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Translabyrinthine Approach for Acoustic Tumor Removal

Derald E. Brackmann, MD[a,*], J. Douglas Green, Jr, MD[b]

[a]*House Ear Clinic and Institute, Los Angeles, California (DEB); and the Mayo Clinic, Jacksonville, Florida (JDG)*
[b]*Jacksonville Hearing and Balance Institute, 10475 Centurion pky N, Jacksonville, FL 32256, USA*

The translabyrinthine approach is the most direct route to the cerebellopontine angle. We believe that this approach offers many advantages for acoustic tumor removal. In this article, the indications and relative contraindications for the approach are outlined. The surgical technique is then detailed and illustrated.

Indications

Small tumors that extend no further than 5 mm into the cerebellopontine angle in patients with good hearing are usually approached via the middle fossa [1]. Larger tumors in which good hearing remains are approached via the retrosigmoid route. This route is ideal when the tumor arises more medially and is not impacted into the fundus of the internal auditory canal and does not expand the canal.

In general, the outlook for hearing preservation for acoustic tumors with greater than 2 cm extension into the cerebellopontine angle is very poor. These tumors and all tumors with poor hearing are removed via the translabyrinthine approach. There is no tumor too large to be approached via the translabyrinthine route. For large tumors, more bone removal is accomplished posterior to the sigmoid sinus to gain access.

Contraindications

The presence of chronic otitis media is a contraindication for the translabyrinthine approach. Perforations of the tympanic membrane should first be repaired, following which the translabyrinthine approach may be used when healing has occurred. In the case of a mastoid cavity, a total obliteration is first performed with blind sac closure of the external auditory canal. The translabyrinthine approach may then be performed when healing has occurred. A relative contraindication is a patient who has good hearing and a tumor amenable to a hearing conservation approach as already described.

Advantages

The translabyrinthine approach offers several advantages for acoustic tumor removal. It requires a minimum of cerebellar retraction. Exposure and dissection of the lateral end of the internal auditory canal ensures complete tumor removal from that area and allows positive identification of the facial nerve at a consistent anatomic location [2].

If the facial nerve is lost during acoustic tumor removal, the translabyrinthine approach offers the best opportunity for immediate repair by end-to-end anastomosis or interposition of a nerve graft [3].

There is a lower incidence of cerebrospinal fluid leaks with this approach compared with the retrosigmoid approach.

Finally and most importantly, this approach carries the lowest morbidity and mortality. The mortality rate for this approach is 0.4% for the last 2300 cases [4]. Experienced teams performing the retrosigmoid approach are reporting nearly equivalent mortality rates.

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* Corresponding author: House Ear Clinic, 2122 West Third Street, Los Angeles, CA 90057.

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Limitations

The obvious disadvantage of the translabyrinthine approach is the sacrifice of any residual hearing in the operated ear. The approach is therefore reserved for patients whose hearing is poor or for large tumors in which the possibility of hearing preservation is slight.

In the past, it has been said that the approach is limited to smaller tumors. As already stated, we have not found this to be true. There is no tumor too large to be approached translabyrinthine. In fact, we believe that there are advantages for large and giant tumors in that the approach puts one directly into the center of the tumor at its origin. Intracapsular removal of the tumor allows the capsule to be displaced toward the opening by surrounding brain structures.

Technique

Preparation for surgery

The patient is placed supine on the operating table with the head at the foot of the table. This allows the anesthesiologist, who is seated at the patient's feet, easy access to the controls for moving the table. The patient's head is turned toward the opposite side and maintained in a natural position without fixation. The surgeon is then seated at the patient's side. This position minimizes fatigue and allows stabilization of the arms and hands during the exacting microsurgical procedures (Fig. 1).

Instruments

Standard neurotologic instruments are used. One special instrument s used and is discussed later.

Anesthesia

General endotracheal anesthesia with inhalation agents is used. Muscle relaxants are used only for induction of anesthesia because intraoperative monitoring of facial nerve activity is routinely used. Prophylactic antibiotics or steroids are not routinely used. Occasionally with very large tumors these measures are employed. A nasogastric tube and Foley catheter are placed after the patient is asleep.

Operative technique

The suboccipital area, pinna, and ear canal are prepared with povidone-iodine (Betadine

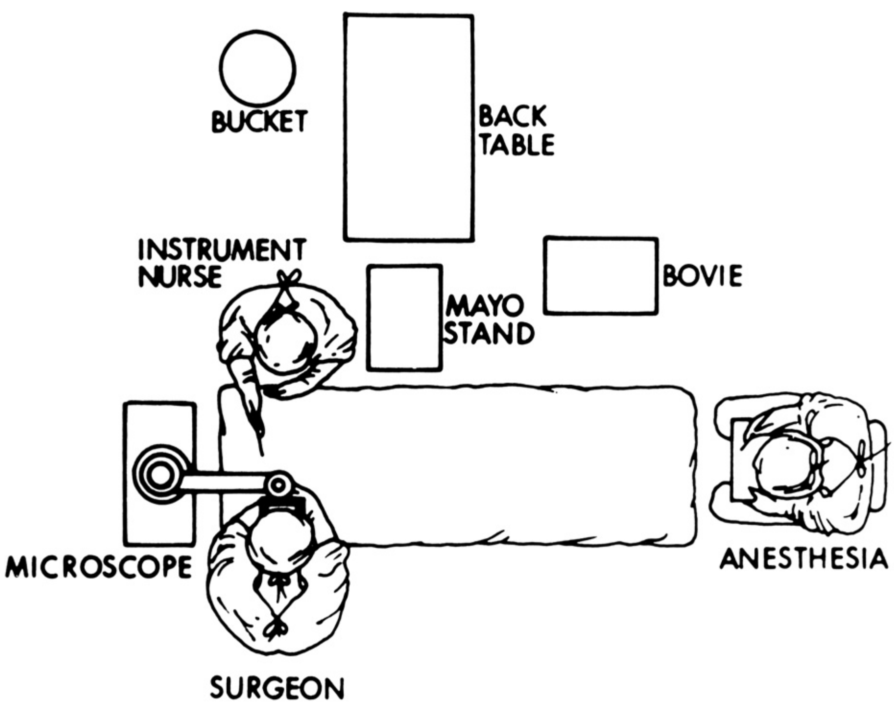

Fig. 1. Room arrangement for the translabyrinthine aproach. Note positions of surgeon, anesthesiologist, and nurse.

solution), and plastic drapes are applied. A postauricular incision is made approximately 2 cm behind the postauricular crease (Fig. 2). The incision is curved anteriorly to allow anterior retraction of the pinna. The posterior curve of the incision allows access to the area behind the sigmoid sinus. Because most of the surgical view of the cerebellopontine angle is along the plane of the posterior fossa dura, posterior access is important.

