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Transnasal Endoscopic Surgery for Suprasellar Meningiomas

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Abstract

Aim: Endoscopic trans-nasal surgery has evolved a long way from the days of narrow corridors with high rates of cerebrospinal fluid (CSF) leak to the present state of HD optics with better tissue differentiation, extended approaches, and use of vascularized flaps for defect closure. Trans-nasal approach is an established technique for pituitary tumors practiced worldwide. However, trans-nasal endoscopic excision of suprasellar meningiomas provides a tougher challenge in terms of instrument manipulation, tumor excision with good visual outcome, and a robust defect closure to prevent CSF leaks. **Materials and Methods:** Out of 83 cases of midline anterior cranial fossa meningiomas operated over 14 years, our experience in 12 cases of suprasellar meningiomas for radical resection via the trans-nasal endoscopic route is discussed. **Results:** Amongst these, six were excised via primary extended endoscopic trans-sphenoidal surgery, four cases had a residual lesion or recurrence after primary transcranial surgery, and two cases involved a combined transcranial and extended endoscopic approach. Visual improvement along with resolution of headache was seen in all patients postoperatively. None of the patients had CSF leak requiring further repair. Syndrome of inappropriate antidiuretic hormone was found in one patient, which was transient and easily corrected. **Conclusion:** Trans-nasal endoscopic surgery for suprasellar meningiomas is an effective technique that provides results of tumor excision comparable to the transcranial approach in suitable cases. Visual outcome was found to be superior, and rates of CSF leak were remarkably reduced with vascularized flap. However, each case must be assessed individually and lateral extension beyond the optic canals with internal carotid artery encasement must be considered before planning surgery.

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Full Text

Suprasellar meningiomas account for approximately 5–10% of all intracranial meningiomas.[1] Suprasellar term usually encompasses lesions arising from the tuberculum sellae or planum sphenoidale. They present with symptoms attributable to mass effect over the surrounding structures, namely optic apparatus,

diaphragm sellae, pituitary stalk, and basifrontal lobe. These tumors may manifest in the form of visual disturbances, headache, frontal lobe syndrome, Foster–Kennedy syndrome, hemiparesis, and anosmia.[2],[3],[4],[5],[6]

Traditionally, the most common approaches for suprasellar meningiomas are pterional/fronto-temporal approach, bifrontal interhemispheric approach or the fronto-temporo- orbito-zygomatic approach.[7] Regardless of the approach, the central goal of the surgery is the safe and complete resection of the tumor along with decompression of the optic apparatus. Weiss, in 1987, first described extended trans-sphenoidal microscopic approach for suprasellar lesions.[8] Endonasal endoscopic approach (EEA) offers benefits of less neurovascular manipulation, approaching the lesion from its attachment, wide panoramic view, and better visual outcomes. The key to achieve successful and effective outcomes after endonasal approach is to be selective in case identification. The scope of extended endonasal approach for suprasellar meningiomas has been reinforced with newer advancement in angled endoscopes, neuronavigation, neurophysiological monitoring, and most importantly description of vascularised nasoseptal flaps for reconstruction.

We hereby present our experience of 12 cases of EEA for suprasellar meningiomas. The aim of this paper is to discuss the advantages and indications of EEA for suprasellar meningiomas and to assess which specific subset of these lesions can be safely taken up by this approach.

Materials and Methods

This is a retrospective observational case series of patients admitted with anterior cranial fossa meningiomas in a neurosurgical unit at Bombay Hospital Institute of Medical Sciences, Mumbai from 1st January 2004 to 1st January 2018. A total of 83 cases of midline anterior cranial fossa meningiomas were operated during this time frame. Out of these 83 cases, 12 cases of suprasellar meningiomas were tackled via the transnasal endoscopic approach. Inclusion criteria consisted of patients more than 18 years of age and having lesions arising from tuberculum sellae or planum sphenoidale. Tumors with more than 270 degree lateral vascular encasement were excluded in the case selection. The 12 cases comprised of six patients who underwent primary extended endoscopic trans-sphenoidal surgery, four patients who had a residual lesion/recurrence after primary transcranial surgery [Figure 1], and two patients who had a combined transcranial and extended endoscopic approach. All patients underwent preoperative MRI brain, CT paranasal sinus, and visual perimetry, while hormonal evaluation was reserved for cases with diagnostic dilemmas. A binostril, four hand technique was used in all the cases. Intraoperative adjuncts used were Doppler probe and neuronavigation in with vascular encroachment or anatomical distortion. This helped us in localizing the boundaries of clival carotid and helped plan the extent of transplanum/transtuberculum corridor for surgery. A 30 degree endoscope was used in all cases. Closure consisted of a multilayer technique with fascia lata, fat, bone, glue, and Hadad Bassagasteguy flap followed by nasal packing, which was kept for 72 h. Lumbar drain was used in 6 of the 12 cases, where there was anticipation of postoperative cerebrospinal fluid (CSF) leak. In four cases, lumbar drain was removed immediately after surgery, while in two cases, it was kept for 48 h, as there was copious intraoperative CSF leak. Follow up MRI was done once after 3 months of surgery and then every following year. Outcome has been evaluated in terms of postoperative visual field charting, any damage to pituitary-hypothalamic axis and CSF leak.{Figure 1}

