

Maxillary sinus hypoplasia

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Abstract

Functional endoscopic sinus surgery (FESS) is now a routine surgical procedure performed all around the world. A pre-operative computed tomography (CT) scan is considered mandatory in most countries where these are available but there are still some surgeons who question the need for imaging especially in patients due to undergo limited FESS or middle meatal antrostomy. There are excellent papers, describing how to read scans looking for anatomical abnormalities, but unfortunately their description of maxillary sinus hypoplasia and the associated uncinate process deformities are limited. This article describes two cases, one of unilateral and one of bilateral maxillary sinus hypoplasia (MSH) and discusses their implications. Awareness of these anatomical variants is crucial to avoid orbital complications.

Key words: Paranasal Sinuses; Surgical Procedures; Operative; Orbit; Post Operative Complications

Introduction

The decision to perform endoscopic sinus surgery is made on the basis of the history, endoscopic findings and failed response to medical treatment. A CT scan is performed pre-operatively to assess the extent of the pathology and as a 'road map for surgery'. Anatomical variants can be noted by the surgeon and complications avoided. There are excellent papers describing, how to systematically read scans¹ and what anatomical abnormalities could be present² but they do not describe in detail maxillary sinus hypoplasia and associated uncinate process abnormalities, which is crucial for avoiding complications, even in limited endoscopic sinus surgery.

Case reports

Case 1

A 47-year-old female patient presented with a history of recurrent acute sinusitis needing multiple courses of antibiotics. There was no previous history of surgery or facial trauma. The symptoms were more marked on the right side compared to the left. Nasal endoscopy, due to a crowded middle meatus on both sides, did not give a very clear picture of the ostiomeatal complex but mucosal oedema was noted. A CT scan was performed prior to endoscopic sinus surgery. The scan clearly shows in coronal (Figure 1) and axial planes (Figure 2) a left maxillary sinus hypoplasia and hypoplastic uncinate process directed to the inferior wall of the orbit. The patient underwent anterior ethmoidectomy and right middle meatal antrostomy.

Case 2

A 62-year-old female patient presented with a history of chronic rhino-sinusitis, which had failed to respond to maximal medical therapy by her general practitioner.

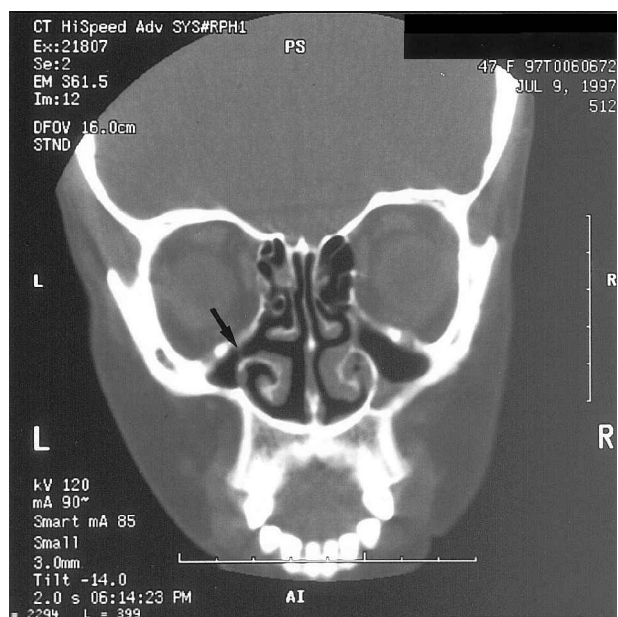


FIG. 1

Coronal CT scan showing left maxillary sinus hypoplasia. Uncinate process is hypoplastic (black arrow).

There was no previous history of facial trauma nor nasal surgery. Nasal endoscopy showed no apparent abnormality on the left side but showed a concha bullosa on the right side and a congested ostio-meatal complex. A CT scan was requested, which showed bilateral maxillary sinus hypoplasia and right ethmoid disease (Figure 3). The uncinate process was not identified on either side. This patient underwent right-sided endoscopic surgery.

