

Modern approach for complex treatment of odontogenic maxillary sinusitis

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Abstract

Introduction: Odontogenic maxillary sinusitis is associated with diseases of the maxillary teeth. The close anatomical relationship of these teeth with the floor of the maxillary sinus leads to violation of the integrity of its mucosa and creates prerequisites for the infection to pass into the sinus cavity. Odontogenic maxillary sinusitis is characterized by dental complaints and the typical symptoms of all rhinosinusitis. There is lack of consensus in the literature on the algorithm of behaviour in these cases.

Aim: To recommend a contemporary algorithm of management in patients with odontogenic maxillary sinusitis, which is consistent with both the established rules for the treatment of rhinosinusitis and the individual characteristics of each clinical case.

Materials and methods: For the period 2001-2021, 157 patients were treated at St. George University Hospital, after extraction of an upper tooth (4-6) or with symptoms of nasal breathing difficulties and unilateral whitish secretion with an unpleasant odour. All of them had a history of dental intervention and CT data for changes in the osteomeatal complex or „foreign bodies“ in the maxillary sinus.

Results: All patients were discharged on the third day after admission in improved general condition without complaints. No late postoperative complications were observed. In 8 of the patients with sinuscopy, after the control CT examination, performed a month later, a second intervention was necessary for the extraction of residual fungal material.

Conclusion: The treatment of odontogenic maxillary sinusitis involves interdisciplinary approach of otorhinolaryngologists and dental specialists. However, modern understanding of the functioning of the nasal cavities and the development of pathological processes in them help us to build and present an adequate concept for diagnosis and therapeutic behavior.

Keywords: functional endoscopic sinus surgery (FESS), maxillary sinus, odontogenic rhinosinusitis, oroantral fistula, sinuscopy

Introduction

The concept of odontogenic sinusitis was first described in the literature by William Bauer in 1943. In essence, this is a maxillary sinusitis with or without covering the other surrounding cavities. Its frequency varies from 25-40% of all chronic maxillary sinusitis. (1, 2) Dental pathologies such as endodontic or periodontal inflammation, as well as iatrogenic injuries (placement of dental implants, the introduction of foreign bodies through the root canal of the tooth or establishment of oroantral communication during tooth extraction) are considered to be the main etiological factors. (1, 4, 5, 3) Once the sterile dental pulp is infected, the root of the tooth is colonized with bacteria (mainly anaerobes). When these bacteria spread to the periapical part of the tooth and further to the jaw, they cause the development of a dentoalveolar abscess. (6) According to various authors, the most common symptoms are facial pain, discharge back to the throat and impaired nasal breathing. (4). Symptoms usually occur after odontogenic pathology or dental treatment. The infection is most often polymicrobial, but the anaerobic microbiome dominates, which determines the unpleasant odour of the exudate and the secretions. (7) When odontogenic sinusitis occurs as a result of treatable dental pathology, treatment options include treatment of the cause, conservative and surgical treatment of the sinuses, or a combination thereof.

Numerous studies over the past two decades have undoubtedly shown the role of the natural opening of the sinus in its functioning and the development



of disease due to its blockage. (8, 4)

Good ventilation and drainage of the sinus through its natural opening is a prerequisite for the rapid normalization of the mucosa, regardless of its changes (8, 9).

The nasal and paranasal cavities are covered with a multi-row cylindrical epithelium. It is unique in nature and is also called the Schneider membrane. Due to the rhythmic movements of the ciliary cells, the mucus produced by the glands and calyx cells moves towards the sinus opening and further towards the nasal cavity and nasopharynx. From there, through the swallowing act, it enters the oesophagus and stomach. This protective function of the nose is referred to as mucociliary clearance. (7, 10) Frequent irritation and/or disruption of the integrity of the Schneider membrane leads to inflammation of the mucosa and impaired mucociliary function, which in turn disrupts the transport of secretions and normal defence mechanisms. As a result, a blockage of the natural openings of the sinuses occurs with subsequent bacterial infection and the development of acute or chronic sinusitis. (7) Such a pathophysiological mechanism can occur precisely due to the proximity of the maxillary sinus to the apexes of the maxillary teeth. Any violation of the integrity of the Schneider membrane due to infection in the periapical part of these teeth or penetrating trauma increases the risk of developing maxillary sinusitis, which is referred to as odontogenic. (11)

