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Case Report

A Review of Delayed Facial Nerve Paresis as Complication Following Total Endoscopic Ear Surgery

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The aim of this study is to evaluate the incidence of delayed facial nerve paresis after total endoscopic ear surgery. This review also aims to describe the possible contributing factors and its management. This is a retrospective review of all patients who had undergone total endoscopic ear surgery for all otologic cases that required endoscopic intervention in a single otologic center from 2014 up to 2020. The delayed facial nerve paresis is defined as deterioration of facial nerve function 72 hours after total endoscopic ear surgery. A total of 56 patients were included in the study. Delayed facial nerve paresis following total endoscopic ear surgery was observed in 2 patients (3.4%). Facial weakness sets in on day 6 post operation and another one developed at day 16 after the surgery. Both patients were investigated and only one of them showed a higher titer of Varicella zoster virus antibody while another patient showed no raise of titer. Thus, explanation of postoperative edema or mechanical compression is discussed. The incidence of delayed facial nerve paresis following total endoscopic ear surgery is rare. It can occur probably several days after surgery up to 3 weeks. Our 2 cases revealed that virus reactivation may not be the only factor for delayed facial nerve palsy after surgery. The overall prognosis for incomplete delayed facial nerve paresis is very good as both patients recovered well few days after treatment with steroids.

KEYWORDS: Endoscopic ear, facial nerve paresis, middle ear surgery

INTRODUCTION

The advent of ear surgery has included endoscopic ear surgery as one of its techniques for almost all types of ear diseases since its introduction in the 1990s. Established delayed complications related with total endoscopic ear surgery (TEES) was reported to be less than 1.0%.[1] Delayed facial nerve paresis (DFNP) has been described only in microscopic surgery, which share similar complications with TEES.[2] The role of surgeon to ensure the integrity of facial nerve is undoubted for ear surgery. Thus, having a postoperative facial nerve injury may be a severe complication to the surgeon and the patients alike. The relevance of concerns of facial nerve injury will be less intense in a delayed onset but equally worrisome.

The technique between microsurgery and TEES is proven to be slightly different in assessing and identifying the facial nerve during the tympanomastoid surgery. Both techniques have their advantages and disadvantages. In microscopic surgery, the mastoid segment of the facial nerve will be identified in later stage of surgery after mastoid bony drilling and subsequently the tympanic segment will be traced once the middle ear is entered. However, in TEES, the tympanic segment of the facial nerve will be determined in the early part of the surgery as the middle ear approaches transcanally.

Delayed onset facial nerve palsy after any tympanomastoid surgery has been reported infrequently. Vrabec et al[3] described 7 patients with DFNP in a series of 486 cases who have undergone tympanomastoid surgery, which accounted for 1.4%. On the other hand, other literature studies described much lower incidence of DFNP, which were 0.4% to 0.9%.[2,4] Many postulations about the likely etiologies of this problem had been discussed and one of it is viral reactivation. Other causes include overmanipulation of dehiscence nerve, direct thermal effect to the nerve during drilling, and cautery adjacent to the nerve causing necrosis of the nerve.[5] Therefore, visualization of the facial nerve should be sought diligently especially in dealing with dehiscence or abnormal

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course of the facial nerve.[6] Identifying the cause of such condition has important implications in preparedness to perform the appropriate investigations and managements.

MATERIALS AND METHODS

This is a retrospective review on all patients who underwent TEES from January 2014 up to December 2019. The hospital wherein the surgeries were performed incorporated information technology-based system in which the documentation can easily be retrievable during the study period. All patients were operated by a single experienced surgeon who was trained in TEES. The inclusion criteria included that the surgery must be performed by single surgeon to reduce bias of credibility, and it must be the sole procedure counted for TEES for whatever pathologies. Exclusion criteria were all ear surgeries that use microscopic or combined microscopic approach.

