Removal of Selected Infralabyrinthine Lesions Without Facial Nerve Mobilization

Abstract—The infralabyrinthine approach can be modified for the removal of certain lesions without facial nerve mobilization. This procedure is to be used for lesions falling under the three following categories: glomus jugulare tumors, infralabyrinthine cholesteatomas, and cholesterol cysts of the temporal bone. This report includes three glomus jugulare tumors (C1 Fisch type) and five infralabyrinthine cholesteatomas operated on with such a technique. Some anatomic data concerning access to the infralabyrinthine area are analyzed. This technique requires very good preoperative imaging screening and is made easier by intraoperative facial nerve monitoring. It can be combined with the translabyrinthine and transcochlear approaches and, if necessary, be modified into an infratemporal approach at any time. (*Skull Base Surgery, Volume 2, Number 4, 1992, p. 220*)

Chemodectomas, infratemporal cholesteatomas, and cholesterol cysts of the temporal bone can have extensions under the labyrinth.

In some of these cases, facial nerve mobilization can be avoided by the use of an infralabyrinthine approach, thus reducing the risk of permanent facial dysfunction.¹⁻⁴ In 1978, Fisch⁵ described the infratemporal approach. In this approach the facial nerve is mobilized and transposed anteriorly from the stylomastoid foramen to the geniculate crest. This widely exposes the infralabyrinthine compartment of the temporal bone. The infralabyrinthine approach has since been given up, for the most part.

However, some authors have recently stressed the fact that on some occasions the facial nerve should not be transposed, thus avoiding any kind of facial injury.⁶⁻⁸

ANATOMIC CONSIDERATION

The posterior access to the infralabyrinthine area is limited by: the third portion of the facial nerve laterally, the inferior part of the labyrinth above, the jugular bulb inferiorly, the lateral sinus behind, and the dura of the posterior fossa on the medial side.

When there is good development of the infralabyrinthine cells, drilling them away and skeletonizing the facial nerve can provide good access to the infralabyrinthine area. On the contrary, when the lateral and the sigmoid sinus are anterior, the access is quite narrow. An anterior transposition of the facial nerve is then necessary to allow sufficient access to the infralabyrinthine compartment.

PATIENTS AND METHODS

Patients

Three Fisch class C1 chemodectomas and five temporal bone cholesteatomas with infralabyrinthine extensions are reported. In each case we operated on the patient using an infralabyrinthine approach without facial mobilization.

Except for one case of a chemodectoma operated on with an intact canal wall tympanoplasty, all the remaining cases have undergone a canal wall down technique.

In two cases a transcochlear approach and in one a middle fossa translabyrinthine and transcochlear ap-

proach have been combined with the infralabyrinthine approach to remove the cholesteatoma.

TECHNIQUE

The infralabyrinthine approach usually uses a post-auricular incision extended into the neck as in an infra-temporal approach. An anteriorly based flap is created from the mastoid periosteum and soft tissues. A circumferential incision of the posterior skin of the external auditory canal (EAC) is performed and the tympanomeatal flap is elevated to give access to the tympanic cavity. The vital neurovascular anatomy of the neck is exposed for control, as is the facial nerve at the stylomastoid foramen in the parotid.

A complete mastoidectomy is performed with an extended facial recess. The mastoid portion of the facial nerve inferior to the labyrinth is completely skeletonized. The lateral sinus, the jugular bulb, and the dura of the posterior fossa are exposed.

If the lesion has only a small anterior extension, the use of a canal wall up technique is sometimes possible (Fig. 1). However, in most cases a canal wall down technique must be carried out in order to manage the anterior part of the lesion (Fig. 2). At the end of the open cavity procedure, a meatoplasty is performed and a large graft of fascia is placed under the tympanic remnants, closing the tympanic cavity and covering the attic of the mastoid and most often the exposed retrofacial region. If the ear function is preserved, an ossiculoplasty is associated.

