

Gastroesophageal reflux disease and tympanoplasty surgical outcome: is there a relationship?

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Abstract

Objective: To investigate the possible clinical relationship between gastroesophageal reflux disease and the type one tympanoplasty surgical outcomes of adults with chronic otitis media, by using a simple, cost-effective, reliable questionnaire and physical findings.

Methods: Fifty-two of 147 patients undergoing type one tympanoplasty were studied. Gastroesophageal reflux disease symptoms were evaluated using the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease questionnaire. Laryngoscopic physical findings of laryngopharyngeal reflux were evaluated using the Reflux Finding Score. A successful outcome was defined as an intact tympanic membrane. Correlations between the two assessment tool results and the patient's surgical success were calculated.

Results: The gastroesophageal reflux disease questionnaire score was significantly higher in patients with unsuccessful tympanic membrane closure (group one) than in patients with successful closure (group two) ($p < 0.05$). The Reflux Finding Score was also significantly higher in group one than group two ($p < 0.05$). There was a significant positive relationship between the gastroesophageal reflux disease questionnaire score and the Reflux Finding Score ($p < 0.01$).

Conclusion: Gastroesophageal reflux disease may be a significant prognostic factor for tympanoplasty failure. Therefore, reflux investigation may be important during the treatment of chronic otitis media, and positive cases may need reflux treatment as well as ear disease treatment.

Key words: Myringoplasty; Gastroesophageal Reflux; Treatment Outcome; Prognosis

Introduction

The goals of successful tympanoplasty are the removal of pathology and the achievement of a mucosa-lined middle-ear cleft with an intact tympanic membrane.¹ The reported incidence of surgical success of tympanoplasty ranges from 60 to 99 per cent in adults.²

There are various reported prognostic factors which may influence tympanoplasty success.³ These comprise age, perforation location and size, eustachian tube condition, middle-ear mucosa status, graft type and surgeon experience.⁴

Gastroesophageal reflux disease causes several symptoms and affects many people; hence, otolaryngologists will encounter patients with gastroesophageal reflux disease. Gastroesophageal reflux disease causing supraesophageal lesions can have manifestations in the larynx, pharynx, nasal cavity and middle ear.⁵ Animal studies have revealed that an acidic pH and the presence of pepsin can cause laryngeal complications and eustachian tube dysfunction as a result of

gastroesophageal reflux disease.^{6–8} Gastroesophageal reflux disease may manifest as nasopharyngitis, leading to ear disease, and may also cause chronic, therapy-resistant middle-ear disease.⁹

However, we were unable to find any previous studies specifically assessing the association between gastroesophageal reflux disease and tympanoplasty success. Therefore, we investigated the possible clinical relationship between gastroesophageal reflux disease and the surgical outcomes of type one tympanoplasty in adults with chronic otitis media, by using a simple, cost-effective, reliable questionnaire together with assessment of physical findings.

Materials and methods

Our study group comprised patients who presented to the ENT department of Istanbul Haydarpaşa Numune Education and Research Hospital and were treated with type one tympanoplasty between January 2009 and January 2010.

This study was approved by Haydarpasa Numune Education and Research Hospital ethics committee, and a completed informed consent form was obtained from each patient prior to study commencement.

The medical charts of 147 patients were reviewed by the first two data collectors. Variables such as age, sex, presence of systemic disease, perforation location and size, and dry period duration were evaluated. Patients who had a central tympanic membrane perforation of less than 50 per cent, and a dry period of more than three months, were included in the study.

Patients with systemic disease, marginal perforation, previous ear surgery on the same side or graft material other than temporalis fascia, and those who died during follow up, were excluded from the study. Any patients who had been treated with histamine antagonists or proton pump inhibitors in the six months prior to the study were also excluded. In this way, we excluded most known prognostic factors affecting tympanoplasty surgical outcomes, in order to focus only the effect of gastroesophageal reflux disease.

The underlay tympanoplasty technique, in which temporalis fascia is harvested as the graft material, was used in all patients, under general anaesthesia. The surgical approach was retroauricular. All surgical procedures were performed by three senior surgeons.

