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Original Article

Otolaryngological and immunological features of the chronic purulent maxillary sinusitis in patients with type 1 diabetes mellitus

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Abstract

This work aims to study the otolaryngological and immunological features of the course of chronic purulent maxillary sinusitis in patients with type 1 diabetes mellitus. We examined 74 patients aged 15 to 40 years. In 44 of them, ChPMS has been diagnosed with type 1 DM of moderate severity at the stage of exacerbation. In 20 – exacerbation of CPMS without concomitant pathology, 10 – healthy donors. All patients underwent standard otorhinolaryngological examination, endovideorhinoscopy, X-ray and computed tomography of the paranasal sinuses, general blood test, urine, blood sugar analysis and immunological examination. The obtained digital results of otolaryngological and immunological studies were processed by variational statistics methods. As a result of the conducted studies, it was established that the course of ChPMS in patients with T1DM is characterized mainly by the bilateral lesion (77.3%), the intensity of clinical manifestations, subfebrile condition (43.2%), pronounced nasal obstruction (90.9%), mucopurulent nature of the exudate (79.5%), a sharp increase in the number of leukocytes and ESR (22–35 mm/h) in 95.4% and complications in 23% of cases.

Keywords: chronic purulent sinusitis, diabetes mellitus type 1.

Abbreviations: ChPMS – chronic purulent maxillary sinusitis; ENT – Ear, nose and throat; PPN – purulent diseases of the paranasal sinuses; T1DM – type 1 diabetes mellitus.

Introduction

Chronic purulent sinusitis is an actual problem and one of the most common diseases in otolaryngology. In the literature, there are isolated reports on the peculiarities of the course of the pathology of the ENT organs in patients with T1DM, the analysis of which indicates the need for an in-depth study of the clinic, pathogenesis and principles of treatment of PPN against the background of T1DM [1]. The problem of bacterial infection of any localization in patients with diabetes was and remains topical [2, 3]. The risk of developing PPN pathology in T1DM is associated with a disorder of the immune system, mainly with a decrease in the body's overall resistance [4–6].

As it is known, the metabolic processes in the body under conditions of diabetes undergo significant changes, affecting the body's adaptive capabilities and determining the degree of its immunoreactivity [7–9]. The specificity of banal purulent inflammation in T1DM is theoretically justified by the fact that it occurs in the diseased body against the background of existing significant changes in homeostasis and therefore has grounds to be considered a "disease within a disease" [5, 7, 8].

The study of the state of the body adaptation reserves and the mechanisms of the initiation of maladaptation processes becomes especially relevant in the case of DM, which is characterized by serious disorders of the neuroendocrine and immune interaction, which

determines the severity of the course and the prognosis of the disease [10–13].

The research aims to study the clinical and immunological features of the course of ChPMS in patients with type 1 diabetes mellitus.

Material and methods

In the focus of our research, 74 patients aged 15 to 40 have been treated and examined in the ENT department of the regional clinical hospital. Out of 74 patients, 44 have been diagnosed with ChPMS with T1DM of moderate severity in the exacerbation stage (main group), 20 have been diagnosed with exacerbation of ChPMS without accompanying pathology (control group) and 10 people have been healthy donors. All patients underwent a standard otolaryngological examination, which included complaints and anamnesis, anterior and posterior rhinoscopy, endorhinovideoscopy of the nasal cavity and nasopharynx, radiography and CT scan of the paranasal sinuses, general blood and urine analysis, blood analysis for immunological studies.

Blood for immunological studies was taken from the cubital vein by venipuncture and after fasting before the exam in the volume of 10 ml from 9 a.m. to 10 a.m. Blood was poured into two test tubes: in the first – 5 ml of blood with the addition of heparin at the rate of 5 units/ml to determine indicators of cellular immunity, and in the second – 5 ml of whole blood to determine indicators of humoral immunity and non-specific resistance.

The general blood analysis was performed according to the generally accepted method to determine the percentage ratio of individual subpopulations of granulocytic cells when counting them in Goryaev's chamber [14–16].

The content of immunoglobulins of the main classes (M, G, A) in blood serum was determined by the method of radial immunodiffusion in agar according to the Mancini technique [17].

The concentration of serum immunoglobulins of classes M, G and A (IgM, IgG, IgA), the level of circulating immune complexes (CIC), as well as calculated indices relative to immunoglobulins of the main classes (IgM/B-lymphocytes, IgG/B-lymphocytes, IgA/B-lymphocytes, IgM+IgG+IgA/B-lymphocytes), which characterize the functional (immunoglobulin-secretory) activity of B-lymphocytes, were studied using generally accepted methods [18].

Circulating immune complexes were determined spectrophotometrically after serum treatment by the method of selective precipitation with a solution of 3.75% polyethylene glycol (M 6000) (Serva, Germany) [19]. The phagocytic activity (PhA) of neutrophils (percentage of phagocytizing cells) and the phagocytic number (PhN, the average number of bacteria phagocytosed by one cell) were determined according to the generally accepted method (Chernushenko K.F., 1999). Phagocytic index (the number of captured latex particles per one phagocytizing "lymphocyte – monocyte"), as recommended by O.F. Chernushenko [20].

As an object of phagocytosis, latex particles with a diameter of 1.1 μm [reagents of the company "Serva" (Germany)] were used. Spontaneous and pyrogenic-stimulated nitroblue tetrazolium reduction test (NBT-test) was carried out based on the reaction of soluble nitroblue tetrazolium absorbed by a phagocyte into insoluble diformazan. The induced NBT test was performed with a neutrophil stimulator – pyrogenic. The NBT test and its reserve reflect the degree of activation of the oxygen-dependent mechanisms of the bactericidal activity of phagocytic cells, which are based on the activation of NADPh2-oxidase and the hexose monophosphate shunt, which characterize the phagocytic system of non-specific anti-infective protection of the body (the ability of neutrophils to complete phagocytosis) [21, 22].

