Successful Microsurgical Clipping of Basilar Tip Aneurysm: A Case Report

The authors report a case of basilar tip aneurysm who presented with the features of subarachnoid hemorrhage. After making a diagnosis of basilar tip aneurysm on CT angiogram, it was clipped successfully via right subtemporal approach and patient was discharged on 16th postoperative day with Glasgow Outcome Score (GOS) of 4/5. Literature on basilar tip aneurysm, its management and outcome would be reviewed.

Key words: Basilar tip aneurysm, Microsurgical clipping, Multislices MD CT angiogram, subtemporal approach

About 10% of intracranial aneurysms are posterior circulation aneurysms. And about 45-55% of posterior circulation aneurysms are basilar tip aneurysms. Basilar tip aneurysm is a rare neurovascular condition and it was first described by Blackahall in 1814. They usually present with the features of SAH and sometimes they may have brainstem compression signs, one of the cranial nerve palsy and focal deficit. Diagnosis is confirmed by cerebral angiogram and treatment ranged from microsurgical clipping of aneurysm to endovascular coiling. In this report we present a case of basilar tip aneurysm and review of previous international literatures.

Address for correspondence:
Gopal Raman Sharma, MS
NNRC, NAMS, Bir Hospital, Kathmandu, Nepal
E-mail: gopal47@hotmail.com

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Case Report

A 61 year old right handed gentleman, farmer by profession was brought to ER with history of sudden onset of headache, vomiting followed by unconsciousness. There was no history of trauma, hypertension and diabetes mellitus. He had suffered from pulmonary tuberculosis 26 years back for which he had a 9 month’s course of antitubercular drugs. He was non smoker and non alcoholic. On examination, his pulse was 68/min regular, blood pressure was 140/90 mm of Hg. He had GCS of 14/15 and pupils were bilaterally equal and reacting to light. On funduscropy there was no papilloedma and subhyloid hemorrhage. He had no focal neurological deficit, but had neck rigidity. He had Hunt and Hess clinical grade III. Other systems were normal.

His hematology and biochemical test were within normal limit. Plain CT scan of brain showed diffuse SAH with intraventricular extension (Miller Fischer grade IV) (Figure 1).

He was diagnosed as a case of spontaneous subarachnoid hemorrhage, most probably due to ruptured intracranial aneurysm and was subjected for cerebral angiogram. 64 slice-MD CT angiogram showed basilar tip aneurysm. The aneurysm was saccular measuring about 5.2 x 3.7 mm in size and neck was 2mm wide. The fundus of the aneurysm was projected anterosuperiorly and located below the midsellar line. Angiogram also revealed vasospasm of the left posterior cerebral and left superior cerebellar arteries (Figure 2).

After one week of ictus, patient underwent right subtemporal craniotomy and microsurgical clipping of basilar tip aneurysm. 7.0mm straight Sugita titanium clip was used. This is the first basilar tip aneurysm clipped in Bir Hospital and most probably the first one in Nepal. During surgery the aneurysm which was arised from basilar bifurcation found to be bilobed and projected anteriorly, few clots were found around the aneurysm and there were stenosed left posterior cerebral and left superior cerebellar arteries. No complication was observed during procedure.

Postoperative CT angiogram showed complete occlusion of aneurysm neck with obliteration of sac and clip was in situ (Figure 3). Postoperatively patient had developed right 3rd nerve palsy and transient diabetes insipidus. Patient was discharged on 16th postoperative day with GOS (Glasgow Outcome Score) of 4/5 and advised for regular follow up in Neurosurgical OPD. After 4 months of surgery, he was again brought to emergency department with history of drowsiness for few days. On examination, he had GCS (Glasgow Coma Score) of 13/15 with right sided residual 3rd nerve palsy. There was no neck rigidity. Hematolgy and biochemistry were within normal limit and CT scans of brain showed communicating hydrocephalus (Figure 4). Lumbar puncture with CSF analysis was carried out prior to VP shunt to rule out meningitis.

CSF was clear and cells, sugar, protein were within normal limits. Emergent VP shunt of medium pressure valve (Surgiwear, Chhabra, India) was implanted. Post operatively patient gradually became conscious and developed no further complications. He was discharged on 7th post Op day after removing stitches with GOS of 4/5.