The definition used for DFNP in this study was deterioration in facial nerve function noticed 72 hours after surgery without any evidence of iatrogenic facial nerve injury intraoperatively, and patient had normal facial nerve function records immediately following surgery. The facial nerve function was graded by using House–Brackmann scale and Sunny Brook score. The Varicella zoster viral (VZV) titer was taken during the initial onset of DFNP, and serial follow-up in assessing the facial nerve functions was recorded.

RESULTS

A total of 56 patients who underwent exclusive TEES were included in the study. There were 36 males and 23 females. The mean age of the study population was 37.31 $\pm$ 18.47 years, which ranged from 5 to 79 years. Of all cases, 34 cases were related to middle ear cholesteatoma, which comprises 26 cases of primary cholesteatoma and 8 recurrent cases. Only 2 patients were identified as having DFNP according to the established criteria, and both of them had TEES for middle ear cholesteatoma as shown in Table 1.

CASE 1

A 42-year-old lady with no known medical illness presented with right ear discharge with possibility of cholesteatoma. Otoscopic examination revealed retraction pockets over bilateral ears: the right side showed significantly more severe retraction with evidence of keratin, while the left side showed mild retracted pocket and the fundus was able to be visualized with no keratin seen. The hearing test revealed bilateral conductive loss with bigger air–bone gap on the right side. High-resolution computed tomography (HRCT) of the temporal bone demonstrated soft tissue density in the epitympanum with erosion of the scutum. The mastoid air cells appeared sclerotic.

The decision was to do TEES on the right side, while on the left a myringotomy and ventilation tube was performed. Intraoperative finding showed the right tympanic membrane was retracted with keratin in the antrum. The incus fixated to malleus and was removed. Reconstruction was performed with tympanoplasty type II. Horizontal segment of facial nerve was not dehiscence and preserved while the lateral semicircular canal was normal. Facial nerve function tested using intraoperative nerve monitoring throughout the surgery and recorded to be functioning well. Patient was documented to have normal facial nerve function postoperatively. He was discharged well 1 day after the operation.

However, on the next follow-up, patient claimed to have facial asymmetry that occurred 6 days after the operation. The right facial nerve paresis was of House–Brackman grade III and the Sunny Brook score was 60. There was no vesicular lesion to suggest herpetic infection. Varicella zoster virus (VZV) antibody for IgM and IgG showed positive results, thus indicating reactivation of varicella infection. She was given oral prednisolone in a tapering dose and discharged after she made complete recovery 1 week later with full facial nerve functions. No acyclovir started due to the absence of active symptoms. Magnetic resonance imaging (MRI) of internal acoustic meatus was not performed in view of delayed onset of the facial nerve paresis, and patient responded well to the corticosteroid therapy.

CASE 2

A 23-year-old man presented with persistent left ear discharge post mastoidectomy for 8 years. He had left ear moderate conductive hearing loss, and otoscopic finding showed evidence of previous mastoidectomy with high facial ridge and keratin pearl in the attic region. HRCT of the temporal bone showed an evidence of mastoidectomy and soft tissue obliteration of the middle ear cavity extending to the antrum with sclerotic remaining mastoid air cells (Figure 1A-B).

He was operated on the left ear with TEES approach to an adequate canal with narrowed meatoplasty. Intraoperative finding showed congenital malformation of the tympanic segment of the facial nerve, which was overhang above the stapes superstructures (Figure 1C). There was large cholesteatoma with granulation tissue within the mastoid bowl, retrotympanum, and epitympanum regions. The middle ear mucosa were polypoidal and edematous. The high facial ridge was brought down and the vertical and horizontal segments of the facial nerve were identified and preserved. The facial nerve function was recorded to be normal postoperatively. He was discharged well and upon returning for follow-up 1 week later, there was no issues noted in his facial nerve.