Results

None of the patients showed the presence of bony hyperostosis. This series consisted of eight females and four males. Mean age of the patients was 49.3 years. Nine cases were planum sphenoidale meningiomas, and three cases were tuberculum sellae meningiomas. The most common clinical symptom with which the patient presented was visual complaints only (58.33%) followed by visual complaints and headache (25%) and only headache (16.67%). Mean size of tumor excised was 2.7 cm. Optic canal was drilled to achieve gross total resection (GTR) in cases where canal invasion was present on preoperative images [Figure 2].{Figure 2}

GTR was achieved in 11 cases (91.6%). In the single case where GTR was not possible, the goal of surgery was to decompress the optic apparatus considering the lateral extension of the tumor, the concurrent morbidities, and the old age of the patient. Lumbar drain was used in six cases where there was anticipation of postoperative CSF leak due to suprasellar extension and thinning of the diaphragm sellae. In four cases, the lumbar drain was removed immediately after surgery since there was no intraoperative leak of CSF and the arachnoid over the diaphragm was intact. There was evident CSF leakage in the remaining two cases, and hence the drain was kept for 48 h in the postoperative period. Nasal pack was uniformly removed for all cases on the third day postoperatively. Visual improvement along with the resolution of headache was seen in all patients postoperatively. Syndrome of inappropriate antidiuretic hormone secretion was encountered in one patient, which was corrected before the patient was discharged. Transient diabetes insipidus was found in one patient. None of the patient had CSF leakage postoperatively. There was no mortality in this series. Nine cases were transitional meningiomas on pathological examination, and three cases were psammomatous meningiomas. Thus, all of them were WHO grade I in nature. Average stay in hospital was five days. Four patients had hyposmia, and one had anosmia in the follow-up period. Healing of the nasal mucosa took about 3–4 weeks on average. Persistent crusting with infection occurred in two patients who took 7-8 weeks to recover. Every patient had check endoscopy after surgery for a minimum of three times. Follow-up period varied from 1 to 14 years [Figure 3] with mean follow up duration of 6 years and 8 months. There has been one small asymptomatic recurrence in a single case till date.{Figure 3}

Discussion

The transcranial approaches for suprasellar meningiomas are subfrontal, pterional, frontotemporal, and orbit-zygomatic.[7] The unilateral or bilateral subfrontal approach provides a direct view of the bilateral optic nerve along with internal carotid artery (ICA) and anterior cerebral artery (ACA) complex, but it requires some degree of brain retraction. There is also possible risk of infarction, loss of olfaction, and difficulty in reaching below the optic nerves with this approach.[9] Pterional approach leads to early visualization of ipsilateral ICA, optic nerve, and ACA, but there is difficulty in visualization of contralateral carotid artery and optic nerve.[10] Supraorbital keyhole approach provides a minimally invasive access for tumors in the suprasellar region especially those which are off the midline, growing beyond the supraclinoid carotids, and more than 3 cm in size [Figure 4].[11] Endoscope assistance offers better visualization and safer dissection through this approach [Figure 5][12] Supraorbital approach has its limitations when it comes to anterior and medial skull base drilling as has been shown in a cadaveric study of anterior skull base approaches by the Pittsburgh group.[13]{Figure 4}{Figure 5}

Ideal case selection for EEA would include tumors consistent with the following features [Figure 6]:{Figure 6}

Small midline lesions preferable <2.5–3.0 cm.Less than 270 degree vessel encasement laterally.Absence of parasellar extension.Optic canal involvement only medially and inferiorly.Sphenoid sinus extension.

In such carefully selected cases, EEA to suprasellar lesions has certain advantages, namely being the most direct approach, providing early devascularization of tumor, early decompression of optic canal, comparable rate of GTR, better visual outcome, and limited manipulation of neurovascular structures. EEA also has added advantage of removal of underlying involved bone due to the tumor and a panoramic visualization of operative field with wider access to the anterior skull base. Bony hyperostosis requires extensive drilling but cannot be considered an absolute contraindication with the advent of latest drilling instruments. The presence of hyperostosis makes the endonasal approach technically challenging.

