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RESEARCH ARTICLE
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Comparison of Endoscopic and Microscopic Type 1 Tympanoplasty on Surgical Outcomes and Quality of Life*

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ABSTRACT

Objective: The purpose of this study was to compare the surgical and functional outcomes, as well as the quality of life, of patients who underwent endoscopic and microscopic type 1 tympanoplasty.

Material and Methods: In two groups of patients undergoing endoscopic and microscopic tympanoplasty, pre- and postoperative audiological outcomes, Middle Ear Risk Index, and Chronic Otitis Media Benefit Inventory, a newly designed questionnaire specific for chronic otitis media surgery, were prospectively evaluated.

Results: The endoscopic tympanoplasty group had 30 patients, while the microscopic tympanoplasty group had 22 participants. There were no statistically significant differences in demographic parameters, Middle Ear Risk Index, or graft material chosen between the groups, although the time of hospitalization was considerably shorter in the endoscopic tympanoplasty group ($p<0.001$). In terms of air conduction thresholds and air-bone gap, the difference between pre and postoperative time points was statistically significant in both groups ($p<0.001$), but not between groups. There was no statistically significant difference between the groups in terms of hearing gain and Chronic Otitis Media Benefit Inventory scores.

Conclusion: Although the endoscopic tympanoplasty group is known to decrease early postoperative complaints and shorten hospitalization periods, the equivalent late functional outcomes (audiological and quality of life results) reveal that the two surgical procedures are not superior to each other in the long term.

Keywords: Endoscopic tympanoplasty, microscopic tympanoplasty, quality of life, middle ear

INTRODUCTION

Chronic otitis media (COM) is a condition that causes irreversible changes in the eardrum, middle ear components, and mastoid cells, resulting in ear discharge, hearing loss, tinnitus, and balance problems (1). Different surgical methods have been described for both the removal of the existing disease and the improvement of hearing (2). Tympanoplasty is a surgical treatment used to restore the tympanic membrane (TM) and/or ossicles. Type 1 tympanoplasty was described by Berthold in 1878 and popularized by Wullstein and Zollner after 1950 and involves repair of TM perforation only in the absence of pathology in the middle ear and mastoid cells (3). Traditionally, since their origin, all ear operations have been performed microscopically. Despite microscopes being highly comfortable due to their binocular and high three-dimensional vision and the surgeon's freedom to use both hands, the conical working field may require extra soft tissue and bone excision to provide adequate vision and light. These unnecessary resections in microscopic tympanoplasty (MT) open the way for a variety of complications and have a negative impact on patient comfort due to prolonged recovery time and increased pain (4). Since the 1990s, endoscopes have been introduced in ear surgeries and are now used in practically all ear surgeries such as tympanoplasty, otosclerosis surgery and even cochlear implantation. Endoscopes allow access to the TM and middle ear without creating a large skin incision, minimizing pain and enhancing cosmetic outcomes. Endoscopes also provide a wider field of view, especially angled endoscopes can provide direct visualization of hidden areas that are difficult to view

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under a microscope, such as epitympanum, sinus tympani and facial recesses. Despite these advantages, endoscopic tympanoplasty (ET) has disadvantages, such as being a single-handed technique, having a long learning curve, and not being three-dimensional (5). Patient-reported outcome measures (PROMs) enable clinicians to assess the outcome of different treatment modalities from the patients' perspective. Until recently, ear surgery success was measured by graft success and hearing outcomes, as well as disease eradication. The analysis of health-related quality of life (HRQoL) is a current area of research in the field of otology, therefore it has become popular in recent years to assess the outcome of ear procedures with PROMs (6). Phillips et al. developed the Chronic Otitis Media Benefit Inventory (COMBI) in 2017, and Kara et al. conducted a Turkish validity-reliability study in 2020 (7, 8). The COMBI is a PROM that compares the postoperative and preoperative periods in a single questionnaire and focuses on the change in patients' complaints related to COM in the postoperative period (7).

Although there have been many studies investigating the surgical and audiological outcomes of endoscopic and microscopic tympanoplasty, there are limited studies comparing these two techniques with the PROM.

The objective of this study was to evaluate the surgical and audiological outcomes of patients who underwent endoscopic and microscopic type 1 tympanoplasty, as well as the results of HRQoL using a recently introduced ear specific questionnaire (COMBI).

MATERIAL AND METHODS

This prospective observational study was conducted at Ondokuz Mayis University Department of Otorhinolaryngology between September 2020 and February 2022. Following obtaining approval from the Ondokuzmayıs University Clinical Research Ethics Committee (Date: 12.05.2020, No: OMU KAEK 2020/331), the study was performed in accordance with the Helsinki Declaration. Written informed consent was obtained.

Patients

The study included 52 patients with conductive hearing loss between the ages of 18 and 65 who had endoscopic and microscopic Type 1 tympanoplasty for isolated tympanic membrane perforation. All patients were followed up on for at least 6 months after the surgery. Thirty (30) patients were included in the endoscopic tympanoplasty group (ETG) and 22 patients were included in the microscopic tympanoplasty group (MTG). Patients with other known otologic diseases (otosclerosis, vestibular pathology, history of temporal bone trauma and neoplasia, mixed or sensorineural hearing loss in the preoperative and postoperative periods), prior ear surgery, examination findings other than perforation (retraction, atelectasis, cholesteatoma, wet ear), posterior quadrant perforation, and patients who did not continue regular follow-up were excluded.

Prospectively collected data included demographic characteristics, surgical techniques and findings, duration of hospitalization, preoperative audiological findings, postoperative audiological findings at the sixth month, and graft status at the sixth month were recorded.

Audiological evaluation

Hearing improvement was assessed with the guidelines of the American Academy of Otolaryngology—Head and Neck Surgery (9). Air Conduction (AC) thresholds, Bone Conduction (BC) thresholds and Air-Bone Gap (ABG) values were calculated by measuring the average of 500, 1000, 2000 and 3000 Hz frequencies with Pure Tone Audiometry in the preoperative period and the sixth month postoperatively. We interpolated a 3000-Hz threshold by averaging the thresholds at 2000 Hz and 4000 Hz when 3000-Hz thresholds were not available, according to the guidelines.(10) Hearing Gain (HG) was calculated as the difference between preoperative and postoperative ABG values.

Surgical procedure

All surgeries were performed by clinicians with at least 8 years of otologic surgery expertise. For ETG, a 0-degree, 3 mm, 14 cm endoscope (Karl Storz, Tuttlingen, Germany), and for MTG, an Opmi Vario 700 microscope (Carl Zeiss, Oberkochen, Germany) were used. An endomeatal incision was performed in ETG, whereas a postauricular incision was performed in MTG. The tympanomeatal flap was lifted 10 mm lateral to the fibrous annulus. Before grafting, the perforation margins are circularly extracted and renewed. The fibrous annulus was detached from the tympanic sulcus whilst preserving the chorda tympani, providing access to the middle ear. The integrity and mobility of the ossicular chain were examined. Cartilage graft with perichondrium from the tragus was used in both ETG and MTG. Absorbable sponges were placed in the middle ear to support the graft. The graft material was placed beneath the manibrium mallei and the fibrous annulus. Absorbable sponges were placed in the EAC. Compressed ear dressing was applied to the patients in the MTG group for 2 days postoperatively. In the second week, absorbable sponges were aspirated from the EAC.

Middle ear risk index (MERI)

The Middle Ear Risk Index (MERI) is the most well-known grading system for classifying the severity of middle ear disease (11). The MERI score is calculated by assigning a specific value to each risk factor and summing these values. Risk factors include Belluci criteria for assessing the degree of ear discharge, Austin/Kartush criteria for ossicular status, presence of perforation, cholesteatoma middle ear granulation/effusions, history of previous surgery and smoking. Risk categories are as follows: 0 = normal; 1-3 = mild disease; 4-6 = moderate disease; 7-12 = severe disease (11).

Quality of life assessment

COMBI is a questionnaire that asks how the patient's ear disease complaints and quality of life altered after surgery versus before surgery. At the six month after surgery, patients were asked to rate each question on the 12-question questionnaire from 5 to 1 as "much better," "slightly better," "no change," "slightly worse," and "very bad," in that order. Low scores indicate symptom worsening, whereas high scores indicate symptom improvement (7, 8). The first seven questions (Q1-7) addressed the intensity of ear problems, questions 8-11 (Q8-11) concerned the impact of surgery on lifestyle, employment and health, and question 12 (Q12) examined overall well-being, and we analyzed these sub-scores separately.

Statistical analysis

Statistical analyses were performed with SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Shapiro-Wilk, Kolmogorov-Smirnov tests and skewness-kurtosis statistics were used to assess normal distribution. Categorical variables were analyzed using the Pearson Chi-Square test. An independent sample t-test was used for normally distributed data and Mann Whitney U test was used for non-normally distributed data. Analysis of covariances (ANCOVA) was performed to answer the question of whether the surgical technique or the patient's existing hearing reserve was more effective on postoperative audiological measurements. Partial eta squared (η2) values were calculated. η2 values calculate the strength of the effect of the independent variable on the dependent variable (postoperative hearing outcomes) while controlling for the main and joint effects of other independent variables (time). The level of significance was set at $p<0.05$.

RESULTS

The ETG included 30 patients (18 female/12 male;mean age=36.23±13.35). The MTG had 22 patients (16 female/6 male; mean age=39.54±12.42). There was no statistically significant difference between the two groups in terms of age and gender (p=0.368 and p=0.341 respectively). Also, there was no difference between the groups in terms of right ear/left ear ratio (ETG=14/16; MTG=12/10) (p=0.575). While one patient in ETG and three patients in MTG had moderate disease, all other patients were in the mild disease category, and there was no statistical difference in the MERI category between the groups. The duration of hospitalization was significantly shorter in the ET group (p<0.001). Table 1 summarizes the demographic and surgical characteristics of the groups.

The effect of surgical method on AC, BC and ABG postop results was analyzed by the ANCOVA test. When the preop values were added to the model as a covariate variable, it was determined that the postop results did not differ according to the groups (p=0.137, p=0.960 and p=0.139 respectively). The effect of preop values on postop values was found to be significant (p<0.001). When partial eta square values were analyzed, the effect of groups on postop measurements for AC, BC and ABG variables were 0.045, 0.960 and 0.139, respectively, while the effect of preop values were calculated as 0.704, 0.889 and 0.443, respectively. In other words, the effect of preop values on postop values is more independent of the groups. In other words, the variable that has an effect on postoperative audiological measurements is preoperative measurements and not the method of surgery (Table 2).

The mean hearing gain was 11.8±5.01 in the endoscopic tympanoplasty group and 9.36±6.98 in the microscopic tympanoplasty group with no statistically significant difference between the two groups (p=0.149) (Figure 1).

Postoperative surgical results and quality of life assessment questionnaire results of the groups are demonstrated in Table 3. The graft failed in 2 patients in ETG and 3 patients in MTG. There were no statistically significant differences between groups in terms of severity of ear symptoms (Q1-7), impact of surgery on lifestyle, work and health (Q8-11), general well-being (Q12) and total COMBI score (p>0.05) (Table 3).

DISCUSSION

Chronic otitis media surgery includes repair of the tympanic membrane, removal of pathological tissues such as cholesteatoma, sclerosis, or granulation tissue, and interventions on the ossicular chain for hearing reconstruction. For this purpose, numerous surgical procedures, hearing reconstruction techniques, graft materials, and grafting techniques have been used (4, 11, 12). While the microscopic approach was the only accepted surgical approach for ear surgeries for many years, the endoscopic approach has been used with increasing frequency since the 1990s (4). Endoscopic type 1 tympanoplasty has become increasingly popular recently (13). In addition to the significant differences in surgical comfort, learning curve, and field of view between microscopic and endoscopic techniques, many studies analyzing the surgical results of the two surgical approaches have been published in recent years (13).

The Middle Ear Risk Index (MERI) is the most well-known grading system for classifying the severity of middle ear disease (11). Based on MERI scores, in this study, one patient in ETG and three patients in MTG had moderate disease, while all other patients had mild disease, and there was no statistical difference between the groups. This was essential baseline data for assessing the severity of the disease. In a retrospective study, Ismi et al. reported that graft failure rates were more common in patients with high MERI scores, and they recommended double-layer tympanoplasty instead of single-layer grafting for patients with medium-high MERI scores (14). We preferred single-layer cartilage grafting, as none of the patients' MERI scores was high. According to Tseng et al., graft success rates were similar, as 85.1% and 86.4% for endoscopic and microscopic tympanoplasty, respectively (15). Graft success rates ranged between 83.3%-100% for endoscopic and 82.4%-100% for microscopic approaches in various studies that compare the endoscopic and microscopic tympanoplasty (16-18). In our study, these rates were 93.3% for ETG and 95.5% for MTG, which is similar with the literature.

