

Original Article

Modified extradural temporopolar approach with mini-peeling of dura propria for paraclinoid and/or parasellar tumors: Operative technique and nuances

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Abstract

Background: Modified extradural temporopolar approach (EDTPA) with mini-peeling of the dura propria can provide extensive exposure of the anterior clinoid process and early exposure, as well as complete mobilization and decompression of the optic nerve and internal carotid artery, which can prevent intraoperative neurovascular injury for paraclinoid and/or parasellar lesions. The present study investigated the usefulness of this modified technique and discusses the operative nuances.

Methods: We retrospectively reviewed medical charts of 27 consecutive patients with neoplastic paraclinoid and/or parasellar lesions who underwent this modified approach between September 2009 and August 2016.

Results: Preoperative visual acuity worsened in 2 patients (7.4%), and worsening of visual field function occurred in 2 patients (7.4%). Postoperative outcome was good recovery in 25 patients (92.6%) and moderate disability in 2 (7.4%). No operation-related mortality occurred in the series.

Conclusions: The modified EDTPA is safe and recommended for surgical treatment of paraclinoid and/or parasellar tumors to reduce the risk of intraoperative optic neurovascular injury.

Key Words: Extradural temporopolar approach, microneurosurgery, paraclinoid tumor, skull base surgery

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INTRODUCTION

Tumors in the paraclinoid and/or parasellar areas are still challenging to resect completely and safely because of their tendency to adhere to the optic apparatus, pituitary stalk, or internal carotid artery (ICA), as well as to invade the cavernous sinus (CS), orbit, and sella turcica.^[9,18] Consequently, surgical management of these tumors^[2,10,15] may require removal of the anterior clinoid process (ACP). Anterior clinoidectomy is one of the essential skull base techniques to treat many lesions including deeply located aneurysms and skull

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base tumors. Removal of the ACP resulted in increased length of the optic nerve, better exposure of the carotid artery, and increased size of the optico-carotid triangle in a recent cadaveric morphometric study.^[8] These findings suggest that removal of the ACP can provide improved access routes and exposure of the structures around the optic nerve, ICA, and optic canal, and hence, may reduce the risk of intraoperative optic nerve injury because the optic nerve can be decompressed, visualized early, and mobilized safely.

The extradural technique for complete removal of the ACP was first introduced by Dolenc in 1983,^[4] and was improved as part of an extensive transcavernous approach with opening of the optic sheath in 1985.^[5] The extradural temporopolar approach (EDTPA) is a variant of Dolenc's technique but focuses more on temporal lobe retraction over the dura mater, providing a surgical corridor to the central skull base via the opened CS. The original EDTPA is a useful technique to treat tumors in the central skull base including paraclinoid tumors. The original EDTPA requires the drilling of both the superior orbital fissure (SOF) and foramen rotundum (FR) and dural propria incision over the SOF. The disadvantage of the original EDTPA is the risk of injuring the neurovascular structures passing through the SOF during dissection.^[21] In contrast, extradural anterior clinoidectomy via the trans-SOF approach (dura propria mini-peeling) was recently found to provide less invasive but adequate exposure of the ACP.^[11-13] In particular, we have recently proposed modified EDTPA with mini-peeling of the dura propria as a less invasive technique to reduce the risk of intraoperative neurovascular injury.^[16] This modified approach requires only skeletonization of the SOF to expose the dura propria border and only needs minimal dural incision between the SOF and FR where no cranial nerves are present.

The present study demonstrated the usefulness of this modified EDTPA and its operative techniques, and evaluated the surgical outcomes with special emphasis on the clinical and visual outcomes after surgical resection of paraclinoid and/or parasellar tumors in a series of 27 consecutive patients.

