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Ocular surface culture changes in patients after septoplasty

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Aim: To investigate the interrelationships between pre- and postoperative microbiological changes by taking samples from both eyes of 40 patients who underwent septoplasty due to septal deviation.

Materials and methods: Forty patients diagnosed with septal deviation who underwent a septoplasty operation under general anesthesia were enrolled in this study. The study was conducted on 40 patients who met the inclusion criteria and attended follow-up visits. One day before the operation and 48 h after the operation, cultures were taken individually from the conjunctivas and puncta of both eyes and sent to the microbiology laboratory.

Results: Patients who were candidates for nasal surgery due to their symptoms and clinical examination results were randomly selected and 40 of these completed the study. No statistically significant differences in bacterial growth were observed between the eyes before the operation ($P > 0.05$). There were, however, statistically significant differences between the eyes in terms of bacterial growth in the postoperative period ($P < 0.05$). Pathogenic bacterial cultures were grown in 47 eyes in the postoperative period, and this finding was statistically significant. In the eye cultures, the most commonly isolated pathogens were *S. epidermidis*, and *S. aureus*.

Conclusion: Although the indicated microorganisms isolated from the patient groups were grown in cultures, there were neither clinical symptoms nor signs related to ocular infections.

Key words: Septoplasty, ocular surface, nasal flora

1. Introduction

Nasal airway obstruction is one of the most common complaints encountered by ear-nose-throat (ENT) specialists. In patients with chronic nasal obstruction due to mechanical causes, surgical procedures such as septoplasty or submucosal septum resection are applied in order to increase nasal air flow (1). Since the nasal cavity and the eyes are interconnected via the nasolacrimal duct and they neighbor each other, an infection developing in one may affect the other.

Nasal and oropharyngeal flora consist of numerous strains of aerobic bacteria that maintain a balance through strategies of antagonism and coexistence. The location, severity, and complexity of nasal septal deviation influence airflow dynamics in the nasal cavity (2). This interaction may also be observed after septoplasty operations. This condition may affect the nasal cavity and flora (3).

The increase in the local microbiological load, due to both tampon placement and trauma, further supports the potential microbiological interrelation between the nose and eyes. A literature search revealed that no studies investigating such an interrelationship have been conducted up to now. Therefore, the aim of this study was to investigate, both pre- and postoperatively, whether there are potential changes via the above-mentioned pathways (i.e. the nasolacrimal duct or directly via the lamina papyracea) in the microbiologic flora of the eyes of patients who underwent classical septoplasty due to septal deviation.

2. Materials and methods

Forty patients, who were diagnosed with septal deviation and underwent a septoplasty operation in our ENT Department at Bozok University Training and Research Hospital between January 2012 and April 2012, were enrolled in this study. This study was carried out in accordance with the Helsinki Declaration of the World Medical Association and was approved by the institutional ethics committee of Bozok University. Informed consent was obtained from all the patients.

Patients with vasomotor rhinitis, nasal polyposis, allergic rhinitis, autoimmune disorders, and systemic

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and cardiovascular disorders, and those who received long-term drug therapy, were excluded from the study. The inclusion criteria were: having a complaint of nasal obstruction, being a candidate for surgery, accepting participation in the study and the operation procedure, and allowing the taking of ocular samples both pre- and postoperatively. The study was conducted on 40 patients who met the inclusion criteria and attended follow-up visits. There were 8 patients who were excluded from the study because they did not attend follow-up examinations. Twenty-two of the patients were male while the rest (n = 18) were female. The age range was 18–51 years. Signs in the patients were classified as uni- or bilateral anterior or posterior deviation, septal crest, or hypertrophy of the concha (Table 1).

All of the patients were asked about their complaints and the pathology was confirmed by nasal endoscopy (i.e. septal deviation, septal crest) a week before the surgical procedure to ensure a clear indication for operation. Age, sex, vital signs, types of pathology requiring septoplasty (i.e. uni- or bilateral, anterior or posterior deviation of the septum, septal crest), drug allergies, and past medical histories were also recorded.

