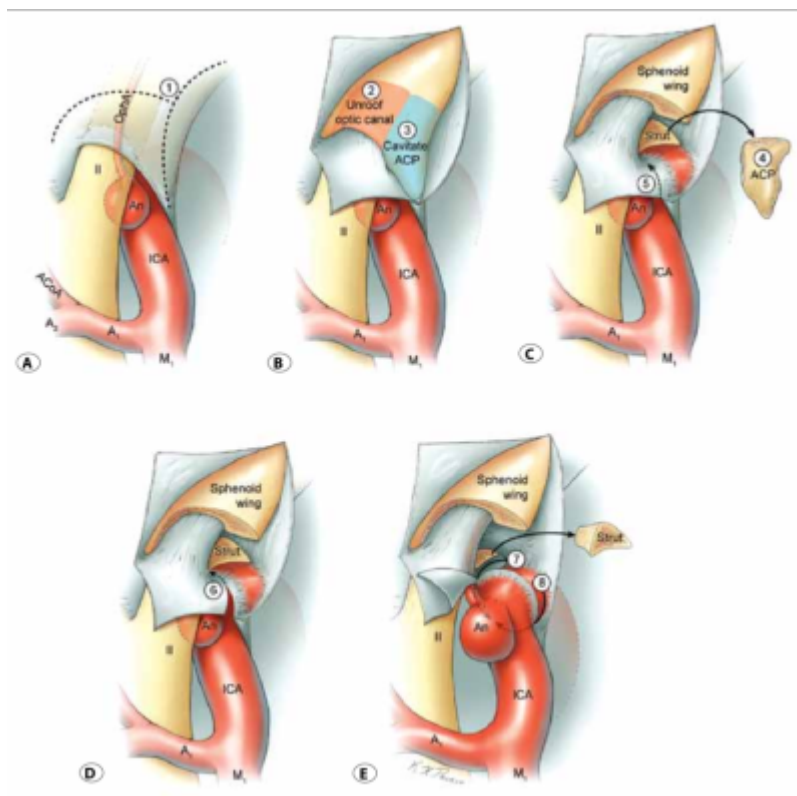


Anterior clinoidectomy



The [optic nerve](#) within the [optic canal](#), the parophthalmic segment of the [internal carotid artery](#), and the [oculomotor nerve](#) in the [superior orbital fissure](#) all lay against the [anterior clinoid process](#). Bone resection uncovers these structures.

Indications

Removal of the [anterior clinoid process](#) (ACP) facilitates radical [removal](#) of [tumors](#) or radical neck [clipping](#) of [aneurysms](#) in the [suprasellar region](#) and [parasellar regions](#) by providing a wide operative exposure of the [internal carotid artery](#) (ICA) and the [optic nerve](#) and by reducing the need for brain [retraction](#).

Preoperative imaging of [anterior clinoid region meningioma](#) can accurately predict the presence or absence of tumor involvement of the clinoid in only approximately 75% of cases. In light of the fact that a quarter of patients with radiographically negative clinoids will have tumor present on pathological analysis, Copeland et al. recommend a clinoidectomy for all [anterior clinoid region meningiomas](#) ¹⁾.

Initially developed intradurally ^{2) 3)}, later extradural ⁴⁾.

Technique

A high-speed power-drilling technique of anterior clinoidectomy has been advocated in all publications on paraclinoid region surgery. The entire shaft of the power drill is exposed in the operative field; thus, all neurovascular structures in proximity to any portion of the full length of the rotating drill bit are at risk for direct mechanical and/or thermal injury. Ultrasonic bone removal has recently been developed to mitigate the potential complications of the traditional power-drilling technique of anterior clinoidectomy. However, ultrasound-related cranial neuropathies are recognized complications of its use, as well as the increased cost of device acquisition and maintenance.

see [Endoscopic extradural anterior clinoidectomy](#).

Extradural clinoidectomy

see [Extradural anterior clinoidectomy](#).

