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Inflammatory Disease Involving a Concha Bullosa (Enlarged Pneumatized Middle Nasal Turbinate): MR and CT Appearance

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An enlarged pneumatized middle turbinate, called a concha bullosa, may be the site of inflammatory disease ranging from simple mucosal thickening to a mucocele. Four patients with inflammatory disease involving a concha bullosa were studied with MR and/or CT. Both imaging techniques detected the presence of mucosal inflammation and a mucocele within the concha bullosa, but CT better demonstrated the thin bony wall of the mucocele, allowing differentiation from other soft-tissue nasal masses.

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An enlarged pneumatized middle turbinate is a relatively common anatomic variant that is usually referred to as a concha bullosa. Most commonly, it is an incidental finding on CT, but because it is in open communication with the ethmoid sinuses and nasal fossa it may be the site of mucosal inflammatory disease that ranges from simple inflammation to a mucocele. The purpose of this article is to present several examples of inflammatory disease involving concha bullosa and discuss the MR and CT appearance of a conchal mucocele.

Materials and Methods

Four patients with inflammatory disease involving a concha bullosa were studied. MR examinations were performed on a 0.5-T, Elscint Gyrex S5000 scanner (Elscint, Boston). CT was performed on a GE 9800 scanner (General Electric, Milwaukee). MR examinations consisted of T1-weighted axial or coronal scans, 500/30/2 (TR/TE/average no. of excitations), and T2-weighted axial scans, 2500/30,80/1. CT examinations were made with IV contrast material, and 5-mm-thick scans were obtained in the axial and coronal planes.

Results

The pertinent clinical data on these patients are summarized in Table 1. Both imaging techniques detected the mucosal changes and mucocele; however, CT better demonstrated the bony margin of the conchal wall and the thinned bony rim of the conchal mucocele.

Discussion

The cystic expansion of a pneumatized middle turbinate is termed concha bullosa. It is an anatomic variant that is reported to occur in 4–12% of patients [1]. If the definition is broadened to include all middle turbinates that have any degree of pneumatization, even those without expansion, the frequency of this variant increases to a reported 34% of patients [2].

The middle turbinate is a thin, scrolled sheet of bone formed from the medial portion of the ethmoid bone. The middle turbinate projects into the nasal fossa and

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TABLE 1: Summary of Patient Data

Patient No.	Age (years)	Sex	Clinical Presentation	Conchal Disease	Examination Performed	
					CT	MR
1	41	M	Difficulty breathing through nose	Conchal Sinusitis (minimal)	Yes	No
2	45	F	Difficulty breathing through nose	Nasal polyp	Yes	No
3	52	M	Nasal discharge with chronic sinusitis	Conchal sinusitis (minimal)	Yes	No
4	32	F	Chronic sinusitis	Conchal mucocele	Yes	Yes

