Management of Retraction pockets of the Pars Tensa

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Abstract
Objective: In the present study, we investigated long-term outcomes after treatment for advanced retraction pockets of pars tensa using tympanostomy tube insertion combined with laser-assisted contraction-lifting myringoplasty in adult considering CO2 laser myringoplasty combined with tympanostomy tube insertion. All patients were followed for 5 years postoperatively. The mastoid pneumatization and eustachian tubes were evaluated using temporal CT multiphase reconstruction method. Results: If a successful outcome was defined as an intact tympanic membrane with no retraction or the development of a stable, grade I mild retraction, the retractions had normalized or improved in most of the patients by the end of the follow-up.

Background & Objectives
Retraction pockets (RPs) are commonly encountered as sequelae of atelectasis of the tympanic membrane (TM) when recurrent otitis media with or without effusion has been a long-standing problem, which may cause conductive hearing loss, ossicular chain erosion and cholesteatoma formation.

Eustachian tube (ET) dysfunction, impaired gas diffusion resulting in sustained negative pressure in the middle ear and weakening of the TM secondary from secretory otitis media have been identified as the underlying pathogenic mechanisms.

Sade’s classification
It has been known that the functional status of ET is one of the most important factors during the disease progression. Pressure equalization, mucociliary clearance & protection of middle ear are the three main functions of the ET. Therefore, ET anatomy, physiology and function need to be clarified to understand the pathogenesis of RPs of the pars tensa.

The previous studies based on TBCT demonstrate that the differences of the physiology of ET due to anatomical variants may contribute to development of COM, which suggested that the angle, position or patency of ET is a predisposing factor for ET dysfunction. However, the imaging findings associated with ET have not been extensively described in middle ear atelectasis. One study found narrow ET to tympanic cavity angle in patients with adhesive otitis media.

The aim of this study is to investigate (1) the long-term treatment outcomes after treatment for advanced retraction pockets of pars tensa using a tympanostomy tube insertion combined with laser-assisted myringoplasty and (2) the anatomical assessment of ET and ET angles in patients with advanced retraction using temporal bone CT.

Methods
Subjects
The study enrolled (1) total 42 ears of 31 children with the pars tensa retractions persisted more than 3 months between 2013 ~ 2015, who followed-up more than 3 years and (2) 22 adults and 20 children who presented with advanced retraction of the pars tensa in one ear for radiological study between 2013 ~ 2017. Sex and age matched controls who have no evidence of middle ear disease clinically and radiologically were collected during study period. Patients with bilateral involvement, grade I mild retraction, ossicular chain erosion, cholesteatoma, or major congenital anomalies were excluded. The severity of the retraction was graded according to Sade’s classification.

CO2 laser-assisted myringoplasty
Defocusing mode of the laser beam allows for laser not to penetrate the TM, and the resulting heat-induced coagulative effects tighten the TM.

Settings: 1-2W power, 0.10-0.15 seconds in duration, and a single, defocused pulse

Radiologic measurements
1. Reid plane-ET angle which was defined as the angle of a straight line representing the length of the ET against Reid’s standard plane.
2. TuTubotympanic angle between line extending through the tympanic orifice of the ET and the longitudinal line bisecting external bony ear canal.
3. ET pretympanic bony diameter, the connection between cartilaginous and osseous segments of the ET which is the most irregular and narrowest portion on axial CT image.

Clinical features
The mean age was 7.6 ± 3.1 years with 9 (29%) girls and 22 (71%) boys. Out of 42 ears, 20 were unilateral and 11 were bilateral involvement. Mean follow-up periods were 31.1 ± 5.4 months. Previously, 11 patients (35.5%) had undertaken adenoidecctomy.

Surgical outcomes
- Overall time to tube egression was 8.1 ± 3.1 months (range, 4–14 months).
- After initial treatment
  - Normalization of ET
  - Successful retraction
  - Second surgery with VT
  - Revision LM without VT
- Final outcomes
  - 4.8%
  - 7.1%
  - 33.3%
  - 61.9%

- If a successful outcome was defined as an intact TM with no RP or the development of a stable, grade I mild retraction, overall success rate was 95.2% by the end of follow-up.

ET parameters in patients and controls

<table>
<thead>
<tr>
<th>Pediatrics (n=20)</th>
<th>Retracted ear</th>
<th>Contralateral ear</th>
<th>Controls</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reid plane-ET angle</td>
<td>22.4 ± 4.7</td>
<td>23.6 ± 4.8</td>
<td>24.2 ± 4.2</td>
<td>NS</td>
</tr>
<tr>
<td>Tubotympanic angle</td>
<td>144.2 ± 4.4</td>
<td>145.2 ± 4.2</td>
<td>143.2 ± 4.2</td>
<td>NS</td>
</tr>
<tr>
<td>ET pretympanic diameter (mm)</td>
<td>3.8 ± 2.8</td>
<td>4.2 ± 2.2</td>
<td>4.4 ± 2.4</td>
<td>NS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adults (n=22)</th>
<th>Retracted ear</th>
<th>Contralateral ear</th>
<th>Controls</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reid plane-ET angle</td>
<td>27.4 ± 4.7</td>
<td>30.6 ± 4.6</td>
<td>32.2 ± 4.2</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Tubotympanic angle</td>
<td>148.2 ± 4.4</td>
<td>145.2 ± 4.2</td>
<td>143.2 ± 4.2</td>
<td>NS</td>
</tr>
<tr>
<td>ET pretympanic diameter (mm)</td>
<td>3.3 ± 2.6</td>
<td>4.9 ± 2.2</td>
<td>5.2 ± 2.4</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Significant differences are marked. NS, not significant

Conclusion
1. CO2 laser myringoplasty combined with tympanostomy tube insertion offers a safe and well-controlled treatment for the pediatric pars tensa retractions although it does not correct the underlying eustachian tube dysfunction.
2. Although RPs of the pars tensa is a multifactorial disorder, the decrease in Reid plane-ET angle and ET pretympanic diameter and increase in adults may play a significant role in its etiology and disease progression.
3. The present study suggests that different pathology may occur in the development of RPs of the pars tensa in adults and children, which may supports adapting a more conservative flexible approaches as the treatment for children with retraction pockets.