A day before the operation, cultures were taken individually from both eyes, conjunctivas, and puncta and were sent to the microbiology laboratory. Septoplasty was conducted in the patients under general anesthesia. Conjunctival scarring during the operation was prevented by applying Thilo Tears SE gel (1.5 mg carbomer and 25 mg sorbitol) on both eyes during the operation. This solution did not contain an antibacterial agent. To achieve antisepsis during the operation, the nasal area was stained carefully with 4.0% polyvinylpyrrolidone-iodine so that there was no contamination in the ocular areas. After the operation, Merocel nasal tampons with bepanthene (dexpanthenol pomade) were applied to both sides of the nasal cavities. The Merocel nasal tampons were removed on the second day after the operation, and ocular samples were sent to the microbiology laboratory to be cultured in the same manner as the baseline samples. All patients were treated with an antihistamine (i.e. desloratidine, 1 × 5 mg/day) and an analgesic (i.e. paracetamol tablets, 2 × 500 mg/day) for 7 days postoperatively, but no antibiotics were prescribed. All patients were discharged the day after the operation. The materials taken with ocular swabs were evaluated in the microbiology laboratory. The samples were inoculated into eosin methylene blue (EMB), chocolate, and blood agar cultures by the decrement method. Part of the sample was also smeared on a slide and stained with Gram's stain to determine the presence of erythrocytes, leucocytes, and eosinophilic cells. Samples inoculated in cultures were incubated at 37 °C for 24 h. The chocolate agars underwent the same procedure in a desiccator because some microorganisms grow better in a 5%–10% CO_2 environment. Chocolate and blood agar cultures without any growth after the first incubation period were incubated for another 24 h. Therefore, the maximum culture duration was 48 h. Samples from cultures with growth were smeared on a cover-glass for Gram staining. They were classified as gram-positive or gram-negative according to their staining features. The colonies of gram-positive cocci demonstrated beta-hemolysis in blood agar; were opaque, cream, or golden-yellow colored; and appeared as grape-like bunches under 100× magnification. These were deemed to be staphylococci and a catalase test was performed to support this classification. Lastly, a coagulase test was performed and those with a positive result were classified as *Staphylococcus aureus* while those with a negative result were determined to be coagulase-negative staphylococci. Cultures displaying a diameter of 0.3–0.5 mm and dew-drop shaped growth were also sampled for Gram staining. The Gram staining yielded sharp-ended, round, gram-negative coccobacilli. An oxidase test, wet-nurse phenomenon, and X and V tests were all positive for *Haemophilus influenza*. In all patients, the culture results were evaluated for each of the eyes. The microorganisms produced and the results of direct microscopic examination were recorded.

Table 1. Clinical and demographic characteristics of all patients.

Age (mean ± SD)	
Female	36.9 ± 15.6
Male	39.5 ± 13.8
Sex	
Female	18
Male	22
Septal deviation	
Right	19
Left	21
Clinical characteristics	
Nasal obstruction	31
Headache	9

2.1. Microbiological evaluation of sampled ocular material

Ocular material was taken either via a swab or a surgical apparatus from the lower conjunctiva or the medial canthus. The specimen was inoculated in chocolate-blood agar enriched with thioglycolate and incubated under a CO_2 environment. When possible, stained preparations were made from the same culture samples and were examined. Even when no infection is apparent, it is recommended to take samples from both eyes, especially since pathogenic microorganisms can sometimes be isolated from one eye in the absence of infection. Since sometimes the difference between the eyes may be significant, the samples taken

Table 2. Distribution of preoperative and postoperative growth in the presence of eye culture [n (%)].

	Preoperative		Postoperative		
	Growth (+)	Growth (–)	Growth (+)	Growth (–)	P
Right eye	10 (25)	30 (75)	23 (57.5)	17 (42.5)	<0.05
Left eye	13 (32.5)	27 (67.5)	24 (60)	16 (40)	<0.05

by the ophthalmologist were smeared on a clean slide to determine eosinophilic cells and viral inclusion bodies (4).

2.2. Statistical analysis

The statistical analyses were performed with SPSS 18.0 (SPSS Inc., Chicago, IL, USA). The chi-square test, along with Fisher's exact method, was used to compare qualitative data. McNemar's test was used to compare changes between the preoperative and postoperative periods. The results were interpreted within a confidence interval of 95% and a significance level of 0.05.

3. Results

In this prospective study, the results of cultures from each of the patients' eyes, taken both pre- and 48 h postoperatively, were evaluated. The patients who were assessed as candidates for nasal surgery due to their symptoms and clinical examination results were selected, and 40 of these selected patients completed the study.

No statistically significant difference between the eyes was observed in bacterial growth before the operation ($P > 0.05$). Ten of the patients (25%) displayed growth in cultures from their right eye samples, while 13 patients displayed growth in cultures from their left eyes (32.5%).

