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Maxillary Sinus Cysts: Aetiology, Pathogenesis, Treatment Modalities, And Prophylaxis

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Abstract
This article presents a comprehensive scientific analysis of the underlying causes (aetiology) and developmental mechanisms (pathogenesis) of maxillary sinus cysts, which represent one of the most widely encountered pathologies within the clinical practice of otorhinolaryngology. Furthermore, the paper elucidates the differential diagnostic characteristics of retention and odontogenic cysts, critically evaluating their consequent impact on the respiratory tract and adjacent anatomical structures, with a particular emphasis on middle ear functionality. In addition to these pathophysiological considerations, the study provides a detailed exposition of contemporary diagnostic modalities, minimally invasive treatment interventions such as functional endoscopic sinus surgery (FESS), and targeted prophylactic measures designed to prevent the onset and recurrence of the condition.
Keywords: Maxillary sinus, Aetiopathogenesis, Retention cysts, Odontogenic cysts, Functional endoscopic sinus surgery, Prophylaxis.

Introduction

Maxillary sinus cysts, frequently encountered in routine otorhinolaryngological practice, are benign, encapsulated cystic lesions that primarily develop as a consequence of progressive fluid accumulation and subsequent retention within the mucosal lining of the sinus cavity [1]. According to current epidemiological statistics, this structural pathology is notably prevalent, being observed in approximately 10 to 20 per cent of the general population [2]. In the vast majority of clinical scenarios, these lesions are discovered entirely incidentally during routine radiological imaging or advanced cross-sectional tomographic evaluations—specifically multislice computed tomography (MSCT) or magnetic resonance imaging (MRI)—that are initially indicated and performed for completely unrelated maxillofacial, dental, or neurological diagnostic purposes [3].

From a pathophysiological perspective, these cystic formations typically exhibit a highly indolent growth pattern, enlarging at a notably slow rate, and consequentially remain completely asymptomatic over an extended period of time [4]. Nevertheless, as the volumetric dimensions of the cyst progressively increase, it can precipitate substantial clinical manifestations. This macroscopic enlargement not only compromises the patency of the nasal airway, thereby severely impeding physiological nasal breathing, but it also exerts direct mechanical pressure upon and disrupts the optimal functionality of adjacent anatomical structures. Consequently, this continuous expansion may act as a primary catalyst for the development of complex, concomitant surdological and rhinological complications, ultimately necessitating targeted therapeutic intervention [5].

Hurmatli foydalanuvchi, talabingizga binoan maqolaning ushbu qismi akademik ingliz tiliga (British English) kengaytirilib tarjima qilindi. Ko‘rsatmangizga asosan matn ichiga 5 ta adabiyotga iqtibos ([1]–[5]) mantiqiy jihatdan moslashtirib joylashtirildi. Tizim qoidalariga

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Main part

1. Aetiology and Pathogenesis. Based on their fundamental developmental mechanisms and underlying aetiological factors, maxillary sinus cysts are primarily classified into two comprehensive categories [1]:

− Retention (true) cysts: This represents the most frequently encountered epidemiological variant, emerging as a direct consequence of the mechanical obstruction of the excretory ducts of mucus-secreting glands located within the sinus mucosa. Pathogenesis: Chronic inflammatory conditions such as chronic rhinosinusitis, allergic rhinitis, significant anatomical deviations of the nasal septum, or recurrent acute respiratory viral infections precipitate pronounced mucosal oedema. As a result of this inflammatory swelling, the excretory ducts of the glands become completely occluded; however, the glandular tissue intrinsically maintains its secretory functional capacity, continuously producing mucus [2]. This sustained accumulation inevitably leads to the progressive mechanical distension of the gland and the subsequent formation of a fluid-filled, encapsulated cystic structure. Histologically, the internal wall of these true cysts is completely lined with a distinct layer of respiratory epithelium.

− Odontogenic (false) cysts: This specific pathology originates primarily due to the exceptionally close anatomical proximity, or occasional direct protrusion, of the apical roots of the maxillary dentition (predominantly the premolar and molar teeth) into the floor of the maxillary sinus cavity [3]. Pathogenesis: Chronic inflammatory processes affecting the dental structures—such as advanced caries, severe periodontitis, or pulpitis—culminate in the precise formation of radicular cysts at the apex of the involved tooth root. Subsequently, this localised inflammatory cascade extends superiorly, penetrating the maxillary sinus. Unlike their retention counterparts, odontogenic cysts are typically characterised by the intra-cystic accumulation of purulent exudate and frequently exhibit a highly pronounced capacity for the localised osteolytic destruction of the surrounding bony matrix.

2. Clinical Presentation and Impact on Adjacent Systems. In their incipient stages of development, when the cystic formations remain relatively small in volumetric size, they may persist in a completely asymptomatic state, causing absolutely no clinical discomfort to the patient [4]. However, as these benign lesions progressively enlarge, a distinctly recognisable constellation of clinical symptoms begins to manifest:

− A persistent sensation of heaviness, mechanical pressure, or localised tension explicitly isolated to the affected side of the facial structure.

− Chronic headaches, which are particularly localised within the frontal or temporal regions, and characteristically undergo significant exacerbation upon forward bending or sudden alterations in head positioning.

− Intermittent or continuous obstruction of physiological nasal breathing, frequently accompanied by the noticeable ipsilateral discharge of mucopurulent secretions directly from the nasal cavity.