A systematic review of literature by Turel MK et al. has found mean tumor volume to be 6.6 cc and mean tumor size to be 2.5 cm in successfully tackled endonasal cases.[14]

It is now a well-documented fact that EEA provides better visual outcome.[15],[16],[17] Muskens et al.[18] have published meta-analysis results comparing endonasal transsphenoidal approach to microscopic transcranial approach for anterior skull base meningiomas. Gross resection rates were almost similar in both the approaches, but visual improvement was higher in the endoscopy group. Analysis of articles enumerating

operative treatment of tuberculum sellae meningiomas published over 12 years describing 1026 transcranial and 144 transnasal cases by Nisha Gadgil et al.[19] have shown that transnasal approach should be preferred in cases with compromise of optic nerve. Quality of life and the 3-year recurrence rates comparison between the two approaches have also been found to be similar.[20]

CSF leak rates after endonasal surgery has long been considered the most important deterrent for this approach. However, honing of technique over time along with better reconstruction methods, namely vascularized nasoseptal flap have reduced the rates remarkably. CSF leak rate in recent times has been reported to be as low as 8%.[21] In this series, a multilayered technique utilizing fat, fascia, glue, bone, and nasoseptal flap for closure was applied. In four cases, the bone was not suitable to be kept back. Fascia was kept as an underlay or as a gasket seal with the bone. All cases had Hadad flaps with tissue glue applied over it. It has been reported in literature that the rate of CSF leakage is unaffected by size, location of tumor or age, and apart from need for operative repair in certain cases, CSF leakage leads to no additional morbidity.[22] Khan OH et al.[23] from Ontario, Canada, have compared the results of surgery in two groups of planum and tuberculum sellae meningiomas (before and after 2008). They found CSF leak rates improved from 14.2% in the pre-2008 group to 0% in the post 2008 group. A single-institution study from Weil Cornell[24] of a similar cohort of suprasellar meningiomas has shown that EEA provided equivalent rates of resection with better visual outcome, less retraction injury to brain, and fewer seizures. Recently, preoperative scoring systems have been described by Mascarella et al.[25] and by Mortazavi et al.[26] These help in predicting the probability of successful endoscopic resection. Some of the factors taken into account in the scoring systems are bony hyperostosis, vascular invasion, dural-tail length ratio, optic canal involvement, brain invasion, etc.

Pedicled nasoseptal flap is the workhorse of endonasal endoscopic surgery for skullbase lesions. However, healing of the donor septal cartilage site often led to crust formation, which contributed to nasal morbidity. This has now been overcome by the addition of a contralateral reverse rotation flap that helps in healing of the donor site by reducing chances of crusting.[27]

EEA offers a minimally invasive route to the midline anterior skull base, reducing manipulation of the large vessels and optic apparatus; hastens postoperative recovery; and improves patient compliance.[28] This route must be avoided in cases with sinonasal infection, significant tumor component lateral to carotids or clinoids and wherein appropriate instruments are unavailable.

Our case series is small to infer conclusive evidence on outcomes and complications, the reason being that we have selected only 12 cases out of 83 cases of anterior cranial fossa meningiomas that were amenable to complete excision via the EEA.

Conclusion

Based on our experience of 12 cases operated endonasally over 14 years, we have enumerated the points for the ideal case selection of EEA for suprasellar meningiomas. EEA can achieve very good results by experienced hands with comparable resection outcomes to microscopic transcranial resection and better visual relief.

