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Original Article

Traumatic brain aneurysm

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Abstract
Rare cases of traumatic brain aneurysms are being reported which were successfully treated by endovascular occlusion of parent artery just at the aneurysmal site by a single detachable latex balloonin one case and cauterization of distal cortical parent artery in other cases.
Conclusion: *Clipping and coiling is not ideal treatment of Traumatic Brain aneurysms, occlusion of parent artery is safer treatment.*
Keywords: *Traumatic intracranial aneurysm, Head injury, Detachable balloon, Extradural haematoma.*

Introduction

Traumatic aneurysms are rare lesions; they develop as an outpunching or ballooning from the vessel wall following brain or cervical injury. Direct injury to the vessel may cause dissection of the vessel or transmural vessel damage, which results in a contained hematoma or a pseudo-aneurysm. Blunt or penetrating cerebrovascular trauma is increasingly being diagnosed with resulting aneurysm formation in the intracranial and extracranial vasculature (Kamlesh et al, 2016).

An intracranial aneurysm that develops after trauma presents a unique challenge both during the diagnostic as well as the treatment phase. Traumatic pseudoaneurysms are usually associated with blunt or shearing forces on the vessel against a fixed surface of the skull base; or, as a direct injury over the convexity of the skull (Bell et al, 2010; Cohen et al, 2008).

The clinical consequences of the presence of an extracranial vessel aneurysm are also poorly understood. These aneurysms are often associated with a high velocity cerebrovascular trauma. Traumatic aneurysms of the extracranial internal carotid artery (ICA) and vertebral artery (VA) have been reported in approximately 15-23% and 4-8% cases of traumatic cerebrovascular injury, respectively (Foreman et al, 2014).

This study was conducted to see incidence of traumatic brain aneurysm in head injury patients and to decide safer and effective treatment plan.

Methods

In traumatic right precavernous ICA aneurysm (Fig.1), right common carotid artery compression

was done manually for 15 minutes (Matas test). It was well tolerated by the patient. Due to difficult location, we decide to occlude ICA by endovascular route.

After part preparation and draping of right femoral region, 1 ml of 1% xylocain was infiltrated in the skin 2 cms below the mid inguinal point. 8F percutaneous catheter introducer sheath was placed in right femoral artery by the Seldinger's technique. Left internal carotid artery DSA was done with cross compression which showed adequate filling of left sided anterior and middle cerebral arteries (Fig.2). 8F guiding catheter (CG, 8F, 100, BALT, France) was then placed in right internal carotid artery, just upto the petrous part through the introducer sheath. A detachable balloon of size larger than the aneurysmal ostium was selected (used the diameter of petrous part of ICA as a scale to measure size of aneurysms,diameter of petrous part of ICA=5 mm). Aneurysmal ostium in our case measured 7.5 mm.

A balloon (latex, BAL 4, 0.8 ml, 10 X 11 mm, BALT, France) was mounted on the single lumen Magic catheter for detachable balloon (PURSIL 3F/1.8 F, 155 cm, with Teflon distal tip, BALT, France) and placed in the precavernous internal carotid artery just at the aneurysmal ostium. It was inflated and detached. Post occlusion right and left internal carotid DSA was done to see the patency of right ICA and filling of right anterior circulation by left ICA (Fig.3).

In other 2 patients, aneurysm was found on cortical branches of ACA and MCA on DSA. DSA was done because CT angiography showed doubtful aneurysms. Both patients were treated by craniotomy and cauterization of cortical parent artery because clipping was not pssible due to thin wall and lack of neck of aneurism.

Results

Intracranial aneurysms are rare complication of head injury. In this study, 250 patients of brain contusion and hematoma were included. All patients underwent CT angiography and DSA when CT angiography was having doubt of aneurysm.

More than one third of patients were 41-50 years of age (35.6%) followed by 30-40 (28.8%), 51-60 (21.2%) and >60 years (14.4%). More than half of patients were males (57.2%) (Table-1).

Out of 250 patients, only three patients (1.2%) had traumatic aneurysm (Graph-1). One patient had precavernous ICA aneurysm and one had aneurysm at cortical branch of left ACA and one had aneurysm at cortical branches of right MCA.

