Objective: The aim of the study was to study the closure of dry central type of tympanic membrane perforations by chemical cautery and improvement of hearing, to analyse the effect of Gelfoam on nonhealing small tympanic membrane perforations, and to examine the relevance of conservative means of closure of tympanic membrane perforations as an office procedure.

Materials and Methods: In this study, 100 patients attending the outpatient department were enrolled. Cautery of perforation margin was carried out with 50% trichloroacetic acid (TCA). After cautery, in small perforations less than 4 mm, a small piece of Gelfoam larger than the size of perforation was cut, impregnated with corticosteroid ointment, and carefully placed over the cauterized area under endoscopic visualization. In slightly larger perforations, that is, between 4 and 5 mm, after applying TCA to the margins of the perforation, a piece of Gelfoam larger than the size of perforation was soaked with corticosteroid ointment and placed in the middle ear cavity.

Results: Patients had relief from various symptoms, such as tinnitus, heaviness, and so on. There was some amount of auditory improvement in almost all the cases. It ranged from 5 to 23 dB. Conclusions: Cautery and patching of tympanic membrane perforation may be considered as the first-line management in the small- to medium-sized perforations before attempting the surgical closure.

Keywords: Cautery, Gelfoam, patching, trichloroacetic acid, tympanic membrane perforation

INTRODUCTION

Hippocrates (460-377 BC) was the first to regard the tympanic membrane as a part of organ of hearing and described it as a dry, thin spun web. The tympanic membrane got its name from Gabriel Fallopius of Padua (1523-1562), who was the first to use the term “tympanum.” The tympanic membrane is frequently injured and the relative incidence of myringal lesions has been reported to range from 0.4% to 2.3% of all disorders of the ear.[2] Persistence of tympanic membrane perforation has long been a challenge to medical science. The central perforation can be divided into two groups on the basis of the causes: (1) traumatic and (2) inflammatory [Table 1].

A perforation in the tympanic membrane makes it very difficult for the sufferer to take part in water sports. A person may be unfit for some skilled jobs such as air pilot or scuba diving if he or she is having a perforated drum.[3] For the closure of tympanic membrane perforation, a number of methods have been used.[4,5,6]

Surgical repair of the tympanic membrane using various types of tissue grafts (e.g., skin, temporal fascia, and perichondrium) by various researchers by using various techniques is generally accepted. Cauterization helps in establishing the natural pattern of migration of epithelium of perforated tympanic membrane, hence helping to achieve healing.[8,9,11,12]

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Repeated cautery is required at the rim of the perforation to close it, which often results in a very thin atrophic scar due to thinning of the lamina propria from its normal thickness of 100 µm to approximately 2-3 µm.[14]

Different patching materials have also been used for promoting healing of tympanic membrane perforation, for example, absorbable gelatin sponge was introduced. Gelfoam is a denatured porous gelatin sponge that is nontoxic and nonallergic.[6] The study of the closure of tympanic membrane perforation by repeated cautery with trichloroacetic acid (TCA) and Gelfoam (which is easily available) was carried out in our department.

**Materials and Methods**

This study was conducted among 100 patients attending the Outpatient Department of Otorhinolaryngology and Head and Neck Surgery, Government Medical College, Rajindra Hospital, Patiala, India. These patients had small- and medium-sized (up to 5 mm) dry central tympanic membrane perforations. A detailed history was noted and a functional examination was carried out. An approximate method was used to determine the size of the tympanic membrane perforation. A thorough cleaning of the external auditory meatus was performed, and a tiny scab or wax was carefully picked up from the meatus as well as tympanic membranes. For anesthesia, a cotton ball soaked in 4% xylocaine was applied in the external auditory canal and over the tympanic membrane.

**Cautery of perforation margin**

Cautery of perforation margin was carried out using a 0°endoscope with 50% TCA. A small bead of cotton was tightly wound to the end of a fine metal applicator and moistened with TCA. The excess acid was removed from the applicator by touching it to an absorbent tissue paper or cotton. This acid application was carried out over the epithelial lining to retard epithelial progression and extend out upon epithelial meatal surface for a distance of 0.5-1 mm, producing a solid white eschar. The applicator tip was stroked over the edge of perforation in an inward to outward direction.

