Paraclinoid internal carotid artery aneurysm

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Paraclinoid internal carotid artery aneurysm is defined as an aneurysm that originates at the internal carotid artery (ICA) distal to the proximal dural ring (PDR) and proximal to the posterior communicating artery (PCoA), which means both ophthalmic and clinoidal segments of the ICA.

Ophthalmic segment aneurysms (OSAs) OSAs include (NB: nomenclature varies among authors):

1. ophthalmic artery aneurysms:

2. superior hypophyseal artery aneurysms:

a) Paraclinoid internal carotid artery aneurysm: usually does not produce visual symptoms

b) suprasellar variant: when giant, may mimic pituitary tumor on CT

Treatment

see Paraclinoid internal carotid artery aneurysm treatment.

Case series

A retrospective chart review of all patients undergoing treatment for paraophthalmic aneurysms from 2017-2019 was performed. Factors including patient demographics, aneurysm characteristics, treatment modality, radiographic treatment outcome, clinical outcome, and length of stay were collected, and bivariate analysis was performed.

In total 84.5% (82/97) of aneurysms were treated endovascularly and 15.5% (15/97) surgically. In the surgery cohort, there were three transient perioperative complications (20%) and one minor postoperative complication (6.7%). Complete aneurysm occlusion or near complete (<2mm residual) was achieved in 100% (15/15). All but one patient had mRS ≤1 at the last follow-up. In the endovascular group, 78.1% (64/82) underwent flow diversion alone. Endovascular treatment was associated with a 4.9% (4/82) rate of periprocedural complications: 3 transient events, and 1 death,

and a 3.7% (3/82) rate of delayed complications: 2 transient vision changes, and one death. Rate of total occlusion was 87.8% (72/82). 76 patients (92.7%) had mRS ≤1 at the last follow-up. Length of stay was significantly shorter in the endovascular group (3.4 days vs. 7.0 days) [$p < 0.001$].

This series demonstrates similar safety to previously reported series as well as the efficacy of both surgical clipping and endovascular embolization of paraophthalmic aneurysms. Rate of complications and treatment efficacy were similar in both groups although this represents a single institution series not generalizable to all centers [1)]

A review was conducted on 18 cases of large paraclinoid internal carotid artery aneurysm which were clipped by balloon non-fluoroscopic occlusion of the parent artery via a micro-bone window frontolateral approach in hybrid operating room at Neurosurgery Department of Tianjin Medical University General Hospital from June 2014 to December 2017. There were 8 males and 10 females with age of (63±4) years. There were 6 cases of unruptured aneurysm and 12 cases of ruptured aneurysm of subarachnoid hemorrhage (6 cases of grade Ⅱ, 4 cases of grade Ⅲ and 2 cases of grade Ⅳ in Hunt-Hess classification). Frontolateral approach incision (average length of about 5 cm) and bone window about 3 cm×3 cm were performed. No incision of the neck was needed to expose the internal carotid artery for temporary occlusion. In the operation, the balloon was slowly pushed to the preset position of the internal carotid artery under non-fluoroscopy. The balloon was expanded to block the blood flow of internal carotid artery. Then aneurysm was clipped. The balloon was loosened and retraced to the guiding catheter after clipping. The clipping condition was examined by cerebral angiography. If there was residual aneurysm neck or stenosis of the parent artery, the balloon was pushed under non-fluoroscopy again to temporary occlusion and the clip was adjusted until the aneurysm neck was clamped satisfactorily. Results: Eighteen aneurysms were successfully clipped in hybrid operating room. Fourteen aneurysms showed complete occlusion of the aneurysm neck and no stenosis of the parent artery. Four cases showed residual aneurysm neck after clipping by intraoperative angiography, then aneurysms were clipped satisfy by adjusting the aneurysm clip. The patients were followed up for 3 months to 1 year. Ten patients recovered well (modifed Rankin score (mRS): 0), and 3 patients had no obvious disability (mRS: 1). Two patients with Hunt-Hess grade Ⅲ were slightly disabled (mRS: 2). 1 patients with Hunt-Hess grade Ⅲ were moderately disabled (mRS: 3). 1 patients with Hunt-Hess grade Ⅳ were severely disabled (mRS: 4). One elderly patients with Hunt-Hess grade Ⅳ were seriously disabled (mRS: 5). Conclusions: Application of balloon non-fluoroscopic occlusion clipping for large paraclinoid internal carotid artery aneurysm via a micro-bone window frontolateral approach is safe, effective and minimally invasive [2)].