Patients were followed up six months post-operatively. An intact graft in the correct position was considered a success.

The second stage of the study was conducted by two different data collectors. Twenty-two patients had unsuccessful tympanic membrane closure. Of these, 19 patients met our selection criteria; these patients were classified as group one. One hundred and twenty-five patients had successful surgery. These patients were arranged in order of patient hospital protocol number, and 45 consecutive patients were invited to take part in the study. Thirty-three of these patients agreed and met our selection criteria; these patients were classified as group two (Figure 1).

In the third stage of the study, the selected patients underwent evaluation of gastroesophageal reflux disease symptoms using the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease questionnaire, administered by two blinded otolaryngologists who were unaware of the previous stages of data collection (Appendix 1). The Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease is a new method of assessing gastroesophageal reflux disease, and addresses the most common symptoms of the disease.¹⁰ This questionnaire comprises seven questions on acid reflux and five questions on dysmotility.¹¹ Subjects answered questions about the frequency of their symptoms, scoring them as follows: never = 0, occasionally = 1, sometimes = 2, often = 3 and always = 4. We calculated the acid reflux, dysmotility and total scores. A total score of 8 or more was considered to indicate probable gastroesophageal reflux disease.¹²

Since there is no pathognomonic laryngopharyngeal reflux finding, Belafsky *et al.* have developed an eight-item clinical severity scale with which to rate the laryngoscopic findings of laryngopharyngeal reflux. This Reflux Finding Score appears to be useful for assessment and follow up of laryngopharyngeal reflux patients.¹³ Belafsky *et al.* rated, on a variably weighted scale from 0 to 4, the following eight findings associated with laryngopharyngeal reflux: subglottic oedema, ventricular obliteration, erythema or hyperaemia, vocal fold oedema, diffuse laryngeal oedema, posterior commissure hypertrophy, granuloma, and thick endolaryngeal oedema. Possible results ranged from 0 (normal) to 26 (worst possible score). Based on this analysis, one could be 95 per cent certain that a patient with a Reflux Finding Score of 7 or more had laryngopharyngeal reflux.¹⁴

Our study evaluated the physical findings of laryngopharyngeal reflux seen during fibre-optic laryngoscopy, using this Reflux Finding Score, administered by the same two blinded otolaryngologists (Appendix 2).¹³

Subsequently, we calculated the correlations between the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease score, the Reflux Finding Score and the patient's tympanoplasty surgical success.

Statistical analysis

The NCSS 2007 and PASS 2008 Statistical Software packages (Kaysville, Utah, USA) was used for all analyses, and a biostatistician reviewed the results. The Mann–Whitney U test was used to compare the values obtained in the two groups. Spearman's rho coefficient was used to assess the correlation between the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease score and the Reflux Finding Score. Statistical significance was defined as a *p* value of less than 0.05. A confidence interval of 95 per cent was used.

Results

There were 25 male and 27 female patients in this study. The age range of the patients was 18 to 48 years. Nineteen patients had unsuccessful tympanic membrane closure. Thirty-three patients with successful surgery were evaluated as a control group.

The Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease had a mean score \pm standard deviation and a median score of 16.8 ± 12.0 and 13, respectively, in group one, and 9.4 ± 10.6 and 5, respectively, in group two. Group one had a significantly higher mean score than group two ($p < 0.05$) (Table I, Figure 2).

The Reflux Finding Score had a mean \pm standard deviation and a median of 6.4 ± 4.0 and 5, respectively, in group one, and 2.2 ± 3.1 and 1, respectively, in group two (Table II, Figure 3).