Although transcranial microsurgical technique still remains the gold standard for the removal of anterior cranial fossa meningiomas of all sizes, extremely careful selection of cases by an experienced hand along with meticulous closure of the wound can lead to better outcome in case of EEA as compared to transcranial approach.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Suri A, Narang KS, Sharma BS, Mahapatra AK. Visual outcome after surgery in patients with suprasellar tumors and preoperative blindness. J Neurosurg 2008;108:19-25.
2 Chi JH, McDermott MW. Tuberculum sellae meningiomas. Neurosurg Focus 2003;14:e63.
3 Chicani CF, Miller NR. Visual outcome in surgically treated suprasellar meningiomas. J Neuroophthalmol 2003;23:3-10.
4 Jallo GI, Benjamin V. Tuberculum sellae meningiomas: Microsurgical anatomy and surgical technique. Neurosurgery 2002;51:1432-9.
5 Gökalp HZ, Arasil E, Kanpolat Y, Balim T. Meningiomas of the tuberculum sella. Neurosurg Rev 1993;16:111-4.
6 DeMonte F. Surgical treatment of anterior basal meningiomas. J Neurooncol 1996;29:239-48.
7 Sughrue ME, Sanai N, McDermott MW. Tuberculum sellae meningiomas. In: DeMonte Fetal, eds. Al-Mefty's Meningiomas. 2nd ed. New York, NY: Thieme Medical; 2011.
8 Weiss MH. The transnasal transsphenoidal approach. In: Apuzzo ML, editor. Surgery of the Third Ventricle. Baltimore: Williams and Wilkins; 1987. p. 476-94.
9 Chokyu I, Goto T, Ishibashi K, Nagata T, Ohata K. Bilateral subfrontal approach for tuberculum sellae meningiomas in long-term postoperative visual outcome. J Neurosurg 2011;115:802-10.
10 Fahlbusch R, Schott W. Pterional surgery of meningiomas of the tuberculum sellae and planum sphenoidale: Surgical results with special consideration of ophthalmological and endocrinological outcomes. J Neurosurg 2002;96:235-43.
11 Fatemi N, Dusick JR, de Paiva Neto MA, Malkasian D, Kelly DF. Endonasal versus supraorbital keyhole removal of craniopharyngiomas and tuberculum sellae meningiomas. Neurosurgery 2009;64 (5 Suppl 2):269-84; discussion 284-6.
12 Iacoangeli M, Nocchi N, Nasi D, DI Rienzo A, Dobran M, Gladi M, *et al*. Minimally invasive supraorbital key-hole approach for the treatment of anterior cranial fossa meningiomas. Neurol Med Chir (Tokyo) 2016;56:180-5.
13 Borghei-Razavi H, Truong HQ, Fernandes-Cabral DT, Celtikci E, Chabot JD, Stefko ST, *et al*. Minimally invasive approaches for anterior skull base meningiomas: Supraorbital eyebrow, endoscopic endonasal, or a combination of both? Anatomic study, limitations, and surgical application. World Neurosurg 2018;112:e666-74.
14 Turel MK, Tsermoulas G, Reddy D, Andrade-Barazarte H, Zadeh G, Gentili F. Endonasal endoscopic transsphenoidal excision of tuberculum sellae meningiomas: A systematic review. J Neurosurg Sci 2016;60:463-75.
15 Clark AJ, Jahangiri A, Garcia RM, George JR, Sughrue ME, McDermott MW, *et al*. Endoscopic surgery for tuberculum sellae meningiomas: A systematic review and meta-analysis. Neurosurg Rev 2013;36:349-59.
16 Shin M, Kondo K, Saito N. Current status of endoscopic endonasal surgery for skull base meningiomas: Review of the literature. Neurol Med Chir (Tokyo) 2015;55:735-43.
17 Ruggeri AG, Cappelletti M, Fazzolari B, Marotta N, Delfini R. Frontobasal midline meningiomas: Is it right to shed doubt on the transcranial approaches? Updates and review of the literature. World Neurosurg 2016;88:374-82.
18 Muskens IS, Briceno V, Ouwehand TL, Castlen JP, Gormley WB, Aglio LS, *et al*. The endoscopic endonasal approach is not superior to the microscopic transcranial approach for anterior skull base meningiomas-a meta-analysis. Acta Neurochir (Wien) 2018;160:59-75.
19 Gadgil N, Thomas JG, Takashima M, Yoshor D. Endoscopic resection of tuberculum sellae meningiomas. J Neurol Surg B Skull Base 2013;74:201-10.

20 Bohman LE, Stein SC, Newman JG, Palmer JN, Adappa ND, Khan A, *et al*. Endoscopic versus open resection of tuberculum sellae meningiomas: A decision analysis. ORL J Otorhinolaryngol Relat Spec 2012;74:255-63.
21 Elshazly K, Kshettry VR, Farrell CJ, Nyquist G, Rosen M, Evans JJ. Clinical outcome after endoscopic endonasal resection of tuberculum sella meningiomas. Oper Neurosurg (Hagerstown) 2018;14:494-502.
22 Van Gompel JJ, Frank G, Pasquini E, Zoli M, Hoover J, Lanzino G. Expanded endonasal endoscopic resection of anterior fossa meningiomas: Report of 13 cases and meta-analysis of the literature. Neurosurg Focus 2011;30:E15.
23 Khan OH, Anand VK, Schwartz TH. Endoscopic endonasal resection of skull base meningiomas: The significance of a "cortical cuff" and brain edema compared with careful case selection and surgical experience in predicting morbidity and extent of resection. Neurosurg Focus 2014;37:E7.
24 Bander ED, Singh H, Ogilvie CB, Cusic RC, Pisapia DJ, Tsiouris AJ, *et al*. Endoscopic endonasal versus transcranial approach to tuberculum sellae and planum sphenoidale meningiomas in a similar cohort of patients. J Neurosurg. 2018;128:40-8.
25 Mascarella MA, Tewfik MA, Aldosari M, Sirhan D, Zeitouni A, Di Maio S. A simple scoring system to predict the resectability of skull base meningiomas via an endoscopic endonasal approach. World Neurosurg 2016;91:582-91.
26 Mortazavi MM, Brito da Silva H, Ferreira M Jr, Barber JK, Pridgeon JS, Sekhar LN, *et al*. Planum sphenoidale and tuberculum sellae meningiomas: Operative nuances of a modern surgical technique with outcome and proposal of a new classification system. World Neurosurg 2016;86:270-86.
27 Kasemsiri P, Carrau RL, Otto BA, Tang IP, Prevedello DM, Muto J, *et al*. Reconstruction of the pedicled nasoseptal flap donor site with a contralateral reverse rotation flap: Technical modifications and outcomes. Laryngoscope 2013;123:2601-4.
28 Tan SH, Brand Y, Prepageran N, Waran V. Endoscopic transnasal approach to anterior and middle cranial base lesions. Neurol India 2015;63:673-80.