Table 1: Demographic and clinic features of groups

	ETG (n:30)	MTG (n:22)	p
Age (Mean±SD)	36.23±13.35	39.54±12.42	0.368[a]
Gender (F/M)	18/12	16/6	0.341[b]
Ear Side (Right/Left)	14/16	12/10	0.575[b]
MERI score (mild/moderate)	29/1	19/3	0.168[b]
Hospitalization (day) (Median (min-max))	1 (1-2)	3 (2-4)	**<0.001**[c]

a : Independent sample t test, b: Chi-Square test, c: Mann Whitney U test, ETG: Endoscopic tympanoplasty group, MTG: Microscopic tympanoplasty group, SD: standard deviation, F: female, M: male, MERI: Middle Ear Risk Index. Bold prints in 'p' column, indicate a significant difference between groups

Table 2: Preoperative and postoperative audiological results of the groups

		Descriptive Statistics		ANCOVA Results			
		Group		Group		Pre	
		ETG (n=30)	MTG (n=22)	p	PES	p	PES
AC (Mean±SD)	Pre	37.47±11.48	39.59±10.02	0.137	0.045	**<0.001**	0.704
	Post	25.67±11.78	30.23±11.01				
BC (Mean±SD)	Pre	11.87±8.04	14.91±5.49	0.960	0.000	**<0.001**	0.889
	Post	12.03±7.9	14.91±5.57				
ABG (Mean±SD)	Pre	25.6±7.43	24.68±7.34	0.139	0.044	**<0.001**	0.443
	Post	13.63±7.01	15.32±7.33				

ETG: Endoscopic tympanoplasty group, MTG: Microscopic tympanoplasty group, SD: standard deviation, AC: Air conduction threshold, BC: Bone conduction threshold, ABG: Air-bone gap, pre: preoperative results, post: postoperative results, PES: Partial Eta Squared
Bold prints in 'p' column, indicate a significant difference between groups

Table 3: Graft success and postoperative quality of life results of the groups

	ETG	MTG	p
Graft success (success/unsuccess)	28/2	18/1	0.746[a]
COMBI total (Mean±SD)	49.63±6.04	47.86±4.83	0.263[b]
Q1-7 (Mean±SD)	29.43±3.73	27.73±3.49	0.101[b]
Q8-11 (Mean±SD)	16.13±2.7	15.77±2.07	0.603[b]
Q12 (Mean±SD)	4.07±0.91	4.32±0.57	0.258[b]

a: Chi-Square test, b: independent sample t test, ETG: Endoscopic tympanoplasty group, MTG: Microscopic tympanoplasty group, SD: Standard deviation, COMBI: Chronic Otitis Media Benefit Inventory, Q1-7, First 7 question of COMBI, severity of ear symptoms, Q8-11, 8-11th questions of COMBI, lifestyle, work and health service impact, Q12, 12th question of COMBI, general wellness. Bold prints in 'p' column, indicate a significant difference between groups

Similar studies comparing the results of microscopic and endoscopic type 1 tympanoplasty by Kim et al., Gulsen et al., and Ohki et al. found that preoperative AC and ABG values decreased significantly in the postoperative period within the group, but there was no difference in preoperative and postoperative values between the groups (19-21). As in our work, there was no difference in HG across groups in the studies of Gulsen et al. and Ohki et al. (20, 21).

Endoscopic Type 1 tympanoplasty, according to Yonglan Zhang et al. 2021, has a smaller incision, less postoperative pain, and no postoperative scarring or periauricular paresthesia compared to microscopic Type 1 tympanoplasty (2). Several meta-analyses and review studies on endoscopic ear surgery confirm the approach's safety with minimal morbidity (13). Although early discomfort and scar formation were not addressed in our research, the length of hospitalization was significantly shorter in ETG (p<0.001). Although brief hospitalization is a preferred and satisfactory condition for all patients in the early period, it is not sufficient to measure the success or benefit of a surgery.

As with many procedures targeting functional outcomes, there are conceptual differences in how patients and surgeons perceive treatment success in ear surgery. According to otologists, healing of the perforation, a non-draining ear,

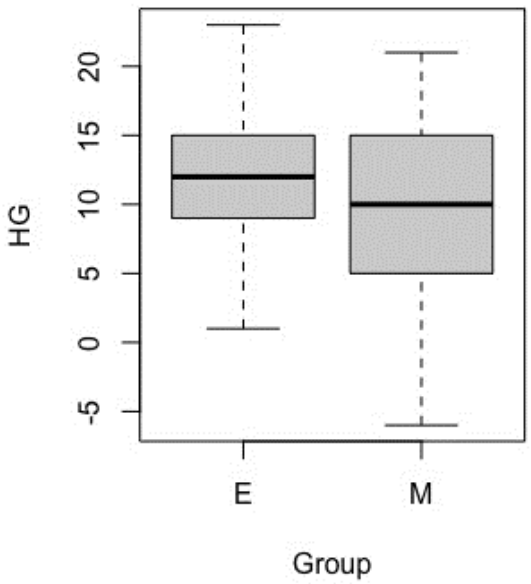

Figure 1: Comparison of HG in endoscopic and microscopic tympanoplasty groups. Boxes indicate the first and third quartiles, and median observations are denoted by a line in each box.
HG: Hearing gain, E: Endoscopic tympanoplasty, M: Microscopic tympanoplasty

improvement in hearing values on audiological evaluation, and the lack of residual disease on postoperative imaging are all signs of successful surgery. However, these measurements are inadequate to assess patients' quality of life. In recent years, there has been a lot of interest in determining a disease's physical and mental impacts from the patients' point of view. Combining clinical data and patient feedback is believed to provide more accurate information for evaluating surgical outcomes (22). While objective evaluation tools should be applied to highlight the benefits of procedures, self-assessment tools such as quality-of-life surveys should be preferred to accurately predict changes in patients' quality of life (8). Although many studies investigate the surgical and audiological results of endoscopic and microscopic tympanoplasty, a limited number of studies compare them with PROM. Kallyadan et al. compared the two techniques regarding patient satisfaction, and they reported that patients who underwent surgery with the endoscopic method reported significantly less pain, shorter hospital stays, and better cosmetic results (23). Metwaly et al. evaluated the satisfaction of their patients to whom they performed endoscopic and microscopic tympanoplasty using the Chronic Ear Survey (CES), and they reported that the subscale and total scores of those who had surgery using the endoscopic method were significantly better (11). We compared ear surgery-related quality of life using COMBI. The severity of ear symptoms (Q1-7), impact of surgery on lifestyle, work, and health (Q8-11), general well-being (Q12), and total COMBI score were similar in the two groups in our study. The most crucial aspect distinguishing COMBI from other ear-related surveys is comparing the postoperative and preoperative conditions with a single survey. Our study did not ask the patients any questions about early-term satisfaction. However, through the COMBI, which we performed in the 6th postoperative month, we saw that the two surgical methods were not superior to each other in terms of long-term satisfaction. However, due to the limited number of participants in our study, larger patient groups are needed to reach a definitive conclusion.

This prospective study was limited by several factors. First, since the number of microscopic tympanoplasties has decreased considerably in recent years, the sample size was limited to avoid intergroup differences. Additionally, this study was only conducted in one hospital. A more thorough case survey, relatively long-term follow-up data, or a multicenter investigation would be more informative.

CONCLUSION

We determined that endoscopic and microscopic tympanoplasty have equivalent success rates in terms of perforation repair and hearing improvement. The endoscopic approach, however, has less postoperative morbidity, a shorter operation time, better intraoperative visualization of the middle ear, and better cosmetic results. However, there are disadvantages to the endoscopic technique, such as the difficulty of one-handed operation, the need for frequent cleaning and vaporization of the optics, and the lack of three dimensional vision and depth perception. In this study, we evaluated these two techniques together with their effects on patient-reported COMBI and quality of life. Although there have been numerous studies examining the surgical and audiological outcomes of these two approaches, there have been few studies comparing these two methods with the PROM. More extensive studies are needed in this area.

Ethics Committee Approval: This study was approved by the Ethics Committee of Ondokuz Mayis University (Date: 12.05.2020, No: OMU KAEK 2020/331).

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Evaluation of Subjective Eustachian Tube Function and Hearing Perception of Patients with Acute and Chronic Rhinosinusitis

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ABSTRACT

Objective: Rhinological or otological diseases can negatively affect eustachian tube functions and cause eustachian tube dysfunction. Hearing loss can be seen in patients with eustachian tube dysfunction. The aim of this study is to evaluate the effects of acute or chronic rhinosinusitis on eustachian tube dysfunction with the Eustachian Tube Dysfunction Questionnaire (ETDQ-7) and perception of hearing impairment and disability with the Amsterdam Inventory for Auditory Disability and Handicap (AIADH).
Material and Methods: This study was carried out with 33 acute rhinosinusitis, 32 chronic rhinosinusitis (study groups), and 32 undiagnosed (control group) participants who applied to the ENT outpatient clinic. All participants filled out the ETDQ-7 and AIADH.
Results: It was determined that the participants in the control group had lower ETDQ-7 and AIADH scale scores than the scale scores of the participants in the acute rhinosinusitis and chronic rhinosinusitis groups ($p<0.05$). There was no significant difference between the ETDQ-7 and AIADH scale scores between the acute and chronic rhinosinusitis groups ($p>0.05$).
Conclusions: Rhinosinusitis can cause eustachian tube dysfunction and problems in hearing perception by negatively affecting eustachian tube functions and hearing perception.
Keywords: Acute rhinosinusitis, chronic rhinosinusitis, eustachian tube dysfunction, hearing perception

INTRODUCTION

Rhinosinusitis is a disease caused by inflammation of the paranasal sinuses and nasal mucosa (1). Acute rhinosinusitis is defined as acute inflammation with sudden onset of symptoms and reversible inflammation. The most common symptoms associated with acute rhinosinusitis (ARS) have been reported as runny nose and congestion, pain and pressure in the facial region, and decreased sense of smell (2). Chronic rhinosinusitis (CRS) is defined as the presence of multiple sinonasal symptoms with inflammation for more than 12 weeks. It has been reported that most of the patients diagnosed with chronic rhinosinusitis have otological symptoms such as ear fullness/occlusion, cracking/popping sound in the ear, dizziness, and otalgia (3).

The Eustachian tube is part of the system of adjacent organs, including the nose, palate, nasopharynx, and middle ear cleft. The function of the eustachian tube is to protect the middle ear against inflammation and infection from viruses, bacteria, and gastroesophageal reflux, and patients with any dysfunction may have mild to moderate conductive hearing loss (4). Eustachian tube obstruction caused by inflammation of the nasopharynx; may cause allergic rhinitis, chronic rhinosinusitis, and reflux with eustachian tube dysfunction (ETD) (5).

Studies related to the effect of rhinosinusitis on eustachian tube dysfunction and hearing perception is very few in number. Lin et al. reported a significant correlation between chronic rhinosinusitis, outer hair cell destruction, and sensorineural hearing loss (6). In a study conducted in a tertiary rhinology clinic, it was reported that the increase in

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sinonasal symptoms was also a precursor to the increase in ETD symptoms (7).

The aim of our study is to evaluate the effects of acute or chronic rhinosinusitis on eustachian tube dysfunction with the Eustachian Tube Dysfunction Questionnaire (ETDQ-7) and perception of hearing impairment and disability with the Amsterdam Inventory for Auditory Disability and Handicap (AIADH).

MATERIAL AND METHODS

This study was approved by the Medical Research Ethics Committee of the Ege University, Faculty of Medicine (Date: 18.11.2021, No: 21-11.1T/16). The study was performed following the ethical principles of the Helsinki Declaration. The study consisted of two study groups of volunteers, 33 of whom were diagnosed with acute rhinosinusitis and 32 of whom were diagnosed with chronic rhinosinusitis by ENT physicians, who applied to the Department of Ear Nose and Throat, Ege University Faculty of Medicine Hospital and 32 undiagnosed healthy volunteers formed the control group between November 2021 and February 2022. A total of 97 participants were involved in the study. Participants between the ages of 18-65 who were diagnosed with acute or chronic rhinosinusitis by clinical examination, endoscopy, and radiological examinations, and who had not been diagnosed/have experienced hearing loss before the diagnosis of acute or chronic rhinosinusitis were included in this study. After these participants were informed about the study, an informed consent form was obtained, and the case report form was filled out.

