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IMPROVEMENT OF ALGORITHMS FOR THE TREATMENT OF PATIENTS WITH COMBINED ENT AND DENTAL PATHOLOGY DURING MINIMALLY INVASIVE SIMULTANEOUS OPERATIONS

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ABSTRACT — The aim of the study was to assess the effect of pathogenic microflora on the postoperative period of simultaneous surgical intervention in patients with chronic maxillary sinusitis and partial absence of teeth in the distal parts of the maxilla in 49 patients (25 to 65 years old), who were divided into 2 groups (I — with identified pathogenic microflora, II — with normal microflora). Simultaneous surgical intervention included endonasal endoscopic maxillofacial surgery in combination with subantral plastic surgery and/or dental implantation, if necessary, with correction of intra-nasal structures. According to the results of clinical, hardware and laboratory research methods, it was noted that the proposed algorithm of examination and simultaneous surgical intervention in combination with conservative therapy allows for such treatment in patients with pathological flora in the maxillary sinus.

KEYWORDS — simultaneous surgery, ENT doctor, dentist, dental implant, chronic maxillary sinusitis, pathogenic microflora.

INTRODUCTION

A long-term partial absence of teeth in the maxilla leads to atrophy of the alveolar process, which significantly limits the possibilities of treating patients using dental implants. To solve the problem of replenishing the bone base in the vertical direction, oral surgeons perform an operation — subantral plastic surgery using osteoplastic materials of various origins [1–6].

Despite the developed protocol of subantral plastic surgery, both intraoperative and postoperative complications are often possible. The most significant intraoperative complications that occur with a frequency of up to 40% of cases are perforation of the Schneider membrane, migration of osteoplastic material into the maxillary sinus cavity and, as a consequence, the development of odontogenic maxillary sinusitis [7].

An unfavorable factor for the development of postoperative inflammatory complications is the already existing chronic maxillary sinusitis (CMS) [8–12]. Therefore, before performing subantral plastic surgery in the designated group of patients, a preoperative assessment of the condition of the maxillary sinus (MS) is necessary in order to diagnose inflammatory changes and prevent postoperative complications.

In international practice, a classification based on an X-ray conclusion on the thickness of the mucous membrane of the MS is actively used, which makes it possible to judge the severity of the inflammatory process and choose an adequate tactics of preoperative preparation. One of the contraindications to dental implantation is the thickness of the mucous membrane of the bottom of the MS more than 6 mm and, caused by this change, the block of the natural anastomosis [13–15]. This category of patients traditionally receives two-stage treatment: the first stage is a sanitizing intervention (functional surgery — FESS); then, after 3–4 months, the second stage is subantral plastic surgery [16]. Currently, the possibilities of combining these two stages into one or a simultaneous surgical approach are of particular interest.

There is an opinion that CMS is supported by immunopathological changes, which are based on the features of the microbial landscape [17, 18]. Thus, it was shown that in the group of patients with CMS there is a high infection with Staphylococcus aureus with a decrease in the proportion or absence of other cultures of microorganisms. Huvenne W. et al. (2013) [19] showed the role of the environment in the formation of dysbiosis, when one or more bacterial species occupy a dominant position in the microbial landscape of the nose, suppressing normal microflora. Staphylococcus aureus is often combined with streptococci and pneumococci, forming microbial associations. In one of the latest studies, Velasquez N.

et al. (2021) found in chronic sinusitis the presence of normoflora in 56%, hemophilic bacillus in 13%, and Pseudomonas aeruginosa in 6.5% of cases. The authors concluded that microbial aggression and a defect in the epithelial barrier of the nasal sinus mucosa play a key role in the development of CMS [20].

The purpose of this study is to assess the effect of pathogenic microflora on the course of the postoperative period of simultaneous surgical intervention in patients with CMS and partial absence of teeth in the distal parts of the maxilla.

MATERIALS AND METHODS

The study involved 49 patients diagnosed with partial absence of teeth in the distal parts of the maxilla, CMS. The age of the patients ranged from 25 to 65 years.

Initially, patients planned to be treated only by a dentist in order to make up for a defect in the dentition of the distal upper jaw using dental implants, however, during a preoperative examination (computed tomography of the paranasal sinuses — CT PS), CMS was detected, which required FESS.

