

## ORIGINAL STUDY

# Comparative analysis of features of chronic maxillary sinusitis of various genesis

Aleksandre Kobakhidze<sup>1</sup>, Elena Merkulova<sup>1</sup>, Natalia Gvozdeva<sup>1</sup>, Dilyana Vicheva<sup>2</sup>

<sup>1</sup>Belarusian Medical Academy of Postgraduate Education, Department of Otorhinolaryngology, Minsk, Belarus

<sup>2</sup>Department of Otorhinolaryngology, Medical Faculty, Medical University, Plovdiv, Bulgaria

## ABSTRACT

**BACKGROUND.** There are not many works devoted to the structures of a nasal cavity in odontogenic maxillary sinusitis and to a condition of an alveolar ridge of the maxilla with a rhinogenous genesis of the disease.

**MATERIAL AND METHODS.** 100 patients (N) with chronic sinusitis hospitalized at the ENT (N=50) and Oral and Maxillofacial Surgery (N=50) Departments were examined. The character of anatomic options of a nasal septum in chronic maxillary sinusitis is estimated according to a cone-beam computed tomography (CBCT) with use of our own developed scheme of coordinates in the form of "triangles" which allows establishing versions of the block of the ostiomeatal complex and nasal septum deviation.

**RESULTS.** In cases of rhinogenous and odontogenic causes of maxillary sinusitis, the triangle deviation is detected more often, including a perpendicular plate of the ethmoid bone, the vomer and the quadrangular cartilage, contributing to the block of the ostiomeatal complex. This scheme has allowed us to establish a group of patients with the mixed genesis of maxillary sinusitis in the Otorhinolaryngology and MFS Departments (36% and 42% respectively) and that, in its turn, requires a cross-disciplinary approach when choosing a strategy of treatment.

**CONCLUSION.** In case of rhinogenous genesis of the disease, the bilateral nature of the process with involvement of other paranasal sinuses in the inflammatory process is detected more often. The category of patients with mixed genesis (rhinogenous plus odontogenic) of sinusitis demands a cross-disciplinary approach to diagnosis and making a decision about treatment strategies.

