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ORIGINAL ARTICLE

Maxillary sinus mucocele: predisposing factors, clinical presentations, and treatment

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Abstract
Purpose Maxillary sinus mucocele (MSM) is uncommon lesion and has many presenting features. The aim of this study was to detect the possible predisposing factors, clinical characteristics, and to assess the efficacy of trans-nasal endoscopic treatment of this lesion.
Methods This retrospective multicenter study was conducted on 36 patients with MSM, the diagnosis of the disease was based on computed tomographic criteria. The patients' history, presenting features, and surgical management were reviewed. All patients were followed up postoperatively for at least 3 years.
Results Chronic sinusitis, previous surgery, allergic rhinitis, and nasal trauma may be implicated as predisposing factors for the disease. However, in some patients (56%) the cause may remain uncertain. MSM may present with unilateral cheek pain, heaviness, swelling, numbness, hemifacial pain, nasal obstruction, nasal discharge, and/or proptosis. All patients were treated with trans-nasal endoscopic marsupialization through the middle meatus, patients with large MSM showed bulged medial maxillary wall, and they needed to empty the fluid through inferior antrostomy to facilitate introduction of the instruments to the middle meatus. All patients reported resolution of their symptoms, and none required revision surgery through the follow-up period.
Conclusions MSM has several predisposing factors such as chronic sinusitis, previous surgery, allergic rhinitis and nasal trauma. However, some patients have no identifiable cause. The disease can present with a variety of symptoms which are usually related to their expansion and subsequent pressure on the surrounding structures. Trans-nasal endoscopic approach is an effective and safe method for treatment of the lesion.

Keywords Maxillary sinus mucocele · Endoscopic sinus surgery · Paranasal sinuses · Endoscopic marsupialization

Background

Mucocele of the paranasal sinuses is a cystic expansion of the sinus with mucus, it is a benign slow growing pathology, causing smooth expansile regular mass [1]. It is believed to follow obstruction of the sinus ostium, with retention of mucus within a mucoperiosteal lined cavity. As mucus continued to be accumulated within the mucocele, it enlarges gradually, resulting in erosion and remodeling of the surrounding bone [2]. Although it is a benign lesion, it can cause significant compression on the surrounding structures [3]. The most common causes of mucoceles are chronic infection, allergic sinonasal disease, trauma, previous surgery, and in some cases the cause remains uncertain [2, 4]. Frontal and ethmoid sinuses are common locations for the mucoceles, with less frequent involvement of the sphenoid sinuses. However, maxillary sinus mucoceles (MSM) are relatively rare, accounting less than 10% [5, 6].

The treatment of MSM is principally surgical. Historically, Caldwell-Luc operation was the treatment of choice for the disease, with removal of all sinus mucosa. However, it may be

The study was carried out in the Departments of Otolaryngology of Cairo University, and Beni Suef University, Egypt.

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followed by annoying symptoms such as numbness and edema of the cheek. Recently, endoscopic sinus surgery is favored over external approach with a lower morbidity and reduced hospital stay, it aims to marsupialize the mucocele towards the nasal cavity, attempting to ensure a good permanent ventilation and drainage of the affected sinus [1, 7, 8]. The objective of our study was to detect the possible predisposing factors and clinical characteristics of maxillary sinus mucoceles, and to assess the efficacy of trans-nasal endoscopic approach in the treatment of such lesions.

Materials and methods

This retrospective multicenter study was conducted in the Departments of Otolaryngology of Cairo University, and Beni Suef University, Egypt; in the period from December 2008 to December 2015. Thirty six patients with MSM were enrolled in the study after approval of the research protocol by the ethics committee of our institutes. The possible etiological factors that may be involved in the occurrence of the pathology were analyzed; also the different clinical characteristics of the lesion were discussed. Diagnostic nasal endoscopy was performed for all patients, however, diagnosis of the disease was based on the computed tomography (CT) findings [7]. Assessment of the efficacy of ESS in the treatment of MSM was investigated. All patients were followed up postoperatively for at least 3 years.

Results

The study included 21 males and 15 females, their mean age at the time of diagnosis is 39 years with a range between 15 and 52 years. The most common presenting symptom of MSM was cheek pain (83%), however, other associated symptoms were found (Table 1), and the lesion was presented on the right side in 19 patients and on the left side on 17 patients. Predisposing factors were identified in 16 patients (44%), 12 patients gave history of chronic sinusitis with 7 of them were subjected to endoscopic sinus surgery, while 3 patients gave history of allergic rhinitis, and 1 patient gave history of nasal trauma which was treated with rhinoplasty.

Preoperative CT imaging of the paranasal sinuses was performed for all patients (Fig. 1). The affected maxillary sinus was completely opacified with homogenous cyst-like lesions and the natural ostium was obstructed. Forward bulging of the anterolateral wall of the maxillary sinus was seen in all patients. Also, bulging of the medial wall of the maxillary sinus was a characteristic finding in all patients. Upward bulging of the orbital floor was seen in 12 patients, and the nasal septum was pushed by the lesion to the opposite side in 30 patients.

