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The role of Extraesophageal reflux on the eustachian tube function

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Abstract:

Objective: The purpose of the study was to identify tubal dysfunction by tympanometry in patients with extraesophageal reflux measured by the Reflux Symptom Index (RSI) scale.

Methods: This is a prospective and analytical study that included 37 patients (20 women and 17 men, mean age: 48.3 years) with extraesophageal reflux diagnosed by RSI, a complete ENT examination and tympanometry were performed. A group of 37 healthy controls (19 women and 18 men, mean age: 45.7 years) were recruited.

Results: 61 ears (82%) curves type A, 12 (16%) type As, 0 (0%) type Ad, 0 (0%) type B and 1 (1%) type C were observed in patients with reflux extraesophageal and an average of 31 points in the RSI. 70 (95%) curves type A, 4 (5%) type As, 0 (0%) type Ad, 0 (0%) type B and 0 (0%) type C were identified and an average of 11 points in the RSI. Significant differences were found in the RSI values ($p = 0.001$) and in the proportion of patients who presented As curves ($p = 0.032$). No significant difference was found between the pressure inside the middle ear ($p = 0.679$).

Conclusion: The association between extraesophageal reflux and eustachian tube dysfunction was not found. A significant increase in thickened tympanic membranes or with sclerotic foci was found in patients with extraesophageal reflux disease compared to healthy controls.

Keywords: Extraesophageal reflux; Tubal dysfunction; Eustachian tube; Tympanometry

1. Introduction

Extraesophageal or laryngopharyngeal reflux is a growing pathology that has increased in recent years and causes a variety of ENT manifestations. In addition, there is evidence that otitis media is related to the presence of reflux. [1,2]

Extraesophageal reflux has been measured with different markers to identify its presence and make the diagnosis in addition to assessing its severity and classifying it. Two of the most commonly used scales are the Reflux Symptom Index (RSI) which consists of nine items where it is scored from 0 to 5, where a score above 13 is pathological. [3] Another scale is the Reflux Finding Score, in which endoscopic laryngeal characteristics are evaluated where a score above 11 is pathological. [4] However, there is evidence that there is a greater correlation between the reflux and the RSI scale based on a pH meter. [5]

The Eustachian tube has three well-defined functions: equalize the pressure and ventilate the middle ear, mucociliary drainage of the secretions of the middle ear and protection of the middle ear (of sounds and pathogens). [6] Tubal dysfunction is an entity in which the process of opening and closing the eustachian tube is altered and consequently its functions cannot be fulfilled. [6,7] This dysfunction can be diagnosed by tympanic retraction or negative pressure on the tympanometric curves. [8]

There are no reports that have investigated whether extraesophageal reflux is associated with eustachian tube dysfunction. Therefore, the objective of this study is to identify tubal dysfunction by tympanometry in patients presenting with extraesophageal reflux measured by RSI.

Patients and Methods

A total of 37 subjects with gastroesophageal reflux diagnosed by the RSI between January and August 2019 were evaluated in the Otolaryngology Service, University Hospital, Autonomous University of Nuevo León in Monterrey, Mexico.

All patients who had a clinical diagnosis of gastroesophageal reflux with a score above 13 in the RSI were invited to participate. Subjects who had the following inclusion criteria were enrolled: over 18 years of age and clinical diagnosis of extraesophageal reflux. Subjects with the following criteria were excluded: symptoms history of infectious or neoplasic diseases of the ear and sinuses, history of cerebrovascular disease, head trauma that required hospitalization, history of head and neck surgery and previous treatment for gastroesophageal or extraesophageal reflux . A group of 52 healthy controls were enrolled who were over 18 years old, without comorbidities and had no extraesophageal reflux symptoms at the time of exploration or in the previous 6 weeks.

After verbal consent was granted, each subject was examined with a clinical history and ENT examination by the same otolaryngologist. The function of the Eustachian tube of all participants was evaluated by means of a multifrequency tympanometry with the 425h equipment of the Interacoustics brand. The type of tympanometric curve of each ear was identified and classified into A, As, Ad, B, C and D according to the Jerger classification. [9] In addition, the volume and pressure of the middle ear, the compliance of the tympanic membrane and the acoustic reflex of each ear were determined.

