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Balloon Test Occlusion for An Option to Decide Whether Simple ICA Ligation is Better Option than Trapping and High Flow Bypass of The Giant ICA Cavernous Aneurysm

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Balloon Test occlusion (BTO) is a pre-operative angiographic test used to estimate the risk of stroke after permanent therapeutic occlusion of an internal carotid artery (ICA) involved by aneurysms. Temporary balloon occlusion at the cavernous ICA aneurysm neck was performed in an attempt to assess the adequacy of cross flow from the opposite ICA**.** Adequate flow following BTO are preferred to have simple ICA ligation and incase of those who did not pass BTO trapping and high flow bypass is preferred .We have done Right ICA Ligation on our case report.

Key Words: balloon test occlusion, cavernous segment aneurysm (CSA), digital subtraction angiography (DSA), internal carotid artery

Intracranial aneurysms larger than 25 mm in maximum diameter are classified as giant aneurysm.[4,6] Giant aneurysms constitute 3-13.5% of all intracranial aneurysms with an incidence averaging 5% in various series and 90% of all aneurysms are located in the anterior circulation.[5] The natural history of giant intracranial aneurysms is generally morbid as a result of hemorrhage, neural compression, and thromboembolic episodes.[5] In our study we have done BTO for an option to decide whether simple ICA ligation is better option than trapping and high flow bypass of the giant ICA cavernous aneurysm.

Case Report

A67-year-oldladypresentedinAnnapurnaNeurological Institute and Allied Sciences (ANIAS) with complains of right eye diplopia and unable to open her right eye associated with vertigo, headache and multiple episodes of vomiting. Patient was hypertensive under amlodipine 5 mg once daily. Neurological examination was suggestive of right sided third cranial nerve palsy. So, patient was initially asked to do a computerized tomography (CT) of head – plain and contrast which showed hyperdense space occupying lesion (SOL) at right cavernous sinus **(Figure 1 A)** so magnetic resonance imaging (MRI) brain plain and contrast was done which showed large intensely enhancing lesion in right cavernous ICA projecting site with extension to right middle cranial fossa suggestive of giant cavernous ICA aneurysm (Figure 1 B). DSA later confirmed the diagnosis of giant cavernous right ICA aneurysm **(Figure 1 C)**.

Under monitor – electrocardiography (ECG), oxygen saturation (SpO2), with nasal prongs oxygen , right and left femoral access was done with 5-French ('F') femoral

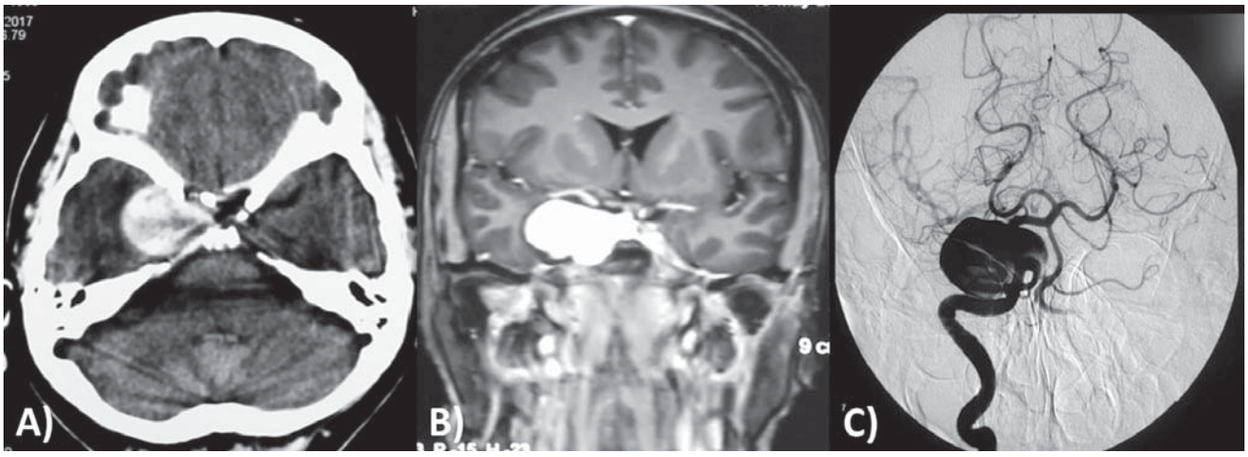

Figure 1: A) CT Head-Contrast shows lobulated enhancing mass lesion at the left parasellar region, B) MRI-Brain shows Large intensely enhancing lesion arising from right cavernous ICA projecting site with extension to right middle cranial fossa suggestive of Giant cavernous ICA aneurysm, C)DSA shows Giant Cavernous Right ICA Aneurysm

sheath under single wall puncture technique **(Figure 2)**. Through right femoral access , 5 'F'diagnostic catheter was used to access right ICA with road mapping . It was then replaced by BTO catheter **(Figure 3)**. Similarly left ICA was access with 5 'F' diagnostic catheter through left femoral artery and also 4 vessel DSA was performed **(Figure 4)**. Pre-occlusion mean arterial pressure (MAP) and post-occlusion stump pressure was noted. Pre-occlusion arterial blood gas analysis (ABG) was noted and post occlusion ABG was also noted .The occlusion was continued for 30 min and patient neurological function was examined every 5 minutes . Limb movements, power and speech was examined as neurological function.

