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Original Article

Association of laryngopharyngeal reflux with nasal obstruction

Hasan Cakar[1], Sami Bercin[2], Ergun Sevil[3], Muzaffer Kiris[2]

[1]Avcılar Murat Koluk State Hospital, Clinic of Otorhinolaryngology, Istanbul, Turkey
[2]Yildirim Beyazit University, Faculty of Medicine, Department of Otorhinolaryngology, Ankara, Turkey
[3]Trabzon Training and Research Hospital, Clinic of Otorhinolaryngology, Trabzon, Turkey

Abstract

Aim: To evaluate the effect of nasal obstruction on the laryngopharyngeal reflux (LPR).

Material and Methods: Between April 2013 and October 2014, 40 patients with a diagnosis of nasal septum deviation and 40 controls with no signs and symptoms of reflux were prospectively included in this study. Results of pH monitoring of two groups of patients were analyzed for LPR. In the evaluation, two different criteria, based on reflux number and time spent in reflux were used.

Results: The proximal canal reflux episode ratios were found 3.0±4.18, 2.05±3.81 and 5.05±7.35 for upright, supine and totally in the study group respectively. These ratios were found 0.94±0.29, 0.0±0.0 and 0.94±0.29 for upright, supine and totally in the control group respectively. Upright, supine and total reflux episodes of patients in the study group were found higher than the control group and these differences reached statistically significant in two groups ($p<0.05$). The distal canal upright, supine and total reflux episodes of patients in the study group were found higher than the control group. This difference was found to be statistically significant in the total reflux episode patients ($p<0.05$).

Conclusion: Nasal obstruction had a negative effect on LPR and that may play a role in the formation of reflux.

Keywords: Laryngopharyngeal reflux; nasal obstruction; pH monitorization.

INTRODUCTION

Gastroesophageal reflux disease (GERD) states to the escape of stomach contents into the esophagus without vomiting. If the contents reach to the larynx or pharynx, it is defined as laryngopharyngeal reflux (LPR) which is also known as an extraesophageal manifestation of GERD may be seen in 4–10% of patients presenting for outpatient clinic (1).

Stimulation of esophagus with acid and intestinal stress could increase the central vagal output (vagovagal reflex) (2, 3). Sinusitis may also trigger coughing via the assumed sinopulmonary reflex (2). Although the interactive relation between nasal mucosa and the upper gastrointestinal tract is more often, it is disregarded in the literature.

The goal of this research was to observe the effect of nasal obstruction on the LPR and to determine the subsequent changes in symptoms through the 24-hour pH monitorization method.

MATERIAL and METHODS

This prospective controlled study included 2 groups and 80 participants. In the study group, the patients who performed nasal surgery because of nasal septum deviation (NSD) at a Training and Research Hospital between April 2013 and October 2014. The control group was formed of 40 healthy subjects without NSD or other upper airway obstruction (UAO) reasons. Informed consent was obtained from all individual participants included in the study. The Institutional Review Board of School of Medicine granted approval for the study (Ethics Committee Decision no: 29/04/2013-70).

The study group consisted of patients who had nasal septum deviation had no GERD symptoms such as heartburn and regurgitation. Reflux Symptom Index (RSI) < 13.0 Figure 1), Reflux Finding Score (RFS) <7.0 (Figure 2), normal body mass index (BMI) (19-25) and had no acute or chronic nasal infection, allergic rhinitis, nasal polyps, or other nasal diseases except septal deviation and turbinate

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Corresponding Author: Ergun Sevil, Trabzon Training and Research Hospital, Clinic of Otorhinolaryngology, Trabzon, Turkey.
E-mail: drergunsevil@yahoo.com

hypertrophy. The control group consisted of healthy participants without any complaint about LPR (RFS <7.0 and RSI <13.0), without any history of nasal disease.