From the picture formed in this way, each specialist has several main questions:

1. When there is a fistula (oroantral), in addition to its closure, should action be taken with regard to the sinuses?
2. What diagnostics should we use to be sure about the condition of the nasal cavities, the volume of the pathological process and, accordingly, the type and volume of the surgical intervention?
3. Which operative method to choose – radical treatment such as Caldwell-Luke or endoscopic sinus surgery?

Aim

The aim is to present a modern approach for diagnosis and treatment of inflammatory pathology of the nasal cavities of dental origin and to propose for approval a multidisciplinary clinical algorithm for the management of this problem.

Materials and methods

For the period from 2001–2021, 157 patients with data for odontogenic sinusitis, oroantral fistula or foreign body in the maxillary sinus went through the ENT clinic at St. George University Hospital, Plovdiv, Bulgaria. All of them had a history of dental treatment in the area of the upper row of teeth. At different times after that, mostly unilateral complaints began, with troubled nasal breathing, heaviness in only one half of the face and whitish nasal secretions. The latter was also seen when performing anterior rhinoscopy.

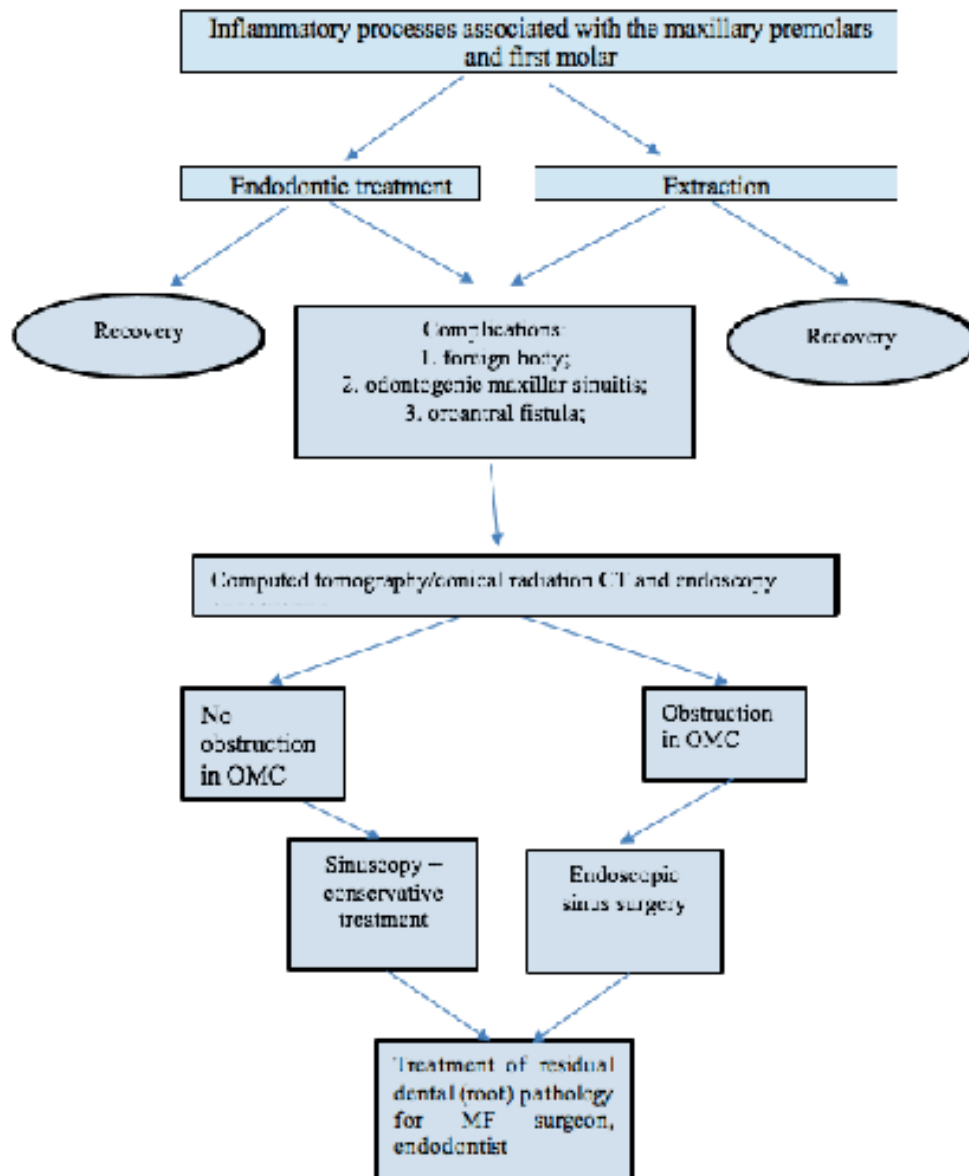
All patients underwent endoscopic diagnosis. 47 patients with CT data for free natural sinus opening were referred to the Maxillofacial surgery clinic for the subsequent treatment of root pathology or closure of the fistula with the Reeman technique. Surgical intervention – infundibulotomy with accompanying ethmoidectomy or pansinusotomy was performed in 110 patients. The surgical treatment was combined with conservative – intravenous administration of broad-spectrum antibiotics from the group of cephalosporins and quinolones. Treatment of the primary focus of the upper teeth was performed by maxillofacial surgeons in 59 of the patients, shortly thereafter. For extraction of a „foreign body“ from the maxillary sinus, sinuscopy was performed through the fossa canina, especially in the absence of involvement of the infundibulum and other sinuses. It was performed in 12 of the patients with a free orifice and in 62 of the patients who underwent ethmoidectomy and pansinusotomy.