**KEYWORDS:** rhinogenous, odontogenic, mixed, maxillary sinusitis, nasal septum deviation, cone-beam CT.

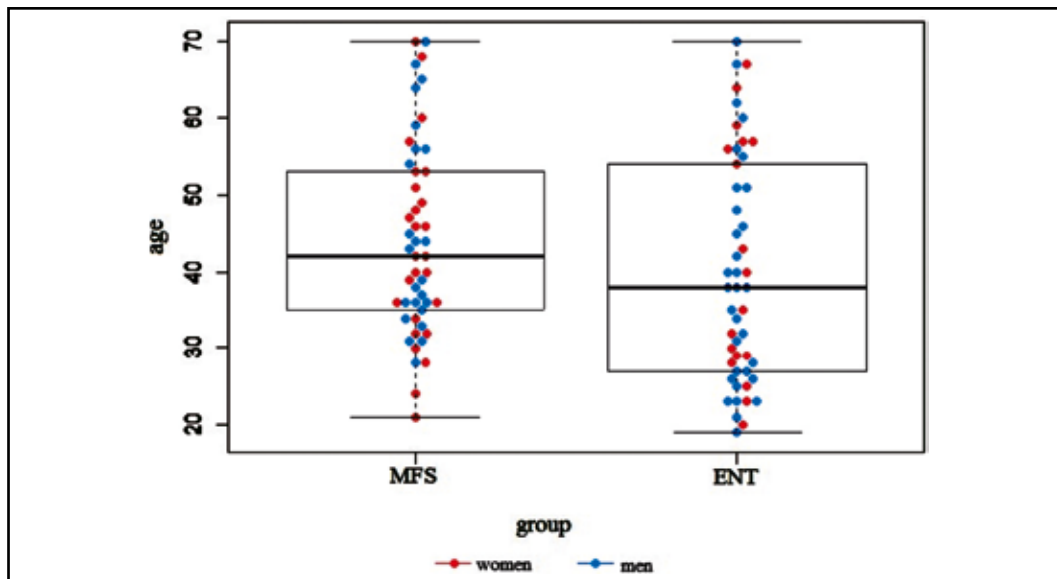
## INTRODUCTION

Involvement of the maxilla in the formation of the nasal cavity, paranasal sinuses and the oral and maxillofacial apparatus determines the high attack rate and peculiarity of pathogenesis, clinical manifestations and treatment of patients with infectious and inflammatory diseases of the middle zone of the facial skeleton. The prevalence of a focal rhinogenous and odontogenic infection, its late diagnosis lead to serious problems concerning health, social status and patients' quality of life. The relevance of improvement in prevention, diagnostic and treatment methods of the chronic rhinogenous and odontogenic infection can be defined by the following: (1) high frequency of

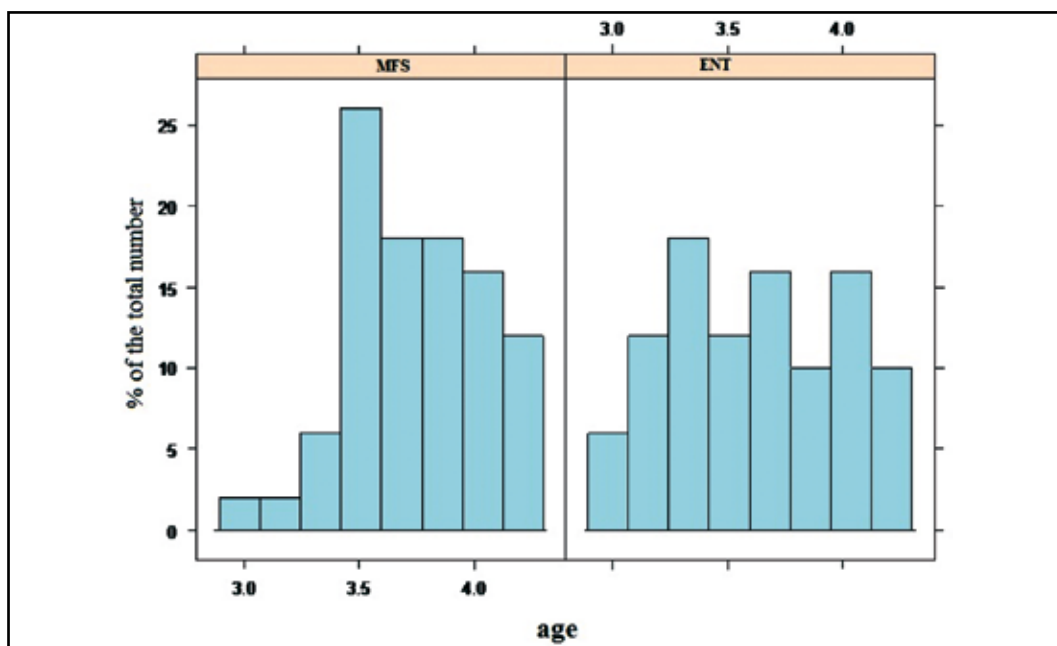
upper respiratory airway diseases; (2) high frequency of the pulps, periodontium and parodontium pathology; (3) complications connected with the development of a diffuse purulent complication in the paranasal sinuses area; (4) microbial intoxication due to organism sensitization with an increased risk of focal pathology development.

There are not many works devoted to the structures of a nasal cavity in odontogenic maxillary sinusitis and to a condition of an alveolar ridge of the maxilla with a rhinogenous genesis of the disease<sup>1,2</sup>.

The displacement of the nasal septum is considered one of the important causes for the creation of the inflammatory process, contributing



**Figure 1** Histogram of the median age of patients undergoing treatment in the Otorhinolaryngology and MFS Departments of the 11th State Clinical Hospital of Minsk.