The Eustachian Tube Dysfunction Questionnaire (ETDQ-7) was applied for the evaluation of the eustachian tube functions of the participants. The Turkish validity and reliability study of this scale was carried out by Erdoğan Özgür et al. in 2016 and it was recommended to be used in the detection of eustachian tube dysfunction and the evaluation of the severity of the disease. The total scale score was specified as 14.5 as the threshold value. A total scale score above this value indicates eustachian tube dysfunction (8).

For the evaluation of hearing perception, the Amsterdam Inventory for Auditory Disability and Handicap (AIADH) was used. The Turkish validity and reliability study of this questionnaire was conducted by Müjdeci et al (9). The total score of the questionnaire is between 0 and 90, and the higher the score, the more the hearing problem is reported (9).

Statistical analysis

SPSS (Statistical Package for the Social Sciences) 23.0 package program was used for statistical analysis of the data. Categorical measurements were summarized as numbers and percentages, and continuous measurements as mean and standard deviation (median and minimum-maximum where necessary). The Shapiro-Wilk test was used to determine whether the parameters in the study showed a normal distribution. The Mann Whitney u test was used for binary variables and Kruskal Wallis tests were used for more than two groups for parameters that did not show normal distribution. Tamhane's T2 tests, one of the Post Hoc tests, were used to determine the source of the difference between the groups. The statistical significance level was taken as 0.05 in all tests.

RESULTS

A total of 97 volunteer participants, 33 of whom were diagnosed with acute rhinosinusitis, 32 with chronic rhinosinusitis, and 32 without diagnosis, were included in the study.

Among the study groups included in the study, 63.6% of the patients diagnosed with acute rhinosinusitis were female and 71.9% of the patients diagnosed with chronic rhinosinusitis were female. Among the study groups, the mean age of patients diagnosed with acute rhinosinusitis was 31.2±13.6, and the mean age of patients diagnosed with chronic rhinosinusitis was 35.8±13.2 (Table 1).

It was determined that the average duration of diagnosis of patients with acute rhinosinusitis was 50.06 days, and the average duration of diagnosis of patients with chronic rhinosinusitis was 3528.125 days.

Symptoms were found in 64 (98.5%) of the patients. Fatigue in 47 (72.3%); Painful sensitive teeth in 25 (38.5%); cough in 20 (30.8%); ear pain in 41 (63.1%); ear fullness in 50 (76.9%) cases; 51 (78.5%) had headache, 27 (41.5%) had a feeling of pressure and swelling in the head and nose; Limited nasal breathing in 29 (44.6%), sore throat in 19 (29.2%); Fullness in the facial region in 7 (10.8%) of the patients; It was determined that 46 (70.8%) of them had tinnitus symptoms. Hearing loss after rhinosinusitis was detected in 21 (32.3%) of the patients (Table 2).

The frequency of fullness in the face area of the chronic rhinosinusitis group (p=0.004) was higher than the acute rhinosinusitis group (p<0.05). No significant difference was

Table 1: The age of the participants

	Acute rhinosinusitis	Chronic rhinosinusitis	Undiagnosed (control) group
	Mean±SD Med (Min-Max)	Mean±SD Med (Min-Max)	Mean±SD Med (Min-Max)
Age	31.2±13.6 25 (18-64)	35.8±13.2 31.5 (21-62)	32±10.1 28 (22-64)

SD: Standard deviation

Table 2: The symptoms observed in the study groups

	Frequency (n)	Percent (%)
Symptom		
No	1	1.5
Yes	64	98.5
Weakness		
No	18	27.7
Yes	47	72.3
Painful sensitive teeth		
No	40	61.5
Yes	25	38.5
Cough		
No	45	69.2
Yes	20	30.8
Earache		
No	24	36.9
Yes	41	63.1
Ear Fullness		
No	15	23.1
Yes	50	76.9
Headache		
No	14	21.5
Yes	51	78.5
Pressure sensation and swelling in the head and nose		
No	38	58.5
Yes	27	41.5
Limited nasal breathing		
No	36	55.4
Yes	29	44.6
Throat Ache		
No	46	70.8
Yes	19	29.2
Fullness in the face area		
No	58	89.2
Yes	7	10.8
Tinnitus		
No	19	29.2
Yes	46	70.8
Hearing loss sensation		
No	44	67.7
Yes	21	32.3

found in terms of other symptoms in the acute rhinosinusitis and chronic rhinosinusitis groups (p>0.05).

No significant difference was obtained between acute and chronic rhinosinusitis groups regarding AIADH and ETDQ-7 scores.

It was determined that there were differences between all groups (p<0.05) according to ETDQ-7 (p<0.001), AIADH (p=0.001), localization of sounds, which are the sub-parameters of AIADH (p=0.011) and speech intelligibility in a noisy environment (p=0.007).

When Tamhane's T2 test, one of the Post Hoc tests, was applied to determine the differences between the groups, those in the undiagnosed (control) group;

- Since the ETDQ-7 scale scores were lower than the scale scores of the patients in the acute rhinosinusitis (p<0.001) and chronic rhinosinusitis (p<0.001) groups,
- Since the T-AIADH scale scores were lower than the scale scores of the patients in the acute rhinosinusitis (p=0.002) and chronic rhinosinusitis (p=0.019) groups,
- Since the sub-parameter scores of the localization of voices were lower than the scale scores of the patients in the acute rhinosinusitis (p=0.003) and chronic rhinosinusitis (p=0.014) groups,
- It was determined that the speech intelligibility parameter scores in a noisy environment were lower than the scale scores of the patients in the acute rhinosinusitis (p<0.001) and chronic rhinosinusitis (p=0.002) groups (p<0.05) (Table 3).

DISCUSSION

As a result of the literature, the lack of sufficient research evaluating the subjective eustachian tube dysfunction and perception of hearing impairment in patients with rhinosinusitis is one of the reasons for this study.

There is a consensus in the literature that the incidence of rhinosinusitis is higher in women than in men. The prevalence and incidence of rhinosinusitis were reported to be higher in women than in men (10, 11). In our study, the fact that 63.6% of the participants diagnosed with acute rhinosinusitis were women and 71.9% of the participants diagnosed with chronic rhinosinusitis were women, supports the literature.

There is no consensus in the literature about the relationship of rhinosinusitis with age. The highest reported prevalence of chronic rhinosinusitis in both genders in the Canadian population was found to be in persons aged 30 to 60 years. This trend is similar to that reported by the National Center for Health Statistics, with the prevalence appearing to be highest in individuals aged 45 to 60 years, at 17.4% (10). Studies show that the incidence of acute rhinosinusitis is highest in people aged 25 to 44 years (12). Albu et al. reported that CRS is one of the most common chronic medical conditions worldwide, affecting all age groups (13). In our study, the mean age of the participants diagnosed with acute rhinosinusitis was 31.2, and the mean age of the participants diagnosed with chronic rhinosinusitis was 35.8.

Table 3: The differences between the groups regarding the scale scores

	Acute rhinosinusitis (a) (n=33)	Chronic rhinosinusitis (b) (n=32)	Undiagnosed (control) (c) (n=32)	p	Post Hoc p significance
	Mean±ss Med (Min-Max)	Mean±ss Med (Min-Max)	Mean±ss Med (Min-Max)		
ETDQ-7	25.3±8.3 26 (8-37)	22.8±6.6 22.5 (10-37)	12.9±8.1 9 (7-41)	**<0.001**, d**	a-c; p<0.001 b-c; p<0.001
T-AIADH	17.2±11.7 18 (6-37)	15.5±11.3 9.5 (6-39)	8.9±6.4 6 (2-30)	**0.001**, d**	a-c; p=0.002 b-c; p=0.019
Discrimination / identification of sounds	1.8±2.5 0 (0-8)	1.7±2.6 0 (0-7)	0.9±1.9 0 (0-8)	0.361**d**	No difference
Localization of sounds	2.6±2.8 2 (0-10)	2.0±2.3 1 (0-6)	0.6±1.3 0 (0-5)	**0.011**, d**	a-c; p=0.003 b-c; p=0.014
Speech intelligibility in a noisy environment	4.2±4.1 4 (0-10)	3.7±3.9 2 (0-10)	0.97±1.6 0 (0-5)	**0.007**, d**	a-c; p<0.001 b-c; p=0.002

* P<0.05, **p<0.001, d: Kruskal wallis test, Post hoc p= Post hoc Tamhane's T2 test

The most commonly reported symptoms of chronic rhinosinusitis are fatigue, headache, facial pressure, ear pain, and ear fullness (14). Symptoms for acute rhinosinusitis are usually runny nose, nasal congestion and facial pain or pressure, fever, headache, cough, earache or pressure (15). In our study, most of the symptoms in the literature were present in 98.5% of all patients.

The prevalence of otological symptoms in patients with rhinosinusitis is significant and ranges from 15% to 42% in the literature. Eustachian tube dysfunction (ETD) is stated to be one of the most common otological manifestations of CRS. It is assumed that mucosal edema and sinonasal secretions may cause pressure, fullness, and pain in the ear by impairing the dilatation and pressure equalization functions of the eustachian tube. Communication difficulties can be counted among the long-term effects of ETD. Auditory fullness is the most common symptom among ETD patients, while other shared symptoms include tinnitus and hearing loss (16). Tangbumruntham et al. found that the 3rd and 4th questions representing auditory fullness and ear problems with cold or sinusitis had the highest scores among the individual questions in patients with CRS who were administered ETDQ-7 (17). Maniakas et al. evaluated patients with rhinosinusitis using the Sinonasal Outcome Test (SNOT-22) quality of life tool. SNOT-22 includes two questions that screen for ear pain and ear fullness, which are symptoms of eustachian tube dysfunction (18). It was reported that eustachian tube dysfunction is high in patients with a diagnosis of rhinosinusitis. In our study, 70.8% of patients had tinnitus and 32.3% had symptoms of hearing loss. Lin et al. reported a significant relationship between chronic rhinosinusitis (CRS) and auditory impairment. It has been determined that CRS may impair cochlear functions by damaging inner hair cells and/or outer hair cells, and consequently change the activity of the entire auditory pathway from the VCN to the inferior colliculus. Therefore, attention should be paid to the patient's hearing, such as tinnitus and other symptoms in the early stages of CRS (19). Likewise, eustachian tube dysfunction can cause otitis media, and research has shown that sensorineural hearing loss is one of the sequelae of otitis media. Noxious substances in the middle ear can penetrate the perilymph through the round window, causing damage to the blood-maze barrier in the spiral ligament region (20). In our study, it was determined that the patient group diagnosed with rhinosinusitis had lower ETDQ-7 and AIADH scores than the undiagnosed (control) group.

Ananthakrishnan et al. reported that patients with sensorineural hearing loss experience greater speech perception problems compared to those with normal hearing, and this may be due to cochlear damage altering the neural representation of speech transmitted to higher centers along the auditory neurax, in addition to raising the audiometric thresholds (21). Picou et al. reported that patients with sensorineural hearing loss have difficulty in perceiving daily speech, especially in noisy and resounding environments (22). In our study, it was determined that the patient group diagnosed with rhinosinusitis had a lower speech intelligibility parameter score in a noisy environment, which is a sub-parameter of the AIADH than the undiagnosed (control) group. This supports that rhinosinusitis can negatively affect speech intelligibility in noisy environments.

Patients with sensorineural hearing loss often have difficulty understanding speech among other sounds. Findings show that hearing loss hinders the ability to filter sound sources by location and causes communication difficulties in social situations. They also have difficulty understanding speech sounds coming from different directions (23). Meuret et al. reported that patients with sensorineural hearing loss also had a decrease in the localization of sound compared to those with normal hearing (24). Sensorineural hearing loss may involve dysfunction of both inner hair cells and outer hair cells. In most etiologies, outer hair cell damage is more prominent. In this case, the spectral resolution and cochlear gain of the auditory system decreases and naturally affects the sound localization performance negatively (25). Speech information processing capacity is impaired due to reduced audibility. Impairment of speech capacity is due to physiological defects somewhere

along the auditory pathway, resulting in reduced localization (26). In our study, it was determined that the patient group diagnosed with rhinosinusitis had lower localization of sound scores, which is a sub-parameter of the AIADH than the undiagnosed (control) group. This supports that rhinosinusitis can negatively affect sound localization.

