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Technical notes

Telecanthal Approach for Meningiomas in the Ethmoid and Sphenoid Sinuses

Kazuhiko Fujitsu, M.D., Masakuni Saijoh, M.D., Fumihiko Aoki, M.D., Katsumi Sakata, M.D., Satoshi Fujii, M.D., Yasuhiko Mochimatsu, M.D., and Takeo Kuwabara, M.D.

Departments of Neurosurgery (KF, KS, SF, YM, TK) and Plastic Surgery (MS, FA), Yokohama City University School of Medicine, Yokohama, Japan

In three cases involving meningiomas in the ethmoid and sphenoid sinuses, transbasal spreading of the interocular distance (telecanthal approach) was used for tumor removal and reconstruction of the skull base. This telecanthal approach involves 1) bilateral *en bloc* removal of the superior lateral rim of the orbit, the nasal bone, and the posterior lateral wall of the orbit; 2) detachment of the medial canthal ligaments; and 3) spreading of the interocular distance. This approach provides a wide working space beneath the anterior half of the midline skull base, and needs neither a facial incision nor significant retraction of the brain. The surgical technique and its modification are described. The discussion focuses not only on comparisons with other techniques, but on the indications for this approach. Meningiomas originating in the paranasal sinuses are rare; a brief review of the literature concerning the clinicopathological features and pathogenesis is also given. (*Neurosurgery* 28:714–720, 1991)

Key words: Meningioma, Orbit, Paranasal sinus, Skull base surgery, Telecanthal approach

Meningiomas originating in the paranasal sinuses are rare and their clinicopathological features, including pathogenesis, have not fully been understood (1–5, 7–9, 11, 13–18, 21, 23–30, 32–40, 42–47, 49, 50). In cases in which these tumors extend deep into the sphenoid sinus or to the upper clivus, surgical resection and reconstruction also pose a special technical problem. In three patients with meningiomas in the ethmoid and sphenoid sinuses, tumors were removed by spreading the interocular distance and creating a wide space through the nasion—the *telecanthal approach*. The cases of two of these three patients are presented with the surgical technique for tumor removal and for reconstruction of the skull base. A brief review of the literature is also given as to the clinicopathological features and pathogenesis of meningiomas in the paranasal sinuses.

OPERATIVE TECHNIQUE

A bicoronal incision is made extending on both sides to just in front of the tragus. During subperiosteal reflection of the scalp flap, the continuity of the pericranium and the periorbita is maintained to facilitate exposure of the nasal bone and the superior lateral rims of the orbits. On the reflected scalp flap over the nasal bone, a midline incision is made into the periosteum and the procerus muscle (Fig. 1). To expose the lateral walls of the orbits sufficiently, the temporal muscle is detached bilaterally along the anterior margin of the temporal fascia and retracted posteriorly and inferiorly. After eight burr hole openings are made, a narrow, bifrontal, free bone flap craniotomy, extending bilaterally just lateral to the linea temporalis, is elevated (Fig. 1).

The frontal sinuses are always opened in this craniotomy. The posterior walls and the mucous membranes of the sinuses are removed from the craniotomy flap, which is then rinsed with an antibiotic solution. With the aid of an air drill, a transverse cut is made extradurally in the frontal cranial base. Just behind the orbital rims, this bone cut is extended bilaterally to incorporate the posterior lateral walls of the orbits. The extent of the removal of the posterior lateral walls of the orbits depends on the width of the working space needed.

If the lesion is large and involves the sphenoid sinus or the upper clivus, complete removal of the posterior lateral walls of the orbits is helpful for obtaining a wide working space between the retrobulbar orbital contents. In such instances, the inferior orbital fissures are reached and, with the aid of a chisel and an electric bone saw, the orbital frame that has thus been fashioned is removed *en bloc*, incorporating a portion of the nasal bone 1 cm below the nasion (Fig. 1). The posterior walls and the mucous membranes of the frontal sinuses are removed from this bone frame, which is rinsed with an antibiotic solution. The rest of the mucous membranes of the frontal sinuses are removed, and their exits to the nasal cavities are sutured. If intradural manipulation is needed, the sagittal sinus and the falx are divided near the frontal base, and the cerebrospinal fluid is aspirated through the interhemispheric approach (Fig. 1). The ethmoid sinuses are removed, and their mucous membranes are sutured near the exits to the nasal cavities. The upper half of the nasal septum is also removed to mobilize the upper nasal cavities. The medial canthal ligament is detached bilaterally from the dacryon (the attachment of the ligament to the fronto-maxillo-lacrimal suture). Two small holes are made near the dacryon, and ligatures are tied on the ligaments (Fig. 1). These holes and ligatures are helpful at the end of the operation to fix the ligaments to their former attachments. With the upper nasal cavities displaced from one side to the other, the lesion can be approached from both sides (Fig. 2).