Inclusion criteria — patients with combined pathology: partial absence of teeth in the distal part of the maxilla, signs of CMS — retention cystic changes occupying up to ⅔ of the maxillary sinus, hypertrophy of the mucous membrane in the alveolar bay, circularly thickened mucous membrane with a block of natural anastomosis (Fig. 1, 2).

nose, CT PS, and bacteriological examination of the contents of the nasal cavity were performed. Endoscopic evaluation was performed on the 10^{th} and 90^{th} days after surgical treatment, CT PS and microbiological evaluation — 90 days after surgery.

To assess the microflora of the nasal mucosa before surgical treatment, seeding of the discharge was carried out on nutrient differential diagnostic media (KA, ZHSA, Endo, enterococcus agar). When taking samples of pathological material from the nasal mucosa and transporting it for further research, sterile tupfers with Ames commercial transport medium were used. Sowing was carried out by the sector method. Incubated in a thermostat at 37° C for 24 hours. For normal values of microbial flora, digital indicators up to 10^6, Neisseria spp were taken for Streptococcus spp. — up to 10^4, Staphylococcus spp. — up to 10^4, Haemophilus spp — up to 10^2 [21].

Depending on the detected microflora (pathogenic/non-pathogenic), patients were divided into 2 groups. Group I included 24 patients with detected pathogenic microflora, group II — 25 patients with normal microflora.

The operation consisted of simultaneous surgical intervention: endonasal endoscopic maxillofacial surgery in combination with subantral plastic surgery and/or dental implantation, if necessary, the intervention was supplemented with correction of intra-nasal structures — septoplasty, vasotomy of the lower nasal

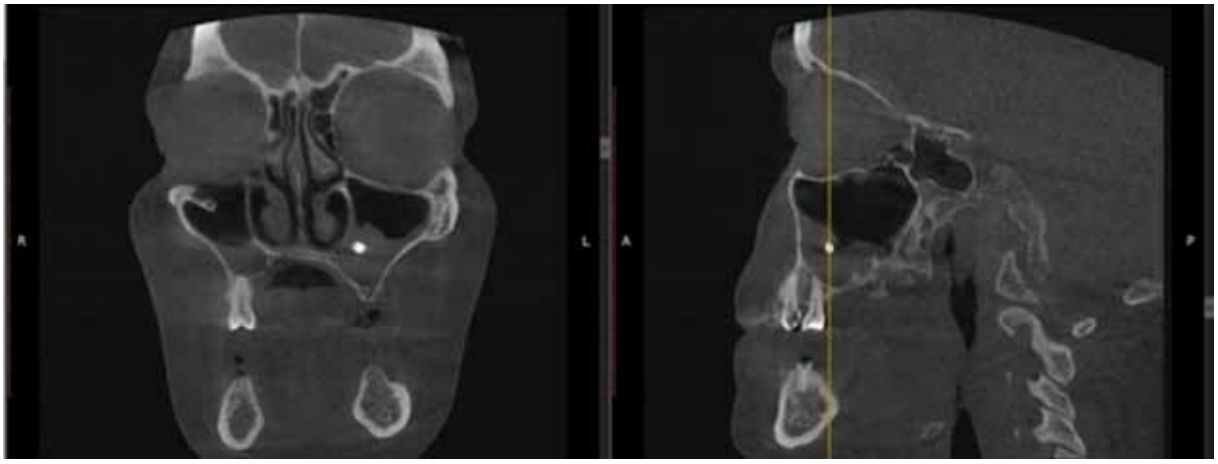

Fig. 1. *Reformat of cone-beam computed tomography of a patient diagnosed with the presence of a foreign body in the maxillary sinus*

The criteria for non-inclusion were: allergic rhinitis, acute rhinosinusitis, polypous sinusitis, pregnancy and lactation.

Anamnesis was collected in all patients at the preoperative stage, an endoscopic examination of the

concha, partial resection of bullous-altered middle nasal concha. Unilateral treatment was performed in 43 patients (87.8%), bilateral — in 6 patients (12.2%).

In order to prevent the exacerbation of CMS in the postoperative period, no nasal cavity tamponing