All the participants underwent flexible nasopharyngolaryngoscopic examination, and patients with a diagnosis of acute or chronic nasal infection, allergic rhinitis, nasal polyps, or other nasal diseases except septum deviation and turbinate hypertrophy were applied exclusion criteria. Exclusion criteria were also current use of intranasal corticosteroid, antihistamine, decongestant and/or systemic corticosteroid, proton pump inhibitor, or histamine H2 receptor antagonist, use of cigarette or alcohol. The Turkish Reflux Symptom Index (RSI) (Figure 1) and Reflux Finding Score (RFS) (Figure 2) were used to identify the diagnosis of LPR (4).

Within the past month, how did the following problems affect you?

0 = no problem 5= severe problem						
Hoarseness or other voice problem	0	1	2	3	4	5
Clearing throat	0	1	2	3	4	5
Excess throat mucus or postnasal drip	0	1	2	3	4	5
Difficulty swallowing food, liquid, or pills	0	1	2	3	4	5
Coughing after eating or after lying down	0	1	2	3	4	5
Breathing difficulties or choking episodes	0	1	2	3	4	5
Troublesome or annoying cough	0	1	2	3	4	5
Sensation of something sticking in throat or lump in throat	0	1	2	3	4	5
Heartburn, chest pain, indigestion, or lump in throat	0	1	2	3	4	5

Figure 1. Reflux Symptom Index

Study design

Herein, Medical Measurement Systems (MMS) Orion II monitoring device (Orion Ambulatory pH Metre device, USA) that measures pH at both hypopharyngeal and lower esophageal levels, and PH Ersaflex catheter probe (PH Ersaflex disposable pH catheter, Alpine biomed; USA), with 2 sensors, which are 15 cm apart, are used. Before follow up, both sensors were calibrated to pH 7.00 and pH 2.00 respectively.

A 24-hour double channel ambulatory esophageal pH monitoring study was performed in all participants. The catheter was applied transnasally. Since the point of interest for pH events are above the upper esophageal sphincter (UES) in ORL patients, the black reference band, which is 1 cm proximal to the proximal sensor, was positioned just behind the arytenoids by transnasal flexible endoscopy. Thus, the distal sensor remained approximately 15 cm below the UES and about 5 cm above the lower esophageal sphincter (LES) (5,6). This allows the proximal recorder to remain just above the upper esophageal sphincter. In this way, the location of the proximal recorder in catheter placement is constant at each examination; the purpose of the data from the distal recorder is to monitor the pH drop in the proximal canal.

In the groups, topical anesthesia with 10% lidocaine spray was performed to oropharynx and nasal mucosa. With the help of endoscope, the proximal probe was put down back of the laryngeal inlet, over the UES transnasally, and lower probe was located over the LES and the catheter was fixed over the dorsum of the nose. Then, the pH observation was commenced.

Participants were informed and requested to record their eatings and body positions by pushing keys on the monitor. Carbonated and caffeinated drinks were limited in the course of the study, and the patients keep a diary that certificated starting and ending times of the meals, sleep, supine periods, heartburn and regurgitation, and any other important symptoms. After 24-h monitoring, parameters were sent to the Synthetics Esophagogram Software on the hardware system, recorded and printed. When the pH was equal to or less than four, the total time, the number of reflux events, the longest reflux episode time, while in the supine and upright position were analyzed separately for both probes. The pH in the proximal probe less than 4 was ignored when the acid in the esophagus was not accompanied by reflux and occurred during the meal. At least one reflux event at the hypopharyngeal level was considered a reflux event in the light of the literature (5). The LPR results were scored as 0, 1, and 2 according to the number of recorded reflux episodes at probe. The score is "0" when there is no reflux, "1" between 1 and 7 reflux event, "2" when there were more than 7 reflux (7). For the other criterion, the presence of reflux was accepted when the time spent for the reflux/total time (acid exposure time, AET) was >1% (5). The two groups of participants were compared in terms of both criteria.

