C, D, E, F, G, H, I** – Intraprocedural DSA images; Postprocedural Cerebral CT Images.

The intervention performed the next day on a biplane angiography system (INFINIX, Toshiba, Canon Medical System) under general anesthesia by our neurosurgical team with many years of experience in neuroendovascular interventions. Written informed consent was obtained prior to the treatment. Commercially available 6F introducer sheath from Merit Medical was placed into the right femoral artery. A 6F Chaperon guiding catheters (Microvention) was carefully advanced over 0.035 glidewire up to the proximal segment of the left internal carotid artery. Using the 3D-CT images analysis a favourable working angle roadmap for the target aneurysm was obtained. A Prowler 10 microcatheter (Codman J&J) was then very carefully advanced over a 0.014 Transed microwire (Boston

Scientific) and positioned into the aneurysm sac. Keeping the microcatheter in this fixed position a second Prowler Select Plus microcatheter (Codman J&J) was inserted up to the M1 / M2 bifurcation level of the left middle cerebral artery. With its help a 4/16 mm Enterprise 2 intracranial stent (Codman J&J) is deployed over the aneurysm neck and the first microcatheter in a jailed configuration. After the Prowler Select Plus microcatheter withdraws, two Galaxy G3 MINI microcoils (Cerenovus Johnson&Johnson) were then inserted and detached into aneurysm. The coils placement was done very slowly, and gentle handling of the microcatheter was used to avoid tension build-up in the aneurysm and to allow the coil loop to form inside the aneurysm. After detaching the last coil, the microcatheter is carefully retracted so as not to cause any movement of the stent. A DSA acquisition is performed to check the permeability of all vessels and complete occlusion of the aneurysm. Finally, the entire guiding system is retracted with a compressive dressing of the femoral puncture site. The patient was placed into intensive care and received 75mg clopidogrel and 100mg aspirin daily. A cerebral CT scan was performed 7 days postoperatively and showed the lenticular hematoma resorption. The patient was discharged home after 3 days in good neurological condition.

Discussions

The literature reports that very small intracranial aneurysms (≤3 mm) represent 13.2%–15.1% of all intracranial aneurysms. On the other hand, according to ISUIA study only 0.1% (per year) of small aneurysms (<5 mm) of the anterior circulation will manifested by rupture. There have been also several particular studies that have reported incidences of small aneurysms of up to 7% of all ruptured aneurysms[s]. In this clinical situation an emergency treatment must be initiated. Endovascular coil embolization or microsurgical clipping of ruptured very small cerebral aneurysms are still challenging methods due to distinctive technical difficulties [t,x,s]. If in the case of endovascular treatment the very small size of the aneurysmal dome frequently associated with a wide neck make it difficult to place a coil safely, in the case of microsurgical treatment the thin-walled and too small neck make it difficult to accept a clip without narrowing or tearing the parent artery [3,6,9].

The stent-assisted coiling technique represents an efficacious adjuvant technique for treating wide-necked aneurysms. The advent of these adjuvant techniques has made possible the endovascular occlusion of an increasing number of very small aneurysms. The stent-assisted coil-jailing technique has become often considered as the most efficient option for the embolization of very small aneurysms. This technique allowed, not only to provided the necessary support to achieve a stable coil arrangement, but also solved the problem of overestimating the coil length in small aneurysms. By this technique, if the coil is too long for a small aneurysm, the remaining coil segment (tail) could be purposely left and jailed between the stent and the parent artery wall at the end of the embolization procedure.

The main complication reported in very small aneurysms was intraprocedural rupture. If the first studies reported significantly higher rates of procedural rupture, with the continuing development of endovascular devices and greater operator experience, the last ones did not show a significant association between very small aneurysms and intraprocedural rupture. It seems that the preferred use of stent-assisted coil-jailing technique might explain the evolution of the previously mentioned results. Obtaining a stable position of the microcatheter by fixing it between the arterial wall and the stent, as well as the possibility of coils insertion into aneurysm with the tip of the microcatheter in its neck area, without the need of navigation in the aneurysmal sac caused a significant reduction in the risk of intraprocedural rupture in very small aneurysms [1,3,6,9]

Another complication described in very small aneurysms was that of thrombemolism. Because of a restricted intra-aneurysmal space and an improper dome/neck ratio, coil migration and coil loop protrusion may frequently occur in very small aneurysms embolization. The thromboembolic complications rate for such events has been reported in the literature as varying between 2.1%–12%. The new designs of the intracranial stents and development of the assisted coil techniques have allowed the significant reduction of these complications by their ability to prevent the herniation of the coils and at the same time to fix outside the blood flow the possible oversized coils. These have also simplified the procedure and

prevent possible complications caused by the replacement of the coils [2,4,6].