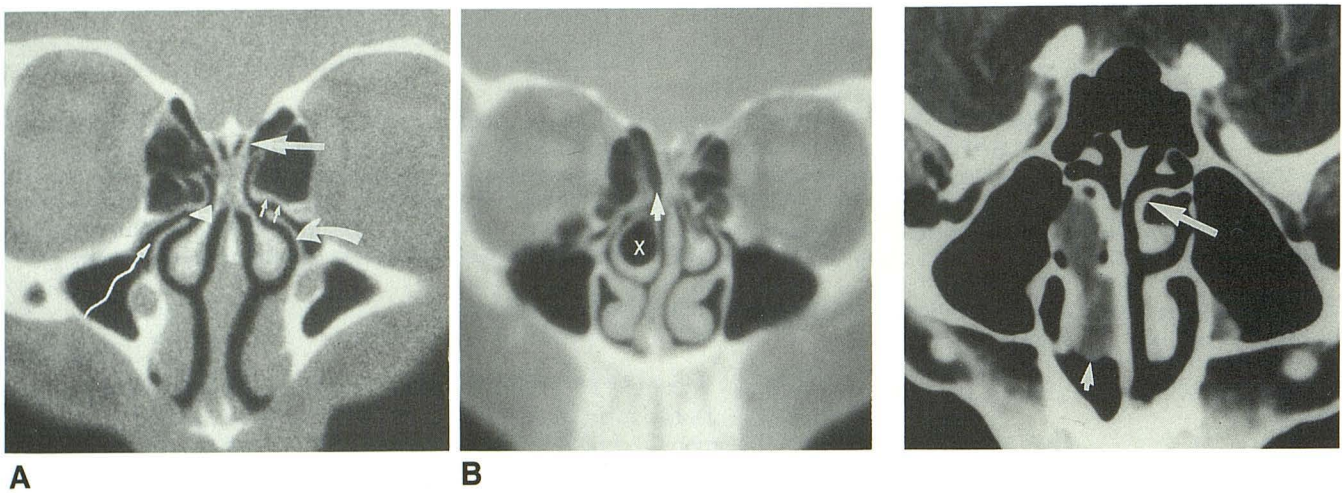

Fig. 1.—*A*, Coronal CT of normal nasal structures. *Large arrow* indicates superior attachment of anterior portion of left middle turbinate to lateral aspect of cribriform plate. *Curved arrow* indicates left uncinate process. The two *small arrows* indicate left bulla ethmoidalis. On the right side, *wavy arrow* lies in the infundibulum and the *arrowhead* points to the hiatus semilunaris.

***B*, Coronal CT scan of patient with a right concha bullosa that drains into right anterior ethmoid. X indicates air within the dilated middle turbinate. *Arrow* indicates drainage of concha bullosa into frontoethmoid region.**

Fig. 2.—CT scan of right nasal polyps. No bony wall is identified (*small arrow*) around the mass, helping to distinguish this polyp from a concha bullosa. *Large arrow* indicates lateral attachment of posterior portion of middle turbinate.

is supported anteriorly and superiorly by its attachment to the lateral margin of the cribriform plate (Fig. 1A). Posteriorly and laterally, the attachment of the middle turbinate represents the site of the fetal basal lamella, which extends laterally from the middle turbinate, through the ethmoid cells, to insert into the medial side of the lamina papyracea, thus dividing the ethmoid air cells into anterior and posterior groups (Fig. 2). The relationship of the middle turbinate to the structures forming the osteomeatal complex is illustrated in Figure 1.

Pneumatization of the middle turbinate occurs as part of the normal process of pneumatization of the ethmoid bone. Embryologically, the ethmoid cells arise as evaginations of nasal epithelium into the cartilage of the lateral nasal wall in the fifth or sixth fetal month. These evaginations correspond to the future ethmoidal cell groups, which develop in utero to measure approximately 5 mm in length at birth. The cells continue to expand and elongate after birth, their growth finally being halted only when they encounter another expanding cell or compact bone. Ultimately, the ethmoid bone is transformed into a honeycomb of air cells separated by thin bony septations. In addition to growing within the ethmoid bone, ethmoid air cells are commonly found extending into the frontal, maxillary, and sphenoid bones [3]. The expanding air cells retain their ostia at the site of initial evagination, and this ostia remains their route of drainage. The middle turbinate most commonly may be pneumatized by cells from the anterior ethmoidal group, which usually drain into the frontal recess of the hiatus semilunaris [2]. Pneumatization of the concha bullosa by cells of the posterior group has also been reported, as well as pneumatization from multiple cells in both the anterior and posterior groups [3]. In turn, the concha bullosa has two routes of drainage. Most commonly, this occurs through the conchal ostium, which is located near the frontal recess. This recess represents the most anterior upper portion of the hiatus semilunaris and is the region into which the frontal sinus drains. Less commonly, the concha bullosa drains along the basal lamella to open directly into the adjacent air cells.

When the concha bullosa is perceived as an ethmoid air cell, it becomes clear that any inflammatory disease that affects the main ethmoid cells can also involve the concha bullosa. In addition, the location of the conchal ostium near the frontal recess brings it in proximity to the frontal sinus ostium and thus makes it vulnerable to spread of infection