Endocrinologists verified the diagnosis based on in-depth clinical anamnestic and laboratory-instrumental studies using the criteria proposed by the WHO expert committee. All patients were in the stage of sub-compensation of the disease, which was achieved by using hypoglycemic therapy – "basal-bolus" insulin therapy for T1DM.

The severity of T1DM was determined by the degree of clinical symptoms. It was established that the course of the disease unfolded against the background of an increased content of glycosylated hemoglobin HbAlC in the blood of all studied patients (10±0.92%), which made it possible to testify to inadequate control of glycemia (poor compensation of diabetes) in the examined patients.

The obtained digital results of clinical and immunological studies are processed by the methods of variational statistics [23]. The arithmetic mean and its error (M±t) were determined. Differences in average and relative frequencies were considered reliable at the confidence level ($p<0.05$). The research results were processed using the Statistica for Windows 5.0 software product (StatSoft, USA).

Table 1: Distribution of patients with chronic purulent maxillary sinusitis, associated with type 1 diabetes mellitus by gender and age.

Age	15–20		21–30		31–44		Total number	
Gender	M	F	M	F	M	F	M	F
Number of patients	2	0	10	8	12	12	24	20
Total	2		18		24			
Number	(4.54%)		(40.9%)		(54.5%)		54.5%	45.5%

Table 2: Duration of type 1 diabetes mellitus in patients with chronic purulent maxillary sinusitis before admission to the clinic.

Duration of the disease	Under the age of 5	At the age of 5–10	At the age of 10–20	Over the age of 20
Number of the patients	4	10	24	6
Percentage	9.1%	22.7%	54.5%	13.7%

Results

The group under study consisted of 44 patients with chronic purulent maxillary sinusitis (ChPMS) associated with type 1 diabetes mellitus (T1DM) of moderate severity in the acute stage. The age of the patients is from 15 to 40 years; among them, 24 (54.5%) are male and 20 (45.5%) are female (Table 1).

Based on the analysis of the data of clinical, immunological studies and instrumental examinations, the possibility of the distinct manifestation of the pathology of the cardiovascular system, digestive organs, various lesions of the liver and kidneys in the people examined by us, which could significantly affect the results of the studies, was excluded.

In all patients, the collection of anamnesis necessarily included clarification of the following points: the age of the disease, the number of exacerbations per year, and the nature of the previous treatment. The obtained data are shown in Tables 2 and 3.

As shown in Table 4 and Figure 1, chronic purulent maxillary sinusitis was most often aggravated 1–2 times a year by 66% and more often by 4–6.8% of the examined patients.

The diagnosis of ChPMS was established based on a set of examinations, which included: the study of complaints and anamnesis of the disease, examination of the patient, X-ray examination of PPN, if necessary – MRT, CT scan, diagnostic puncture, as well as determination of some indicators of systemic immunity.

All patients had similar complaints (Table 5). Most often, it is a one- or two-sided worsening of nasal breathing, a feeling of pressure in the area of the affected maxillary sinus, a headache, and less often, a deterioration of the sense of smell, an increase in body temperature. At the time of the examination, there were

Table 3: The duration of the disease of patients with chronic purulent maxillary sinusitis before admission to the clinic.

Duration of the disease	Under the age of 1	At the age of 1–3	At the age of 4–6	At the age of 7–9	Over the age of 10	Total
Number of the patients	2	5	14	20	3	44
Percentage	4.5%	11.4%	31.8%	45.5%	6.8%	100%

Table 4: Frequency of exacerbations of chronic purulent maxillary sinusitis associated with type 1 diabetes mellitus among examined patients.

Number of exacerbations	1–2 times per year	3–4 times per year	Over 4 times per year	Total
Number of patients	29	12	3	44
Percentage	66%	27.2%	6.8%	100%

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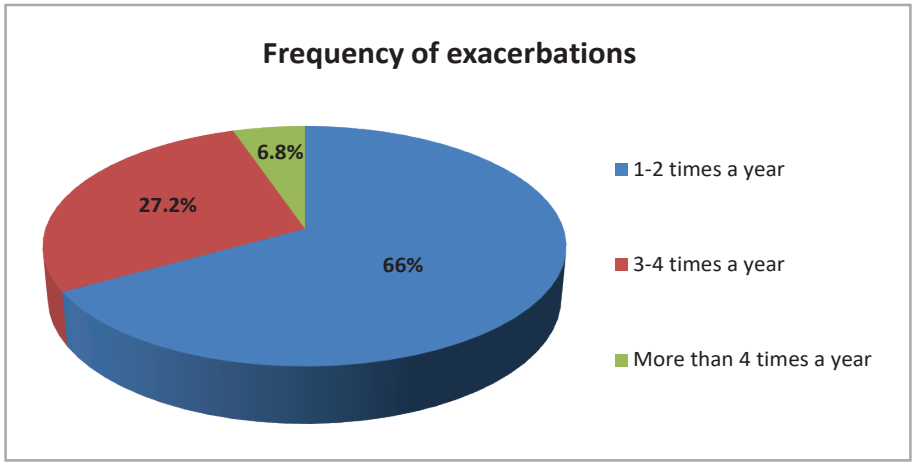

Figure 1: Frequency of exacerbations of chronic purulent maxillary sinusitis associated with type 1 diabetes mellitus among examined patients.

no clinical signs of acute pathology on the part of other organs and systems. During the survey, some patients noted general weakness and reduced work capacity.

Clinically, the aggravation of ChPMS exacerbation against the background of T1DM was manifested by local and general clinical symptoms listed in Table 6.

During anterior rhinoscopy and endovideo rhinoscopy, a typical picture of purulent sinusitis was observed in almost all patients: hyperemia and infiltration of the mucous membrane of the nasal cavity (mainly in the area of the middle nasal passage and inferior nasal concha) – in 44 (100%), purulent or mucopurulent discharge on average in the nasal passage and at the bottom of the nasal cavity – in 42 (95.45%) (Figure 2).

