Treatment approaches for maxillary sinus cysts

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Abstract

Maxillary sinus cysts are frequently asymptomatic and are often discovered accidentally on radiographs. Panoramic radiography and plain radiography of the skull can be used in routine practice to highlight these cysts, which usually appear as rounded, dome-shaped masses located on the floor of the maxillary sinus. Computed tomography (CT) should be used to determine their dimensions or relationship to neighboring anatomical structures.

Treatment of maxillary sinus cysts is consistent with their size, location, pathology and potential for recurrence. Interdisciplinary treatment planning is important in its long-term success. The following surgical methods are described as treatment methods: marsupialization, enucleation or radical cure (extirpation of the cystic membrane) and radical cure by the rhinological method and as an exceptional, sometimes transient method, the drainage of the cystic content through a polyethylene tube.

Keywords: maxillary sinus cysts, treatment methods, marsupialization, enucleation

INTRODUCTION

The maxillary sinus was first illustrated by Leonardo da Vinci, but the first scientific description was made by the British surgeon Nathaniel Highmore [1].

The maxillary sinus is located infraorbital, posterior to the anterior wall of the maxillary bone and superior to the alveolar bone. It has a pyramidal shape with average dimensions of 33 mm vertically, 23 mm transversely, 34 mm sagittally and a volume of approximately 15 cc (Figure 1) [2].

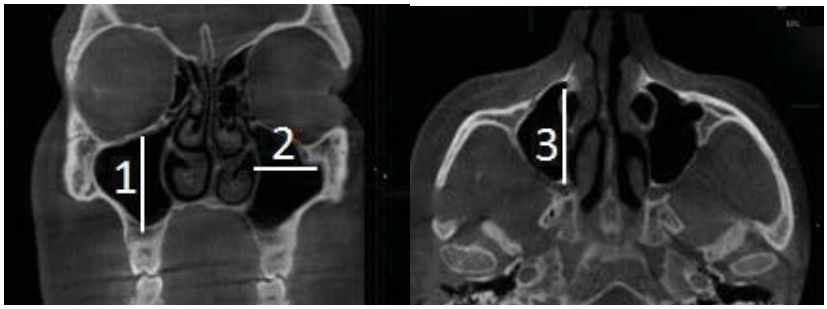

Figure 1. The average dimensions of the maxillary sinus: 1 - inferosuperior 33 mm, 2 - mediolateral 23 mm, 3 - anteroposterior 34 mm

Maxillary sinus cyst is a cavitary lesion consisting of an epithelial sac, containing liquid or semi-solid material and surrounded by a capsule of fibrous connective tissue. The origin of the epithelium delimiting the cyst cavity divides cysts into odontogenic or non-odontogenic. Odontogenic cysts are more common and often come from ectomesenchymal structures involved in odontogenesis [2,3]. The World Health Organization divides odontogenic cysts into developmental and inflammatory cysts. The most common types of developmental cysts are follicular (denting) cysts and odontogenic keratocysts, and inflammatory cysts are mainly radicular [4,5].

Maxillary sinus cysts can arise either from the lining of the sinus (intrinsic cyst) or from adjacent tissues (maxillary bone, maxillary tooth). Mucous retention cyst is the most common intrinsic cyst of the maxillary sinus. It usually arises from the floor or walls of the sinus. Large cysts can cause facial deformity. On imaging, an opacification is usually seen in the maxillary sinus. Computed tomography (CT) should be used to assess the nature, size, or relationship of cysts to adjacent anatomical structures. Most extrinsic maxillary sinus cysts are dental in origin and are most likely dentigerous cysts. Other dental cysts in the maxillary sinus are odontogenic keratocyst, radicular cyst, median palatine cyst and nasopalatine duct cyst. Root cysts are associated with the tip of the root of a tooth with complicated decay and are usually a few millimeters to a centimeter in size [6-8]. Large cystic mass that grows to occupy almost the entire maxillary sinus is rare and has rarely been reported in the literature [6,9,10].

