

## Evaluation of Prognostic Factors in Tympanoplasty

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Tympanoplasty is a surgical procedure to eradicate infection and restore the function of the middle ear. There are several prognostic factors that influence the success of tympanoplasty surgery. The aim of this study was to evaluate the prognostic factors that influence the result of the tympanoplasty surgery in Ahvaz University. This was a descriptive and cross sectional study conducted on 168 patients who underwent tympanoplasty operations during March 2012 to March 2014 in Emam Hospital of Ahvaz (Khuzestan, Iran). Prognostic factors such as age, sex, presence of systemic disease, location and size of perforation, duration of dry period, presence of myringosclerosis, Type of operation and status of the contra lateral ear and middle risk index (MERI) were investigated. Pearson chi-square, fishers exact test and logistic regression were used to determine the role of prognostic factors in successful of tympanoplasty. The success rate was 67.2%. Analyses showed that size of perforation (<50%), healthy opposite ear, absence of myringosclerosis, dry period greater three months and low middle ear risk index were significant prognostic factors. The consideration of these factors allows the surgeon to confer the patient before surgery. Furthermore, this will enable the surgeon to design a case specific operation strategy for each patient.

**Key words:** Tympanoplasty, Prognostic Factor, Successful Rate

Tympanoplasty is a surgical procedure performed to eradicate infection and restore the function of the middle ear<sup>1</sup>. Many studies report the success of this operation 69-99% in adults and 35– 94% in children<sup>2,4</sup>. Post operative middle ear aeration is successful key of tympanic membrane repair and restoration of hearing<sup>1</sup>. Some authors consider a healthy tympanic membrane is as a successful result, while others consider middle ear aeration and amount of hearing after operation as a proper result<sup>2,4</sup>. There are several prognostic

factors that influence the success of tympanoplasty surgery. Some studies declare some of these factors as significant factors while others reject it<sup>2</sup>.

The purpose of this study was to evaluate the prognostic value of the technical and anatomic factors that influence the result of the tympanoplasty surgery in patients operated on for chronic otitis media in Imam Khomeini Hospital of Ahvaz (Khuzestan, Iran).

### MATERIAL AND METHODS

This was a descriptive and cross sectional study conducted on 168 patients who underwent tympanoplasty operations during March 2012 to

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March 2014 in Emam Hospital of Ahvaz (Khuzestan, Iran) affiliated with Ahvaz Jundishapur University of Medical Sciences. All patients underwent a preoperative audiologic evaluation from 0.5 to 4 KHz. Variables such as age, sex, presence of systemic disease (diabetes mellitus and hypertension), location and size of the perforation, status of the opposite ear, duration of the dry period, presence of myringosclerosis, type of operation, presence of nasal septum deviation and hypertrophy of inferior turbinate and risk of the MERI were evaluated. MERI combines the known preoperative and intraoperative risk factors for tympanoplasty prognosis as a numeric value<sup>4</sup> (Table 1). MERI score as a numeric value correlates to severity and prognosis of disease (Table 2). Patients with the severe septal deviation and inferior turbinate hypertrophy and who didn't back to follow up were excluded from the study. The underlay tympanoplasty technique by the temporalis fascia was used as the graft material in all surgical procedures. Type of operation was intact canal wall technique and canal wall down. The patients were following up after third month. The mean of follow up was 4.9 months (range from 3 month to 6 month). An intact graft in proper position and aerated middle ear at the end of three month was considered a success result. Physical exams, Eustachian tube function test and audiologic evaluation (from 0.5 to 4 KHz) were performed after the third month. In our study 17 patients with sever septal deviation and turbinate hypertrophy and 26 patients that didn't back to follow up were excluded. Pearson coefficient test, Chi-square, Fishers exact test and logistic regression were used to determine the significant role of prognostic factors in successful of tympanoplasty.