The diagnosis was based on the data of radiography and computed tomography of the PPN, which were performed on all patients at the time of application. When conducting x-ray examinations among 44 patients of the main clinical group, 34 patients (77.3%) had a bilateral pathological process in the maxillary sinus and 10 patients (22.7%) had a unilateral lesion (Figure 3).

However, the x-ray picture did not always reflect the nature of the pathological process. However, the main criterion for establishing a diagnosis was a diagnostic puncture of the maxillary sinus, performed by all patients, mostly with a bilateral process, at the time of application. At the same time, the volume of the sinus, which was reduced in all the examined subjects (Table 7), and the nature of the pathological content in the lavage fluid (Table 8) were evaluated.

As a result of the first diagnostic and therapeutic punctures of the affected maxillary sinuses, exudate was obtained in the form of liquid pus or mucopurulent clots. The volume of the sinuses was from 2.0 ml to 6.0 ml.

The glucose level in the patient's blood varied between 8.0 and 11.7 mmol/l.

In the blood of patients, there were an increase in the number of leukocytes (9.2±0.65 × 10^9/l) against the background of an increase in the relative and absolute number of rod cells (6.0±0.31%; 0.55±0.032) × 10^9/l) and segmentonuclear (64.0±1.21%; 5.89±0.16) × 10^9/l) neutrophils. A decrease in the relative content of lymphocytes

Table 5: Complaints of patients with exacerbation of chronic purulent maxillary sinusitis against the background of type 1 diabetes mellitus.

Complaints	Number of patients
Worsening of nasal breathing	44 (100%)
Mucous-purulent secretions from the nose	34 (77.3%)
Headache	40 (90.91%)
Pain in the projection area of the affected maxillary sinus	28 (63.63%)
General weakness	32 (72.7%)
Increase in body temperature	19 (43.2%)
Deterioration of the sense of smell	28 (63.6%)

Table 6: The main manifestations of exacerbation of chronic purulent maxillary sinusitis against the background of type 1 diabetes mellitus among the examined patients.

Manifestations	Number of patients	% of patients per total number of patients
Headache	40	90.9%
Pain in the projection of the maxillary sinus	28	63.6%
Significant difficulty in nasal breathing	40	90.9%
Absence of nasal breathing	4	9.1%
Hyposmia	28	63.6%
Deterioration of sleep	33	75%
General weakness	32	72.7%
An increase in body temperature to 37.3°C–37.5°C	19	43.2%
Hyperemia and infiltration of the mucous membrane of the nasal cavity	44	100%
Purulent and mucopurulent secretions in the middle nasal passage and at the base of the nose	42	95.45%
Mucous-purulent content in the washing liquid	35	79.5%
Purulent content in the washing liquid	9	20.5%

in the blood (22.5±1.27%), noted in 91.8% of patients, was not accompanied by a decrease in their absolute number [(1.9±0.18) × 10^9/l]. A sharp increase in ESR (22–35 mm/h) was registered in 95.4% of the examined subjects. When assessing the immune status of patients, it was found that the disease occurs against the background of a decrease in the content of CD3+ and CD4+ cells in the blood and an increase in the proportion of CD25+ and CD19+ cells. At the same time, no significant changes in the content of CD8+ cells were found in the patients. In the study of blood serum, it was established that there was a tendency to increase the IgG concentration and, characteristically, an increase in the content of CIC in the blood. In addition, the phagocytic activity of leukocytes (PhN and PhI) in patients was significantly lower ($p<0.05$) than in healthy people [1]. The indicator of the spontaneous NBT-test was 1.6 times higher in them, and the induced NBT-test was 1.2 times lower than in the norm.

Accordingly, the index of the metabolic reserve of phagocytes in patients was significantly weaker (index 1.23±0.17) than in healthy individuals (index 2.42±0.21). The obtained data indicate that ChPMS in patients with T1DM occurs against the background of pronounced changes in the immune status, with the involvement of all links of immunity.

The results of the study of immune status in patients with ChPMS with T1DM and in patients with ChPMS without T1DM are presented in Table 9.

As can be seen from Table 9, in the peripheral blood of patients with ChPMS with T1DM, compared to healthy donors and the control group, there are likely differences in most of the studied parameters. In particular, there is a probable increase in the absolute number of leukocytes with a probable decrease in the relative number of lymphocytes (however, it should be noted that no potential changes in the absolute number of immunocompetent cells were noted). However, when analyzing the quantitative and absolute values of cells of the phagocytic series, a probable increase in the absolute number of segmented nuclear neutrophils and the absolute number of monocytes was noted compared to patients with ChPMS without T1DM and healthy donors. Data growth meaningfully correlates with a probable increase in the level of leukocytes.

Discussion

Exacerbation of unilateral ChPMS was diagnosed in 10 (22.7%) patients, and bilateral ChPMS was identified in 34 (77.3%) patients with T1DM.

As can be seen from Table 1, among the examined patients, men are more often ill – 54.5% as compared with 45.5% of women.

Out of the 44 examined patients with ChPMS, the duration of their type 1 diabetes mellitus before treatment was as follows: in 4 examined, the duration of