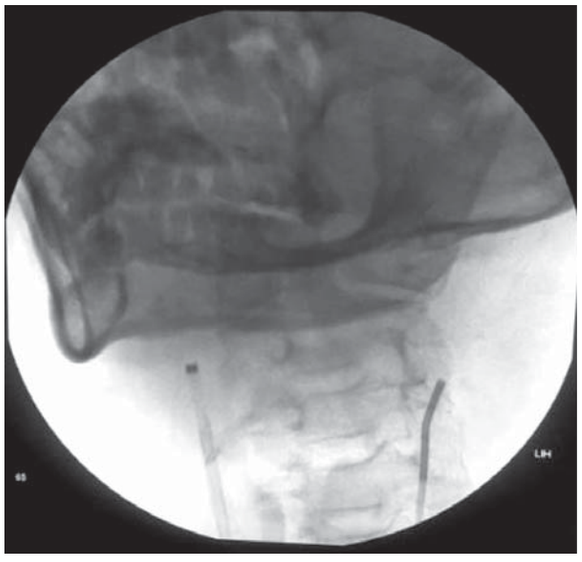

Figure 2:5F catheter in Bilateral (B/L) Common Carotid Artery

Blood Pressure (BP) and MAP was reduced (BP-90/60, MAP-58 to 82) and watched for any neurological deficit but no any neurological deficit was noted After BTO, The left ICA DSA was suggestive of adequate flow to right middle cerebral artery (MCA) till capillary and venous phase **(Figure 4)**.

The pre occlusion ABG and post occlusion ABG was same oxygen saturation (SaO2)-97.1% suggestive of adequate flow from opposite ICA .

This features suggested that simple ICA ligation was preferred instead of trapping and high flow bypass .

After 2 days patient was planned for right ICA ligation under laryngeal mask airway (LMA) (sleep awake sleep). Linear vertical incision made at right lateral neck anterior to sternocleidomastoid Muscle (SCM muscle). SCM and underlying soft tissue dissected. ICA/External Carotid Artery (ECA) bifurcation exposed. Patient awaken and Intravenous (IV) heparin given. ICA dissected and clamped with bull dog in normal BP and MAP 90-100 for approximately 30 minutes, persistently checking the opposite side motor power and speech. Patient was generally obeying command and no motor deficit noted. Patient was then induced hypotension (BP 90/60mm hg) and MAP up to 59-82 for around 30 minutes in total. Under persistent motor observation no deficit was seen even then, then the ICA was ligated with silk in 2 different places.

Post operatively she managed with antiepileptic carbamazepine 200 mg BD and aspirin 150 mg OD. Aspirin was started to prevent patient from thromboembolic complication which could have arised from the giant cavernous ICA aneurysm.

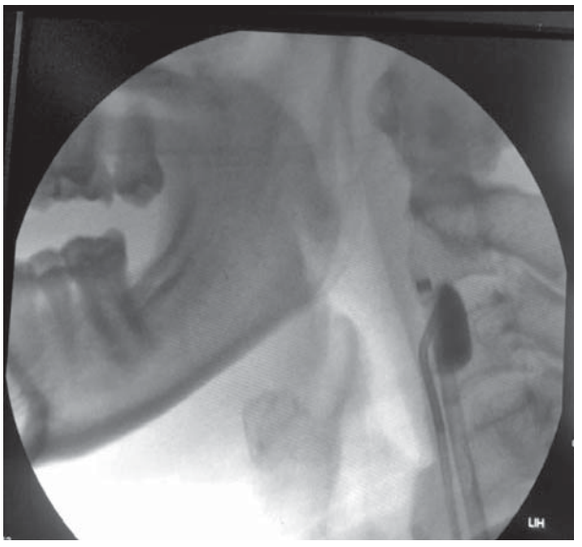

Figure 3: Inflated Balloon catheter seen in Right ICA.

