Interdisciplinary Neurosurgery: Advanced Techniques and Case Management 23 (2021) 100998

Contents lists available at ScienceDirect

Interdisciplinary Neurosurgery: Advanced Techniques and Case Management

journal homepage: www.elsevier.com/locate/inat

Case Reports & Case Series

The microsurgical management of a brainstem compression resulted from an embolized cerebral tentorial dural arteriovenous fistula

Mohammad Ghorbani [a], Farhad Rahbarian [a], Ghazwan A. Lafta [b,*]

[a] Division of Vascular and Endovascular Neurosurgery, Firoozgar Hospital, Iran University of Medical Sciences, Tehran, Iran
[b] Department of Surgery, Faculty of Medicine, University of Al-Ameed, Karbala, Iraq

ARTICLE INFO

Keywords:
Tentorial DAVF
Brain stem compression
Transarterial embolization

ABSTRACT

Intracranial dural arteriovenous fistulas (DAVFs) are abnormal connections between an arterial feeder and a dural venous sinus or leptomeningeal vein with the nidus located within the dural leaflets. In this article we report an uncommon event which is a hematoma inside a dilated draining vein formed after embolization of tentorial DAVF causing pressure on the brain stem and removed surgically. A 47 years old male with a history of ventriculoperitonial (V-P) shunt 2 years ago and embolization of arteriovenous malformation 15 years ago, presented to our hospital having symptoms due to tentorial dural arteriovenous fistula (TDAVF) fed from branches of external and internal carotid arteries. Two sessions of transarterial embolization were performed with total occlusion. Six months later, he was admitted to the hospital with gait unsteadiness, swallowing difficulties and confusion. Brain MRI revealed a hyperintense heterogenous mass like a pouch from thrombosed draining veins with a localized hematoma compressing the brainstem and causing these symptoms. A small hematoma was seen and removed microsurgically. The patient was improved clinically and was discharged home after 5 days. Neurointerventionalist must be aware when deciding to occlude TDAVMs as there is a risk of venous varix formation and rupture if incompletely occluded. Surgical intervention is sometimes needed to alleviate the hazardous compression on the brain stem and other vital structures.

1. Introduction

Intracranial dural arteriovenous fistulas (DAVFs) are abnormal connections between an arterial feeder and a dural venous sinus or leptomeningeal vein with the nidus located within the dural leaflets [1]. They are about 10% to 15% of all intracranial vascular malformations. The plan of endovascular intervention or surgical excision of tentorial DAVF (TDAVF) is challenging because of its multiple feeders and deep location [2]. TDAVFs have the most aggressive neurological behavior and can cause hemorrhage and focal deficit as they possibly drain into pial veins [3]. In this article we report a serious complication which is a mass of hemorrhage adjacent to a dilated draining vein formed after embolization of tentorial DAVF and removed surgically, both caused a pressure on the brainstem.

2. Case presentation

A 47 years old male was admitted in the emergency room complaining of headache, unsteadiness, blurred vision, on examination he had papilledema, ataxia. He had a history of ventriculoperitoneal (V-P) shunt for hydrocephalus 2 years ago and cerebral AVM embolization and Gamma knife 15 years ago. Brain CT scan showed an infratentorial mass (Fig. 1-A), and a diagnostic catheter angiography was done and revealed tentorial dural arteriovenous fistula (AVF) fed from right posterior cerebral artery (PCA), left tentorial artery, right (MMA) and was drained into great cerebral vein of Galen (Fig. 1-B). A session of endovascular embolization through right femoral artery was decided and embolization of feeders from right MMA was done using 3 vials of Onyx (Medtronic Neurovascular Inc., Irvine, CA, USA), thus occluding about 90% of the fistula, the other feeders were not accessible (Fig. 1-C).

Two months later he had come back with headache, ataxia and visual disturbance. A second session of intervention was done by performing transarterial embolization of feeders from left occipital artery, right PCA branches, left tentorial artery, and left MMA. A total occlusion of the fistula was performed (Fig. 2). The patient was improved and was discharged home after two days.