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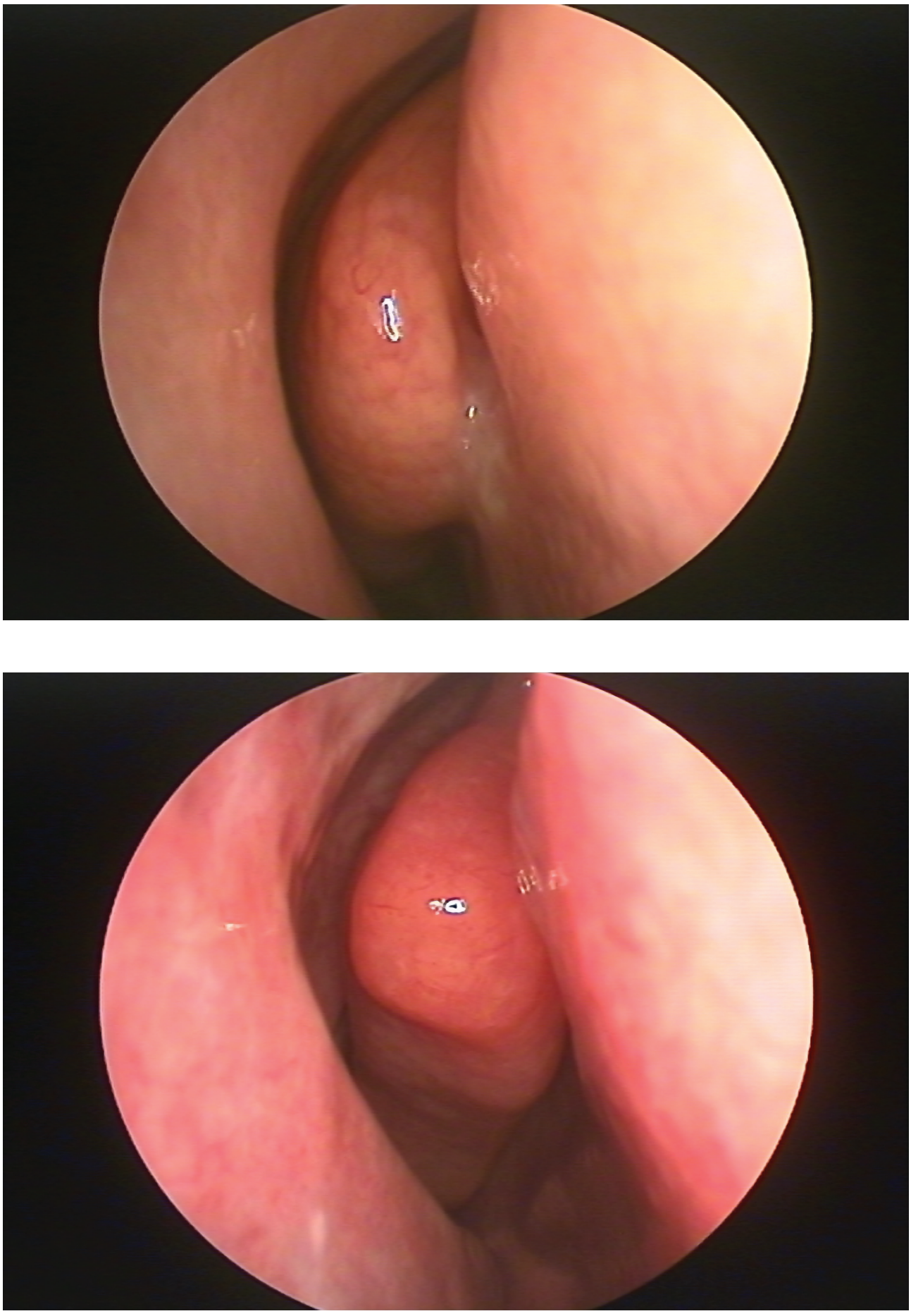