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Figure 1: (a) MRI brain sagittal contrast view of a 51-year-old female with a large planum sphenoidale meningioma with suprasellar extension. (b) She underwent transcranial surgery initially with postoperative CT scan showing total resection. Patient failed to follow up. (c) MRI brain coronal contrast image after 6 years when she presented with visual deterioration and headache. Recurrence of meningioma seen with approximately 270 degree vascular encasement. (d) MRI brain coronal contrast image 3 months after transnasal endoscopic transplanum approach showing complete resection of the tumor

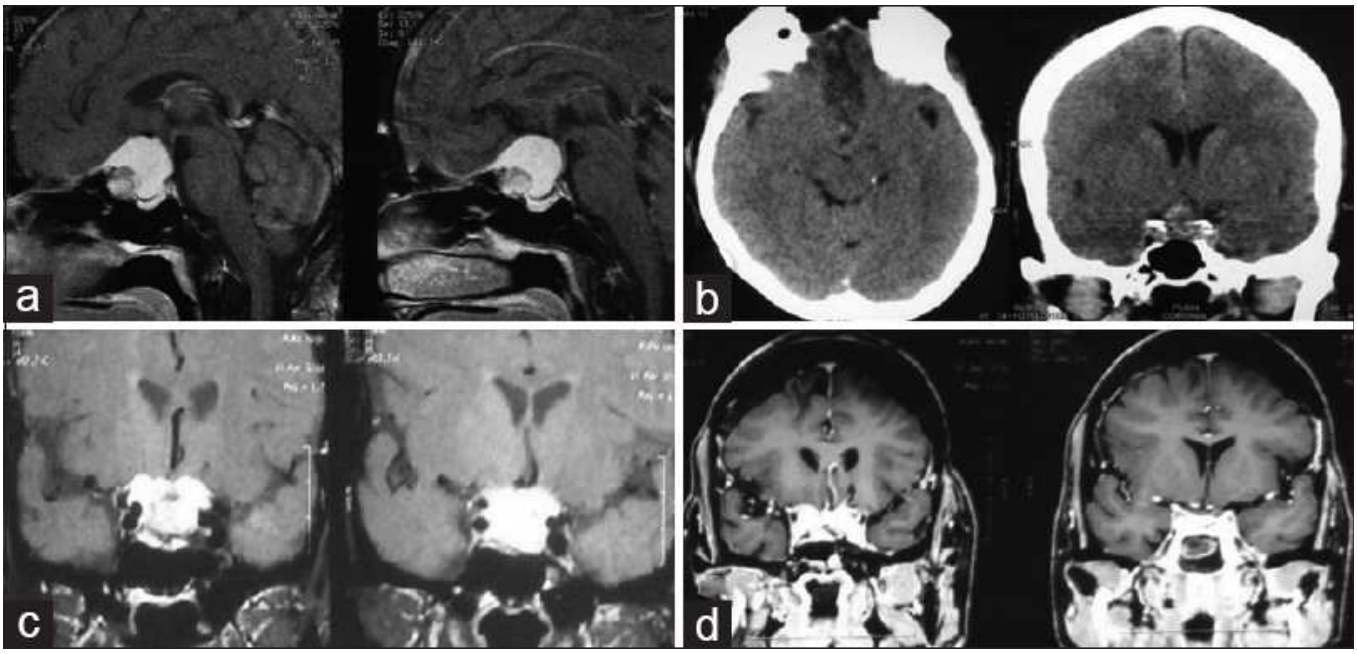

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Figure 2: (a) MRI brain post contrast images of an 18-year-old female showing a small suprasellar meningioma extending to tuberculum and planum sphenoidale with right optic canal invasion. The patient had presented with visual complaints. (b) Intraoperative endoscopic image showing separation of the tumor from the underlying optic nerve. (c) Intraoperative image of meningioma being separated from its bony attachment. (d) Intraoperative image after drilling of the optic canal and removing the final tumor from the canal. (e) Postoperative MRI coronal view after 3 months showing complete excision of the tumor