## RESULTS

In the present study 125 patients were evaluated that include 54 male (43.3%) and 71 Female (56.8%). The age range of the patients was 11 to 65 years. The success rate of tympanoplasty was 67.2% (84 of 125 patients), and the mean air-bone gap improvement was  $9\pm 6$  db.

Size of the perforation (<50%) (P=0.001), healthy opposite ear (P=0.011), more than 3 month dry period of the ear (P=0.028), absence of myringosclerosis (P=0.006), operation type (intact canal wall group) (P=0.008) and the low MERI score (P= 0.001) were found to be statistically significant prognostic factors that affect success rate (Table. 3).

We used logistic regression to determine the independent variables and the relative importance of them. The following results were founded: Size of the perforation (<50%) (OR: 3.449), healthy opposite ear (OR: 2.770), absence of myringosclerosis (OR: 2.954) and the low MERI score (OR: 5.539). were determined as independent prognostic factors (Table 3). Duration of dryness (P = 0.095) and the operation type (P=0.273) were not found as an independent prognostic factors. The size of perforation was correlated with the time of dryness ( $r=0.259$ ;  $P=0.004$ ) (Table.4). A MERI score of 0 to 3 represents mild disease, 4 to 6 moderate disease and 7 to 12 severe disease. 61 (48.8%) of Patients had low risk, 36 (28.8%) medium risk and 28 (22.4%) high risk. The mean MERI score was found as 8.23 in the canal wall down mastoidectomy group and 3.08 in the intact canal wall group. The mean MERI score was higher in CWD mastoidectomy group (P=0.000) (Table 5).

**Table 1.** Variables studied in the study

| Variables               | Value     | N  | Value       | N    | Value   | N    |
|-------------------------|-----------|----|-------------|------|---------|------|
| Systemic disorders      | presence  | 7  | absence     | 118  | ****    | **** |
| Duration of dry ear     | <3 months | 78 | <3 months   | 47   | ****    | **** |
| Size peforation         | <50%      | 58 | <50%        | 67   | ****    | **** |
| Myringosclerosis        | presences | 82 | absence     | 43   | ****    | **** |
| Status of opposite ear  | healthy   | 63 | abnormal    | 62   | ****    | **** |
| Type of operation       | ICW       | 84 | CWD         | 41   | ****    | **** |
| Location of perforation | anterior  | 25 | posterior   | 29   | Central | 71   |
| MERI                    | Low       | 61 | Moderate    | High | 28      |      |
| Age                     |           |    | 31.05 years |      |         |      |

**Table 2.** The MERI Score

|                                     | Risk factor               | Risk value |
|-------------------------------------|---------------------------|------------|
| Otorrhea (bellucci)                 | I-Dry                     | 0          |
|                                     | II-Occasionally wet       | 1          |
|                                     | III-Persistently wet      | 2          |
|                                     | IV-Wet, cleft palate      | 3          |
| Perforation                         | None                      | 0          |
|                                     | Present                   | 1          |
| Cholesteatoma                       | None                      | 0          |
|                                     | Present                   | 1          |
| Ossicular status (Austin/Kartush)   | 0) M+I+S+                 | 0          |
|                                     | A) M+S+                   | 1          |
|                                     | B) M+S-                   | 2          |
|                                     | C) M-S+                   | 3          |
|                                     | D) M-S-                   | 4          |
|                                     | E) Ossicula head fixation | 2          |
| Middle year granulation or effusion | No                        | 0          |
|                                     | Yes                       | 2          |
| Pervious surgery                    | None                      | 0          |
|                                     | Staged                    | 1          |
|                                     | Revision                  | 2          |
| Smoker                              | No                        | 0          |
|                                     | Yes                       | 2          |