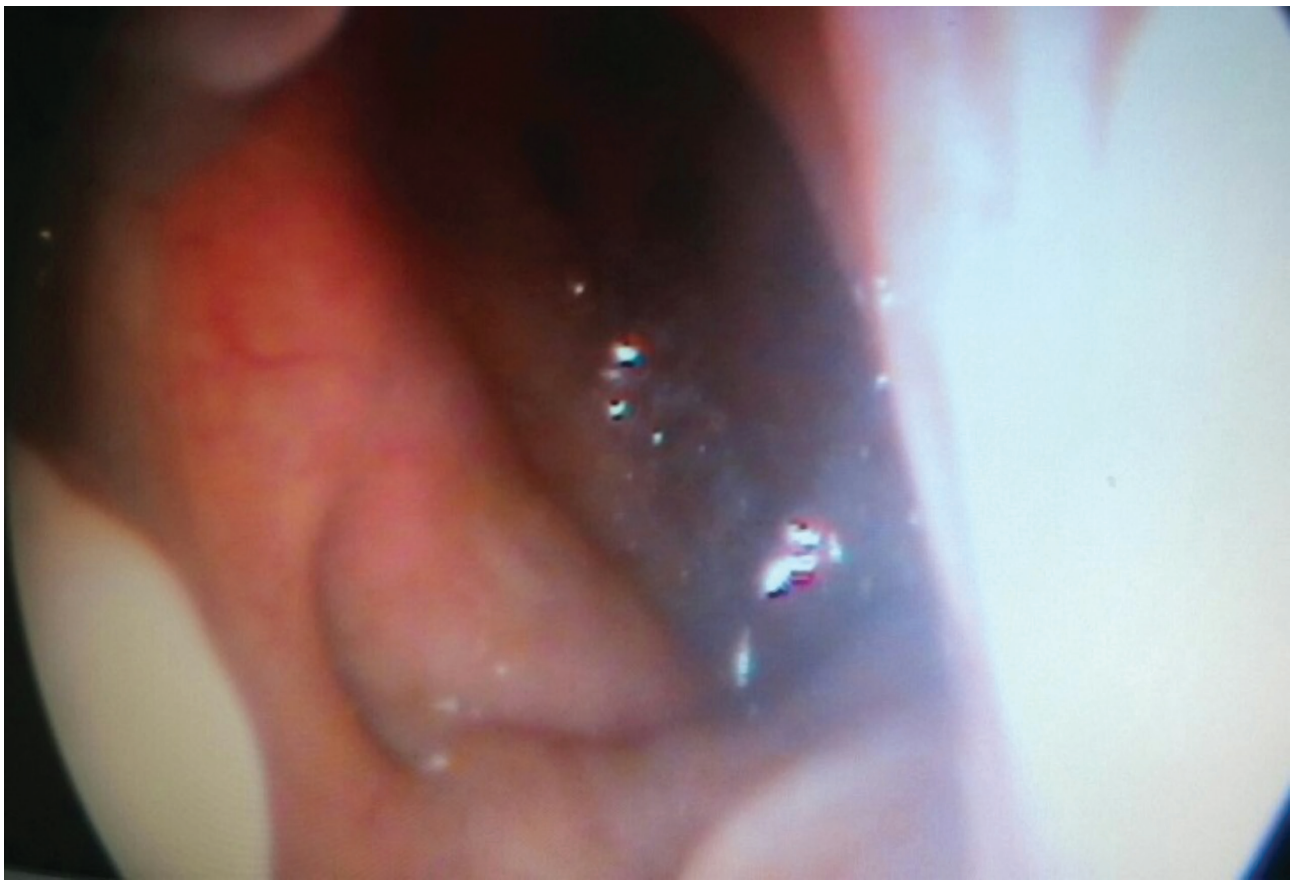
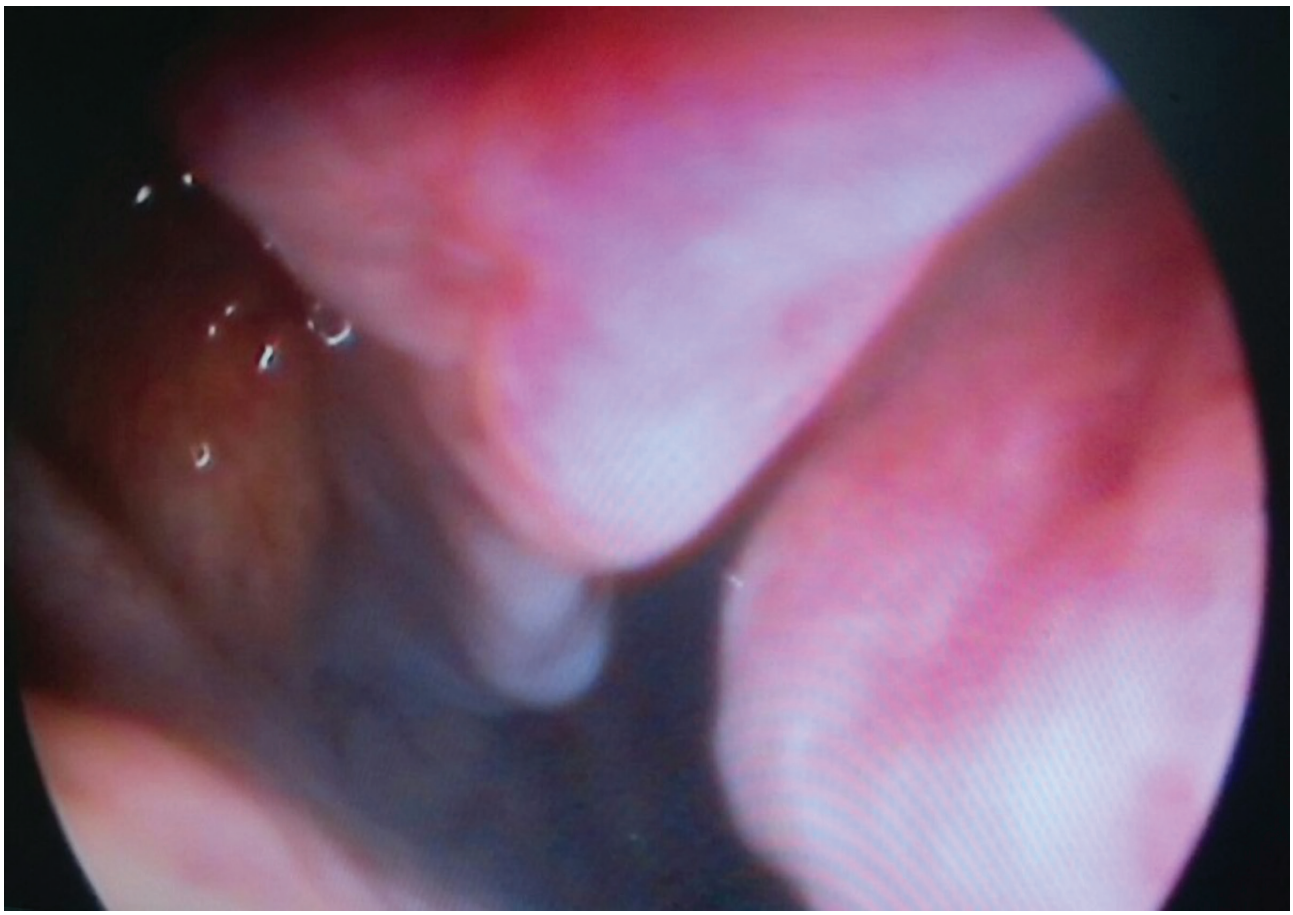