Analyzing the cases of sinus pathology of odontogenic origin in the period 2001–2021 and applying to all CT as the main method of diagnosis for the condition of the sinuses, along with sinuscopy (through the fossa canina or open alveolus) we built the following concept.

For its evaluation, all patients underwent computed tomography of the sinuses according to a standard protocol. (3)

In patients with oroantral fistula, in addition to CT, endoscopy through the fistula with 2.7 mm optics (Karl Storz Germany Full HD monitor and camera head) was used to examine the natural opening and assess its patency.

CT and endoscopy data for a natural opening and infundibulum without changes were grounds for non-surgical intervention on the sinuses. Only in

Table 1. Concept for treatment of complications of the nasal cavities of odontogenic origin


the presence of a „foreign body“, cyst or polyp (rare single polyps), we used sinuscopy through the fossa canina to remove them without touching the natural openings.

All patients before and after our interventions were consulted with a maxillofacial surgeon or the treating dentist in order to treat the primary cause of the complication.

In 47 patients (29.9%) a free natural opening of the maxillary sinus was demonstrated and the symptoms of the fistula or a „foreign body“ were in the foreground.

In 12 of the 47 patients with a free natural opening, isolated sinuscopy was performed with the extraction of the present foreign body, cyst or polyp for-

mation from the sinus, without intervention on the natural opening.

In 74 patients (47.1%) there was solid data for the presence of a foreign body with metal density in the maxillary sinus and inflammatory changes, ranging from parietal hypertrophy to total involvement of the sinus cavity with partial involvement and ethmoidal cells. (Figure 2)

In 36 of the cases (22.9%) inflammatory changes in the frontal sinus ipsilaterally were also observed. This necessitated the implementation of operative intervention as the first choice. Endoscopic endonasal surgery with infundibulotomy or pansinusotomy and removal of the foreign body from the affected sinus was performed. (Figure 3)