In first patient at that time, she was in GCS=8. Her CT scan was suggestive of right temporal polar extradural haematoma with fracture of right temporal bone for which a right temporal craniectomy with evacuation of haematoma was done at other centre. Post-operatively on second day, she developed proptosis of right eye and on third day when she regained consciousness, she noticed that she was having diminution of vision and pain in her right eye. On examination, she was found to have chemosis and proptosis of right eye, her vision was only finger counting at 1.5 meter distance in right eye and 6/6 in left eye, 90% sensory loss for all modalities over V_1 and V_2 territory and complete ophthalmoplegia on right side. No bruit was audible overhead. With these findings, a differential diagnosis of orbital cellulitis and small post-traumatic right carotid cavernous fistula were made. MRI was done which revealed orbital cellulitis with prominent right cavernous sinus. With this problem, she was referred to our hospital for further management.

To look for the possibility of carotid-cavernous fistula, she was subjected to 4-vessel DSA which showed traumatic pre-cavernous internal carotid artery aneurysm but no carotid-cavernous fistula. Retrospectively, after DSA, we concluded that extradural haematoma could be due to laceration of pre-cavernous internal carotid artery which latter on led to formation of false aneurysm. By this time, she had no perception of light in her right eye together with severe pain in the same eye which could not be explained by this aneurysm. We sought opinion of an ophthalmologist who

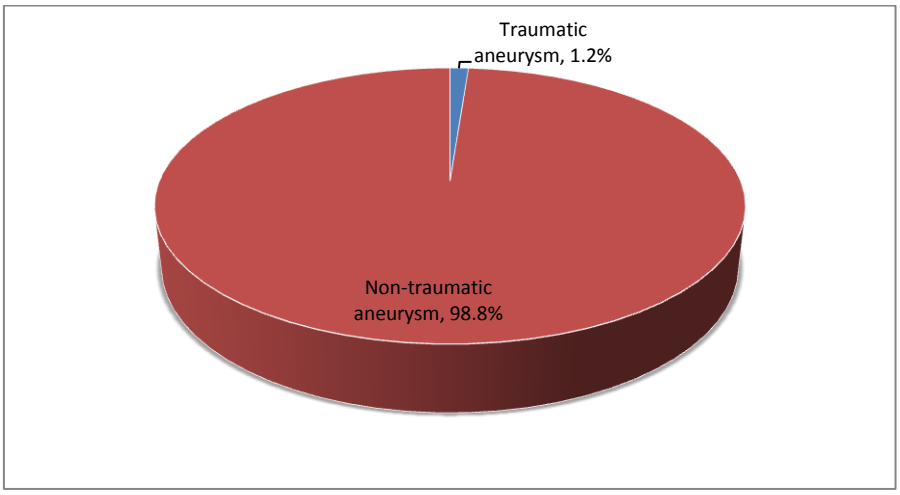
advised enucleation of painful, blind and proptosed right eye. Enucleation was done which relieved the patient in terms of eye pain.

The occlusion of right internal carotid artery was done just at the origin of aneurysm by detachable latex balloon via right transfemoral approach under local anaesthesia. Patient stood the procedure well. There was no neurological deficit. After the procedure, right and left ICA DSA was done which showed complete occlusion of right pre-cavernous ICA and the aneurysm. It also showed good filling of bilateral anterior circulation from left ICA.

In other 2 patients, aneurysm was found on cortical branches of ACA & MCA on DSA. DSA was done because CT angiography showed doubtful aneurysms. Both patients were treated by craniotomy and cauterization of cortical parent artery.

Table-1: Age and gender distribution of patients

Age and gender	No. (n=250)	%
Age in years		
30-40	72	28.8
41-50	89	35.6
51-60	53	21.2
>60	36	14.4
Gender		
Male	143	57.2
Female	107	42.8