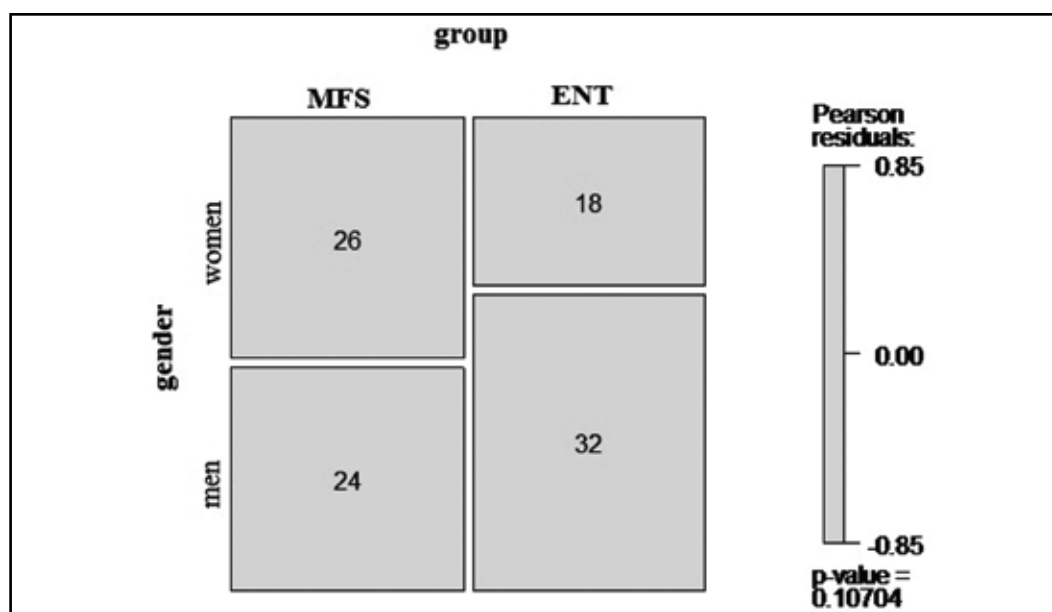


**Figure 2** Histogram of the age distribution of patients undergoing treatment regarding purulent maxillary sinusitis.

to a bad drainage of the exudate from the sinus. At the same time, the search for optimum ways of diagnosis and treatment of this pathology continues<sup>3-5</sup>. In clinical practice, there is no uniform classification of pathological conditions of the nasal septum<sup>6,7</sup>. In many regards, they are caused by problems which are solved by the surgeon when performing a septum surgery<sup>8</sup>.

The uniform cross-disciplinary diagnostic procedure of inspection of patients with a rhino-

odontogenic infection has not yet been developed. There are not many studies about the role and the significance of the methods of radiodiagnosis for the conservative and surgical treatment of patients with infectious and inflammatory diseases of the paranasal sinuses, nasal cavities and the oral and maxillofacial area. Usually, the maxillofacial surgeons do not focus on problems in the sinonasal cavities and on a condition of an ostiomeatal complex.



**Figure 3** Gender characteristics of the patients with maxillary sinusitis.

## OBJECTIVES

To characterize the features of the clinical course of rhinogenous and odontogenic maxillary sinusitis with an assessment of the feasibility of analysing the nasal septum by the proposed scheme of triangular coordinates according to the cone-beam computed tomography (CBCT).

## MATERIAL AND METHODS

100 patients (N), hospitalized at the 11th City Clinical Hospital of Minsk in the Department of Otorhinolaryngology (N=50) and in the No. 1 and No. 2 Departments of Maxillofacial Surgery (MFS) (N=50) in 2017 were examined. Specialized medical care was provided to all patients when they contacted the Emergency Department of the clinic. Patients were treated for purulent maxillary sinusitis (MS).