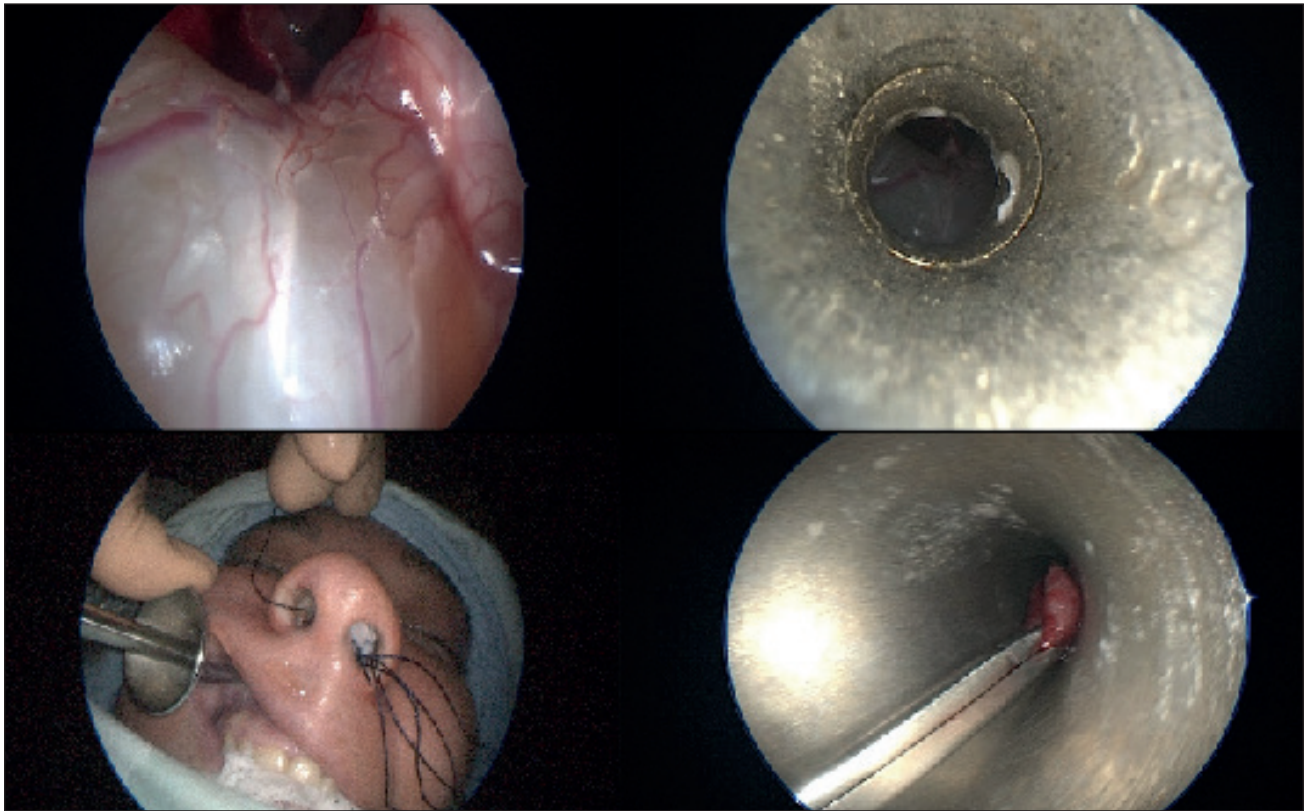


Figure 1. Sinuscopy through the fossa canina with the removal of the cyst from the sinus

