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CASE REPORT

# Delayed Facial Nerve Palsy after Endolymphatic Sac Surgery

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**Objective:** Delayed facial nerve palsy (DFP) after otological and neurotological surgeries is always observed ipsilateral to the operated side, while it is rare in other types of ENT surgery including head and neck, suggesting that DFP may result from procedures selective to temporal bone surgery. Herein, we present a rare case of DFP after endolymphatic sac surgery, and review the pathogenesis and prevention of DFP after otological and neurotological surgeries.

**Materials and Methods:** The incidence of DFP after endolymphatic sac surgery from 1998 to 2008 at our hospital was 0.67% (1 out of 150 cases). A 44-year-old male with complaints of repeated vertigo attacks and cochlear symptoms such as persistent tinnitus and fluctuating hearing loss of the right ear. The patient received endolymphatic sac surgery on the right ear for treatment of intractable Meniere's disease, resulting in the onset of DFP.

**Results:** DFP onset occurred at post-operative day 8, with the House-Brackmann grade III. HSV and VZV serum tests were negative.

**Conclusion:** The later onset DFP observed in the present case after endolymphatic sac surgery might relate to the reactivation of a virus other than HSV and VZV in the geniculate ganglion induced by surgery.

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## Introduction

Delayed facial nerve palsy (DFP) can occasionally occur several days after temporal bone surgery, despite no direct contact with the facial nerve during operative procedures[1,2]. DFP was reported to actually occur after otologicical and neurotological surgeries including tympanoplasty with mastoidectomy, stapes surgery, and cochlear implant[1-13]. DPF only occurs on the same side as that operated, and is rare following other types of ENT surgery such as to the head and neck, suggesting a direct role of temporal bone surgery procedures. However, the underlying cause of DFP remains unclear. Herein, we report a novel case of DFP after endolymphatic sac surgery, and review the pathogenesis of DFP after otological and neurotological surgeries.

## Case Report

The incidence of DFP after endolymphatic sac surgery from 1998 to 2008 at our hospital was 0.67% (1 out of 150 cases). A 44-year old male patient presented to our hospital in July, 2004 with complaints of repeated vertigo with cochlear symptoms including tinnitus and hearing loss in the right ear. He had been suffering from these symptoms since February, 2004, and had received medication at his former hospital without any affect. We diagnosed this case as intractable Meniere's disease and performed endolymphatic sac surgery on his right ear in September, 2004 to prevent from intractable vertigo attack and progressive sensorineural hearing loss.

The technical details of endolymphatic sac surgery (termed endolymphatic sac drainage and steroid-instillation surgery: EDSS) were previously reported [14-16]. In brief, a simple mastoidectomy was performed, clearly exposing the endolymphatic sac in the area between the sigmoid sinus and the inferior margin of the posterior semicircular canal (Figure 1A). The sac was opened with an L-shaped incision made along the posterior and distal margins of the lateral wall. The sac was then filled with a solid mass of 20 mg prednisolone powder (Figure 1B). While dissolving the mass in the sac, we prepared a bundle of absorbable gelatin films (approximately five 4×20×0.7 mm sheets) with fan- and stick-shaped ends (Figures 1C, 1D). These films were tied together with a

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biochemical adhesive (human thrombin combined with human fibrinogen) at only the stick-shaped end in the same manner as for sac expanding surgery[17]. The fan-shaped end was then inserted into the sac, and small pieces of absorbable gelatin sponges soaked in a high concentration of dexamethasone (32 mg/4 ml) were placed inside and outside the sac lumen expanded with the bundle. The sponges containing dexamethasone placed outside the sac were coated with the adhesive to form a natural sustained-release vehicle for prolonged slow release of dexamethasone delivered into the sac. Using the same adhesive the stick-shaped end extending out of the sac was fixed to the front edge of the mastoid cavity to expand the incision into the sac for an adequate period of time after surgery. The mastoid cavity was filled with relatively large pieces of absorbable gelatin sponges dipped in antibiotic solution, after which the wound was closed with skin sutures.