All patients were treated with ESS, however, the nasal passage on the affected side was narrowed by bulging of the medial wall of the maxillary sinus. So to facilitate introduction of the endoscope, inferior meatal antrostomy with drainage of mucus was performed endoscopically. Emptying the fluid of the mucocele leaded to decrease the intra-sinus pressure with easy lateralization of the medial maxillary wall and widening of the nasal passage. Middle meatal antrostomy and marsupialization of the lesion was performed. The residual contents of the mucocele were evacuated with curved maxillary sinus suction without the need to totally remove the mucocele lining. Small piece of gauze soaked with antibiotic and steroid cream was introduced in the middle meatus, and the nasal cavity was packed with a merocel. There were no intraoperative or postoperative complications. The pack and the piece of gauze were removed after 48 h. All patients were followed up for at least 3 years, endoscopic examination was performed weekly in the first month, and then monthly afterwards for inspection of the middle meatus and removal of the crusts, and the patients were informed to use saline irrigation daily for at least 3 months. Postoperative CT images of patients showed clear maxillary sinus with patent middle meatus (Fig. 2). All patients reported resolution of their symptoms and no patients required revision surgery.

Table 1 Clinical characteristics of maxillary sinus mucoceles

Clinical presentation	Number of patients	Percentage (%)
Cheek pain	30	83
Cheek heaviness	28	78
Nasal obstruction	28	78
Cheek swelling	18	50
Cheek numbness	14	39
Hemifacial pain and headache	12	33
Proptosis	10	28
Nasal discharge	7	19

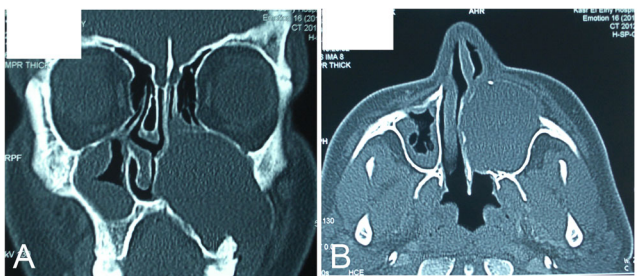

Fig. 1 A preoperative computed tomography for the paranasal sinuses. **a** Coronal and **b** axial views show completely opacified right maxillary sinus with homogenous cyst-like lesion and pushed nasal septum to the opposite side

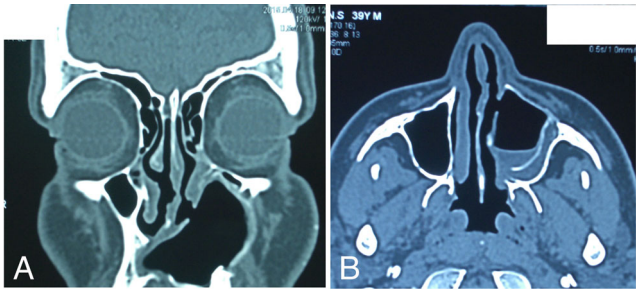

Fig. 2 A postoperative computed tomography for the paranasal sinuses. **a** Coronal and **b** axial views show clear right maxillary sinus and open marsupialization site

Discussion

Maxillary sinus mucocele is not a rare disease, it constitutes about 10% of paranasal sinus mucoceles. Many theoretical causes have been suggested for its development, such as chronic infection, allergic sinonasal disease, trauma, previous surgery, and even previous radiotherapy to the head and neck [2, 4, 7, 9]. The end result of these causes is obstruction of the sinus ostium, with accumulation of mucus within the sinus cavity that enlarges gradually, resulting in erosion and remodeling of the surrounding bone [7]. The obstruction of the mucus outflow in combination with the superimposed infection may cause release of cytokines from lymphocytes and monocytes, which in turn stimulate fibroblasts to secrete prostoglandins and collagenases that cause bone resorption leading to expansion of the mucocele [10].

In this study, we examined 36 patients with maxillary sinus mucoceles, aiming to analyze the possible predisposing factors and the clinical characteristics of the disease, and to assess the efficacy of trans-nasal endoscopic approach in the treatment of such lesions. The diagnosis of MSM was based mainly on CT radiographic findings, the mucocele appears as a homogenous lesion with smooth clear-cut margins of bone erosions in the sinus walls, the lesion is iso-dense with brain and no contrast enhancement, unless infected [2, 7, 11, 12]. Maxillary sinus mucocele may expand upwards to the orbit causing proptosis and may affect the visual acuity [3, 13], downwards to the alveolus can even cause loosening of teeth [14], medially to the nasal cavity displaces the inferior turbinate and causes nasal obstruction [15], and anteriorly to the cheek causing a unilateral facial swelling [7]. Surgical drainage and marsupialization is the standard surgical treatment of mucocele, recently endoscopic approach is preferable on external one, creation of a wide permanent opening is the goal to prevent recurrence [1, 5, 7].