Table 1. Summary of Patients With DFNP

Case	Age (year)	Sex	Diagnosis	Status of Facial Nerve Intraop	Onset of DNFP	Facial Nerve Grading (HB, SB)	VZV Titer	Treatment	Recovery (HB, SB)
1	42	F	Attico-antral cholesteatoma	No facial canal dehiscence	Day 7 post-op	III, 60	+	Steroid	1 week after treatment (I,100)
2	23	M	Recurrent extensive middle ear cholesteatoma	Tympanic segment overhang above stapes suprastructure	Day 16 post-op	III, 63	–	Steroid, ear packing removal	1 week after treatment (I,100)

DFNP, delayed facial nerve paresis; HB, House–Brackmann; F, female; M, male; SB, Sunny Brook; VZV, Varicella zoster virus.

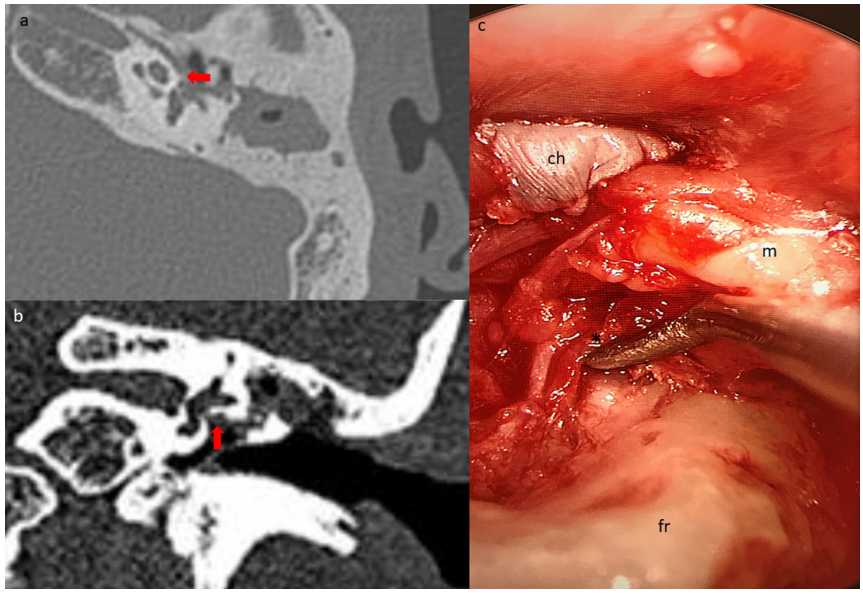

Figure 1. The preoperative high-resolution computed tomography of the temporal bone for case 2 showed dehiscence facial canal over distal tympanic segment of the facial nerve as shown in the axial view (A) and the coronal view (B). Endoscopic view of the intraoperative findings for case 2 showed hanging dehiscence facial nerve (*) over the stapes suprastructure, which covered with granulation tissue with evidence of high facial ridge (C). ch, cholesteatoma; fr, facial ridge; m, malleus.

However, packing was still remained in the ear and only be removed on day 16 postoperation of which he was noted to have left facial nerve paresis House–Brackmann grade III and Sunny Brook score of 63. He did not have any other symptoms, and decision was made to remove the ear packing. Upon reviewing the intraoperative video, it revealed that the facial nerve was being dehiscent and abnormally positioned, which contributed to the possible etiology for this problem. High dose of oral prednisolone was given for 1 week. The VZV studies for IgM and IgG were negative; thus, the likely cause was due to the compression by the ear pack. He was reviewed a week later and the facial nerve paresis completely resolved.

DISCUSSION

The incidence of DFNP in this series was 3.4%, which is more than previously reported.[2-4] It could be attributed by smaller number of cases in total as we looked exclusively only in TEES, which is one of the options for ear surgery. Rather, we still do microscopic surgery in some of the otologic cases. Our facial nerve cases are only 2 in delayed onset, which may not represent thorough nature of the TEES as the immediate facial nerve palsy is more of urgent than delayed but relatively of similar concern to the patients. TEES is a relatively newer approach in managing middle ear disease.[7,8] Concerns of higher complication rates are understandable, but as in learning curve for a new approach, one has to be ready with reports of related procedural eventuality.