The surgical bone removal very often follows the bony destruction induced by the lesion. If it invades the bony labyrinth, a translabyrinthine approach and a transcochlear approach are combined (Fig. 3). Obliteration of the operative cavity with fat tissue and transection and closure of the EAC are needed in some cases to prevent cerebrospinal fluid (CSF) leak.

The extension of the lesion toward the lateral and the

Figure 1. Infralabyrinthine approach preserving the external auditory canal.

Figure 2. Infralabyrinthine approach with canal wall down technique and control of the tympanic part of the internal carotid artery.

Figure 3. Infralabyrinthine approach combined with a canal wall down, a translabyrinthine, and a transcochlear approach.

sigmoid sinus is not a significant problem. The infralabyrinthine approach only permits removal of lesions that have no or very little intraluminal extension. If the lesions deeply invade the lateral and the sigmoid sinus, transposing the facial nerve is then necessary to remove them. Moreover the technique is inadequate in exposing tumor

involvement of deep aspects of the posterior fossa dura, medial aspect of the carotid artery, and the areas deep to the stylomastoid foramen. In such cases the facial nerve must be transposed to remove the lesions. Therefore, in addition to careful clinical and audiologic examination, very good preoperative imaging screening is necessary.

Although we never needed to do it, this infralabyrinthine approach can be modified anytime if necessary by transposing the facial nerve, as in an infratemporal approach.

For 3 years intraoperative facial nerve monitoring has been systematically used in this type of surgery and has proved particularly helpful.

CASE REPORTS

Case 1

A 39-year-old man had been complaining for 1 month of right-sided pulsating tinnitus. Otoscopy showed a red lesion behind the tympanic membrane. An audiogram revealed normal hearing. A computed tomography (CT) scan and an arteriography showed a small lesion in the tympanic cavity consistent with a chemodectoma. The patient underwent a right endaural approach (4/25/1983). The lesion removal seemed to be complete.

Two years later, the tinnitus returned and a recurrence was suspected. An audiogram revealed mild conductive hearing loss. A CT scan (Fig. 4) and arteriography (Fig. 5) showed clearly a Fisch class C1 chemodectoma recurrence.

The patient underwent a right infralabyrinthine approach (8/26/1985). A complete mastoidectomy with the

Figure 4. Coronal scan showing an erosion of the bony structures separating the middle ear and the jugular fossa, case 1.

Figure 5. Arteriography showing the chemodectoma, case 1.

canal wall down technique, facial nerve skeletization, lateral sinus and jugular bulb exposure were performed. The chemodectoma had no intraluminal extension into the jugular bulb. The lesion was totally removed without opening the jugular bulb and without facial nerve mobilization or facial paralysis. An open tympanoplasty technique was carried out. A large graft of fascia was placed under the tympanic remnants closing the tympanic cavity and covering posterior cavities. A head of a malleus was set on the head of the stapes as an ossiculoplasty.

Five years later no tumor recurrence could be noticed.

Case 2

A 49-year-old man was complaining of 1-year left-sided deafness without tinnitus or vertigo. Otoscopy showed a red pulsating lesion in the middle ear cavity extending into the EAC. An audiogram revealed a total homolateral anacusis. A CT scan (Fig. 6), magnetic resonance imaging (MRI) (Fig. 7), and arteriography (Fig. 8) showed a Fisch class C1 lesion. A preoperative selective embolization was performed 2 days before surgery.

On July 6, 1990, the patient underwent a left infralabyrinthine approach with the same technique as described in case 1. In addition, the internal carotid artery was exposed in its tympanic portion because of an extension of the chemodectoma. The lesion extended from the jugular bulb and the lateral sinus into the tympanic cavity, invading the labyrinth, reaching the eustachian tube and the internal carotid artery on a large part of its tympanic portion. Nevertheless, there was no deep intraluminal extension of the tumor into the lateral sinus or the jugular

Figure 6. Coronal scan showing an erosion of the infralabyrinthine cells and of the bony structures separating the middle ear and the jugular fossa, case 2.

bulb. The lesion could be totally removed without vein injury or facial mobilization. The patient showed very little facial paresis, which completely disappeared 2 months after surgery.