The types of bacteria cultured also did not differ significantly between the eyes in the preoperative period ($P > 0.05$). In the 10 patients with positive samples from their right eyes, *S. epidermidis* (25%) was grown, while the remainder displayed no growth (75%). In the 13 patients with positive samples from their left eyes, *S. epidermidis* (32.5%) was grown, while the remainder displayed no growth (67.5%).

There was a statistically significant difference between eyes in terms of bacterial growth in the postoperative period ($P < 0.05$). Samples from 47 eyes, both left and right, displayed growth. The bacterial types also differed significantly between eyes ($P < 0.05$). Among the right eye cultures, 19 (47.5%) were positive for *S. epidermidis* and 4 (10%) were positive for *S. aureus*. Among the left eye cultures, 21 (52.5%) were positive for *S. epidermidis* and 3 (7.5%) were positive for *S. aureus*.

There were 10 patients who showed culture growth in their right eyes before the operation and this increased to 23 in the postoperative period. This increase was statistically significant ($P < 0.05$). The corresponding culture positivity numbers for the left eyes were 13 and 24 for the preoperative and postoperative samples, respectively, and this increase was also statistically significant ($P < 0.05$) (Tables 2 and 3).

There were 6 patients (15%) who displayed a large number of erythrocytes in the postoperative period, while 5 displayed few erythrocytes (12.5%). Erythrocytes were absent in 29 patients.

4. Discussion

Septal deviations are the most commonly encountered nasal septal ailments. Therefore, ENT specialists frequently come across them in their daily practice, and this is one of the most common areas of intervention. Septal deviation can occur in the septal cartilage, in the bone, or in both. Nowadays, submucosal resection and septoplasty are the most common procedures used to address these conditions (2). In order to comprehend ocular culture changes after septoplasty, both the nature of the intranasal microorganisms and the routes through which they reach the ocular regions must be understood.

Many investigations have been conducted regarding bacteria located in nasal cavities. In about 40% of

Table 3. Distribution of bacterial types in preoperative and postoperative bacterial culture [n (%)].

	Right eye		Left eye		
	Preoperative	Postoperative	Preoperative	Postoperative	P
S. epidermidis	10 (25)	19 (47.5)	13 (32.5)	21 (52.5)	<0.05
S. aureus	0 (0)	4 (10)	0 (0)	3 (7.5)	<0.05
Growth (–)	30 (75)	27 (42.5)	27 (67.5)	16 (40)	<0.05

healthy individuals, the nasal vestibule is colonized by *Staphylococcus aureus*, and the vestibules of a substantial number of healthy individuals are also colonized by *Staphylococcus epidermidis*. Although in children, the nasopharynx is mainly colonized by *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Haemophilus influenzae*, and *Moraxella catarrhalis*, these bacteria are rather rare in adult nasopharynges (5). A few studies have investigated whether there are any bacteria in the middle meatus and osteomeatal complex in asymptomatic aseptic adults. Chow et al. (6) obtained samples from the middle meatus by calcium alginate swab during endoscopy in 10 healthy adults without nasal septi. After the swab was kept for 15 s in the above-mentioned area, it was used for culturing. Staphylococcal growth was observed in 60% of the samples, whereas the remaining 40% (4 out of 10) were sterile. None of the known causative agents of sinusitis were isolated. Klossek et al. (7) obtained samples from the osteomeatal complex by a similar method and isolated coagulase-negative staphylococcus in 50% of the samples, *S. aureus* in 12%, and *Corynebacterium* in 12%. Bacteria were isolated in 22 samples out of 139, and *S. pneumoniae* and *H. influenzae* were isolated in 2 out of 139. The isolation of staphylococci and corynebacteria was considered to be due to nasal vestibule contamination, since in both studies the nasal vestibuli were not sterilized prior to sampling. Both studies concluded that the osteomeatal complex was not contaminated by pathogenic bacteria in the normal nasopharynx. Many problems might be encountered in the postoperative period of nasal surgery, and they are due to the abundance of microorganisms colonizing the nasal cavity. The risk of infection is increased by both preexisting microorganisms colonizing the nasal cavity and tampon systems applied postoperatively (8,9).