We performed the Reflux Symptom Index (RSI) scale to assess the presence of extraesophageal reflux. This instrument comprises 9 questions and each answer varies between a score of 0 to 5 points. A score below 13 will be considered normal, mild symptoms from 13 to 23, moderate from 24 to 34, severe from 35 to 45. [10]

The research protocol was approved by the local Ethics Committee.

The study values were contrasted by hypothesis tests for means and proportions at 95% reliability; The association and correlation determination was determined by the student's T test and X2, Pearson or Spearman (depending on the type of distribution) at the same reliability. For quantitative variables, measures of central tendency, dispersion and position were used. Statistical analysis was performed using the IBM SPSS Statistics for macOs 10.15, Version 24.0. Armonk, NY: IBM Corp.

Results

Patients with extraesophageal reflux

A group of 37 patients (72 ears) with extraesophageal reflux were evaluated, 20 (54%) were women and 17 (46%) men. The ages of the patients varied from 18 to 61, with an average of 48.3 years. Thirty (81%) patients were known to have type 2 diabetes mellitus, 22 (59%) had high blood pressure, 17 (46%) drank alcohol regularly and 15 (40%) were smokers of more than 4 cigarettes a day.

Of the total of patients 28 (76%) had chronic cough, 34 (92%) constant pharyngeal clearance, 10 (27%) otic fullness, 31 (84%) foreign body sensation, 4 (11%) dysphagia, 5 (14 %) dyspnea, 9 (24%) click feeling when swallowing, 30 (81%) dysphonia, 21 (57%) feeling of heartburn, 5 (14%) hearing loss and 2 (5%) tinnitus. The otoscopy was normal in 37 (100%) patients, however in 26 (70%) patients thickened membranes were observed thickened or with some point of sclerosis.

In the group of patients with reflux, tympanometry showed 61 (82%) curves type A, 12 (16%) type As, 0 (0%) type Ad, 0 (0%) type B and 1 (1%) type C The average pressure within the middle ear was -38 dPa and volume 0.78 mL. The mean compliance of the typical membrane of the patients was 0.56 mL. The acoustic reflex was present in 74 (100%) ears.

The average of the Reflux symptom index was 31 points.

Healthy subjects

A group of 37 healthy controls (74 ears) were evaluated, 19 (51%) were women and 18 (49%) men. The ages of the subjects varied from 18 to 66, with an average of 45.7 years.

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None of the control subjects had reflux symptoms at the time of the examination or in the previous 6 weeks. Otoscopy was normal in 37 (100%) patients, however in 7 patients thickened tympanic membranes were observed.

In the group of healthy subjects, tympanometry showed 70 (95%) curves type A, 4 (5%) type As, 0 (0%) type Ad, 0 (0%) type B and 0 (0%) type C. The average pressure within the middle ear was -12 dPa and volume 1.16 mL. The mean compliance of the typical membrane of the patients was 0.72 mL. The acoustic reflex was present in 74 (100%) of the healthy controls.

The average Reflux symptom index was 11 points.

No significant difference was found in the gender ($p = 0.124$) or in the age ($p = 0.241$) of the study subjects when purchased with healthy controls. A significant difference was found in the RSI values between both groups ($p = 0.001$). A significant difference was identified in the patients who presented As curves between both groups ($p = 0.032$). No significant difference was found between the pressure inside the middle ear ($p = 0.679$).

Discusion

The most important findings of the present study were: finding that there is no increase in B and C curves in patients with extraesophageal reflux disease, ruling out a dysfunction of the Eustachian tube in patients with this pathology; and the identification of a normal variant as a tympanometric pattern in the tympanic membranes of the study subjects compared to healthy controls.

