INTRODUCTION

Tympanic membrane perforation is a common problem in ENT clinical practice. Most tympanic membrane perforations are due to infective etiology like acute or chronic otitis media, and some are of traumatic cause. The perforations with infective etiology usually get healed unless there is coexisting eustachian tube dysfunction. The perforations with traumatic etiology usually heal spontaneously within 3-4 weeks and do not require any intervention, so it is preferable to wait for at least 3-4 weeks before doing any interventions. On Histopathologic examination, the stratified squamous epithelium of permanent perforations grows medially over the edge of the perforation. This medially grown epithelium arrests the subsequent spontaneous closure of the perforation. Removal of this medialized epithelium by chemical cauterization with trichloroacetic acid forms the basis of closure of tympanic membrane perforation. The most common manifestations of tympanic membrane perforation are hearing loss (conductive deafness) and ear discharge. A simple perforation of the tympanic membrane, without any lesion of the middle ear transformer mechanism, has two different effects on the hearing. (1) The surface area of tympanic membrane on which sound pressure is exerted is decreased, it causes dampened ossicular chain excursion. (2) Sound reaching the round window directly without the dampening and phase-changing effect of an intact tympanic membrane. This leads to loss of differential pressure at round and oval window and leads to decreased hearing. Closure of these perforations provides a barrier between the external pathogens and middle ear mucosa and prevents middle ear mucosa from exogenous pathogens. Also it restores the vibrating area of the tympanic membrane and provides round window protection and thus improves

Key Words: TCA; Tympanic Membrane Perforation; Chemical Cautery

ABSTRACT

BACKGROUND: Tympanic membrane perforation is a common problem seen in ENT practice. It is mainly either of infective or traumatic etiology. Perforation of tympanic membrane causes hearing loss and exposure of middle ear mucosa. In the time of 17th to the 19th centuries, many techniques were used to close tympanic membrane perforations like paper-patch technique, split thickness grafting, chemical cauterization with silver nitrate and trichloroacetic acid (TCA). Perforation of tympanic membrane can be closed by Chemical cauterization with trichloroacetic acid. 60 Patients having conductive deafness and dry perforation for at least 1 month were selected for the study. These cases were then studied for reduction in size of perforation and hearing improvement by chemical cauterization with use of trichloroacetic acid. Cauterization with TCA was repeated at 2 weekly intervals for 4 times.

RESULTS: Out of the 60 patients, in 45 perforation was completely healed; in the rest, size of the perforation was reduced. Average pretreatment hearing loss (Air Bone Gap) was 21.5 db and average post-treatment hearing loss (Air Bone Gap) was 12.2 db with average hearing improvement of 9.3 db. Study achieved 75% success rate with average of 2.53 TCA applications which was comparable to other studies done in the past.

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ORIGINAL ARTICLE

Efficacy Of Chemical Cauterisation In Tympanic Membrane Perforation; A Prospective Study

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Efficacy of Chemical Cauterisation In Tympanic Membrane Perforation
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As tympanic membrane perforations are commonly seen in ENT practice, intervention in the form of chemical cauterisation of tympanic membrane helps to relieve patient of his complaints. In the time of 17th to the 19th centuries, many techniques were used to close tympanic membrane perforations. In 1887, Blake developed the “paper patch” technique. In 1876, Roosa used cauterizing agents to promote healing of tympanic membrane perforations. He used the silver nitrate to cauterize the rim of a perforation. In 1895 the trichloroacetic acid was used for the first time for chemical cauterisation. Joynt combined the cautery and paper patch techniques and the closure rate improved, it formed the basis of the modern-day use of the paper patch technique. Derlacki popularized the modern day paper-patch technique. The surgical repair of permanent tympanic membrane perforations was first attempted at the same time as the paper patch technique. In 1952, Wullstein used split-thickness skin graft for closing perforations. A year later, Zöllner described his experiences with a similar graft. Wullstein and Zöllner introduced the use of the operating microscope which significantly enhanced surgical results due to improved the accuracy of the technique. Chemical cauterisation of tympanic membrane perforation using trichloroacetic acid is a procedure done to repair tympanic membrane perforations. While surgical closure of tympanic membrane perforation still remains the choice of management, effective closure of tympanic membrane perforation can be achieved by using chemical cautery and patch technique together for small and moderate sized perforations. The closure of perforation by chemical cauterization is very effective and easy method. It can be performed on an out-patient basis and does not require hospitalization. This procedure of chemical cauterization by TCA can achieve the improvement in hearing likely to be achieved by tympanoplasty.

