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ORIGINAL STUDY

Fungus ball of the maxillary sinus: clinical and diagnostic characteristics

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ABSTRACT

Fungus ball of the maxillary sinus (FBMS) is the most common form of chronic fungal rhinosinusitis in adults. It is a condition of old age, usually with unilateral involvement, and with female preponderance. It is especially described in immunocompetent individuals and is characterized by a slow and benign evolution. Although the etiology, pathogenesis and natural history of fungal rhinosinusitis have been studied extensively, they are far from being fully understood. The clinical presentation and endoscopic findings in patients with fungus ball of the maxillary sinus are nonspecific, often identical to those of chronic bacterial rhinosinusitis and the cultures are often negative. Imaging evaluation by CT scan suggests, by characteristic signs, a correct diagnosis, which is then correlated with the histological identification of fungal hyphae. Microbiological, histopathological and mycological examinations of nasal secretion established with certainty a variety of bacteria (70%) and fungi (61.7%) in a group of 60 patients with FBMS included in a three-year study. The most commonly detected bacterial floras were *Staphylococcus aureus, Citrobacter Koseri, Haemophilus influenzae, Pseudomonas aeruginosa, Moraxella catarrhalis* and *Klebsiella oxytoca*. On culture media, the most common fungal agents were *Aspergillus fumigatus* and *Aspergillus flavus*.

KEYWORDS: fungus ball, maxillary sinus, fungi, fungal hyphae.

INTRODUCTION

Fungus ball (FB) of the paranasal sinuses (FBPS) is a distinct clinical entity, the most common form of non-invasive fungal rhinosinusitis, defined as an accumulation of dense fungal elements in the cavity of a single sinus, most commonly in the maxillary sinus. The disease is a localized manifestation, non-invasive, not at all or slightly aggressive, extramucosal, occurring especially in immunocompetent patients[1-5].

FBPS develops in the elderly (60-70 years old), usually triggering nonspecific symptoms of chronic rhinosinusitis (CRS)[4,6], with a considerable and constant predilection for the female sex (57-64%)[5-7]. According to recent data, FBPS is diagnosed in approximately 3.7% of all cases of CRS subjected to surgery[5-7]. The pathogenesis and risk factors for FBPS remain largely unknown, and the incidence of the disease has shown an important increase in recent years[1-5].

Generally, the condition is unilateral, affecting only one sinus (up to 90-99% of cases)[1-5]. The most common location is the maxillary sinus (78-94%), followed by the sphenoid sinus (4-15%). Most often, the involvement of ethmoid sinuses (1-15%) is adjacent to the maxillary sinus, and the involvement of the frontal sinuses is much rarer (2%)[1-3,5].

The treatment of fungus ball involving the paranasal sinuses allows a rhinosinusal endoscopic approach, with good results, low recurrence rates and disappearance of symptoms. Thus, the rapid and accurate diagnosis of FB is important to avoid unnecessary medical treatment[1-3,5].

The aim of this study was to investigate the clinical, imaging and histopathological presentation of the fungal ball of the maxillary sinus (FBMS).

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MATERIAL AND METHODS

The present study was carried out in the Department of Functional Surgery, Phono-audiology and Otorhinolaryngological Rehabilitation of the "Timofei Moșneaga" Public Medical and Sanitary Institution Republican Clinical Hospital from Chisinau, Republic of Moldova, in the period 2016-2019.

Patients

The study was performed on a group of 60 adult patients (26.7% men and 73.3% women), aged between 18 and 68 years (average age 41±1 years), diagnosed with FBMS.

Methods of investigation

We used the following investigation methods: clinical, laboratory (complete blood count and the concentration of C-reactive protein in the blood serum, the number of eosinophils / neutrophils in the nasal mucus, bacteriological and cytological examinations of the nasal secretion), histopathological examination of the sections of nasal mucosa and fungal material, optical microscopic examination of ciliated epithelial fragments with high-speed video images (Carl Zeiss A2 optical microscope and Nikon full HD camcorder), instrumental methods (nasal endoscopy, conventional radiological examination and computed tomography (CT) of the paranasal sinuses)[8]. All study participants completed the SNOT-22 questionnaire at the beginning and end of the study, this being a subjective test for estimating the quality of life of patients with CRS[9].

Diagnosis

The diagnosis of FBMS was established based on clinical manifestations, endoscopic and imaging examinations, allowing to suspect the condition, but the positive diagnosis was confirmed by histopathological study.

We considered the following criteria important for the positive diagnosis of FBMS: 1). non-specific clinical symptoms, similar to recurrent paucisymptomatic CRS, resistant to antibacterial treatment; 2). unilateral sinus involvement; 3). imagistic evidence of an opacity of the paranasal sinuses with or without associated microcalcifications; 4). mucopurulent, clay-like or caseous material inside the affected sinuses; 5). histopathological criteria confirming the diagnosis (chronic inflammation of varying intensity of the sinus mucosa, lack of fungal invasion in the sinus mucosa, lack of allergic mucin in the sinuses and of granulomatous reaction in the mucosa and visualization of dense agglomerations of fungal hyphae, separated by the adjacent sinus mucosa)[1-3,6].