PATIENTS AND METHODS

Patient characteristics

This retrospective analysis included 27 consecutive patients, 17 women and 10 men aged 24–78 years (mean, 58.2 years), with neoplastic lesions who underwent modified EDTPA with mini-peeling of the dura propria at the National Defense Medical College Hospital and Juntendo University Shizuoka Hospital between September 2009 and August 2015. Medical charts, radiological findings, surgical techniques, complications, and final results were retrospectively reviewed. The

topography of all tumors was analyzed accurately using preoperative magnetic resonance (MR) imaging and intraoperative surgical assessment. Tumor size, obtained by measuring the greatest diameter in any single plane on the preoperative MR images, ranged from 12 to 78 mm (mean, 33.6 mm). The ACP size, shape, pneumatization, and relationship with the sphenoid or ethmoid sinus were assessed on bone computed tomography (CT) scans for safe clinoidectomy. The presence of contraindications for extradural anterior clinoidectomy, such as caroticoclinoid foramen and interclinoid osseous ligament, was also assessed preoperatively. The extent of tumor removal was based on intraoperative assessment and contrast-enhanced CT and/or MR imaging performed on the day after surgery. All patients underwent detailed pre and postoperative evaluation of visual function by a neuro-ophthalmologist, except for 2 patients with severe disorientation. Ophthalmological examinations consisted of testing visual acuity with optimum correction lenses for both eyes, visual field examinations, and funduscopy.

Surgical procedure

Schematic illustrations show the surgical procedure in Figures 1 and 2. Microsurgical procedures using the modified EDTPA technique for removal of paraclinoid or anterior skull base tumors are performed as follows.

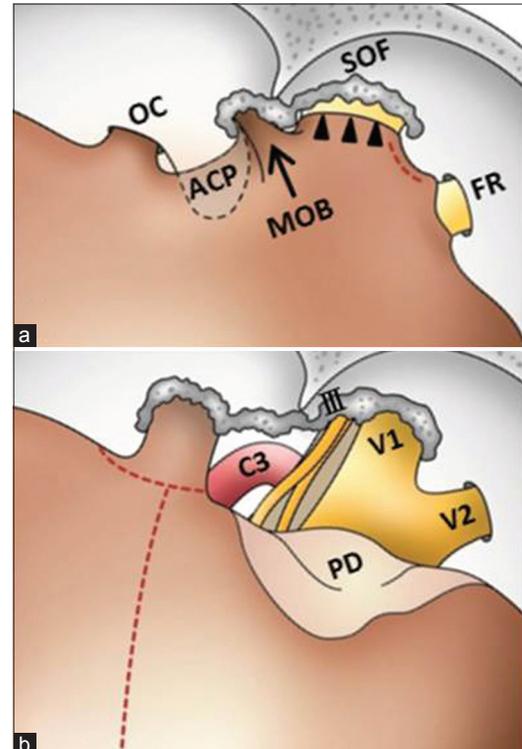


Figure 1: Schematic illustration of the operative techniques of EAC with mini-peeling of the dura propria followed by ETA. MOB = meningo-orbital band; PD = periosteal dura; V1 = first division of the trigeminal nerve; V2 = second division of the trigeminal nerve

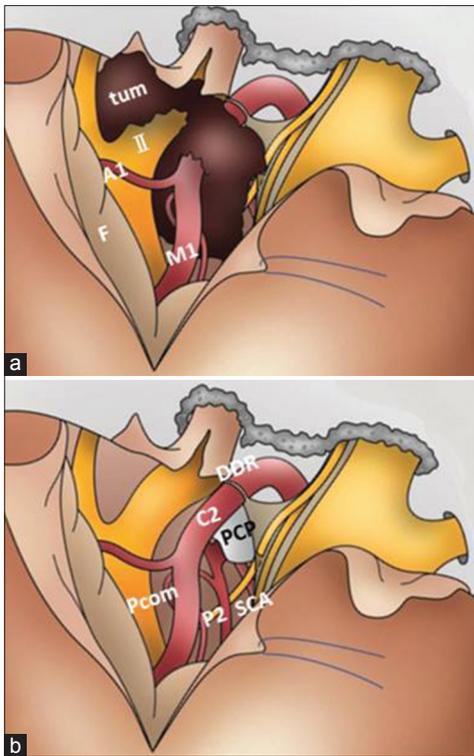


Figure 2: Surgical procedures for removal of paraclinoid and/or parasellar tumors using the modified EDTPA technique. AI = horizontal portion of the ACA; C2 = C2 portion of the ICA; F = frontal lobe; MI = horizontal portion of the MCA; P2 = P2 portion of the PCA; Pcom = posterior communicating artery; PCP = posterior clinoid process; SCA = superior cerebellar artery; tum = tumor; DDR; distal dural ring