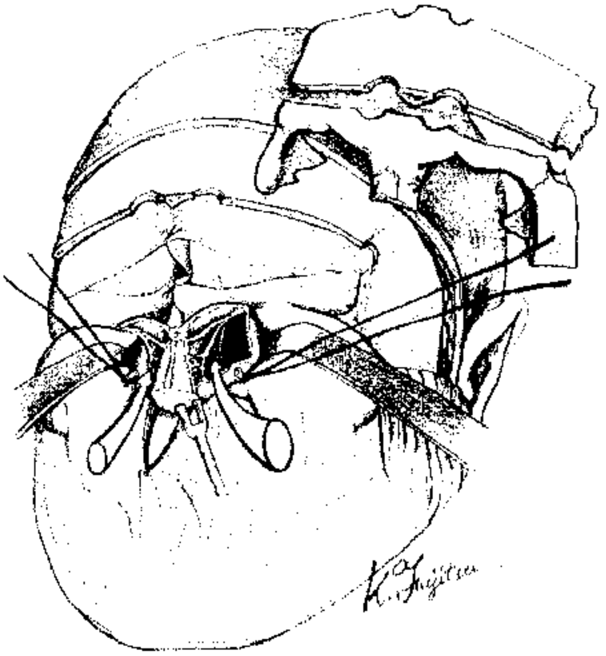

FIG. 1. Telecanthal approach. Note the ligatures on the medial canthal ligaments and small holes near the dacryon. Also note the midline incision into the periosteum and the procerus muscle over the nasal bone.

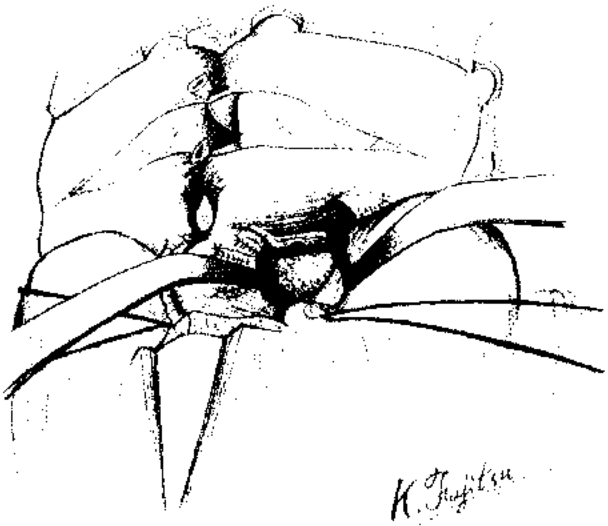

FIG. 2. The upper half of the nasal septum is removed. By displacing the upper nasal cavities from one side to the other, lesions in the sphenoid sinus or in the upper clivus are approached from both sides.

Another route to the sphenoid sinus is the submucosal transseptal approach through the midline. For this route, the rest of the nasal bone is split at the midline and the nasal cavities are separated (Fig. 3). The continuity of the olfactory nerve, lamina cribrosa, and mucous membranes of the upper nasal cavity is maintained on both sides unless the lesion involves these structures (Figs. 2 and 3). In anosmic patients, however, the mucous membranes of the upper nasal cavity can be separated bilaterally from the lamina cribrosa (Fig. 4). Downward displacement of the upper nasal cavities creates ample space in the midline.