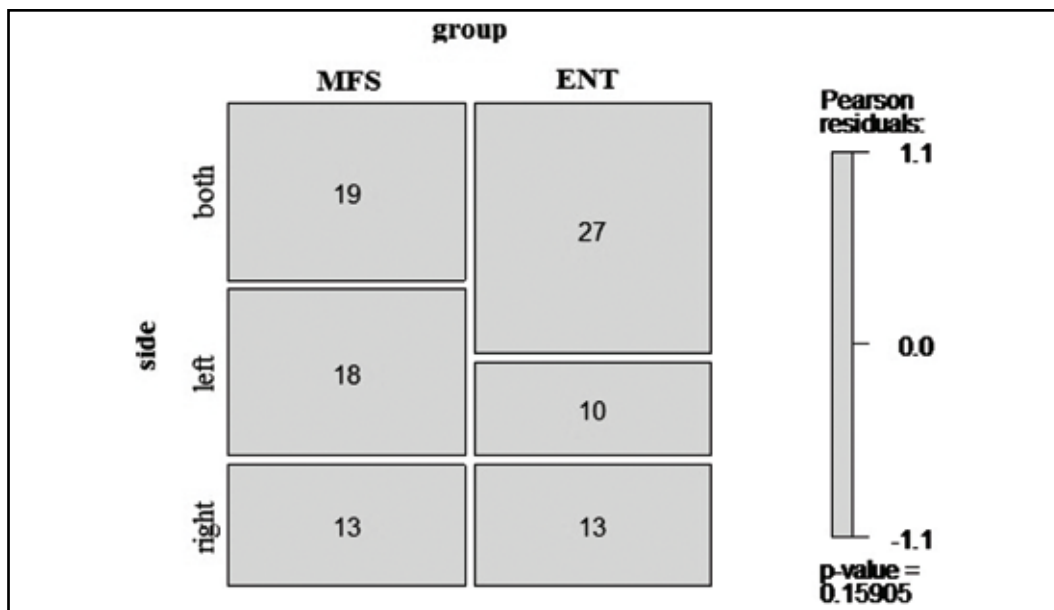
The current and retrospective analysis of data from the clinical material (case history of inpatients', outpatients' medical records) and the radiation computer archive was carried out. As a diagnostic method, to clarify the condition of the paranasal sinuses and the pathology of the nasal cavity, we used plain radiographs of the paranasal sinuses in the anterior-posterior projection and CDs with cone-beam CT results of the paranasal sinuses, the nasal cavity and the oral and maxillofacial area. The procedure for analysing a

three-dimensional X-ray computer image of the middle zone of the facial region of the head included: 1) the study of the anatomical structures of the nasal cavity and paranasal sinuses in the "X-ray" mode in the frontal, axial and sagittal projections; 2) the analysis of the dentition in the "Orthopantomography" mode using the "slice window". A comparative analysis of the condition of the nasal septum according to CBCT data was carried out among the two groups mentioned above. Statistical data processing was performed by the non-parametric method Pearson and Wilcoxon, after checking the indicators for the normal distribution by the Shapiro-Wilk test.

## RESULTS AND DISCUSSIONS

A statistical analysis of the data on the age characteristics of patients showed that the median age of patients does not have a statistically significant difference: in the Department of Otorhinolaryngology it was 39.9 years {27.25; 53.25} and in MFS 44.1 years {35.25; 53.0} ( $p=0.07$ , Wilcoxon test), which is shown in Figure 1. At the same time, the patient's age in the Department of Otorhinolaryngology varied from 18 years to 70 years, while in the MFS Department most patients belonged to the "over 35" age group, as shown in Figure 2.