Lumbar spinal drainage is instituted just before positioning in the surgical posture to ensure adequate brain relaxation to obtain full exposure of the epidural space in the extradural surgical procedures and avoid postoperative cerebrospinal fluid (CSF) leakage. Intraoperative monitoring procedures of the motor evoked potentials and/or visual evoked potentials are performed, if necessary. A semi-coronal skin incision is performed followed by interfascial dissection. The temporal muscle is retracted inferiorly. A standard frontotemporal craniotomy is performed up to the supraorbital notch, and the temporal squama is rongeuired out until the floor of the middle cranial fossa is exposed, followed by orbito-zygomatic osteotomy, if needed. The lesser wing of the sphenoid is flattened until the meningo-orbital band (MOB) is exposed. The middle fossa dura is dissected until the SOF and the FR are exposed [Figure 1a]. Then, the feeding arteries from the dura around the foramen spinosum can be easily and safely coagulated and cut if needed. The roof of the SOF is skeletonized and opened to expose the junction between the dura propria and the periosteal dura [Figure 1a, arrowheads]. The bone around the MOB is drilled [Figure 1a, arrow]. Extensive orbital unroofing is not needed. The tip of the microscissors should be pointed at the dura propria junction at the

SOF, and the MOB is incised to a length of approximately 4 mm. The dura between the SOF and FR, where no neuronal structure is present, is partially incised [Figure 1a, red dashed line]. Peeling of the dura propria is started from the lateral wall of the SOF to the anterior part of the CS and continued until the ACP is entirely exposed epidurally. Care should be taken to maintain the sphenoparietal sinus on the dura propria side and to stop the peeling at the point where the sphenoparietal sinus drains into the CS to prevent postoperative venous congestion. Before drilling of the ACP, dissection of the inferolateral part of the ACP, where the extradural part of the oculomotor nerve passes, is needed to avoid nerve injury. Drilling of the ACP with a high-speed drill using ample cold saline irrigation is started from the lateral part of the ACP, and the optic canal is then opened partially in the medial part of the ACP using a micropunch to avoid heat injury. The core of the ACP is hollowed like an egg shell with a small 2-mm diamond burr and dissected from the carotid-oculomotor membrane. After removal of the ACP, the clinoid segment (C3) of the ICA can be seen through carotid-oculomotor membrane in Dolenc's triangle [Figure 1b]. Final removal of the ACP may induce bleeding from the CS, which is easily controlled with surgical cottonoid packing and/or direct fibrin glue injection. The partially opened optic canal can be enlarged using a micropunch, and the remainder of the optic strut between the opened clinoid space and optic canal can be removed with either a small diamond drill or micropunch.

The dura mater is opened along the sylvian fissure, and continued inferomedially to the level of the optic nerve [Figure 1b, red dashed line]. The proximal part of the sylvian fissure is opened to drain the CSF and allow relaxation of the brain. Additional wide opening of the sylvian fissure is helpful for minimal retraction of the frontal lobe to expose the ICA and the optic nerve. For removal of the tumors located underneath the chiasm or retrocarotid space, an incision from the falciform ligament to the optic sheath helps to mobilize the optic nerve. Complete circumferential incision of the distal dural ring is not usually needed. Incision of the falciform ligament and partial incision of the distal dural ring will facilitate mobilization of the optic nerve and ICA to create surgical corridors from either the opticocarotid space or oculomotor trigone to the tumor [Figure 2a]. Just before the tentorial incision, the sylvian fissure should be opened widely and the arachnoid membrane around the oculomotor nerve should be incised to free the nerve from the medial temporal lobe. The medial tentorial edge is shaved from the anterior petroclinoid ligament. Following these procedures, the temporal lobe can be retracted posteriorly with the temporal dura mater to complete the EDTPA with adequate surgical corridor and working space of the opened anterior part of the middle fossa and the CS. If a tumor extends laterally

across the tentorial edge, the lateral part of the tumor should be removed intradurally to expose the tentorium, and then the tentorial edge is secured for its incision.