The study protocol was approved by the Ethics Committee of the Public Institution "Nicolae Testemitanu" State University of Medicine and Pharmacy. The informed consent was obtained from each patient prior to inclusion in the study.

Statistical analysis

Primary data processing was performed using the functions and modules of the programs "Statistical Package for the Social Science" (SPSS) version 16.0 for Windows (SPSS Inc., Belmont, CA, USA, 2008) and Microsoft Office Excel 2016, by descriptive statistical methods (frequency tables, graphs, numerical indicators – the lowest and highest values, average, average error, etc.) and inferential statistics (assessing the characteristics of a population and testing statistical hypotheses). The "t" test for independent samples was used to estimate the significant differences between the averages of two groups. The dynamics of the group mean values was evaluated by the paired-samples "t" test. The data in the contingency tables were analyzed by the method of variational statistics (χ^2). Differences with bilateral value $p < 0.05$ were considered statistically significant.

RESULTS

The study included 60 patients with FBMS treated by FESS (functional endoscopic sinus surgery), 16 men (26.7%) and 44 women (73.3%). The age of the patients ranged from 18 to 68 years (average age 41±1 years). FB involved a maxillary sinus in 86.7% of cases (25 the right maxillary sinus – 41.7%, 27 the left maxillary sinus – 45%) and both sinuses in 8 cases (13.3%).

Risk factors

Of all patients included in the study, 19 were smokers (31.7%; 12 men and 7 women), 10 patients frequently took medication (16.7%) and 3 patients reported an allergy to drugs or various cosmetics (5%).

Considering the potential risk factors at the workplace, 33 (55%) patients reported none. The remaining 27 patients (45%) mentioned the following risk factors: different types of allergens in 7 cases, dry air in 9 cases, sudden changes in temperature in 16 cases. Various combinations of these factors have also been found: allergens and sudden changes in temperature in 3 patients, dry air and sudden changes in temperature in 6 patients, and the association of the three risk factors in the case of 3 patients.

Personal pathological and heredo-collateral antecedents

Pathological rhinosinusal history was reported in all patients included in the study: 52 patients (86.7%) were diagnosed and treated in the past of acute or chronic rhinosinusitis, 4 patients (6.7%) underwent rhinological interventions (operated nasal septum

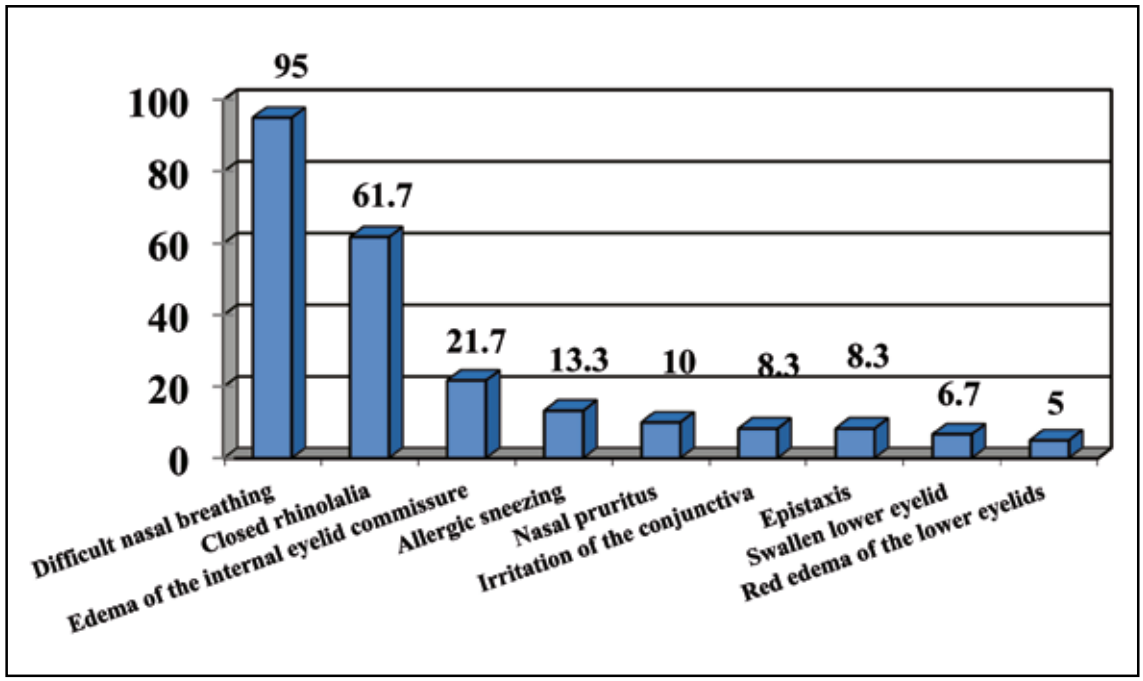

Figure 1. Frequency of symptoms (%) in patients with FBMS.

deviation) and 30 patients (50%) various dental procedures. It should be mentioned that 25 (41.7%) patients reported 2 or 3 pathological antecedents.