Case 3

A 59-year-old woman had left facial hemipasmus without tinnitus or deafness for 3 months.

Otосcopy showed a red pulsating lesion in middle ear cavity. The MRI (Fig. 9) and arteriography (Fig. 10)

Figure 8. Arteriography showing the vascularization of the chemodectoma, case 2.

Figure 7. Magnetic resonance imaging without gadolinium. Coronal view showing a large infralabyrinthine lesion, case 2.

Figure 9. Magnetic resonance imaging without gadolinium. Axial view showing a Fisch C1 chemodectoma, case 3.

Figure 10. Arteriography showing the vascularization of the chemodectoma, case 3.

Figure 11. Arteriography after embolization of the lesion, case 3.

revealed a Fisch C1 chemodectoma. Preoperative selective embolization was performed 2 days before surgery (Fig. 11).

An infralabyrinthine approach preserving the EAC was performed (2/18/1991) because the patient had normal hearing.

The lesion surrounded the third portion of the facial nerve. It developed from the jugular bulb and extended through the middle ear cavity but did not involve the internal carotid artery. A small part of the tumor could not be removed because of its bleeding. It was left in the jugular bulb; removing it completely would have required facial nerve mobilization.

Two months later, the patient no longer had facial hemispasms and could enjoy normal hearing.

Case 4

A 38-year-old man presented with left-sided total deafness and persistent otorrhea in spite of a radical mastoidectomy performed 11 years before for a cholesteatoma. An operation was performed on April 4, 1980, and an extensive recurrent cholesteatoma was found, reaching the dura of the posterior fossa, the lateral sinus, and the jugular bulb, spreading into the tympanic cavity, invading the cochlea, and denuding the internal carotid artery.

Because of a recurrence confirmed by a CT scan and MRI, the patient underwent a left transcochlear and infralabyrinthine approach on April 19, 1989.

The lesion was completely removed without facial nerve mobilization.

Adipose tissue was placed into the cavity covered by a large graft of fascia in order to prevent CSF leak. The EAC was left open. No facial paresis occurred. Two years later there was no sign of cholesteatoma recurrence.

Case 5

A 26-year-old patient was referred to us because of a right facial palsy that occurred after an operation performed with an endaural approach in order to treat a cholesteatoma. An audiogram showed total homolateral deafness. A CT scan revealed a supra-, retro-, and trans-labyrinthine cholesteatoma.

A middle fossa and translabyrinthine combined approach was performed (10/6/1982). No facial nerve mobilization was used in order to prevent aggravation of the facial paralysis in spite of some squamous remnants probably left in the area of the jugular bulb. We must emphasize the fact that an infratemporal approach would probably have allowed a better removal of the lesions. Adipose tissue was placed into the cavity covered by a large graft of fascia in order to prevent a CSF leak. The EAC was left open. Within 6 months, the facial paralysis was almost completely resolved.

Three years later, because of a cholesteatoma recurrence, an infralabyrinthine and transotic combined approach was performed (10/22/1985). The operation allowed complete removal of the lesions without facial nerve mobilization. A graft was placed to cover the transotic wound but the open technique was preferred for better postoperative observation. No facial paralysis occurred. Six years later, there was no cholesteatoma recurrence.

Case 6

A 30-year-old man already operated on elsewhere six times was sent to us in order to treat a right temporal bone cholesteatoma recurrence. An audiogram showed total homolateral deafness. CT scan revealed an infralabyrinthine petrous bone erosion.

An infralabyrinthine approach was performed on November 27, 1981. The lesion spread along the posterior fossa dura, the lateral and sigmoid sinus, reaching the tympanic cavity, passing under the third portion of the facial nerve.

The cholesteatoma was removed without facial nerve mobilization. An open tympanoplasty technique was used without closing the EAC. No facial paralysis occurred.