For removal of anterior skull base tumors such as paraclinoid meningioma, after opening of the sylvian fissure, dural detachment and devascularization can be completely and safely performed. After identification of the ipsilateral optic nerve and ICA, the tumor capsule is opened and the tumor is internally decompressed with ultrasonic surgical aspiration. After internal decompression and reduction of the tumor volume, the ipsilateral optic nerve and chiasm are decompressed by sharp dissection between the tumor capsule and the arachnoid membrane. After identification of the contralateral optic nerve, the site of the dural attachment is progressively and completely coagulated with bipolar coagulating forceps to interrupt the blood supply. The bilateral olfactory nerves can be preserved anatomically. The superior pole of the tumor can be reduced from beneath the arachnoid membrane covering the ipsilateral anterior cerebral artery. After additional piecemeal debulking of the tumor, the tumor located underneath the optic chiasm can be removed in the contralateral to the ipsilateral direction and then from beneath the ipsilateral optic nerve and ICA. Finally, the tumor can be dissected from the pituitary stalk and anatomical vital structures located in the interpeduncular cistern [Figure 2b]. The site of the dural attachment of the tumor is widely coagulated. CSF leakage is a potential risk if the ethmoid air cells are opened during anterior clinoidectomy. Therefore, the opened ethmoid air cells should be carefully packed with autologous muscle with fibrin glue sealant. The dural defect around the distal dural ring is approximated using a temporal muscle fascia patch with fibrin glue. CSF drainage through the lumbar spinal drainage tube is continued for a few days after the operation to prevent CSF rhinorrhea.

RESULTS

Patient characteristics

The clinical characteristics of the patients are summarized in Table 1. Twenty-seven patients were treated for paraclinoid tumors, including paraclinoid meningioma in 10, tuberculum sellae meningioma in 4, CS tumor in 1, craniopharyngioma in 7, sphenoorbital tumor in 3, parasellar epidermoid in 1, and trigeminal V1 neurinoma in 1 patient. All patients underwent detailed pre and postoperative evaluation of visual function. Visual disturbance was the most common initial symptom in this group. Twenty-four patients presented with disturbance of visual acuity. Visual field deficits were present in 24 patients: 2 were nearly blind, 9 had unilateral nasal anopsia, 5 had bitemporal hemianopsia, 6 had unilateral temporal hemianopia, and 2 had central

Table 1: Clinical characteristics of paraclinoid lesions in 27 patients who underwent extradural anterior clinoidectomy via the modified EDTPA with mini-peeling of the dura propria

Clinical Characteristics	No
Age, yrs	
Range	24-78
Mean	58.2
Sex	
Male	10
Female	17
Side	
Right	13
Left	14
Tumor size, mm	
Range	12-78
Mean	33.6
Symptom	
Visual disturbance	24
Diplopia	1
Tumor enlargement	2
Hypopituitarism	2
Motor disturbance	3
Cognitive dysfunction	2
Types of tumors	
Paraclinoid meningioma	10
TS meningioma	4
Sphenoorbital tumor	3
CS tumor	1
Parasellar epidermoid	1
Trigeminal (V1) neurinoma	1
Craniopharyngioma	7

CS: Cavernous sinus, TS: Tuberculum sellae

scotoma. All patients had normal endocrine function except for 2 patients with hypopituitarism caused by mass effect of the tumor.