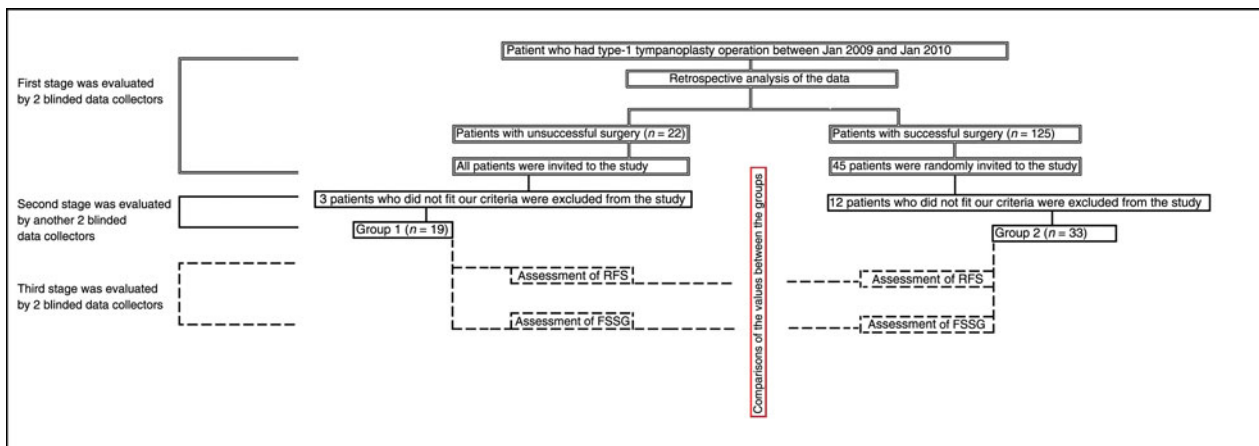


FIG. 1

Flow diagram showing progress of patients through the study procedure. Jan = January; RFS = Reflux Finding Score; FSSG = Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease

Group	FSSG score	
	Mean ± SD	Med (25%–75%)
1*	16.78 ± 11.90	13 (6–29)
2†	9.39 ± 10.56	5 (0–15)
<i>p</i> ‡	0.014	

**n* = 19; †*n* = 33. ‡Mann–Whitney U test. FSSG = Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease; SD = standard deviation; Med = median

Both the Reflux Finding Score and the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease generated significantly higher scores for group one than for group two ($p = 0.014$ and $p = 0.001$, respectively). For all cases, there was a significant positive relationship between the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease score and the Reflux Finding Score, at the level of 36 per cent, with an r value of 0.360 (Spearman’s rho coefficient) and a p value of 0.009.

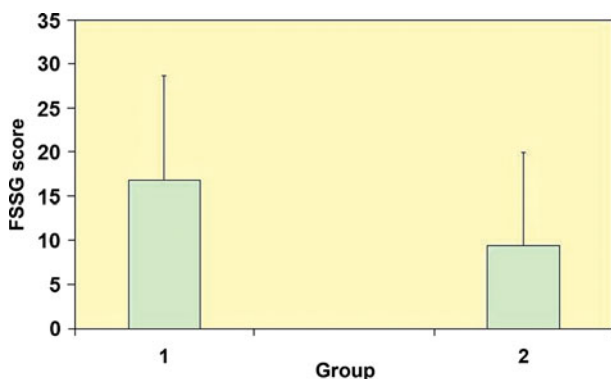


FIG. 2

Mean Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease (FSSG) scores in group one ($n = 19$) and group two ($n = 33$).

Discussion

Gastroesophageal reflux disease is the most frequent disease of the oesophagus, and is present in about 20 to 40 per cent of the Western population.⁹ Pathophysiologically, two mechanisms are responsible for the mucosal injury caused by gastroesophageal reflux disease. One is the action of acid and the proteolytic enzyme pepsin. The other may be the reflexes mediated by the vagal nerve.¹⁵

The relationship between reflux oesophagitis and otorhinolaryngological problems has been described before.^{5–9} Patients with laryngeal problems have acid reflux reaching higher levels of the proximal oesophagus, compared with normal individuals.¹⁵ Oedema of the mucosa around the eustachian tube, as a direct effect of gastroesophageal reflux disease, might cause a difference in pressure between the middle-ear cavity and the nasopharynx which could result in the ingress of a bolus of reflux material from the pharynx into the middle ear.¹⁶ Transient reflux of acid and resultant conversion of pepsinogen to pepsin could cause further eustachian tube dysfunction, as suggested by studies on animal models.⁷