If the lesion is not as large and is confined to the ethmoid sinuses, the extensive lateral and inferior orbitotomy described

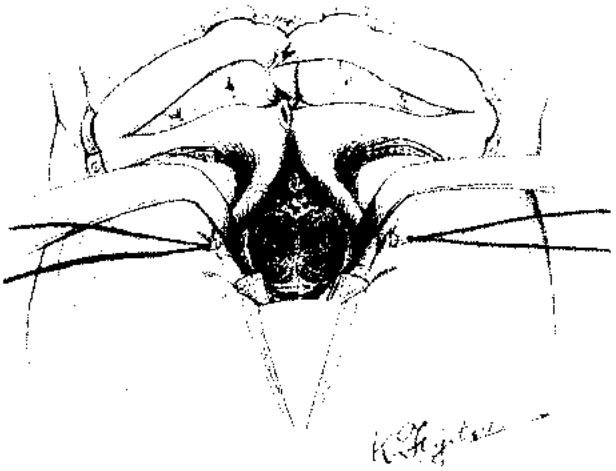

FIG. 3. The midline submucosal transseptal route is another route to the sphenoid sinus. For this route, the rest of the nasal bone is split in the midline.

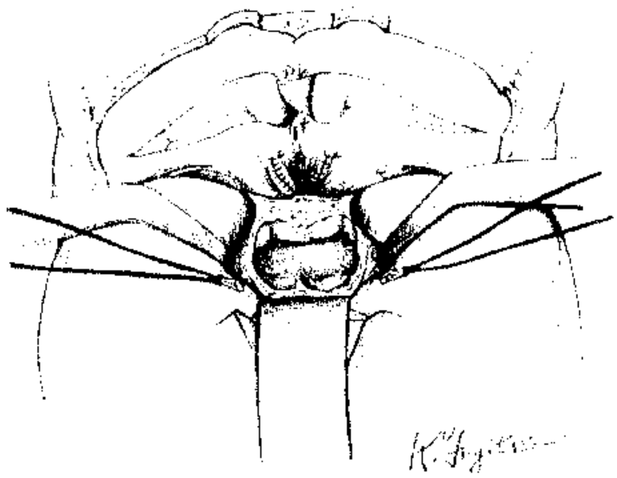

FIG. 4. Downward displacement of the upper nasal cavities creates ample space in the midline. This method is used only in anosmic patients.

above is not necessary. In such instances, a small unilateral cranio-orbitotomy may be carried out without either detachment of the medial canthal ligament or opening of the dura mater. Any tears of the mucous membranes of the nasal cavities are sutured with absorbable ligatures (Figs. 2–4), and a pericranial flap fed by both supratrochlear arteries is prepared to shield these suture lines. The medial wall of the orbit (the lateral wall of the ethmoid sinus, which is usually almost totally removed) may be reconstructed with a free bone graft taken from the outer table of the parietal skull and wrapped in the above fashioned vascularized tissues. After removal of a large and deep-seated tumor, a vascularized bone graft is often needed to reinforce the skull base further.

CASE REPORTS

Patient 1

The patient, a 63-year-old man, had a meningothelial meningioma diagnosed by biopsy in September 1983. It occupied both ethmoid sinuses and protruded into the upper nasal cavities. He developed intermittent nasal bleeding and severe nasal obstruction, and was admitted to our neurosurgical department in February 1985. At admission, he showed prominent swelling around the nasion, hyperte-

FIG. 5. Preoperative photograph (*left*) and CT scan (*right*) of Patient 1.

lorism, bilateral exophthalmos, loss of convergent ocular movements, and total anosmia (Fig. 5, *left*). Computed tomographic (CT) scans disclosed an enhancing mass lesion that occupied the bilateral ethmoid sinuses, the sphenoid sinus, and the entire nasal cavities (Fig. 5, *right*). The tumor also protruded into both orbits and into the frontal cranial cavity.

Operation

The patient underwent surgery on March 31, 1988. Because the skin over the swelling was extremely thin, a midline incision was made through the forehead down to 3 cm below the nasion in addition to a bicoronal incision. With these incisions and through the telecanthal approach, a working space wide enough for tumor removal and for skull base reconstruction was obtained. The tumor involved the ethmoid sinus bilaterally, the lamina cribrosa, the medial half of the orbital roof, the medial wall of the orbit, and the anterior wall of the sphenoid sinus. The overlying dura was invaded by the tumor, but the periorbita was intact. The tumor also involved the nasal bone and the upper two-thirds of the nasal septum, but the medial canthal ligament and nasolacrimal duct were bilaterally intact. The superior and middle turbinate bones, including the covering mucous membranes, were also bilaterally involved with the tumor.