Hybrid technique

It is important to note that the surgeon should prefer the method he or she feels most comfortable with. This preference is often affected by the surgeon's training. Extradural clinoidectomy is advantageous during removal of the [medial sphenoid wing meningiomas](#) as aggressive bony removal facilitates extradural devascularization of the tumor and may enhance gross tumor removal, especially if the clinoid is infiltrated with tumor. The intradural technique may be preferred for clipping of ophthalmic aneurysms as bony removal can be tailored based on the pathology at hand and clinoidectomy can be done under careful monitoring of the aneurysm to prevent manipulations that would place the aneurysm at risk of intraoperative rupture.

The hybrid method theoretically can be used as a versatile method under both circumstances mentioned above. Cutting the dura along the sphenoid wing will prevent the dural layers from obscuring the clinoid and offers intradural visualization to monitor the lesion and potentially tailor bony removal. ⁵⁾.

In a study, Tayebi Meybodi et al., sought to develop a hybrid technique based on localization of the [optic strut](#) (OS) to combine the advantages and avoid the disadvantages of both techniques. Ten cadaveric specimens were prepared for surgical simulation. After a standard [pterional craniotomy](#), the [anterior clinoid process](#) (ACP) was resected in 2 steps. The segment anterior to the OS was resected extradurally, while the segment posterior to the OS was resected [intradurally](#). The proposed technique was performed in 6 clinical cases to evaluate its safety and efficiency. Anterior [clinoidectomy](#) was successfully performed in all [cadaveric specimens](#) and all 6 patients by using the proposed technique. The extradural phase enabled early decompression of the [optic nerve](#) while avoiding the adjacent [internal carotid artery](#). The OS was drilled intradurally under direct visualization of the adjacent neurovascular structures. The described [landmarks](#) were easily identifiable and applicable in the surgically treated patients. No operative [complication](#) was encountered. A proposed 2-step hybrid technique combines the advantages of the extradural and intradural techniques while

avoiding their **disadvantages**. This technique allows reduced intradural drilling and subarachnoid **bone dust** deposition. Moreover, the most critical part of the **clinoidectomy**-that is, **drilling** of the OS and removal of the body of the ACP-is left for the intradural phase, when critical **neurovascular** structures can be directly viewed ⁶⁾.

Videos

Extradural anterior **clinoidectomy** is a versatile technique to increase exposure of the sellar and **parasellar region**. It is of particular use in the resection of clinoidal meningiomas, as sphenoidal and clinoidal hyperostosis can cause compression of the **optic nerve**. Extradural clinoidectomy follows a series of steps, consisting of (1) unroofing of the **superior orbital fissure**, (2) unroofing of the optic canal, (3) removal of the **optic strut**, and (4) removal of the **anterior clinoid process**. The authors show these steps in detail, as well as their application to the resection of a large clinoidal meningioma. The video can be found here: <https://youtu.be/O1Fcef29ETg> ⁷⁾.

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Case series

2012

Between June 2007 and January 2011, a total of 82 patients with neoplastic and vascular lesions underwent anterior clinoidectomy by the senior author (J.H.) through the LSO approach. They analyzed the operative videos paying particular attention to the surgical technique used for removal of the anterior clinoid process (ACP) and compared the microsurgical nuances to postoperative complications related to anterior clinoidectomy.

Forty-five patients were treated for aneurysms; 35 patients for intraorbital, parasellar, and suprasellar tumors; and 2 patients for carotid-cavernous fistulas. Intradural anterior clinoidectomy was performed in 67 (82%) cases; in 15 (18%) cases an extradural approach was used. In 51 (62%) cases, ACP was removed completely, whereas in the remaining 31 (38%) a tailored anterior clinoidectomy was performed. Four (5%) patients had new postoperative visual deficits and 3 (4%) experienced a worsening of preoperative visual deficits. Twelve (15%) patients improved their preoperative visual deficits after intradural anterior clinoidectomy. Ultrasonic bone device is a useful tool but may damage the optic nerve when performing anterior clinoidectomy. There was no mortality in our series.