Obstruction of the sinus ostium is accused to be the cause of mucocele development. Possible predisposing factors were identified in 16 (44%) out of 36 patients, 12 of our patients (33%) gave history of chronic sinusitis, seven of them were subjected to ESS, 3 patients had allergic rhinitis, and 1 patient had a history of nasal trauma. Martel-Martín et al. [1] found risk factors in 55% of their patients, surgical trauma was the most common condemned factor followed by nasal polyposis, facial fracture, and obstruction of the sinus ostium by osteoma. However, Lee and Lee [16] identified surgical trauma in all of their patients, and Bockmühl et al. [8] reported surgical trauma in 66% of their mucocele patients.

Mucocele of the maxillary sinus can present with a variety of symptoms which are related to their expansion and subsequent pressure on and obstruction of the surrounding anatomic structures [1, 7]. However, Garg et al. [17] reported that MSM may remain asymptomatic for years as long as it is not infected, as it needs a long time to enlarge enough and compresses the surrounding structures. A unilateral cheek pain was the most common presenting symptom in our patients, it was found in 30/36 patients (83%). Cheek heaviness and nasal obstruction were found in 28 patients (78%), half of our patients presented with cheek swelling, while cheek numbness was found in 14 patients (39%), and one third of our patients complained of hemifacial pain and headache. Proptosis was found in 10 patients (28%), and unilateral nasal discharge was a complaint in 7 patients (19%). Caylakli et al. [7] reported that MSM is commonly presented as a painless bulging of the cheek, and Martel-Martín et al. [1] found the same feature in half of their patients. Khong et al. [15] reported that medial expansion of the wall of the maxillary sinus into the nasal cavity may displace the inferior turbinate and causes nasal obstruction. Proptosis has been reported as a presenting symptom by many authors [3, 13, 14, 18], it is due to upward expansion of the antrum into the orbit with displacement of the orbital contents. Downward displacement into the alveolus may cause dental pain and loosening of teeth [7, 19]. However, stretch of the nerves which are situated in relation to the expanded sinus walls may be the cause of pain, headache, and/or numbness [1, 2].

There is a universal agreement that the treatment of MSM is surgical. Historically, the recommended treatment was complete excision through an open approach that includes Caldwell-Luc procedure with inferior antrostomy and removal of the mucocele lining [7]. However, Caldwell-Luc operation is accused to be a cause of development of maxillary sinus mucocele, it may be due to entrapment of sinus mucosa [1, 7, 16]. Recently, ESS is used for treatment of the disease, the objective of surgery is to marsupialize the cavity of the mucocele towards the nasal cavity, attempting to ensure good ventilation and drainage of the affected sinus with no hazards of preserving the external wall of the mucocele as the secreted mucus is healthy, and to resume its normal appearance when it is well ventilated [1, 8]. Many authors preferred ESS over the open approach as ESS is safe and effective in treatment of mucocele with a lower morbidity, reduced hospital stay, and a recurrence rate between 0.9 and 8% [3, 6, 18].

In our study, some difficulty was encountered in introducing the endoscope to the middle meatus as the medial wall of the maxillary sinus was displaced medially obstructing the nasal cavity, so inferior meatal antrostomy was performed as a routine technique, this is to facilitate drainage of mucocele and decrease the intra-sinus pressure with lateralization of medial maxillary wall to widen the nasal cavity. It was an important helpful step to reach comfortably to the middle meatus. None of our patients developed recurrence through the follow-up period; it may be attributed to the postoperative regular endoscopic examination and regular saline irrigation that dissolve crusts and debris to maintain the cavity of the mucocele open.

It is worth mentioning that our study is based on somewhat clinical and radiologic findings, and it does not include bacteriologic examination of the mucocele fluid content. A mucocele may remain latent for a long time until it enlarges enough and impinges on the surrounding structures. However, an infected mucocele which is termed mucopyocele can symptomatize early. So, it is better to examine the fluid content of the mucocele to detect if it is infected or not. As our study is a retrospective one, no bacteriological evaluation was available for our patients, so we recommend prospective studies with bacteriologic examination to determine the effect of infection on the clinical characteristics of the disease.

Conclusions

Finally, we can conclude that maxillary sinus mucocele has several predisposing factors such as chronic sinusitis, previous surgery, allergic rhinitis and nasal trauma. However, some patients have no identifiable cause. Although the disease is benign, it can present with a variety of symptoms which are related to their expansion and subsequent pressure on the surrounding structures, and CT is a helpful diagnostic tool. Endoscopic marsupialization through the middle meatus is a safe and effective treatment, however, patients with large maxillary sinus mucocele may need to empty the fluid through the inferior meatus to facilitate introduction of the instruments to the middle meatus. Postoperative regular endoscopic examination and saline irrigation are important methods to prevent recurrence.

Compliance with ethical standards

Financial disclosure None.

Competing interests The authors declare that they have no competing interests.

Ethical approval The study was approved by the institutional ethical committee.

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