Gender characteristics of patients suggests that men suffer from rhinogenous sinusitis more often – 64% ( $N=32/50$ ), which can be explained by having to do outdoor work more frequently with



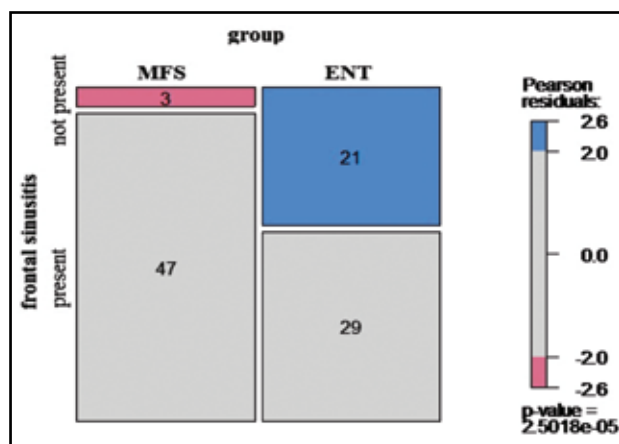
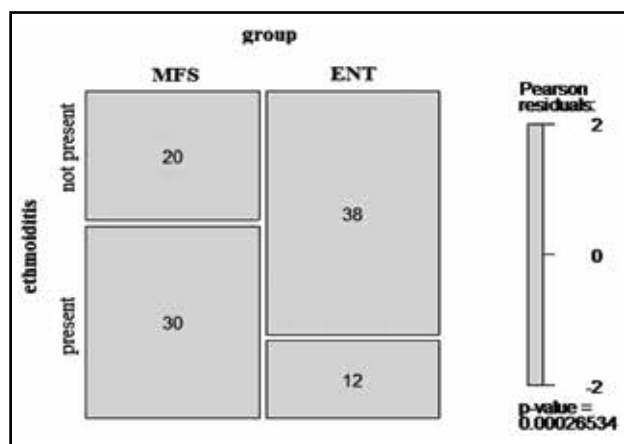
**Figure 4** Incidence of bilateral maxillary sinusitis with rhinogenous and odontogenic causes of the disease.

changing temperatures and humidity levels. The bad habit of smoking and drinking alcohol is also more common among men. At the same time, the odontogenic genesis of the disease was equally common among men (48%) and women (52%). The results of the gender characteristics of patients are presented in Figure 3. The information we obtained also determines the preventive direction of the work of the general practitioner and specialist doctor.

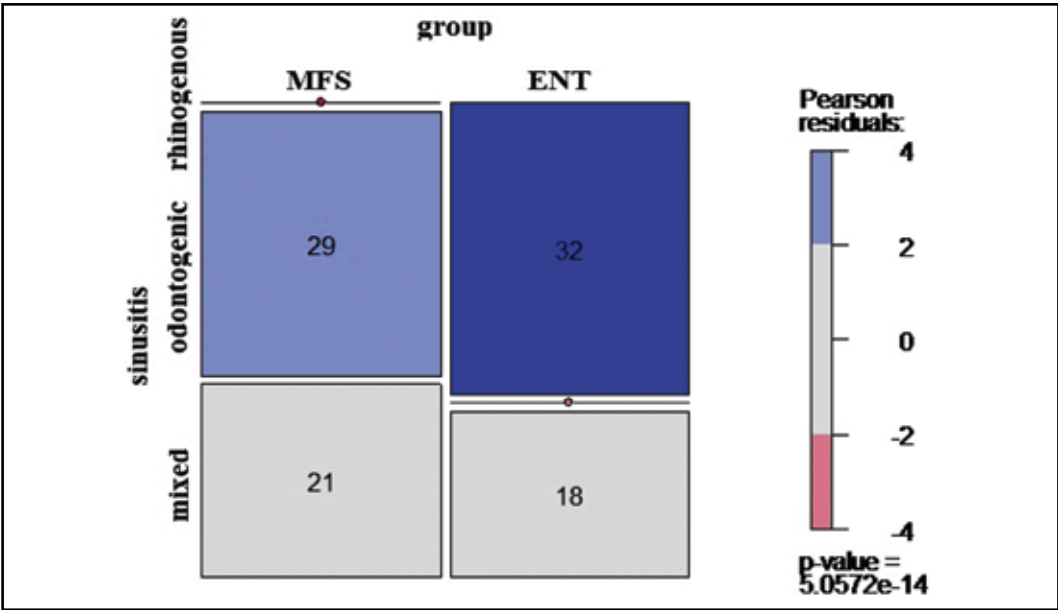
A common criterion for the differential diagnosis of the rhinogenous or odontogenic processes in the sinuses is the one-sided involvement in the pathology of the oral and maxillofacial system. Our analysis of the data on the disease indicates that this criterion