Maxillary sinus cysts are frequently asymptomatic and discovered incidentally on radiographs. Some of them grow in size and cause symptoms by obstructing the maxillary sinus. Rarely they may protrude into the middle meatus and mimic antrochoanal polyps, or erode the bony walls and emerge into the inferior meatus by making a defect in the medial wall of the maxillary sinus [11-13].

When a common pathology has an unusual presentation, it is important to evaluate it gradually to avoid misdiagnosis. The final diagnosis of these cystic lesions is possible only after their histological evaluation.

Aim and objectives

In this study we summarized the different surgical treatment modalities performed for cystic lesions of the jaws.

METHODS OF TREATMENT OF MAXILLARY SINUS CYSTS

1. *Marsupialization,* also called the Partsch I operation or cystotomy, involves making an incision in the capsule of the cyst, lowering the intracystic pressure and evacuating its contents. The edges of the cyst are frequently sutured to the healthy surface of the oral mucosa to make a large, permanent opening (Figure 2a). Maxillary cysts can also be marsupialized in the maxillary sinus or nasal cavity (Figures 2b, 2c) [14-16].

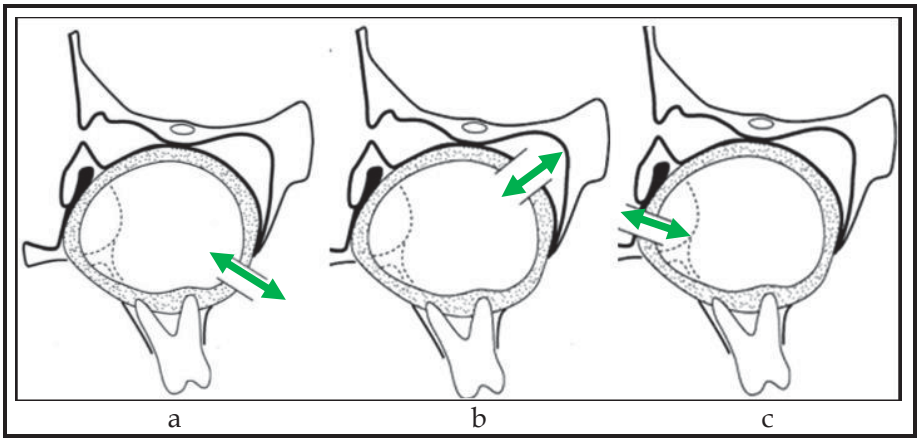

Figure 2. Marsupialization of a maxillary cyst: a) to the oral cavity, b) into the sinus, c) to the nasal cavity

2. *Decompression* is the treatment method by which the pressure inside the cyst is reduced through a small opening that is maintained with the help of a drain or obturator (Figure 3). It is removed daily and the cyst cavity is irrigated. Thus the cyst decreases in size and tissue damage is reduced during its subsequent enucleation [17,18].

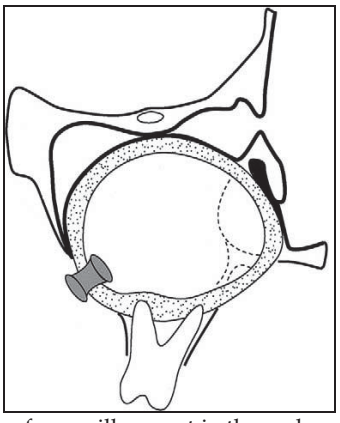

Figure 3. Decompression of a maxillary cyst in the oral cavity with a drainage tube

The Odontogenic Cyst Evacuator (Evocyst) (Figure 4) is a vacuum-like device used to apply active negative pressure inside a cyst and stimulate osteogenesis [19]. The device provides a negative pressure of 45 mmHg. The intraoral unit is a two-way tubing system: irrigation and decompression. A lavage solution (normal saline solution 0.9%) is introduced through the irrigation tube. A suction or decompression tube is attached to the irrigation tube.

The distal ends of both tubes are inserted into the cavity. The anterior end of the decompression tube connects to the apparatus [20-22]. The intraoral unit is fixed to the teeth with orthodontic wire (Figure 5) [21].

