Periaqueductal Approach to Cholesterol Granulomas of the Petrous Apex

Abstract—The periaqueductal approach for the drainage of cholesterol granulomas of the petrous apex is described. As with previously reported approaches, the periaqueductal approach takes advantage of the high pneumatization of the temporal bone in this disease. It requires dissection of the supralabyrinthine air cell tract as well as air cells medial to the posterior semicircular canal. This requires a circumferential bony dissection, skeletonization, and preservation of the vestibular aqueduct and the identification of the internal auditory canal. This periaqueductal approach preserves hearing and provides an alternative to the infralabyrinthine and infracochlear approaches when their use is precluded by variations in the temporal bone. (*Skull Base Surgery, Volume 2, Number 4, 1992, p. 204*)

Conservative drainage procedures for the treatment of cholesterol granulomas of the petrous apex have gained popularity because they provide control of the disease and allow for the preservation of hearing.

Transmastoid approaches take advantage of the increased amount of pneumatization of the temporal bone that is usually associated with cholesterol granuloma. One such approach is the infralabyrinthine approach.¹ In this approach, a mastoidectomy is performed. The retrofacial air cell tract is then opened and followed to a tract that is inferior to the posterior semicircular and superior to the jugular bulb. If the anatomy is favorable, this tract is followed anteriorly and medially to the cholesterol granuloma cyst. The cyst is opened and a drainage tube is inserted to drain the cavity of the lesion into the mastoid. In some cases, a high jugular bulb may preclude the use of the infralabyrinthine approach to the petrous apex. In such cases, alternative approaches are used.

The subcochlear approach was first described by Ghorayeb and Jahrsdoerfer.² It requires the drilling of the temporal bone in a triangular area bounded by the basal turn of the cochlea superiorly, the deep jugular vein poste-

riorly, and the intratemporal internal carotid artery anteriorly. The subcochlear approach is performed following a canal wall down mastoidectomy. Giddings et al³ described a modification of this approach, called the infracochlear approach. Similar to the approach described by Ghorayeb and Jahrsdoerfer, access to the petrous apex is achieved by following the same landmarks in the middle ear. However, unlike the subcochlear approach, the infracochlear approach allows the preservation of the external auditory canal.

The anatomy of the temporal bone is highly variable; consequently, variations in the pneumatization, degree of erosion by cholesterol granuloma, and the relative positions of the jugular bulb, carotid artery, and internal auditory canal may not be favorable for the performance of the approaches just described.

A new approach that allows access to the petrous apex is described. It takes advantage of an air cell tract that is medial to the posterior semicircular canal and requires a circumferential dissection of the vestibular aqueduct as it courses from the vestibule to the endolymphatic sac.

CASE REPORT

A 58-year-old woman presented with facial twitching of 2 years' and facial weakness of 3 months' duration. On examination, she had marked facial paresis (House-Brackmann grade 5).⁴ Her preoperative audiogram showed a speech threshold of 20 dB and a speech discrimination score of 96%. Neuroradiologic studies showed a 2 by 3 cm lytic lesion in the petrous apex of the right temporal bone. The findings were consistent with the diagnosis of cholesterol granuloma. The internal auditory canal was compressed. The temporal bone was well pneumatized. In particular, an area of pneumatization medial to the otic capsule, at the level of the posterior semicircular canal, was noted.

The Periaqueductal Approach

An attempt at performing an infralabyrinthine approach failed because of a high-riding jugular bulb. The bony dissection was extended superiorly into the supralabyrinthine air cell tract. The crus commune was identified. The pneumatized bone medial to the medial surface of the posterior semicircular canal was then exenterated. The vestibular aqueduct was encountered. The bone around it was dissected circumferentially. At the end of the dissection, the vestibular aqueduct had the appearance of a pillar that bridged the posterior fossa dura to the otic capsule at the level of the vestibule (Fig. 1). It was easy to see past the vestibular aqueduct by maneuvering the operating microscope. Further dissection of the bone antero-medially led to the internal auditory canal. The lesion had eroded the roof of the internal auditory canal and com-

pressed its contents extradurally. The cholesterol granuloma was incised, drained, and the cavity irrigated. A rigid scope was then used to inspect the cavity. It had a shiny white color. A Silastic tube was then inserted into the cavity in order to vent it into the mastoid cavity.

The patient did well. Her postoperative hearing was unchanged. At 1 year postoperatively, her facial function continued to improve (House-Brackmann grade 3). She did not develop symptoms of cochlear hydrops.

DISCUSSION

Cholesterol granulomas of the petrous apex can be treated with drainage procedures. This can be accomplished with the use of surgical approaches that allow the preservation of hearing. These approaches take advantage of the increased pneumatization of the temporal bone in this disease. When the lesion is inferior in the petrous apex, it can be drained via a subcochlear² (or infracochlear) approach. When the jugular bulb is not high, the infralabyrinthine¹ approach is also useful. The cholesterol granuloma in our case presented itself in a superior location at the level of the roof of the internal auditory canal. Moreover, the position of the jugular bulb was high. Consequently, we were unable to carry out any of the approaches that were previously described in the literature. Also, we avoided the translabyrinthine approach, since the patient's preoperative hearing was good. When we encountered the vestibular aqueduct, we were presented with two choices: we either had to cut it or preserve it. Again, because of the patient's good preoperative hearing, we opted for the second choice. The literature is not clear on the long-term effects of ablating the vestibular aqueduct. This case demonstrates, however, that it is possible

Figure 1. View through a right transmastoid approach. The vestibular aqueduct is dissected circumferentially. It bridges the medial surface of the vestibule to the posterior fossa dura.

to dissect the vestibular aqueduct along its course from the vestibule to the endolymphatic sac without substantial morbidity. This case also demonstrates the usefulness of rigid endoscopes for the inspection of deep recesses in the temporal bone.

CONCLUSION

The periaqueductal approach for the drainage of cholesterol granulomas of the petrous apex has been described. This surgical approach requires the circumferential dissection and preservation of the vestibular aqueduct. In suitably pneumatized temporal bones, it permits access to the petrous apex and the preservation of hearing. Similar to other previously described approaches, it is dependent on favorable anatomy and location of the lesion in the

temporal bone. This report also demonstrates that it is possible to dissect the vestibular aqueduct along its course from the vestibule to the endolymphatic sac without significant morbidity.

REFERENCES

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REVIEWER'S COMMENTS

I appreciated having the opportunity of reviewing the article "Periaqueductal Approach to Cholesterol Granulomas of the Petrous Apex" by Joseph Feghali, M.D., and Allen Kantrowitz, M.D. The authors reviewed surgical approaches to the petrous apex. Their case report of a 58-year-old woman with cholesterol granuloma presenting with facial twitching and paresis implies proximity to the superior or anterior internal auditory canal, or both. The anatomy to the petrous apex has been reviewed by Richard Chole, M.D. (Petrous apicitis: surgical anatomy. *Ann Otol Rhinol Laryngol* 94:251-257, 1985). He provided a detailed historical critique of the surgical approaches to the petrous apex. The periaqueductal approach reported by Feghali and Kantrowitz is similar to the retrolabyrinthine or sinodural angle approach. However, the authors are to be commended in that this article demonstrates the technical achievement of dissecting around the endolymphatic duct and sac without incurring any cochlear or vestibular morbidity. This article enhances our understanding of the anatomy of the pneumatized temporal bone and the potential approaches to the petrous apex.

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