After 20 days patient came back with headache and paraparesis, CT scan was done and acute hydrocephalus occurred (Fig. 3-A), therefore;

* Corresponding author.
E-mail address: ghazwan_altayy@yahoo.com (G.A. Lafta).

https://doi.org/10.1016/j.inat.2020.100998
Received 25 September 2020; Received in revised form 25 October 2020; Accepted 31 October 2020
Available online 7 November 2020

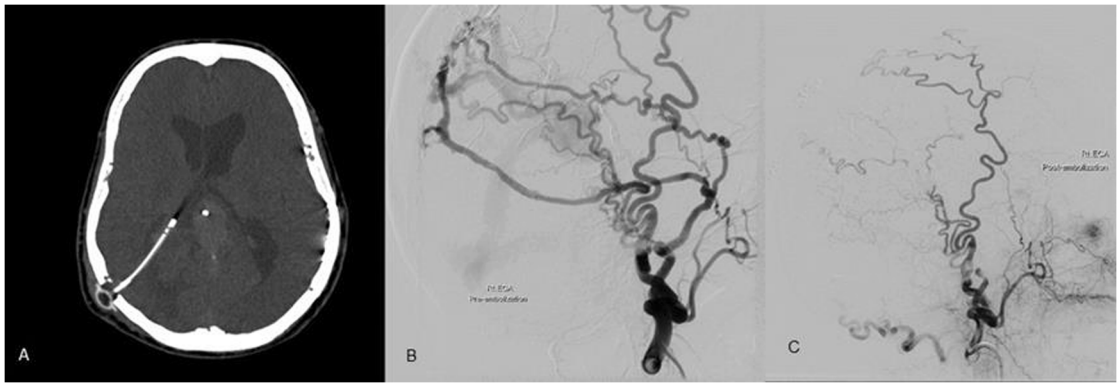

Fig. 1. A- Brain CT scan showing the catheter of V-P shunt, a hyperdense fungating mass of A-V fistula, B-Right MMA angiography before the first embolization session, C- Right MMA after embolization.

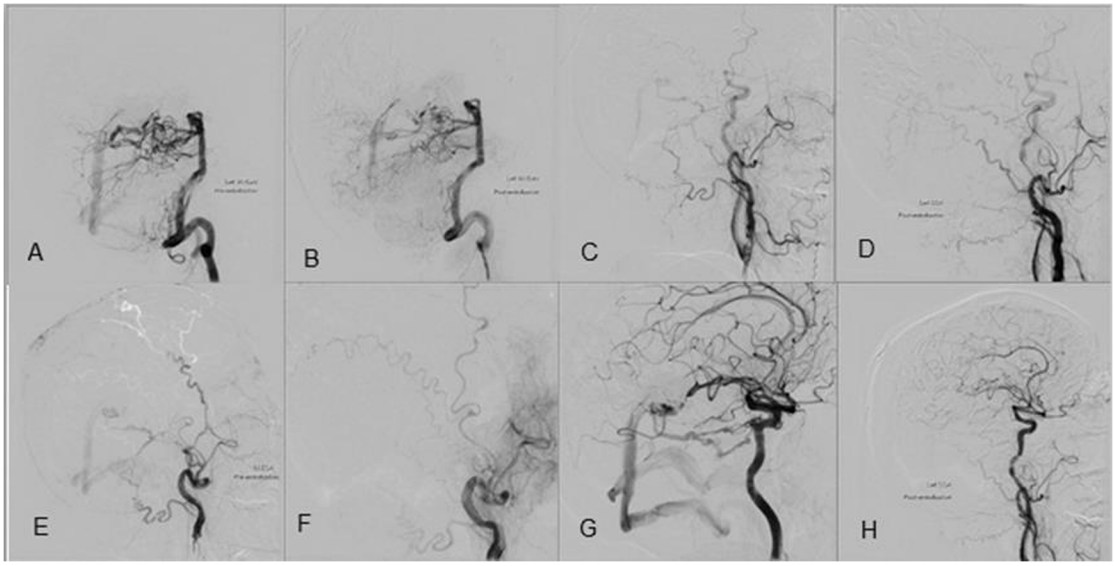

Fig. 2. The second session of embolization, A-Right PCA before embolization, B- Right PCA after embolization, C-Left occipital artery after embolization, D-Left occipital artery before embolization, E-Left MMA before embolization, F-Left MMA after embolization, G-Left tentorial artery before embolization, H-Left tentorial artery after embolization.