The incision first extends to the fascia temporalis, and the dissection is carried to the linea temporalis, lateral to the fascia temporalis. An incision is then made through the fascia and periosteum along the linea temporalis posteriorly to the sinodural angle and then inferiorly on the mastoid bone to the mastoid tip. The Lempert periosteal elevator is used to free the postauricular tissues from the underlying cortex, posterior to the sinodural angle and forward until the spine of Henle and the external auditory canal are identified. Care must be taken not to tear into the external auditory canal because this would introduce a possible route for infection. If this should occur, the patient is placed on prophylactic antibiotics, the defect into the external auditory canal is repaired, and the operation is continued.

Self-retaining retractors are placed to maintain the ear forward and to elevate the temporalis muscle superiorly. Suction on the posterior blade of the retractor removes excess irrigation fluid and blood from the wound.

Cortical mastoidectomy

After adequate exposure of the cortex has been obtained, bone removal is carried out with continuous suction-irrigation and a large cutting bur. Bone removal is started along the external auditory canal, and then a horizontal incision is made along the temporal line. The junction of these incisions lies over the mastoid antrum. Identification of the mastoid antrum and the lateral semicircular canal therein is the key to the beginning dissection of the temporal bone.

Bone removal continues with care taken not to undercut the mastoid cortex. The external opening must be as large as possible. The middle fossa plate is identified superiorly and the sigmoid sinus posteriorly. Removal of bone is then continued over the sigmoid sinus to the area of the posterior fossa dura. In large tumors, bone removal is carried out far behind the sigmoid sinus. In some cases, the bone is removed with a rongeur or drill as far as 2 or 3 cm posterior to the sigmoid sinus and inferiorly beneath the cerebellar hemisphere. This gives more decompression of the posterior fossa and allows room for retraction of the dura posteriorly. Care must be taken, however, not to injure the dura. Dural tears allow the cerebellum to herniate into the defect, which may result in infarction of that portion of the cerebellum.

Removal of bone over the sigmoid must be done carefully. If the cutting bur tears the sigmoid

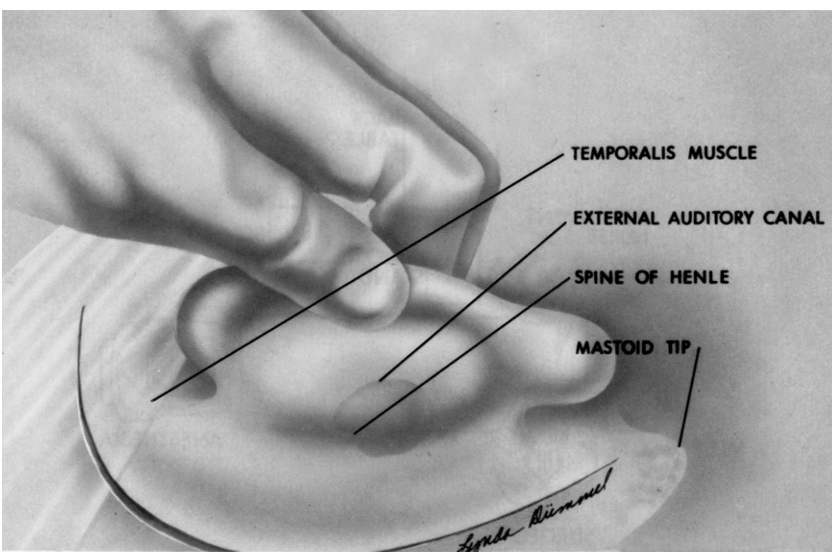

Fig. 2. Skin incision 2 cm behind the postauricular sarcous.

sinus, profuse bleeding ensues and requires packing with oxidized regenerated cellulose (Surgicel). Large emissary veins often arise from the posterior aspect of the sigmoid sinus. They can be identified through the bone as it is removed, since suction-irrigation keeps the bone clean. If the emissary vein is injured, bleeding must be controlled with bone wax, cautery, Surgicel packing, or in some cases suture of the emissary.

Complete, simple mastoidectomy

As soon as the mastoid cortex has been removed and the sigmoid sinus has been outlined, the operating microscope is brought into place. Magnification allows more accurate bone removal and exposure of all the structures of the temporal bone. A thin layer of bone is left over the sigmoid sinus and around the emissary veins, and a complete, simple mastoidectomy is performed down to the level of the horizontal semicircular canal (Fig. 3). It is important that the antrum be opened and the horizontal semicircular canal be identified. This canal is the basic landmark in temporal bone surgery. Once the position of this canal is known, the depth and three-dimensional relationship of the facial nerve and posterior and superior semicircular canals can be viewed. Expertise in temporal bone surgery depends on a thorough knowledge of the anatomy of the temporal bone and the ability to identify the structures as they are encountered. This appreciation of the anatomy comes only after many hours of diligent temporal bone dissection.

Labyrinthectomy

After the mastoid air cells have been removed to the level of the horizontal semicircular canal, labyrinthectomy is begun. Bone is removed in the sinodural angle along the superior petrosal sinus. This area, which is farthest from the facial nerve, is the key to this step in the dissection. The opening along the superior petrosal sinus is gradually deepened and widened until the labyrinthine bone is encountered. The lateral and posterior semicircular canals are then progressively removed, and the facial nerve, which lies anteriorly, is carefully approached (Fig. 4). The lateral semicircular canal is opened, and the common crus of the superior and posterior semicircular canals is identified deep in the dissection. The superior semicircular canal is followed to its ampulla. The vestibule is then opened, and the facial nerve is skeletonized from the genu inferiorly to near the stylomastoid foramen. It is not necessary to remove bone lateral to the facial nerve; rather, the facial nerve is skeletonized from a posterior direction, where access is needed to approach the cerebellopontine angle.