After total resection of the tumor and the involved tissues, a free rectus abdominis musculocutaneous flap was prepared for reconstruction of the frontal base (Fig. 6). The fascia of the external oblique abdominal muscle and the deep inferior epigastric artery and vein were also included in the flap. The dural defect of the frontal base was repaired with the fascial portion of this flap. A free bone graft was taken from the external table of the parietal skull and was placed epidurally between the lateral rests of the orbital roofs. The medial wall of the orbit was also reconstructed bilaterally with free bone grafts. The muscular portion of the flap was packed into the upper part of the cavity that was created by the tumor removal. The mucous membranes over the rest of the nasal septum were approximated and sutured. The cutaneous portion of the flap was sutured to the rests of the nasal mucous membranes in order to reconstruct a single cavity nasal airway. A small incision was made near the jaw angle to expose the facial artery and vein. In order to let the artery and vein of the musculocutaneous flap run underneath the facial skin, a tunnel was made from the cavity to this incision. The artery and the vein of the flap were anastomosed to the facial artery and vein. For reconstruction of the nasal bone, a 1 × 4 cm bone stick was taken from the outer table of the parietal skull and was wired to the midline lower edge of the frontal bone flap. To adjust the intercanthal distance, the medial canthal ligaments were approximated under the reconstructed nasal bone.

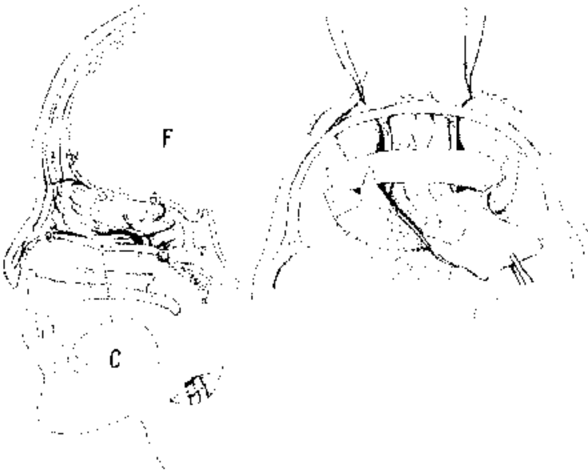

FIG. 6. Schematic drawing of reconstruction of the skull base in Patient 1. The fascial portion (*F*) of a free rectus abdominis musculocutaneous flap was sutured to the dura of the frontal base, while the cutaneous portion (*C*) of the flap was sutured to the mucous membranes of the nasal cavity. The ligatures are on the medial canthal ligaments.

FIG. 7. Postoperative photograph (*left*) and CT scan (*right*) of Patient 1.

The patient's postoperative course was uneventful. CT scans showed total removal of the tumor, but also residual separation of the eye balls (Fig. 7, *right*). This was probably because of the enlargement of the bony orbits, which had been present preoperatively. He regained convergent ocular movements and cosmetically satisfactory features (Fig. 7, *left*).

Patient 2

A 38-year-old man with a 2-year history of double vision and slight exophthalmos on the left side was admitted in June 1989 for surgical resection of a tumor in the sphenoid and left ethmoid sinuses. The tumor had been diagnosed as a meningothelial meningioma by biopsy in July 1987. On admission, he showed left-sided exophthalmos of 3 mm on the Hertel exophthalmometric examination, slight restriction of the lateral movement of the left eyeball, and left-sided loss of olfactory function. A CT scan showed a homogeneously enhancing lesion in the sphenoid and left ethmoid sinuses that protruded into the right ethmoid sinus and into the left orbit. The tumor also involved the planum sphenoidale and the tuberculum sellae, bulging intracranially like a blister (Fig. 8, *left*).