The discovery of pepsin and pepsinogen in the middle-ear effusions of children provides strong evidence of a causal relationship between gastroesophageal reflux disease and otitis media.¹⁷ Most investigations of the relationship between otitis media and gastroesophageal reflux disease have been conducted in children, with only limited research in adults.^{9,16,18–20}

One of the common sequelae of chronic otitis media is tympanic membrane perforation, which can cause hearing loss and otorrhoea. The major goals of tympanoplasty are to reduce the number of infections and improve hearing. Reported factors that may influence the success of such surgery are age, perforation location and size, eustachian tube condition, middle-ear mucosa status, graft type, and surgeon experience.⁴

Abnormal eustachian tube function appears to be the most important factor in the pathogenesis of middle-ear

TABLE II
COMPARISON OF RFS

Group	RFS	
	Mean \pm SD	Med (25%–75%)
1*	6.42 \pm 3.97	5 (4–9)
2†	2.24 \pm 3.13	1 (0–3)
<i>p</i> ‡	0.001	

**n* = 19; †*n* = 33. ‡Mann–Whitney U test. RFS = Reflux Finding Score; SD = standard deviation; Med = median

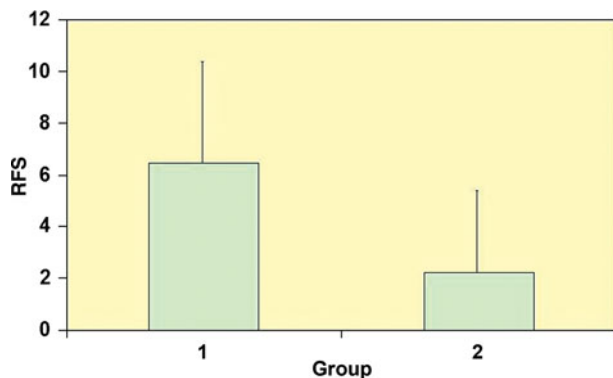


FIG. 3

Mean Reflux Finding Score (RFS) in group one (*n* = 19) and group two (*n* = 33).

disease in all age groups.²¹ Firstly, direct contact between reflux and eustachian tube mucosa may occur, based on the eustachian tube's proximity to the upper airway. Secondly, occlusion of the eustachian tube by inflammation may cause secondary changes. Finally, reflux exposure may generate inflammatory mediators, stimulating a cascade of inflammation which leads to middle-ear disease. A previously conducted literature review of modifiable risk factors for otitis media identified gastroesophageal reflux disease as a risk factor.²² Although gastroesophageal reflux disease has been demonstrated to be related to eustachian tube dysfunction and middle-ear disease, we have not encountered any previously published literature concerning gastroesophageal reflux disease as a possible prognostic factor for tympanoplasty success.^{7,8,19}

The goal of the present study was to investigate the relationship between gastroesophageal reflux disease and tympanoplasty success. In our patients, scores for both the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease and the Reflux Finding Score were significantly higher in group one than group two. These higher scores in group one can be explained by eustachian tube dysfunction caused by reflux. Therefore, we hypothesise that gastroesophageal reflux disease may be a significant prognostic factor for tympanoplasty success.

Although scores for both research tools were significantly higher in group one, the limitation of our study

was the lack of exact diagnosis of gastroesophageal reflux disease, due to the fact that endoscopic examinations are invasive and stressful for patients, especially for those who have only ear symptoms. Moreover, studies have shown that 24-hour pH monitoring may not be the 'gold standard' for diagnosing gastroesophageal reflux disease.²³ Thus, we used a questionnaire (the Frequency Scale for the Symptoms of Gastroesophageal Reflux Disease) together with assessment of physical findings of laryngopharyngeal reflux on laryngoscopy (rated using the Reflux Finding Score), and found this approach to be simple, reliable, cost-effective and well tolerated by patients.