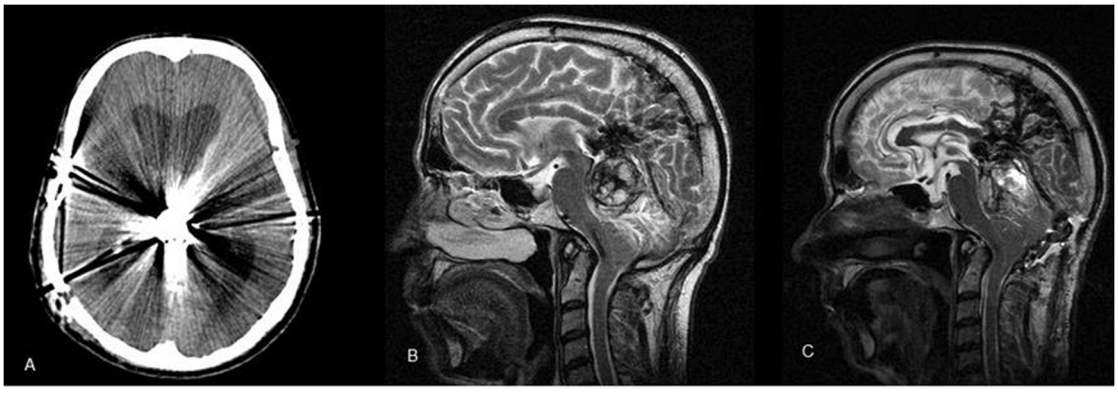

Fig. 3. A- Brain CT scan after the second session of embolization revealing Onyx cast and hydrocephalus, B- sagittal brain MRI showing the venous pouch and hematoma posterior to the brain stem before the surgery, C- sagittal brain MRI post-operatively showing a decreased size of the mass compressing the brain stem.

(V-P) shunt of the left side was done. He had improved and was discharged home after 3 days. 6 months later he was admitted to the hospital with gait unsteadiness, swallowing difficulties and confusion. Brain MRI revealed a heterogenous mass like a pouch from thrombosed draining veins with a localized hematoma compressing the brainstem and causing these symptoms (Fig. 3-B). A surgery was decided to remove the compressing mass through infratentorial supracereballar approach. During surgery, the venous varix was opened and a small hematoma was

seen and removed microsurgically. A post-operative brain MRI was done showing a decreased compression on the brain stem (Fig. 3-C). The patient clinical status was improved and was discharged home after 5 days.

3. Discussion

DAVF is supplied by meningeal arteries and is drained into venous sinuses, meningeal veins, or subarachnoid veins [4]. Although most of these meningeal arteries are dural arteries according to the pathogenesis of DAVF, pial arteries were found to supply the arteries of TDAVF. [5] TDAVFs consist of about 8% of all intracranial DAVFs. [6] To date, endovascular treatment has become the best option for DAVF, including TDAVF [7]. While the incidence of Onyx embolization complications in patients with TDAVF could be as low as 0% [8], the TDAVF embolization seems to be different. Wu et al. suggested that the feeding of pial arteries could increase the risk of periprocedural complications during embolization with Onyx for DAVF. [9] The aim of the DAVF treatment is complete obliteration of all arterial supply or occlusion of proximal draining vein. Therapeutic options for treating DAVF include transvenous and/or transarterial embolization and surgical excision of the DAVF nidus with ligation of the draining veins. Usually the transvenous embolization was preferred when the veins ware patent and not very tortuous for catheterization of the draining vein and fistula. These options of embolization procedures provide an excellent obliteration rates for most DAVF, but TDAVF are different. Transvenous navigation is difficult to locations deep around the tentorium. More importantly, transvenous access is limited as TDAVF usually drain to subarachnoid veins rather than to their associated sinus (Borden Type III). [10] In our case and regarding to the hemorrhage formed after embolization, it is not possible to occlude all the feeders in one session, therefore; a possibility of Onyx migration and occlusion to the distal veins occur; hence, they may rupture and bleed, forming a localized hematoma compressing the surrounding neural structures. According to Jiang C. et al, when the fistula is subtotally obliterated, the Onyx may migrate and this may lead to a rupture of venous varix. [6] The only way to deal with the formed hematoma mass and brain stem compression is to remove it surgically, hence; the symptoms of our patient were alleviated and his clinical condition was improved.

