

Olgu Sunumu

# Surgical Management of Symptomatic Posterior Circulation Aneurysms

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Surgical treatment of posterior circulation aneurysms is more difficult than surgical treatment of anterior circulation aneurysms and poses a greater technical challenge for the practicing neurosurgeon. There are different surgical options available for the surgical treatment of posterior circulation aneurysms despite the use of the pterional approach to anterior circulation aneurysms. We present our surgical experiences with three cases of posterior circulation aneurysms. Three cases of posterior circulation aneurysms were treated by surgical clipping. We preferred pterional approach for posterior cerebral artery aneurysms, infratentorial supracerebellar approach for superior cerebellar aneurysm, and the combined lateral supracerebellar infratentorial retrosigmoid approach for vertebrobasilar junction aneurysm. The morbidity and mortality associated with open surgery for posterior circulation aneurysms are higher because of the location of the aneurysms within the posterior fossa. For neurosurgeons, the surgical treatment of posterior circulation aneurysms can be challenging.

**Key words:** Aneurysm, infratentorial supracerebellar approach, pterional approach, posterior circulation, retrosigmoid approach

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## Semptomatik Posterior Sirkülasyon Anevrizmalarının Cerrahi Tedavisi

Posterior sirkülasyon anevrizmalarının cerrahi tedavisi anterior sirkülasyon anevrizmalarının cerrahi tedavisinden daha zordur ve nöroşirurji pratiği için büyük bir teknik sorun teşkil etmektedir. Anterior sirkülasyon anevrizmaları için pterional yaklaşım kullanılmasına rağmen posterior sirkülasyon anevrizmalarının cerrahi tedavisi için farklı cerrahi yaklaşım seçenekleri vardır. Biz üç olgu eşliğinde posterior sirkülasyon anevrizmalarında cerrahi deneyimlerimizi sunuyoruz. Üç olguda posterior sirkülasyon anevrizmaları, cerrahi kliplleme ile tedavi edildi. Biz, posterior serebral arter anevrizması için pterional yaklaşımı, süperior serebellar arter anevrizması için inferiortentorial supraserebellar yaklaşımı, vertebrobasiler bileşke anevrizması için kombine lateral supraserebellar infratentorial-retrosigmoid yaklaşımı tercih ettik. Posterior fossa içinde anevrizmaların konumu nedeniyle posterior sirkülasyon anevrizmalarında açık cerrahi ile ilişkili morbidite ve mortalite yüksektir. Beyin cerrahları için, posterior sirkülasyon anevrizmalarının cerrahi tedavisi zor olabilir.

**Anahtar kelimeler:** Anevrizma, infratentorial supraserebellar yaklaşım, pterional yaklaşım, posterior sirkülasyon, retrosigmoid yaklaşım

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**A**neurysms arising from the posterior circulation are estimated to account for approximately 6-15 % of all intracra-

nial aneurysms<sup>(1-3)</sup>. Although there is high morbidity with the surgical treatment of posterior circulation aneurysms, the technical and clinical success of this type of treatment remain high. The complex nature of posterior circulation aneurysms is compounded by the difficulty of surgical exposure, and cramped working space. The frequent need for the intraoperative retrac-

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tion of the brainstem to visualize the aneurysm neck and surrounding vessels together with the intimate relationship of the aneurysm with brain stem perforators poses additional problems. There are different approaches for surgical treatment of posterior circulation aneurysms despite the use of the pterional approach to anterior circulation aneurysms <sup>(1,4-8)</sup>. The selection of the specific surgical approach depends on the site of the posterior circulation aneurysm. We present our surgical experiences with three cases of posterior circulation aneurysms.