MATERIALS AND METHOD

This study was carried out in the Department of E.N.T., Sir T. Hospital and Government Medical College, Bhavnagar.

Patient Selection: Every case attending the ENT OPD with complaints of ear discharge and decreased hearing was examined in detail. The following were the criteria for selection of cases:

Inclusion Criteria:
1. Patients with central perforation of tympanic membrane.
2. Ear must be dry (without discharge) for at least 4 weeks.
3. Patient should have pure conductive type of hearing loss.
4. Age > 18 years

Exclusion Criteria:
1. History of previous ear surgery
2. Attico-antral disease
3. Patients with Active discharge
4. Pure sensorineural hearing loss

After considering all these criteria for selection, the cases were studied as follows:

General Examination: In the beginning detailed history taking followed by thorough clinical examination of ear, nose and throat was carried out and relevant details were recorded. Eustachian tube patency was ascertained by Valsalva's maneuver. Patients with active pus discharge from ear were subjected to culture and sensitivity testing; appropriate antibiotics were given to the patients to maintain the ear dry for at least 4 weeks.

Otoscopic Examination: It was done in every case to confirm useful perforation size, location according to quadrant (antero-inferior, antero-superior, postero-inferior and postero-superior), status of the middle ear mucosa.

Audiometric Examination: The Audiometric examination was done with manual audiometer, calibrated to I.S.O. with standard headphones. The technique followed was 5 up and 10 down method. After explaining the procedure to the patient, Pure tone audiometry was performed and the hearing level recorded in acoustically treated room. Pure tone audiogram is done in every selected patient, and AC threshold and BC thresholds in all the patients who were considered for the study to assess the degree and the type of hearing loss. For
calculation of average of hearing loss (air bone gap) four frequencies were selected. They were: 500 Hz; 1000Hz; 2000Hz and 4000Hz. Only the patients with pure conductive type of hearing loss are taken into study. Audiometry was performed on every follow up to record the changes in the hearing loss and the improvement in hearing. The pre-treatment audiogram was compare with post-treatment audiogram (after 4 TCA applications) to know the hearing improvement.

Procedure For Tca Application : After cleaning the external auditory canal, the margins of the perforation were cauterized with solution of 2.5% tri-chloro acetic acid while viewing through the microscope using cotton tipped Jobson Horne probe. TCA was applied over the edge of the perforation in an inward to outward direction to break the epithelial barrier. It is signified by white discoloration of margin of the perforation. Sterile wet antibiotic soaked gel foam was placed on the cauterised margin of the perforation. Cauterization of tympanic membrane perforation was repeated at two weekly intervals for a maximum of four times and the size of the perforation was recorded. Case was considered successful once the perforation closed. The principles of repair of perforation by chemical cautery were as follows: The outer stratified squamous epithelium that has grown inwards across the edges prevents spontaneous closure of the perforation. This epithelium must be destroyed not just once but repeatedly to permit fibroblastic proliferation of the fibrous layer. Hyperemia stimulates fibroblastic proliferation and should be induced by mild irritation of perforation.

RESULTS
Sixty patients were taken in this study, out of which 27 were mals and 33 were females. Age range of the patients included was 18 to 60 years with maximum number of patients in the age group of 18 to 40 years. Out of 60, infection was the etiology in 50 patients and trauma in 10 patients. Pre-treatment dry period was at least 4 weeks. Most of the patients had small central perforation involving one quadrant of the tympanic membrane only. Maximum numbers of patients were having pre-treatment ABG in the range of 10 – 30 dB and in the post-treatment ABG below 20 dB. Out of the 60 patients, the perforation was closed successfully in 45 patients with overall success rate of 75%. In the rest of the patients the perforation did not close completely but the size of the perforation was reduces and there was improvement in hearing. Average pretreatment ABG was 21.5 dB and average post treatment ABG was 12.2 dB. The average hearing improvement in the form of closure of ABG was 9.3 dB. Of all the successfully closed perforations, majority of the patients required 2 to 3 TCA applications. Average no of TCA required in successful ears was 2.53.

