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RESEARCH ARTICLE

Unmasking Silent Sinus Syndrome: The Concha Bullosa Connection

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Abstract: Silent sinus syndrome is a clinical entity which deals with Enophthalmos and hypoglobus, with maxillary sinus hypoplasia and orbital floor resorption. It results from maxillary sinus atelactesis due to chronic ipsilateral hypoventilation either idiopathic, surgery or trauma.The authors report a case of 52 year old female, came with the complaints of left eye asymmetry, Hertel exophthalmometry revealed a 4mm enophthalmos on the left eye. Imaging studies revealed left maxillary sinus hypoplasia, with minimal mucosal thickening and lowering of left infraorbital floor with left concha bullosa. patient underwent successful left middle meatal antrostomy with conchoplasty followed by trans-conjunctival orbital floor repair .This case highlights the pathophysiology of concha bullosa causing the silent sinus syndrome presenting with ophthalmological complaints and sussessful antrostomy with conchoplasty and orbital floor repair in the management of this clinical entity and serve as a catalyst for further research on this significant medical issue faced by patients with concha bullosa.

Keywords: Silent sinus syndrome, Concha bullosa, Enophthalmos, Hertel exophthalmometry, Antrostomy.

INTRODUCTION

Silent Sinus Syndrome (SSS) is a condition where the eye sinks and the lower eyelid retracts due to negative pressure in the maxillary sinus, leading to gradual absorption of the sinus walls and orbital floor. Since it is asymptomatic, called as Silent Sinus Syndrome.Originally considered idiopathic, it can also result from trauma or surgery. First described in 1964 by Montgomery and named in 1994, SSS is otherwise known as 'imploding antrum' or chronic maxillary sinus atelectasis which is thought to result from sinus outflow obstruction creating negative pressure and characterized by a sustained reduction in sinus volume due to the inward retraction of the maxillary sinus walls.This vacuum effect leads to bone resorption, sinus wall retraction, and downward displacement of orbital contents [7]. SSS typically affects people in their 30s to 50s and presents with orbital asymmetry, deepening of the superior sulcus, and occasionally diplopia or ptosis [1]. Concha bullosa, a deviated nasal septum, and acute or chronic infections are significant risk factors for the development of silent sinus syndrome (SSS). Concha bullosa refers to the air- filled cavities(pneumatisation) of middle turbinate. Concha bullosa originates via the frontal recess or agger nasi cells, is unlikely to cause sinusitis through mucosal changes alone. However, large concha bullosa may contribute to sinusitis by causing obstruction.[8].This alters the normal air flow and mucosal drainage pathways, leading to mucosal edema and obstruction of osteomeatal complex [3,9]. CT studies report a 14-53% incidence of middle turbinate concha bullosa, with its link to paranasal sinus disease remaining controversial [10].

CASE REPORT:

A 52 year-old female was referred by ophthalmology clinic with the complaints of left eye progressive asymmetry over 1 year. No h/o diplopia, ptosis, lacrimation from eyes, visual disturbances. Patient reported no previous history of sino-nasal symptoms, facial trauma, malignancy, nasal surgeries. Visual acquity is normal,

Hertel exophthalmometry revealed a 4mm enophthalmos on the left eye as in figure 1.

Figure 1: Anterior view of patient image showing left eye enophthalmos

Nasoendoscopic examination of nose revealed mild Deviated nasal septum towards right with right inferior turbinate hypertrophy with enlarged left middle turbinate. Initially computed tomography (CT) orbit revealed an opacified hypoplastic left maxillary sinus with minimal mucosal thickening at the left ostiomeatal complex with left concha bullosa,and lowering of

inferior orbital wall with increased orbital volume resulting from osteopenia as in figure 2.

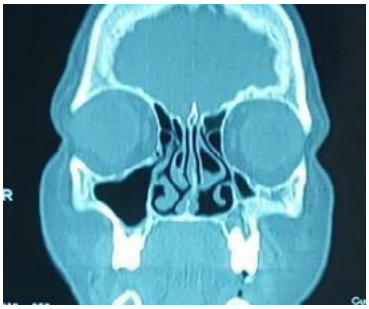

Figure 2: CT-PNS coronal section showing left maxillary sinus hypoplasia with minimal mucosal thickening, and increased left orbital volume, with left concha bullosa impinging the osteomeatal complex, contralateral sinus is unaffected

The left frontal, ethmoidal and sphenoidal sinuses were and contralateral sinuses were normal. Patient underwent left middle meatal antrostomy with left conchoplasty followed by trans-conjunctival orbital floor repair with Medpore implant.No intraoperative complications were noted. Biopsy of the sinus mucosa reported as chronic inflammation and culture sensitivity showed negative for bacteria. Postoperatively patient improved clinically with Hertel exophthalmometry showed 0 mm within 6 months.

