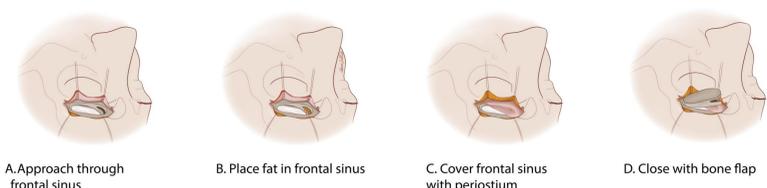


**Figure 1.** Illustration demonstrating angle of approach for traditional pterional and supra-orbital craniotomies, as well as supra-orbital trans-frontal approach described here.

## Introduction

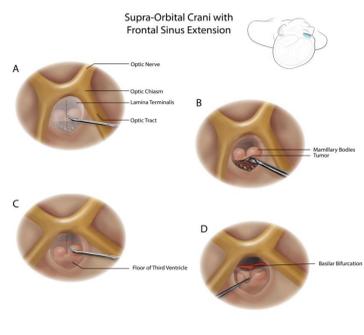
Lamina terminalis provides an excellent corridor to access isolated 3rd ventricular (TV) masses. Tumor location in the TV and its long axis determines the choice of surgical approach. Endoscopic endonasal approach (EEA) provides an excellent midline approach to anterior TV but can cause visual deficits due to compression of optic apparatus and high-flow CSF leak. A traditional bicoronal craniotomy provides excellent midline, trans-lamina terminalis access, but it requires a large incision and craniotomy. A standard eyebrow supraorbital and pterional craniotomy can put significant stress on the ipsilateral optic tract. Here, we advocate the use of an extended eyebrow supra-orbital craniotomy (SOC) with extension through frontal sinus to provide a more midline access through lamina-terminalis (Fig. 1).



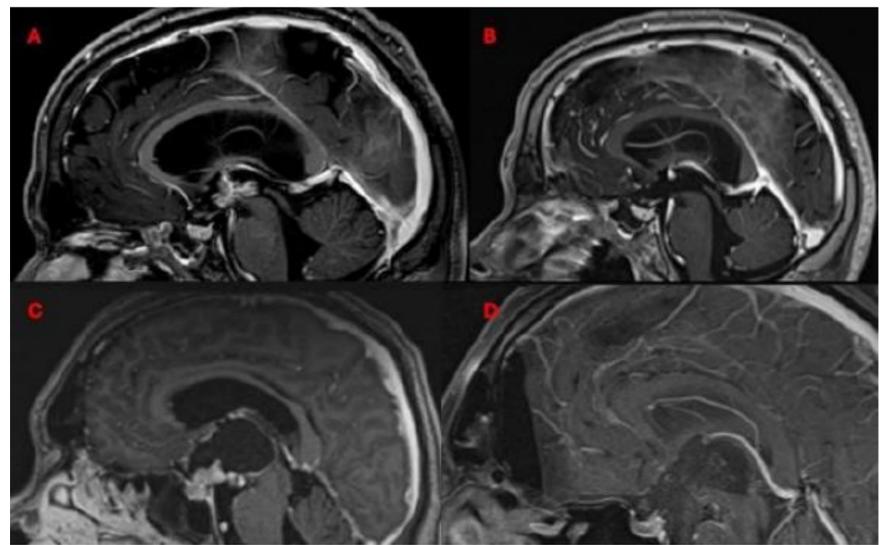
**Figure 2.** Stepwise supraorbital trans-frontal approach. A. Supraorbital craniotomy extending through frontal sinus. B. Abdominal fat graft packed into site. C. Pericranial flap used to cover defect. D. Bone flap replaced.

## Methods and Materials

We identified 3 cases of TV masses in past 18 months, a choroid plexus papilloma (Fig. 3A&B), a craniopharyngioma (Fig. 3C&D) and a pineal parenchymal tumor of intermediate differentiation (PPTID).



**Figure 3.** A. Supra-orbital approach to lamina terminalis. Lamina terminalis opened midline. B. Tumor is removed in a piecemeal fashion. C. Dissection is continued to open to cistern. D. Basilar bifurcation is ultimately exposed.



**Figure 4.** A and B. Choroid plexus papilloma. C and D. Craniopharyngioma.

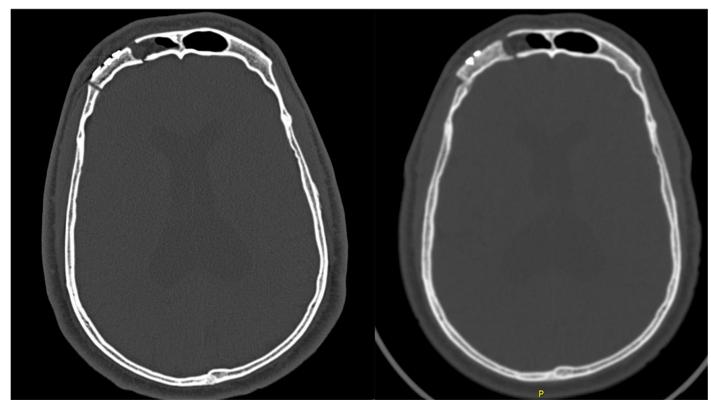
## Results

Surgical approach (Fig. 2) - A standard eyebrow incision is extended to the medial extent of the eyebrow. A pericranial flap (PCF) is elevated with its base towards the orbital rim. The supra-orbital craniotomy is extended medially into the frontal sinus. The mucosa of the lateral frontal sinus is removed. Dura is opened in a traditional fashion and lamina terminalis is opened. Using a microscope and with endoscopic assistance, the masses were removed in a piecemeal fashion. No fixed retraction was used in any of the cases. The lamina terminalis is covered with oxidized cellulose. Primary closure of dura is performed. The lateral frontal sinus is packed with abdominal fat, taking care not to block the frontal recess, which can result in frontal mucocele formation. The frontal sinus defect is further covered with the PCF and the bone flap is secured. Follow-up ranged from 3 months to 4 years. None of the patients have developed a frontal mucocele (Fig. 5).

In the case of PPTID, patient had presented with hydrocephalus. Tumor was debulked and 3rd ventriculostomy performed through the same approach using a 45-degree endoscope (Fig. X). This prevented a secondary approach to perform an ETV.

Complications included numbness of forehead due to sacrifice of supra-orbital nerve from medial extension into the frontal sinus.

Limitations: This approach is based on the keyhole concept. Familiarity and comfort with the surgical anatomy, operating in narrow corridor and use of the endoscope are essential. Frontal mucoceles can develop in delayed fashion, therefore attention to follow-up is needed.



**Figure 5.** CT head of supraorbital trans-frontal approach patient immediately (left) and six months (right) post-op, without evident mucocele.

## Conclusions

This approach provides a minimally invasive corridor through lamina terminalis for masses isolated in the TV. This medial extension into the frontal sinus provides better visualization due to its midline approach and prevents compression of the optic apparatus. Importantly, frontal sinus should not be overpacked, which can inadvertently block the drainage of frontal sinus through frontal recess, and may result in frontal mucocele.

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