Ten years later, there was no cholesteatoma recurrence, but the cavity has been partially obliterated.

Case 7

A 25-year-old woman who had gone through previous surgical treatment 7 years before was referred to us because of a left temporal bone cholesteatoma recurrence. An audiogram showed total homolateral deafness. A CT scan revealed an infralabyrinthine and transcochlear extension of the lesion.

An infralabyrinthine and transcochlear combined approach was utilized (5/25/1982).

The cholesteatoma, which invaded the cochlea and spread along the posterior fossa dura, the lateral and the sigmoid sinuses, and under the third portion of the facial nerve, was removed without facial nerve mobilization. An open technique was used without EAC closure. No facial paresis occurred.

No cholesteatoma recurrence could be noticed 9 years later.

Case 8

A 34-year-old woman who had gone through previous surgical treatment in both ears consulted us because of a right ear cholesteatoma.

An audiogram revealed mild bilateral conductive hearing loss. A CT scan showed an erosion of the infralabyrinthine cells.

On October 7, 1989, the patient underwent a right transmastoid infralabyrinthine approach without facial nerve mobilization. The cholesteatoma spread along the posterior fossa dura, the lateral and the sigmoid sinus, reaching the tympanic cavity, passing under the third portion of the facial nerve. Some squamous epithelial cells, which adhered too much to the jugular bulb, were left and a wrapped up Silastic sheet was put around the third portion of the facial nerve (Fig. 12). Four months later, the Silastic sheet was removed. No facial paralysis occurred.

One year later, there was no cholesteatoma recurrence (Fig. 13), as surveyed through the open cavity.

Figure 12. Wrapped up Silastic sheet put all around the third portion of facial nerve, case 8.

Figure 13. The cavity is perfectly dry with no cholesteatoma recurrence in the infralabyrinthine area under the third portion of the facial nerve, case 8.

old patient, who was the only one operated on with a canal wall up technique, a very small part of the tumor was left in the jugular bulb.

In all but one case the infralabyrinthine cholesteatomas were removed completely with no evidence of recurrence several years later. In the one remaining case some squamous epithelial cells, which adhered too much to the jugular bulb, were left.

The postoperative facial function was normal in seven cases. In one case a light paresis occurred that completely disappeared 2 months after surgery.

RESULTS

A Fisch class C1 chemodectoma was completely removed from two patients. In a third case, in a 59-year-

DISCUSSION

Certain glomus jugulare tumors, infralabyrinthine cholesteatomas, and cholesterol cysts of the temporal bone

can be removed without facial nerve mobilization, using an infralabyrinthine approach if the infralabyrinthine cells are well developed.

Glomus jugulare tumors pose the main problem. Removing them with the infralabyrinthine approach is only possible if they do not have a large intraluminal extension into the lateral or sigmoid sinus and if they do not involve deep aspects of the posterior fossa dura medial aspect of the carotid artery and the areas deep to the stylomastoid foramen.

Recent imaging techniques, including high resolution CT scan and MRI with and without gadolinium, now perfectly show the size of the tumor and its relationship with the surrounding structures.⁹ Lateral and sigmoid sinus intraluminal extension can be precisely determined preoperatively. The infralabyrinthine approach can be modified anytime if necessary by transposing the facial nerve.

In case 3 a small part of the tumor was left in the jugular bulb. Because it was a Fisch class C1 tumor, the lesion could probably have been completely removed by transposing the facial nerve in its mastoid portion only, as in the technique described by Jackson et al.⁷ Nevertheless, the patient was 59 years old and we preferred to leave a small part of this slow-growing tumor rather than to risk a facial palsy.

Infralabyrinthine cholesteatomas are not so unusual.^{10,11} Lesions extending along the posterior dura fossa, the lateral and sigmoid sinus, reach the tympanic cavity passing under the third portion of the facial nerve. In most cases they invade the bony labyrinth, inducing total hearing loss.^{10,11} In these cases a translabyrinthine or transcochlear approach will be combined with the infralabyrinthine approach.