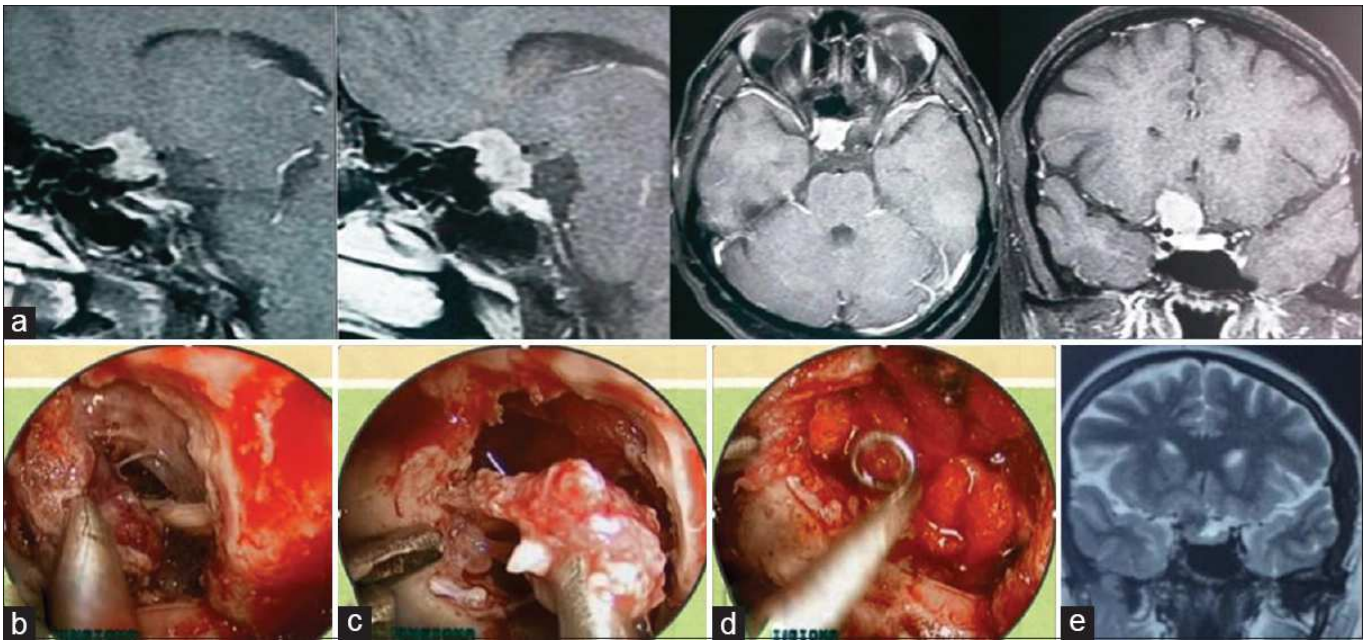

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Figure 3: (a) Left to right (MRI brain postcontrast coronal, sagittal, CT brain postcontrast axial sections) showing a planum sphenoidale meningioma in a 33-year-old male operated via the bifrontal approach. Postoperative CT scan of brain (far right) showing complete resection. (b) MRI brain (postcontrast) coronal and sagittal views showing recurrence of the meningioma after 7 years with ethmoidal extension. An endoscopic transplanum approach was taken for excision. (c) MRI brain (postcontrast coronal and T1W sagittal image) taken after 14 years of endoscopic surgery showing absence of recurrenc