Graph.1: Incidence of traumatic aneurysm

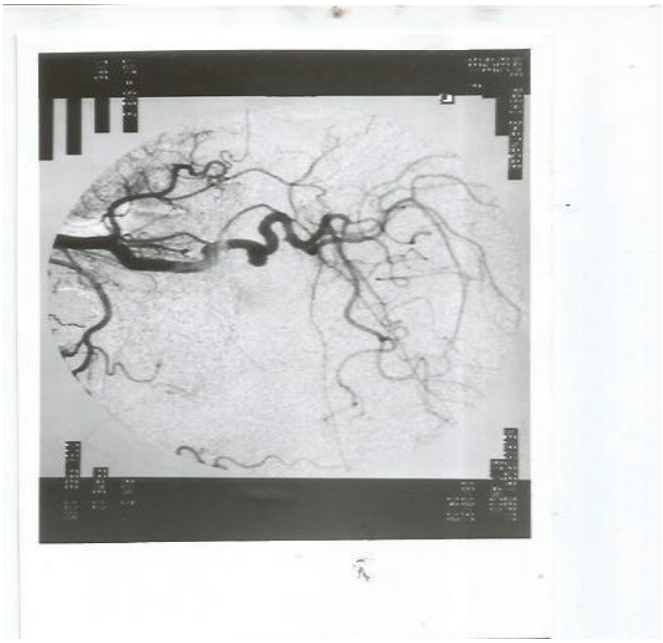


Fig.1: Right ICA, DSA showing precavernous aneurysm

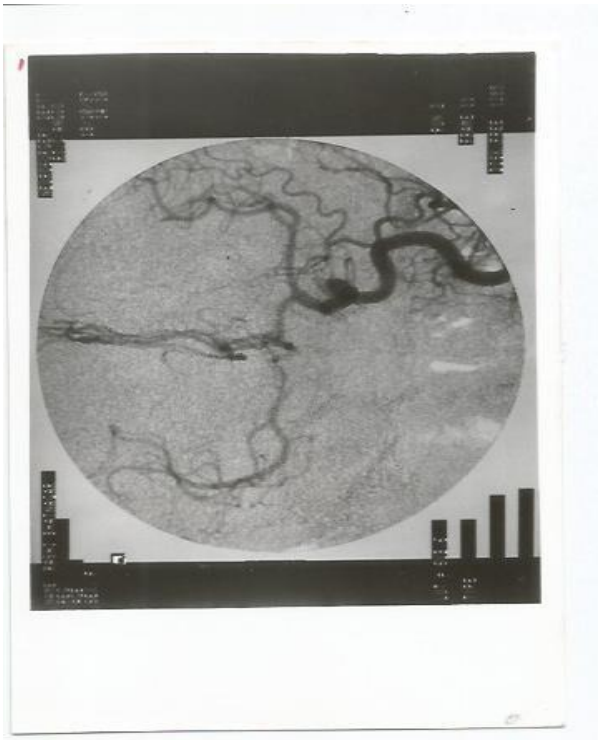


Fig.2: Left ICA, DSA showing adequate filling of opposite circulation

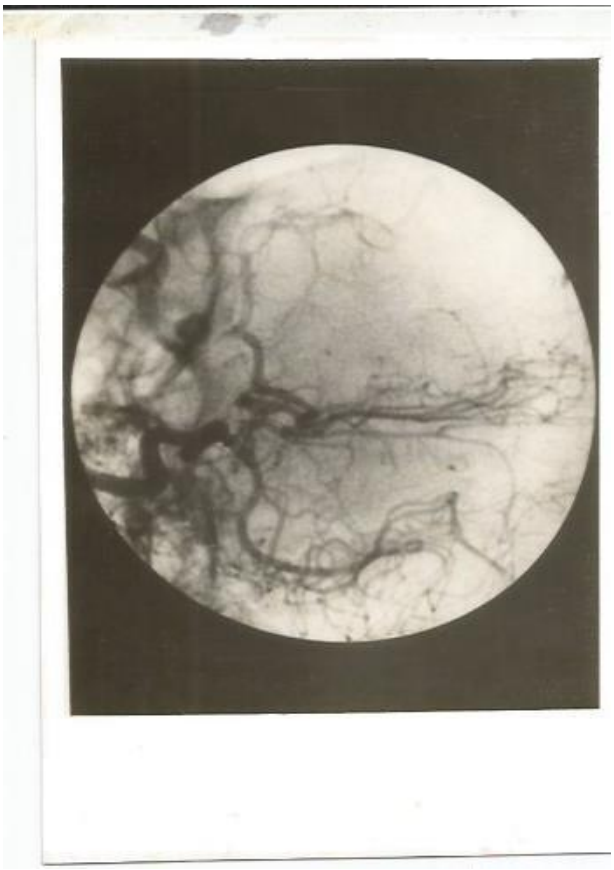


Fig. 3: Left ICA, DSA post balloon occlusion of right ICA showing adequate filling of opposite circulation and detachable balloon in situ