High resolution CT scan shows the temporal bone erosion and MRI reveals a soft tissue mass more prominent on T₂ than on T₁ views.

Removing the cholesteatoma from the facial nerve, the posterior fossa dura, and the lateral and sigmoid sinus can sometimes be very difficult. The combination of a subtotal petrosectomy with the infratemporal fossa type A approach¹² is then needed. Nevertheless, in our experience, in most cases the lesions can be removed without facial nerve mobilization. If some epithelial cells cannot be removed from the vein or the dura without inducing large injuries, the technique described in case 8 can be employed. A wrapped up Silastic sheet can be placed around the third portion of the facial nerve and left for 3 or 4 months. It will facilitate the cicatrization of the "open technique" while leaving the infralabyrinthine area easy to observe.

To treat cholesterol cysts of the petrous apex, the

infralabyrinthine approach is the procedure of choice when hearing preservation is desired.⁸

CONCLUSION

Certain glomus jugulare tumors, infralabyrinthine cholesteatomas, and cholesterol cysts of the temporal bone can be removed using an infralabyrinthine approach without facial nerve mobilization in order to avoid any facial nerve injury.

This procedure can be used if there is good development of the infralabyrinthine cells. It is also limited to lesions that do not have large intraluminal extensions into the lateral and sigmoid sinus and do not involve deep aspects of the posterior fossa dura, medial aspect of the carotid artery, and the areas deep to the stylomastoid foramen.

The technique requires good preoperative imaging screening, is facilitated by intraoperative facial nerve monitoring, and, if necessary, can be modified to a classic infratemporal approach at anytime by transposing the facial nerve.

REFERENCES

1. House WF, Glasscock ME: Glomus tympanicum tumors. *Arch Otolaryngol* 87:550-554, 1986
2. Portmann M: Quelques cas de tumeurs glomiques envahissantes de l'os temporal. *J Fr Otorhinolaryngol* 20:25-28, 1971
3. Spector GJ, Maisel RH, Ogura JH: Glomus tumors in the middle ear. Analysis of 46 patients. *Laryngoscope* 83:1652-1762, 1973
4. Charachon R, Junien Lavillauroy C: Intérêt de la voie inter-sinus-faciale sous labyrinthe. *Ann Otolaryng (Paris)* 92:445-449, 1975
5. Fisch U: Infratemporal fossa approach to tumors of the temporal bone and base of the skull. *J Laryngol Otol* 92:949-967, 1978
6. Leonetti JP, Matz GJ, Smith PG, Beck DL: Facial nerve monitoring in otologic surgery: clinical indications and intraoperative technique. *Ann Otol Rhinol Laryngol* 99:911-918, 1990
7. Jackson CG, Cueva RA, Thedinger BA, Glasscock ME: Conservation surgery for glomus jugulare tumors: The value of early diagnosis. *Laryngoscope* 100:1031-1036, 1990
8. Goldofsky E, Hoffman RA, Holliday RA, Cohen NL: Cholesterol cysts of the temporal bone: Diagnosis and treatment. *Ann Otol Rhinol Laryngol* 100:181-187, 1991
9. Phelps PD: Imaging jugulo-tympanic glomus tumors. *Arch Otolaryngol Head Neck Surg* 116:940-945, 1990
10. Charachon R, Martin Ch., Gratacap B, Perron X: Les cholestéatomas intra-pétreux. A propos de 42 cas. *Ann Oto Laryngol (Paris)* 105:567-579, 1988
11. Charachon R, Martin Ch., Gratacap B, Perron X: Temporal bone cholesteatoma. Neurological surgery of the ear and the skull base. Proceedings of the Sixth International Symposium, Zurich, May 28-June 2, 1988. Kugler & Chedini, 1988, pp 21-28
12. Fisch U, Mattox D: Microsurgery of the skull base. New York: Thieme Medical Publishers, 1988