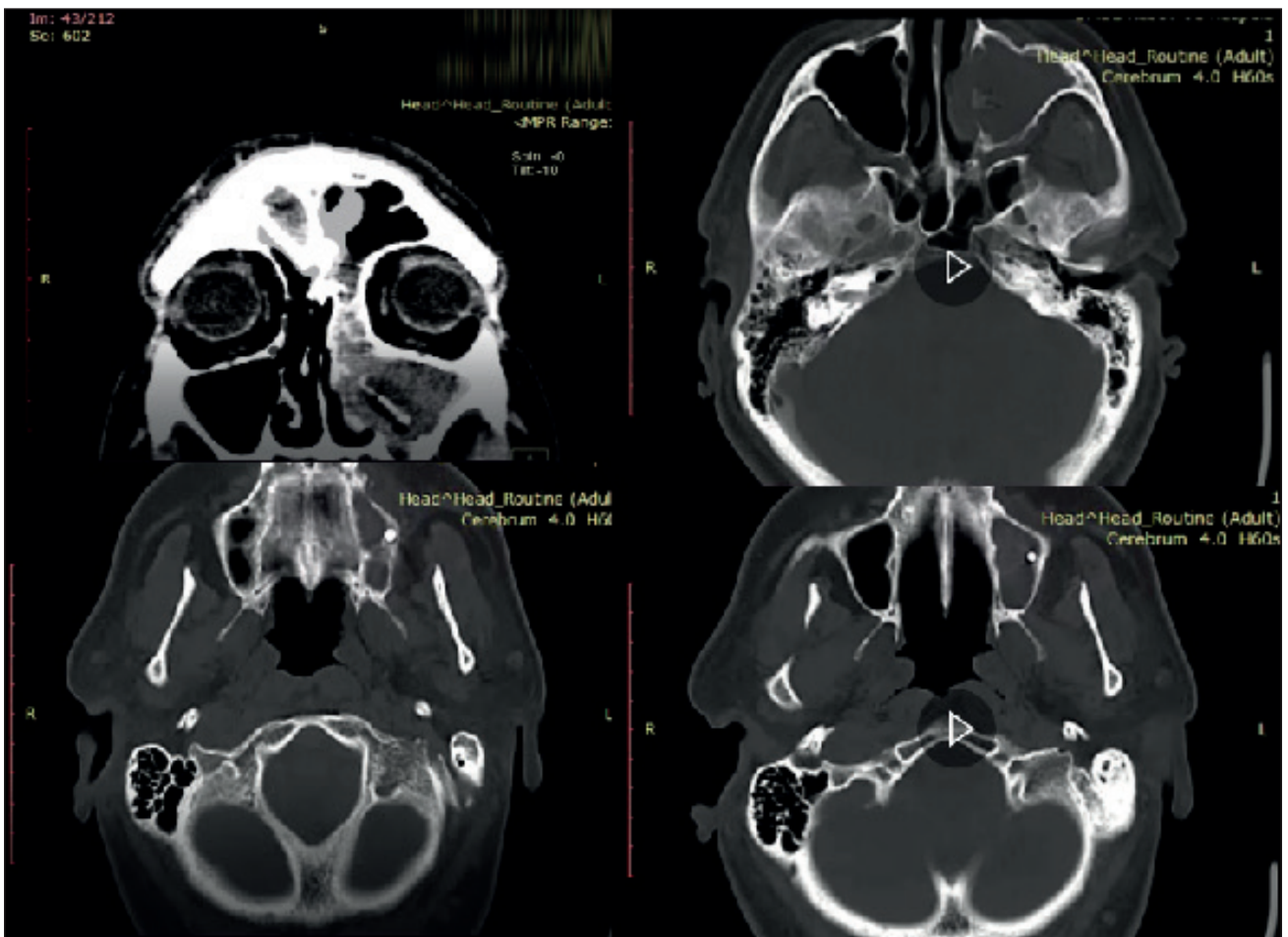


Figure 2. Coronal and axial CT scan of the peripheral cavities with data on a foreign body with metal density, passing through the floor of the left maxillary sinus. Reactive pansinusitis and ethmoiditis on the left