Discussion

Until 1974, Serbinenko (1974) reported a successful method of closing the fistula using detachable balloon. The deflated balloon is small enough to flow through the fistula into the cavernous sinus and it can be inflated as big as being expected. This help settling the disadvantage of fixed dimensions of the piece of the muscle, enable possibility of ICA preservation and further more we also can retrieve back the devices if it is not applicable for the balloon to be detached. Since that evolution, series of studies in treating CCF were reported using this method i.e. Debrun and Lacour (1981) in 1981 with successful rate of 94%, complication rate of 5.5%, Higashida and Halbach (1990) in 1990, Lewis et al (1995) in 1995 with successful rate of 86%, complication rate of 4%. These authors shared common features that endovascular intervention have high successful rates, less complication and less recurrence incidence compared to previous methods. We applied same endovascular technique for our first case.

Our reasons for considering these aneurysms to be traumatic to be of traumatic origin are its distance from bifurcation, delayed filling and emptying of the sac and absence of the neck. Because of the extradural haematoma in the vicinity of aneurysm in first patient, we considered this aneurysm to be traumatic aneurysm. In first two cases, it was DSA finding contributing to traumatic aneurysm.

The traumatic pre-cavernous internal carotid artery aneurysm and other distal cortical aneurysms were asymptomatic when patients came to us but we decided to treat these because with passage of time these false aneurysms are known to enlarge and in most of the cases catastrophic rupture is the usual late event. Traumatic brain aneurysms are located near skull base or on distal cortical branches. These traumatic aneurysm have no aneurysmal wall and neck. Aneurysm located on or near skull base or surrounded by cranial nerves and veins, so direct approach is very difficult and dangerous.

All of these special risks favor trapping of the aneurysm and cauterizationof distal cortical parent artery. In routine endovascular trapping, two balloons are inflated in the parent artery, one distal and other proximal to the aneurysm, but we have inflated a single detachable balloon of size larger than the aneurysmal ostium in the parent artery to successfully achieve isolation of aneurysm.

Conclusion

Traumatic aneurysms are very rare. Out of 250 patients of head injury, only 3 patients had traumatic brain aneurysm. These patients can be saved by early diagnosis and treatment of aneurysm. Clipping and coiling of traumatic aneurysm is dangerous and one should avoid it.

References

1. Kamlesh S Bhaisora, Sanjay Behari, Chaitanya Godbole, Rajendra V Phadke. Traumatic aneurysms of the intracranial and cervical vessels: A review. Neurol India 2016; 64: 14-23.
2. Bell RS, Vo AH, Roberts R, Wanebo J, Armonda RA. Wartime traumatic aneurysms: Acute presentation, diagnosis, and multimodal treatment of 64 craniocervical arterial injuries. Neurosurgery 2010;66:66-79.
3. Cohen JE, Gomori JM, Segal R, Spivak A, Margolin E, Sviri G, Rajz G, Fraifeld S, Spektor S. Results of endovascular treatment of traumatic intracranial aneurysms. Neurosurgery 2008;63:476-86.
4. Foreman PM, Griessenauer CJ, Falola M, Harrigan MR. Extracranial traumatic aneurysms due to blunt cerebrovascular injury. J Neurosurg 2014;120:1437-45
5. Serbinenko FA. Balloon catheterization and occlusion of major cerebral vessels. J Neurosurg. 1974;41:50–55.
6. Debrun G, Lacour P. Treatment of 54 traumatic carotid-cavernous fistulas. J Neurosurg. 1981;55(5):678–692.
7. Higashida RT, Halbach VV, Tsai FY, et al. Interventional neurovascular treatment of traumatic carotid and vertebral lesion: results in 234 patients. Am J Roentgenol. 1989;153:577–582.
8. Lewis AI, Tomsick TA, Tew JM., Jr Management of 100 consecutive direct carotid-cavernous fistulas: results of treatment with detachable balloons. Neurosurgery. 1995;36(2):239–244.