Silent Sinus Syndrome (SSS) is an uncommon clinical entity predominantly affecting the maxillary sinus, characterized by chronic maxillary sinus atelectasis leading to progressive orbital and facial deformities. This condition typically manifests with enophthalmos (posterior displacement of the eye) and hypoglobus (downward displacement of the globe), often without overt sinonasal symptoms. In 1997, Kass introduced a classification system for chronic maxillary atelectasis (CMA), categorizing it into three stages based on severity. Stage I involves lateralization of the maxillary fontanel, Stage II is characterized by inward bowing of one or more osseous walls of the maxillary sinus, and Stage III presents with clinical deformities such as enophthalmos, hypoglobus, and midfacial asymmetry.

Brandt and Wright later argued that SSS represents a specific subtype within the spectrum of CMA. Expanding the scope of silent sinus pathologies, Brown and McArdle[4,5] reported two cases involving the ethmoid sinus, coining the term "silent ethmoid sinus syndrome," while Naik documented a case of "silent frontal sinus syndrome"[6]. Interestingly, bacterial cultures in SSS are typically negative, reinforcing its non-infective etiology[1].

Silent Sinus Syndrome (SSS) is thought to arise from the complete obstruction of the maxillary sinus ostium, which leads to prolonged negative pressure within the sinus. This negative pressure results in hypoventilation and accumulation of secretions. Over time, gas resorption creates a vacuum effect, causing osteopenia (bone loss), bone remodeling, and retraction of the sinus wall. This process results in thinning of the orbital floor, which can no longer adequately support the eye, causing it to sink inward and leading to enophthalmos.

Diagnosing SSS accurately is essential because its symptoms can resemble those of other conditions, such as tumors, trauma, congenital facial asymmetry, diffuse facial lipodystrophy, Parry-Romberg syndrome, and linear scleroderma. Each of these conditions requires different management approaches [2]. In some severe instances, reconstructing the orbital floor may require the use of a titanium mesh or autogenous cartilage.[3]

Ophthalmological presentations in SSS include Enophthalmos ranging from 1 to 6 mm, Hypoglobus ranging from 0 to 6 mm, Apparent retraction of the eyelid, Lagophthalmos, Normal eye mobility and visual function, Sinking of the eye, orbital asymmetry, Deepening of the superior sulcus, diplopia, ptosis, blepharoptosis or oscillopsia.

Radiological presentations in SSS include lateral retraction of the uncinate process, partial or complete opacification of the maxillary sinus with or without air-fluid levels and thickened mucosa , lowering of the inferior orbital wall, often with osteopenia, partial or complete resorption inward retraction of other sinus walls, nasal septum deviation often towards the involved sinus, lateralization of the ipsilateral middle nasal concha.

Two hypotheses explain the relationship between concha bullosa and a deviated nasal septum (DNS): the e vacuo theory suggests DNS creates a contralateral nasal space that promotes concha bullosa formation, while the second posits they are incidental coexisting findings.

This study challenges the e vacuo hypothesis, finding no statistical link between concha bullosa and contralateral DNS. However, one study reported a significant association between DNS and unilateral, but not bilateral concha bullosa [11,12]. Middle turbinate concha bullosa is classified into three types: lamellar [22.2%](pneumatization of the vertical lamella), bulbous [28.3 %] (pneumatization of the inferior part), and extensive [49.5 %] (pneumatization involving both the vertical and inferior parts)[9,13]. Sinonasal tract diseases can impact concha bullosa, causing mucosal thickening, mucus retention, mucocele, or pyocele within the middle turbinate. Middle turbinate concha bullosa is usually asymptomatic and is often incidentally detected during nasal endoscopy or CT paranasal scan. However, excessive pneumatization may cause nasal obstruction, contact headaches, deviated nasal septum, or chronic sinusitis, leading to symptoms like nasal blockage, epistaxis, and headaches [13], and it also plays a role in

Silent sinus syndrome by blocking of osteomeatal complex and negative maxillary sinus pressure.

CONCLUSION:

Patients with silent sinus syndrome commonly present to an ophthalmologist with enophthalmos, regardless of the underlying cause. After a comprehensive evaluation, concurrent surgical correction of the sinus pathology and enophthalmos is typically effective. Understanding the importance of identifying and managing Concha bullosa in patients with or without sinonasal complaints to prevent or mitigate the risk of developing

Silent sinus syndrome. Early diagnosis of Silent Sinus Syndrome (SSS) is essential to prevent orbital complications, vision disorders, and facial deformities. It allows for less invasive surgical interventions, by facilitating careful analysis of imaging studies.

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