has a relative diagnostic value, since 38% of patients with diseases of the oral and maxillofacial area had bilateral pathology of the maxillary sinusitis, as shown in Figure 4.

In making an assessment regarding the genesis of the disease, information on the involvement of other sinuses in the inflammatory process is clinically more significant. Figure 5 demonstrates that ethmoiditis and frontal sinusitis are significantly more likely to accompany the maxillary sinusitis of a rhinogenous cause. It should be emphasized that this provision also concerns sphenoiditis, since it was observed in 22% of cases with rhinogenous inflammation of the maxillary sinus and in only 2% of cases with



**Figure 5** Incidence of the combination of maxillary sinusitis with ethmoiditis and frontal sinusitis with different genesis of the disease.

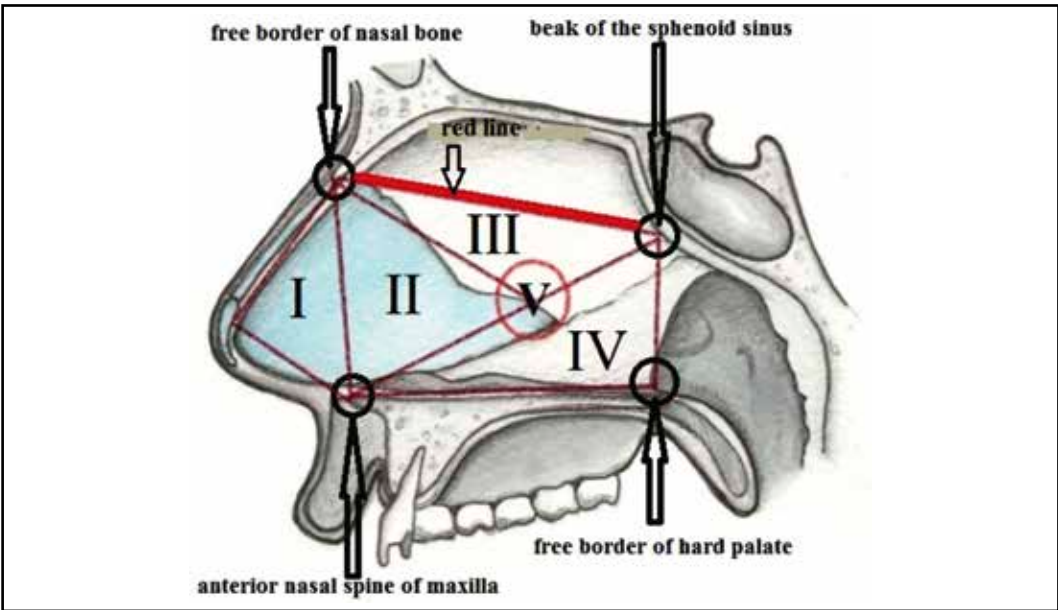


**Figure 6** Disposition of patients with chronic maxillary sinusitis of mixed genesis in the Otorhinolaryngology and MFS Departments.