2017

Otani et al. describe 13 consecutive patients and the clipping of complicated, large-sized paraclinoid aneurysms using a modified extradural temporopolar approach combined with retrograde suction decompression and discuss its advantages and pitfalls.

Modified extradural temporopolar approach with suction decompression (SD) assistance was performed in all patients. There was no complication related to the surgical procedure. Postoperative outcome was good recovery in 7 patients, moderate disability in 4, and severe disability in 2 caused by severe subarachnoid hemorrhage. Favorable outcomes were achieved in 10 patients (84.6%).

They recommend its less invasive, safe, and useful combined technique in the treatment of symptomatic paraclinoid aneurysms, which carry the risk of neurovascular injury caused by dissection from the aneurysm dome [3].

2016

23 patients with large and giant paraclinoid aneurysms who underwent surgical treatment consisting of direct clipping with suction decompression between March 2004 and August 2014. Direct puncture of the common carotid artery (CCA) was performed with a 20-gauge needle. The aneurysm was temporarily trapped by clamping of the CCA and external carotid artery (ECA), followed by temporary clipping of the intracranial internal carotid artery (ICA) distal to the aneurysm neck. Blood was then gently aspirated through a catheter introduced into the cervical ICA, resulting in collapse of the aneurysm. Therefore, safe aneurysm dissection was feasible during interruption of the blood flow, which could be maintained for up to 5 min. This procedure was repeated until dissection and clipping of the aneurysm were completed. RESULTS:

Seven patients were admitted with SAH, 11 with asymptomatic unruptured aneurysm, and 5 with symptomatic unruptured aneurysm. The aneurysms were located on the paraclinoidal segment of the ICA in 15 cases, on the ICA-posterior communicating artery (PComA) in 6, at the ICA bifurcation in 1, and on the anterior wall of the ICA in 1. None of them suffered complications related to the CCA puncture. Surgical outcome was good recovery in 13 patients, moderate disability in 4, severe disability in 4, and vegetative state in 1.

Retrograde suction decompression through direct puncture of the common carotid artery is a useful adjunct technique for the clipping of paraclinoid ICA aneurysms [4].

A study was aimed to evaluate safety and efficacy of stent-assisted coil embolization for paraclinoid aneurysms and explore the factors influencing the long-term outcomes. Under an institutional review board approved protocol, the clinical and angiographic data of 129 paraclinoid aneurysms in 120 patients (Male:Female=36:84; median age, 52years; range, 21-84) treated by stent-assisted coil embolization were reviewed retrospectively. Clinical status, aneurysmal morphology, treatment strategy and results were analyzed using Chi-squared tests in the univariate analysis and further analyzed using backward stepwise logistic regression. The univariate analysis indicated significance between the groups regarding hypertension, ruptured aneurysms, size, wide neck and immediate treatment results (P<0.05). Multivariate logistic regression analysis found that ruptured aneurysms (odds ratio [OR]=5.893, 95% confidence interval [CI], 1.512-23.054; p=0.011), larger size (OR=2.339; 95%CI, 1.148-4.781; p=0.020) and hypertension (OR=6.143; 95%CI, 1.560-24.183; p=0.009) might be predictors of recurrence. Stent-assisted coil embolization of paraclinoid aneurysm has a risk of recurrence. Ruptured aneurysms, larger size and hypertension may be the risk factors for recurrence [5].

Between January 2010 and September 2013, a total of 49 surgical patients with the preoperative diagnoses of paraclinoid aneurysm and 1 symptomatic cavernous-clinoid aneurysm were retrospectively identified. With the source images from CTA, the optic strut OS and the tuberculum sellae (TS) were used as landmarks to predict the location of the paraclinoid aneurysm and its relation to the distal dural ring (DDR). The operative findings were examined to confirm the definitive location

of the paraclinoid aneurysm. Statistical analysis was performed to determine the diagnostic effectiveness of the landmarks.