**Table 3.** Statistical results of study

| Variable                | value     | patients | success rate | Incidence | P-value       |
|-------------------------|-----------|----------|--------------|-----------|---------------|
| Location of perforation | anterior  | 25       | 20           | 80.0      | <b>0.244</b>  |
|                         | posterior | 29       | 20           | 69.0      |               |
|                         | central   | 71       | 44           | 62.0      |               |
| Size of perforation     | <50%      | 58       | 48           | 82.8      | <b>0.001*</b> |
|                         | >50%      | 67       | 10           | 14.9      |               |
| Status of opposite ear  | healthy   | 63       | 49           | 77.8      | <b>0.011*</b> |
|                         | abnormal  | 62       | 35           | 56.5      |               |
| Duration of dry ear     | <3 months | 78       | 58           | 74.4      | <b>0.028*</b> |
|                         | >3 months | 47       | 26           | 55.3      |               |
| Myringo-sclerosis       | presence  | 43       | 22           | 51.2      | <b>0.006*</b> |
|                         | absence   | 82       | 62           | 75.6      |               |
| Type of operation       | ICW       | 84       | 63           | 75.0      | <b>0.008*</b> |
|                         | CWD       | 41       | 21           | 51.2      |               |
| MERI                    | Low       | 61       | 49           | 80.3      | <b>0.001*</b> |
|                         | Moderate  | 36       | 24           | 66.7      |               |
|                         | High      | 28       | 11           | 39.3      |               |
| Age                     | <16 years | 12       | 8            | 66.7      | <b>0.967</b>  |
|                         | >16 years | 113      | 76           | 67.3      |               |
| Sex                     | Male      | 54       | 38           | 70.4      |               |
|                         | Female    | 71       | 47           | 66.2      |               |
| Systemic disorders      | presence  | 118      | 80           | 67.8      | <b>0.683</b>  |
|                         | absence   | 7        | 4            | 57.1      |               |

**Table 4.** Multivariate analysis of the significant prognostic parameters

| Variable                    | B     | Wald  | df | Sig.  | Exp(B) | 95.0% C.I. for EXP(B) |        |
|-----------------------------|-------|-------|----|-------|--------|-----------------------|--------|
|                             |       |       |    |       |        | Lower                 | Upper  |
| Size(<50%)                  | 1.238 | 6.145 | 1  | 0.013 | 3.449  | 1.296                 | 9.182  |
| Healthy opposite ear        | 1.019 | 4.492 | 1  | 0.034 | 2.770  | 1.080                 | 7.107  |
| More than 3 months period   | 0.837 | 2.794 | 1  | 0.095 | 2.308  | 0.866                 | 6.157  |
| Absence of myringosclerosis | 1.083 | 5.064 | 1  | 0.024 | 2.954  | 1.150                 | 7.588  |
| Operation type(ICW)         | 0.648 | 1.204 | 1  | 0.273 | 1.912  | 0.601                 | 6.082  |
| MERI(Low score)             | 1.712 | 5.949 | 1  | 0.015 | 5.539  | 1.400                 | 21.920 |

B, Beta coefficient; CI, Confidence Interval; ICW, Intact Canal Wall

**Table 5.** Correlation between type of operation and MERI score

| Variables         | N  | Mean MERI score | P-value     |
|-------------------|----|-----------------|-------------|
| Type of operation |    |                 | <b>.000</b> |
| intact canal wall | 62 | 3.08            |             |
| canal wall down   | 21 | 8.24            |             |

## DISCUSSION

Results in tympanoplasty depended to the different recognized factors that is related to both the surgical technique and pathologic situation<sup>3,5,14</sup>. The purpose of the present study is evaluation of some variable that they may be able to predict the result of tympanoplasty. The definition of successful tympanoplasty varies from one author to other. Some authors consider a healthy tympanic membrane as a successful result; while others consider middle ear aeration and amount of hearing after operation as a proper result<sup>2,4</sup>. In our study an intact graft in adequate position and aerated middle ear after 3 month was considered a success, that former by physical exams and later by Eustachian tube function test was evaluated. In our study success rate was %67.2. In the study of Pinar *et al* success rate was 74.4%<sup>4</sup>. Many studies report a success rate from 60-99% in adults, where as a 35-94% success in children<sup>2,4,7,8</sup>. In the study of Koch<sup>6</sup> and Ullah<sup>9</sup> successful rate in tympanoplasty of children was 73% and 80% respectively.