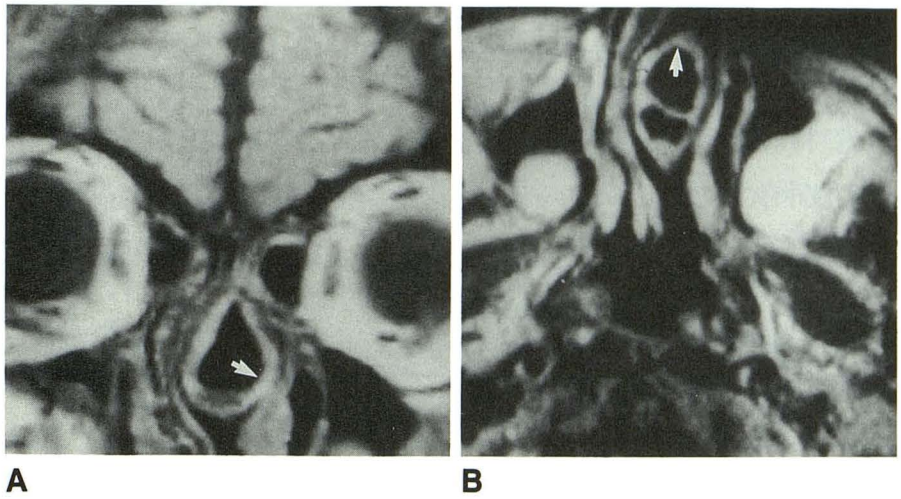

Fig. 3.—MR images of patient with minimal mucosal inflammation of concha bullosa (*arrows*).
***A*, Coronal balanced image (2500/30).**
***B*, Axial T2-weighted image (2500/80).**

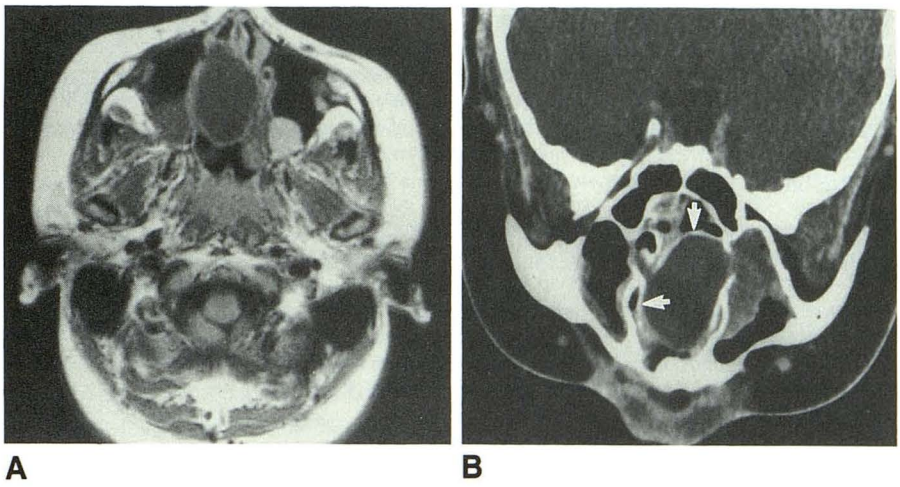

Fig. 4.—MR axial (T1-weighted 500/30) image (*A*) and coronal CT scan (*B*) of conchal mucocele. Note that CT shows thinned bony rim (*arrows*), allowing easy differentiation from other soft-tissue masses of nasal fossa.

from this sinus. Inflammatory changes within the conchal mucosa consist of mucosal edema and sinusitis (Fig. 3), free fluid, and, when obstruction of the conchal ostia occurs, a mucocele (Fig. 4).

Mucoceles of the concha bullosa, like mucoceles elsewhere, can have a highly variable appearance on MR. Mucoceles are collections of obstructed mucous secretions, and one would expect their MR appearance to reflect their predominant free-water content. However, with the passage of time, resorption of the free water occurs, the mucous glycoprotein concentration increases, and the viscosity increases. These changes result in variable degrees of both T1 and T2 shortening [4]. Thus, early in its evolution a mucocele typically has low signal intensity on T1-weighted images and high signal intensity on T2-weighted images. However, a more chronic lesion can have variable signal intensities on both T1- and T2-weighted studies. Eventually, almost complete desiccation of the secretions produces signal voids on both T1- and T2-weighted images that can be difficult to differentiate from a normally aerated sinus [4].

Because MR does not detect thin areas of compact bone, especially when this bone is adjacent to air, CT may be a better method for evaluating a concha bullosa. CT demonstrates the expanded middle turbinate, the thinned compact bone at its margins, and the usual deviation of the nasal septum to the contralateral side. Any secretions within a concha bullosa will have a mucoid attenuation (10–18 H), a CT appearance that is virtually diagnostic. In contrast, the MR appearance of an evolving conchal mucocele may, in some stages, be difficult to differentiate from that of a benign cyst near the nasal ostium or a nasal polyp. The presence of a bony margin on CT evaluation allows a conchal mucocele to be differentiated from other nasal fossa masses (Fig. 2). In a patient with a normal, well aerated concha bullosa or a conchal mucocele with desiccated secretions, MR may fail to detect the process.

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