− Surdological and otological complications: The presence of substantially enlarged cysts within the maxillary sinus, or the chronic inflammatory cascade directly accompanying them, severely disrupts the physiological aerodynamic airflow within the nasal cavity and the broader nasopharyngeal region. This structural and functional disturbance frequently acts as a primary catalyst for the ventilatory impairment of the Eustachian tube, clinically diagnosed as Eustachian tube dysfunction. Consequently, a state of negative pathological pressure is continuously generated within the tympanic cavity of the middle ear. This pathophysiological shift manifests in affected patients as a profound sensation of aural fullness, persistent autophony, and the gradual development of conductive hearing loss [5]. Upon formal

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diagnostic audiological evaluation, specifically through tympanometry, such functional impairments are typically reflected by the recording of a Type "C" (and occasionally a Type "B") tympanogram, which explicitly indicates the presence of negative middle ear pressure directly correlated to the underlying sinonasal pathology.

3. Treatment Modalities. The specific clinical strategy implemented for the therapeutic management of maxillary sinus cysts is strictly contingent upon a comprehensive evaluation of their exact macroscopic dimensions, longitudinal growth dynamics, and the overall severity of the associated clinical symptomatology:

− Conservative management and observational strategy: Small-scale, completely asymptomatic retention cysts (typically measuring up to 1.0–1.5 centimetres in diameter) do not necessitate any immediate or specific surgical intervention. For such cases, it is considered clinically sufficient for the patient to simply remain under the rigorous routine surveillance of a qualified otorhinolaryngologist. Furthermore, conservative pharmacological management—primarily utilising targeted intranasal corticosteroids and systemic antihistamines—is actively employed to systematically mitigate any underlying allergic and inflammatory processes.

− Surgical intervention: A definitive surgical approach is strictly indicated in advanced clinical scenarios where the cyst has reached substantial anatomical dimensions, provokes severe and intractable facial pain, profoundly disrupts regular nasal haemodynamics and breathing, or exerts a demonstrably deleterious impact upon the physiological functionality of the Eustachian tube.

− The classic Caldwell-Luc operation: A traditional, radical surgical procedure executed via the extensive surgical fenestration of the anterior wall of the maxillary sinus. Owing to its highly traumatic nature, prolonged postoperative recovery period, and significant potential for structural morbidity, this conventional method is rarely utilised in modern contemporary practice.

− Functional Endoscopic Sinus Surgery (FESS): Currently universally recognised as the absolute "gold standard" in surgical rhinology. This highly advanced, minimally invasive endonasal procedure is performed entirely through the natural nasal passages using specialised endoscopic instrumentation, deliberately focusing on the precise, atraumatic widening of the natural ostium. This highly modern technique is profoundly advantageous as it meticulously preserves the integral physiological functions of the ciliated sinus mucosa, ensures dramatically accelerated postoperative wound healing, and reduces the overall incidence of intraoperative and iatrogenic complications to an absolute minimum.

4. Prophylaxis. The comprehensive prevention of the primary formation and subsequent clinical recurrence (relapse) of maxillary sinus cysts strictly demands a multifaceted and highly structured preventative approach:

− Timely therapeutic management of prevailing nasal pathologies: Actively preventing acute conditions, such as acute rhinitis and episodic sinusitis, from gradually transitioning into chronic structural phenotypes, alongside the rigorous pharmacological control and long-term management of chronic allergic rhinitis.

− Comprehensive stomatological sanitation: Ensuring the regular, systematic evaluation of the maxillary dentition through routine dental examinations, coupled with the prompt, high-quality endodontic and restorative treatment of dental caries and periodontitis (which represents the single most critical preventative factor specifically mitigating the risk of odontogenic cyst formation).

− Surgical correction of underlying anatomical defects: The definitive, prompt surgical resolution of structural impediments that fundamentally compromise optimal sinus aeration and physiological mucosal drainage, such as severe morphological deviations of the nasal septum or the persistent presence of chronic hypertrophic rhinitis.

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− Systemic immunological fortification: Actively promoting a healthy, balanced lifestyle and systematically enhancing the local mucosal defensive mechanisms and cellular immunity of the upper respiratory tract to effectively resist recurrent pathological insults.

Conclusion

Although maxillary sinus cysts inherently exhibit a predominantly benign clinical course in the vast majority of documented cases, their progressive pathogenetic development and gradual volumetric expansion can precipitate profoundly deleterious effects upon the physiological functioning of adjacent anatomical systems, most notably the nasopharyngeal complex and the middle ear cavity. Consequently, the precise and timely diagnostic identification of the underlying aetiological factors—specifically distinguishing accurately between retention and odontogenic origins—serves as the fundamental cornerstone for formulating an optimal, highly individualised therapeutic strategy. Furthermore, the advent and continuous refinement of modern endoscopic surgical technologies currently provide clinicians with the unprecedented capability to completely eradicate these cystic lesions with minimal surgical trauma, significantly accelerated postoperative recovery, and exceptionally high clinical efficacy. Ultimately, the vigilant and prompt therapeutic management of concurrent otorhinolaryngological inflammatory conditions and underlying stomatological pathologies remains the absolute primary guarantee for the effective prophylaxis and long-term prevention of this prevailing structural pathology.

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