Figure 2: Endovideo rhinoscopy of the osteomeatal complex.





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the disease before inclusion in the study was less than five years (3.47±0.76 years), in 10 people diabetes lasted from 5 to 10 years (7.94±0.76 years), in 24 patients the duration of type 1 diabetes mellitus was 10–20 years (16.84±1.76 years), and in 6 people diabetes lasted more than 20 years (23.30±1.14 years).

Table 3 shows that the disease duration in most patients exceeded 1 year and in 39 (88.6%) patients, the disease duration was from 1 to 9 years. The longest duration of the disease was 16 years, and the shortest was 9 months. Most patients – 34 (72.3%) were treated repeatedly, including 24 (54.5%) in the inpatient

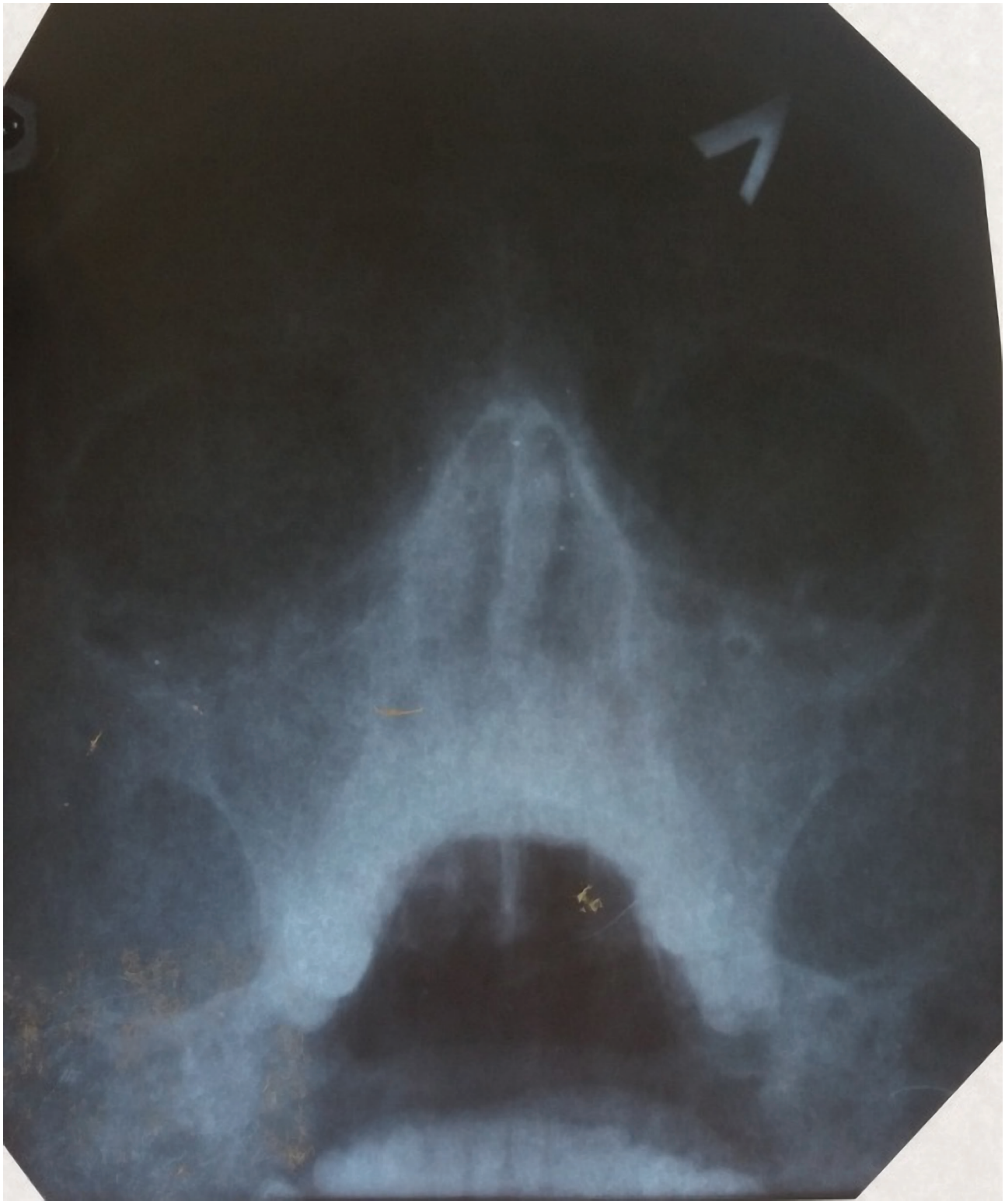

Figure 3: X-ray of the paranasal sinuses in patients with chronic purulent maxillary sinusitis with type 1 diabetes mellitus.