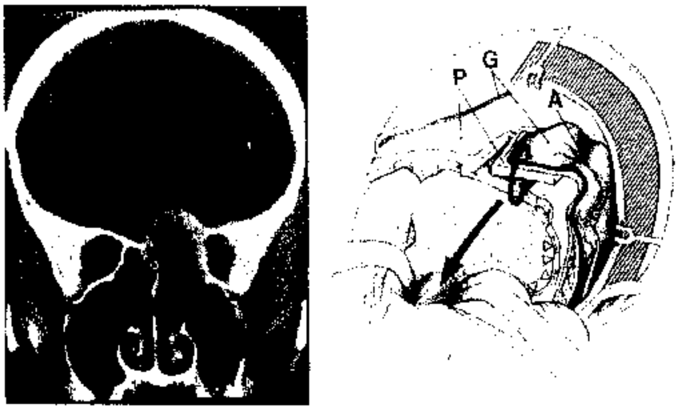

FIG. 8. Preoperative CT scan (*left*) and schematic drawing of reconstruction of the skull base (*right*) in Patient 2. The galeal portion of the vascularized calvarial bone graft is in contact with the mucous membranes of the nasal cavities (*arrows*). The craniotomy is more laterally based (*open arrowheads*) to obtain a vascularized flap of sufficient length. The *hatched area* indicates that the galeal flap is detached from the scalp. *A*, parietal branch of the superficial temporal artery; *G*, galea aponeurotica; *P*, pericranium.

Operation

The patient underwent surgery on July 3, 1989. A bicoronal incision, which was not supplemented by the midline incision used in the first patient, was made. Before the craniotomy, a vascularized calvarial bone graft, about 3 × 5 cm, was prepared from the outer table of the parietal skull. The vascularized pedicle was about 3 × 12 cm and included the pericranium, the galea aponeurotica, and the parietal branch of the superficial temporal artery (Fig. 8, *right*). The same cranio-orbitotomy as was used in the first patient was carried out, except that the craniotomy was more laterally based on the left side and the inferior orbital fissure was not reached on the right side. The following procedures were carried out by detaching the medial canthal ligament on the left side only and without opening the dura mater. The left ethmoid sinus was easily approached by creating a working space between the orbit and the nasal cavity on the left side. The sphenoid sinus was approached from both sides by spreading the interocular distance and displacing the upper nasal cavities from one side to the other. The nasal cavities were not separated from the cribriform plates. Both the dura of the frontal base and the periorbita of the left orbit appeared intact. The tumor, consisting of a thin, bony shell and suckable contents, was removed totally. The olfactory nerve, the lamina cribrosa, and the mucous membranes of the superior nasal meatus were all preserved on both sides.

A bone defect involved the planum sphenoidale, the tuberculum sellae, the sella floor, the posterior and anterior walls of the sphenoid sinus, and the medial wall of the left orbit. The vascularized calvarial bone graft, which had been prepared before the craniotomy, was accommodated to this bone defect and was placed epidurally. The bone portion of the graft faced the dural surface, while the galeal portion was in contact with the mucous membranes of the nasal cavity. To maintain the galeal portion against the mucosa, the flap was rotated 180 degrees. Because of the craniotomy defect in the temporal base and the sufficient length of the flap, this rotation did not compromise the vascularity of the bone graft (Fig. 8, *right*). The detached medial canthal ligament was fixed to its former place, and the rest of the craniotomy defect was filled with free bone chips.

The patient's exophthalmos and double vision disappeared, and he retained the sense of smell on the right side. His course complicated by a subgaleal abscess in the area near the left temporal craniotomy. This complication was treated by removal of the free bone chips, administration of systemic antibiotics, and subgaleal irrigation with an antibiotic solution for 4 weeks. A CT scan performed 6 weeks after the operation showed that the tumor had been totally removed and that the vascularized bone graft was intact; however, it also showed osteomyelitic changes in the left half of the craniotomy bone flap (Fig. 9, *left*). The patient showed no evidence of recurrent osteomyelitis thereafter, and his intercanthal distance was normal (Fig. 9, *right*).

FIG. 9. Postoperative CT scan (*left*) and photograph (*right*) of Patient 2. The *arrow* indicates the vascularized calvarial bone graft.