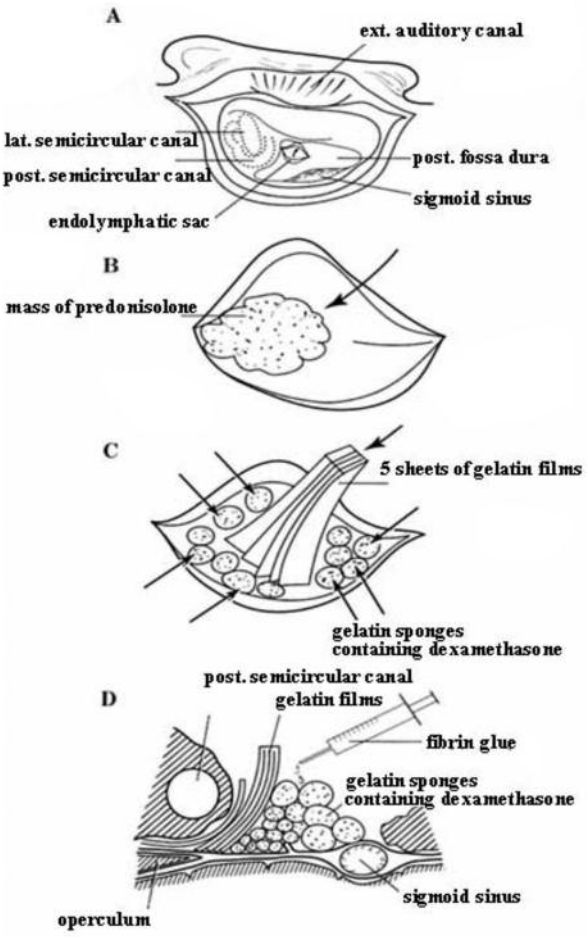


**Figure 1.** Schematic representation of endolymphatic sac drainage and steroid-instillation surgery.

DFP was observed at post-operative day eight (Figure 2). The House-Brackmann grade was III at DFP onset. Systemic steroid treatment was started immediately after DFP onset and was continued for one week. DFP had improved to grade II at eighteen days after onset. Two herpes serum tests, HSV and VZV, were completely negative. Four years after surgery, the patients' vertigo attack disappeared completely and his average hearing level in the right ear improved from 57.7dB to 40.0dB.

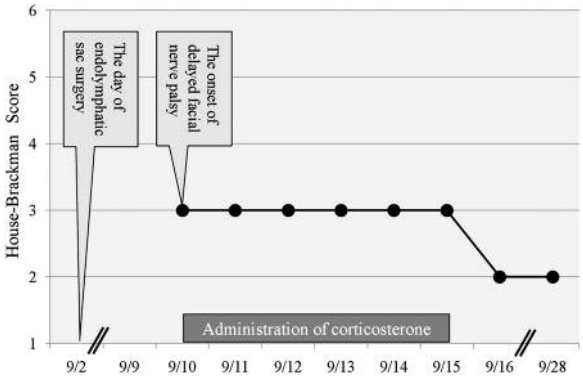


**Figure 2.** Time course of delayed facial nerve palsy after endolymphatic sac drainage and steroid-instillation surgery.

## Discussion

The incidence of DFP after otological and neurotological surgeries was previously reported as 10—30% in acoustic neurinoma surgery[2,10,12] and vestibular neurectomy[13], 0.3—8.5% in tympanoplasty with mastoidectomy[1-3] and cochlear implant[4-6], and 0.2—0.5% in stapes surgery[7-9]. By comparison, the ratio of idiopathic facial nerve paresis such as Bell's palsy was reported to be lower by approximately 0.01—0.03% in Sweden, Ireland, England, Norway, United States, Colombia, and Japan[18], suggesting a greater effect of otological and neurotological surgeries on DFP than the idiopathic lesion.