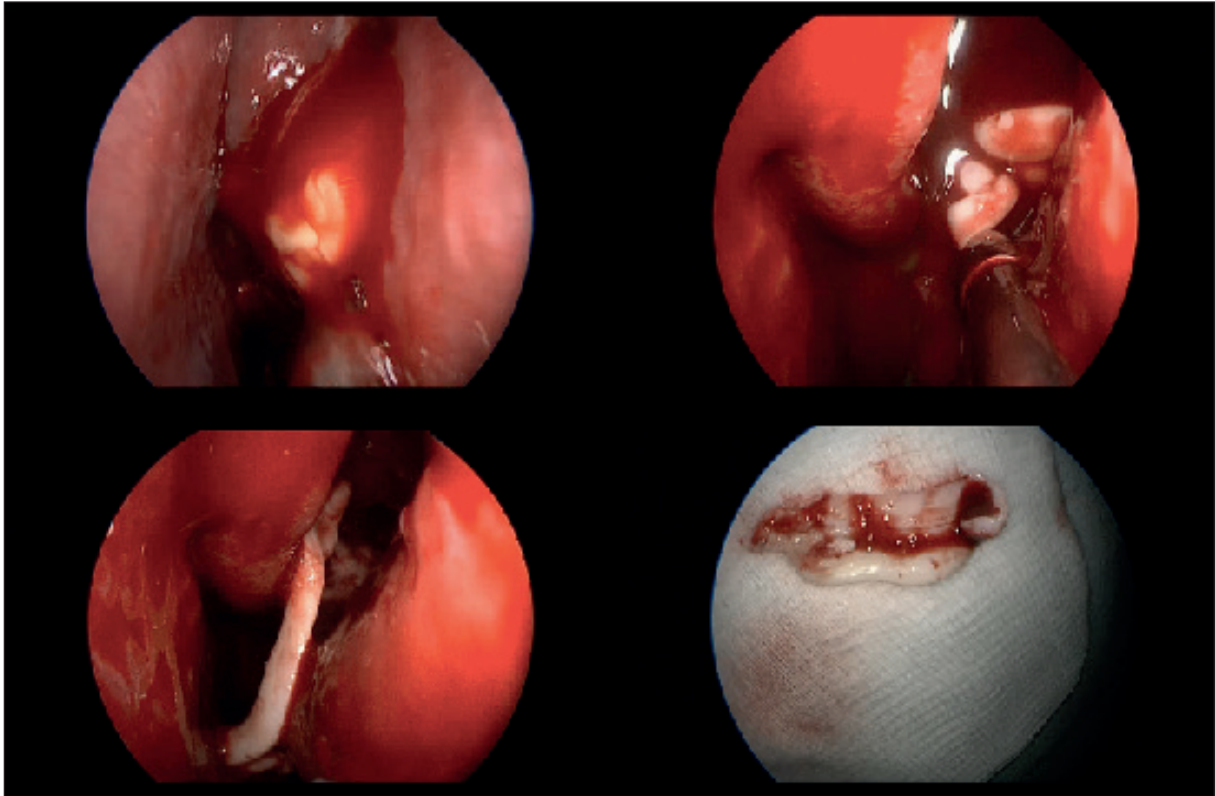


Figure 3. Endoscopic endonasal surgery with wide opening of the openings of the affected sinuses and removal of the foreign body from the maxillary sinus

Results

Postoperative period without complications was observed in 110 patients undergoing endoscopic infundibulotomy, ethmoidectomy or pansinusotomy, and they were discharged as standard on the third day in improved general condition. No complaints were observed clinically and no late postoperative complications were reported. On day 14, the intraoperatively placed synechia plaques were removed.

Shortly afterwards, 59 of them underwent treatment by maxillofacial surgeons.

In 47 of the patients, in whom free natural opening and infundibulum were proved by CT and endoscopy, after sinuscopy, independent endodontic treatment or treatment by a maxillofacial surgeon was performed – plastic surgery, apical osteotomy, etc. with success.

Due to CT-proven residual fungal material one month after sinuscopy in 8 of the patients, it was necessary to repeat it.