CONCLUSION

In our study, we aimed to evaluate the eustachian tube dysfunctions and perception of hearing impairment in patients diagnosed with rhinosinusitis simply and inexpensively in outpatient clinics with the ETDQ-7 and T-AIADH and to evaluate the relationship between eustachian tube dysfunctions and perception of hearing disability. The results of our study show that rhinosinusitis negatively affects eustachian tube functions, speech intelligibility, sound localization, and perception of hearing impairment and increases tinnitus perception.

With this study, we think that the use of ETDQ-7 and T-AIADH in routine outpatient services may be beneficial in evaluating the perception of eustachian tube dysfunction and hearing disability accompanying rhinosinusitis patients, and their response to follow-up and treatment. In cases with suspected eustachian tube dysfunction and hearing loss, the ETDQ-7 and the T-AIADH can be used to determine the severity of the disease, as well as for treatment and follow-up.

One of the limitations of our study is the relatively small number of patients and the fact that the evaluation was not supported by objective methods. In order to reach more precise results, it is thought that it will be important to increase the number of patients in future studies, to add objective tests, and to compare them with subjective test results.

Ethics Committee Approval: This study was approved by the Medical Research Ethics Committee of the Ege University, Faculty of Medicine (Date: 18.11.2021, No: 21-11.1T/16)

Informed Consent: Written informed consent was obtained.

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Prolonging Postoperative Hospitalization in Patients with Recurrent Tonsillitis to Reduce the Risk of Bleeding After Tonsillectomy*

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ABSTRACT

Objective: This study aims to investigate the effect of lengthening early postoperative hospitalization on post-tonsillectomy bleeding and retrospectively analyzes patients who were operated on for a recurrent tonsillitis diagnosis.
Materials and Methods: The study includes a total of 92 patients who underwent a tonsillectomy for a recurrent tonsillitis diagnosis. The patients were divided into two groups: those discharged on postoperative day 1 (Group A), and those hospitalized for a more extended period (Group B). Both groups were compared in terms of bleeding after the tonsillectomy.
Results: In both groups, none of the patients aged 15 or under presented with post-tonsillectomy bleeding. For patients over the age of 15, no re-admission to the hospital with postoperative bleeding occurred in Group B, while 10 patients (10.9%) from Group A presented with complaints of bleeding and were re-hospitalized.
Conclusion: Extending the early hospitalization period to at least two days in tonsillectomies to be performed for recurrent tonsillitis, especially for late adolescents and adult patients, may reduce the likelihood of a revisit with post-tonsillectomy bleeding.
Keywords: Adult tonsillectomy, postoperative pain, post-tonsillectomy hemorrhage, prolonged hospitalization, recurrent tonsillitis

INTRODUCTION

Tonsillectomies are one of the most common surgical procedures in the ear, nose, and throat (ENT) practice (1, 2). A tonsillectomy operation involves removing both tonsils entirely, as well as its capsule and the muscular wall, and is performed with or without an adenoidectomy. The main symptoms of a tonsillectomy are tonsil hypertrophy causing obstructive sleep disorders and recurrent tonsillitis (3, 4). In additions to these symptoms, tonsillectomies are also performed for those with a history of peri-tonsillar abscess; halitosis; periodic fevers with aphthous stomatitis, pharyngitis, and adenitis (PFAPA) syndrome; or malignancy (1, 5). Tonsillectomies are considered a safe procedure for outpatient surgery. However, the referral rate to emergency services is relatively high after a tonsillectomy (approximately 10-12%) due to bleeding, inability to feed orally, and pain (6, 7).

Tonsillectomy operations involve certain complications, including trauma to the teeth, larynx, pharyngeal wall, and soft palate; difficult intubation; laryngospasm; laryngeal edema; aspiration; respiratory compromise; endotracheal tube kinking; and cardiac arrest. Postoperative complications include bleeding, nausea, vomiting, pain, dehydration, referred otalgia, post-obstructive pulmonary edema, velopharyngeal insufficiency, and nasopharyngeal stenosis (8, 9). The most important complication is undoubtedly post-tonsillectomy hemorrhaging (PTH). PTH can develop on a spectrum ranging from minor self-limiting hemorrhages to massive bleeding leading to hypovolemia and death. The prevention of postoperative bleeding has been discussed with regard to many topics such as the operation method, operation season, devices used, and drugs.

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PTH that occurs within the first 24 hours is called primary hemorrhaging, while PTH that occurs later is called secondary hemorrhaging. The present study includes two groups of patients diagnosed with recurrent tonsillitis. The first group consists of patients discharged on the first postoperative day (Group A), and the second group involves those who were hospitalized for more than one day (Group B). The study retrospectively compares postoperative bleeding status and total hospital stay.

MATERIAL AND METHODS

This retrospective study of 92 (54 females and 38 males) patients has been conducted to evaluate the hospitalization length required for surgical treatment. Patients diagnosed with recurrent tonsillitis underwent tonsillectomy operations between June 2016-January 2020. Recurrent tonsillitis was diagnosed in patients with at least two tonsillitis attacks in the outpatient clinic, and their symptoms and signs were recorded (i.e., fever, tonsil exudates, presence of a cervical lap larger than 2 cm, group A beta-hemolytic streptococcal growth in culture). The study similarly includes patients who reported having five or more attacks per year and whose other episodes have been confirmed clinically. The study includes a total of 92 patients (38 females and 54 males) between the ages of 4 and 42. All patients were operated on under general anesthesia by the same otorhinolaryngologist. Due to the study's retrospective nature, formal voluntary consent is not required.

Patients were selected whose surgeries involved using the combination of cold blade dissection and bipolar cautery coagulation as the surgical technique.

The study has the following exclusion criteria:

- tonsillectomy/adenotonsillectomy performed due to obstructive sleep disorder (136 patients excluded from the study),
- acute tonsillectomies (one patient excluded from the study),
- tonsillectomies performed with suspicion of malignancy in the presence of asymmetric tonsils (two patients excluded from the study),
- tonsillectomies performed with the indication of halitosis (four patients excluded from the study),
- tonsillectomies for PFAPA syndrome (three children excluded from the study),
- patients who underwent their tonsillectomy after a peritonsillar abscess had developed (three patients excluded from the study),
- tonsil surgeries performed within the scope of snoring surgery (seven patients excluded from the study),
- tonsillectomies performed using a technique other than the combined cold blade dissection and bipolar cautery coagulation (21 patients excluded from the study),
- patients who did not come for postoperative control on the 14th day and were not recorded (18 patients excluded from the study),
- and patients admitted to the hospital and hospitalized after revisiting with complaints other than bleeding (e.g., pain, inability to feed, dehydration, fever; nine patients excluded in this way).

All patients were administered a standard per-operative single-dose intravenous prophylactic antibiotic (ampicillin-sulbactam). All patients received intravenous fluids (0.09% NaCl isotonic / 5% dextrose-0.45% NaCl balanced fluid / 5% dextrose), pain relief support (paracetamol), and antibiotics (ampicillin-sulbactam) during the postoperative hospitalization. Movement and solid food restrictions were applied to all patients and all groups. A liquid and soft foods diet was recommended for 10 days. Also, oral antibiotic syrups were prescribed for the five days post-discharge.

The Erzurum Regional Training and Research Hospital Ethics Committee approved this single-center retrospective study (Approval No. 2020/17-182, dated Sept. 21, 2020). This study was conducted according to the latest version of the Helsinki Declaration and Guidelines for Good Clinical Practice. No patient consent was required based on the condition that the computing department had anonymized data such as names and citizenship numbers with the ethics committee's permission.

Statistical analysis

While evaluating the study's findings, the program Statistical Package for Social Sciences (SPSS 22.0) for Windows was used for the statistical analyses. Chi-square analysis was used to compare categorical data. The suitability of the study data parameters to normal distribution was evaluated with the Kolmogorov-Smirnov test. While evaluating the data, the t-test was used in independent groups to compare the normally distributed parameters in the quantitative data, in addition to the descriptive statistical methods (mean, standard deviation, frequency, and percentage). Pearson's correlation analysis was used to compare the two-measurement data, with the level of significance being evaluated as $p<0.05$.

RESULTS

This study includes 92 patients (54 females and 38 males) who have a mean age of 15.3±8.9 years. According to the Brodsky tonsil staging, 27 (29.3%) patients were grade 1-2, and 65 (70.7%) were grade 3-4 and had had a history of 5-15 tonsillitis attacks per year.

Of the patients, 59 (64.1%) were hospitalized after the tonsillectomy for one day (Group A), and 33 (35.9%) for two or more days (Group B). No patient from Group B revisited

Table 1: Comparison of the post-op hospitalization periods of the patients included in the study with socio-demographic and clinical characteristics

		Group A		Group B		*p*
		n	%	n	%	
Age		13.1±8.7		19.1±8.3		0.002[a]
Gender	Female	24	40.7	14	42.4	0.870[b]
	Male	35	59.3	19	57.6	
Tonsillitis attacks (per year)	5-8 times	35	59.3	19	57.6	0.344[b]
	9-11 times	19	32.2	8	24.2	
	≥12	5	8.5	6	18.2	
Tonsil size	Grade 1-2	14	23.7	13	39.4	0.114[b]
	Grade 3-4	45	76.3	20	60.6	
PTH	Yes	10	16.9	0	0	**0.012b**
	No	49	83.1	33	100.0	

[a]: T-test, [b]: Chi-square test, PTH: Post-tonsillectomy hemorrhage, n= Number of patients, P=Level of significance evaluated at $p<0.05$.

Table 2: Relationship between tonsillitis attack and post- tonsillectomy hemorrhage status and tonsil size

		Tonsillitis attacks						*p**
		5-8 times		9-11 times		≥12		
		n	%	n	%	n	%	
PTH	Yes	3	5.6	4	14.8	3	27.3	0.062
	No	51	94.4	23	85.2	8	72.7	
Tonsil size	Grade 1-2	9	16.7	10	37.0	8	72.7	**0.001**
	Grade 3-4	45	83.3	17	63.0	3	27.3	

*: Chi-square test, PTH= Post-tonsillectomy hemorrhage, P=Level of significance evaluated at $p<0.05$.

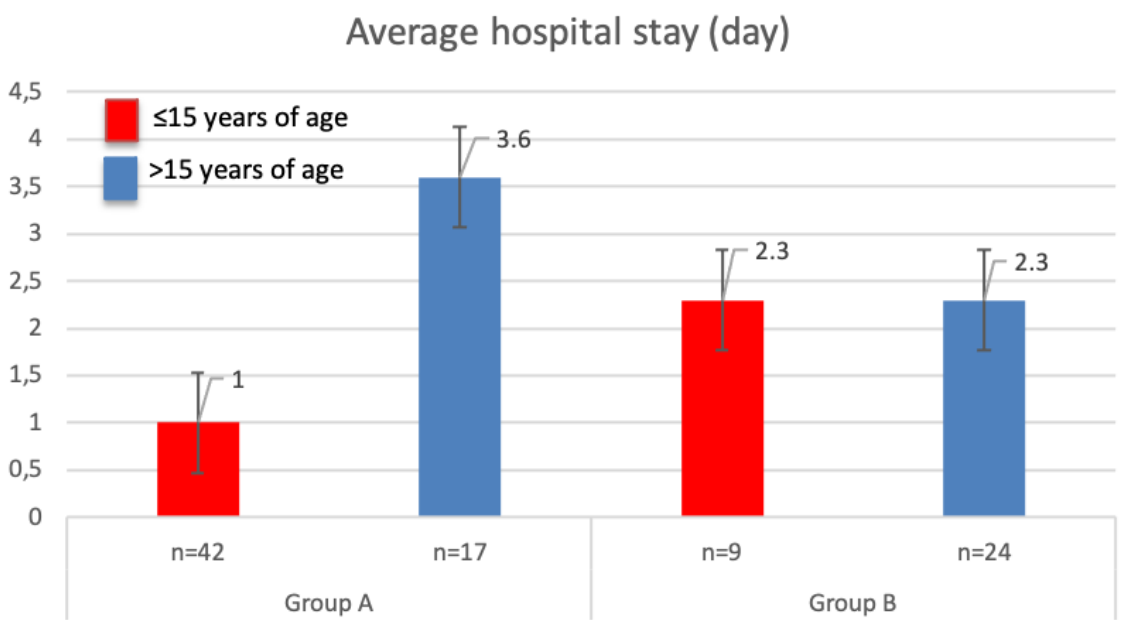

Figure 1: Graph showing average hospitalization periods for both groups.

the hospital with postoperative bleeding, while 10 patients (10.9%) in Group A presented with bleeding complaints and were re-hospitalized due to PTH. A comparison shows the bleeding to have been self-contained in six of the 10 patients without surgical intervention, while four required surgery (Table 1).