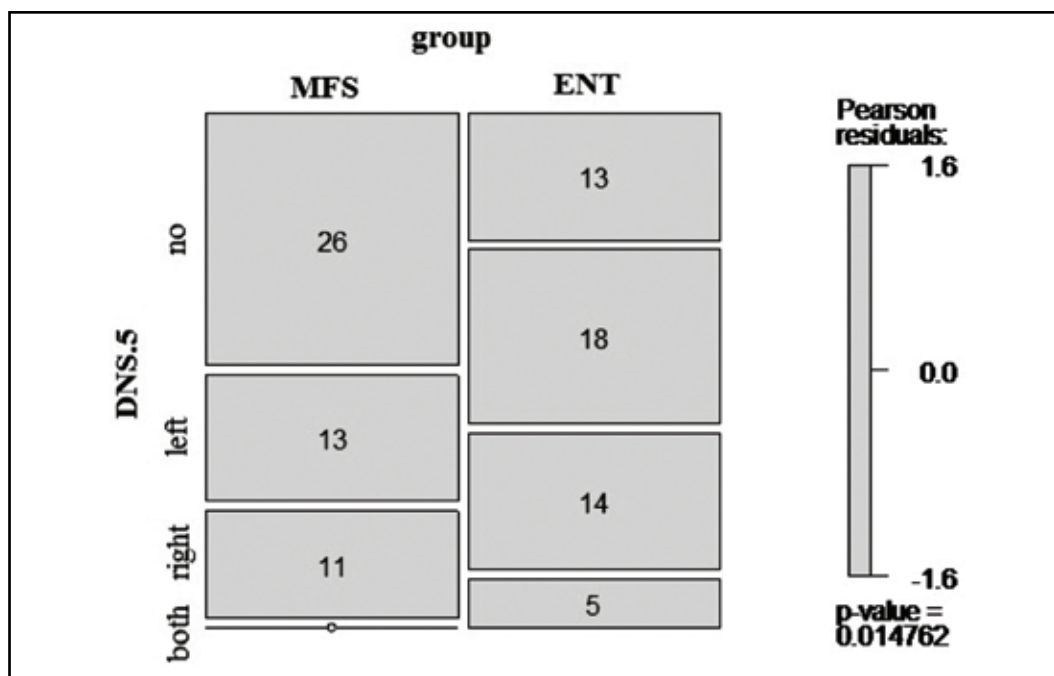
odontogenic cause of the disease.

At the same time, the results of the study we obtained show that, according to the examination data received by the dentist of the clinic, 36% of the patients in the Department of Otorhinolaryngology needed a full mouth debridement (surgical or therapeutic). Meanwhile, the chronic odontogenic inflammatory process in the subantral area of the maxilla and underlying soft tissues was diagnosed and announced to the patient for the first time. An

analysis of the state of the anatomical structures of the nasal cavity among patients of the MFS Department also revealed an important feature. When analyzing the condition of the nasal septum and the paranasal sinuses, according to CBCT and the endoscopic examination of the nasal cavity, a block of the ostiomeatal complex was established in the setting of a displacement of the nasal septum in 42% of patients in the MFS Department. In other words, we are talking about a separate category of



**Figure 7** Schematic illustration of the fixed points, their connections, forming the triangles of the nasal septum.



**Figure 8** Disposition of patients with maxillary sinusitis depending on the existence of the pathology of the nasal septum (DNS – deviated nasal septum in the zone 5).

patients, which should be designated to the third group – with mixed genesis of maxillary sinusitis, which was generally found in 39% of 100 patients. This category of patients requires a more advanced diagnostic procedure. Therefore, the established mixed genesis of the disease requires an integrated treatment approach (Figure 6).

We have developed an assessment system for the nasal septum according to the data from CBCT, using a system of triangular coordinates (Figure 7).

The proposed coordinate system in the form of triangles allows determining the localization and type of deformation of the nasal septum with the participation of anatomical organizations, including its posterior segments which are often insufficiently foreseeable with the anterior-posterior rhinoscopy and endoscopy.

In cases of rhinogenous and odontogenic causes of maxillary sinusitis, the triangle deviation is more often noted, including a perpendicular plate of the ethmoid bone, the vomer and the quadrangular cartilage, contributing to the block of the ostiomeatal complex (Figure 8).