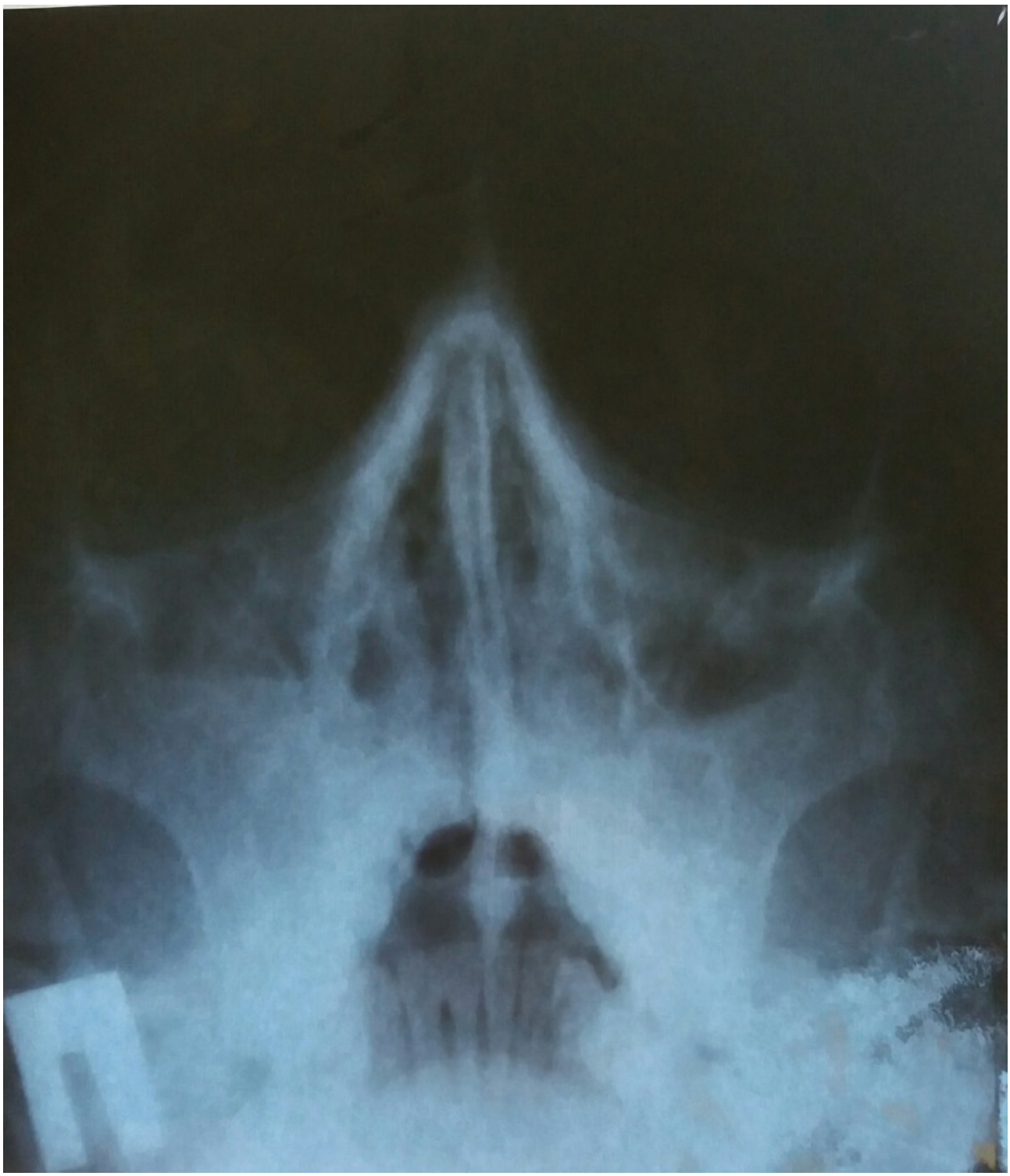

Figure 3: Continued.

department. The course of treatment of these persons included: medical punctures of the maxillary sinuses with local administration of antibacterial or antiseptic drugs, antihistamines, vasoconstrictor and antiseptic drops in the nose, secretolytics and physiotherapeutic procedures. In patients previously treated on an outpatient basis, it was impossible to find out the nature of the treatment. When studying anamnestic data, attention was paid to the frequency of exacerbations. The majority of patients, 34 (72.3%), associated the occurrence of exacerbations with hypothermia, regardless of the season.

The main complaints of the examinees during an exacerbation of chronic purulent maxillary sinusitis were as follows: purulent or mucopurulent discharge – in 34 (77.3%), diffuse or localized headache – in

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Table 7: Data on the volume of punctured maxillary sinuses in patients with chronic purulent maxillary sinusitis with type 1 diabetes mellitus at the first diagnostic and therapeutic puncture.

Sinus volume	V=0–2 cm³	V=3–4 cm³	V=5–7 cm³
Number of patients	4 (9.1%)	14 (31.8%)	26 (59.1%)

Table 8: The results of diagnostic and therapeutic punctures of the affected maxillary sinuses.

Nature of the content	Purulent	Mucopurulent
Number of patients	9 (20.5%)	35 (79.5%)

Table 9: Indicators of the immune status of patients with chronic purulent maxillary sinusitis in the acute stage with type 1 diabetes mellitus (M±m).

Blood parameters	Patients with ChPMS with T1DM (n=44)	Patients with ChPMS without T1DM (n=20)	Healthy donors (n=10)
Leukocytes, abs. number/L	9.2±0.65*,**	6.65±0.58	6.3+0.57
Lymphocytes, % abs. number/L (x109)	22.54±1.27*,** 1.9±0.18	31.2±1.26 2.07±0.14	30.9+1.16 1.9±0.15
Rod-shaped neutrophils, % abs. number/L (x109)	6.0±0.31*,** 0.55±0.032*,**	4.71±0.28* 0.31±0.025*	2.5±0.10 0.15+0.010
Segmented neutrophils, % abs. number/L (x109)	64.0±1.21 5.89±0.16*,**	58.14±1.19 3.87±0.16	57.5±1.19 3.60±0.16
Monocytes,% abs. number/L (x109)	6.3±0.69 0.58±0.064*,**	5.71±0.61 0.38±0.040	7.14±0.18 0.45±0.017
T-lymphocytes, CD3+cells, %	49.3±2.36*	56.4±2.83	62.5±2.56
T-helpers, CD4+ cells, %	29.1±2.87*	30.2±1.96*	37.7±1.95
T-cytotoxic suppressors, CD8+ cells, %	20.5±1.34	19.4±1.31	19.3±1.27
CD25+ cells, %	12.6±1.31*,**	8.14±0.61*	5.84±0.50
CD19+ cells, %	26.7±1.53*	21.6±1.57	18.1±1.46
Ig A, g/L	1.4±0.17	1.5±0.16	1.7±0.16
Ig M, g/L	1.6±0.19	1.7±0.18	1.8±0.18
Ig G, g/L	15.2±1.17	13.2±1.14	12.6±1.14
CIC general, g/L	2.31±0.11*,**	1.83±0.11*	1.28±0.08
PhN, %	44.7±2.23*,**	60.9±1.91	62.5±2.61
PhI	3.1±0.32*,**	6.6±0.47	6.4±0.32
The percentage of bacteria that survived after phagocytosis	17.8±1.6*,**	9.6±0.9*	4.9±0.6
NBT - spontaneous test, %	18.9±1.91*	18.1±1.92*	11.6±1.08
NBT-induced test, %	23.4±2.16*	25.4±2.23	28.1±2.05
Index NBT induced/NBT spontaneous	1.23±0.17*	1.40±0.19*	2.42±0.21

Note: * – $p<0.05$ when compared with healthy donors; ** – $p<0.05$ when comparing blood parameters of patients with ChPMS with T1DM and patients with ChPMS without T1DM.

40 (90.9%), soreness when palpating the front wall of the affected maxilla sinuses – in 28 (63.6), significant difficulty in nasal breathing – in 40 (90.9), hyposmia – in 28 (63.6), sleep deterioration – in 33 (75), general weakness – in 32 (72.7%), increased body temperature to subfebrile – in 19 (43.2%).

A study of nasal breathing according to the method of V.G. Yermolayev allowed the establishment of the fourth degree of nasal breathing disorder in 4 (9.1%) and the second and third degrees in 40 (90.9%) patients.