One of four patients was reoperated on under local anesthesia and three under general anesthesia to cauterize the focus of the bleeding. A 21-year-old male patient who started to bleed on postoperative day 4 began to bleed again in the form of leakage one day after the second operation. The patient was diagnosed with Type 1 von Willebrand disease due to the hematology consultation and was treated in the hematology clinic. No recurrent bleeding was observed in the patient after treatment with fresh frozen plasma and factor extracts. Another patient (26 years old, female) who'd been operated on with PTH had major bleeding. The patient's hemoglobin levels (15.4 g/dl preoperatively) fell to 7 g/dl after the bleeding. Two units of an erythrocyte suspension were given to the patient, who had tachycardia, palpitations, and symptoms of anemia. No death was observed in the patients.

The postoperative re-hospitalization rate with PTH was significantly higher in group A than in group B (p=0.012). No significant difference occurred with respect to gender and postoperative hospitalization time, number of tonsillitis attacks, or tonsil size (p>0.05; Table 1).

Patients with 12 or more tonsillitis attacks had a significantly higher incidence of Grade 1-2 tonsils compared to those with 11 or fewer tonsillitis attacks (p=0.001). No significant relationship was found between PTH and the number of tonsillitis attacks (p=0.062, Table 2).

When considering both groups, PTH did not occur in either one for those under 15 (childhood/early adolescence: 51 patients, 42 in Group A and nine in Group B). When analyzing those in the 4- to 15-year-old age range, the average length of hospital stay for those in Group A was significantly shorter (Table 3a). Among the remaining 41 people over the age of 15 (late adolescents and adults), 24 patients were in Group B and 17 in Group A. With regard to the hospitalization statistics, when comparing the total and average length of hospital stay in this subgroup of 41 patients, Group A had significantly longer stays than Group B. The total length of the hospital stay after the first hospitalization and revisit was 61 days (Mean = 3.6±2.4) for Group A (17 patients) and 55 days (Mean=2.3±0.8) for Group B (24 patients; p=0.042; see Table 3b and Figure 1).

DISCUSSION

Tonsillectomies are the most common surgical operation (20-40%) in the ENT practice (1, 2). Tonsillectomies that had been performed for the most common throat infections in the 1970s and 1980s are now performed more frequently for obstructive sleep disorders. The complication rate for bleeding is higher in tonsillectomies performed for recurrent tonsillitis (7, 10). The study has aimed to compare the probability of bleeding in patients with recurrent tonsillitis after the tonsillectomy operation in terms of the overall postoperative hospital stay.

Recurrent tonsillitis causes vascular proliferation in the tonsils and adjacent tissues. Inflammation from each attack causes scar formation and fibrosis of the peritonsillar space during the healing period. Thus, recognizing the anatomical structures in patients with recurrent tonsillitis becomes difficult. The number and diameter of vessels in patients with recurrent tonsillitis are higher than those who have been operated on for obstructive reasons (10-13).

No signs of infection were found in patients admitted with obstructions during the dissection of the tonsils. Also, their anatomical structures could be seen more clearly, and their tonsils could be removed in a shorter time with less intraoperative bleeding. The situation described above clarifies

Table 3a: Comparison of postoperative hospitalization length of stay in patients under 15 years of age.

	Group A n=42	**Group B n=9**	***p***
	Mean±*SD*	Mean±*SD*	
Average length of stay in the hospital (# of days)	1.0±0	2.3±0.5	**<0.001[a]**
Total length of stay in the hospital	42 days	22 days	

[a]: T-tests

Table 3b: The comparison of postoperative hospitalization length of stay in patients above 15.

	Group A n=17	**Group B n=24**	***p***
	Mean±SD	**Mean±SD**	
Average length of stay in the hospital (# of days)	3.6±2.4 days	2.3±0.8 days	**0.042***
Total length of stay in the hospital	61 days	55 days	

*: T-tests

the mechanism by which more intra-operative and PTH patients are operated on for recurrent tonsillitis compared to those with only obstructions. In addition, the increase in the number of infections in adults explains the higher possibility of developing PTH compared to children via the same mechanism. PTH rates are higher in adult tonsillectomies than in children (5). Our study found no rehospitalization admissions with PTH in children under 15 years old. The postoperative bleeding rates for acute tonsillectomies are higher than those for other tonsillectomies (13). The present study excluded acute tonsillectomies. The most common reason for post-op re-admissions was bleeding in patients with acute tonsillectomies.

Patients who applied to the emergency department or ENT polyclinics after discharge had such complaints apart from the bleeding as pain, difficulty swallowing, inability to feed, dehydration, fever, and nausea. Curtis et al.'s study on children reported that inadequate pain control and inadequate oral nutrition were the most common reasons for re-admission to the hospital after a tonsillectomy (14). Zagólski et al. stated that readmissions to a hospital with postoperative pain and dehydration complaints were lower in patients with recurrent tonsillitis than in patients who'd undergone a tonsillectomy with other symptoms (15). Bhattacharyya and Kepnes found the postoperative hospital readmission rate to be 11.6% in a multi-center study examining 7,748 adult patients undergoing tonsillectomies (6). The reoperation rate due to PTH with regard to tonsillectomies is around 1-2% (16).

In countries such as Germany and Switzerland, adults are monitored by being hospitalized for 5-7 days after a tonsillectomy. Deitmer and Neuwirth as well as Ikoma et al. suggested that extending the postoperative hospital stay to 7-8 days would better control complications (17, 18). Vyskocil et al. reported no difference in PTH in their study comparing patients discharged for one day with those hospitalized for three days (19). Their study obtained an opposite result compared to the current study. However, this may have been due to including all tonsillectomies without distinguishing the patients in terms of their diagnosis and age groups.

Secondary hemorrhages presenting with multiple PTH may have an underlying cause of undiagnosed-occult bleeding disorder. One study conducted on children found bleeding disorders to be significantly higher in children who'd been readmitted with multiple PTHs compared to those with a single PTH (20). In the current study, the diagnosis of von Willebrand disease was made after bleeding in a 21-year-old male patient had been followed up by multiple PTHs.

When comparing only the discharge times of a well-standardized patient group in this study, no PTH was observed in either group for patients under 15 years of age. Therefore, tonsillectomies can be considered an outpatient surgery for children and young adolescents, even for recurrent tonsillitis.

No bleeding was observed in any of the patients in Group B. Only the patients over 15 years of age in Group A were admitted with PTH. When considering how these patients who were discharged after the bleeding had been brought under control, whether spontaneously or by operation, had longer hospital stays, having an initial hospitalization of at least two days leads to the conclusion that hospital facilities can be used more effectively.

Based on all these results, the adult and the adolescent patient group that had been operated on with a diagnosis of recurrent tonsillitis was hospitalized for at least 48 hours and discharged after the onset of fluid and painkiller support, effective pain control, and adequate oral nutrition. However, their overall hospitalization period was shorter compared to Group B, and the resources (e.g., healthcare personnel, emergency room, operating room, patient beds) were used more effectively. Overall, evaluating this from the patients' points of view will help them have a more comfortable early postoperative period with better pain control in the hospital.

Because of the study's retrospective nature, it has some limitations. The study's main limitation can be considered the low number of patients due to the patient groups that were removed while standardizing the data. Again, due to the study's purpose, the lack of comparing different techniques or surgeons can be considered another weakness. These constraints can be considered as new study topics for researchers.

CONCLUSION

In conclusion, patients diagnosed with recurrent tonsillitis undergo tonsillectomies, and prolonging the hospitalization in the early postoperative period for adolescents and adults decreases the possibility of bleeding and shortens the total hospitalization period. Thus, a prospective study would be most helpful in determining whether the risk factors identified for hemorrhage in this study are valid.

Ethics Committee Approval: The study was carried out with the permission of the Erzurum Bölge Research and Training Hospital Ethics Committee (Date: 21.09.2020, Decision 2020/17-182).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Peer Review: Externally peer-reviewed.

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RESEARCH ARTICLE
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Concha Bullosa as a Cause of Rhinological Halitosis

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ABSTRACT

Objective: Sinonasal diseases are one of the main causes of foul breath. Disruption of mucus drainage leading to bacterial putrefaction is the leading factor of volatile organic compounds (VOCs) production. Concha bullosa (CB) is also one of the factors affecting mucus drainage. Its effect on foul breath was investigated in this study.
Materials and Methods: Sixty patients were included in the study. The participants were selected from those complaining of halitosis, who have CB formation on at least one side, and pathologic VOCs, hydrogen sulfide, methylmercaptan, and dimethylsulfide levels in their OralChroma measurements. The patients were divided into two groups. Surgery was applied to 32 patients, and no treatment was given to 28 patients. The VOCs levels were evaluated using OralChroma.
Results: Sixty patients with a mean age of 36.5 years were included in the study. Before and after the operation of concha bullosa and also when the surgical group and control groups were compared, the decrease in methylmercaptan values was shown to be statistically significant ($p<0.05$).
Conclusion: Concha bullosa should be considered in the etiology of halitosis in cases with no determined cause and high methylmercaptan values.
Keywords: Halitosis, concha bullosa, VOCs, oral chroma, methyl mercaptan

INTRODUCTION

Halitosis, a medical term for foul breath, is a problem that negatively affects the social life of many individuals (1). Its etiology is classified into two groups, as intraoral and extraoral pathologies, where the former makes up nearly 90% of all cases. Intraoral causes consist especially of periodontitis, as well as gingivitis, dental cavities, tonsil stones, and tongue coating. Extraoral causes include gastrointestinal diseases (especially reflux), chronic liver diseases, and systemic diseases, such as diabetes mellitus (2-6). Anaerobic and gram-negative microorganisms that cause putrefaction are responsible for the etiology of extra-digestive intraoral and extraoral-nasal pathologies. These microorganisms produce volatile organic compounds (VOCs) which can be efficiently measured by the gas chromatography device called OralChroma. In intraoral and extraoral extra-digestive pathologies, the hydrogen sulfide (HS) and methylmercaptan (MM) levels are frequently found to be high in mouth breathing measurements, while the dimethylsulfide (DMS) levels are generally normal. However, in several studies, high DMS levels are also reported in extraoral pathologies (6-9). Extraoral nasal pathologies that can result in halitosis include adenoid hypertrophy, allergic rhinitis, and chronic sinusitis (4,8,9).

Concha bullosa (CB) is one of the nasal pathologies that can cause chronic sinusitis. It is defined as the pneumatization of the middle turbinate, and it constitutes one of the most common variations of the middle turbinate (10,11). It can cause mucus accumulation in the ostiomeatal complex and recurrent sinusitis by altering mucociliary activity and middle meatal drainage (10,12). When persisting mucus due to impaired drainage or increased amount is digested by bacteria, it may cause generation of HS and MM due to methionine and cysteine in its content and may appear as the culprit of foul breath (8,13).

Elmassry et al., in the review they published by compiling many articles, stated that many different VOCs can be detected in in the respiratory system colonization and infection of many different bacteria (14). In this direction, we thought that CB,

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which can cause recurrent sinusitis by affecting bacterial colonization, may also be involved in the etiology of halitosis.

In this study, we aimed to compare the changes in MM levels in oral and nasal gas chromatography measurements before and after concha bullosa resection in patients who presented halitosis and displayed no etiological cause other than isolated concha bullosa.

MATERIAL AND METHODS

Patients who applied to the otorhinolaryngology outpatient clinic of the Acibadem Taksim Hospital Hospital between January 2019 and February 2022 with the complaint of halitosis were included in this study. The study was approved by the Medical Ethics Committee of Acibadem University (Date: 03.12.2021, No: 2021-23/01). All studies were conducted in accordance with the Declaration of Helsinki regarding biomedical studies involving human subjects, and written informed consent was obtained from all participants prior to the study.