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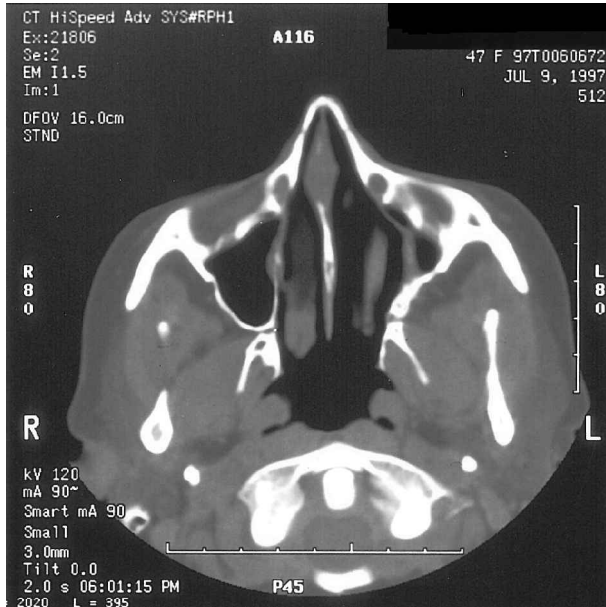


FIG. 2

Axial CT scan showing left maxillary hypoplasia.

Discussion

Maxillary sinus aplasia is an extremely rare condition, only six cases have been described in the world literature.³ Maxillary sinus hypoplasia (MSH) is a clinical entity known to anatomists and otolaryngologists. Unilateral hypoplasia has been reported in 1.73 per cent⁴ to 10.4 per cent⁵ and bilateral hypoplasia in 7.2 per cent.⁴

The reasons for maxillary sinus hypoplasia are poorly understood. Hall⁶ has proposed intra-uterine developmental abnormalities and Wasson⁷ has suggested sinus infection during the first year of life as reasons for maxillary sinus hypoplasia.

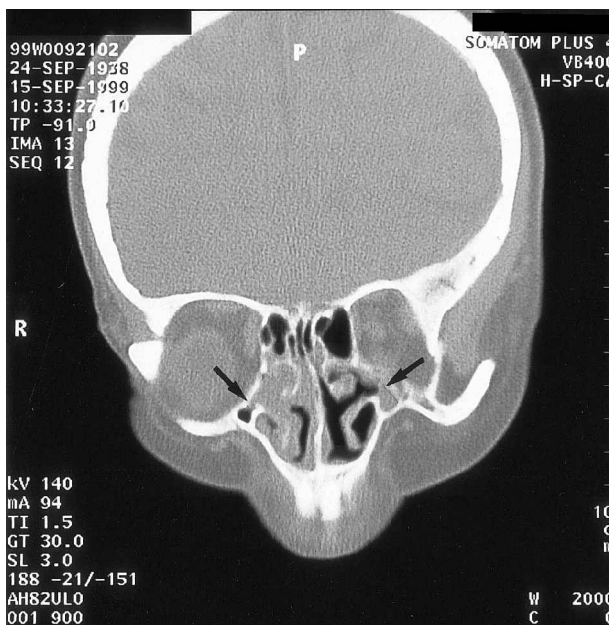


FIG. 3

Coronal CT scan showing bilateral maxillary sinus hypoplasia. Uncinate process is absent on both sides (black arrows).

TABLE I
CLASSIFICATION OF MAXILLARY SINUS HYPOPLASIA

Type 1	Mild sinus hypoplasia Normally developed uncinate process Well-developed infundibular passage Varying degree of mucosal thickening of affected sinus
Type 2	Significant sinus hypoplasia Hypoplastic or absent uncinate process Ill-defined or absent infundibular passage. Total opacification of affected sinus
Type 3	Profound sinus hypoplasia: sinus represented by shallow cleft in the lateral nasal wall of the nose Absent uncinate process

Bolger *et al.*⁵ have described the association between hypoplasia or aplasia of the uncinate process and maxillary sinus hypoplasia. Ethmoidal and maxillary structures are intimately related in the embryogenesis of the maxillary sinus and it follows that abnormal development of the uncinate process may follow the abnormal development of the maxillary sinus. They have classified MSH in to three types (Table I). In our patients, *Case 1* falls into type 2 hypoplasia and *Case 2* falls in to type 3 hypoplasia of the Bolger *et al.*⁵ classification.

