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Orbitocraniobasal Approach for Anterior Communicating Artery Aneurysms

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We describe an orbitofrontotemporobasal craniotomy technique that allows excellent access to anterior communicating artery aneurysms. This orbitocraniobasal approach is particularly useful for the surgical treatment of ruptured aneurysms in the acute stage of subarachnoid hemorrhage, when retraction of the brain needs to be kept to a minimum. With this approach, retraction of the orbital contents decreases the amount of retraction of the brain to such an extent that a brain spatula is not necessary for access to the anterior communicating artery complex. The procedure is described, as is a modification of the approach for removal of large tumors on the skull base. (*Neurosurgery* 18:367–369, 1986)

Key words: Cerebral aneurysm, Early operation of ruptured aneurysm, Orbitocraniobasal approach, Suprasellar tumor, Surgical approach, Ventriculocisternal drainage

INTRODUCTION

Appropriate exposure with minimal retraction of the brain is especially important in early operation of ruptured aneurysms. Among the most deeply seated aneurysms in the supratentorial compartment are anterior communicating artery aneurysms; surgical approach to these aneurysms often requires a considerable amount of brain retraction.

We have developed an orbitocraniobasal approach that involves removal of the superolateral portion of the orbit. In this approach, retraction of the orbital contents provides excellent exposure of the anterior communicating artery complex without any significant retraction of the brain.

SURGICAL TECHNIQUE

The patient is placed in the supine position with the head turned 60° to the contralateral side and tilted down 30° so as to bring the frontal process of the zygomatic bone to the highest point of the surgical field. The skull is stabilized using a rotatable head holder (Mizuho-Ikakogyo, Tokyo, Japan) that allows the surgeon to rotate the patient's head at any time during the procedure (Fig. 1) (3).

A frontotemporal skin incision is made beginning just in front of the tragus over the zygomatic arch, extending upward and forward along the hairline, and terminating near the midline (Fig. 1). The majority of the superior branches of the facial nerve are anteriorly placed and thus escape the incision. The temporal muscle, in continuity with the frontal pericranium, is detached from the skull and reflected inferiorly. At the superior and lateral orbital ridges, the continuity of the pericranium and the periorbita is maintained to facilitate inferomedial displacement of the orbital contents.

The supraorbital nerve can be saved by freeing it from the supraorbital canal. For the purpose of gaining sufficient room behind the lateral orbital rim (fossa temporalis), the temporal muscle is detached along the anterior margin of the temporal fascia and retracted posteroinferiorly. By displacing the orbital contents inferomedially, the lateral and superior orbital ridges are extensively exposed (Fig. 2).

Three burr holes are drilled. The first one is in the frontal bone just above the superior ridge of the orbit and 1 cm medial to the linea temporalis; the second is in the lateral frontal bone just behind the zygomatic process, and the third is in the temporal squama, below the pterion, as low as possible relative to the temporal base. Using a chisel or an air drill, the lateral wall of the orbit is perforated just behind the frontozygomatic junction, and this opening is further widened with a rongeur toward the inferior orbital fissure (Fig. 2).

The orbital contents are displaced downward, and the first and the second burr holes are connected through the orbital roof just behind the orbital rim (Fig. 2). The orbital contents are then displaced medially and protected with a spatula, and

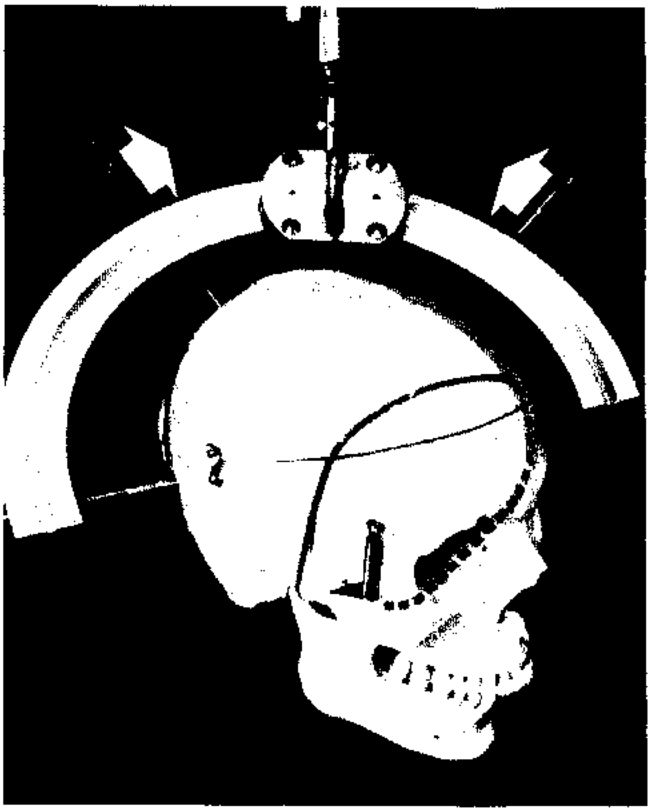

FIG. 1. Four-point skeletal fixation device. The patient's head can be rotated at any time during the procedure by loosening the lock of the device (*arrows*). The placement of the scalp incision (*solid line*) and the anterior margin of the skull exposure (*interrupted line*) are shown.