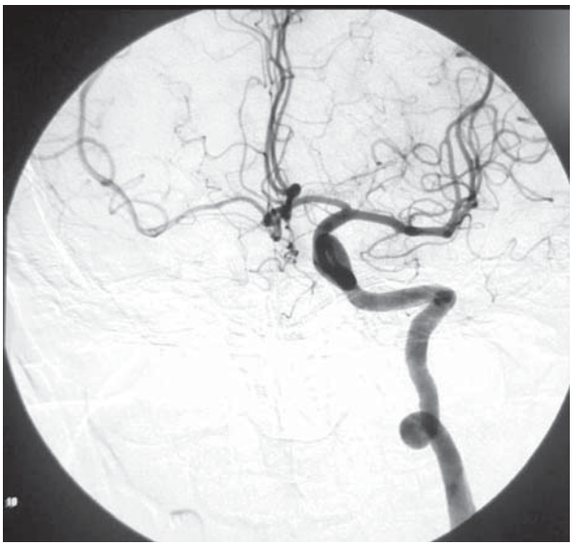

Figure 4: Frontal left internal carotid angiogram with balloon inflated in the right internal carotid artery shows flow through the ACOM filling the right ACA and right MCA.

Discussion

The underlying principle of BTO is to evaluate the efficacy of the intracranial cross-circulation in maintaining perfusion of the affected vascular territory during temporary occlusion of the main arterial supply.[2] During the inflation of the balloon in ICA, neurological monitoring is an essential component of the BTO procedure. Numerous tests, including measurement of carotid stump pressure, electroencephalographic (EEG) monitoring, hypotensive challenge, angiographic cross filling, cerebral blood flow (CBF) measurements, and Transcranial Doppler (TCD) ultrasonography have been employed in conjunction with neurological monitoring to determine if patients can tolerate carotid ligation safely and to reduce the incidence of ischemic complications .[1,3,6,7] In our case EEG and TCD ultrasonography wasn't performed instead close neurological monitoring and other adjuncts were evaluated .

Venous phase comparison of the two hemisphere is useful in evaluation of the patient's cross-circulation before parent artery ligation. A delay of more than 0.5 seconds was considered a high ischemic risk for ligation.[1]

Similarly maintenance of a stump pressure ratio (initial mean stump pressure/pre occlusion MAP) of 60% or more during BTO is a useful marker of an adequate intracranial collateral circulation.[6]

The cerebral oximeter is a useful, real-time, non-invasive method to measure brain oxygenation during BTO which need to evaluate brain ischemia. A fall of greater than 10% from the SaO2 baseline value is dangerous, but less than 5% is safe.[4] In our case pre occlusion and post occlusion ABG was done.

Inducing hypotension during a BTO can provide further information about whether the patient's intracranial cross circulation will provide adequate blood flow after ligation. Twenty minutes after the start of the BTO, the mean arterial pressure is decreased 30%lower than baseline. This decrease is maintained for an additional 15 to 20 minutes with a normal neurologic examination suggest adequate Intracranial cross circulation.[3]

Conclusion

BTO in a giant ICA aneurysm would guide the neurosurgeons the technique of managing the case ahead. In our patient simple ligation of ICA aneurysm was done after cross circulation was confirmed by BTO .The approach would be trapping giant aneurysm with high flow bypass or flow diversion would be another option if there was no intracranial cross circulation.

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References

1. Abud DG, Spelle L, Piotin M et al. Venous phase timing during balloon test occlusion as a criterion for permanent internal carotid artery sacrifice. **Am J Neuroradiol 26:**2602-2609, 2005
2. Bisschops RH, Klijn CJ, Kappelle LJ et al. Collateral flow and ischemic brain lesions in patients with unilateral carotid artery occlusion. **Neurology 60:** 1435-1441, 2003
3. Dare AO, Chaloupka JC, Putman CM et al. Failure of the hypotensive provocative test during temporary balloon test occlusion of the internal carotid artery to predict delayed hemodynamic ischemia after therapeutic carotid occlusion. **SurgNeurol 50:**147-155, 1998
4. DujovnyM, Salvin KV, Hernandez G, Geremia GK, Ausman JI. Use of cerebral oximetry to monitor Brain Oxygenation reserves for skull base surgery. **Skull base Surgery 4:**117-221,1994
5. Locksley HB. Report on the cooperative study of intracranial aneurysms and subarachnoid hemorrhage, section V, Part II. Natural history of subarachnoid hemorrhage, intracranial aneurysms and arteriovenousmalformations: based on 6368 cases in the cooperative study. **J Neurosurg25:**321-368, 1996
6. Morishima H, Kurata A, Miyasaka Y et al. Efficacy of the stump pressure ratio as a guide to the safety of permanent occlusion of the internal carotid artery. **Neurol Res 20:**732-736, 1998
7. Vazquez Anon V, Aymard A, Gobin YP, et al. Balloon occlusion of the internal carotid artery in 40 cases of giant intracavernous aneurysm: technical aspects, cerebral monitoring, and results. **Neuroradiology 34:**245-251,1992