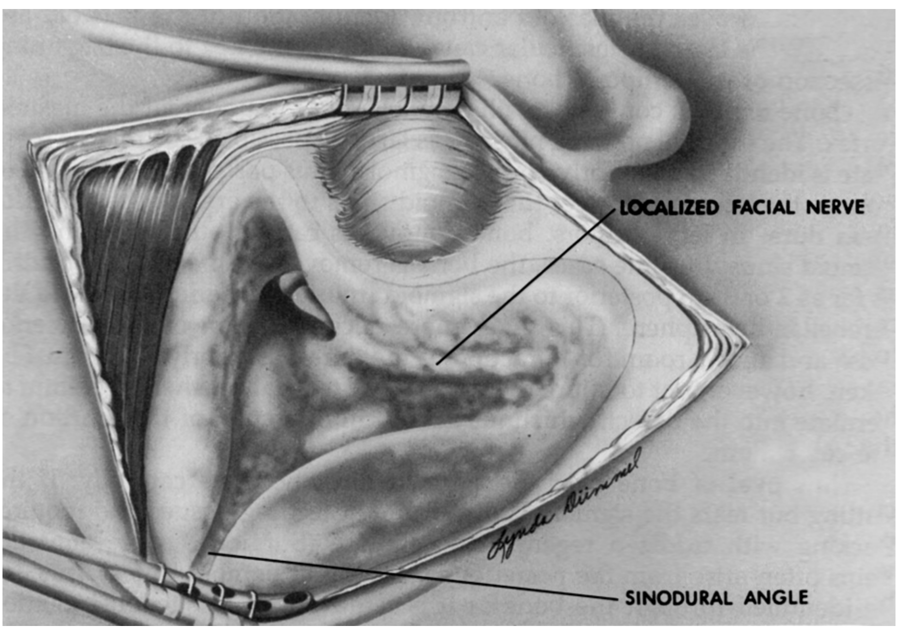

Fig. 3. Mastoidectomy is completed. Facial nerve is localized and sigmoid sinus skeletonized.

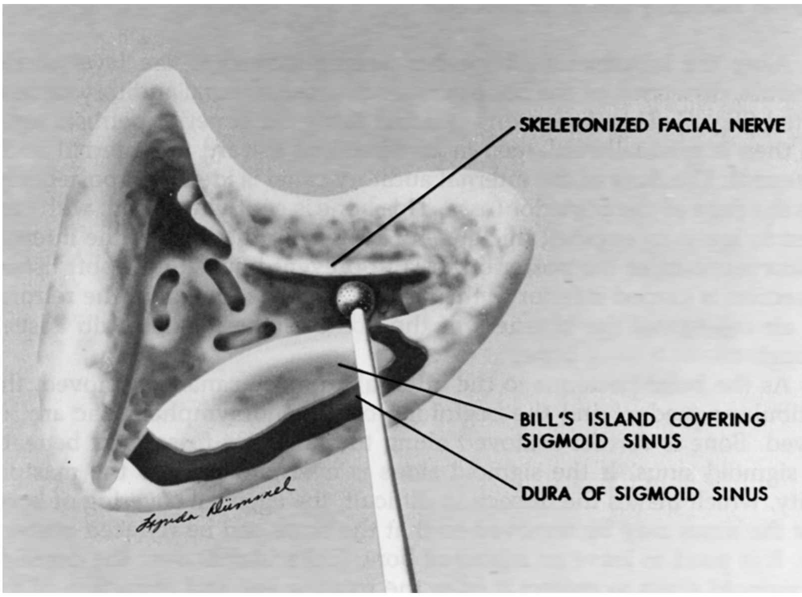

Fig. 4. Semicircular canals are opened. An island of bone over the sigmoid sinus is created.

The final removal of bone along the facial nerve is accomplished with a diamond bur. Having removed the labyrinthine bone from posterior to the nerve, the surgeon may then use the side of the diamond bur rather than the end and at all times view the plane between the side of the bur and the facial nerve. This reduces the hazard of injury to the facial nerve, which is very slight with this technique. As the facial nerve is skeletonized, the cribriform area of the superior vestibular nerve entering the vestibule is seen. It is important to skeletonize the facial nerve adequately so that the vestibule can be seen in this area (Fig. 5).

Internal auditory canal dissection

After the labyrinthine bone has been removed to the level of the vestibule, dissection of the bone surrounding the internal auditory canal is started (Fig. 6). This dissection is started along the superior petrosal sinus and then is gradually enlarged in all directions toward the internal auditory canal. The dura of the internal auditory canal is identified posteriorly, as is the dura of the posterior fossa. This bone is gently removed, with care taken to leave an eggshell thickness of bone over the dura of the internal auditory canal and the posterior fossa to prevent injury to the soft tissue. Dissection is carried inferior to the labyrinth, with removal of the retrofacial air cells, until the blueness of the dome of the jugular bulb is seen through the overlying bone.

As the bone posterior to the internal auditory canal is removed, the vestibular aqueduct and the beginning of the endolymphatic sac are removed. Bone is further removed along the posterior fossa dura beneath the sigmoid sinus. If the sigmoid sinus is overhanging into the mastoid cavity, which makes the dissection difficult, the eggshell covering of bone over the sinus may be removed so that the sinus can be retraced posteriorly. It is good to leave an island of bone (Bill's island) over the dome of the sigmoid sinus to protect it from the rotating bur and retraction of the suction-irrigation at this point.

We complete the dissection around the inferior portion of the internal auditory canal first. This is the area that is farthest from the facial nerve, and we find that completing the dissection here makes orientation to the superior portion of the internal auditory canal easier. Bone removal is continued medially and anteriorly between the dome of the jugular bulb and the internal auditory canal until the cochlear aqueduct is identified.

The cochlear aqueduct is not always readily identifiable. In large tumors, it is occluded at its

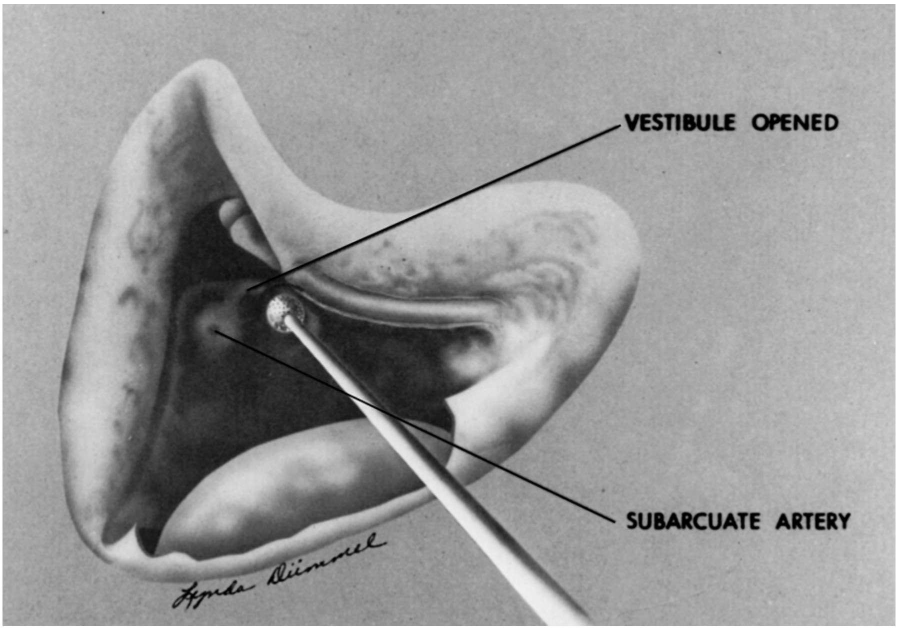

Fig. 5. Lateral and posterior semicircular canals are removed. The vestibule is opened and the facial nerve is skeletonized in its tympanic segment.