Discussion

Despite their high incidence of 25–40% (1, 2), odontogenic maxillary sinusitis has received little at-

tention in the literature compared to other forms of sinusitis. Therapeutic behaviour is not discussed at all in the various treatment recommendations. The main reason for this is the lack of collaboration between otolaryngologists and dentists, which in turn has led to difficulties in understanding the nature, diagnosis and methods of treatment of odontogenic sinusitis. (1) In the absence of a formal protocol, doctors are often unsure about the treatment strategy to choose. (5) Craig et al. are adamant that only antibiotic treatment without treatment of the underlying cause is extremely inappropriate. Most of their reviews show that the highest positive results are achieved with the simultaneous application of dental and surgical treatment. They also pay attention to the leading symptoms and believe that if the sinus pre-dental complaints are leading for the particular patient, then the surgical treatment should be leading, followed by a dental one, if necessary. Its purpose is the fastest possible reverse resolution of symptoms. If dental complaints predominate over sinus complaints, then the main method of choice should be dental treatment, followed by surgery, if necessary. (8)

According to Psilas et al. treatment in cases of oro-antral communication depends on the size of the



defect and the presence of sinus changes. Fistulas that have been present for more than three weeks should be surgically closed and granulation tissue should be eliminated by endoscopic surgery and the osteomeatal complex should remain intact. Fistulas smaller than 3 mm in which there are no clinical symptoms usually close spontaneously. Different buccal or palatal flaps are used to close the fistula. The methods are the most diverse – plastic with local tissues (flap in proximity), flap from a distance, tissue transplantation, guided tissue regeneration. The most commonly used and established in practice is the Rehrmann method with buccal mucosa – the method of choice for the primary closure of oroantral fistulas. (12, 2)

Imaging studies play a major role in this process and include periapical radiography, a panoramic image of the jaws. Today, computed tomography (CT) is considered the gold standard in the diagnosis of odontogenic sinusitis. (13)

Surgical treatment is functional endoscopic sinus surgery or open surgical treatment. Open techniques such as Caldwell-Luke surgery are not shown and should be severely limited today, as this type of intervention removes the physiological mucosa of the sinus, which changes its function and impairs normal drainage. After surgery, the mucosa usually re-epithelializes, but it is replaced by connective tissue and clearance is severely impaired. (4, 2) In the past, open surgical techniques were widely used, but today they have been replaced by functional endoscopic sinus surgery. It is considered the gold standard in the treatment of chronic rhinosinusitis due to its minimal invasiveness and the most physiological access possible. (4) Its purpose is to surgically restore patency of the natural opening of the sinus and to ensure normal drainage. Only cysts and polypoid changes of the sinus mucosa are removed, and the rest is preserved and after a certain period of time, the mucociliary clearance is restored. (4, 7) Planning the most appropriate surgical treatment requires an accurate assessment of the cause and extent of inflammation.

Endoscopic sinus surgery is highly recommended when there is evidence of involvement of the osteomeatal complex or if the inflamed mucosa occupies more than half of the sinus cavity. (12, 5) All studies show that in the case of data on orbital or intracranial complications, endoscopic surgery with opening of the openings of all sinuses is mandatory. Craig et al. are adamant that surgical treatment as the first means of choice before dental, leads to significantly faster resolution of symptoms and better endoscopic findings in the shortest possible time. The improvement occurred within 7–12 days in patients treated with endoscopic surgery, and in those with successful self-dental treatment, symptoms improved after 35–56 days. (14)

Conclusion

The complex genesis of odontogenic maxillary sinusitis presupposes a joint approach of otorhinolaryngologists and dental specialists. However, modern understanding of the functioning of the nasal cavities and the development of pathological processes in them help us to build and present an adequate concept for diagnosis and therapeutic behaviour.

Treatment of odontogenic sinusitis should include a shared decision-making process between otorhinolaryngologists, dentists, and the patient himself. The advantages and disadvantages of surgical and dental treatment in each case should be carefully considered. The patient must be informed that antibiotic treatment alone would be extremely insufficient to reverse the symptoms. If he chooses dental treatment as the means of the first choice, he must be informed that sinus changes may persist and subsequent surgical treatment may be necessary.

The joint treatment of dental pathology and associated sinusitis ensures the complete elimination of the infection and prevents further complications, as modern endoscopic techniques ensure low morbidity, high patient comfort, a short postoperative period and preservation of the function of the affected sinuses.

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