Discussion

Basilar tip aneurysm (BTA) is an infrequent neurovascular condition. About 10% of intracerebral aneurysms are posterior circulation aneurysms. About half of the posterior circulation aneurysms are basilar tip.
aneurysm which accounts about 45-50% of posterior circulation aneurysms. BTA was first described by Blackahall. Majority of patients with BTA present as features of SAH or features of local mass effect. Sudden onset of severe headache, vomiting followed by decreased level of consciousness are the classical presentation of SAH. Patient may develop brainstem signs and cranial nerve palsies. Most of them have neck rigidity and may also have focal neurological deficit.

Initial choice of investigation is CT scan of brain which shows diffuse SAH, more blood in basal cistern and blood may extend intraventricularly and may develop hydrocephalus.

Final diagnosis of BTA is made by cerebral angiogram. Conventional three vessels cerebral angiogram or DSA(Digital Substraction Angiogram) is the gold standard diagnostic tool. However, these days, Multislice MD CT angiogram is equally sensitive to make a diagnosis of BTA. It is cheap, easily available, non-invasive and highly sensitive. MRA may be useful if CTA and DSA are not available.

Most of the BTA are saccular in shape. About 55% of BTA are small (<1.25cm), 30% are large (1.25-2.5cm) and 15% are giant (>2.5cm) in size respectively. About 70% of BTA are projected upward, 10-15% anteriorly, 5-10% posteriorly and <5% laterally projected.

Technically upward directed BTA are easier to clip than in other direction. Relation of position of basilar bifurcation to the posterior clinoid is very crucial in terms of surgical strategy and approaches. 50% of basilar bifurcation is at the level of posterior clinoid, 25% several mm below and 25% several mm above the posterior clinoid.

The aim of the treatment of BTA is to occlude the neck of the aneurysm completely to prevent further rebleeding and this can be achieved either by microsurgical clipping or by endovascular coiling.

The management of basilar apex aneurysms remain one of the most challenging areas of neurosurgery. The technical challenge involved with clipping these aneurysm has inspired several generations of surgeons to push the limits of technical achievement.

Advances is neuroanaesthesia, cerebral protection paradigms and critical care management have enhanced the care and probably the outcome for the patient harboring a BTA.

Endovascular techniques have improved to the point of offering an alternative to open surgery for some aneurysms in this location. Results of international series of endovascular coiling and microsurgical clipping have demonstrated lower rates of death and disability with endovascular treatment than open surgery to secure the ruptured intracranial aneurysm, however, cost effectiveness may not be favorable because of the greater need for follow up cerebral angiogram and additional follow up treatment with endovascular techniques.

If we go back to the history of BTA surgery, the first reported attempt to obliterate a BTA was that made by Olivecrona. In 1954 using a subtemporal approach, he was able to clip a ruptured forward projecting aneurysm at the basilar bifurcation. The patient improved remarkably from post operative hemiparesis and aphasia and was capable of part time work. The same year another BTA was successfully operated on by Bohn in the same clinic in Sweden.

Then in 1965, Drake reported his first series of seven patients with BTA who underwent microsurgical clipping and the results were not promising; four died, one severely disabled and only two returned to normal life. In 1968, Drake reported 12 additional cases with no direct operative

![Figure 3: Post operative Ct angiography showing total occlusion of aneurysm neck and clip in situ](image3.png)

![Figure 4: Follow up CT scan of brain depicting communicating hydrocephalus](image4.png)
death and 10 good results. In 1975, Yasagil published his series of BTA who underwent microsurgical clipping using pterional Transsylvian approach and results were promising. 

The anatomic complexity of the interpeduncular cistern makes basilar apex aneurysm surgery one of the most technically challenging operation in our specialty. Optimal surgical results and outcome require excellent technical skill, thorough knowledge of operative anatomy and familiarity with operative nuances accumulated by Drake and Yasagil.

There are several surgical approaches to clip BTA, but commonly used approaches are subtemporal, pterional transsylvian, combination of both and orbitozygomatic.