## CASE REPORTS

**CASE 1:** A 39-year-old woman was presented to the hospital with sudden severe headache. Upon admittance to the hospital, the patient was alert and had no focal neurological deficits except for mild neck stiffness. The patient had suffered from a subarachnoid hemorrhage (SAH) according to the classification system of the WFNS. A computed tomography (CT) scan on admission showed a Fisher Grade II SAH. Cerebral angiography revealed an aneurysm measuring approximately 3x4.5 mm in the hemispheric branch of the left superior cerebellar artery (SCA). A decision was made to clip the aneurysm. On the 16th day following the diagnosis of SAH, the patient

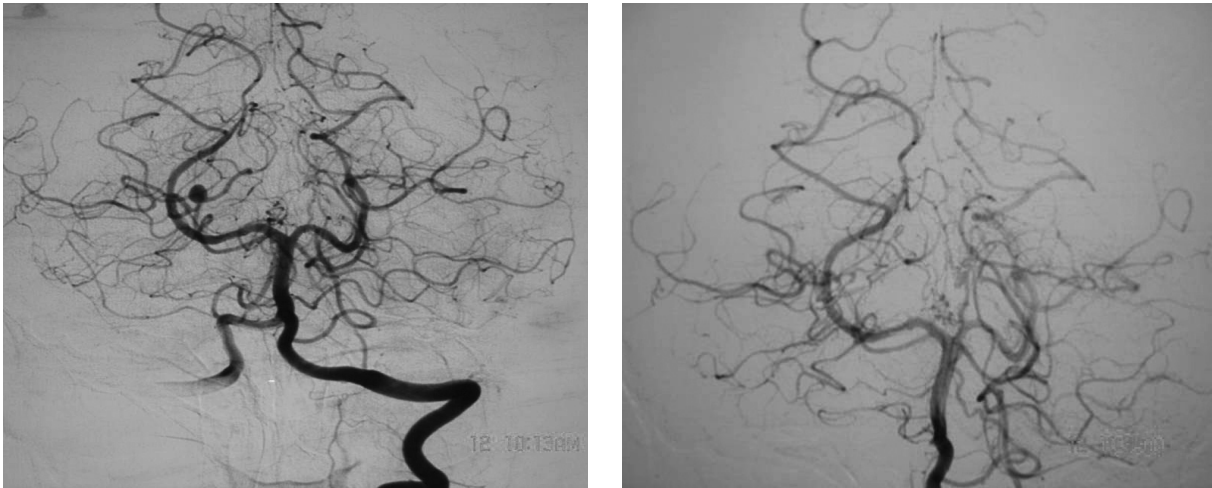
underwent surgery. The aneurysm was clipped using the combined lateral supracerebellar infratentorial - retrosigmoid approach. A control angiogram showed complete occlusion of the aneurysm. The patient's postoperative course was unremarkable, and she was discharged without any neurological deficits (Figure 1).

**CASE 2:** A 42-year-old man was presented with vertigo of 3 days' duration. On physical examination, the patient displayed no neurological deficits. A cranial CT scan and magnetic resonance imaging (MRI) revealed an enhancing mass in the basilar cistern. Cerebral angiography revealed an aneurysm in the P1-P2 junction of the posterior cerebral artery (PCA). Fourteen days following the onset of symptoms, the aneurysm was clipped using the right pterional approach. A control angiogram showed complete occlusion of the aneurysm. The patient's postoperative course was unremarkable, and she was discharged without any neurological deficits (Figure 2).