Figure 4. Evacuator for odontogenic cysts (Evocyst) [21,22] (Modified image); a) Component parts: A - extraoral unit (vacuum), B - intraoral unit, a double-way tubing system (irrigation and decompression tubes); b) Liquid collected in outdoor unit

Figure 5. Intraoral unit fixed with orthodontic wire to the teeth: upper - decompression tube; lower – irrigation tube (a needle port – green arrow) [21] (Modified image)

3. *Enucleation,* also called the Partsch II operation or cystectomy, is a surgical technique in which the pathological tissue is completely removed and the edges of the wound are sutured. The attitude towards the cystic membrane is radical, with its complete removal [23]. Enucleation is indicated for unicystic ameloblastomas of the luminal and intraluminal subtype that do not show extraosseous spread: dentigerous cyst, radicular cyst, glandular odontogenic cyst, botryoid odontogenic cyst [24]. The enucleation and curettage procedure is limited in the treatment of multicystic lesions because the enucleation process may not completely remove the pathological tissue and physical and chemical curettage may not be able to access or remove all remnants of the cystic lesion. [25]. To facilitate cyst removal and ensure complete enucleation, various modifications of this method have been proposed, which attempt to address residual tissue to prevent recurrence [26]. Enucleation followed by superficial cautery may be used for some aggressive maxillary cysts [27]. Other proposed adjuvant treatments are: cryotherapy (freezing) with liquid nitrogen and the use of Carnoy's solution (absolute ethanol, chloroform, acetic acid, formalin) in the cyst cavity after enucleation [28, 29].

The classic Caldwell-Luc surgical technique is over 125 years old and involves opening the maxillary sinus at the level of its anterior wall through a gingival-labial incision, ensuring surgical drainage in the inferior meatus, to evacuate the pathological contents. The

incision is made 3 mm above the reflection line, from the lateral incisor to the second molar. The mucoperiosteal tissue is reflected inferiorly and superiorly over the canine fossa to the infraorbital foramen so as not to injure the nerve (Figure 6). The surface of the jaw bone is exposed. With spherical cutters at low speed or with chisel and hammer, a circular opening of approximately 1.5-2 cm is made in the maxillary antrum, between the canine and the first premolar (canine fossa). Cystectomy is performed and the membranes of the inflamed sinuses are enucleated [30-32].

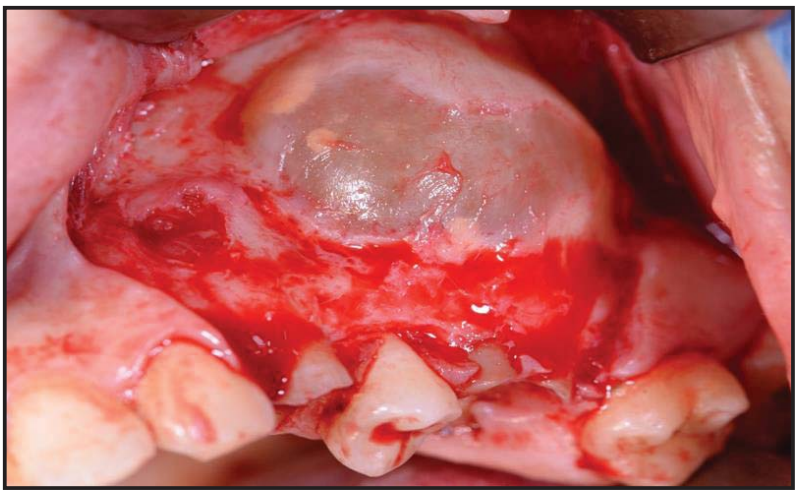

Figure 6. Detachment of the muco-periosteal flap with the exposure of the cystic lesion

4. *Functional endoscopic sinus surgery (FESS)* replaces the radical Caldwell-Luc approach, for several reasons: it is more conservative, has a higher cure rate and a lower complication rate [33-35]. Cystectomy can be performed in three ways: through the natural sinus ostium, through the inferior meatus or through the canine fossa (Figures 7,8). The cyst is extracted through the cannula or lower antrostomy [36].