Surgical procedures performed

The surgical procedures are summarized in Table 2. Extradural anterior clinoidectomy via the trans-SOF approach was performed in all cases. Spinal drainage was induced in 26 patients (96.2%). Orbito-zygomatic craniotomy was additionally performed in 13 (48.1%). Total removal of the ACP was performed in 25 patients (92.6%) and partial clinoidectomy in 2 (7.4%). The optic canal was opened widely in 25 patients (92.6%) and partially in 2 (7.4%). The falciform ligament was cut in 15 patients (55.6%).

Surgical and visual outcome

The surgical outcome is summarized in Table 3. Complete resection of the tumor was achieved in 18 patients (66.7%). Subtotal resection was performed in 8 patients (29.6%). Partial removal was performed in

1 patient with posterior clinoidal meningioma, which extended into the petroclival region. Overall visual acuity after surgery was improved in 12 patients (44.4%), unchanged in 13 (48.1%), and worsened in 2 (7.4%). Visual field deficit was improved in 15 patients (55.6%), unchanged in 10 (37.0%), and worsened in 2 (7.4%)

Table 2: Surgical procedures for paraclinoid lesions in 27 patients who underwent extradural anterior clinoidectomy via the modified EDTPA with mini-peeling of the dura propria

Surgical procedure	No of patients (%)
Removal of the ACP	
Entirely	25 (92.6)
Partially	2 (7.4)
Optic canal opening	
Wide	25 (92.6)
Partial	2 (7.4)
Falciform ligament	
Cut	15 (55.6)
No-cut	12 (44.4)
O-Z craniotomy	13 (48.1)
Spinal drainage	26 (96.2)

ACP:Anterior clinoid process, O-Z:Orbito-zygomatic

Table 3: Surgical outcome of paraclinoid lesions in 27 patients who underwent extradural anterior clinoidectomy via the modified EDTPA with mini-peeling of the dura propria

Surgical outcome	No of tumors (%)
Extent of tumor removal	
GTR	18 (66.7)
STR	8 (29.6)
PR	1 (3.7)
Visual acuity	
Improved	12 (44.4)
Unchanged	13 (48.1)
Worsened	2 (7.4)
Visual field deficit	
Improved	15 (55.6)
Unchanged	10 (37.0)
Worsened	2 (7.4)
Oculomotor nerve injury	1 (3.7)
CSF leakage	1 (3.7)
Diabetes insipidus	2 (7.4)
Surgical outcome	
GR	25 (92.6)
MD	2 (7.4)
SD	0
VS	0
D	0

CSF: Cerebrospinal fluid, D: Death,GR: Good recovery, GTR: Gross total removal, MD: Moderate disability, PR: Partial removal, SD: Severe disability, STR: Subtotal removal, VS:Vegetative state

postoperatively. In particular, preoperative visual disturbance was confirmed in 12 (85.7%) of 14 patients with paraclinoid and tuberculum sellae meningioma. Visual outcome was improved in 7 (50.0%), worsened in 2 (14.3%), and unchanged in 5 (35.7%) of these patients. These postoperative visual disturbances were usually confirmed as transient unilateral lower nasal quadrantanopsia, which was detected using quantitative visual examination without subjective visual symptoms. Postoperative outcome was good recovery in 25 patients (92.6%) and moderate disability in 2 (7.4%). No surgical mortality related to EDTPA occurred.

Complications related to modified EDTPA

Complications are summarized in Table 3. One patient developed oculomotor nerve palsy but recovered within 3 months. One patient suffered CSF rhinorrhea, which needed dural repair surgery. No temporal lobe contusion was noted.