medial orifice, and spinal fluid is not likely to escape. The cochlear aqueduct enters the posterior fossa directly inferior to the midportion of the internal auditory canal above the jugular bulb. It is an important landmark because it identifies the location of the IXth, Xth, and XIth cranial nerves in the neural compartment of the jugular foramen anterior to the jugular bulb. If the dissection is

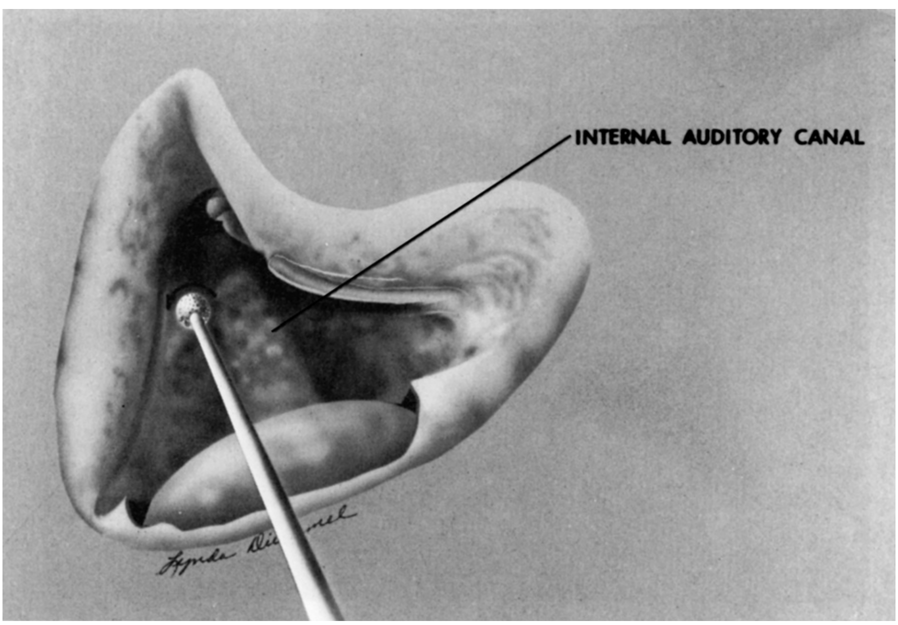

Fig. 6. The internal auditory canal is skeletonized. Note rotation of direction of bur.

confined to the area superior to the cochlear aqueduct, these nerves are not injured.

After the cochlear aqueduct has been identified, bone removal is continued around the internal auditory canal to the porus acusticus until the entire posterior lip of the internal auditory canal is removed. The diamond bur is used for these later parts of the dissection. The bone of the posterior fossa dura is then removed inferiorly until the sigmoid sinus is skeletonized. This completes the dissection inferiorly.

Dissection is then carried superiorly and anteriorly around the inter nal auditory canal. This bone removal is tedious because the facial nerve often underlies the dura along the anterior-superior aspect of the internal auditory canal. The surgeon must be very careful not to allow the bur to slip into the internal auditory canal. We prefer to remove the entire porus and the medial portion of the internal auditory canal first, leaving the dissection of the lateral end of the internal auditory canal until last. In this way the facial nerve is not exposed until most of the bone removal is completed.

Removal of the superior lip of the porus acusticus is tedious, but it is one of the most important parts of the dissection. If this is not entirely removed, the facial nerve underlies the ridge of bone at the porus and makes identification and removal of the tumor from the nerve in this area very difficult. Diamond burs are used to continue the dissection until two thirds of the porus acusticus is removed. Bone removal is then carried laterally, and the end of the internal auditory canal is exposed.

Dissection of the lateral end of the internal auditory canal begins inferiorly. The singular nerve is first identified, and bone removal done inferiorly then exposes the inferior vestibular nerve. As dissection proceeds superiorly, the transverse crest is identified. The superior aspect of the internal auditory canal is then dissected, and the facial nerve is identified as it exits the internal auditory canal and begins its labyrinthine segment. Finally the bar of bone (*Bill's bar*) separating the superior vestibular nerve from the facial nerve is identified. This completes the dissection around the internal auditory canal.

During the dissection of the internal auditory canal, an eggshell thickness of bone was left on the sigmoid sinus and the posterior and middle fossa dura. At this stage, this is removed completely, and the surgeon is ready to open the posterior fossa dura to expose the cerebellopontine angle. It is noteworthy that until this point all of the dissection has been extradural and the morbidity of the approach has been minimal.

Dural incision

The dura of the posterior fossa is then incised over the midportion of the internal auditory canal (Fig. 7). The incision then extends around the porus acusticus superiorly and inferiorly. Care is taken to avoid vessels on the surface of the tumor, and anteriorly-superiorly care is exercised to avoid injury to the facial nerve, which lies directly beneath the dura in this area. Posteriorly the petrosal vein lies just beneath the dura, and insertion of a Rosen elevator separates underlying blood vessels from the dura before incision. Keeping the deep blade of the scissors just beneath the dura prevents injury to underlying blood vessels as the incision progresses. The dural flaps are then retracted superiorly and inferiorly and Cottonoids are placed between the tumor and the cerebellum posteriorly.

An arachnoid cyst is often encountered around the posterior aspect of the tumor. The cyst is opened, and the plane of the tumor and cerebellum is further developed around the posterior aspects of the tumor. Cottonoids are advanced into this plane. It is extremely important to develop this plane accurately because doing so separates the major vessels of the cerebellopontine angle from the tumor. The operating microscope makes it possible to follow this proper plane and to a large extent has eliminated the major bleeding often associated with removal of cerebellopontine angle tumors.

As the dura is retracted posteriorly, it lies over the petrosal vein, which originates in the cerebellum and drains into the superior petrosal sinus near the level of the internal auditory canal. At times this vein is torn near its entry into the superior petrosal sinus as it is retracted posteriorly.