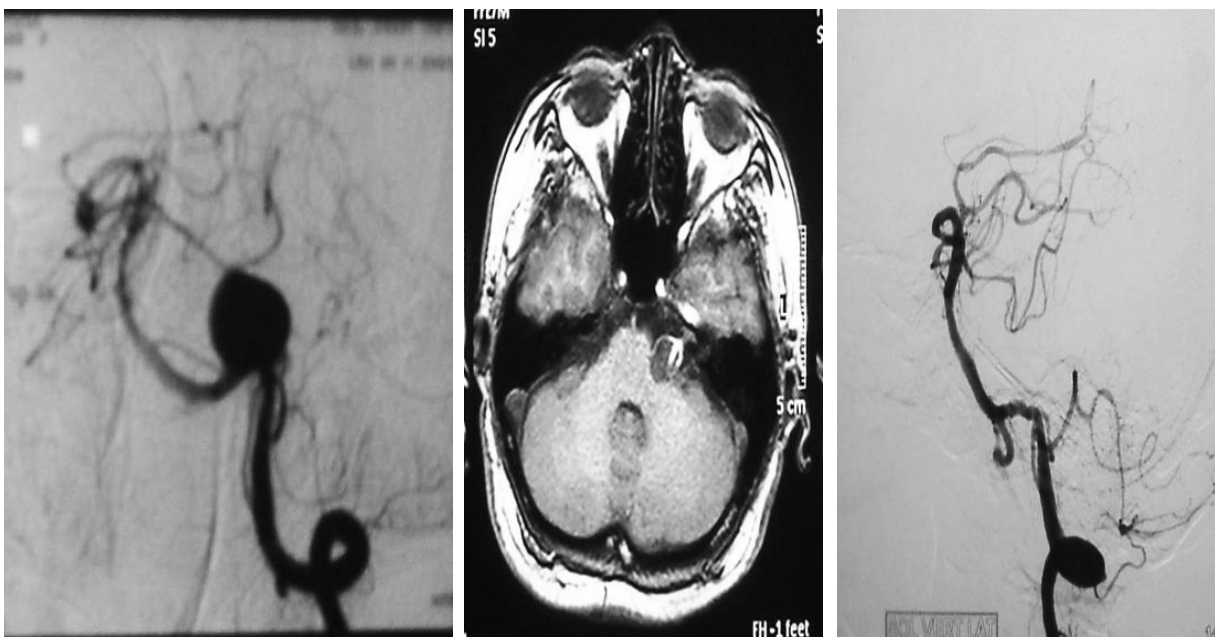
**CASE 3:** A 53-year-old woman presented to our hospital with sudden onset of headache, nausea, and vomiting. Upon admittance, the patient was alert. Cranial CT revealed massive SAH (Fischer Grade III). Cerebral angiography showed a sacular aneurysm on the left vertebrbasilar artery



Figure 1. A 39-year old woman who presented with vertigo of 3 days' duration. A: Cranial CT showing enhancing mass adjacent to the brain stem. B: Cerebral angiography showing an aneurysm in the right P1-P2 junction of the PCA. C: Postoperative cerebral angiography showing complete occlusion of the aneurysm.



**Figure 2.** A 42-year-old man who presented with sudden onset of severe headache. A: Cerebral angiography showing an aneurysm measuring approximately 3x4.5 mm in the hemispheric branch of the left SCA. B: Postoperative cerebral angiography showing complete occlusion of the aneurysm.



**Figure 3.** A 53-year-old woman suffered sudden onset of headache, nausea, and vomiting. A: Cerebral angiography showing a saccular aneurysm of the left VBJ. B: MRI showing a mass in the left CPA. C: Postoperative cerebral angiography showing complete occlusion of the aneurysm.

junction (VBJ). MRI revealed a mass in the left cerebellopontine angle (CPA). The decision was made to clip the aneurysm. On the 12th day following the diagnosis of SAH, the patient underwent surgery. The aneurysm was clipped using the combined lateral supracerebellar infratentorial and retrosigmoid approach. A control angiogram revealed complete occlusion of the aneurysm. The patient's postoperative course was

unremarkable, and she was discharged without any neurological deficits (Figure 3).

## DISCUSSION

Based on the PCA segment involved, the aneurysms are classified as those of the P1, P2, P3, and P4 segments, the P1-P2 junction. The P1-P2 segment extends distally from the dorsal aspect

of the midbrain, the P3 segment begins at the posterior midbrain within the quadrigeminal cistern, and the P4 segment is the distal branch of the P3 segment<sup>(9)</sup>. All PCA aneurysms are uncommon, accounting for approximately 1-3 % of all intracranial aneurysms<sup>(9,10)</sup>. Most (approximately 80 %) of PCA aneurysms mainly arise from the P1 or P1-P2 junction<sup>(11-13)</sup>. Clinical presentation is variable with SAH, oculomotor palsy, visual field deficit or their various combinations<sup>(11,13)</sup>.

The pterional approach (with or without removal of the zygomatic arch) is used for P1 and P1-P2 segment aneurysms<sup>(4,13,14)</sup>. P2 aneurysms and P3 aneurysms are managed with subtemporal and occipital interhemispheric approaches, respectively. In the pterional approach, the P1 segment and the P1-P2 junction are in the center of the surgical field<sup>(15,16)</sup>. The anterior half of the P2 (P2a) segment is exposed, expecting patients with a high basilar artery top. However, the posterior half of the P2 (P2p) segment is never accessible via this approach<sup>(13)</sup>. Aneurysms of P2 segments are usually treated via subtemporal approach. A low-positioned P2a aneurysm can be accessed via subtemporal approach. A high positioned P2p aneurysm in the posterior part of the ambient cistern should be managed using an occipital transtentorial approach, rather than the subtemporal approach. P3 segment aneurysm may be exposed with the occipital interhemispheric transtentorial approach<sup>(4)</sup>.

