Frontal sinus approach to the orbit

Technical note

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The authors have previously advocated a supraorbital approach to tumors of the orbit. In this paper, they describe a technique in which they take advantage of a large frontal sinus as a means of entering the orbit without the necessity of intracranial exposure, as required by the more conventional supraorbital approach. This is achieved without frontal burr holes, allowing for a superior cosmetic result. The anterior wall of the frontal sinus is removed, and with it the roof of the orbit as a single bone flap. A case in which this technique was used is described.

KEY WORDS • frontal sinus • orbital tumor • supraorbital approach • transfrontal sinus approach

The surgical approach to the orbit has aroused interest among many surgical subspecialists. Krönlein1 and those who later modified his approach entered the orbit through the lateral wall, a technique that they believed was least traumatic to surrounding structures.1,4,9 While transorbital surgery11 still offers advantages for anteriorly placed masses, and those outside the optic canal, tumors within the ocular muscle cone and at the orbital apex have often required a transcranial approach to the orbit, which offered improved surgical exposure without an increase in morbidity.6 This involves a frontal craniotomy which incorporates the supraorbital ridge and part of the orbital roof in a single bone flap. We believe that, although this represented an advance over other transcranial approaches, it still includes the problems inherent in intracranial surgery and produces a potential cosmetic blemish by requiring a forehead burr hole. We have recently modified our technique to approach through the frontal sinus, thus eliminating the need for a frontal burr hole and allowing entry of the orbit with an entirely extracranial technique when the frontal sinus is large.

Case Report

This 59-year-old right-handed woman presented 4 weeks after the abrupt onset of a complete painful left third cranial nerve palsy with the gradual development of left facial pain referable to the distribution of the first division of the left fifth nerve. There were no complaints of headache or visual loss. She had previously undergone a left Caldwell-Luc procedure for sinusitis.

Examination. On physical examination there was a complete third and possible fourth nerve palsy on the left. Funduscopic examination was normal. Visual acuity was 20/20 on the right and 20/25 on the left, with completely full fields and no afferent pupillary defect. There was mild decreased sensation in the distribution of the first and second divisions of the fifth nerve, without evidence of proptosis. The corneal reflex was normal. No bruit could be detected. Laboratory data included a normal erythrocyte sedimentation rate and glucose tolerance test.

Skull x-ray films and cerebral arteriograms were normal. A contrast-enhanced computerized tomography (CT) scan (Fig. 1) showed an enhancing mass on the coronal cut at the level of the superior orbital fissure on the left, extending into the orbit. The cavernous sinus regions and brain stem had a normal appearance. There was no improvement of the patient's symptoms with steroids.

Operative Technique. As can be seen on the CT scan (Fig. 1), a large portion of the orbital roof was composed of the frontal sinus. Figure 2 is a posteroanterior x-ray film of the skull, confirming the prominent frontal sinus. A template was formed by cutting out the
FIG. 1. Computerized tomography scans showing the orbital roof made up extensively of the frontal sinus, and a mass present on the coronal cut in the superior orbit on the left (arrow).

FIG. 2. Posteroanterior skull film showing the prominent frontal sinus.

FIG. 3. The anterior wall of the frontal sinus being removed by the Hall air drill. A sterilized template from the x-ray film is used to mark the outline of the frontal sinus.


sinus on the skull film. A bicoronal skin incision including the pericranium was made, and subperiosteal dissection was carried forward to expose the supraorbital ridge bilaterally. The sterilized template was then placed on the skull, and the sinus outlined with Evans blue dye. A Hall air drill was then used to penetrate the anterior wall of the frontal sinus (Fig. 3). The orbital contents were drawn inferiorly with malleable retractors, and the cuts were continued through the supraorbital ridge bilaterally (Fig. 4 left). With periosteal elevators, the bone flap, which included part of the orbital roof, was snapped forward (Fig. 4 right).

The frontal sinus was then exenterated bilaterally, with care being taken not to damage the nasofrontal ducts. Rongeurs were used to complete the removal of the orbital roof on the left as necessary for adequate exposure. After the periorbita had been incised, intraorbital exploration was undertaken. No tumor could be found and the only abnormality identified was what appeared to be an enlargement of the superior ophthalmic vein in the orbital apex. At the completion of the procedure, the bone flap was wired in place. It was not deemed necessary to replace the orbital roof with mesh to prevent upward herniation of the orbital contents since it has proven unnecessary in our previous experience with the supraorbital approach. The cosmetic result was very satisfactory since there were no frontal burr holes. At no time during this procedure was intracranial exposure necessary to afford additional visualization.

Discussion

The number of various approaches to orbital tumors that have been described would indicate that there are disadvantages to each one. For a tumor that is clearly intraorbital and not inferiorly placed, the technique described here provides a technically simple and cosmetically superior approach. Exposure of the orbital contents is generous and intracranial exposure, as produced by the transcranial approach, is avoided. The supraorbital nerve can be saved with careful reflection of the bone flap. We advocate exenteration of the mucosa of the frontal sinus with care to avoid damage to the frontonasal duct. There is no need to pack the sinus since there is no connection with the intracranial compartment. The temporary osteoplastic reflection of the anterior wall of the sinus was originally described by Briejer. Many modifications have been described, and Goodale and Montgomery have had extensive experience with this approach, adding the use of a template to trace the outline of the sinus. The only requirement is a moderately large frontal sinus and a mass that is completely intraorbital and not inferiorly placed.

The etiology of the patient's disease in this case remains obscure. The absence of a response to steroids argues against a diagnosis of Tolosa-Hunt syndrome. The abruptness of onset of her symptoms makes an ischemic cause likely. The anatomical location for an infarct without brain-stem signs is again problematic.
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Follow-up CT scanning 8 months later showed partial resolution of the mass seen on the original scan. Examination at that time showed moderate return of third nerve function with evidence of aberrant regeneration.

This approach would not be suitable for treating orbital masses of childhood in which frontal sinus development is insufficient for adequate exposure. This approach could be further modified to allow intracranial exploration utilizing a burr hole through the posterior wall of the frontal sinus, as we have previously described. If operative exploration reveals intracranial extension of the pathology, this would involve turning a standard osteoplastic frontal flap with a burr hole at the junction of the superior temporal line with the zygomatic process of the frontal bone, under the insertion of the temporalis muscle.

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References


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