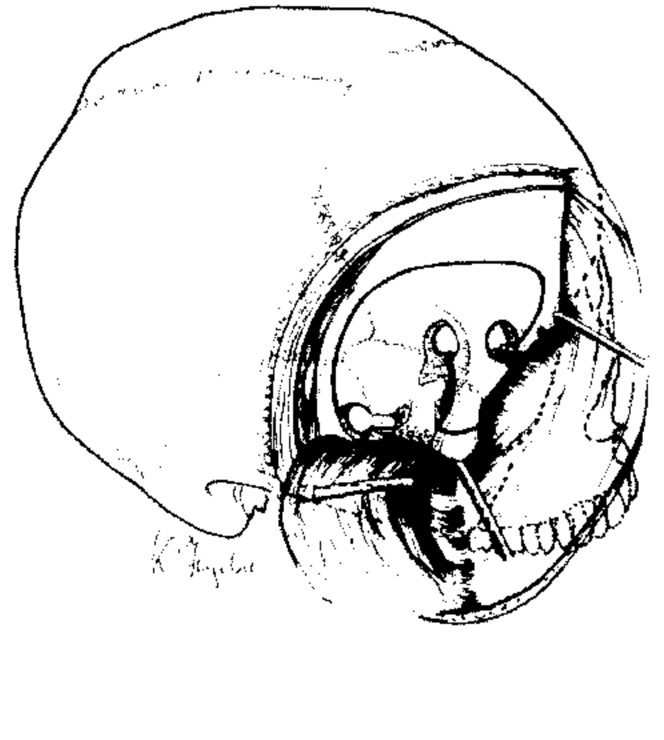

FIG. 2. Orbitocraniobasal craniotomy incorporating the superolateral rim of the orbit.

the frontal process of the zygomatic bone is cut by an electric bone saw (Fig. 2). After the first and the third burr holes are connected with a craniotome, fracture of the bone is made between the second and the third burr hole. Thus, a free bone flap is fashioned by orbitofrontotemporal craniotomy incorporating the superolateral rim of the orbit (Fig. 2).

When the lateral ventricles are large enough on computed tomography to allow withdrawal of a sufficient amount of cerebrospinal fluid (CSF), a ventricular catheter is introduced through a small dural opening at the edge of the craniotomy. If the ventricles are small, an intrathecal catheter is placed via a lumbar puncture immediately after the patient is anesthetized. Approximately 20 to 30 ml of CSF is withdrawn either by a ventricular or lumbar catheter in order to facilitate extensive removal of the bone of the skull base.

The sphenoid ridge, incorporating the lateral one-third of the orbital roof and the posterolateral wall of the orbit, is removed en bloc and saved for orbital reconstruction near the end of the procedure. The rest of the sphenoid ridge, as well as the middle one-third of the orbital roof, is drilled off with the aid of an air drill, so that the lateral end of the superior orbital fissure is eventually enlarged (Fig. 3, *left*). With a spatula retained by a self-retaining retractor, the orbital contents are compressed inferomedially in order to expose extensively the extradural basal aspect of the Sylvian fissure (Fig. 3, *right*).

The dura mater is opened in a semicircular fashion near the stem of the sylvian fissure; the intradural procedure is conducted with the aid of an operating microscope. Because

