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Case Report

Chemical Closure of Tympanic Membrane Perforation: Call for Caution

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Chemical closure of tympanic membrane perforation is a commonly practiced office-based otological procedure, which is labeled to be effective and safe. In this paper, we report a case of a young lady with disastrous complications following an attempt of chemical cauterization of her perforated tympanic membrane.

KEYWORDS: Tympanoplasty, chronic otitis media, perforation, silver nitrate, cautery

INTRODUCTION

Silver nitrate cautery has been used by otolaryngologists for more than 150 years for treating small- to medium-sized tympanic membrane perforations. The first case was reported by William Wilde in 1848 [1]. Silver nitrate cautery is an office-based procedure that involves silver nitrate application to the perforation margin, thereby causing break up of fibrosis and promotion of granulation and new tissue formation [2].

The procedure has been considered to be effective, safe, and non-invasive. Some otologists believe that it is a first-line modality in the management of small- to medium-sized perforations before attempting formal surgical closure [1].

In this paper, we present a case of a young lady who developed iatrogenic complete facial palsy and profound sensorineural hearing loss following silver nitrate application to a small, posteriorly placed tympanic membrane perforation.

CASE PRESENTATION

A 38-year-old female patient was referred to our department from a private clinic with right-sided facial palsy, rotatory dizziness, and decreased hearing of the right ear, that developed immediately following the application of silver nitrate to the perforation margin of her right tympanic membrane.

On examination, there was a right-sided incomplete facial weakness (House-Brackmann IV), associated with horizontal-rotatory nystagmus. Right otoendoscopy showed mucoid discharge and a posterosuperior perforation, comprising 30%-40% of the tympanic membrane. Ossicles were exposed and looked blackish and necrotic (Figure 1).

Severe to profound hearing loss was found on pure tone audiometry.

CT scan of the temporal bone revealed multiple small radiodense metallic structures (average density of 2400 Hounsfield unit) that were adjacent to the dehiscent tympanic segment of the facial nerve, the oval and round windows (Figure 2 a-c).

The patient was given systemic corticosteroids for 2 weeks without any improvement in her hearing and facial nerve paralysis.

Two weeks later, nerve conduction study was performed and revealed severe axonal injury with more than 95% denervation. Electromyography did not demonstrate spontaneous activity; motor unit action potential was not recordable.

Early intervention to clean the debris off the facial nerve and middle ear was not attempted to avoid further damage to the friable facial nerve. No improvement in the patient's condition was observed over a period of three months, and therefore where mid-

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dle ear exploration and subsequent removal of the deposits around the facial nerve was performed, but unfortunately, that resulted in a complete right-sided facial paralysis.

Informed consent was obtained from the patient.

DISCUSSION

Silver nitrate is an inorganic chemical with an antiseptic activity. It can be used for medical application as a cauterizing or sclerosing material. Moreover, silver nitrate is a strong caustic agent and can cause tissue damage and necrosis.

The silver ions on interaction with the proteins lead to their denaturation and precipitation. Another proposed mechanism of the silver nitrate action is its cauterizing effect. As it is applied to a wet surface on the body, nitric acid is formed. This nitric acid has a chemical cauterizing effect. Silver nitrate has been used since long for the repair of tympanic membrane perforation and is still used nowadays as an office-based procedure for managing small- to medium-sized perforations [3, 4].

Figure 1. Right ear otoendoscopy showing posterosuperior perforation with mucoid discharge and blackish-appearing necrosed ossicles

Our explanation regarding this case was that, during the process of chemical cauterization of the perforation margin, silver nitrate trickled to the middle ear and led to caustic burns of the middle ear mucosa, ossicles and the dehiscent facial nerve, leading to ossicular necrosis and facial nerve paralysis.

In addition, deposition and subsequent absorption of silver nitrate through the round window membrane caused acute irreversible inner ear damage, which resulted in vertigo and persistent profound hearing loss. Another alternative explanation is that, silver nitrate deposition in the round window niche led to necrosis of the round window membrane with secondary perilymphatic fistula and inner ear dysfunction.

Proper management of such disastrous complications has not been discussed in the literature before. Early thorough aspiration and irrigation of the middle ear remove as much of the chemical as possible might have led to a better outcome. However, it is difficult to predict if any worsening of the friable facial nerve would be associated with such an attempt.

To the best of our knowledge, ototoxicity of silver nitrate has not been reported before in the literature, although a case of sudden hearing loss following chromic acid application to a tympanic membrane perforation has been reported [5]. Wachter et al. [6] studied the neurotoxicity of silver nitrate and demonstrated, from functional and neuropathological data, that silver nitrate causes significant injury to the rat sciatic nerve. They found that the severity of injury is directly related to the exposure duration.

Chemical cauterization of a posterior perforation renders the facial nerve at a high risk of burn from the dripping silver nitrate solution because the tympanic segment dehiscence can be present in up to 56% of ears [7, 8]. In addition, the trickling of silver nitrate into the retrotympanum may lead to its absorption through the round window membrane into the inner ear causing its damage.

Therefore, we would like to direct the attention of otologists toward the possible disastrous complications, that can be associated with this procedure, which was entitled safe, therefore, we strongly discourage using this procedure, particularly for posterior perforations.

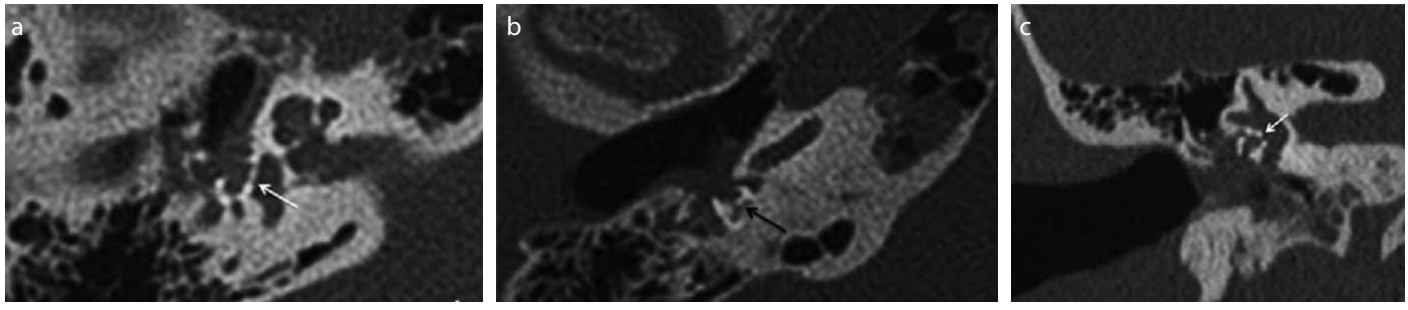

Figure 2. a-c. CT scan of the right temporal bone. Axial section (a) showing radiodense metallic substance adjacent to the oval window (white arrow). Axial section (b) showing radiodense metallic substance adjacent to the round window (black arrow). Coronal cut (c) showing radiodense substance around the tympanic segment of the dehiscent facial nerve (white arrow)

Informed Consent: Written informed consent was obtained from the patient who participated in this study.

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