Study design

Patients complaining from halitosis and presenting pathologic l VOCs detection levels in their oral and nasal breaths as measured by OralChroma were included in the study. It was confirmed that the participants had no known disease in their medical history and did not receive any medical treatment. A standard dental examination was performed by the same expert on all participants. Patients with active or severe dental cavities, gingivitis, advanced periodontitis, or oral thrush were excluded from the study. Patients with gastroesophageal reflux, liver-biliary tract diseases, and gastric-esophageal diseases, which may cause halitosis due to gastrointestinal problems as well as patients who received certain therapies due to systemic diseases that may cause halitosis, such as major head and neck surgery, chemotherapy, and radiotherapy, were also excluded from the study. Nasopharyngeal endoscopy, oropharyngeal examination, and endoscopic laryngeal examinations were performed in all patients. No septum deviation, purulent discharge, or polyp was detected during the nasal endoscopic examinations. Paranasal sinus computed tomography (PNS-CT) was performed on all patients to rule out the presence of chronic sinusitis. Patients that have normal sinus aeration but were found to have unilateral or bilateral CB,, as detected by PNS-CT were included in the study.

Setting

The patients were divided into two groups based on age, gender, and the side with concha bullosa. Concha bullosa surgery was applied to 32 patients who were determined as the surgical group, and no treatment was given to 28 patients who were determined as the control group. Since no other pathology was observed that may explain halitosis, endoscopic concha bullosa surgery was applied in the patients, both oral and nasal VOCs measurements were repeated at the postoperative third month, and the results were compared with preoperative levels. No surgical or medical treatment was applied to the patients in the control group, and the MM levels at 0 and 3 months were measured orally and nasally, before being compared.

Surgical technique

The lateral leaf of the bullous middle turbinate was excised with a 0-degree endoscope under general anesthesia. Bleeding control was done and operations were terminated. Post-operative packing was not used. Peri or post-operative antibiotics were not administered to the patients. Nose bleeding was observed in one patient in the early postoperative period and was controlled with electrocautery.

Measurement of Oral and Nasal VSCs: OralChroma

The HS, MM, and DMS levels were measured using a portable gas chromatography device (OralChroma, AbiMedical) that had previously been validated for clinical studies. This device measures VOCs individually and provides an output by graphing different VOCs in the unit of parts per billion (ppb) (5,15).

To measure the oral malodor using OralChroma, the air inside the oral cavity was sampled directly with a 1-ml syringe after keeping the mouth closed for 60 seconds. The amount of sample injected into the OralChroma was set at 0.5 ml. For sampling nasal breath, one nostril was blocked and the 1 ml syringe, without a plunger, was placed in the other nostril, with the tip of the syringe placed in the nostril cavity. The patient was then asked to breathe out through the nostril containing the syringe. After breathing for 5–10 s, the plunger was replaced and the collected 1-ml of nasal breath was immediately injected into the OralChroma device. Measurements were then taken from the other nostril in the same way. The process was completed in eight minutes. The preoperative and post-operative, oral, and nasal VSC measurements of the patients were displayed on the computer screen, with the graphs of each individual being printed out (OralChroma Data Manager, AbiMedical) (15).

Preparation for OralChroma

All participants were advised not to consume onions, garlic, and spicy foods the day before, and to avoid consumption of alcohol, coffee, and cigarettes 12 hours before their appointment. The use of chewing gum, mint, oral spray, and mouthwash was not allowed on the morning of the appointment. On the other hand, in order to avoid confusion between pathological halitosis and morning halitosis (physiological or temporary halitosis), patients were given breakfast and were allowed to brush their teeth. An information note was provided which included the instructions for oral hygiene after eating and drinking. All measurements were made between 8:30 and 11:30 in the morning (before lunch), two hours following breakfast and the oral hygiene practices. Thresholds for halitosis were accepted as 112 ppb for HS, 26 ppb for MM, and 8 ppb for DMS, which were confirmed in previous studies (15).

Statistical analysis

Statistical analyses were performed using SciPy v1.2.3. A paired t-test was used to investigate statistical significance between repeated measurements. A p-value of less than 0.05 was considered significant.

RESULTS

Population

Sixty patients (31 females, 29 males) with a mean age of 36.5±11.35 years (18-62 years) were included in the study. Concha bullosa was bilateral in 26 patients, while it was only present on the left side in 17 patients, and on the right side in another 17 patients (Table 1).

Surgical Group

Thirty-two patients (16 females, 16 males) with a mean age of 35.2±10.41 years (19-56 years) were included in the study as a surgery group. Concha bullosa was bilateral in 14 patients, while it was only present on the left side in nine patients, and on the right side in another nine patients.

Control Group

Twenty-eight patients (15 females, 13 males) with a mean age of 37.6±12.41 years (18-62 years) were included in the study as a control group. Concha bullosa was bilateral in 12 patients, while it was only present on the left side in 8 patients, and on the right side in another eight patients.

VOCs Measurements

Before and after the operation of bilateral concha bullosa and also when the surgical group and control groups were compared, the decrease in MM values was shown to be statistically significant (p:0.001).

Before and after the operation of right concha bullosa and also when the surgical group and control groups were compared, the decrease in MM values was shown to be statistically significant (p:0.002).

Table 1: Demographic informations of patients.

		Surgery	Control
Age		35.2±10.41	37.6±12.41
Gender			
	Male	16	13
	Female	16	15
	Total	32	28
Concha Bullosa			
	Bilateral	14	12
	Right	9	8
	Left	9	8
	Total	32	28

Before and after the operation of left concha bullosa and also when the surgical group and control groups were compared, the decrease in MM values was shown to be statistically significant (p:0.004).

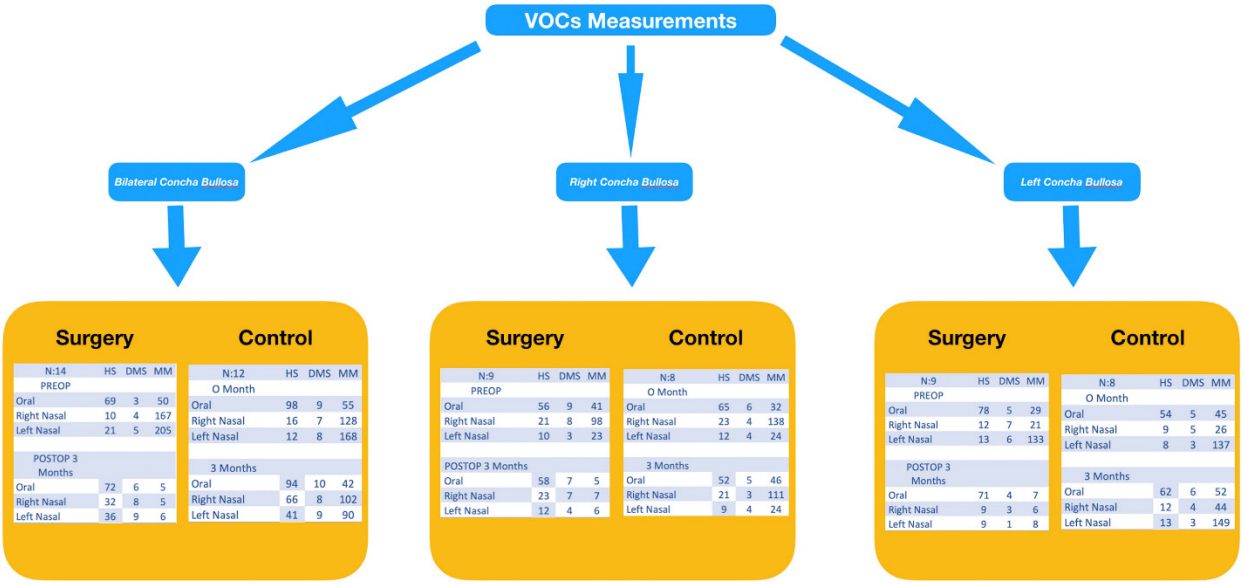
None of the groups' HS and DMS changes were statistically significant (p>0.05). All results from this procedure have been detailed in Figure 1.

DISCUSSION

Nasal and paranasal sinus anatomy is increasingly becoming better understood due to the development of nasal endoscopy and the increased use of paranasal computed tomography. Pneumatization of the middle turbinate is also detected more frequently by endoscopic nasal examinations and PNS-CT imaging. CB is seen in approximately half of all patients and constitutes the most common anatomic variation of the middle turbinate (16). Additionally, approximately half of all patients with CB has accompanying sinusitis findings (17).

It is well-known that chronic sinusitis can cause halitosis (4). However, interestingly, the patients included in our study had no findings compatible with chronic sinusitis (mucosal thickening, secretion, or inflammation) in the nasal endoscopy and PNS-CT. In addition to chronic sinusitis, halitosis has been reported in many nasal and paranasal disorders. These are mainly due to a foreign object in the nasal cavity, chronic postnasal drip, atrophic rhinitis, cleft palate-lip, adenoid hypertrophy, and allergic rhinitis. There are no studies in the literature reporting a CB-halitosis relationship without accompanying sinusitis caused by CB. Although the exact mechanism of CB-related halitosis is not known, we suggest that this might be caused by altered drainage in the middle meatus, causing mucus accumulation in this area. This, in turn, may lead to the formation of VOCs (Figure 2) as in chronic postnasal drip where anaerobic bacteria use the mucus as nutrition and metabolize the cysteine and methionine in the mucus, causing the formation of VOCs, mainly MM. In a study by Avincsal et al. on patients with allergic rhinitis, MM and DMS levels were found to be significantly higher in the study group than in the control group, and it was stated that the increase in MM levels was more prominent than in DMS levels. Similarly, in this study, the authors attributed increased MM levels to increased mucus. In our study, unlike Avincsal et al., no significant elevation was observed in the DMS levels in the preoperative measurements (8).

Secondary to nasal passage obstruction, mouth breathing has a major effect on the formation of dento-facial structures. Although enlarged adenoids are the primary cause of mouth breathing, nasal septal deviation (NSD), and inferior turbinate hypertrophy (TH) have also been implicated as other mechanical obstruction factors. Shetty et al. showed that septum deviation and CB affect the shape of the palate and may cause malocclusion. As the cause of septum deviation, CB may also be the cause of mouth breathing-induced halitosis (18).



N:14	HS	DMS	MM
PREOP			
Oral	69	3	50
Right Nasal	10	4	167
Left Nasal	21	5	205
POSTOP 3 Months			
Oral	72	6	5
Right Nasal	32	8	5
Left Nasal	36	9	6

N:12	HS	DMS	MM
O Month			
Oral	98	9	55
Right Nasal	16	7	128
Left Nasal	12	8	168
3 Months			
Oral	94	10	42
Right Nasal	66	8	102
Left Nasal	41	9	90

N:9	HS	DMS	MM
PREOP			
Oral	56	9	41
Right Nasal	21	8	98
Left Nasal	10	3	23
POSTOP 3 Months			
Oral	58	7	5
Right Nasal	23	7	7
Left Nasal	12	4	6

N:8	HS	DMS	MM
O Month			
Oral	65	6	32
Right Nasal	23	4	138
Left Nasal	12	4	24
3 Months			
Oral	52	5	46
Right Nasal	21	3	111
Left Nasal	9	4	24

N:9	HS	DMS	MM
PREOP			
Oral	78	5	29
Right Nasal	12	7	21
Left Nasal	13	6	133
POSTOP 3 Months			
Oral	71	4	7
Right Nasal	9	3	6
Left Nasal	9	1	8

N:8	HS	DMS	MM
O Month			
Oral	54	5	45
Right Nasal	9	5	26
Left Nasal	8	3	137
3 Months			
Oral	62	6	52
Right Nasal	12	4	44
Left Nasal	13	3	149

Figure 1: Figure of VOCs levels in Bilateral Concha Bullosa, Right Concha Bullosa and Left Concha Bullosa

HS: Hydrogen sulfide, DMS: Dimethylsulfide, MM: Methylmercaptan

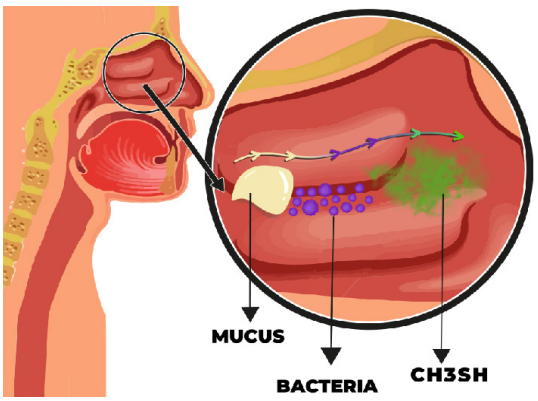


Figure 2: Increased or impaired drainage of mucus causes the formation of volatile sulfur compounds, especially methylmercaptan (CH3SH), as a result of bacterial digestion, and these compounds are excreted from the mouth and nose with respiratory air.