Bleeding from the proximal portion of the vein can be controlled by a clip. Bleeding from the superior petrosal sinus, however, is often much more difficult to manage. One means of controlling this bleeding is to fill the superior petrosal sinus with Surgicel. Another technique is to pack Surgicel extradurally over the petrous ridge at the anterior limit of the dissection. This produces extradural compression of the superior petrosal sinus and thus controls proximal bleeding. Distal back-bleeding from the sinus is controlled by

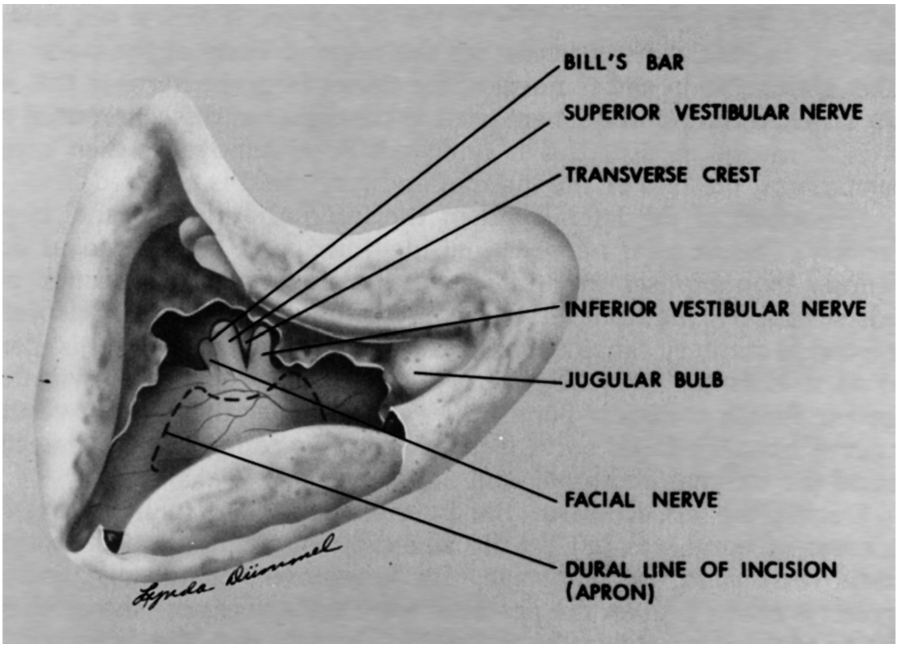

Fig. 7. Dural incision is outlined by the dashed line. An alternative method is to make a single incision over the mid portion of the internal auditory canal and then around the porus acusticus.

placing a clip on the sinus between the sinodural angle, where it enters the sigmoid sinus, and the petrosal vein.

Partial tumor temoval

In the case of a small tumor, the surgeon can begin development of the inferior and superior planes of the tumor. With a medium or large tumor, it is better to begin intracapsular removal of the tumor to reduce its size before developing the other planes.

The posterior surface of the tumor is first carefully inspected for nerve bundles. On rare occasions, the facial nerve may lie on the posterior surface of a tumor. After it has been determined that no nerve bundles are present on the posterior surface of the tumor, the capsule of the tumor is incised (Fig. 8), and intracapsular removal of the tumor is begun with the House-Urban dissector (Fig. 9). During intracapsular removal of the tumor, it is important to avoid excessive movement and pressure on the tumor because this may stretch and injure the facial nerve.

Isolating the tumor

Once the interior of the tumor has been extensively gutted, the development of the tumor plane is carried out further inferiorly and superiorly (Fig. 10). Small Cottonoids are used to develop the plane of the tumor and to separate surrounding structures. Avoidance of injury to surrounding structures is greatly facilitated by use of the fenestrated neurotologic suction tip [5]. Because the tumor has been extensively gutted, the capsule is displaced into the interior of the tumor. The surface of the capsule is then followed to the brain stem. We attempt to develop the posterior aspect of the tumor to the point where it can be seen at the brain stem, and Cottonoids are placed into this plane.

Inferiorly an attempt is made to localize the IXth cranial nerve, which can be best identified near its exit medial to the jugular bulb. In larger tumors, the IXth cranial nerve may be stretched over the surface of the tumor. This plane is carefully developed, and the IXth cranial nerve is isolated from the field with Cottonoids. During manipulation of the Vth, IXth, and Xth cranial nerves, changes in the pulse rate often occur. If these occur, we stop manipulation of the nerves and allow the vital signs to stabilize.

Often large vessels are located around the inferior aspect of the tumor, and these must be carefully separated from the tumor capsule and preserved. After the inferior aspect of the tumor

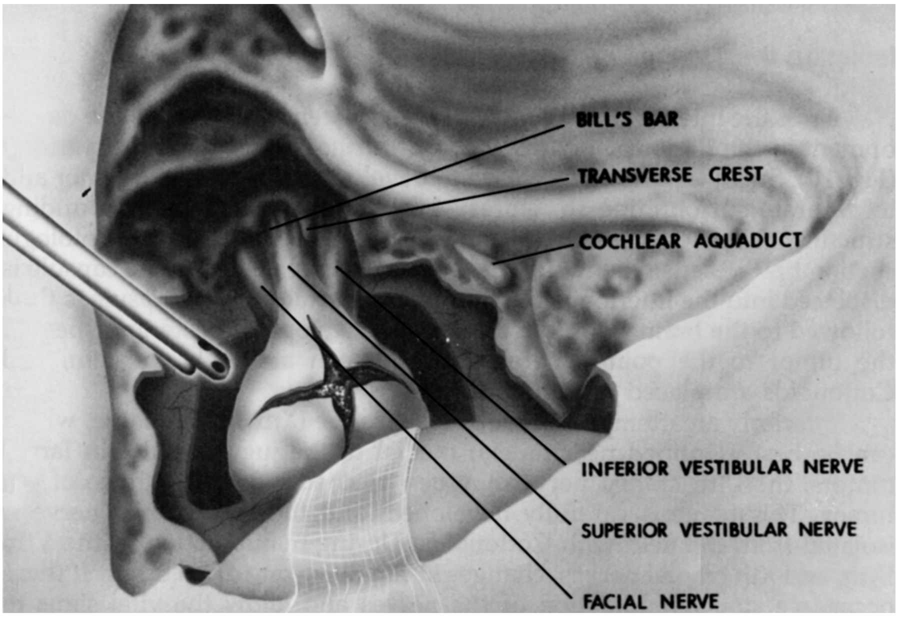

Fig. 8. The tumor capsule has been incised. Note the multiple openings in the fenestrated neurotologic suction irrigator.

has been developed down to the brain stem, additional debulking of the tumor and removal of a portion of the capsule can be completed.