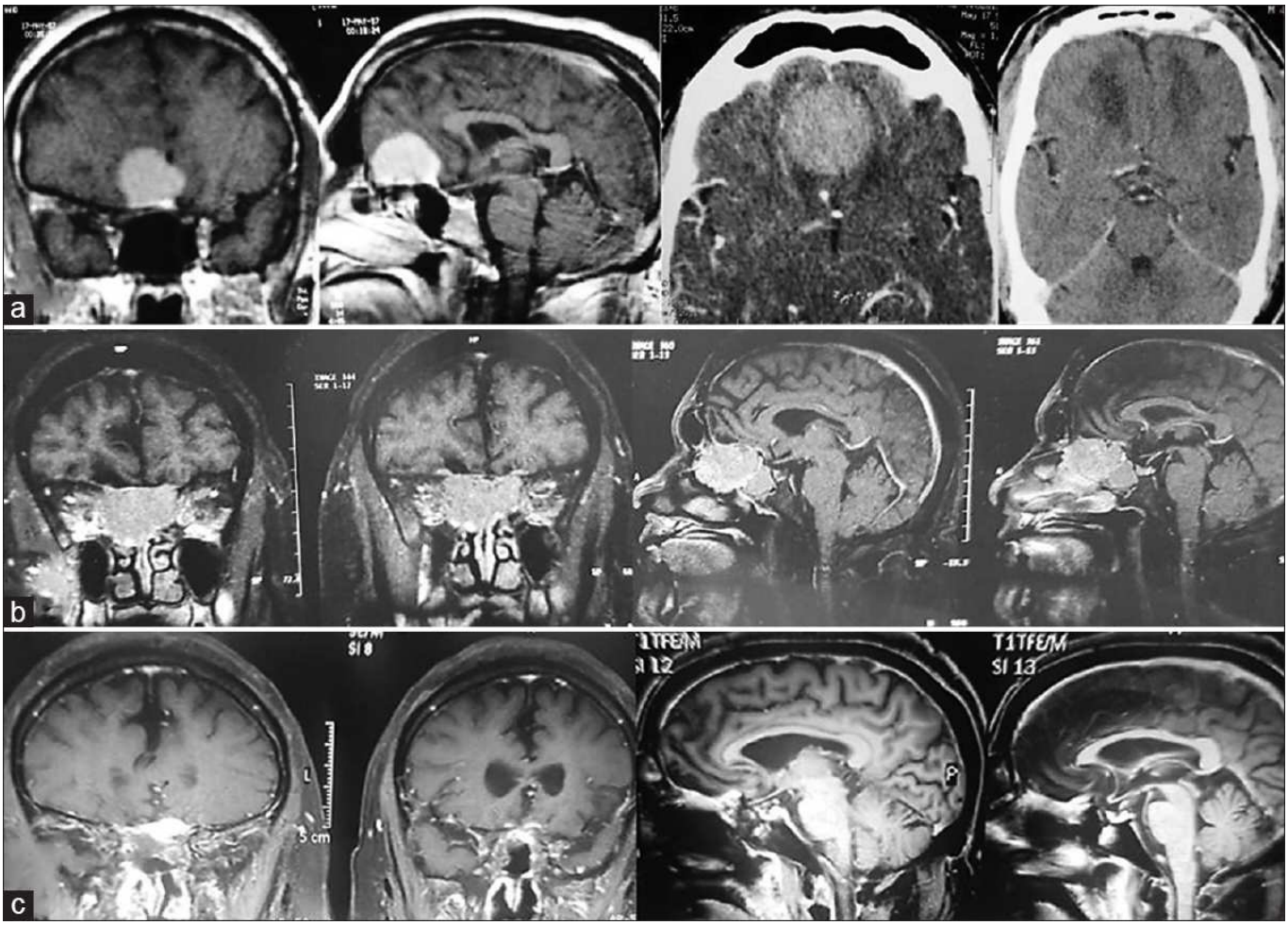

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Figure 4: (a) MRI brain postcontrast images of a 40-year-old female with a suprasellar meningioma, which was off the midline. It was excised via the supraorbital approach. (b) Clinical picture postoperatively showing the suparaorbital scar (Blue arrow). (c) Postoperative MRI showing complete excision