Geraghty and Dolan⁸ have described diagnostic criteria for the maxillary sinus hypoplasia and they are:

- (1) Enlargement of vertical orbit.
- (2) Lateral position of infra-orbital neurovascular canal.
- (3) Elevated canine fossa.
- (4) Enlargement of superior orbital fissure.
- (5) Enlargement of pterygopalatine fissure.

In Figure 1 enlargement of the vertical orbit, lateral position of infraorbital neurovascular canal and elevated canine fossa are seen.

Bassiouny *et al.*⁹ have classified maxillary sinus hypoplasia into developmental and acquired categories.

The developmental categories are:

- (1) Isolated hypoplasia, either primary or related to arrested development secondary to infection, trauma or irradiation.
- (2) Regional developmental anomalies such as facial dysostosis.

The acquired categories are:

- (1) Trauma with deformity due to healing of a fracture or post-operative hypoplasia.
- (2) Inflammatory osteitis, best typified by Wegener's granulomatosis.
- (3) Fibroproliferative abnormality such as fibrous dysplasia or Paget's disease.
- (4) Hypoplasia due to systemic disorder such as thalassaemia or cretinism.
- (5) Neoplastic osteitis or osteoblastic metastasis.

Conclusion

What then is the significance of finding maxillary sinus hypoplasia on CT scan of the sinuses? As described earlier, MSH is associated with uncinate process deformities especially in type, 2 and 3. The uncinate process is a key landmark in endoscopic sinus surgery. The first incision is placed on, or just anterior to, the uncinate process and is the first structure to be dissected free and removed from the lateral nasal wall. If this structure is hypoplastic or absent as seen in the above cases, the first structure encountered in this area may in fact be the lamina papyracea and will cause intra-orbital damage. Maxillary sinus hypoplasia also causes the lateral wall of the nose to bulge laterally, exacerbating the technical difficulty of this surgery.

We hope that greater awareness of this anatomical abnormality will reduce unforeseen orbital complications in endoscopic sinus surgery.

References

- 1 Mason JDT, Jones NS, Hughes RJ, Holland MI. A systematic approach to the interpretation of computed tomography scans prior to endoscopic sinus surgery. *J Laryngol Otol* 1998;**112**:986–90
- 2 Jones NS, Strobl A, Holland I. CT findings in 100 patients with rhinosinusitis and 100 controls. *Clin Otolaryngol* 1997;**22**:47–51
- 3 Clerico DM, Grabo DJ. Maxillary sinus aplasia. *Ann Otol Rhinol Laryngol* 1997;**106**:799–800
- 4 Karmody CS, Carter B, Vincent M. Developmental anomalies of the maxillary sinus. *Trans Am Acad Ophthalmol Otolaryngol* 1977;**84**:723–38
- 5 Bolger WE, Woodruff Jr WW, Morehead J. Maxillary sinus hypoplasia: Classification and description of associated uncinatate process hypoplasia. *Otolaryngol Head Neck Surg* 1990;**103**:759–65
- 6 Hall GW. Embryology and abnormal anatomy of the maxillary sinus. *Northwest Medine* 1969;**68**:1010–1
- 7 Wasson WW. Changes in the nasal accessory sinuses after birth. *Arch Otolaryngol* 1933;**17**:197–211
- 8 Geraghty JJ, Dolan KD. Computed tomography of the hypoplastic maxillary sinus. *Ann Otol Rhinol Laryngol* 1989;**98**:916–8
- 9 Bassiouny A, Newlands WJ, Ali H, Zaki A. Maxillary sinus hypoplasia and superior orbital fissure asymmetry. *Laryngoscope* 1982;**92**:441–8

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