Symptoms

The onset of the disease was slow in all 60 patients with FBMS. In terms of symptoms, one of the most common symptoms reported by patients was difficult nasal breathing (100%), temporary nasal obstruction (19 patients, 31.7%) or permanent nasal obstruction (41 patients, 68.3%). Patients also described rhinorrhea (59 patients, 98.3%), cephalalgia (58 patients, 96.7%), pain in the affected maxillary sinus region (55 patients, 91.7%), pain with irradiation in the teeth of the maxillary arch (54 patients, 90%).

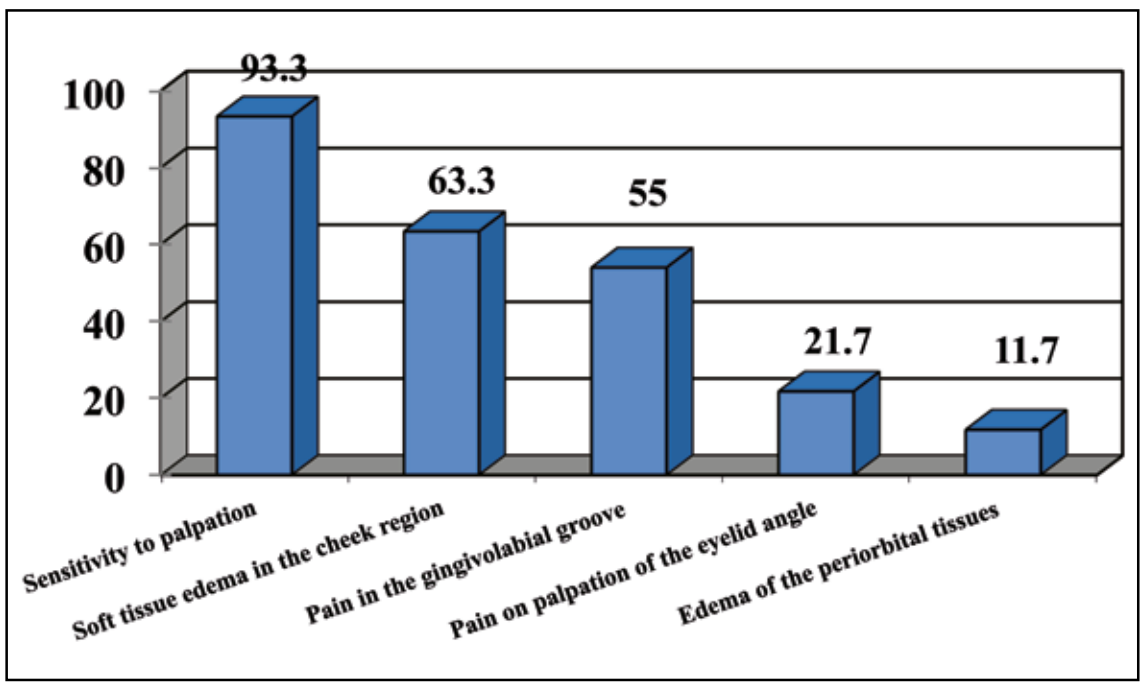

Figure 2. Frequency of clinical manifestations (%) at objective otorhinolaryngological examination (palpation) of patients with FBMS.

Objective otorhinolaryngological examination

At the objective examination, performed by anterior rhinoscopy and nasal endoscopic examination,v nasal secretions of various types were found in 58 patients (96.7%), including purulent nasal secretions in 42 of them (70%). Difficult nasal breathing confirmed rhinomanometrically was observed in the vast majority of patients (57 patients, 95%), closed rhinolalia in 37 patients (61.7%), edema of the internal eyelid commissure in 13 patients (21.7%), sneezing in 8 patients (13.3%), nasal pruritus in 6 patients (10%), irritation of the conjunctiva (tearing, hyperemia) in 5 patients (8.3%), epistaxis in 5 patients (8.3%), swallen lower eyelid in 4 patients (6.7%) and red edema of the lower eyelids in 3 patients (5%) (Figure 1).

56 of the patients (93.3%) presented sensitivity to palpation in the canine fossa region, the upper eyelid region, or the region of the internal angle of the orbit. Of these patients, 13 had pain on palpation of the eyelid angle (21.7%), 7 edema of the periorbital tissues (11.7%), 38 soft tissue edema in the cheek region (63.3%), while 33 patients reported pain in the gingivolabial groove (55%) (Figure 2).

Olfactometry

From an olfactometric point of view, all patients included in the study had subjective olfactory disorders: a patient with anosmia (1.67%), 25 patients (41.67%) with hyposmia, a patient with hyperosmia (1.67%), 16 patients (26.66%) with cacosmia and 17 patients (28.33%) presented different combinations of these disorders.