Anterior clinoidectomy can be performed through an LSO approach with a safety profile that is comparable to other approaches. Ultrasonic bone dissector is a useful tool but may lead to injury of the optic nerve and should be used very carefully in its vicinity ⁸⁾.

2009

A retrospective review of a cerebrovascular/cranial base fellowship-trained neurosurgeon's 45

consecutive cases of anterior clinoidectomy using the “no-drill” technique is presented. Clinical indications have been primarily small to giant aneurysms of the proximal internal carotid artery; however, in addition to ophthalmic segment aneurysms, selected internal carotid artery-posterior communicating artery aneurysms and internal carotid artery bifurcation aneurysms, and other large/giant/complex anterior circulation aneurysms, this surgical series of “no-drill” anterior clinoidectomy includes tuberculum sellae meningiomas, clinoidal meningiomas, cavernous sinus lesions, pituitary macroadenomas with significant suprasellar extension, other perichiasmal lesions (sarcoid), and fibrous dysplasia. A bony opening is made in the mid-to posterior orbital roof after the initial pterional craniotomy. Periorbita is dissected off the bone from inside the orbital compartment. Subsequent piecemeal resection of the medial sphenoid wing, anterior clinoid process, optic canal roof, and optic strut is performed with bone rongeurs of various sizes via the bony window made in the orbital roof. RESULTS: No power drilling was used in this surgical series of anterior clinoidectomies. Optimal microsurgical exposure was obtained in all cases to facilitate complete aneurysm clippings and lesionectomies. There were no cases of direct injury to surrounding neurovascular structures from the use of the “no-drill” technique. The surgical technique is presented with illustrative clinical cases and intraoperative photographs, demonstrating the range of applications in anterior and central cranial base neurosurgery. CONCLUSION: Power drilling is generally not necessary for removal of the anterior clinoid process, optic canal roof, and optic strut. Rigorous study of preoperative computed tomographic scans/computed tomographic angiography scans, magnetic resonance imaging scans, and angiograms is essential to identify important anatomic relationships between the anterior clinoid process, optic strut, optic canal roof, and neighboring neurovascular structures. The “no-drill” technique eliminates the risks of direct power-drilling mechanical/ thermal injury and the risks of ultrasound-associated cranial neuropathies. The “no-drill” technique provides a direct, time-efficient, and efficacious approach to the paraclinoid/ parasellar/pericavernous area, using a simplified mechanical route. This technique is applicable to any neurosurgical diagnosis and approach in which anterior clinoidectomy is necessary. It is arguably the gentlest and most efficient method for exposing the paraclinoid/parasellar/pericavernous region ⁹⁾.

1997

Over a period of 3 years, anterior clinoidectomy was performed in 40 patients, 30 of whom harbored aneurysms (18 of the ICA and 13 of the basilar artery [one patient had two aneurysms]) and 10 of whom had tumors (four large pituitary tumors, four craniopharyngiomas, and two sphenoid ridge meningiomas). The ACP was removed extradurally in 31 cases and intradurally in nine cases. Extradural clinoidectomy was performed in all cases of pituitary neuroendocrine tumor and craniopharyngioma and in most cases of basilar artery aneurysm. Intradural clinoidectomy was performed in two cases of ICA-ophthalmic artery aneurysm, two cases of ICA-posterior communicating artery aneurysm, two cases of ICA cavernous aneurysm, one case of basilar artery aneurysm, and two cases of sphenoid ridge meningioma. The outcome was satisfactory in all patients, except for one patient who underwent clipping of a basilar tip aneurysm and suffered a thalamic and midbrain infarction. Three patients who underwent extradural clinoidectomy suffered a postoperative diminution of visual acuity or a visual field defect on the side of the clinoidectomy. These deficits may have been caused either by drilling of the ACP or by other operative manipulation of the optic nerve. Cerebrospinal fluid rhinorrhea, which required reoperation, occurred in one patient. The authors' experience suggests that the extradural technique of ACP removal is easier and less time consuming than the intradural one and provides better operative exposure. It can be used routinely in treating lesions in the supra- and parasellar region ¹⁰⁾.

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