This work includes the tympanometric study of patients with extraesophageal reflux symptoms in which the clinical diagnosis was made and using the Reflux Symptom Index scale, with the aim of measuring the function of the Eustachian tube in this population and comparing it with a series of healthy controls. The hypothesis of the research team was that in patients presenting with extraesophageal reflux disease there would be evidence of eustachian tube dysfunction, identified with pathological results with B or C curves in tympanometry.

Our hypothesis was discarded by the results shown above. However, a characteristic of the tympanic membranes of patients suffering from extraesophageal reflux disease was identified. The characteristic evidenced was the increase in the As curves, which are variants of normality, in comparison with healthy controls.

No significant differences were found between the demographic characteristics of both groups of patients, avoiding biases when compared using statistical tests.

In a series published in 2017, which studied 121 elderly patients, they found that in more than 21% of subjects who had an average age of 70, tympanometric curves of the As type were found. [11]

In our study, we found that more than 16% of patients with extraesophageal reflux had tympanometric curves of the As type. In addition, in these patients 70% were observed with thickened tympanic membranes or with some point of sclerosis.

In another long series in Italy, 565 pediatric patients were studied between 0 and 24 months. They found that of the total of the patients, 127 patients presented with otitis media with effusion and also did not pass the tests of otoacoustic emissions. [12] Unlike them, our study did not identify the same results. In our series, only one affected ear was observed, demonstrated with a type C curve. However, the most improper difference between the two studies is that in the first one, pediatric patients were studied and in our study only adult patients. Therefore, we can infer that the pediatric patient is more vulnerable to otological changes compared to the adult population.

In our study we used the RSI as a parameter for the diagnosis of extraesophageal reflux. A score above 13 was cataloged as within the diagnosis. This test has proved very useful for, in addition to diagnosing, evaluating clinical improvement after treatment against reflux. This was shown in a series published in 2015 where 72 patients with reflux were included and a significant decrease in the score of said scale was observed after treatment. [13]

Our study was based on the result of the RSI as a validated survey for the diagnosis of patients with extraesophageal reflux disease due to ample evidence that it is related to the laryngoscopic study and also to intraluminal pH measurements. In a study published in the

journal of the American Academy of Otolaryngology — Head and Neck Surgery, it was found that the measurement of dual pH with multichannel intraluminal impedance is a very useful tool to make the diagnosis of extraesophageal reflux disease, it also correlates strongly with the results of the RSI and not with the low vision laryngoscopic scale. [14]

Another series of great impact that was performed at the University of California revealed that patients with eustachian tube dysfunction had a higher prevalence of laryngopharyngeal reflux measured by pHmetry with a nasopharyngeal specimen. [15] In contrast to this series, in our study no tubal dysfunction was found in patients with extraesophageal reflux.

Although our results do not show damage to the middle ear of patients with extraesophageal reflux disease, there are studies in animals that identify the measurable traces left by reflux in the middle ear in murine models. In this work published in Germany, it was found that by marking the gastric acid with ink, it was possible to observe traces of the ink in the middle ear of Mongolian gerbils. [16]

However, recently a Dutch article was published in which 30 children up to 12 years old with otitis media with effusion were studied, of which only 9 were associated with reflux disease. In addition, the authors deny that reflux has an effect on otitis and the microbiota they studied in both groups. [17]

One of the weaknesses of our series and of many studies that have been carried out in this area is that diagnostic tests are not objective. The RSI, a survey used in our study, is one of the best indicators both to diagnose and to evaluate the patient's treatment. However, a study conducted in 2016 and published by the American Academy of Otolaryngology — Head and Neck Surgery, suggests that in addition to felxible laryngoscopy, stroboscopy is a key test to make the correct diagnosis. [18]

Conclusion

Extraesophageal reflux has been shown to cause recurrent otitis media in pediatric patients. However, this study demonstrates that in adult patients, extraesophageal reflux disease and otitis media are not associated. The association between extraesophageal reflux and eustachian tube dysfunction was not found.

A significant increase in thickened tympanic membranes or with sclerotic foci was found in patients with extraesophageal reflux disease compared to healthy controls.

Our research group suggests more and more profound work to find a relationship between middle ear pathology and extraesophageal reflux in order to rule out or state a relationship between them.

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