The superior aspect of the tumor capsule is next developed. The petrosal vein is encountered in this location and must be carefully separated from the tumor. The facial nerve usually lies more anteriorly, but it is not unusual for it to come over the top of the tumor. The Vth cranial nerve is identified at the medial superior aspect of the

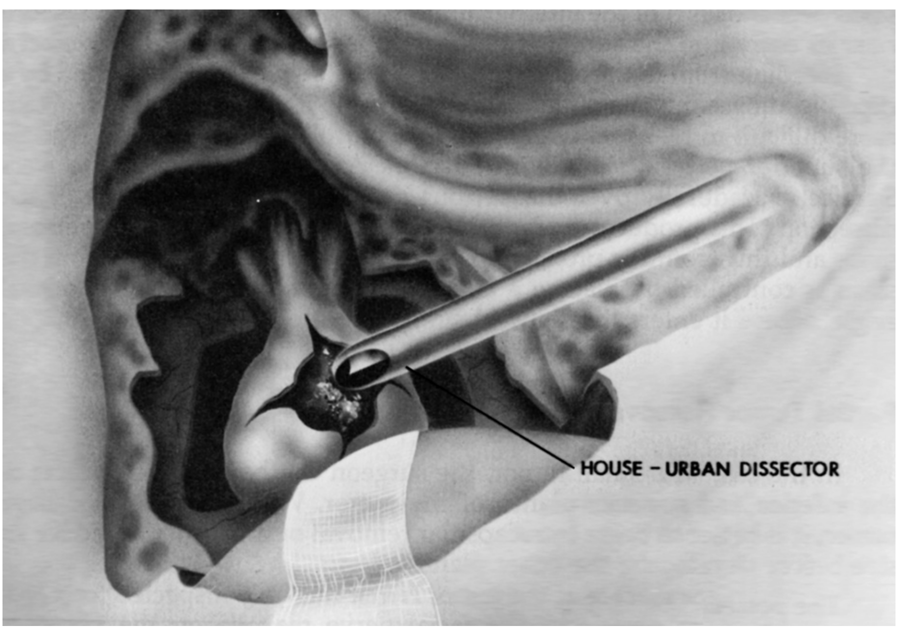

Fig. 9. The House-Urban rotating vacuum dissector begins gutting the tumor within its capsule.

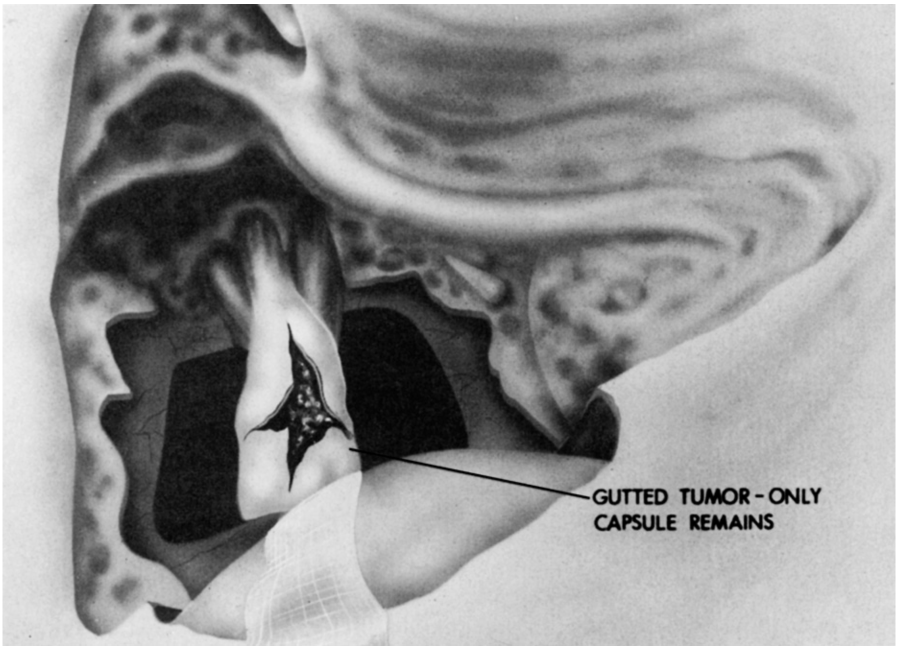

Fig. 10. The tumor is markedly reduced in size. Only the capsule remains.

tumor, and all these structures are carefully separated from the capsule and packed away from the field with Cottonoids.

Identification of the facial nerve

The lateral end of the internal auditory canal is dissected, and the plane of the facial nerve is established by uncovering the labyrinthine segment of the facial nerve. During bone removal, the vertical crest of bone (Bill's bar) separating the facial nerve from the superior vestibular nerve has been clearly identified. A long fine hook is then inserted lateral to Bill's bar to identify the superior vestibular nerve. The hook is gently passed medially and slightly anteriorly until it falls over Bill's bar into the facial nerve canal, which positively identifies the facial nerve. The hook is then withdrawn and placed beneath the superior vestibular nerve, turned inferiorly, and the superior vestibular nerve is pulled out from its canal (Fig. 11). At this point, the underlying facial nerve is seen, and the plane of the facial nerve from the tumor is definitely identified. Positive identification of the facial nerve at the lateral end of the internal auditory canal is one of the principal advantages of the translabyrinthine approach. Continuous intraoperative facial nerve monitoring is routinely used.

Next the hook is used to remove the inferior vestibular nerve, and the dura of the internal auditory canal is opened along the inferior aspect of the tumor. The dura is also opened superiorly, with great care taken to avoid the facial nerve. Incision of the dura of the internal auditory canal frees the tumor so that it can be gently retracted posteriorly away from the facial nerve. The Rosen separator and hooks are used to develop the plane carefully between the facial nerve and the tumor. The tumor is gently retracted posteriorly to bring this plane into relief. After the lateral end of the facial nerve has been definitely identified and separated from the tumor, all tumor remnants are removed from the lateral end of the internal auditory canal. The cochlear nerve is usually removed along with the tumor and the vestibular nerve (Fig. 12).

Facial nerve dissection

Usually it is relatively easy to develop the plane along the facial nerve within the internal auditory canal, but considerable difficulty often arises when the porus acusticus is reached. Dural adhesions to the surface of the tumor at the porus acusticus invariably make dissection of the facial nerve from the tumor very difficult in this area. The facial nerve usually can be followed past the area