Subglottic edema	0 absent 2 present
Ventricular obliteration	2 partial 4 complete
Erythema/hyperemia	2 arytenoids only 4 diffuse
Vocal fold edema	1 mild 2 moderate 3 severe 4 polypoid
Diffuse laryngeal edema	1 mild 2 moderate 3 severe 4 obstructing
Posterior commissure hypertrophy	1 mild 2 moderate 3 severe 4 obstructing
Granuloma/granulation tissue	0 absent 2 present
Thick endolaryngeal mucus	0 absent 2 present

Figure 2. Reflux Finding Score

Statistical analyses

Statistical analyses were performed using statistical package for the social sciences (SPSS) software version 22 for Macintosh. Descriptive analyses were presented using mean and standard deviation for the normally distributed variables. The Kolmogorov-Smirnov test was used to evaluate the distribution of variables, the Student's

t test was used for continuous variables for those with normal distribution and the Chi-square test was used for categorical variables. The statistical significance was set at p<0.05.

RESULTS

A total of 80 adults participated in the study. The study group consisted of 40 patients, 16 women (40%) and 24 men (60%) with a median age of 32,2±7,42. The control group consisted of 40 patients, 18 women (45%) and 22 men (55%) with a median age of 33,85±5,18 years. There was no statistically significant difference between the age and sex distributions of the groups. RSI and RFS of the groups did not reach statistically significant ratio (Table 1).

Table 1. Comparison of the groups according to the age. sex. BMI. RSI. RFS

	age	RSI	RFS	BMI
Study group	32.2±7.42	5.7±2.51	1.85±1.42	22.6±1.5
Control group	33.85±5.18	6.1±1.97	2.1±1.8	23.15±1.38
	p>0.05	p>0.05	p>0.05	p>0.05

BMI; Body mass index. RSI;Reflux symptom index. RFS; Reflux finding Score

Table 1. 24-h pH monitoring results of proximal canal

	Reflux positive	Reflux negative
Study group	16	24
Control group	4	36

Table 3. The proximal canal reflux episode ratio at upright. supine and totally

	Upright	Supine	Totally
Study group	3.0±4.18	2.05±3.81	5.05±7.35
Control group	0.94±0.29	0.0±0.0	0.94±0.29
	P<0.05	P<0.05	P<0.05

24-h pH monitoring results of proximal canal is showed in table 2. The proximal canal upright, supine and total reflux episodes of patients in the study group were found higher than the control group and these differences reached statistically significant in two groups (p<0.05) (Table 3). The percentage of total reflux time in the study group is significantly higher than the control group, whereas the percentage of upright and supine reflux time did not show statistically significant in groups (Table 4).

24-h pH monitoring results of distal canal is demonstrated in table 5. The distal canal upright, supine and total reflux episodes of patients in the study group were found statistically higher than the control group (p<0.05) (Table 6). In the distal canal, when the study group was compared with the control group in terms of upright, supine and total number of reflux episodes, it was seen that there was no statistically difference in upright and supine (P>0.05). It was seen that there was a difference in the total number of reflux episodes and this difference was found to be statistically significant (p<0.05). There was no statistically significant difference in pathologic reflux in upright, supine and total reflux episodes in the study group when 50 or more reflux exposures were accepted as criteria for the diagnosis of pathological reflux in 24 hours (8). The total percentage time-to-reflux rates for the distal channel is showed in Table 7. In the study group, the percentage of distal canal total reflux time was higher than the control group and this difference was statistically significant (P <0.05). When the pathological reflux limit for distal canal reflux time was accepted as 4.2%, there was no difference in the percentage of pathological reflux time between the study group and the control group (P >0.05).

Table 4. The proximal canal upright. supine and totally reflux time (%) of groups

	Upright	Supine	Totally
Study group	0.23±0.31	0.12±0.21	0.34±0.48
Control group	0.08±0.1	0.00±0.1	0.05±1
	p>0.05	p>0.05	p<0.05

Table 5. 24-h pH monitoring results of distal canal

	Reflux positive	Reflux negative
Study group	16	24
Control group	8	32

Table 6. The distal canal reflux episode ratio at upright. supine and totally

	Upright	Supine	Totally
Study group	14.75±10.04	22.8±22.23	37.55±29.0
Control group	15.15±5.93	16.1±4.04	0.8±0.52
	p>0.05	p>0.05	p<0.05

Table 7. The proximal canal upright. supine and totally reflux time (%) of groups

	Total time reflux rates (%)
Study group	2.41±1.82
Control group	0.84±1.01
	P<0.05

DISCUSSION

Laryngopharyngeal reflux is on the screen due to the symptoms by the otolaryngologist in recent years. Laryngopharyngeal reflux was known to be associated with laryngeal disorders. Besides objective evaluation ways, LPR diagnosis is based on laryngeal manifestations. Although, the most common symptoms are hoarseness, sore throat, and sensation of a lump in the throat studies have accepted that inflammation is extended to the extralaryngeal mucosa (9).