The third patient is a 72-year-old woman with a diagnosis of meningothelial meningioma in the left ethmoid sinus who underwent surgery through the extradural telecanthal approach. In this patient, a unilateral small cranio-orbitotomy was carried out, and a bone graft was not necessary for skull base reconstruction.

DISCUSSION

A review of the literature revealed that 36 authors have reported 64 cases of meningiomas originating in the paranasal sinuses: 17 in the ethmoid sinus, 12 in the frontal sinus, 15 in the maxillary sinus, 11 in the sphenoid sinus, and 9 in more than two sinuses (1–5, 7–9, 13–18, 23, 24, 26–30, 32–40, 42–44, 46, 47, 49, 50). About half of these cases were in patients who were under the age of 20 years at diagnosis, and the most common symptoms were nasal obstruction, exophthalmos, and epistaxis. After the preparation of this paper, we examined a 22-year-old man who was diagnosed as having a meningioma in the right ethmoid sinus. We have an impression that the recent spread in popularity of skull base surgery has prompted increasing reports of paranasal sinus meningiomas. The pathogenesis of meningiomas of the paranasal sinuses still remains uncertain. There are several kinds of cells or cell rests from which meningiomas in the paranasal sinuses are believed to derive. These include 1) ectopic arachnoid cell rests in or near the developmental line of fusion (17, 25, 29); 2) ectopic Pacchionian bodies along the course of the nerves (11, 21, 32); 3) meningocytes differentiated from Schwann cells (4, 28); and 4) multipotential mesenchymal cells (45, 46). The postulation that ectopic meningiomas arise from ectopic arachnoid cell rests has received wide acceptance.

The surgical approach to large meningiomas situated near the sphenoid sinus presents a difficult technical problem because reconstruction of the skull base needs to be done in a deep narrow space. The conventional transcranial approach with a bifrontal craniotomy requires significant retraction of the frontal lobes, and a sublabial transseptal approach provides only limited working space. The supraorbital bar technique (20), the transbasal approach (12), and the combined craniofacial approach (6, 10, 22, 33, 48) are all helpful in gaining working space underneath the frontal base. To approach deep-seated lesions and obtain ample working space for reconstruction of the skull base near the sphenoid sinus, however, spreading of the orbital contents is occasionally desirable. The surgical techniques used for separation of the bony orbits or for correction of orbital hypertelorism may be useful for this purpose, but these techniques are complicated and require much operating time (31). Splitting the maxillary bone may provide an excellent view of the sphenoid sinus and upper clivus, but also requires a long operating time and a facial incision (19).

Our telecanthal approach provides sufficient working space for reconstruction near the sphenoid sinus without complicated techniques or a facial incision. On the reflected scalp flap, the midline incision into the pericranium and the procerus muscle can help expose the nasal bone sufficiently. The cranio-orbitotomy is modified according to the size and extent of the lesion, and incorporation of the posterolateral walls of the orbits is not necessary for lesions confined to the ethmoid sinuses. Special attention should be paid to detaching the medial canthal ligaments. We recommend this technique only for large lesions near the sphenoid sinus, because inappropriate approximation of these ligaments causes telecanthus and ocular deformity. Although none of our patients experienced a disturbance of ocular motility postoperatively, fixation of the trochleae to their former places is also desirable. Lacrimal duct obstruction was not experienced either, but care should be taken to avoid damaging the connection between the ducts and the nasal cavities. Transection and resuturing of the lacrimal ducts may be helpful for separating the eyeballs further (41). This technique, however, puts the lacrimal duct function at risk, and is not used in our approach. If the olfactory nerve remains functional on one side, the mucous membranes of the upper nasal cavity on this side should not be separated from the lamina cribrosa.

Meningiomas of the paranasal sinus that are treated surgically are often of substantial size and almost always involve both orbits, the nasal cavities, and the skull base. For this reason, the nasal and paranasal cavities almost always communicate with the cranial and orbital cavity after the tumor is completely removed. To prevent possible contamination and leakage of cerebrospinal fluid, the mucous membranes of the paranasal cavities should be removed and their exits to the nasal cavities sutured. Vascularized tissues should be used to shield these suture lines. Free bone grafts are particularly susceptible to contamination when used near the nasal and paranasal cavities. If free bone grafts are used to reinforce the skull base, they should always be wrapped in vascularized tissue.