We analysed 29 epicrisis of patients undergoing inpatient treatment, with diagnosed maxillary sinusitis of mixed genesis (14 people from the MFS Department and 15 patients from the Otorhinolaryngology Department), who underwent surgical full mouth debridement during their stay in the clinic. Only 1 patient from the MFS Department and 11 from the Otorhinolaryngology

Department noted the need for outpatient monitoring by the otorhinolaryngologist and planned septum surgery in the recommendations for discharge from the hospital.

This circumstance, as well as the difficulty of using the standard approach in treating the category of patients under discussion, led to the introduction of a definition of interdisciplinary tactics for providing specialized medical care to patients with mixed genesis of purulent maxillary sinusitis in our clinic. In any case, the first stage involves stopping the purulent process by provision of anti-inflammatory treatment, drainage methods such as sinus puncture, surgical or therapeutic full mouth debridement. In case of odontogenic sinusitis without a block of the ostiomeatal complex, a month after the completion of the set of therapeutic measures, the otolaryngologist will electively determine the need and type of correction for the anatomical structures of the nasal cavity, basing the decision on the results of the CBCT of the nasal septum described above, among other things.

Among patients with mixed genesis of the maxillary sinusitis in the presence of a block of the ostiomeatal complex and displacement of the nasal septum, an interdisciplinary decision is made on the nature of care at each stage of treatment. This category of patients needs dynamic observation, flexible and individual choice of treatment mode. Clinical practice shows that, as a rule, the second



stage includes planned septum surgery. In case of the block of ostiomeatal complex, endonasal endoscopic sinus surgery is needed. In our clinic, an interdisciplinary consultation using the proposed additional parameters for the interpretation of CBCT data made a decision on the advisability of simultaneous surgical interventions in some cases. Over the past two years, we have performed 15 operations including simultaneous surgical full mouth debridement, endonasal endoscopic sinusotomy and septum surgery. The surgical intervention was performed after jugulation of the purulent process in the setting of antibacterial therapy. This category of patients had a complete block of the ostiomeatal complex due to a severe deformity of the nasal septum in the projection of the ostiomeatal complex. Complications during surgery and in the early postoperative period were not detected. Currently, we are analyzing the results of dynamic monitoring of this category of patients.

Thus, the use of CBCT with the assessment of the nasal septum according to the proposed scheme in the coordinate system of triangles in a comprehensive examination of the patient, along with endoscopy, rhinomanometry, allows to diagnose the anatomical structures of the nasal cavity septum, to characterize the anatomical and functional relationship with the paranasal sinuses and to determine the treatment strategy.

Thus, CBCT is a diagnostic method that can be used in a complex of medical services aimed at diagnosing the displacement of the nasal septum, spaces that are difficult to visualize with endoscopy, the degree and the type of deformity, the involvement of the nasal septum displacement in the dysfunction of the paranasal sinuses. CBCT allows you to optimize the results of a comprehensive diagnosis of the displacement of the nasal septum and sinusitis<sup>1,6,9,10</sup>.

## CONCLUSIONS

1. The results of a comprehensive clinical and radiological examination and treatment of 100 patients with focal infection of the maxillary sinusitis have allowed us to establish three forms of sinusitis: rhinogenous, odontogenic and mixed (with a combination of rhinogenous and odontogenic problems).
2. Patients with a disease of mixed genesis require full mouth debridement, correction of the displacement of the nasal septum and normalization of the sinus ventilation, the sequence and scope of which require a complex of interdisciplinary diagnostic and therapeutic

measures with a flexible and individual approach.

3. Analysis of CBCT data using the triangle coordinate system has allowed us to clarify the nature of the nasal septum displacement, as well as to determine the impaired venous function of the sinuses and the genesis of the pathology of the paranasal sinuses.

**Conflict of interest:** The authors have no conflict of interest.

**Contribution of authors:** All authors have equally contributed to this work.

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