The recurrence rates of previously coiled vary small intracranial aneurysms in early published reports were variably, in a range approximately similar to those of larger intracranial aneurysms (range from 21% - 15%) [s,t,x].With the increasing use of the jail technique in cases of embolization of very small aneurysms, new studies have reported much lower recurrence rates in these vascular lesions (range from 7.5 % - 1.5%.) [3.5.6.9].This technique has proven useful for the dense packing of the very small aneurysm and avoiding the recoiling of an inappropriate aneurysm occlusion.

Conclusions

The stent-assisted coil-jailing technique has been proven as an efficient approach for the treatment of very intracranial aneurysms with excellent and safety profiles. This technique allowed us both to support the coil loops in the aneurysmal sac by stabilizing the microcatheter and to solve the problem related to the possible oversizing of the length of a coil.

References

1. Beuing, O., Lenz, A., Donitza, A., Becker, M., Serowy, S., & Skalej, M. (2020). Stent-assisted coiling of broad-necked intracranial aneurysms with a new braided microstent (Accero): procedural results and long-term follow-up. Scientific reports, 10(1), 1-8.
2. Jindal, G., Miller, T., Iyohe, M., Shivashankar, R., Prasad, V., & Gandhi, D. (2016). Small Intracranial Aneurysm Treatment Using Target (®) Ultrasoft (™) Coils. Journal of vascular and interventional neurology, 9(1), 46–51.
3. Kim, S. M., Lee, H. G., Choi, B. S., Kim, J. S., Lee, S. J., Kim, H. Y., ... & Jin, S. C. (2018). Recurrence of Small Cerebral Aneurysms (< 4 mm) Treated Endovascularly Using Target® Nano™ Coils. Journal of cerebrovascular and endovascular neurosurgery, 20(2), 106.
4. van Rooij WJ, Keeren GJ, Peluso JP, Sluzewski M. Clinical and angiographic results of coiling of 196 very small (< or = 3 mm) intracranial aneurysms. (2009) AJNR Am J Neuroradiol. Apr;30(4):835-9..
5. Rong-Bo Q, Hua J, Kai W, Ze-Lin S. Stent-jail technique in endovascular treatment of wide-necked aneurysm. Turk Neurosurg. 2013;23(2):179-82..
6. Li, C. H., Su, X. H., Zhang, B., Han, Y. F., Zhang, E. W., Yang, L., ... & Gao, B. L. (2014). The stent-assisted coil-jailing technique facilitates efficient embolization of tiny cerebral aneurysms. Korean journal of radiology, 15(6), 850.
7. Zhang Y, Yang M, Zhang H, Zhang X, Li Y, Jiang C, Liu J, Yang X. Stent-Assisted Coiling May Prevent the Recurrence of Very Small Ruptured Intracranial Aneurysms: A Multicenter Study. World Neurosurg. 2017 Apr;100:22-29.
8. Zhou Y, Peng Q, Wu X, Zhang Y, Liu J, Yang X, Mu S. Endovascular Treatment of Tiny Aneurysms With Low-Profile Visualized Intraluminal Support Devices Using a "Compressed" Stent Technique. Front Neurol. 2020 Dec 18;11:610126.
9. Wang, J. W., Li, C. H., Tian, Y. Y., Li, X. Y., Liu, J. F., Li, H., & Gao, B. L. (2020). Safety and efficacy of endovascular treatment of ruptured tiny cerebral aneurysms compared with ruptured larger aneurysms. Interventional Neuroradiology, 26(3), 283-290.
10. Xue, G., Zuo, Q., Tang, H., Zhang, X., Duan, G., Feng, Z. & Liu, J. (2020). Comparison of Low-Profiled Visualized Intraluminal Support Stent-Assisted Coiling and Coiling Only for Acutely Ruptured Intracranial Aneurysms: Safety and Efficacy Based on a Propensity Score-Matched Cohort Study. Neurosurgery, 87(3), 584-591.