Nasal endoscopy

The nasal mucosa and middle nasal turbinates showed various pathological changes in all 60 patients with FBMS. The nasal mucosa was pale pink in 9 patients (15%), hyperemic in 48 patients (80%) and edematous in 55 (91.7%). The middle nasal turbinates were hyperemic in 24 patients (40%), hypertrophied in 20 patients (33.3%), hyperemic and hypertrophied in 16 patients (26.7%). In 53 of the patients included in the study (88.3%) a pathological change of the inferior nasal turbinates was found: hyperemia in 13 cases (21.7%), hypertrophy in 17 patients (28.3%), hyperemia and hypertrophy in 23 cases (38.3%).

The nasal endoscopic examination also revealed nasal secretions of different types in all 60 patients, hypertrophy of the unciform apophysis in 30 patients (50%) and concha bullosa in 6 patients (10%).

Laboratory examination

Bacterial flora in the nasal secretion was detected in 42 of the patients (70%) included in the study: *Staphylococcus aureus* (5 patients, 8.3%), *Citrobacter Koseri* (4 patients, 6.7%), *Klebsiella oxytoca, Haemophilus influenzae* and *Moraxella catarrhalis* in 3 patients each (5%), *Proteus vulgaris* and *Escherichia coli* in 2 patients each (3.3%), *Streptococcus pneumoniae, Neisseria spp., Enterobacter gergoviae, Stenotrophomonas maltophilia, Streptococcus hemolytic, Staphylococcus aureus meticilin-rezistent, Enterobacter aerogenes, Serratia marcescens, Enterococcus faecalis* and *Klebsiella pneumoniae* in one patient each (1.7%). The combination of two microbial agents was determined in 4 patients (6.7%): *Staphylococcus aureus* and *Haemophilus influenzae, Staphylococcus aureus* and *Pseudomonas aeruginosa,* and 2 patients were diagnosed with *Klebsiella oxytoca and Pseudomonas aeruginosa.* In 6 cases (10%), other pathogens were identified.

On culture media, fungal agents were found in 37 (61.7%) patients: *Aspergillus fumigatus* (10 patients, 16.7%), *Aspergillus flavus* (8 patients, 13.4%), *Candida albicans* and *Penicilium* in 5 patients each (8.3%), *Aspergillus niger* (2 patients, 3.3%), *Aspergillus nidulans* and *Mycete* in one patient each (3.3%) (Figure 3). The combination of two fungal agents was determined in 2 patients: *Aspergillus fumigatus* and *Aspergillus nidulans, Aspergillus nidulans* and *Candida albicans.* Other fungal agents were identified in 3 patients.

Direct mycological examination was positive in 33 patients (55%) and histomorphological examination for fungi in 40 patients (66.7%). The content of nasal mucus included fungal conglomerates in 35 patients (58.3%), neutrophils in 30 patients (50%) and eosinophils in 3 patients (5%).

Imaging evaluation

The computed tomography showed opacification of the maxillary sinuses in all patients included in the study. The obstruction of the ostiomeatal complex was observed in 41 patients (68.3%), and the erosion of the inferior orbital wall on the involved side was found in 3 cases (5%).

Optical microscopy

The evaluation of ciliary beat frequency at admission, determined in vitro, noted akinetic cilia (frequency 0 Hz) in 13 patients (21.7%), a ciliary beat frequency of 1-5 Hz in 46 (76.7%) and a ciliary beat frequency of 5-10 Hz in one patient (Figure 4).

Histomorphological examination

The histomorphological examination revealed: disorders of the mucociliary epithelium (intumescent fibrosis, epithelial atrophy) (39 patients, 65%), erosion of the mucociliary epithelium (22 patients, 36.7%), ulcerations of the mucociliary epithelium (infiltration of the lamina propria) (9 patients, 15%), mucociliary epithelium hyperplasia (26 patients, 43.3%), squamous cell metaplasia of