Nineteen patients without preoperative CTA were excluded. The remaining 30 patients comprised the current study. The intraoperative findings confirmed 12 intradural, 12 transitional, and 6 extradural paraclinoid aneurysms, the diagnoses of which were significantly related to the type of aneurysm ($p < 0.05$) but not factors like sex, age, laterality of aneurysm, or relation of the aneurysm to the ophthalmic artery on digital subtraction angiography. To measure agreement with the correct diagnosis, the OS as a reference point was far superior to the TS (Cohen's kappa coefficients 0.462 and 0.138 for the OS and the TS, respectively). For paraclinoid aneurysms of the medial or posterior type, using the base of the OS as a reference point tended to overestimate intradural paraclinoid aneurysms. The receiver operating characteristic curve indicated that if the aneurysmal neck traverses the axial plane 2 mm above the base of the OS, the aneurysm is most likely to grow across the DDR and present as a transitional aneurysm (sensitivity 0.806; specificity 0.792).

High-resolution thin-cut CTA is a fast and crucial tool for diagnosing paraclinoid aneurysms. The OS serves as an effective landmark in CTA source images for distinguishing between intradural and extradural paraclinoid aneurysms. The DDR is supposed to be located 2 mm above the base of the OS in axial planes [6)].

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133 patients with 136 aneurysms treated by neck clipping without bypass surgery. Visual impairments included decreased visual acuity and visual field defect. The aneurysm was classified into superior projecting aneurysm, ventral projecting aneurysm, and carotid cave aneurysm. Plug-in method was defined as filling interspace, which was formed between internal carotid artery and sutured dura in case of detachment of dural ring, by some materials.

Postoperative new visual impairments were observed in 30 aneurysms (22%). During follow up period (median, 600 days), postoperative new visual impairments continued in 23 aneurysms (17%). Multivariate analysis showed that carotid cave location and plug-in method were related to new visual impairments at 30-day (odds ratio (OR), 2.6; 95% confidence interval (CI), 1.1-6.1; $p = 0.031$ and OR, 4.1; 95% CI, 1.4-12; $p = 0.008$) and at 6-month (OR, 4.1; 95% CI, 1.5-11; $p = 0.005$ and OR, 3.3; 95% CI, 1.1-11; $p = 0.045$).

The present study showed that carotid cave location and plug-in method during dural closures were related to postoperative continued visual impairments. Neurosurgeons should carefully consider the surgical indication for unruptured carotid cave location aneurysms and avoid plug-in method [7)].

2015

Liu et al., studied 27 paraclinoid aneurysms (seven recanalized and 20 stable) treated with coils and Enterprise stents. Computational fluid dynamic simulations were performed on patient-specific aneurysm geometries using virtual stenting and porous media technology.

After stent placement in 27 cases, aneurysm flow velocity decreased significantly, the reduction gradually increasing from the neck plane (11.9%), to the residual neck (12.3%), to the aneurysm dome (16.3%). Subsequent coil embolization was performed after stent placement and the hemodynamic factors decreased further and significantly at all aneurysm regions except the neck

plane. In a comparison of recanalized and stable cases, univariate analysis showed no significant differences in any parameter before treatment. After stent-assisted coiling, only the reduction in area-averaged velocity at the neck plane differed significantly between recanalized (8.1%) and stable cases (20.5%) (p=0.016).

Aneurysm flow velocity can be significantly decreased by stent placement and coil embolization. However, hemodynamics at the aneurysm neck plane is less sensitive to coils. Significant reduction in flow velocity at the neck plane may be an important factor in preventing recanalization of paraclinoid aneurysms after subtotal SACE [8].

2014

Between January 2008 and December 2012, Bae et al., treated 61 paraclinoid ICA aneurysms created by surgical clipping or endovascular coiling. Preoperative neurologic status and postoperative outcome were evaluated using the Glasgow coma scale (GCS) and the modified Rankin scale (mRS). Postoperative hydrocephalus and vasospasm were reviewed using the patients' medical charts.