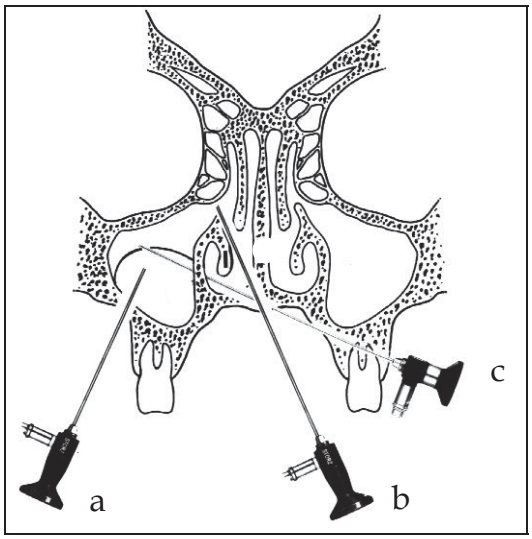

Figure 7. Endoscopic approach to the maxillary sinus with a trocar: a - through the natural ostium, b - through the inferior meatus, c - through the canine fossa [33] (Modified image)

Figure 8. Endoscopic image of a mucocele

RESULTS AND DISCUSSIONS

Aggressive surgical treatments for maxillary sinus cysts, such as partial resection, have a low risk of recurrence, but have the major disadvantage of leading to jaw deformity and the need for subsequent reconstruction [37].

Marsupialization/decompression are treatments that last from 2 to 80 months, with an average of 6-14 months, so they are not accepted by all patients. Most studies consider these techniques to be necessary prior to treatment with enucleation and curettage [38-40]. Nakamura *et al*. evaluated the effects of marsupialization on odontogenic keratocysts, finding that this method is effective as a preliminary treatment [41]. Al-Moraissi *et al*. concluded that cystectomy is necessary after marsupialization to reduce the recurrence rate [42]. Castro *et al*. demonstrated in their study a lower recurrence rate in decompression, followed by enucleation compared to pure enucleation [43]. Tabrizi *et al*. compared the recurrence rate between marsupialization and decompression in the treatment of keratocystic odontogenic tumors with or without adjuvant treatments. They concluded that the recurrence rate for decompression without adjuvant treatment may be lower than for marsupialization, this being no different when enucleation was performed after marsupialization/decompression [44].

The decompression of the cystic cavity determines the achievement of a negative pressure that facilitates the formation of new bone. Because it is a method that requires time and patient compliance, the combined use of platelet-rich fibrin (LPF) and bone meal, which promotes osteoblast proliferation, has been promoted in recent years [45,46].

Endoscopically assisted surgical treatment of maxillary cysts can reduce the surgical trauma to some extent and help the doctor to determine whether the residual cyst tissue has been completely removed. At the same time, damage to the tissues around the cyst is avoided and operative time is reduced, as most of the affected teeth can be saved [47-49].

In the endoscopic era, the Caldwell-Luc surgical technique is often used because it provides easy access to the maxillary sinus when endoscopic sinus surgery (ESS) is insufficient. These two methods can be used simultaneously, the surgical instruments and the

endoscope can help each other due to the presence of two openings in two different planes [50].

CONCLUSIONS

Indications for such marsupialization and decompression are large cysts with thin bony walls that may cause spontaneous fracture, cysts that are very close to structures such as the n. alveolaris inferior or nasal floor, and infected cysts. Marsupialization/decompression should be used in cooperative patients to avoid complications and relapses.

For large cysts, a two-stage therapeutic approach, marsupialization followed by enucleation, allows preservation of important structures, reduces sequelae and the need for aggressive and expensive surgical reconstruction.

Treatment of maxillary sinus cysts depends on the extent, location and associated infections of the cystic lesion, histopathological features, as well as the characteristics of each patient.

Endoscopic sinus surgery is an effective treatment for odontogenic cysts.

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