In conclusion, our telecanthal approach is indicated for large and deep-seated tumors near the sphenoid sinus that require ample working space for reconstruction of the skull base. Cooperation with plastic surgeons, otolaryngologists, and ophthalmologists is important in implementing all these techniques of reconstruction of the skull base.

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Reprint requests: Kazuhiko Fujitsu, M.D., Department of Neurosurgery, Yokohama City University, School of Medicine, 3-46 Urafune-cho, Minami-ku, Yokohama, 232 Japan.

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COMMENTS

Including various portions of the bony orbit in the cranial flap to obtain low basal exposure of lesions at the skull base has become an established technique. The merit of this maneuver has been well-documented since it was first described by McArthur and Frazier in 1912 and 1913, respectively. The actual technique differs according to the lesion being attacked and the surgeon's innovations. We have used several different variations (1). Dr. Fujitsu and his colleagues present here yet another modification under the name *telecanthal approach*. They convincingly outline the indications for its use and superbly illustrate the technique. They emphasize exenterating the frontal sinus mucosa and using a well-vascularized pericranial flap. They justifiably warn of actual and potential complications of this technique. Alarming in their series is that infection necessitated removal of the bone flap in one of their three patients.

O. Al-Mefty
Jackson, Mississippi

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Dr. Fujitsu and colleagues describe an operative approach to expose the anterior cranial base by removing the supraorbital rims bilaterally, the frontal sinus, superior nasal bones, and medial and lateral orbital walls. The technique offers wide visibility of the anterior cranial base and avoids brain retraction. The authors have employed this technique successfully for removal of meningiomas involving the anterior cranial base.

The approach described by the authors has certain drawbacks, however. As compared with the supraorbital bar (1) and frontal sinus (2, 3) techniques, it involves additional dissection and operative time. The justification the authors give for this need for additional exposure is that, in addition to affording a wider field of tumor visibility, it allows more complete reconstruction of the anterior cranial base after resection of the tumor. In some instances, reconstruction of the base is definitely required, but the limits of bone resection in the anterior cranial base that lead to obvious negative sequelae have not yet been determined. In clinical practice, however, the defect must be quite large. In the patient who has undergone irradiation of the skull base, wide exposure is necessary when the dura is removed and a nonvascularized patch graft is used as a dural substitute. Vascularized flaps are often transferred microvascularly and frequently are required to support the graft; the technical manipulations associated with this technique necessitate a larger field of exposure. In many instances, however, we have found the use of the galea as a locally transferred vascularized flap coupled with fibrin glue sufficient to seal these defects without consequent leakage of cerebrospinal fluid or brain herniation.

The recommendation of the authors for removal of the medial canthal tendon by stripping it from the lacrimal bone is, as the authors state, a relatively infrequent occurrence. This may lead to rounding out of the medial canthal region and postoperative deformity. The technique that we have found useful in preventing this is to allow the medial canthal tendon to remain attached to a "window" of lacrimal bone, so that this bone with the canthal attachment may be affixed to surrounding nasal bone later in the reconstruction. This normalizes the intercanthal distance and restores normal appearance.

The authors state that the use of a vascularized calvarial bone graft was helpful in reconstructing the anterior cranial base in Patient 2. Although the defect appears to be relatively small, and whether reconstruction was necessary may be questioned, the use of a vascularized pedicle from the temporalis muscle should include the perforating vessels entering the calvarial bone at the level of the temporal crest. Bone taken farther out in the parietal region without these perforating vessels has minimal, if any, vascular supply from the temporalis muscle. In this case, the authors use the galea to wrap around the bone graft itself, providing additional support from which blood supply may ultimately be obtained.

Finally, I believe the authors correctly point out the benefits of a multidisciplinary approach to the treatment of cranial base tumors. They have achieved excellent technical results by drawing upon the combined expertise of plastic surgeons, otolaryngologists, and ophthalmologists, as well as on their own expertise in neurosurgery.