Most patients were in good clinical condition before the operations and had good treatment outcomes. Clinical vasospasm was observed after the operation in five patients, and hydrocephalus occurred in six patients. No statistically significant difference regarding aneurysm size, sex, GCS score, H-H grade, and mRS was observed between the surgical clipping group and the endovascular coiling group. In addition, the treatment results and complications did not show statistically significant difference in either group.

Surgical occlusion of paraclinoid ICA aneurysms is difficult; however, no significant differences were observed in the treatment results or complications when compared with coil embolization. In particular, use of an adequate surgical technique may lead to better outcomes than those for coil embolization in the treatment of large and/or wide-neck paraclinoid ICA aneurysms [9].

2013

Ninety-five patients harboring 106 paraclinoid aneurysms underwent surgery (1990-2010). Age, 11-72 years old. Sex, 74:21 female/male. Follow-up; 1-192 months (mean = 51.7 months). Eighty-six patients had single and 9 had multiple paraclinoid aneurysms. Sixty-six were ophthalmic, 14 were in the ICA superior wall, 13 in the inferior, 10 in the medial, and 3 in the ICA lateral wall. Eleven were giant, 29 were large, and 66 were small. Sixty-three patients had ruptured and 32 had unruptured aneurysms. Two patients with bilateral aneurysms had bilateral approaches, totaling 97 procedures. A total of 98.2% of aneurysms were clipped (complete exclusion in 93.8%). ICA occlusion occurred in 10 (5.6%). There was no patient rebleeding during the follow-up period. A good outcome was achieved in 76.8%, with better results for unruptured aneurysms, worse results for patients with vasospasm, and with no difference according to size. Thirty-six (37.9%) patients had transient/permanent postoperative neurological deficits (25.4% ruptured vs. 62.5% unruptured aneurysms). The most frequent deficits were visual impairment and third cranial nerve palsies. Operative mortality was 11.6%, all in patients presenting with ruptured aneurysms. Despite relatively high morbidity/mortality, especially for patients with ruptured aneurysms, microsurgical treatment of paraclinoid aneurysm has high efficacy, with better outcome for unruptured aneurysms and worse outcome for patients with vasospasm [10].

2003

A retrospective analysis of 61 patients with aneurysms in this location, Barami et al., developed a simple numerical classification system to guide surgical planning. We used angiographic findings to categorize the aneurysms. We followed the nomenclature of the carotid segments by Bouthillier et al (Neurosurgery 1996;38:425-432), C4 being the intracavernous ICA, C5 the clinoidal segment, and C6 the ophthalmic segment of the ICA. The aneurysms were divided into four major types: Types Ia and Ib projected superiorly and arose from the dorsal surface of C6. Type Ia was related to the ophthalmic artery. Type Ib aneurysms were sessile and had no branch relations. Type II aneurysms were related to the ventral wall of the C6 segment without any branch relation. Type IIIa variant arose from medial wall of the C6 segment and was related to the superior hypophyseal artery. Type IIIb arose from the medial wall of the C5 segment below the dural reflection without any branch relation. Large type IV aneurysms arose from the C5 and C6 segments, widening the distal dural ring. Patients' postoperative status and visual and overall outcomes were analyzed. Ultimately, this classification helped them to plan operative approaches and clip selection [11)].

1999

De Jesús et al., reviewed 35 clinoid and paraclinoid ICA aneurysms operated in 28 patients and classify them according to their anatomic location and angiographic pattern. The operative techniques, surgical outcomes, and indications for surgery are reviewed.