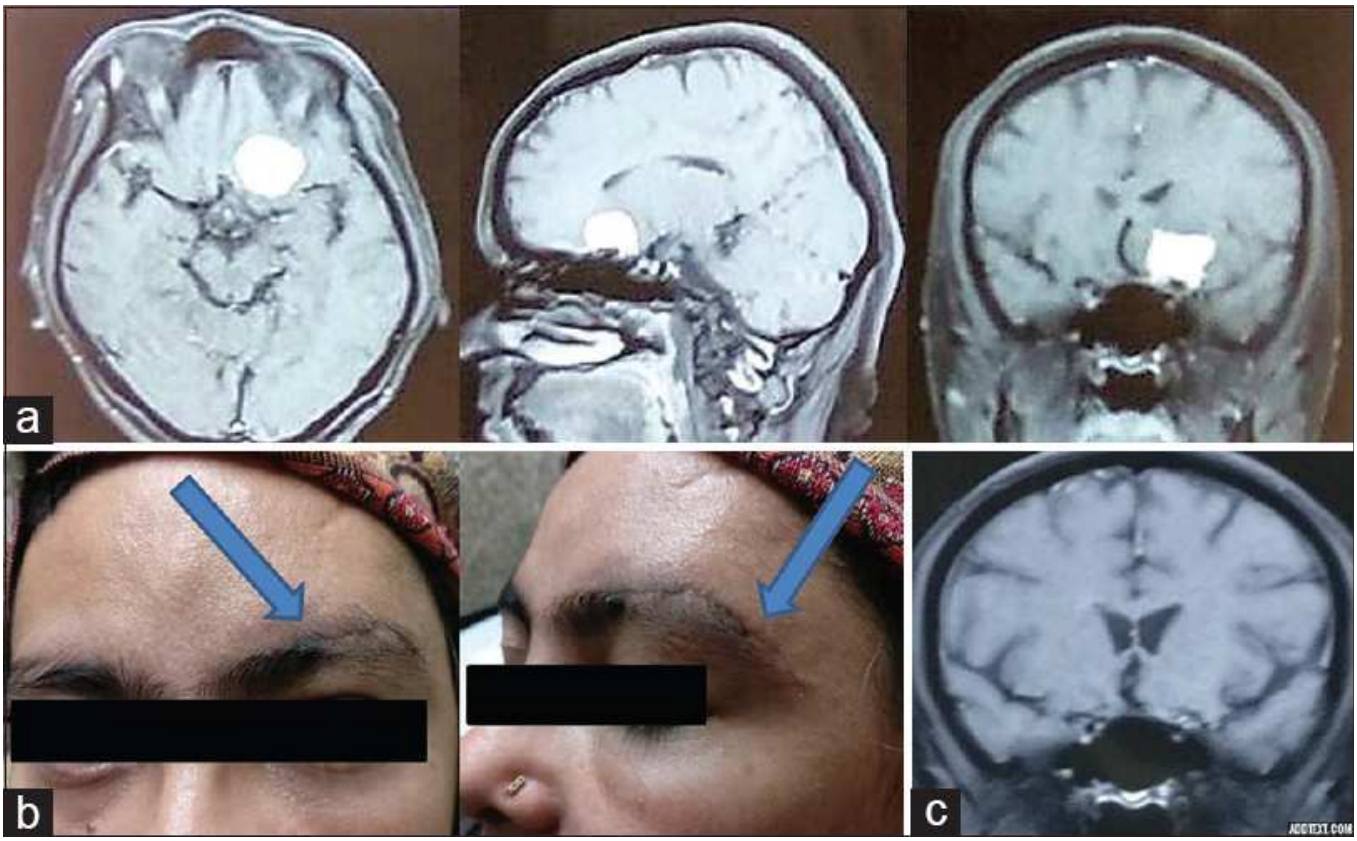

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Figure 5: Endoscope assistance image in a case of supraorbital keyhole craniotomy for suprasellar meningioma

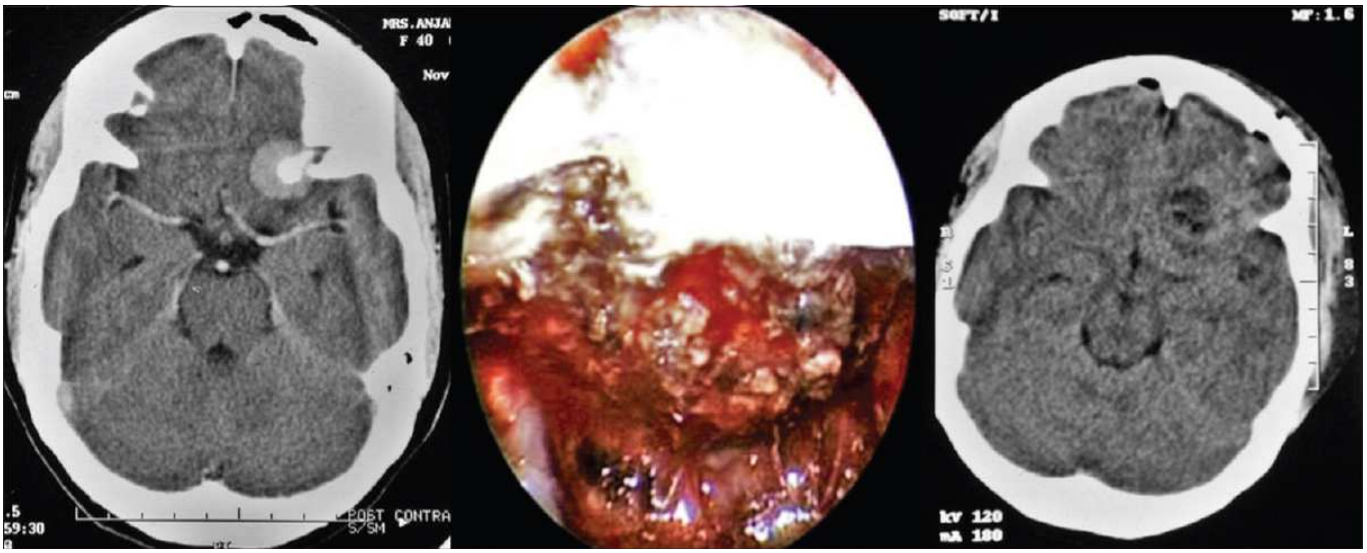

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Figure 6: MRI brain postcontrast images showing an ideal suprasellar meningioma for endonasal excision. The tumor is around 2.5–3 cm in size. There is no parasellar extension. Vascular encasement is less than 270 degree, and there is absence of any marked bony hyperostosis