A study by Marchioni et al[1] showed a low rate of complications by 2 experienced surgeons, but DFNP is not one of them and it may not be related to the surgery.[1] However, the approach could be thoroughly predicated to have higher chances of facial nerve issue because the first structure often we look for in the middle ear besides ossicles and stapes footplate will be the tympanic segment of the facial nerve. The facial nerve is readily identified as the facial canal is consistent in landmark as compared to the mastoid segment of the facial nerve. However, in our case, we may encounter dehiscence and overhanging facial nerve as in case 2. Perhaps the exposed facial nerve induces inflammatory reaction to the nerve and longstanding pressure effect from the cholesteatoma.[6] As such, one need to be sure of the anatomy not in normal state but in a diseased middle ear, which often sent chills to a someone starting endoscopic ear surgery work. Therefore, delineation of the facial nerve integrity is one of the most important steps in TEES, especially in abnormal course of the facial nerve.

The facial nerve is likely to be injured more than microscopic work from the intensity of light source that may heat the labyrinthine fluid and nerve structures in the middle ear. This thermogenesis results in nervous tissue damage, which can manifest as DFNP. The recommended light intensity was not exceeding 50% of the light source voltage, along with frequent cooling and misting the tip end with anti-fog solutions.[9,10] Newer light-emitting diode (LED) further gives brighter light with lower temperature. One of the difficulties in middle ear surgery is the nature of disease that caused erosion to the facial canal, thus exposing the nerve raw. Not only that, often the polypoidal mucosa encased the exposed facial nerve, making it difficult to differentiate between normal and disease structures. Manipulating the facial nerve may contribute to trauma, thus it is believed to cause herpetic reactivation at the geniculate ganglion as evidenced by Gianolli et al.[11] Both VZV and Herpes simplex virus have been isolated from the geniculate ganglion with high percentage from autopsies.[12]

As shown in case 1, likely the VZV reactivation is the corresponding reason for DFNP. Another patient developed DFNP without evidence of VZV infection, suggesting the possibilities of direct compression to the nerve by middle ear packing as evidenced by intraoperative findings of bare facial nerve. It was completely resolved after ear pack was removed. Although such a case of direct compression to that facial nerve is discussed much in the literature, one must always consider as nerve is quite resilient to minor manipulation. However, with time, the nerve may be irritated enough to produce symptoms.[13] It is suggested

that surgeons should review the patients' intraoperative videos when need arises as depicted in our case. It will shed more light on the etiology of the underlying problem when the likely cause is doubtful.

The role of imaging in DFNP is controversial. Although the literature had mentioned that MRI with gadolinium showed enhancement of the nerve, most of the time imaging is not indicated in incomplete and delayed onset of facial nerve paresis.[14] The choice of treatment is always to reduce the inflammatory process and edema, thus high dose steroids are recommended. The prognosis of incomplete DFNP is very good and full recovery is expected though some centers may resort to facial nerve decompression if the medical intervention does not improve the facial nerve function.[2] Both of our cases who were having incomplete DFNP (House–Brackmann grade III) had shown full recovery with medical therapy alone. This review is derived from a limited number of TESS patients in our facilities and more is required to have better significant impact of the risk. The role of single surgeon in performing the TESS will avoid credibility bias. Nevertheless, DFNP was proven to be not intraoperative mishap, rather a sequel of other factors discussed.

CONCLUSION

Total endoscopic ear surgery is relatively a safe surgical approach in addressing middle ear cholesteatoma. The incidence of DFNP following TEES is equally comparable to conventional postauricular microscopic mastoid surgery. Recognition of possible causative factor for DFNP is warranted to ensure the administration of appropriate treatment. The treatment of this condition is mainly medical and the prognosis for incomplete DFNP is excellent as shown in our series.

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