- **Gastroesophageal reflux disease is associated with eustachian tube dysfunction and middle-ear disease**
- **This study assessed the relationship between gastroesophageal reflux disease and adult tympanoplasty success, via a questionnaire and physical findings**
- **Pre-existing gastroesophageal reflux disease may affect tympanoplasty outcomes**
- **Reflux treatment should be considered for patients with ear complaints and gastroesophageal reflux symptoms**

The results of this study demonstrate that the presence of gastroesophageal reflux disease in patients with chronic otitis media who have undergone type one tympanoplasty may affect their surgical outcome. Thus, treatment for gastroesophageal reflux disease should be considered for patients with ear complaints, especially those who have gastroesophageal reflux disease related symptoms.

Conclusion

There are various prognostic factors reported in the literature which may influence the surgical success of tympanoplasty. In this study, we excluded most of these factors in order to assess only the effect of gastroesophageal reflux disease on tympanoplasty success. To our best knowledge, this is the first study to describe the relationship between gastroesophageal reflux disease and tympanoplasty success. In the future, further studies should be conducted assessing a wider range of relevant prognostic factors (e.g. nasal and eustachian tube pathology, perforation location and size, and graft type), compared using multivariate analysis in a larger patient group.

Gastroesophageal reflux disease has been demonstrated to be related to eustachian tube dysfunction and middle-ear disease. It may also be a significant prognostic factor for tympanoplasty success. Therefore, reflux investigation may be important in patients receiving treatment for chronic otitis media, and in positive cases reflux treatment may be necessary

in addition to treatment of the primary disease. The next step should be to detect the existence of pepsin (or pepsinogen) in the middle ear of patients whose tympanoplasty has failed.

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APPENDIX 1

FREQUENCY SCALE FOR THE SYMPTOMS OF GASTROESOPHAGEAL REFLUX DISEASE

Question	Frequency				
	Never	Occasionally	Sometimes	Often	Always
Do you get heartburn?	0	1	2	3	4
Does your stomach get bloated?	0	1	2	3	4
Does your stomach ever feel heavy after meals?	0	1	2	3	4
Do you sometimes subconsciously rub your chest with your hand?	0	1	2	3	4
Do you ever feel sick after meals?	0	1	2	3	4
Do you get heartburn after meals?	0	1	2	3	4
Do you have an unusual (e.g. burning) sensation in your throat?	0	1	2	3	4
Do you feel full while eating meals?	0	1	2	3	4
Do some things get stuck when you swallow?	0	1	2	3	4
Do you get bitter liquid (acid) coming up into your throat?	0	1	2	3	4
Do you burp a lot?	0	1	2	3	4
Do you get heartburn if you bend over?	0	1	2	3	4

Patients were asked to score each question as never = 0; occasionally = 1; sometimes = 2; often = 3; or always = 4. In the frequency scale for the symptoms of gastroesophageal reflux disease (FSSG), there are seven acid-reflux-related symptoms (questions 1, 4, 6, 7, 9, 10 and 12), and five dysmotility-like symptoms (questions 2, 3, 5, 8 and 11). The acid reflux, dysmotility and total scores (acid reflux and dysmotility scores) were calculated, and a total score of = 8 was considered to indicate probable GERD

APPENDIX 2 REFLUX FINDING SCORE	
Finding	Score
Subglottic oedema	0 = absent 2 = present
Ventricular oedema	2 = partial 4 = complete
Arytenoidal &/or interarytenoidal erythema or hyperaemia	2 = arytenoids only 4 = diffuse
Vocal fold oedema	1 = mild 2 = moderate 3 = severe 4 = polypoid
Diffuse laryngeal oedema	1 = mild 2 = moderate 3 = severe 4 = obstructing
Posterior commissure hypertrophy	1 = mild 2 = moderate 3 = severe 4 = obstructing
Granuloma or granulation tissue	0 = absent 2 = present
Thick endolaryngeal mucus	0 = absent 2 = present