Patients with ChPMS complicated by T1DM, when admitted to the hospital, complained of general weakness, headache, increased body temperature to 37.3–37.5°C and increased emotionality. 90.9% of those examined noted significant nasal obstruction, which did not decrease after using vasoconstrictor drugs. Discharges from the nose were mucopurulent, in contrast to patients without type 1 diabetes mellitus, in whom the discharge was purulent. In 63.6% of patients, when palpating the exit points of the trigeminal nerve, the pain was noted in areas I, II and even III of its branches and when percussing the PPN. In the vast majority of patients – 34 (77.3%) patients, the PPN lesion was bilateral (in patients without type 1 diabetes mellitus, the ratio was the same: bilateral lesions were equal). During anterior rhinoscopy and endovideorhinoscopy, the examined patients showed either stagnant hyperemia of the mucous membrane or its bluish and whitish color against the background of swelling of the nasal concha (mucous-purulent secretions in the middle nasal passages, the floor of the nose, and in the nasopharynx), mucopurulent content in the lavage fluid – in 35 (79.5%), purulent content – in 9 (20.51%). The length of stay in the hospital of patients with ChPMS on the background of type 1 diabetes mellitus was 11.3±1.5 days. When admitted to the hospital, 23% of patients had complications (acute tubootitis, acute otitis media, acute ethmoiditis, acute frontitis, acute pharyngitis, reactive swelling of the eyelids and soft tissues of the cheek).

The obtained results of a decrease in the relative number of CD3+ cells and CD4+ cells meaningfully correlate with a decrease in the absolute values of the level of lymphocytes in the peripheral blood of patients with ChPMS with diabetes, and their decrease can be considered as a consequence of reverse regulation by a relatively increased number of CD25+ cells because the immunosuppressive effect of the last ones is well known [24–26]. At the same time, the analysis of the relative number of CD8+ cells (T – cytotoxic suppressor lymphocytes) did not undergo significant changes in any of the studied groups. From the obtained results of the study, it can be seen that in patients with ChPMS with type 1 diabetes mellitus, there is a kind of redistribution of the nature of the inflammatory process by reducing the share of the adaptive immune response in it (a decrease in the relative number of CD3+ cells and CD4+ cells with an increase in CD25+ cells) and an increase of innate immunity (an increase in the absolute number of leukocytes, rod- and segmentonuclear neutrophils).

This redistribution of the "players" of immune resistance is caused, first of all, by disturbances caused by the metabolic effects of T1DM, as well as, mainly by the bacterial nature of inflammation, which determines the need for activation of innate immune mechanisms, with the aim of further activation of the phagocytic system for the elimination of pathogenic associations of the pathological biofilm as an important cause of inflammation in ChPMS. Indirect proof of this is the absence of probable changes in the level of CD8+ cells, the activation of which is usually observed in the presence of intracellular microbial associations. However, at the same time, changes in T-lymphocyte immunoregulatory potential are visible through an increase in the relative number of "immunosuppression markers" – CD25+ cells. This feature of changes in the immune status in patients with ChPMS with T1DM is most likely caused by the metabolic influence of the background disease [21, 22, 27, 28].

The study results of the relative level of CD19+ cells (B-lymphocytes) showed a potential difference only between the groups of patients with chronic obstructive pulmonary disease and T1DM and healthy individuals – an increase in this indicator is noted. However, the level of the products of the functioning of plasma cells (activated B-lymphocytes) – immunoglobulins remains without probable changes in all three studied groups for all three studied immunoglobulins (IgA, IgM and IgG). At the same time, in the peripheral blood of patients with ChPMS with T1DM, there is a probable, rather pronounced increase in the level of CIC, both in relation to the group of healthy donors and in relation to the group of patients with ChPMS without T1DM. This feature indicates the presence of a circulating antigenic component in association with an antibody and an activated component, which completely coincides with the microbial theory of ChPMS. It should be noted that a probable increase in CIC is also observed in the group of patients with ChPMS without diabetes but less pronounced than in the group of patients with ChPMS with T1DM.

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When studying the indicators of the absorptive and digestive capacity of phagocytic cells, it was found that patients with ChPMS with T1DM have a pronounced probable decrease in PhN and PhI compared to groups of ChPMS patients without diabetes and, especially to the group of healthy donors. This decrease in PhN and PhI is combined with a logical increase in the percentage of bacteria surviving after phagocytosis, which is logical for such changes. It should be noted that although this indicator probably increases in patients with ChPMS without diabetes, its importance is significantly different – an increase of 3.63 times *versus* 1.95 times. Such an increase in the percentage of bacteria surviving after phagocytosis indicates the failure of the phagocytic function, which correlates with a decrease in PhN and PhI and can be considered one of the reasons for the persistence of infection and the chronicity of the inflammatory process of ChPMS in patients with T1DM [10, 12, 13]. These assumptions are confirmed by the results of the functional state of phagocytes according to the NBT test. In particular, there is a likely increase in the spontaneous NBT test in patients of both groups with ChPMS (with and without diabetes) compared to healthy donors, with a likely decrease in the induced NBT test in the group of ChPMS patients with type 1 diabetes mellitus which is naturally expressed by a sharp decrease in the NBT index.

Conclusions

The course of ChPMS in patients with type 1 diabetes mellitus is characterized mainly by bilateral damage, duration, intensity of clinical manifestations, subfebrility, severe nasal obstruction, mucopurulent nature of the exudate, involvement of other PPN in the process, atypical radiological picture, sharp increase in ESR against the background of a moderate shift to the left in the leukocyte formula, the development of complications.

The clinical course of ChPMS with T1DM is accompanied by changes in the body's immune status, which are characterized by a predominant depression of the cellular link of the immune system, activation of B cells and a lack of factors and mechanisms of non-specific resistance of the body.

Conflict of interest

The authors declare no conflict of interest.

Ethics approval

The approval for this study was obtained from the Ethics Committee of the Bukovinian State Medical University (approval ID: No. 19.08.202).

Consent to participate

Written informed consent was obtained from the participants.

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