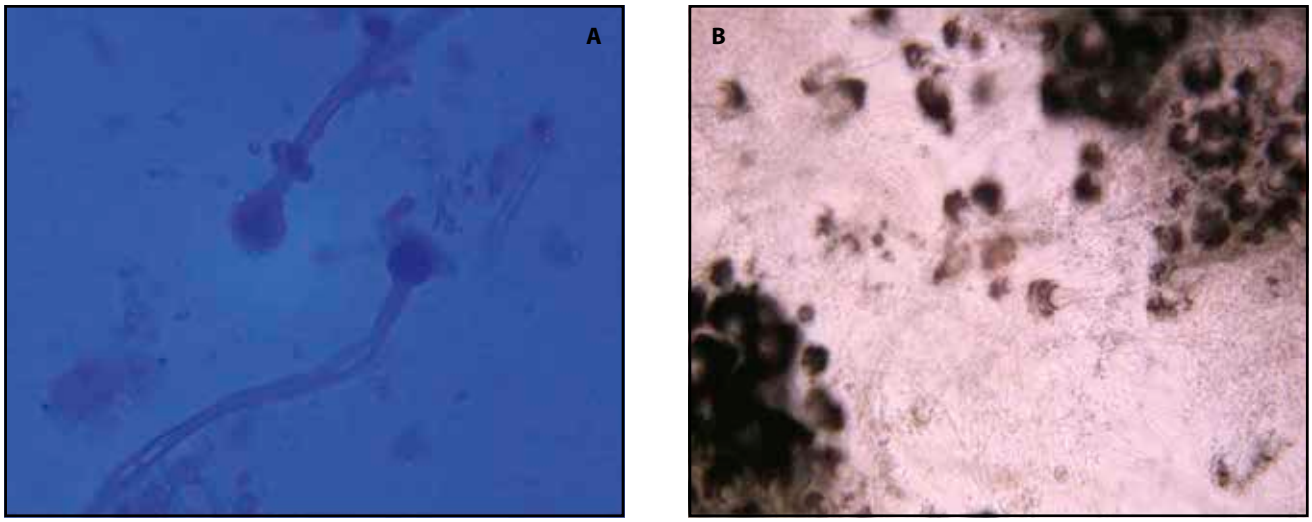

Figure 3. Fungal hyphae: A - Aspergillus fumigatus. B – Aspergillus niger.

the mucociliary epithelium (9 patients, 15%), mucoid degeneration (24 patients, 40%), polypoid changes in the nasal mucosa (11 patients, 18.3%), invasion of the mucosa with fungal agents (2 patients, 3.3%) and invasion of the mucosa with bacterial agents (3 patients, 5%).

The histopathological examination of FB confirmed the presence of fungal agents in 39 cases (65%). The mucociliary epithelium, lamina propria, submucosa and periglandular space were infiltrated with lymphocytes, neutrophils, mast cells, mast cells in the degranulation phase and plasma cells.

Therefore, in patients with FBMS, bacterial flora in nasal secretion was detected in 70% of cases and fungal agents in 61.7% of cases. The content of nasal mucus included fungal conglomerates (58.3%), neutrophils (50%) and eosinophils (5%). The most common changes on CT examination were opacification of the maxillary sinuses (100%) and obstruction of the ostiomeatal complex (68.3%). The histomorphological examination revealed disorders of the integrity of the mucociliary epithelium in 65% of cases, infiltration with inflammatory cells (polymorphonuclear and mononuclear) of the mucociliary epithelium, lamina propria, submucosa and periglandular space in 100% of cases. The mucosa itself undergoes hyperplastic and dystrophic changes. The mucosal epi-

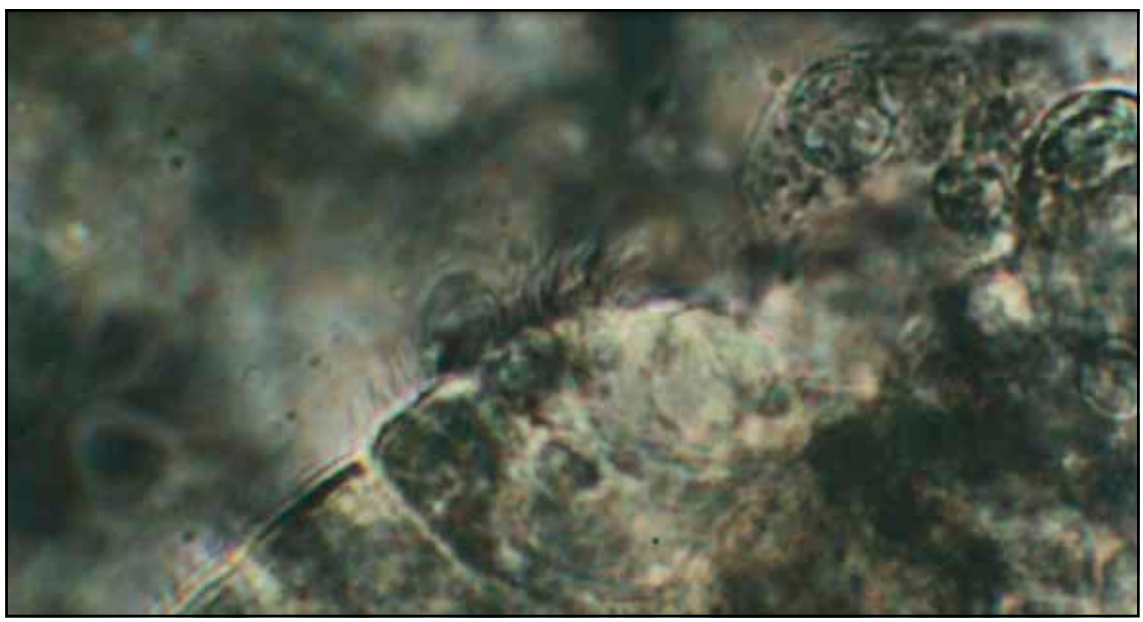

Figure 4. Phase-contrast optical microscopy of nasal mucociliary epithelial cells, in the active phase of motion (x40).