Representative cases

Case 1: A 68-year-old female presented with right progressive visual disturbance. Three-dimensional CT angiography showed a tumor adjacent to the ACP [Figure 3a]. Preoperative enhanced MR imaging

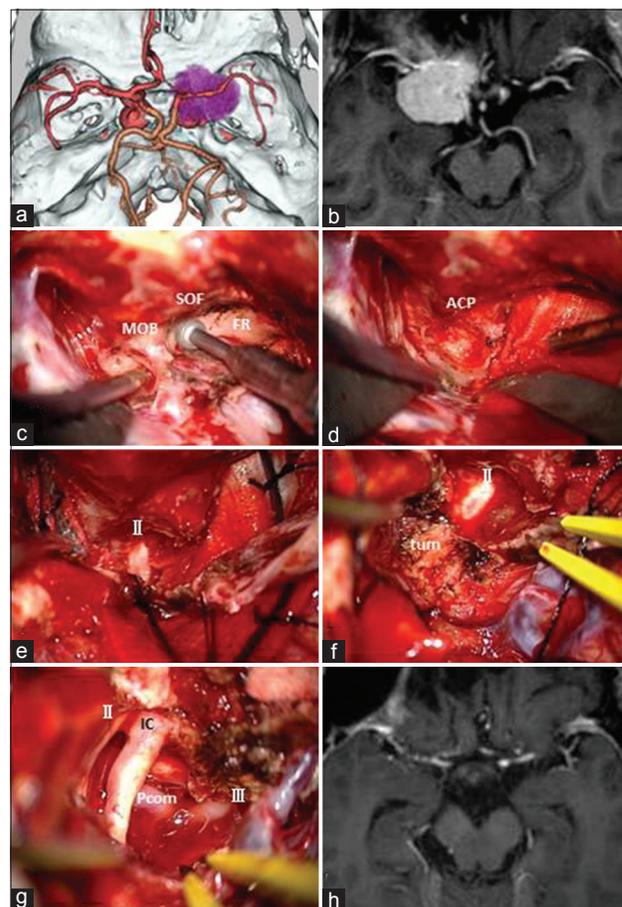


Figure 3: Representative case of right clinoidal meningioma in a 68-year-old female. MOB = meningo-orbital band; tum = tumor; II = optic nerve; III = oculomotor nerve

showed the right clinoidal meningioma with a diameter of 33 mm [Figure 3b]. The modified EDTPA with standard frontotemporal craniotomy was performed [Figure 3c-g]. Gross total removal was achieved [Figure 3h] and the postoperative course was uneventful. Postoperative visual examination showed her visual disturbance had improved.

Case 2: A 42-year-old male presented with right progressive visual disturbance. Three-dimensional CT angiography showed a tumor adjacent to the ACP [Figure 4a]. The modified EDTPA with standard frontotemporal craniotomy was performed [Figure 4b and c]. Complete incision of the falciform ligament will facilitate mobilization of the optic nerve to create surgical corridors from the opticocarotid space to the tumor [Figure 4d]. Gross total removal was achieved and the postoperative course was uneventful.

DISCUSSION

We have modified the original EDTPA to establish a less invasive transcavernous approach. Our modifications consist of skeletonization of the SOF, small dura propria incision between SOF and FR where no neurovascular structure is present, and limited dura propria peeling up to the V2 adequate to expose the entire ACP epidurally. In the present study, we applied our modified EDTPA to 27 cases of paraclinoid and/or parasellar tumors, resulting in relatively high removal rate and low incidence of cranial nerve disturbances such as visual disturbance, oculomotor nerve palsy, and trigeminal nerve dysfunction.

Technical considerations and advantages in modified EDTPA with mini-peeling of dura propria

Removal of the ACP is one of the essential skull base techniques to treat skull base tumors. Cadaveric studies have shown that the anterior clinoidectomy technique can double the exposure and mobilization of the optic nerve and ICA, as well as triple or quadruple the opticocarotid triangle width and oculomotor triangle size.^[8,17] Anterior clinoidectomy can be performed through the intradural approach or extradural approach.^[2,3,6,7,20] Extradural anterior clinoidectomy (EAC) is more extensive than the intradural procedure and requires a clear understanding of the anatomical background of the ACP and its surrounding neurovascular structures. Table 4 compares these various surgical procedures in the EAC. EAC was originally described in 1985 by Dolenc.^[5] This technique was then developed as selective EAC without the transcavernous approach for treatment of tumors in structures related to the sphenoid bone.^[20] Selective EAC without peeling of the lateral wall of the CS requires opening of the optic canal and en bloc removal of the ACP.^[15,20] EAC through the trans-CS approach requires peeling of the lateral wall of the CS to expose the entire