The SCA can be divided into two segments: the cisternal segment which encompasses the anterior pontine segment up to the quadrigeminal segment, and the cortical segment which involves interhemispheric, vermian, and marginal branches. Aneurysms arising from the SCA are rare, with an incidence of just 1.7 % of the treated aneurysms<sup>(17,18)</sup>. In most cases the aneurysms rupture, and patients present with an SAH<sup>(3,19,20)</sup>. Patient with SCA aneurysms may rarely present with paralysis of cranial nerve with trochlear nerve,

oculomotor nerve or trigeminal nerve, and incidentally ischemia is detected<sup>(21)</sup>. Most of SCA aneurysms are treated with neck clipping. Aneurysms of the cisternal segment may be treated by pterional transsylvian, subtemporal transtentorial or occipital transtentorial approaches<sup>(15,20-22)</sup>. Aneurysms arising from the cortical segment of the SCA may be difficult to treat surgically because of its inaccessibility and the difficulty generally encountered in preserving the involved parent artery. Usually, marginal branches of such aneurysms are clipped through the the suboccipital approach or the vermian branch is clamped using either the infratentorial supracerebellar or the occipital transtentorial approach<sup>(3,21)</sup>.

Aneurysms located at the VBJ are uncommon, accounting for approximately 0.5-4 % of all treated aneurysms<sup>(23,24)</sup>. Surgical access to the VBJ is difficult, and the local anatomy is complex due to the presence of perforators to the brain stem, and inferior cranial nerves<sup>(25)</sup>. For aneurysm of the lower basilar trunk and VBJ, supra- or infratentorial approaches are very difficult to achieve and pose considerable risk of damage to the neighboring neovascular structures of the brainstem and cranial nerves<sup>(26)</sup>. Aneurysms of VBJ may be treated by the pterional, the subtemporal, the suboccipital-retromastoidal approaches. For far lateral, and extremely lateral aneurysms anterior transpetrosal, the retrolabyrinthine transsigmoid and transcondylar approaches are used, respectively<sup>(24,26-29)</sup>. The majority of aneurysms of the VBJ are located in or close to the midline. Posteriorly directed VBJ aneurysms are intimately associated with the complex of perforators to the foramen cecum. Laterally projecting VBJ aneurysms are closely associated with perforators from the posterior aspect of the VBJ. These perforators are difficult to visualize using either the subtemporal or the suboccipital approach<sup>(26)</sup>. Such aneurysms are better managed using the inferior suboccipital and lateral transmastoid approaches. The unilateral suboccipital approach

is suitable for aneurysms located lateral to the midline or in CPA, as in our case 3.

Endovascular treatment of posterior circulation aneurysms is an alternative method that is effective in the short term<sup>(23,25)</sup>. However, this approach is associated with recurrences and, requires close surveillance, and possible retreatment. Moreover, albeit very rarely, endovascular treatment can lead to rehemorrhage. Endovascular occlusion of the parent vessel and aneurysm appears to be an appropriate procedure for treating P2 segment aneurysms<sup>(15)</sup>. Trapping or endovascular occlusion of the SCA may be performed in cases where the aneurysm is distal to the perforating branches entering into the brain stem<sup>(21)</sup>.

## CONCLUSION

The treatment of posterior circulation aneurysms is more difficult than that of anterior circulation aneurysms. Surgical treatment of posterior circulation aneurysms is technically challenging owing to the complexity of the arterial structure and its relationship with the cranial nerves and the upper brainstem. However, such aneurysms can be successfully treated by adopting and modifying established procedures, using careful microsurgical technique, and incorporating recent neuroradiological interventional advances. The selection of the surgical procedure for aneurysms of the posterior circulation should take into account the complex anatomy of the posterior circulation.

Based on our experience, aneurysms of the distal cortical segment of the SCA can be managed using the infratentorial supracerebellar approach, whereas those of the P1 and P1-P2 junction, and the VBJ can be treated using the pterional approach and a combination of retrosigmoid and the infratentorial supracerebellar approaches, respectively.

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