Based on surgical anatomy and angiographic patterns, the aneurysms were classified into two categories: clinoid segment and paraclinoid (ophthalmic) segment. The clinoid segment aneurysms consisted of medial, lateral and anterior varieties. The paraclinoid aneurysms could be classified topographically into medial, posterior and anterior varieties, or based on the artery of origin into ophthalmic, superior, hypophyseal, and posterior paraclinoid aneurysms. Ophthalmic aneurysms were most common (40%), followed by posterior ICA wall aneurysms (29%), superior hypophyseal aneurysms (14%), and clinoid aneurysms (17%). Twenty patients (71%) had single aneurysms. Of the remaining eight, six had bilateral aneurysms and two had unilateral multiple aneurysms. Of the 35 aneurysms, 32 were clipped satisfactorily, as confirmed by intraoperative or postoperative angiography. One small broad-based aneurysm was wrapped, and two others were treated by trapping and bypass techniques. Three patients who had bilateral aneurysms underwent successful clipping of four contralateral, left-sided aneurysms via a right frontotemporal, transorbital approach. On follow-up (mean, 39 months), 25 patients were in excellent condition (returned to their prior occupation), two were in good condition (independent, but not working), and one died postoperatively of vasospasm [12)].

Case reports

Paraclinoid Internal Carotid Artery Aneurysm Case Reports.

Videos

Direct suction decompression and fenestrated clip reconstruction of complex paraclinoid carotid artery aneurysm: operative video and nuances of skull base technique

<html><iframe width="420" height="315" src="https://www.youtube.com/embed/IPS6lslk1ds" frameborder="0" allowfullscreen></iframe></html>

Case reports from the HGUA

Case Report:

Title: *Management of a Ruptured Internal Carotid Artery Aneurysm with Subarachnoid Hemorrhage: A Case Report*

Abstract: We report the case of a 57-year-old woman presenting with a massive subarachnoid hemorrhage (SAH) secondary to the rupture of an aneurysm of the left supraclinoid segment of the internal carotid artery (ICA). Following emergency intervention, including coil embolization of the aneurysm and critical care management, the patient showed favorable recovery despite early complications, including elevated intracranial pressure (ICP), seizures, and signs of encephalopathy. This case highlights the importance of early diagnosis, urgent intervention, and comprehensive multidisciplinary care in managing complex aneurysmal SAH.

Introduction: Subarachnoid hemorrhage (SAH) is a life-threatening condition, often caused by the rupture of an intracranial aneurysm. The management of aneurysmal SAH requires rapid diagnosis, early intervention to control the hemorrhage, and intensive monitoring to manage complications such as elevated intracranial pressure (ICP) and seizures. We present the case of a 57-year-old woman with a ruptured aneurysm of the left internal carotid artery (ICA), treated with coil embolization, and follow-up in the neurocritical care unit.

Case Presentation: A 57-year-old woman with a history of hypertension (HTA), dyslipidemia (DLP), nephrotic syndrome, and hypothyroidism was transferred to our institution from the Hospital de San Juan after presenting with a massive subarachnoid hemorrhage. Emergency responders had initially found her unconscious at home, but she had regained consciousness upon their arrival. She subsequently suffered a generalized tonic-clonic seizure with vomiting, resulting in a Glasgow Coma Scale (GCS) score of 3. Following intubation and sedation, she was transferred to the hospital for further management.

Upon arrival, her vital signs were stable: - Blood pressure: 113/81 mmHg - Heart rate: 50 bpm - Oxygen saturation: 100% - Neurological examination revealed pupils that were equal, round, and reactive, with no significant abnormalities.

Imaging and Diagnosis: A non-contrast CT scan performed on admission revealed a massive subarachnoid hemorrhage that extended into the suprasellar cisterns, both Sylvian fissures, and multiple frontoparietal and parasagittal sulci. Additionally, a subdural hematoma was noted along the left cerebellar tentorium, and an angiographic CT scan demonstrated a 1×0.5 cm aneurysm located on the left supraclinoid segment of the ICA, with associated vasoconstriction of the intracranial arteries. The diagnosis of a ruptured aneurysm causing massive SAH was confirmed.

Management and Interventions: The patient was urgently transferred to the neurocritical care unit (UCI), where management included sedation, mechanical ventilation, and continuous monitoring of

ICP via ventriculostomy catheter. Despite initial hemodynamic instability, the patient responded to high-dose vasopressors. Seizures were managed with Keppra, and coil embolization of the ruptured aneurysm was successfully performed. Post-embolization imaging revealed the expected artifact from the coils, but no immediate complications related to the procedure.