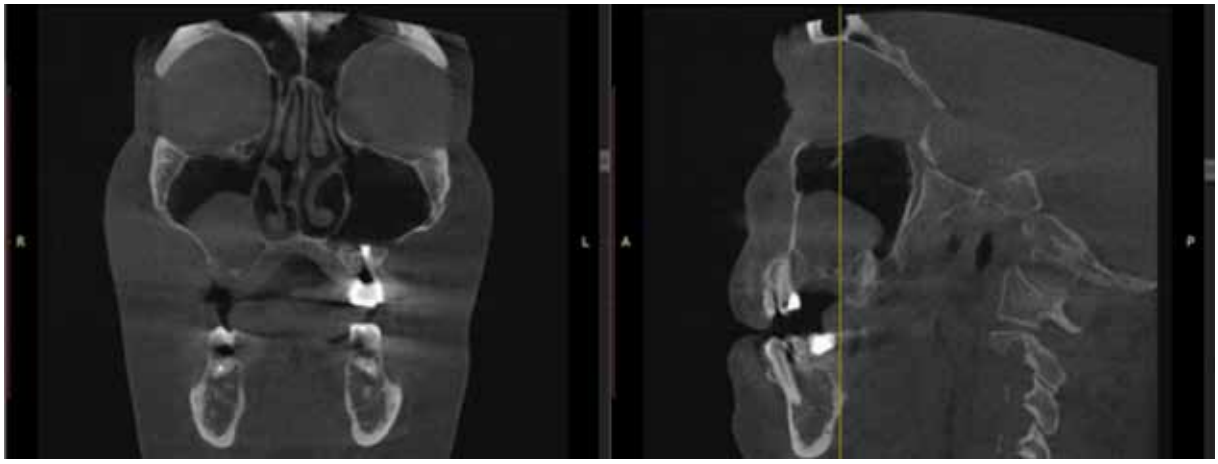

Fig. 2. Reformat of cone-beam computed tomography of a patient who has been diagnosed a cyst of the maxillary sinus

was performed, limiting the placement of a hemostatic sponge in the middle nasal passage for 2 hours. Vasotomy was performed with a Surgitron device, and the nasal septum was splinted with silicone splints.

The data of endoscopic examination of the nasal cavity before and after surgical treatment were interpreted using the Lund–Kennedy scale (1995), adapted to the designated purpose of the study. Attention at the preoperative stage was fixed on the presence of swelling of the nasal mucosa and the nature of the discharge. Since the characteristics of the airflow are affected by the deviation of the nasal septum and the pathology of the structures of the ostiomeatal complex (OMC), their presence was included in the assessment (0 — no sign, 2 — there is a sign) [22, 23].

In the postoperative period, attention was paid to the severity of reactive mucosal edema, the appearance and nature of the discharge, the formation of crusts (0–2), fibrin (0–2), postoperative complications (perforation, severity of sinusitis, etc.), where 0 — there is no sign, 2 — the sign is well expressed [24, 25].

The assessment of changes on CT PS scans before and after surgical treatment was carried out using the Lund–Mackay scale (1993) [26], where total sinus darkening was estimated at 2 points, parietal darkening — 1 point, aplasia — 1 point, absence of darkening — 0 points; blockade of the middle nasal passage — 2 points, its absence — 1 point, changes from the ostiomeatal complex — 2 points. The maximum number of points corresponded to 24, the right and left halves of the nose were evaluated separately.

All patients were prescribed ceftriaxone 2.0 intravenously 30 minutes before the operation. In the postoperative period, anti-inflammatory (INGX — mometasone fuorate 400 mcg/day for 14 days) and local vasoconstrictive therapy (decongestants no more than 5–7 days) were performed. The choice of an antibacterial drug depended on the results of a microbiological study.

Statistical data processing was carried out on a personal computer using the SPSS version 17.0 program. When comparing the two groups, the Student's T-test was used for independent samples. The signs analyzed in the study were qualitative (ordinal or alternative), therefore, to assess the reliability of different frequencies of detection of individual signs in the compared groups of patients, the exact Fisher criterion was used, the values were considered significantly different at $\phi^2 > 1.64$ for p=0.05. The normality of the samples was confirmed using the Shapiro–Wilk criterion, followed by the application of the Mann-Whitney criterion with a significance level of 0.05 for nonparametric data.

RESULTS

According to the results of microbiological studies in the preoperative period in patients of the first group, the most frequently isolated pathogenic microbial culture was Haemophilus influenzae (1), Str. Pyogenes (2), Moraxella catarrhalis (3), Streptococcus pneumoniae (4) in combination with Staphylococcus aureus (5) and Staphylococcus epidermis (6). In 10 patients, a combination of 1–4 (41.7%), 2–3–4 — in 5 patients (20.8%), a combination of 3–5 — in 2 patients (8.3%), 2–4 — in 7 patients (29.2%).

In patients who made up group II, Staphylococcus aureus in 10 patients (40%) and Staphylococcus epidermis in 5 patients (20%) and in microbial association — in 10 patients (40%) were determined in isolation.

