An extensive transbasal approach to frontal skull-base tumors

Technical note

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Lesions in the base of the frontal fossa have conventionally been approached extra- and intradurally through a bilateral frontal craniotomy. However, when the lesion is large or deeply situated, wider bilateral retraction of the frontal lobes is required to obtain a sufficiently large operative field. The authors describe a new operative approach for huge tumors at the frontal skull base, employing an en bloc bilateral osteotomy of the orbital roofs and frontal sinus. This procedure, which is a modification of the transbasal approach described by Derome and Guiot, is termed the "extensive transbasal approach." The advantages of this technique over conventional operative approaches are described.

KEY WORDS: frontal fossa, transbasal approach, skull-base tumor, operative approach, brain tumor

Lesions in the anterior base of the skull are usually approached via intra- and epidural routes after a bilateral frontal craniotomy. However, when the lesion is deep, appropriate compression of the brain parenchyma seems to be needed to obtain a sufficiently large surgical field. For this reason, we have modified the transbasal approach of Derome and Guiot and have applied it in particular to cases of dumbbell-shaped tumors occurring at the frontal skull base and spreading within and outside the skull. In this procedure, a bilateral frontal craniotomy is followed by an en bloc bilateral osteotomy of the orbital roofs and frontal sinus to obtain a large surgical field. Brain compression is minimal with this procedure, and tumor resection is facilitated along with reconstruction of the skull base.

Operative Technique

The aim of this operation is to provide improved exposure of frontal skull-base tumors through an en bloc bilateral osteotomy of the orbital roofs and frontal sinus following an ordinary bifrontal craniotomy (Fig. 1). Dural repair of the frontal skull base is often required with this procedure. For this reason, we use a wide craniotomy in order to develop a pedicled dural flap from the frontal convexity for the dural repair of the frontal skull base. The periorbita is dissected from the orbital wall following subperiosteal dissection of the bifrontal skin flap, but sometimes supraorbital foramen will be necessary to create an opening to preserve the supraorbital nerves and vessels. Dissection of the periorbita may easily cause tearing and even allow the orbital fat to escape in some cases. Therefore, dissection should be as conservative as possible. Dissection of the periorbita is usually easy; however, in some parts of the medial wall it can be more difficult than that of the superior wall because the medial wall is held in place by the medial canthal ligament. When the frontal sinus is released as a result of craniotomy, the mucous membrane of the frontal sinus should be resected as much as possible to establish communication with the ethmoid sinus.

A Zimmer microsagittal bone saw is used for osteotomy of the frontal skull base. The extent of the osteotomy varies from case to case; especially if anosmia has been present preoperatively or if impairment of the olfactory sense is acceptable to the patient, it is possible to extend the osteotomy to the posterior region of the crista galli (that is, the center of the frontal skull base).
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Such an osteotomy creates a larger epidural space for the operation, facilitating direct manipulation as far as the planum sphenoidale.

If any dural defects are observed after removal of the frontal skull-base tumor, the dura is reconstructed with the pedicled dural flap. Particularly when the defect is large, we reconstruct the dura of the frontal skull by using two pedicled dural flaps taken from the frontal convexity and reversing one flap on top of the other (Fig. 2). The resultant dural defect in the frontal convexity used for the pedicled flaps is covered with artificial, sutured dura. The medullary plate of the ilium is used for reconstruction in cases where the frontal skull base itself is defective. It has been said that there is no problem even if the medullary plate of the ilium is directly exposed to the nasal cavity, but we prefer to preserve the nasal mucous membrane carefully so that the underlying region of the medullary plate is fed by circulation from the nasal mucous membrane.

Following reconstruction of the fronto-orbital base, the frontal bar, osteotomized with the microsagittal bone saw, is fixed so that no dislocation is caused by rotation. Before repositioning the frontal bone flap, we affix the pericranial flaps taken from the forehead to the frontal skull base in order to cut off all communication between the nasal cavity (especially the frontal sinus) and the inside of the skull (Fig. 3). In cases when osseous reconstruction of the frontal base is necessary, the pericranial flaps often cover the upper side of the iliac medullary plate positioned on the frontal base, but it is also possible to apply a wide pericranial flap to the

Fig. 1. Schematic drawings showing the extensive transbasal approach to frontal skull-base tumors. Left: Anteroposterior view. Center: Basal view. Right: Disclosure of the frontal skull-base tumor between the orbits (arrows).

Fig. 2. Schematic illustrations of the reconstruction with pedicled dural flaps. Left: Dural defect (arrow) in the frontal skull base is covered with bilateral pedicled flaps reversed from the calvarial dura. Right: Sagittal view of stage shown left. Arrows indicate the pedicled flaps.

Fig. 3. Illustration of the pericranial flap (arrow) for covering the posterior wall of the frontal sinus and the frontal skull base.
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whole frontal skull base. On occasion, a pericranial flap is used to create integrity between the orbital and paranasal cavities. Finally, an elastic bandage is used to prevent postoperative edema of the eyelid region.

Discussion

We have presented the procedure for an extensive transbasal approach, involving en bloc osteotomy of the bilateral supraorbital walls and frontal sinus. This procedure can be regarded as a modification of the transbasal approach of Derome and Guiot.1,2 These two procedures have in common the epidural approach and the use of the patient's own bone (such as the iliac bone) for reconstruction of the frontal skull base. However, our procedure seems to be clinically more advantageous because of reduced brain retraction and a larger surgical field.

Possible complications (in particular nerve damage) with our procedure include damage to the olfactory, frontal, supraorbital, and oculomotor nerves. Damage to the olfactory nerve is inevitable during osteotomy of the anterior skull base and has been reported by Derome1 as the only complication associated with his procedure. To preserve the olfactory nerve, it seems necessary to restrict anterior skull osteotomy to the anterior portion of the crista galli and to leave part of the dura mater affixed in the central anterior skull base. Frontal and supraorbital nerves can be damaged by a blind osteotomy of the anterior skull base; hence, damage to these nerves may be prevented by carefully freeing the periorbital membrane and employing direct vision for the osteotomy of the skull base.

References


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