Belafsky et al. (10) used reflux symptom index (RSI) and reflux finding score (RFS) in the diagnosis of LPR. Park et al. (11) studied hypopharyngeal reflux diagnosis using RSI in 57 patients. Sensitivity and specificity of RSI and RFS in the diagnosis of hypopharyngeal reflux were reported 75.6, 80.7 and 18.8%, 37.5% respectively. It is a valuable clinical tool with high sensitivity for detecting LPR (12). It is easy to use, inexpensive, and it does not require special equipment. It is used worldwide both to assist with the diagnosis of LPR and to measure the outcomes of empiric therapy (13). Double probe pH monitoring, defined by Demeester and Johnson in 1974, is known as gold standard in the diagnosis of LPR (18). Nevertheless, there is no consensus with regard to placement of sensors in pH monitoring (15). Although, it is stated that more than two pharyngeal reflux events could be seen physiologically (16), Postma et al. asserted that only one reflux incident could actually cause reflux disease (17).

In light of this data, current study accepted four and more reflux episode as LPR for proximal canal. The number of physiologically reflux in the literature which is the highest number one more by accepting our work, we tried to increase the reliability of the LPR. The purpose of this study was to evaluate the nasal obstruction as an etiologic factor for LPR. To our knowledge, this is the first study investigating the effect of nasal resistance on LPR.

Trigeminal and vagus nerves consist nasogastric reflex circuit. Sensory inputs starting from nasal mucosa to the general somatic afferent component of the brainstem including the pontine and medullary trigeminal nucleuses could induce the adjacent nucleus of the solitary tract (NST) via the activation of glutaminergic and non-N-methyl-D-aspartate (non-NMDA) signaling pathways (14). It then proceeds into the dorsal motor core of the vagus and commences the symptomatology of vagal stimulation through the efferent fibers of the vagus nerve (14). These interactions between nasal mucosa and the upper gastrointestinal tract may cause reduced food intake, gastric relaxation and increased acid secretion. In addition, vagal pathway plays an important role for reflex relaxation of the lower esophageal sphincter (19). This hypothesis shows that nasal irritation may explain some gastric or upper gastrointestinal symptoms via nasal afferents as mentioned above.

When we look at the work that supports this hypothesis, DiBaise et al. (20) observed abnormal pH meter results in 78% of patients with chronic rhinosinusitis. Additional evidence came from the 20-Item Sino-Nasal Outcome Test (SNOT-20), which was administered to 77 patients with proven GERD and controls. The authors reported that the mean SNOT-20 score was 22.1 in the study group and 9.4 in the control group (21). Dagli et al. reported that laryngopharyngeal reflux had a negative effect on nasal resistance and nasal congestion (22).

As mentioned above, the nasal mucosa has a complex structure in terms of reflexes. Analysis made according to the pathologic reflux criteria show that the number of proximal canal attack was significantly increased in the study group compared with the control group. Besides, totally reflux time percent in the study group is significantly higher than control group. These results show that nasal obstruction may play an important role in LPR etiopathogenesis.

CONCLUSION

The presence of a nasogastric reflex may be related to nasal diseases, which may lead to upper gastrointestinal symptomatology. We hope that our study will shed light on the relationship between nasal obstruction and LPR and on the work to be done for the etiopathogenesis of LPR.

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Hasan Cakar ORCID: 0000-0002-4404-4692
Sami Bercin ORCID: 0000-0003-3626-5492
Ergun Sevil ORCID: 0000-0003-4740-7214
Muzaffer Kiris ORCID: 0000-0002-5181-3621

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