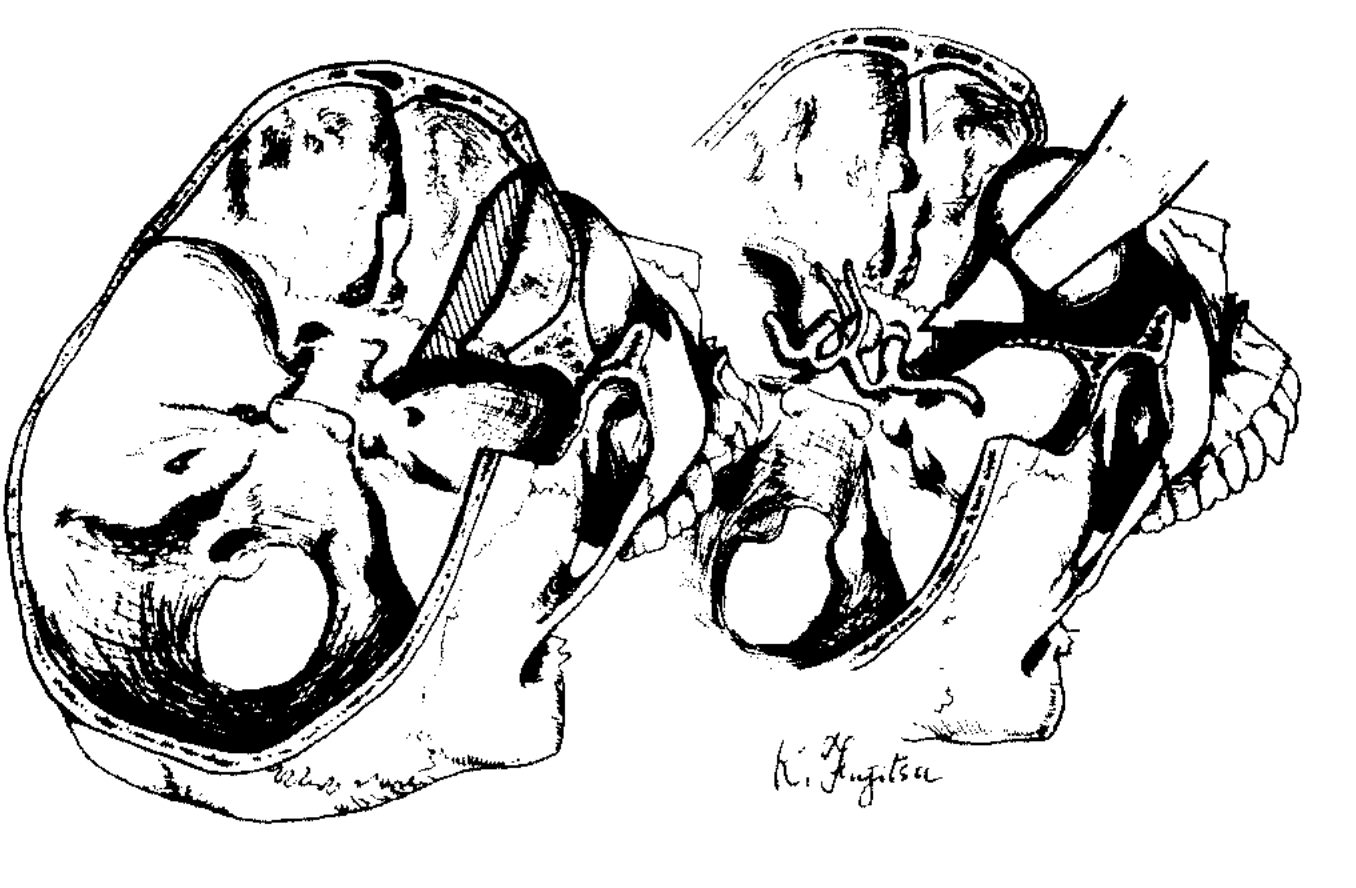

FIG. 3. *Left*, the sphenoid ridge, including the lateral one-third of the orbital roof and the posterolateral wall of the orbit, is removed (see text). The rest of the sphenoid ridge, as well as the middle one-third of the orbital roof (*striped portion*), is drilled off with the aid of an air drill, and the lateral end of the superior orbital fissure is reached. *Right*, the orbital contents are compressed inferomedially during access to the anterior communicating artery complex.

the vertex is down 30° or more and the direction of approach is nearly tangential to the basal aspect of the brain, the brain sinks greatly after aspiration of CSF through the ventricular or lumbar catheter. Inferomedial displacement of the orbital contents creates further space under the frontal lobe, so that retraction of the frontal lobe is not necessary during approach to the anterior communicating artery complex. The M-2 and M-1 portion of the middle cerebral artery, the carotid bifurcation, and the A-1 portion of the anterior cerebral artery are traced in this order with bipolar forceps, microscissors, a sucker, and a small cotton pledget. Blood clots, if present on these major vessels in the subarachnoid space, are removed to the extent possible. In cases in which a more lateral or more anterior approach is required, the patient's head is rotated by loosening the lock of the head rest (Fig. 1). When the aneurysm neck is dissected, a slender, malleable-tip spatula is gently placed on the basal aspect of the frontal lobe so the surgeon may use both hands during clip application or in the event of aneurysm rupture. After the aneurysm is clipped, the lamina terminalis is fenestrated, and a Pudenz's ventricular catheter is placed with its tip in the anterior portion of the third ventricle. Multiple small fenestrations are made in the subarachnoidal portion of this catheter, which is then connected to an external drainage set in order to rinse the subarachnoid space and to drain blood-contaminated CSF.