The sensitivity of the identified flora was determined to amoxicillin clavulanate, levofloxacin, ceftriaxone, ciprofloxacin. The regimens of the drugs used

were as follows: 3–4 days of parenteral administration of the drug, then the transition to oral administration: for amoxicillin clavulanate 875 +125 mg 2 r/d, for levofloxacin — 500 mg 1 r/d, for ceftriaxone 1.0 g 2 r/d, for ciprofloxacin — 500 mg 2 r/d. The duration of antibacterial therapy in all cases was at least 10 days.

The pathology revealed during the examination is reflected in Table 1.

Endoscopic assessment of the condition of the nasal cavity 10 days after surgical treatment showed an increase in the frequency of mucosal edema and discharge in both groups. Unilateral edema was diagnosed in group I in 8 (33.3%), in II — in 9 (36.0%) patients, bilateral — in 11 (44.0%) and 10 (40.0%) cases, respectively. Separation on one side occurred in 5 (20.8%) and 7 (28.0%) patients, on

Table 1. *The frequency of diagnosed changes in the state of the nasal cavity during endoscopy*

Sign		Before the operation		10 days after the operation		After 90 days	
		Group 1 n=24	Group 2 n=25	Group 1 n=24	Group 2 n=25	Group 1 n=24	Group 2 n=25
Edema	d/s	5	6	8*	9*	0*	0*
	d+s	3	5	11*	10*	0*	0*
	absent	16	14	5*	6*	24	25
exudate	d/s	4	5	5	7	0*	0*
	d+s	6	7	3	4	0*	0*
	absent	14	13	16	14	24	25
ostiomeatal complex	d/s	6	7				
	d+s	7	6				
	absent	11	12				
curvature of the nasal septum		18	15				
Crusts	d/s			5	4	0	0
	d+s			3	5	0	0
	absent			16	16	24	25
Fibrin	d/s			1	0	0	0
	d+s			2	1	0	0
	absent			21	24	24	25
Perforation of the nasal septum				0	1	0	1

**p<0.05 (before and after surgery in the group) is the confidence value in the group when comparing data 10 days and 90 days after surgery. The differences obtained were statistically significant (p<0.05)*

At the preoperative stage, unilateral edema of the nasal mucosa was detected in group I in 5 (20.8%), in II — in 6 (24.0%) patients, respectively; bilateral edema — in 3 (12.5%) and 5 (20.0%) patients. Nasal discharge was observed on one side in 4 (16.7%) and 5 (20.0%) patients, on both sides — in 6 (25%) and 7 (28%) patients, respectively. There was also no statistical difference. Features of OMC in patients of the first group were revealed on the one hand in 6 (25.0%) cases, on the two sides — in 7 (29.2%), in group II patients — in 7 (28.0%) and 6 (24.0%) cases, respectively. At the same time, there was no statistical difference in the frequency of detection of edema (8/11, ϕ^2=0.73), nasal cavity discharge (10/12, ϕ^2=0.444), OMC pathology (13/13, ϕ^2=0.154) between groups I/II.

both sides — in 3 (12.5%) and 4 (16.0%) patients, respectively.

Moreover, the increase in reactive changes was significant in both unilateral and bilateral manifestations (p<0.05). In addition to reactive edema and discharge, the formation of crusts was noted — unilateral in 5 (20.8%), bilateral in 3 (12.5%) patients, and in 4 (16.0%) and 5 (20.0%) patients, respectively, groups. There was no statistical difference in the frequency of formation of nasal mucosal edema (19/19, ϕ^2=0.266), discharge (8/11, ϕ^2=0.773) and crusts (8/9, ϕ^2=0.199) between patients of group I/II.

A distinctive feature of the postoperative period was the deposition of fibrin: on the one hand — in 1 (4.2%) and on both sides — in 2 (8.3%) patients

of group I, in group II fibrin was detected only in 1 (4.0%) patient on both sides. A complication of surgical treatment (perforation of the nasal septum) was recorded in one case (2.0%) in a patient of group I.

A control examination 3 months after the operation confirmed the presence of a perforation detected on the 10th day after surgical treatment. No other complications were detected, mucosal edema and discharge were no longer recorded 90 days after surgery.

The endoscopic evaluation of the results on the Lund–Kennedy scale is presented in Table 2.

treatment, regardless of its volume, led to a significant positive result, which affected the indicators.

The frequency and types of pathological changes in the maxillary sinuses according to CT PS at the preoperative stage are presented in Table 3.