Also, if the CB is located opposite the deviated side of the septum, it balances the airflow between the two nostrils. However, the surface area-to-volume ratio and total nasal resistance in this group was significantly higher and the nasal volume was significantly decreased than the patients who do not have CB. This may have affected the nasal microbiota and caused the production of VOCs (19).

In this study, we not only made oral measurements, but also made nasal measurements and observed that in the extra-digestive system, the airway can reveal the odor in all directions during expiration. Accordingly, we found high MM levels on the same side of a concha bullosa formation. After the drainage was corrected in this area, mucus circulation improved, post-operative MM levels decreased, and finally, halitosis was resolved. The limitation of the study was that only patients with halitosis and concha bullosa formations were included in the study. However, in our daily clinical practice, we encounter that many patients with concha bullosa have normal oral and nasal VOCs measurements. Takeshita et al. showed that oral MM HS levels are high in individuals with a high burden of Prevotella, Veillonella, Atopobium, Megasphaera, and Selenomonas in their oral microbiota (20). Whether CB causes bad breath or not may be related to the colonization of these bacteria because not every CB causes bad breath. Simultaneous microbiological examination will provide clearer information about the mechanism of causing halitosis. This research shows that CB may cause halitosis if the etiology cannot be determined in patients with halitosis and MM in the foreground.

Therefore, it should be kept in mind that CB may cause halitosis in cases with prominent MM increase where halitosis etiology cannot be determined.

Main Points

1. Ninety percent of bad breath originates from the oral cavity.
2. The causes of halitosis originating from the nose can be shown as deviation, turbinate hypertrophy, allergy, nasal polyps, and chronic sinusitis.
3. Concha bullosa may cause bad breath by disrupting the drainage in the middle meatus.
4. Patients with concha bullosa without any obvious nasal pathology were included in our study. These patients had high preoperative methylmercaptan levels, and methylmercaptan levels decreased significantly as a result of opening the concha bullosa. Although we cannot provide a clear explanation for the mechanism, we believe that mucus drainage and bacterial putrification are effective in this.

CONCLUSION

The cause of an increase in the clinical measurements of the extra-digestive system may not be revealed sufficiently with an evaluation of only the tongue and teeth. Since it has a connection with the airway, the nasal cavity must also be evaluated, because medical conditions in this area could be the underlying cause of halitosis that reveals itself during expiration.

Ethics Committee Approval: This study was approved by the Medical Ethics Committee of Acibadem University (Date: 03.12.2021, No: 2021-23/01).

Informed Consent: Written informed consent was obtained.

Peer Review: Externally peer-reviewed.

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CASE REPORT
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Catastrophic Bilateral Sudden Sensorineural Hearing Loss Due to Mumps: Report of Two Cases

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ABSTRACT

Mumps is an acute self-limiting systemic disease that can potentially cause serious complications. One of its well-known complications is sensorineural hearing loss. Cases of SNHL associated with mumps are only reported in 1/1000 cases. This condition is also known for its poor prognostic feature regarding the restoration of hearing. Case report: patient 1: A 10-year-old immunized boy complaining of hearing impairment following an insidious onset parotid swelling with low-grade fever. Viral antibody panel serological results of anti-mumps IgM antibody were positive. Following the diagnosis of bilateral complete hearing loss, the patient was hospitalized and received treatment, but unfortunately, there was no improvement in hearing. He was sent home, and a rehabilitation plan was initiated. Patient 2: A 12-year-old non-immunized girl presented with hearing loss after experiencing bilateral tender parotid swelling and low-grade fever. She had complicated hearing loss of gradual onset. A week later a diagnosis of complete bilateral sensorineural hearing loss was confirmed hearing loss was confirmed on audiometry. Salvage therapy trial was initiated. However, there was no improvement. Mumps is highly contagious. In order to eliminate this disease, vaccination programs have been established around the world. The WHO advocates a coverage of 90% to prevent outbreaks. However, in Yemen, immunization programs have been suspended due to the political conflict. This has led to an increase in the number of endemic diseases, including mumps. Bilateral complete SNHL is the rarest form of SNHL, with only 22 cases until 1957. Very few cases have been added since then. Hearing loss may occur at any time before, during, or after the course of a mumps infection. In our cases, hearing loss occurred within the 3rd and 4th day, respectively. Many treatment strategies have failed to restore the hearing, and there is no treatment proven to be effective for sudden SNHL even if steroidal therapy is initiated immediately after the recognition of hearing loss. After hearing loss has occurred due to viral etiology, the retrieval of hearing using medical therapy is considered remote. The failure of treatment in our patient may also be related to the severity of cochlear damage. Hearing loss due to mumps infection is likely to be permanent regardless of treatment. Vaccination alone cannot prevent such deafness and outbreaks.

Keywords: Hearing loss, deafness, mumps

INTRODUCTION

Mumps is an acute self-limiting systemic disease that can potentially cause serious complications, including inflammation of the salivary glands, pancreas, testes, meninges, and inner ear. One of its well-known complications is sensorineural hearing loss (SNHL) (1). Sudden hearing loss SHL is a significant matter of discussion. Bilateral SHL is considered rare in comparison to unilateral hearing loss and it is commonly related to an underlying disease rather than idiopathic etiology. The literature reporting infectious viral etiology causing bilateral SNHL represents only 10% of cases of SNHL, including mumps, HIV, HSV, and Viral Upper respiratory tract infections (2). Cases of SNHL associated with mumps are only reported in 1/1000 cases. This disease is also known for its poor prognostic feature regarding the restoration of hearing, especially for those with profound loss (3-5).

CASE PRESENTATIONS

Patient 1

A 10-year-old immunized boy presented during an endemic period of mumps in a rural area in Yemen. He was brought to Al-Balasi Otolaryngology Hospital by his parents having complained of a hearing impairment for three days following

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an insidious onset of right-sided parotid swelling with low-grade fever which had been followed by a left-sided swelling on the following day. His condition was associated with nausea and vomiting on the first two days, and on the third day, his parotitis started to cease during which he began complaining of tinnitus and his parents started to notice that he had difficulty hearing. On the fourth day he had significant hearing loss, but at this point there was no headache, nor any signs of meningeal irritation. All the patient's family members had mumps during this endemic but none of them developed complications. Otherwise, the family history was negative for hereditary or systemic diseases, and also negative for ototoxic medication, or trauma. On examination, his tympanic membranes were normal, and mobile bilaterally with no evidence of ear inflammation. CBC was unremarkable. The viral antibody panel serological result of anti-mumps IgM antibodies was positive. Pure tone audiometry showed bilateral sensorineural hearing loss at 100 dB. On the auditory brain stem response, no waves were seen, confirming the diagnosis of complete hearing loss. After being diagnosed with bilateral dead ears the patient was hospitalized and received the following treatment plan: Prednisolone oral 60 mg for two weeks and then tapered over two weeks, Aspirin 75 mg three times a day orally for 10 days, Methylcobalamin 500 mcg twice a day intramuscularly, Acyclovir infusion 300 mg intravenously every 8 hours for 3 days, followed by 300 mg orally every 6 hours for another 7 days, and intratympanic methylprednisolone 0.5 ml buffered. During this time, hearing tests were repeated, and there was no improvement in his hearing. The patient was sent home, and a rehabilitation plan was initiated as we kept the patient's prognosis for 6 months with no alteration in hearing.

Patient 2

A 12-year-old non-immunized girl from the highlands of Yemen presented after a 12-day history of hearing loss, having experienced bilateral tender parotid swelling and low-grade fever for three days prior to the onset of otologic symptoms. On the fourth day she started to have hearing loss of gradual onset, and one week later, profound hearing loss was documented on an audiometry. Before being referred to our hospital, she received oral prednisolone 80mg and Vinpocetine for a few days with no improvement. The patient was otherwise healthy and had no significant past medical history. Her family history was also negative for hereditary or systemic diseases apart from the patient's younger siblings who had mumps but none of them was hospitalized or had any complications. On examination, tympanic membranes were normal, and mobile bilaterally with no evidence of ear inflammation. Her CBC was unremarkable. Viral antibody panel serological results of anti-mumps antibodies IgM were positive confirming recent infection. The diagnosis of complete bilateral sensorineural hearing loss was confirmed on pure tone audiometry and on brainstem response as no waves were seen. Hence, we were aware of the association. Another salvage therapy trial for hearing was initiated with intratympanic corticosteroid along with oral vasodilator, anti-inflammatory, and anticoagulants, and we followed up with her for six months. However, there was no improvement in her hearing.

DISCUSSION

Mumps is a disease of children and young adults caused by of an enveloped, single-stranded RNA virus of the paramyxoviridae family. It is an acute self-limiting systemic disease that can potentially cause serious complications. Mumps can attack multiple organs including the salivary glands, pancreas, testes, meninges, and inner ear. One of its well-known complications is SNHL (1). Mumps is highly contagious and can have a long list of complications. In order to eliminate this disease, a program offering the mumps vaccination has been established around the world. The WHO advocates a coverage of 90% to prevent outbreaks and states that mumps hearing loss has almost vanished after vaccination coverage reached this level (3, 6). However, in Yemen, the immunization programs have been suspended due to the political conflict, which has led to an increase in the number of endemic diseases, including mumps. Mumps deafness per se is rare because immunization programs prevent outbreaks. However, unilateral hearing loss is a known complication in comparison with bilateral SNHL which is very rare (1, 2).

Hearing loss due to mumps can present in three different ways: complete unilateral, partial unilateral, and bilateral complete SNHL. The bilateral complete SNHL is the rarest form, with only 22 cases until 1957. Very few cases have been reported since then (7, 8). Hiromi et al. described the incidence of hearing loss in their prospective study as being from 0.5 to 5.0 per 100,000 cases of mumps in 2008. This incidence in Japan was reported because immunization had not been a routine practice at that time, while in Belgium an outbreak in 2004 occurred due to vaccine failure (5, 9, 10). The primary route of viral invasion to the cochlea is hematogenous, and hearing loss may occur at any time before, during, or after the course of a mumps infection (3, 11). In our cases, the hearing loss occurred after the course of the disease was subsiding, within the third and fourth day, respectively. The pathophysiology of hearing loss due to mumps is thought to be by direct invasion of the cochlea damaging the organ of Corti, the cochlear nerve myelin sheath, and degenerating the stria vasicularis, tectorial and Reissner's membrane (4, 12, 13). Tanaka et al. experimentally confirmed that mumps-related deafness is caused by the degeneration of the organ of Corti (12, 14). Even asymptomatic or mild mumps infection can cause hearing impairment (5). Many treatment strategies have failed to restore hearing, and there is no treatment proven to be effective for sudden SNHL. However, a trial of steroidal therapy has been implemented recently. Intratympanic steroidal injection has become more popular in recent years. This method delivers more concentrations of steroids to the affected tissue, as well as treating patients with vasodilators, anticoagulants, and hyperbaric oxygen therapy (15). Shinya et al. reported that 36 patients with SNHL due to mumps received steroidal therapy and only one patient showed improvement (3). In our cases, steroidal therapy was initiated immediately after the recognition of hearing loss. However,

after hearing loss has occurred due to viral etiology, the retrieval of hearing using medical therapy is considered remote. The prognosis for patients with profound SNHL is very poor apart from cochlear implantation surgeries, which achieved good results regarding speech and sound perception in patients who do not have central nervous system damage involved (3, 16). Our patients would have to go overseas to receive a cochlear implant. Failure of treatment in our patients may also be related to the severity of cochlear damage that occurred in both cases. Informing the children and their guardians that the damage was going to be permanent with no further resources available for hearing retrieval, e.g. cochlear implantation, and counseling them about this sudden unexpected complete hearing loss at this age with all its upcoming difficulties and quality of life challenges, was a very traumatic period for both of them, their families, friends and for the working staff as well. It is difficult to know the actual number of cases of mumps-related deafness in Yemen since the outbreaks can trigger such conditions. The majority of hearing loss is unilateral profound or mild to moderate hearing loss. Therefore, many patients, especially children, may not have otologic symptoms severe enough to warrant medical attention for further assessment and diagnosis. These two cases underline the importance of immunization and the effect of wars on developing countries.