4. Conclusion

Neurointerventionalist must be aware when deciding to occlude complicated deeply located multifeeders tentorial AVMs as there is a risk of venous varix formation and rupture if incompletely occluded. Surgical intervention is sometimes needed to alleviate the hazardous compression on the brain stem and other vital structures.

Authorship

All authors participated in the surgical/medical care of the patient and/or helped draft/review the manuscript

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] C. Paula-Lucas, J.-G.-M. Pereica-Caldas, M.N. Prandini, Do leptomeningeal venous drainage and dysplastic venous dilation predict hemorrhage in dural arteriovenous fistula? Surg. Neurol. 66 (Suppl 3) (2006) S2–S5, https://doi.org/10.1016/j.surneu.2006.02.040.
[2] Y. Iwamuro, I. Nakahara, T. Higashi, M. Iwaasa, Y. Watanabe, E. Hirata, K. Tsunetoshi, M. Taha, Tentorial dural arteriovenous fistula presenting symptoms due to mass effect on the dilated draining vein: case report, Surg. Neurol. 65 (2006) 511–515, https://doi.org/10.1016/j.surneu.2005.07.076.
[3] M.T. Lawton, R.O. Sanchez-Mejia, D. Pham, J. Tan, V.V. Halbach, Tentorial dural arteriovenous fistulae : operative strategies and microsurgical results for six types. Neurosurgery 62 (3 Suppl 1) 110–124; discussion 124–125, 2008, https://doi.org/10.1227/01.neu.0000317381.68561.b0.
[4] B.A. Gross, R. Du, The natural history of cerebral dural arteriovenous fistulae, Neurosurgery. 71 (3) (2012) 594–603, https://doi.org/10.1227/NEU.0b013e31825eabdb.
[5] N. Kato, T. Tanaka, Y. Suzuki, H. Sakamoto, T. Arai, Y. Hasegawa, T. Abe, Multistage indocyanine green videoangiography for the convexity dural arteriovenous fistula with angiographically occult pial fistula, J. Stroke Cerebrovascular Diseases. 21 (8) (2012) 918–e1, https://doi.org/10.1016/j.jstrokecerebrovasdis.2012.05.008.
[6] C. Jiang, X. Lv, Y. Li, J. Zhang, Z. Wu, Endovascular treatment of high-risk tentorial dural arteriovenous fistulas: clinical outcomes, Neuroradiology. 51 (2) (2009) 103, https://doi.org/10.1007/s00234-008-0473-8.
[7] R.C. Puffer, D.J. Daniels, D.F. Kallmes, H.J. Cloft, G. Lanzino, Curative Onyx embolization of tentorial dural arteriovenous fistulas, Neurosurg. Focus. 32 (5) (2012) E4, https://doi.org/10.3171/2011.12.FOCUS11323.
[8] C. Liu, B. Xu, D. Song, B. Leng, Y. Mao, Y. Gu, Y. Liao, Clinical approach of using Onyx via transarterial access in treating tentorial dural arteriovenous fistula, Neurol. Res. 36 (11) (2014) 983–991, doi: 10.1179/1743132814Y.0000000383.
[9] Q. Wu, X.S. Zhang, H.D. Wang, Q.R. Zhang, L.L. Wen, C.H. Hang, X. Zhang, Onyx embolization for tentorial dural arteriovenous fistula with pial arterial supply: case series and analysis of complications, World Neurosurg. 1 (92) (2016) 58–64, https://doi.org/10.1016/j.wneu.2016.04.033.
[10] H.J. Kim, J.H. Yang, H.J. Lee, Tentorial dural arteriovenous fistula treated using transarterial Onyx embolization, J. Korean Neurosurg. Soc. 58 (3) (2015) 276, https://doi.org/10.3340/jkns.2015.58.3.276.