Retention cysts occupying ⅔ of the sinus volume were most common — unilateral cysts were recorded in 9 (37.5%) and 8 (32.0%) patients, bilateral — in 2 (8.3%) and 3 (12.0%) cases, respectively, groups. Unilateral hypertrophy of the MS mucosa in group I patients was detected in 6 (25.0%) cases, in II — in

Table 2. *Endoscopic assessment of the nasal cavity on the Lund–Kennedy scale*

Sign	points	Before surgery		10 days after surgery		90 days after surgery	
		Group 1 n=24	Group 2 n=25	Group 1 n=24	Group 2 n=25	Group 1 n=24	Group 2 n=25
Edema	0	11	10	11	14	23	23
	1	7	8	4	3	1	2
	2	6	7	8	8		
		p>0,05		p>0,05		p>0,05	
Exudate	0	15	18	19	19	23	22
	1	6	3	2	1	1	3
	2	3	4	3	5		
		p>0,05		p>0,05		p>0,05	
ostiomeatal complex	0	13	17				
	1	8	5				
	2	3	3				
curvature of the nasal septum	2	22	21				
		p>0,05					
Crusts	2			19	20		
				p>0,05			
Fibrin	2			5	2		
				p>0,05			
Perforation	2				2		1
Total points for all patients/average number of points per patient		89/3,7	86/3,4	77/3,2	76/3,0	2/0,08	6/0,24

**p<0.05 — the values are reliable*

The score before and 10 days after the operation showed that the groups were not different from each other according to the identified endoscopic signs (p>0.05). The performed surgical treatment led to a significant decrease in the sum of points / average score in both groups after 10 days (p<0.05), however, the analysis shows that this decrease occurred due to the correction of OMC structures, the assessment after 90 days showed that the performed surgical

8 (32.0%) cases, bilateral changes were noted in 3 (12.5%) and 2 (8.0%) cases, respectively. Circular thickening of the mucous membrane of the MS on one and two sides was noted in 2 cases in group I, in group II patients — in 3 (12.0%) and 1 (4.0%) cases, respectively.

In addition to the pathology of MS, intra-nasal changes were also detected at the preoperative stage: curvature of the nasal septum in group I in 22 patients

Table 3. *The frequency and types of pathology of the maxillary sinus according to CT PS*

	Group 1 (n=24)		Group 2 (n=25)	
	d/s	d+s	d/s	d+s
Retention cyst, occupying more than 2/3 of the volume	9 (37,5%)	2 (8,3%)	8 (32,0%)	3 (12,0%)
Hypertrophy of the mucous membrane of the alveolar bay	6 (25,0%)	3 (12,5%)	8 (32,0%)	2 (8,0%)
Circular thickening of the mucosa with a block	2 (8,3%)	2 (8,0%)	3 (12,0%)	1 (4,0%)
Total:	17 (70,8%)	7 (29,2%)	19 (76,0%)	6 (24,0%)
	24 (100%)		25 (100%)	

d — right side; s — left side

(92.0%), in II — in 21 patients (84.0%), and hypertrophic rhinitis — in 23 (92.0%) and 22 cases (88.0%), respectively.

According to the severity of pathology, according to the Lund–Mackay scale, the overall assessment before surgical treatment was 7.3±3.5 for group I patients, 6.9±3.7 for group II patients. Although the assessment value in group I (combination of CVS with the presence of pathogenic flora) was higher, however, this excess was not statistically significant compared to the same indicator in group II, where microbial carrier was absent ($p>0.05$). Evaluation of the results of CT PS in patients of groups I/II 3 months after simultaneous surgery showed that the values obtained, according to the Lund–Mackay scale, were 1.9±1.3 and 2.1±1.5, respectively, which is significantly lower than the indicators of the preoperative stage ($p<0.05$). It should be noted that there were no differences between the groups according to CT PS data during all the survey periods ($p>0.05$).

CONCLUSION

1. Preoperative microbiological analysis of a smear from the nasal mucosa in patients with partial absence of teeth in the distal part of maxilla and CMS revealed a high incidence of pathogenic microflora in almost half of the examined patients (48.9%).

2. Preoperative antibacterial therapy corresponding to the identified microflora allowed simultaneous treatment and prevented the development of odontogenic postoperative complications.

3. Thus, the algorithm used for the management of patients with partial absence of teeth in the distal parts of the maxilla and CMS, combined with pathogenic microflora, made it possible to combine two diverse operations into a single surgical intervention, reduce the number of anesthesia, reduce hospital stay and duration of rehabilitation, increase patient compliance and cost-effectiveness of treatment.

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