CONCLUSION

When SNHL occurs due to mumps it is likely to be permanent regardless of treatment. Mumps induced SNHL is preventable, as vaccination alone could prevent outbreaks. The social and psychological cost of hearing loss is a significant matter and for that reason, stakeholders in Yemen should consider implementing both vaccine programs and cochlear implant centers.

Informed Consent: Parents agreed and gave written consent to the publication of this study.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- A.A.B.; Data Acquisition- A.A.B., D.O.; Drafting Manuscript- A.A.B., D.O.; Critical Revision of Manuscript- A.A.B., D.O.; Final Approval and Accountability- A.A.B., D.O.; Material or Technical Support- A.A.B., D.O.; Supervision- A.A.B.

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Intraoral Presentation of Juvenile Nasopharyngeal Angiofibroma: A Case Report

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ABSTRACT

Juvenile nasopharyngeal angiofibroma (JNA) is a vascular, locally destructive, and histologically benign tumor typically affecting the nasopharynx of adolescent males. This rare neoplasm has the potential to permeate through natural foramina and spaces and extend into neighboring structures. However, the intraoral extension of this tumor is extremely uncommon. Dental surgeons should remain alert to this possibility while evaluating such lesions. This article describes a case of JNA with intraoral extension in an 11-year-old boy and outlines the treatment procedures. JNA may rarely manifest intraorally as a submucosal swelling. This neoplasm should be considered in the differential diagnosis of intraoral lesions in adolescent males, especially when associated with nasal complaints.
Keywords: Oral, angiofibroma, adolescent

INTRODUCTION

Juvenile nasopharyngeal angiofibroma (JNA) is a benign but locally aggressive vascular tumor that occurs almost exclusively in the nasopharynx of adolescent males. The tumor is uncommon and constitutes 0.5% of all head and neck neoplasms (1). This type of tumor often infiltrates through the surrounding tissues and has the capacity to extend widely. However, the intraoral presentation of JNA is exceedingly rare, with only a few cases having been reported in the literature (2, 3). Such an unusual presentation of a tumor may present the clinician with diagnostic difficulties while evaluating these types of lesions. This report describes a case of JNA with an extension in the oral cavity, alongside the relevant imaging and histopathological findings. The report also discusses treatment modalities and stresses the importance of an interdisciplinary approach in managing this unusual tumor.

CASE PRESENTATION

An 11-year-old boy reported in with the chief complaint of a large swelling in the right cheek that had been increasing steadily for the last six months, as well as an intraoral mass that had appeared recently, causing difficulty eating (Figure 1). The boy also presented with a history of episodic epistaxis, nasal obstruction, and noisy respiration over the last 6-12 months. The intraoral examination revealed a pinkish mass protruding from the posterior right maxillary alveolus just distal to the permanent first molar involving the pterygomandibular raphe and obliterating the buccal sulcus. The mass was found to be extruding through the tooth socket into the oral cavity. The mass was 2 cm in size, non-hemorrhagic, lobulated, and smooth surfaced. Significant bulging of the soft palate was also seen, as well as a mass to be present in the right nostril and toward the choana of the left nostril. A diffuse soft-to-firm swelling was palpated, encompassing the entire right cheek, extending from the malar process to the inferior border of the mandible.

Computed tomography (CT) showed a large mass in the nasopharynx and oropharynx, nasal cavity, posterior nares with superior extension to the roof of the nasopharynx, and apex of the orbit. Bowing of the posterior wall of the maxillary antrum (Holman-Miller sign) with erosive changes

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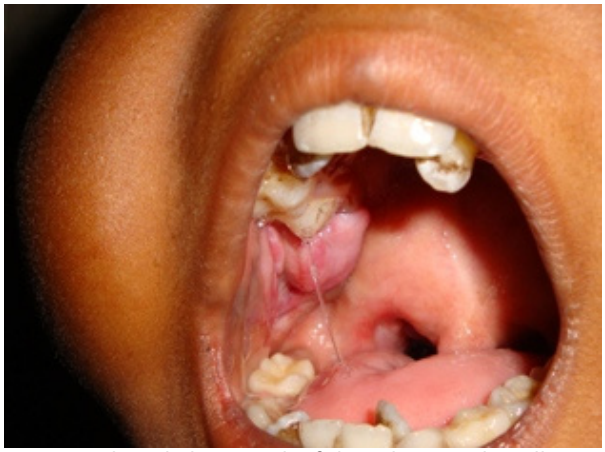

Figure 1: Clinical photograph of the submucosal swelling in the posterior maxillary alveolus.

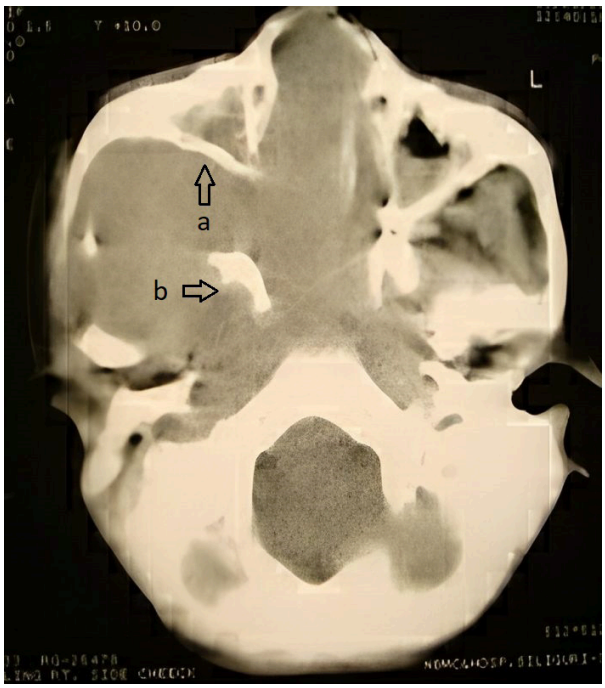

Figure 2: CT scan showing the extent of the lesion. (a) Holman-Miller sign; (b) Erosion of the pterygoid lamina.

in the right pterygoid lamina was also noted (Figure 2). The patient was then referred to the Ear, Nose, and Throat (ENT) Department, and a treatment plan was formulated following interdisciplinary discussions. A provisional diagnosis of JNA was made, and the patient was prepared for surgery. A sublabial incision was applied, extending from the upper central incisors to the retromolar region to expose the tumor. The tumor was removed through a transantral approach, along with midfacial degloving after releasing the attachments, and then removed orally. Brisk blood loss was encountered, which was managed by ligating the vessels in the tumor bed. The excised specimen measured approximately 12 cm along the anteroposterior dimension. Overall, the tumor appeared pale and rubbery firm with indentations from the pterygoids. The cavity was packed with sucralfate metronidazole in a roller pack that was brought

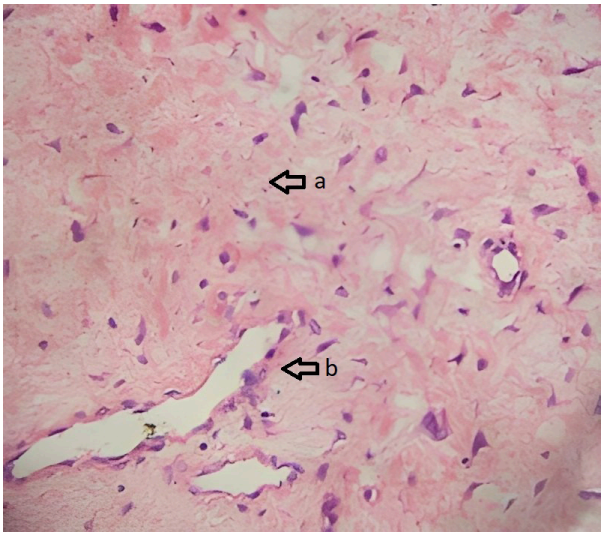

Figure 3: Photomicrograph of H&E stained sections (10x) showing a few vascular spaces in a mature fibrous stroma. (a) fibrous stroma; (b) thin-walled vascular spaces.

out through a widened middle meatus, and the wound was closed with chromic catgut. A histopathological examination of the excised specimen, which was stained with hematoxylin and eosin, revealed stellate fibrocytes in a mature fibrous stroma interspersed by thin-walled vascular spaces of variable calibers. These findings are consistent with the diagnosis of JNA (Figure 3). Postoperative healing was uneventful, other than transient conjunctival congestion and facial edema. The patient was advised to apply a routine nasal alkaline douche and follow-up was maintained with a nasal endoscope. The patient remained free of any recurrence three months post-operation and is scheduled for periodic check-ups.

DISCUSSION

JNA constitutes 0.5% of all head and neck tumors. Though this vascular lesion is benign, it however may show local aggressive behavior by extending through natural foramina and fissures. JNA is infrequently seen in dental clinics because of its rarity in intraoral locations and may cause confusion in diagnosis. Thus, the primary objective of this paper is to familiarize the clinician with this unusual presentation of JNA and to consider the possibility of JNA while evaluating lesions with similar characteristics. The clinical presentation of this neoplasm is often distinctive. It occurs almost exclusively in young males and is associated with rhinologic symptoms such as epistaxis, nasal blockage, and frequently a nasal mass. The site of origin of this tumor has been debated, but evidence suggests that it probably arises in the posterolateral wall of the nasal cavity at the junction formed by the sphenoid process of the palatine bone and the ala of vomer (4). Even the pathogenesis of this tumor remains speculative. Various symptoms such as ambryonal chondro-cartilage, normal embryonal fibrovasculature, testosterone, trauma, and heredity have been implicated in its formation (5).

One characteristic feature of JNA is its ability to spread, sometimes assuming large sizes. Sessions and Fisch classified the tumor under various categories based upon the extent of its spread (6, 7). In 1996, Radkowski proposed a newer staging system that has become more widely used in recent times (8). Facial swelling, proptosis, diplopia, and cranial neuropathy are suggestive of an extensive tumor. Diagnosis of the tumor is suggested by combining the clinical features, age at presentation, male sex, nasal complaints, and the characteristic imaging findings. CT scans are excellent imaging modalities, as they offer a superior delineation of the extent of the lesion and associated bone changes. The Holman-Miller sign, which is the anterior bowing of the posterior maxillary wall, is often picked up in CT scans and lateral radiographs. Surgery remains the most effective form of treatment. Newer treatment methods are being evaluated for unresectable tumors. Hormone therapy and low dose radiotherapy have also been tried in some cases (9). Various surgical approaches (e.g., transpalatal, sublabial and frontoethmoidal) have been advocated with the principal aim of gaining adequate exposure in order to completely remove the tumor, which is essential for avoiding recurrences (10). The prognosis for JNA is excellent in cases that are adequately treated. Angiofibroma has an unmistakable histological appearance, which essentially is the proliferation of the vascular channels lined by a single layer of endothelial cells in a fibrous stroma. The present case demonstrates that the dental practitioner should remain alert to the possibility of JNA while evaluating intraoral maxillary masses in adolescent males. The characteristic clinical presentation and imaging results should suggest the diagnosis. An unnecessary biopsy procedure should be avoided, as this may prove to be dangerous in vascular tumors such as JNA due to the risk of massive bleeding. The present case also underlines the importance of an interdisciplinary approach involving otolaryngologists in order to effectively manage patients with this tumor.

Informed Consent: Written informed consent was obtained from patients' parents who participated in this study.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- S.B., S.Biswas, L.B.M.; Data Acquisition- S.B., S.Biswas, L.B.M.; Data Analysis/Interpretation- S.B., S.Biswas, L.B.M.; Drafting Manuscript- S.B., S.Biswas, L.B.M.; Critical Revision of Manuscript- S.B., S.Biswas, L.B.M.; Final Approval and Accountability- S.B., S.Biswas, L.B.M.; Material or Technical Support- S.B., S.Biswas, L.B.M.; Supervision- S.B., S.Biswas, L.B.M.

Conflict of Interest: The authors have no conflict of interest to declare.

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All acronyms and abbreviations used in the manuscript should be defined at first use, both in the abstract and in the main text. The abbreviation should be provided in parentheses following the definition.

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