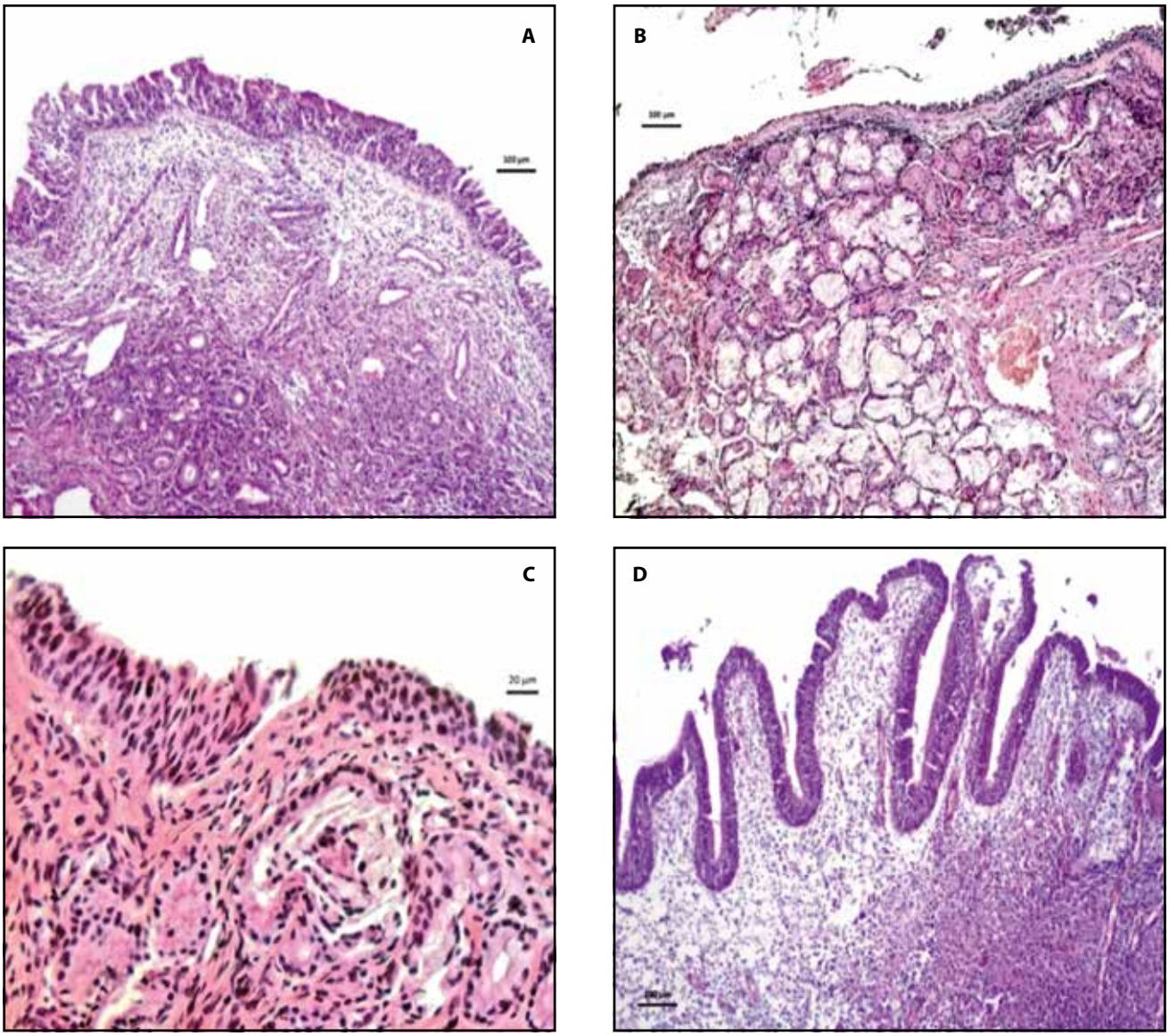

Figure 5. Tissue fragments of the maxillary sinus mucosa taken intraoperatively. Hematoxylin-eosin staining. **A** – microphotogram x10 – epithelium with preserved structure; **B** – microphotogram x10 – atrophied mucosa, consisting of only 1-2 rows of cells in a state of squamous cell metaplasia; **C** – microphotogram x20 – hyperplastic mucosa, with squamous cell metaplasia; **D** – microphotogram x10 – sinus mucosa with exophytic epithelial hyperplasia with pseudo-papillomatous appearance.

thelium only in some cases remains relatively preserved (Figure 5A); in most patients the structure of the sinus mucosa was atrophied, consisting of only 1-2 rows of cells in a state of squamous cell metaplasia (Figure 5B), in places hyperplastic and, likewise, with squamous cell metaplasia (Figure 5C). At the same time, portions of the sinus mucosa with exophytic epithelial hyperplasia with pseudo-papillomatous appearance were determined (Figure 5D). All epithelial changes were accompanied by basement membrane thickening. At the level of the chorion of the rhinosinusal mucosa, hyperplastic changes have been identified, with the proliferation of blood vessels and connective cells – granulation tissue, diffusely infiltrated with lymphocytes, plasma cells and macrophages.