During closure of craniotomy, the en bloc fragment of the sphenoid wing is simply replaced without fixation on the orbital contents. The bone defect of the lateral orbital wall, as well as those of burr holes, is filled by bone fragments and bone dust collected during craniotomy for this purpose. Alkyl α-cyanoacrylate is then applied to them in order to accomplish orbitocranial reconstruction.

DISCUSSION

Among the most deeply seated aneurysms in the supratentorial compartment are anterior communicating artery aneurysms, and surgical approach to these aneurysms often requires significant retraction of the frontal lobe. Few authors have described the surgical technique of removing the orbital roof during approach to anterior communicating artery aneurysms. Yasargil et al. described a modification of the pterional approach which involves partial removal of the orbital roof and stated that this technique was used in cases with pronounced upward extension of the orbital roof (4). Partial removal of the orbital roof, however, is not really helpful in obtaining sufficient space under the frontal lobe. The roof and the posterolateral wall of the orbit, as well as the sphenoid wing, need to be removed extensively in order to reach the lateral end of the superior orbital fissure and to gain sufficient retraction of the orbital contents.

Jane et al. used a supraorbital approach in which a frontal bone flap incorporates the anterior part of the orbital roof (2). Their approach, however, is basically a classical anterior subfrontal approach and has the following technical problems. First, the anterior subfrontal approach requires greater retraction of the frontal lobe than does the lateral pterional approach, because the anterior route to the anterior communicating artery complex is much longer than the lateral route. Secondly, such a low frontal craniotomy as to incorporate the orbital roof almost always enters the frontal sinus and thereby produces considerable technical complexity. Our approach is principally by the lateral route, which is the shortest route to the anterior communicating artery complex and never enters the frontal sinus.

After aspiration of CSF through the lumbar or ventricular catheter and after retraction of the orbital contents, the surgeon is able to obtain such an ample space under the frontal lobe that a spatula is not necessary during access to the anterior communicating artery complex. Subarachnoid clots in the contralateral Sylvian stem may be removable, but removal of the subarachnoid clots in the early operation of ruptured aneurysms is always more or less partial. We believe ventriculocisternal drainage is very helpful in rinsing the subarachnoid space and draining out blood-contaminated CSF. For this purpose, fenestration of the lamina terminalis is a very useful and safe measure.

We used this orbitocraniobasal approach in eight cases with ruptured aneurysm of the anterior communicating artery in different stages of subarachnoid hemorrhage: it was used in three cases on Day 0, two on Day 1, one on Day 2, and two on Day 7.

Postoperative retraction hemorrhage was not encountered in any case. Some cases developed cerebral vasospasm of various degrees of severity, but no cases showed clinical deterioration referable to the surgical procedure.

Bradycardia due to oculocardiac reflex was experienced in one case, but this did not require interruption of the procedure. Postoperative swelling of the upper palpebrae on the operated side was a minor problem and usually required only an elastic bandage on the forehead for 1 week. Ipsilateral ocular pulsation disappeared within 48 hours of operation, and no permanent ocular problems were experienced.

We previously reported a zygomatic approach for lesions in the interpeduncular cistern (1). Combination of the orbitocraniobasal and the zygomatic approach provides an extensive exposure of the frontotemporobasal region and is suitable for surgical excision of huge suprasellar tumors. Although our experience with this approach is limited, we believe that the orbitocraniobasal approach is worthy of consideration when the surgeon is obliged to chose the lowest possible approach with minimal retraction on the frontal lobe.

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REFERENCES

1. Fujitsu K, Kuwabara T: Zygomatic approach for lesions in the interpeduncular cistern. J Neurosurg 62:340–343, 1985.
2. Jane JA, Park TS, Pobereskin LH, Winn HR, Butler AB: The supraorbital approach: Technical note. Neurosurgery 11:537–542, 1982.
3. Sugita K, Hirota T, Mizutani T, Mutsuga N, Shibuya M, Tsugane R: A newly designed multipurpose microneurosurgical head frame: Technical note. J Neurosurg 48:656–657, 1978.
4. Yasargil MG, Fox JL, Ray MW: The operative approach to aneurysms of the anterior communicating artery, in Krayenbühl H (ed): *Advances and Technical Standards in Neurosurgery*. Wien, Springer Verlag, 1975, vol 2, pp 113–170.