John A. Persing
Charlottesville, Virginia

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Operative Approach to the Frontal Skull Base: Extensive Transbasal Approach

Katsuhiro Kawakami, M.D., Yasuo Yamanouchi, M.D., Yasuo Kawamura, M.D., and Hiroshi Matsumura, M.D.

Department of Neurosurgery, Kansai Medical University, Moriguchi, Osaka, Japan

An operative technique called the *extensive transbasal approach* is reported with the operative results of 11 cases. This is an operative mode in which *en bloc* osteotomy of the orbital roofs and frontal sinus is performed after ordinary bifrontal craniotomy. Through this approach, a far wider operative space than that afforded by conventional operative techniques is possible, and reconstruction of the frontal base can be made securely. We consider this approach of major clinical value. (*Neurosurgery* 28:720–725, 1991)

Key words: Anterior cranial fossa, Craniofacial resection, Skull base lesion, Supraorbital approach, Transbasal approach

INTRODUCTION

The conventional approach to lesions located in the frontal skull base has in most cases been intra- and/or extradural through a bilateral frontal craniotomy. Moderately wide brain retraction is necessary, however, to obtain sufficient operative space when the lesion is deep seated.

We have previously reported an operative procedure for dumbbell-shaped tumors in the frontal base called the *extensive transbasal approach*, a modification of the Derome transbasal approach (1, 2), in which a bilateral osteoectomy of the orbital roofs and frontal sinus is done *en bloc* (Fig. 1) (7, 8). We have obtained favorable results utilizing this approach in 11 patients, including 3 with cerebrospinal rhinorrhea associated with fractures of the frontal base, in addition to frontal base tumors. In this report, we introduce the operative technique and its results and compare the data with other operative methods for treating frontal base lesions.

EXTENSIVE TRANSBASAL APPROACH

This procedure is an operative mode aimed at securing reconstruction of the frontal base via an *en bloc* osteotomy of both orbital roofs and the frontal sinus after an ordinary bifrontal craniotomy. We used reversed, pedicled dural flaps from the frontal convexity for reconstruction of the dura of the frontal base (Fig. 2). The skin is incised coronal to the periosteum, and the scalp is reflected to the orbital rim. The periorbital fascia is dissected following the subperiosteal dissection of the scalp; sometimes the supraorbital foramen must be opened to preserve the supraorbital nerves and vessels.

Dissection of the periorbital fascia is made carefully so as to avoid escape of orbital fat. Dissection along the medial orbital wall is sometimes difficult as compared with the superior wall, because the medial wall is fixed by the medial canthal ligament. When the frontal sinus is released as a result of craniotomy, the mucous membrane of the frontal sinus is resected as completely as possible.

A microsagittal bone saw (Zimmer Japan K.K., Tokyo, Japan) is used for the osteotomy of the frontal base, as shown in Figure 1. The range of the osteotomy differs for each case, but if anosmia has been present preoperatively or if sacrificing olfaction is acceptable, osteotomy at the posterior region of the crista galli—that is, the center of the frontal base—is possible. This osteotomy offers a wide epidural space for surgery, enabling the surgeon to use direct manipulation as far as the planum sphenoidale. If a dural defect is observed at the frontal base, the dura is reconstructed by reversing a pedicled dural flap. When the defect is large, we reconstruct the dura of the frontal base by reversing one pedicled dural flap on top of the other taken from the frontal convexity, as shown in Figure 2. The resultant dural defect in the frontal convexity is covered with artificial dura. A medullary plate taken from the ilium is used for reconstruction in patients whose frontal base itself is defective. It has been said that there is no problem if the bone graft is directly exposed to the nasal cavity (15), but we take care to preserve the nasal cavity membrane so that the region below the bone graft may receive circulation from the nasal mucous membrane.

After reconstruction of the fronto-orbital base, the frontal bar, for which osteotomy was performed using a microsagittal bone saw, is fixed so that no dislocation may be caused by rotation. Before repositioning the frontal bone flap, we apply the pericranial flaps taken from the forehead to the frontal base, in order to cut off all communication between the nasal cavity and the inside of the skull (Fig. 3) (11). In cases when osseous reconstruction of the frontal base is necessary, the pericranial flaps cover the upper side of the iliac bone graft laid