The histopathological examination for fungus ball was positive in 39 (65%) of cases.

Patients with FBMS show a significant reduction in the ciliary beat frequency, severe symptoms and reduced quality of life.

Life quality, determined preoperatively according to the SNOT-22 questionnaire, revealed high scores in the vast majority of cases: 81-100 points in 42 patients (70%) and 101-110 points in 6 patients (10%). A score between 61-80 points was found in 9 patients (15%), 41-60 points in 2 patients (3.3%) and 0-20 points in one patient.

DISCUSSIONS

FB is a chronic non-invasive and extramucosal fungal rhinosinusitis (FRS), which usually occurs in immunocompetent individuals as a unilateral lesion[10-12]. The incidence, prevalence and risk factors of FB are not yet fully studied[11]. According to recent studies, the condition was identified in 0.29-5.4% of all cases of inflammatory CRS, subjected to surgery[2,6,13], and in 25% of FRS cases[14].

In cohorts of patients with FB, diagnosed and treated endoscopically in different centers, the age was between 19 and 85 years (on average 49.4 – 64.5 years)[10,11,15-17]. In our study group, the mean age was significantly lower, 41±1 years, and ranged from 18 to 68 years.

Most commonly, FB involves one maxillary sinus (in approximately 75–98.2% of cases). Less commonly affected are the sphenoid sinuses (4–25%), ethmoid sinuses (2.8–3.4%), frontal sinuses (1.1–2%) and, much less often, both maxillary sinuses (1.3–7.6%) or any two sinuses (0.6–4.6%)[2,3,6,13,15,18]. In our study, FB involved one maxillary sinus in 86.7% of the patients (the right maxillary sinus in 25 cases – 41.7%, the left maxillary sinus in 27 cases – 45%) and both sinuses in 8 cases (13.3%).

There is a considerable and constant predilection for females (of about 57–76.7%, with a ratio of 1.5-2.8:1)[3,7,10,12,15,19], circumstances also confirmed by our study (73.3% of patients were women, with a ratio of 2.75:1). The reason for the predominance of women remains inexplicable. One possible argument is that FB occurs more frequently in the elderly population, and women, compared to men, have a longer life expectancy and are more numerous in this population group[2,3,10].

It has been confirmed that endodontic treatment of the maxillary teeth is an independent risk factor for the development of FBMS[5,13,20]. It has been shown that 84–86.7% of the patients suffering from FB have previously received endodontic treatment on the ipsilateral side. In a case-control study, the risk of developing this condition in patients with endodontic treatment was 14 times higher, and the prevalence of endodontic treatment in the group of patients was 41–89.2%, compared to patients without such treatment[2,3,6,12]. In the group of patients in our study, 50% have previously undergone dental procedures.

Generalized rhinosinusal inflammation, tissue edema, inflammatory exudate and other risk factors (obstruction of the ostiomeatal complex or some nasal anatomical variants – septal anatomical changes or nasal turbinate hypertrophy) obstructs drainage paths and promotes stasis of secretions inside the sinuses, which creates an ideal anaerobic environment for the subsequent proliferation of fungi[21]. Among the main risk factors in patients with FBMS from our study, there was a history with predominant acute or chronic rhinosinusitis (86.8%), dental procedures (50%) and anatomical variations with obstruction of the ostiomeatal complex (68.3%).

FB usually triggers a clinical manifestation with nonspecific symptoms of CRS (nasal obstruction, nasal secretions, olfactory disorders and facial pain) or it may even be asymptomatic (about 13.2–20% of patients) and incidentally detected on imaging examination of the head. Only 29% of patients with FB are diagnosed within 1 year after symptom onset[2,4,6,11,16,17].

The most common symptoms in patients with FBMS are: purulent nasal secretions (15.1–75%), nasal obstruction (31.2–76.9%), facial pain (10.9–61.5%), cephalalgia (10.1–56.5%), cacosmia-hyposmia (20.9–26.7%) and eyelid edema (1.5%)[3,5,10,12,13]. In the present study, patients with FBMS most frequently reported nasal obstruction (100%), olfactory disorders (100%), nasal secretions (96.7%), pain in the affected maxillary sinus region (91.7%), cephalalgia (96.7%) and eyelid edema (21.7%).

In 55% of cases, the nasal endoscopic appearance is normal. In other cases, non-specific changes in the mucosa are detected: edema and hyperemia of the mucosa of the uncinate process and of the middle turbinate lateral wall, associated with purulent secretions from the middle meatus (48.2%), mild hyperemia of the mucosa of the ostiomeatal complex (5.1%)[11,15]. In the patients in our study, pale or pale pink nasal mucosa (15%), hyperemic mucosa (80,0%), edematous mucosa (91.7%), hyperemia and / or middle turbinate hypertrophy (100%), unciform apophysis hypertrophy (50%), nasal secretions (100%) – including purulent (76.6%) – were found.