In light of elevated intracranial pressure that was refractory to medical treatment, a ventriculostomy was placed to help manage the pressure. This was accompanied by continued use of sedative agents and anticonvulsants. The patient remained sedated for several days but showed gradual improvement as sedatives were tapered.

Neurological and Radiological Follow-up: Follow-up CT scans demonstrated progressive resolution of the hemorrhage, although small residual hemorrhagic foci remained in the sulci and ventricles. A subdural hygroma developed in the left temporal region without significant mass effect. The patient's ventricular size showed minor improvement, and no further evidence of acute bleeding was seen.

EEG Findings: An EEG revealed continuous delta activity, indicating encephalopathy, but without evidence of seizures. This was consistent with a post-hypoxic encephalopathy following her SAH and subsequent brain injury.

Infection and Sepsis: During her ICU stay, the patient was closely monitored for signs of infection. Cultures obtained from cerebrospinal fluid (CSF), blood, and central venous catheter (CVC) samples were negative, with only minimal growth of Staphylococcus aureus and Enterobacter hormaechei detected, which did not correlate with clinical sepsis. Empiric antibiotic therapy with tazocel and vancomycin was initiated and later discontinued once cultures remained negative.

Outcome and Discharge: The patient’s neurological condition gradually stabilized. She was extubated and the ventriculostomy was removed without complications. Neurologically, she was noted to have a GCS of 12 (with verbal response of 1, motor response of 5), and although her cognitive function remained impaired, she was able to localize pain in all four limbs. After a stable period in the ICU, the decision was made to discharge her to a general ward for ongoing rehabilitation.

The patient was discharged in a stable condition with ongoing care for rehabilitation and a plan for follow-up imaging. At the time of discharge, she had no further seizures and was maintaining adequate cerebral perfusion.

Discussion: This case highlights the challenges and complexities of managing a ruptured ICA aneurysm presenting with massive SAH. The immediate intervention with coil embolization, along with close neurological monitoring, was crucial in preventing further deterioration. Although the patient suffered early complications, including elevated ICP and encephalopathy, these were managed successfully with appropriate medical and surgical interventions.

In SAH cases, early detection of aneurysmal rupture and timely intervention are essential for improving outcomes. The use of advanced imaging, such as CT angiography, is crucial in identifying the source of hemorrhage and guiding treatment decisions. Furthermore, intensive neurocritical care management, including sedation, ICP monitoring, and anticonvulsant therapy, is fundamental in managing these high-risk patients.

Conclusion: This case demonstrates that with timely diagnosis, embolization, and comprehensive critical care, patients with ruptured ICA aneurysms can recover with favorable outcomes, despite the

complexity and severity of the presentation. Continuous monitoring and a multidisciplinary approach are key to optimizing recovery in such challenging cases.

Keywords: Aneurysm, Subarachnoid Hemorrhage, Internal Carotid Artery, Coil Embolization, Neurocritical Care, Seizures, Encephalopathy.