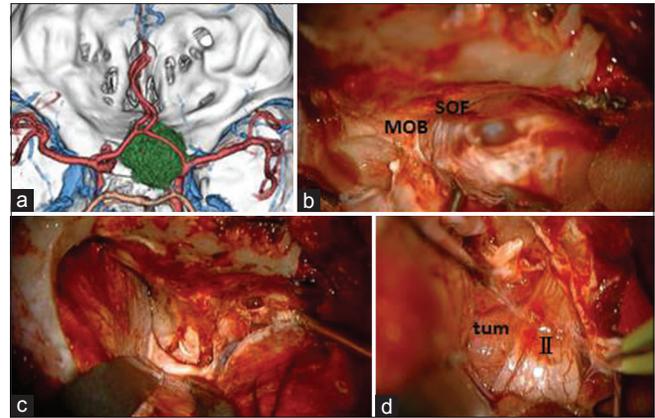


Figure 4: Representative case of tuberculum sellae meningioma in a 42-year-old male. MOB = meningo-orbital band; tum = tumor; II = optic nerve

Table 4: Comparison of surgical procedure for various extradural anterior clinoidectomy procedures

Surgical procedure	Dolenc, 1985	Yonekawa <i>et al.</i> , 1997	Day, 1994	Present Series
		Selective EAC	EDTPA	Modified EDTPA
Orbital unroofing	+	-	-	-
Optic canal opening	+	+	+	+
SOF skeletonization	+	-	+	+
Unroofing FR	-	-	+	-
MOB cutting	+	-	+	+
DR incision at the SOF	+	-	+	+
Peeling of the dura	+	-	+	+
Clinoidal space	wide	narrow	wide	wide

DR: Dural ring, EAC: Extradural anterior clinoidectomy, EDTPA: Extradural temporopolar approach, FR: Foramen rotundum, MOB: Meningo-orbital band, SOF: Superior orbital fissure

ACP for drilling.^[2,3] Recently, the latter method has been refined by minimizing the area of peeling in the lateral wall of the SOF, including the anterior part of the CS that requires extradural exposure of the ACP.^[1,14] In addition, this extradural procedure has been developed as a modified EDTPA with mini-peeling of the dura propria.^[11-13] The working space in the epidural space provided by selective EAC is relatively narrow, whereas EAC via the modified EDTPA can provide complete exposure of the ACP and safe drilling under direct microscopic view. This technique requires peeling of the dura propria of the temporal lobe from the inner reticular layer in the lateral wall of CS. We have recently suggested that the junction between the dura propria and the periosteal dura was invaginated by approximately 1 mm at the SOF. In contrast, no such invagination of the periosteal dura was present at the FR and foramen ovale.^[16] Therefore, SOF skeletonization is mandatory

just before peeling of the dura propria at the SOF level but drilling of the FR is not required. The original Dolenc's procedure requires dural incision at the SOF and carries the potential risk of injury to the cranial nerves. Our method requires only skeletonization of the SOF to expose this junction and needs only minimal dural incision between the SOF and FR where no cranial nerves are present. The dura propria peeling can be safely performed from the dura propria borders from the SOF to the FR until the ACP is totally exposed epidurally. Our modified method requires limited dura propria peeling up to the V2. Dura propria peeling up to the V3 is not required unless anterior petrosectomy needs to be added to remove tumor extending into the upper clival area. Such minimal dura propria peeling up to the V2 with the tentorial incision allows retraction of the temporal lobe over the dura mater and provides more than 25 mm working space in the pretemporal area. The space in the anterior part of the middle fossa enables us to access and manage the tumor in the retrocarotid space. In the present study, we did not experience any temporal lobe contusion because the temporal lobe was retracted over the dura mater. Compared to previous surgical procedures, our modified approach with mini-peeling could cause fewer surgical complications such as visual disturbance, oculomotor nerve disturbance, and trigeminal nerve disturbance.