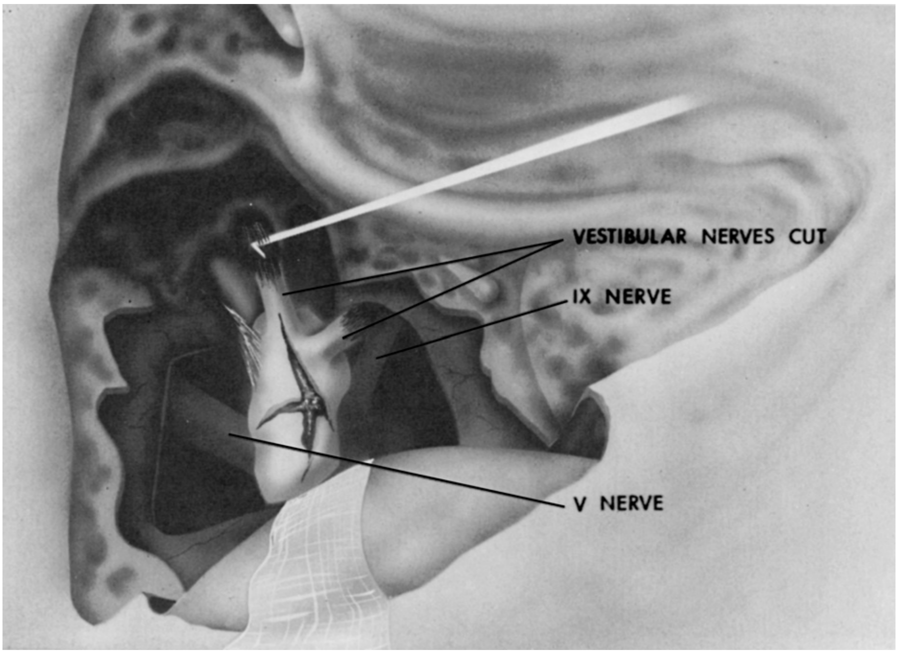

Fig. 11. A sharp hook pulls the superior vestibular nerve from the lateral end of the internal auditory canal. The inferior vestibular and cochlear nerves are also removed. Note the Vth nerve and IXth nerve in the posterior fossa.

of adhesions without undue difficulty. At times, however, this plane becomes very difficult, and we rotate the tumor posteriorly to identify the facial nerve on the tumor medially nearer the brain stem. The facial nerve is then followed medially to laterally until the plane becomes apparent, and tumor removal can be completed at the porus acusticus. During this entire dissection, the

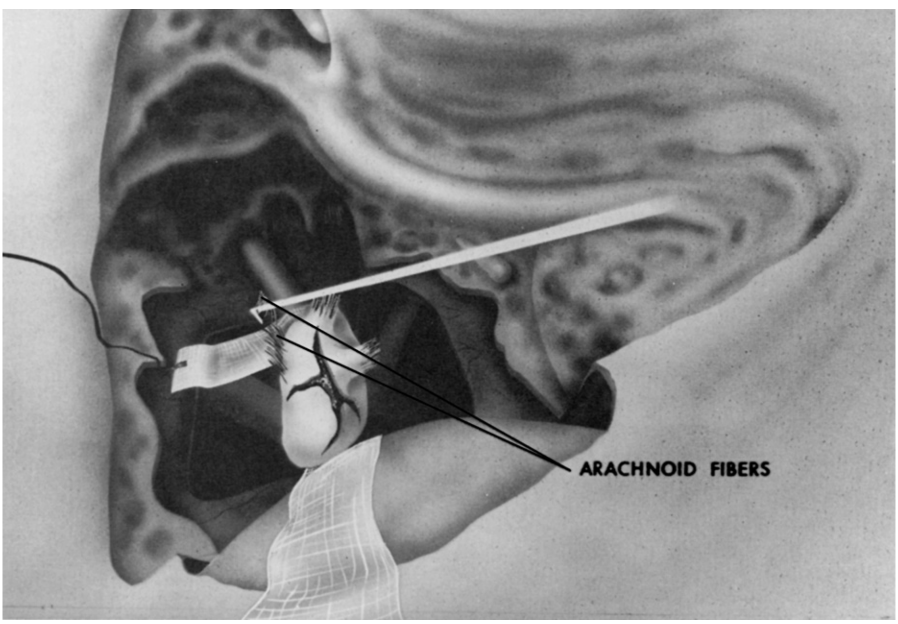

Fig. 12. The tumor is progressively freed from the facial nerve with sharp dissection.

surgeon must be careful not to push the tumor forward or medially, which would stretch the facial nerve. It is better to retract the tumor gently posteriorly and laterally, removing the stretch from the facial nerve.

Completion of tumor removal

Once the facial nerve has been separated from the tumor to the brain stem, the bulk of the tumor is removed with the House-Urban dissector, leaving only a small portion of tumor attached to the brain stem (Fig. 13). Removing the bulk of the tumor allows greater visibility of the tumor–brain stem plane. The last bit of tumor is then removed from the brain stem under direct vision. The adhesions between the tumor and the brain stem are usually not dense and can be easily separated. Bleeding in this area is controlled with bipolar cautery. Only those vessels that actually enter the tumor capsule are coagulated; the others are carefully freed from the tumor capsule. Often a small artery accompanies the VIIIth cranial nerve into the tumor. Bleeding from this artery is controlled by placing a clip on the VIIIth cranial nerve and contained artery or by bipolar coagulation.

Hemostasis and closure

After total tumor removal, the wound is profusely irrigated with Ringer's solution to remove any blood clots. The Cottonoids are then removed, and all bleeding points are controlled with either clips or bipolar cautery. Absolute hemostasis must be obtained, and this may require considerable time and effort. It is best to control bleeding with clipping or cautery rather than Surgicel packing. Using large amounts of Surgicel must be avoided because this substance expands considerably with fluid absorption and can consequently cause pressure on surrounding vessels or the brain stem.

After hemostasis is complete, the dura is sutured and the area of the mastoidectomy obliterated with strips of fat taken from the abdomen. A small piece of muscle is used to obliterate the aditus. The mastoid cavity is then filled to the surface of the cortex with strips of abdominal fat, and the postauricular incision is closed in layers. The skin is closed with interrupted subcuticular sutures. The patient is kept on the operating table until responding well and then is transferred directly to the intensive care unit.

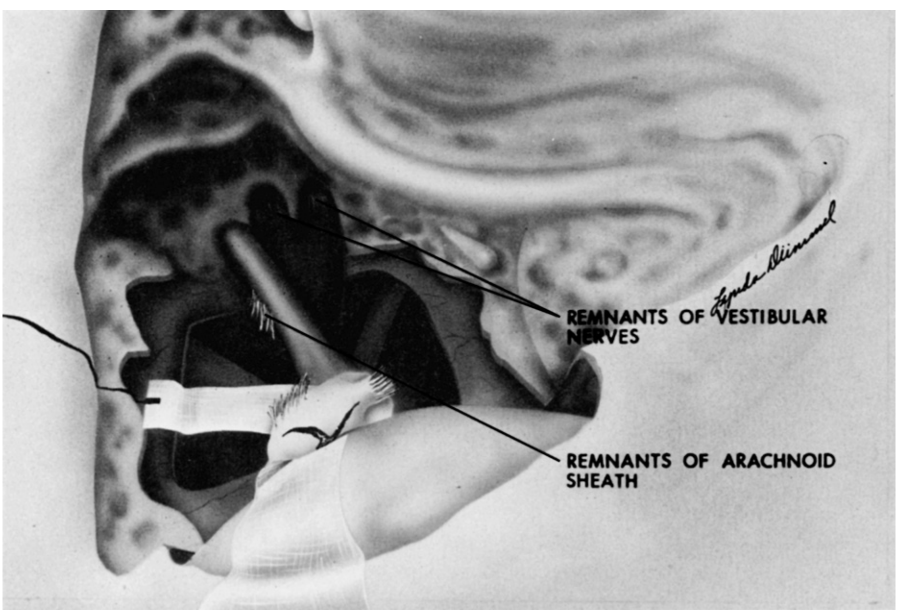

Fig. 13. The tumor has been freed from the facial nerve. It is now carefully dissected from the brain stem, completing tumor removal.