Generally, the idiopathic facial nerve paresis, so-called Bell's palsy, is thought to occur due to intratubal facial nerve ischemia and/or edema under various kinds of stress[18]. In such a sense, all types of surgery could produce surgical stress to the patient and therefore be a potential cause of DFP on either side. Actually after otological and neurotological surgeries, DFP is always observed ipsilateral to the operated ear, and only rarely

in other types of ENT surgery such as to the head and neck. Although total laryngectomy completely removes vocal ability and produces high patient stress, and partial parotidectomy for a parotid benign tumor includes direct contact with the facial nerve outside of temporal bone, no DFP was observed after either procedure (total laryngectomy, 0 out of 629; partial parotidectomy, 0 out of 168: personal communication with Professor Hiroshi Miyahara, Department of Otolaryngology, Osaka Prefectural General Medical Center)[19]. Therefore, the actual surgical procedures themselves during temporal bone surgery may be more important than general surgery stress in the pathogenesis of DFP.

Two surgical procedures potentially important in the pathogenesis of DFP after otological and neurotological surgeries were previously described[2]; the 'mastoidectomy procedure' and 'facial nerve and/or chorda tympani nerve exposure'. During the mastoidectomy procedure, it was suggested that generation of heat and/or inflammation by drilling of the temporal bone might indirectly produce 'intratubal facial nerve edema'; when facial nerve edema is the main cause of DFP, this may account for the relatively early post-operative onset after operation[11,20]. By contrast, exposing the facial nerve and/or chorda tympani nerves in the operative field may induce herpes virus reactivation, which may account for a relatively late post-operative onset[21,22]. During the surgical procedures used for endolymphatic sac surgery in the present case, the facial-chorda tympani nerve was not exposed or touched directly, suggesting a role for the mastoidectomy procedure. However, the onset of DFP after sac surgery was relatively late in the present case (post-operative day 8), suggesting a role of reactivation of a virus; HSV and VZV serum tests were negative, ruling them out as candidates. Of note, although the nerves were not exposed in the surgical field during endolymphatic sac surgery in the present case, a high concentration of steroids around the endolymphatic sac might stimulate the chorda tympani nerve in the tympanic cavity, resulting in reactivation of some virus in the geniculate ganglion.

## Conclusion

We reported the first case of DFP after endolymphatic sac surgery. As longer surgical times result in an increase in the DFP incident ratio from 0.001 to 0.1%, temporal bone surgeries should be performed rapidly without unnecessary procedures. Further basic and clinical studies are needed to elucidate the mechanisms of DFP onset.

**Table 1.** Incident ratio of delayed facial nerve paresis (DFP) after otological and neurotological surgeries.

| Operation | Authors | The Number of Patients | DFP Ratio |
|---|---|---|---|
| Acoustic neurinoma surgery | Arriaga et al.,1993 | 468 | 14.5% |
| | Lalwani et al.,1995 | 129 | 29.5% |
| | Megerian et al.,1996 | 262 | 23.7% |
| | Yamada et al.,2002 | 94 | 9.6% |
| Vestibular neurectomy | Vrabec et al.,2003 | 70 | 11.4% |
| Tympanoplasty with mastoidectomy | Deka et al.,1988 | 235 | 8.5% |
| | Vrabec et al.,1999 | 486 | 1.4% |
| | Yamada et al.,2002 | 1182 | 0.3% |
| Cochlear implant | Cohen et al.,1988 | 459 | 1.7% |
| | Lalwani et al.,1998 | 41 | 4.9% |
| | Fayad et al.,2003 | 705 | 0.7% |
| Stapes surgery | Althaus et al.,1973 | 2307 | 0.2% |
| | Smith et al.,1990 | 1300 | 0.5% |
| | Shea et al.,2001 | 2152 | 0.5% |
| Endolymphatic sac surgery | Kamakura et al.,2010 | 150 | 0.7% |

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