1)
White TG, Krush M, Prashant G, Shah K, Katz JM, Link T, Woo HH, Dehdashti AR. Comparative outcomes of the treatment of unruptured paraophthalmic aneurysms in the era of flow diversion. Br J Neurosurg. 2023 May 10:1-7. doi: 10.1080/02688697.2023.2210220. Epub ahead of print. PMID: 37161776.
2)
Wang HY, Zhao Y, Zhang H, Gao YK, Xin WW, Cui JZ, Yue SY, Yang SY, Zhang JN, Yang XY. [Clipping for large paraclinoid internal carotid artery aneurysms by non-fluoroscopic occlusion via a micro-bone window frontolateral approach]. Zhonghua Wai Ke Za Zhi. 2018 Dec 1;56(12):928-932. doi: 10.3760/cma.j.issn.0529-5815.2018.12.010. Chinese. PubMed PMID: 30497121.
3)
Otani N, Toyooka T, Wada K, Mori K. Modified extradural temporopolar approach with suction decompression for clipping of large paraclinoid aneurysm: Technical note. Surg Neurol Int. 2017 Jul 18;8:148. doi: 10.4103/sni.sni_377_16. eCollection 2017. PubMed PMID: 28791191; PubMed Central PMCID: PMC5525458.
4)
Otani N, Wada K, Toyooka T, Fujii K, Ueno H, Tomura S, Tomiyama A, Nakao Y, Yamamoto T, Mori K. Retrograde Suction Decompression Through Direct Puncture of the Common Carotid Artery for Paraclinoid Aneurysm. Acta Neurochir Suppl. 2016;123:51-6. doi: 10.1007/978-3-319-29887-0_7. PubMed PMID: 27637628.
5)
Lv N, Zhao R, Yang P, Fang Y, Li Q, Xu Y, Hong B, Zhao W, Liu J, Huang Q. Predictors of recurrence after stent-assisted coil embolization of paraclinoid aneurysms. J Clin Neurosci. 2016 Aug 26. pii: S0967-5868(16)30376-9. doi: 10.1016/j.jocn.2016.03.039. [Epub ahead of print] PubMed PMID: 27575747.
6)
Liao CH, Lin CJ, Lin CF, Huang HY, Chen MH, Hsu SP, Shih YH. Comparison of the effectiveness of using the optic strut and tuberculum sellae as radiological landmarks in diagnosing paraclinoid aneurysms with CT angiography. J Neurosurg. 2016 Jan 8:1-8. [Epub ahead of print] PubMed PMID: 26745492.
7)
Matsukawa H, Tanikawa R, Kamiyama H, Tsuboi T, Noda K, Ota N, Miyata S, Takeda R, Tokuda S. Risk factors for visual impairments in patients with unruptured intradural paraclinoid aneurysms treated by neck clipping without bypass surgery. World Neurosurg. 2016 Apr 11. pii: S1878-8750(16)30077-8. doi: 10.1016/j.wneu.2016.04.004. [Epub ahead of print] PubMed PMID: 27080234.
8)
Liu J, Jing L, Wang C, Paliwal N, Wang S, Zhang Y, Xiang J, Siddiqui AH, Meng H, Yang X. Effect of hemodynamics on outcome of subtotally occluded paraclinoid aneurysms after stent-assisted coil embolization. J Neurointerv Surg. 2015 Nov 26. pii: neurintsurg-2015-012050. doi: 10.1136/neurintsurg-2015-012050. [Epub ahead of print] PubMed PMID: 26610731; PubMed Central PMCID: PMC4882272.
9)
Bae DH, Kim JM, Won YD, Choi KS, Cheong JH, Yi HJ, Kim CH. Clinical outcome of paraclinoid internal carotid artery aneurysms after microsurgical neck clipping in comparison with endovascular embolization. J Cerebrovasc Endovasc Neurosurg. 2014 Sep;16(3):225-34. doi: 10.7461/jcen.2014.16.3.225. Epub 2014 Sep 30. PubMed PMID: 25340024; PubMed Central PMCID: PMC4205248.
10)

Colli BO, Carlotti CG Jr, Assirati JA Jr, Abud DG, Amato MC, Dezena RA. Results of microsurgical treatment of paraclinoid carotid aneurysms. Neurosurg Rev. 2013 Jan;36(1):99-114; discussion 114-5. doi: 10.1007/s10143-012-0415-0. Epub 2012 Aug 17. PubMed PMID: 22898891.
11)

Barami K, Hernandez VS, Diaz FG, Guthikonda M. Paraclinoid Carotid Aneurysms: Surgical Management, Complications, and Outcome Based on a New Classification Scheme. Skull Base. 2003 Feb;13(1):31-41. PubMed PMID: 15912157; PubMed Central PMCID: PMC1131827.
12)

De Jesús O, Sekhar LN, Riedel CJ. Clinoid and paraclinoid aneurysms: surgical anatomy, operative techniques, and outcome. Surg Neurol. 1999 May;51(5):477-87; discussion 487-8. PubMed PMID: 10321876.