Perioperative management

The patient is observed in the intensive care unit for a period of 36 hours postoperatively. Steroids or antibiotics are not routinely used. In some patients with very large tumors that exhibit signs of cerebellar swelling, we do use steroids in the immediate postoperative period. Osmotic diuretics, fluid restriction, or lumbar drainage is not routinely employed. A standard mastoid dressing remains in place for 4 days, and the patient is instructed not to lift or strain during the early postoperative period.

We encourage early ambulation, and the patient is walking by the 2nd or 3rd postoperative day. It is rare for patients to require postoperative physical therapy, although this may be used for patients with unusual degrees of unsteadiness or ataxia.

Complications and management

Although rare, the most common early postoperative complication is a hematoma in the cerebellopontine angle. This is manifested by signs of cerebellopontine angle pressure and is managed by immediate opening of the wound and removal of the fat in the intensive care unit. This is a further advantage of the translabyrinthine approach in that the angle may be rapidly decompressed for this uncommon complication. The patient is then taken to surgery, where complete hemostasis is obtained and the wound again closed with abdominal fat.

Meningitis is an uncommon complication and is managed in the usual manner with appropriate antibiotics following culture and identification of the offending organism.

Postoperative cerebrospinal fluid leakage is an unusual complication of the translabyrinthine approach. Rarely these leaks occur through the postauricular incision. These may be controlled by resuturing the wound with an interlocking stitch and reapplication of the mastoid dressing. An occasional patient may have cerebrospinal fluid rhinorrhea after the mastoid dressing is removed. We first reapply a pressure dressing. If that is ineffective, a lumbar drain may be inserted for 3 or 4 days and the patient placed on bed rest. If these conservative measures fail, the wound is reopened and the fat is repositioned. The usual source of leakage is at the anterior margin of the labyrinthine bone removal, and additional fat is placed in this area.

If these measures fail to control the leak, another approach is used. The ear canal is transected and the skin of the meatus everted and closed. The mastoid periosteum is freed and sutured anteriorly to reinforce the meatal closure. The skin of the ear canal is removed completely along with the tympanic membrane, malleus, and incus. The eustachian tube is then firmly packed under direct vision with Surgicel and temporalis muscle. The middle ear is filled with muscle and the postauricular incision closed. A firm pressure dressing is applied and left in place for 3 to 4 days. In our experience, this technique has always been successful in closing cerebrospinal fluid leaks.

If facial weakness occurs, eye care is provided by a consulting ophthalmologist. Conservative measures are first used, including artificial tears, moisture chambers, and soft contact lens. If these measures fail to provide adequate corneal protection, a palpebral spring is inserted. The latter procedure is more commonly necessary when there is a concomitant Vth cranial nerve deficit with corneal anesthesia.

One of the advantages of the translabyrinthine approach, particularly compared with the retrosigmoid approach, is the reduced incidence of postoperative headache. It is unusual for headache to persist beyond the immediate postoperative period.

Because there is little cerebellar retraction, cerebellar dysfunction is unusual with the translabyrinthine approach.

Discussion of series

The House Ear Clinic series numbers over 2700 acoustic tumors as of October 1989. The results in the first 700 patients have been previously published [4]. With experience and refinements in technique, the results have improved throughout the years. Most recently we have studied the results in 216 patients who underwent surgery for acoustic tumors in 1980 and 1981 [2]. The average age of these patients was 47.3 years, and the group was equally divided into male and female.

Tumor size, measured on cranial computed tomography, is reported as extension into the cerebellopontine angle. Small tumors are those that extend less than 0.5 cm into the cerebellopontine angle; 20 of the 216 (9%) fit this category. Medium tumors, which are considered those that extend from 0.5 to 2 cm into the cerebellopontine angle, numbered 110 (51%). Large tumors are those extending from 2 to 4 cm into the cerebellopontine angle; this group included 67 (31%) of the tumors. Tumors that extended more than 4 cm into the cerebellopontine angle are considered giant tumors; 19 patients (9%) had tumors of this size.

The average length of surgery was 3 hours and 12 minutes. There was one death in this series (0.4%). The patient had a postoperative hemorrhage and, despite early evacuation of the clot, sustained brain stem infarction and died.

Facial nerve function was studied 1 year after surgery. At that time, 180 patients (83%) had normal facial function. There was a partial paralysis in 34 patients (16%). In four of these patients, the facial nerve had been divided during tumor removal; they underwent immediate facial anastomosis in the cerebellopontine angle and had satisfactory recovery of facial function. Two patients had total facial paralysis 1 year after surgery; they then underwent hypoglossal facial anastomosis and had satisfactory recovery of facial function.

There was a direct correlation between preservation of normal facial nerve function and size of tumor. All 20 patients with small tumors had normal facial function at 1 year. Of the patients with medium-sized tumors, 85% had normal facial function. In the group with large tumors, 81% of the patients had normal facial function. Of those patients with giant tumors, 63% had normal facial function 1 year after surgery. Despite this correlation, it must be noted that some patients with relatively small tumors may have invasion of the facial nerve and thus incomplete recovery. Therefore the surgeon must be careful not to be overly optimistic in patient discussion even when the tumor is a small one.

Summary

The translabyrinthine approach is the preferred method for removal of all sizes of acoustic tumors when there is nonserviceable hearing.

References

[1] Shelton C, Brackmann DE, House WF, et al. Middle fossa acoustic tumor surgery: Results in 106 cases. Laryngoscope 1989;99:405–8.

[2] House WF, Leutje CM, editors. Acoustic Tumors, vol 1. Baltimore: University Park Press; 1979.

[3] Brackmann DE, Hitselberger WE, Robinson JV. Facial nerve repair in cerebellopontine angle surgery. Ann Otol Rhinol Laryngol 1978;87:772–7.

[4] Brackmann DE, Hitselberger WE, Benecke JE, et al. Acoustic neuromas: Middle fossa and translabyrinthine removal. In: Rand RW, editor. Microneurosurgery. St. Louis: CV Mosby; 1985.

[5] Brackmann DE. Fenestrated suction for neuro-otologic surgery. Trans Am Acad Ophthal Otolaryngol 1977;84:975.