Generally surgical success rate in children is lower than adult<sup>6,7</sup>. Because it was thought to have a high rate of recurrence owing to immature eustachian tube function in children<sup>1</sup>. Of course most of the studies didn't find any difference between the results of tympanoplasty in children and adults<sup>2,4,10</sup>. In the study of Koch<sup>6</sup> tympanoplasty for repair of perforation is recommended for children over 8 years old. In the study of yung surgical result was compared between young children (4-8 years) and older children (9-13 years). They found that patient age did not influence the surgical result<sup>11,20</sup>. In our study pediatric age group included 4 patients (range 11 to 16 years of age) and adult group were 121 patients. We didn't find any relation between surgical success rate and patient age. Although the number of patients in pediatric group was too small to reach statistical significance. In our study we didn't find any relationship between presence of systemic disease and surgical success rate. The number of patients with systemic disease were 7 (all of them had diabetic mellitus). This low number of patient in this group can impress the statistic results. Also Pinar in their large series had similar finding<sup>4</sup>.

The location and size of perforation have been evaluated in different studies. The most common area of tympanoplasty failure when repairing total perforation is the anterior superior area owing to the lack of support<sup>1</sup>. Some studies<sup>3,10,11,13</sup> didn't find any relationship between location of perforation and surgical results. Pinar<sup>4</sup> found that graft success rate for central perforation was higher compared with posterior and anterior perforation. In our study we didn't find any relationship between location of perforation and success rate of surgery. About the size of perforation Pinar<sup>4</sup>, lee<sup>12</sup>, Onal and Albu<sup>13,16</sup> found a significantly higher success rate with perforation smaller than 50%. However no statistically significant association was found between perforation size and successful tympanoplasty in some studies. We also found a significant relationship between graft success and smaller perforation. There are controversy finding about the importance of the dry ear in tympanoplasty outcome. Some author recommend that the ear be dry for 3 to 4 weeks before tympanoplasty<sup>1</sup>. Uyar<sup>15</sup> and Pinar<sup>4</sup> found that there was a significantly higher rate of graft success in patients who had dry ear for 3 months preoperatively. Also some studies didn't find any statistically correlation with respect to dry ear<sup>13,16,17,18</sup>. We also found a significant association between dry ear and success of tympanoplasty similar to these studies.

In our study we found that the status of the opposite ear was a prognostic factor. Adkins<sup>19</sup> find that the presence of bilateral perforation had adversely influence in the success rate. Possible explanation of this could be presence of Eustachian tube dysfunction as a risk factor. Pinar<sup>17</sup> and Collins<sup>4</sup> had similar findings. Singh<sup>11</sup> found no association between opposite ear status and surgical success. Referring to type of operation, we found higher success rate in ICW tympanoplasty compared with CWD tympanoplasty. Pinar also had similar results, but Onal<sup>13</sup> didn't find any relationship between type of operation and successful rate. In addition, patients with low MERI score ( $\leq 3$ ) had significantly higher rates of success. Pinar<sup>4</sup> had similar finding. Mean MERI score was higher in CWD tympanoplasties. Because moderate and sever MERI score in comparison with low MERI score suggest presence of ossicular pathology,

cholesteatoma and other disorder of middle ear consequence this patients also need more extensive intervention<sup>4</sup>. Pinar et al showed that absence of myringosclerosis increased the success rate of tympanoplasty<sup>4</sup>. We found similar findings. Onal et al did not find a correlation between success and myringosclerosis<sup>13</sup>.

### CONCLUSION

The consideration of these factors allows the surgeon to confer the patient before surgery. This will enable the surgeon to design a case specific operation strategy for each patient.

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