There is always confusion among neurosurgeons whether to approach from right or left side. Right sided approach is usually preferable for BTA clipping to prevent damaging the dominant temporal lobe, however, left sided approach is reasonable if there is a right sided hemiparesis, left sided 3rd nerve palsy and left posterior cerebral artery is significantly higher than the right posterior cerebral artery; a right sided approach could risk trapping the left posterior cerebral artery in the clip blades.

Subtemporal approach was popularized by Charles Drake in 1960. Advantages of sub temporal approach are; it gives better exposure for low lying aneurysm, proximal control is easy and lateral view facilitates dissection of perforators. Disadvantages of this sub temporal approach are; operative field is narrow and difficult to control intraoperative bleeding, it would be difficult to have contralateral P1 control, complications like temporal lobe infarction and 3rd nerve palsy is very high with this subtemporal approach.

Pterional Transsylvian approach was developed by Yasargil in 1975. Advantages of this Transsylvian approach are; neurosurgeons are familiar with this approach, good for high lying BTA, proximal control is straight forward, exposure of both P1 segments for temporary trapping is uncomplicated, wide exposure is possible. This approach is good when an anterior circulation aneurysm is to be dealt at the same time. Disadvantages of this pterional transsylvian approach are; greater distance to aneurysm comparable to sub temporal route, needs splitting of sylvian fissure and exposure of posteriorly located perforators is difficult.

Orbitozygomatic approach for BTA was described by Hakuba in 1986. Advantages of this approach are; good for extremely high lying BTA, produces minimum brain retraction and gives direct exposure to mamillary bodies. Disadvantages are; not familiar to many neurosurgeons and is very extensive procedure.

Common postoperative complications after the clipping of BTA are 3rd nerve palsy, focal neurological deficit, temporal lobe infarction, meningitis and hydrocephalus.

Factors which predict the outcome after microsurgical clipping of BTA are, Hunt and Hess clinical grade on admission, age of the patients, size of aneurysm, features of brain stem compression and amount of blood in basal cistern.

Charles Drake had published largest series of BTA in 1996. In his latest series of 885 patients who underwent microsurgical clipping of BTA, 77.3% (366) had excellent result and 3.9% (18) were dead in those groups of patients who harbored small BTA. In large BTA group, 67.2% (178) had excellent outcome and 5.3% (14) died. In giant BTA group, 41.6% (57) had excellent result and 12.4% (17) died. This results have shown that small BTA has better result than large and giant aneurysms after microsurgical clipping.

Wascher and Spetzler collected 975 patients of BTA who underwent surgery from 1980 to 1989 in different neurosurgical centres and found that good outcome was achieved in 82.4% and mortality was 5.1%. In Rice and colleagues series of 99 patients of BTA, good outcome was found in 80.2% and mortality in 4.2%. 

Endovascular management of BTA was started in 1990. Endovascular techniques include endovascular coiling, stenting and ballooning. Results of international series of endovascular coiling have demonstrated lower rates of morbidity and mortality than open surgery to secure the ruptured BTA.

Indications of endovascular treatment of BTA are; aneurysm neck size < 4mm, small sized aneurysms and no posterior cerebral artery originating from the dome of aneurysm. And other relative indications are; poor neurological grade, previously failed clipping, poor medical condition and surgery refused by patient or family.

In moret and et al series of 36 patients of endovascular coiling (1996), complete occlusion was achieved in 79%, failure in 20% and morbidity was 3.5%. In Kazekawa (2002) and et al series of 19 patients, complete occlusion was achieved in 68%, good recovery in 80% and morbidity and mortality was 15% and 5% respectively.

In Guido Gulielmi and et al (2009) of series of 306 patients, complete occlusion was achieved in 45.5% failure in 4%, morbidity in 3.5% and mortality in 1%. 

After reviewing the international series of endovascular coiling it was found out that periprocedural morbidity is 2.7%, rebleeding after endovascular procedure for ruptured aneurysm is 3.3% and for unruptured aneurysm is 4.1%. 

In conclusion, best treatment option for BTA is endovascular coiling (techniques) which has less morbidity and mortality than open microsurgical clipping of BTA, however, open surgery is the only alternative where endovascular procedures are not available.

References