There are a number of articles and case reports about tampon systems used in nasal surgery and the development of infections related to them (8–10). Tampons provide a complex physicochemical environment in which microorganisms can grow. Bleeding during nasal surgery, mucosal tissue destruction, and obstructions caused by tampons may all play facilitative roles in the growth of microorganisms. Nasal tampons are primarily applied to control epistaxis and after intranasal surgical procedures, as well as for internal stabilization of bone cartilage after operations. In addition to homeostasis, nasal tampons are beneficial in the prevention of postoperative synechia and restenosis development (11–13). Therefore, another important problem in using tampon systems is that of which type of nasal tampon should be used and how long it should be kept intranasally (13,14). Tampon application after nasal surgery depends upon the surgeon, such that some investigators may keep the tampon inserted for 1 day postoperatively while others may leave it inserted until the seventh postoperative day (14,15).

It is obvious that the use of packing material and the increased application time of such packing may increase the rate of infection development. However, if there are no additional risk factors, antibiotic treatment in long-duration nasal tamponing is not necessary. The postoperative infection rate does not increase due to nasal tampons. Furthermore, antibiotic-soaked nasal tampons have not always proved to be effective. Antibiotic treatment in cases with nasal tampons is still controversial (5).

Toxic shock syndrome is the most important infection resulting from nasal tamponing after intranasal procedures. It is a rare, life-threatening condition characterized by various symptoms and signs, including sudden fever, erythroderma with a diffuse sunburn pattern, and hypotension and shock as a result of many organ system insufficiencies.

Other complications that may ensue after using nasal tampons include mucosal lesions, tampon dislocation and aspiration, obstructive sleep apnea, paraffin granuloma and spherocytosis, and allergic reaction.

Other rare complications include lamina papyracea fracture due to nasal tampon insertion after epistaxis (16), endocarditis (17), velopharyngeal perforation (18), granuloma pyogenicum (19,20), acute airway obstruction (21), and acute dystonia due to abnormal lingual movements as a neuroleptic side effect (22).

The increased risk of infection due to the use of nasal tampons after nasal surgery may not only be limited to the nasal mucosa but may spread to various areas in the vicinity (23). The ocular region is one of these sites that is in close vicinity and is connected via the drainage system. The nasolacrimal canal connects the tear ducts and the inferior meatus, and before it opens into the nasal mucosa it reaches 5 mm towards the internal meatus. This part, called the meatal part, opens into the nasal cavity through an ostium under the inferior turbinate, which is covered by a mucosal fold known as the valve of Hasner (plica lacrimalis). There are individuals without a meatal part, and the nasolacrimal canal opens directly into the fornix in the nasal inferior meatus in these cases. The valve of Hasner is an actual valve preventing air and liquid refluxes from traveling from the nose into the nasolacrimal canal. In cases of anatomical variations, this valve system will not work effectively and as a result there may be reflux via this system.

In our study, we observed 10 cases of culture growth preoperatively in the right eye, whereas culture growth was seen in 23 cases postoperatively. There were 13 cases of culture growth preoperatively in the left eye, whereas culture growth was seen in 24 cases postoperatively. During the postoperative period, an abundance of erythrocytes was observed in 6 cases (15%) and rare erythrocytes were observed in 5 cases (12.5%). Despite microorganism colonization in the defined patient groups,

neither clinical symptoms nor signs were encountered in the patients. Bacterial colonization from ocular cultures revealed normal flora bacteria from nasal mucosa (*S. aureus*, *S. epidermidis*). This raised the prospect that these bacteria might reach the ocular region through the ductus nasolacrimalis. In the eye cultures, the most common pathogen was *S. epidermidis*, but this could be due to contamination, and therefore it might be dismissed. Differences in infection in one eye versus the other do not seem to be important, but if there is a difference in infection between preoperative and postoperative time points, the rate of infection should increase on the infected side. Our other suggestive finding was that we ran across erythrocyte clusters in the postoperative direct Gram staining of ocular specimens from 11 patients. These erythrocyte clusters are estimated to be regurgitated in an ascending manner through the same canal.

In conclusion, although the indicated microorganisms were grown in cultures from patient groups, there were neither clinical symptoms nor signs related to ocular infections. The valve of Hasner is an actual valve preventing air and liquid reflux from the nose into the nasolacrimal canal. This valve may not function sufficiently in some individuals. This is supported by the observation of erythrocyte clusters in Gram-stained ocular specimens from 11 patients. This insufficiency may cause, after tampon application, microorganisms located in the nose to ascend to the eyes through the nasolacrimal canal after nasal surgery. Pathogenic bacterial cultures were grown from 47 eyes in the postoperative period, and this finding was statistically significant. Our findings indicate that a larger group of patients with a longer follow-up period is required to better determine the possibility of changes in eye culture and flora after septoplasty.

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