**Patching**

After cautery, in small perforations less than 4 mm, a small piece of Gelfoam larger than the size of perforation was cut, impregnated with corticosteroid drops, and carefully placed over the cauterized tympanic membrane under endoscopic visualization. In slightly larger perforations, that is, between 4 and 5 mm, after applying TCA to the margins of the perforation, a piece of Gelfoam larger than the size of perforation was soaked with corticosteroid ointment and placed in the middle ear cavity. Another Gelfoam pack was placed over the cauterized tympanic membrane in the ear canal, thus “sandwiching” the tympanic membrane.

Repeated cautery, as described earlier, was carried out at weekly intervals for 7 weeks. After completion of the period, observations were made in regard to status of the tympanic membrane, any local complication and state of hearing.[10]

**Results**

Patients had varying degree of relief from various symptoms, such as tinnitus, heaviness, and so on. There was some amount of auditory improvement in almost all the cases. It ranged from 5 to 23 dB. The closure of a larger perforation led to a higher gain in hearing than that of a smaller perforation. Of 100 cauterized perforations, 76% were closed with an average of 4.1 applications (range was 1-7 applications) [Table 2].

1. Status of the tympanic membrane perforation, that is, whether there was
   a) complete closure of perforation.
   b) reduction in size of perforation.
   c) persistence of perforation.

**Table 1: Comparison of etiology factors**

<table>
<thead>
<tr>
<th>Name of the author (year)</th>
<th>Total cases</th>
<th>Inflammatory No.</th>
<th>%</th>
<th>Traumatic No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derlacki (1953)</td>
<td>143</td>
<td>129</td>
<td>90.20</td>
<td>14</td>
<td>9.70</td>
</tr>
<tr>
<td>Sellars (1969)</td>
<td>23</td>
<td>21</td>
<td>93.30</td>
<td>2</td>
<td>6.60</td>
</tr>
<tr>
<td>Stenfors (1989)</td>
<td>15</td>
<td>7</td>
<td>46.66</td>
<td>8</td>
<td>53.33</td>
</tr>
<tr>
<td>Uppal (1997)</td>
<td>50</td>
<td>33</td>
<td>66</td>
<td>17</td>
<td>34</td>
</tr>
<tr>
<td>Santhi (2012)</td>
<td>38</td>
<td>30</td>
<td>78.9</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td>Present study</td>
<td>100</td>
<td>72</td>
<td>72</td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

**Table 2: Number of treatments (range and average) taken to close perforations**

<table>
<thead>
<tr>
<th>Name of the author (year)</th>
<th>No. of treatment (range)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Derlacki (1953)</td>
<td>2–64</td>
<td>14.6</td>
</tr>
<tr>
<td>Mitchell (1958)</td>
<td>–</td>
<td>4.25</td>
</tr>
<tr>
<td>Juers (1958)</td>
<td>–</td>
<td>4.2</td>
</tr>
<tr>
<td>Juers (1963)</td>
<td>2–20</td>
<td>3.7</td>
</tr>
<tr>
<td>Sellars (1969)</td>
<td>2–11</td>
<td>6.0</td>
</tr>
<tr>
<td>Uppal (1997)</td>
<td>1–6</td>
<td>2.8</td>
</tr>
<tr>
<td>Santhi (2012)</td>
<td>1–5</td>
<td>3.2</td>
</tr>
<tr>
<td>Parmar (2015)</td>
<td>1–23</td>
<td>4.8</td>
</tr>
<tr>
<td>Present study</td>
<td>1–7</td>
<td>4.1</td>
</tr>
</tbody>
</table>
of 100 cauterized perforations, 76% were closed with an average of 4.1 applications (range was 1-7 applications). With the increase in the size of perforation, the average number of applications required was also higher. Healing was better observed in the younger age group of second and third decades (80% and 81.5%, respectively). The study concluded with a success rate of 76%.

Reviewing the various studies [Table 3], cautery and patching of tympanic membrane perforation may be considered as the first-line management in the small- to medium-sized perforations before attempting the surgical closure. This study has led to the following conclusions:

1. The smaller the perforation, the better the closure rate.
2. Larger perforation may be reduced to a smaller one, thereby making surgical intervention easier.
3. The healing rate was better in patients with traumatic perforation.
4. Correction of primary etiological factors helps in achieving a better closure rate.
5. Surgical complication of the middle ear can be avoided.
6. It may be safely tried among patients who are under control and in whom surgical intervention is contraindicated.

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**Conflicts of interest**
There are no conflicts of interest.

**REFERENCES**