Bleeding from the CS during trans-CS approaches is one of the drawbacks. The opened Dolenc's triangle and Mullan's triangle between V1 and V2 were major bleeding points during the epidural procedures in our modified EDTPA but the bleeding could be safely controlled by either Surgicel (Johnson and Johnson's Ethicon subsidiary) packing or fibrin glue direct injection without any resultant symptoms.^[19] CSF rhinorrhea is another disadvantage of the modified EDTPA due to the dural defect around the distal dural ring. We approximated the dural defect using temporal muscle fascia with fibrin glue and spinal drainage was continued for a few days after the operation. We only experienced one case of postoperative transient CSF rhinorrhea (3.7%).

Surgical advantages of modified EDTPA with mini-peeling of dura propria for removal of paraclinoid and/or parasellar tumors

It is generally recognized that safe removal of the tumors located in the paraclinoid and/or parasellar areas is difficult because the tumor may engulf neurovascular structures such as the optic apparatus and major cerebral arteries including their perforators. Moreover, some tumors extend into the CS, optic canal, or infraoptic and subchiasmatic regions.

Our modified EDTPA with mini-peeling of dura propria requires dura propria peeling of the medial temporal lobe dura as well as periosteal dissection of the both

frontal base dura mater and temporal base dura mater. The ACP is epidurally removed. During these epidural procedures, the meningeal blood supply of the tumors is automatically and efficiently diminished. The modified EDTPA approach also allows extradural early localization and exposure of the optic nerve. The exposed optic nerve can be followed from the optic canal proximally toward any tumor in an intradural location, which allows the surgeon to recognize the exact location of the optic nerve early in the surgical procedure. In addition, the modified EDTPA facilitates access to such difficult locations, especially in the presence of tumor extension into the CS, optic canal, or infraoptic and subchiasmatic regions. The removed ACP gives us enough working space in the paraclinoid area. Furthermore, incision of the falciform ligament and partial incision of the distal dural ring facilitates mobilization of the optic nerve and ICA, which can help to widen the opticocarotid space and oculomotor trigone to access and effectively remove tumor in the retrocarotid and infrachiasmatic space with minimum chances of injuring important neurovascular structures. Indeed, the safe mobilization of optic nerve and ICA is one of the most important advantages of the modified EDTPA. Consequently, the EDTPA technique was useful for maximal resection of tumors involving the retrochiasmatic space with relatively low incidence of postoperative visual disturbance. In all our patients, the pituitary stalks were preserved, so no patient required hormonal replacement or suffered hypothalamic dysfunction postoperatively, and patients with tumors extending into the optic canal achieved improvement in visual deterioration. Oculomotor nerve palsy occurred in only one patient but completely recovered within 3 months. Before drilling, the inferolateral part of the ACP should be dissected because the extradural part of the oculomotor nerve passes there. In our case, oculomotor paresis could be due to the detachment and movement of the intradural part, which was not related to the surgical approach. The medial tentorium incision and temporal lobe retraction over the dura mater gave us enough space in the pretemporal area to access the tumor widely from the antero-lateral trajectory. Due to the temporal lobe retraction over the dura mater, we did not experience any case of temporal lobe contusion.

CONCLUSION

A series of 27 patients with paraclinoid and/or parasellar tumors who underwent modified EDTPA with mini-peeling of the dura propria was analyzed. Total or subtotal resection of the tumors was achieved with minimal surgical complications in majority of the patients. The modified EDTPA technique leads to excellent improvement of the visual function and overall clinical outcomes in patients with tumors encasing the optic nerve and ICA or extending into the optic canal and

infrachiasmatic space. This modified approach provides safe tumor removal with less invasive trans-cavernous approach.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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