Table 1: Air Bone Gap Range

<table>
<thead>
<tr>
<th>Air Bone Gap (Db)</th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 10</td>
<td>3</td>
<td>29</td>
</tr>
<tr>
<td>10.0 – 20</td>
<td>32</td>
<td>24</td>
</tr>
<tr>
<td>21.0 – 30</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>31.0 – 40</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>&gt;40</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

Table2: Showing Average No Of Tca Application

<table>
<thead>
<tr>
<th>No Of Times Tca Applied</th>
<th>No Of Patients Healed</th>
<th>Total Tca Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Once)</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>2 (Twice)</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>3 (3 times)</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>4 (4 times)</td>
<td>11</td>
<td>44</td>
</tr>
<tr>
<td>TOTAL</td>
<td>45</td>
<td>114</td>
</tr>
</tbody>
</table>

Table 3: Showing Average Air-Bone Gap

<table>
<thead>
<tr>
<th>Sr No</th>
<th>AIR BONE GAP</th>
<th>dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Average Pre-treatment ABG</td>
<td>21.5</td>
</tr>
<tr>
<td>2</td>
<td>Average Post-treatment ABG</td>
<td>12.2</td>
</tr>
<tr>
<td>3</td>
<td>Average Hearing Improvement</td>
<td>9.3</td>
</tr>
</tbody>
</table>

DISCUSSION
This study compares well with other studies in past. The biggest study done, includes 143 cases was done by Derlacki et al. He treated 14 cases of traumatic origin and 129 cases of inflammatory origin with 100% tri-chloro acetic acid. They could achieve a success rate of 75.6% with average hearing gain of 16.3 dB. Juers reported an 88% success with an average of 3.7 applications. He had further everted the margins of the perforation under the operating microscope. Derlacki reported 75%
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Success in office treatment at biweekly intervals had used cautery alone.\textsuperscript{10} T. Santhi reported 73.75\% success rate. \textsuperscript{12} Studies done in Indian setting like those of K.S. Uppal et al\textsuperscript{11} and K. Narendra et al\textsuperscript{14} have also achieved 78\% and 83\% success rates respectively which are almost similar to the 75\% achieved in the present study. Average hearing gain was 9.3 dB in these studies. Number of tri-chloro acetic acid applications required for closure of tympanic membrane perforation reported in the studies of Derlacki et al\textsuperscript{9} and Sellars et al is on the higher side at 14.6 and 6 respectively. The average number of applications was 2.8 and 2.5 in the studies done by K.S. Uppal et al\textsuperscript{13} and K. Narendra et al.\textsuperscript{14} Derlacki (1953) had the quickest closure occurring in two treatments and the longest in 64 treatments with average of 14.6.\textsuperscript{10} Juers (1963) had closure with average of 3.7 treatments.\textsuperscript{11} Present study had successful closures with average of 2.53 treatments. The study achieved 75\% success, with average hearing gain of 9.3 dB with an average of 2.53 TCA applications. The healed tympanic membranes were looking normal in all respect, since the membrane obtained by cauterization method has all the layers of normal tympanic membrane. It may be considered as a first line in the management of small to moderate sized perforation before attempting surgical closure. The present study has led to the following conclusions: (1) Smaller perforations had better healing rate with TCA application. (2) Large perforations may or may not get reduced to smaller size. (3) Those with traumatic perforation had a better healing rate. (4) Correction of primary etiological factors can helps for a better closure rate. (5) Surgical complications of middle ear surgery can be avoided.

REFERENCES
1. Banzer M. Disputatio de auditione laesa. 1640.