There are several objective and subjective methods for studying the severity of CRS. The CT exam with Lund-Mackay score calculation, endoscopic evaluation and determination of the quality of life using the SNOT-22 questionnaire are among the most commonly used methods[9]. CT changes include heterogeneous and hyperdense opacity (82–89%), associated with microcalcifications (61–83%) or metal densities in the involved sinus cavity without bone lysis[1-2,6,10,17,18]. The most common changes on the CT examination of patients in our study were opacification of the maxillary sinuses on the affected side (100%) and obstruction of the ostiomeatal complex (68.3%).

Despite the fact that, until recently, bacteria were considered responsible for the pathogenesis of CRS,

the role of fungi is now recognized in the emergence of certain forms of CRS. The most commonly involved fungal agents are *Aspergillus* species, but many other species of fungi are also reported[1,14,15]. Nevertheless, the pathogenic role of fungal organisms and bacterial colonies, but also their complex interactions in CRS remain unclear[22].

In patients with FB, a variety of fungal species[15] and overlapping bacterial infection (in 58.5–85.19% of cases)[5] have been cultivated. *Aspergillus* species represent 16.7–45% of positive cultures and about 94.2% on histological examination[10]. *Aspergillus fumigatus* is the most common etiological agent in FB, followed by *Aspergillus flavus* and *Aspergillus niger. Cephalosporium nidulans, Candida albicans, Scedosporium apiospermum, Mucorales, Cladosporium* are less common[1,3,6,11].

In our group of patients with FBMS, bacterial flora in nasal secretion was detected in 42 (70%) patients: *Staphylococcus aureus* and *Citrobacter Koseri* in 4 patients each (6.67%), *Haemophilus influenzae, Pseudomonas aeruginosa, Moraxella catarrhalis* and *Klebsiella oxytoca* in 3 patients each (5%), *Proteus vulgaris* and *Escherichia coli* in 2 patients each (3.33%), *Streptococcus pneumoniae, Neisseria spp., Stenotrophomonas maltophilia, Streptococcus hemolytic, Enterobacter aerogenes, Serratia marcescens, Enterococcus faecalis* and *Staphylococcus aureus meticilin-rezistant* in one patient each, other microbial agents being described in 4 (6.67%) patients.

Despite the usefulness of the imaging examination, the certainty diagnosis is made by biopsy of the lesion and the adjacent mucosa during surgery. Histological examination, by assessing the presence of fungal hyphae, without evidence of tissue invasion or allergic granulomas or mucin, is essential for diagnosing FB[2,3,6,7,15].

Fungal culture is useful for identifying fungal species, but the failure of fungal growth on culture media is common, the positivity rate ranging from 23% to 55.6%[2,5,6,15,17]. This is probably due to the poor viability of the fungal elements in FB[5]. Several studies have shown a low sensitivity of fungal cultures, with only 16.7–34.6% positive samples, among which the growth of *Aspergillus fumigatus* colonies has been demonstrated in 15.2–93% of cases[5,6,10,12,15,17], *Alternaria spp.* in 2.5% of cases[15], *Penicillium spp.* in 0.8–10.7% of cases[2,12], *Bipolaris spp.* and *Paecilomyces variotii* in 0.8% of cases each[15]. Two or more types of fungi have been identified in about 20% of positive cultures[2,12,15]. In our study, fungal agents were detected on culture media in 37 patients (61.7%), including 2 fungal agents in 3 cases. The most commonly identified were *Aspergillus fumigatus* in 10 patients (16.7%) and *Aspergillus flavus* in 8 (13.4%). *Candida albicans* and *Penicilium* were determined in 5 patients each (8.3%), *Aspergillus niger* and *Aspergillus nidulans* in 2 patients each (3.3%), *Mycete* in one patient and other fungal agents in 3 patients.

CONCLUSIONS

Fungus ball of the maxillary sinus is the most common form of chronic fungal rhinosinusitis in adults, it is a condition of old age, usually with unilateral involvement, female preponderance and among immunocompetent people, with slow and benign evolution. Although the etiology, pathogenesis and natural history of fungal rhinosinusitis have been studied extensively, they are far from fully understood.

The clinical presentation and endoscopic findings in patients with fungus ball of the maxillary sinus are nonspecific, frequently identical to those of chronic bacterial rhinosinusitis, and the cultures are often negative. Imaging by computed tomography suggests, by characteristic signs, a correct diagnosis, which is correlated with the histological identification of fungal hyphae.

Microbiological, histopathological and mycological examinations of nasal secretion established with certainty a variety of bacteria (70%) and fungi (61.7%). The most commonly detected bacterial floras were *Staphylococcus aureus, Citrobacter Koseri, Haemophilus influenzae, Pseudomonas aeruginosa, Moraxella catarrhalis* and *Klebsiella oxytoca.* On culture media, the most common fungal agents were *Aspergillus fumigatus* and *Aspergillus flavus.*

Conflict of Interest: The author has no conflict of interest to declare.

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