

## An unusual variation in the anatomy of the uncinat process in external dacryocystorhinostomy

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Variations in the bony components of the nose are often encountered. One such variation was found in a 49-year-old male who had undergone conventional external dacryocystorhinostomy for adult onset nasolacrimal duct blockage. Intraoperatively, a thick bar of bone was seen beneath and parallel to the lacrimal sac fossa after a complete osteotomy had been made. Another osteotomy had to be fashioned in this bone to reach the nasal cavity. Postoperative 3D computed tomographic scan revealed the bone to be an anatomical variation of the uncinat process of the ethmoidal bone which was rather anteriorly placed, much thicker than usual, and attached to the nasal roof.

The uncinat process is thin, curved and its anterior edge may frequently overlap some part of the lacrimal fossa. However, to our knowledge, the presence of such a large and thick uncinat process necessitating an additional large osteotomy has not been reported.

**Key words:** Dacryocystorhinostomy, nasal bones, uncinat process

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Several anatomical variations can occur in the bones forming the lateral wall of the nose.<sup>1-4</sup> These include variations in attachments, shape and degree of pneumatization apart from hypoplasia and aplasia. Accordingly, the uncinat process of the ethmoid bone may have a blade shape, a mezzaluna shape or indeterminate shape.<sup>5</sup> It may have several different types of superior attachments.<sup>3,4,6,7</sup> This has important implications for surgeries performed in this area. This case report describes an abnormally thick and abnormally placed uncinat process. To the best of our knowledge, such a variation has not been reported in the literature.

### Case Report

A 49-year-old man presented with a year-long history of watering without sticky discharge on the left side. There was no history of any precipitating cause or any nasal symptoms. Lacrimal sac syringing demonstrated a regurgitation of fluid from the opposite punctum and a hard stop on probing. The rest of the ocular examination was unremarkable. A diagnosis of left primary acquired nasolacrimal duct obstruction was made.

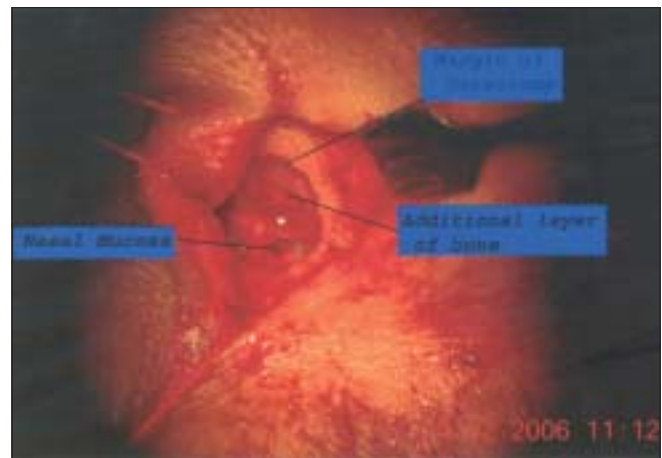
He underwent external dacryocystorhinostomy (DCR) under local anesthesia. Intraoperatively, the bony ostium was fashioned in the conventional manner.<sup>8,9</sup> It extended from

slightly anterior to the anterior lacrimal crest till near the posterior crest of the lacrimal bone, upward till the medial canthal tendon and downward up to the commencement of the nasolacrimal duct. However, another layer of thick bone was encountered just below and in a plane parallel to this osteotomy [Figure 1]. The bone was hard, unlike the thin, brittle bone of ethmoid air cells. It was not lined with mucosa. A window was fashioned in this bone whereupon the nasal mucosa was reached. Nasal mucosal and lacrimal sac flaps were made. Thereafter the standard closure of flaps (anterior only)<sup>10,11</sup> was done. Intraoperatively, the patient had significant ooze on incising the nasal mucosa. The patient had no complications in the postoperative period. He was asymptomatic with regard to watering from his eye at a routine follow-up visit one year later.

As the additional layer of hard bone was an unusual finding, a 3D computed tomographic (CT) scan was performed to find out what anatomical structure it may have been. The report mentioned an accessory bony septum originating from the antero-supero-medial wall of the maxillary sinus, lying in the area of the anterior ethmoidal labyrinth, traversing deep to the lacrimal sac and finally attaching to the floor of the frontal sinus. This was a variation in the uncinat process of the ethmoidal bone which was rather anteriorly placed and attached superiorly to the floor of the frontal sinus [Figures 2A-D]. There was a prominent agger nasi cell and also a concha bullosa (pneumatized middle turbinate) present on the left side. The nasal anatomy on the right was unremarkable. We did not have access to endoscopy at the time of surgery. However, on follow-up one year later, nasal endoscopy showed a patent ostium [Figure 3]. The lateral ridge on the left was far more prominent than on the right.

### Discussion

A nasal examination is a prerequisite before performing a DCR. Adequacy of space for surgical maneuvers, the condition of the mucosa and any anatomic variations are noted. This examination is usually performed by ophthalmologists. Select patients such as those with recurrent cold or sinusitis, trauma or surgeries in the nasal area, unusual nasal anatomy or nasal problems are referred for an ENT opinion.

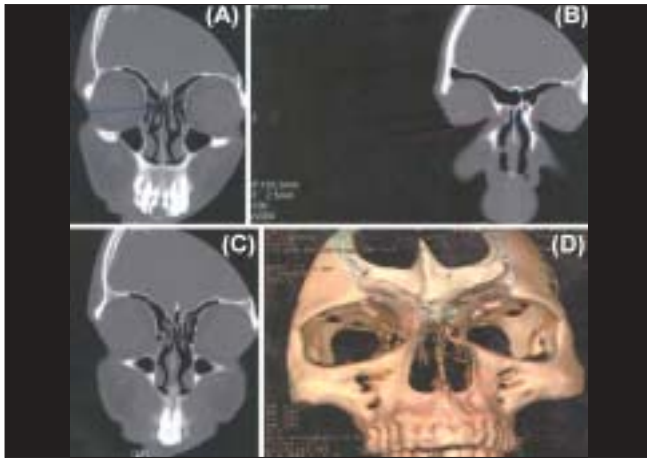


**Figure 1:** The margins of the osteotomy are seen, an additional layer of bone is seen below and parallel to the osteotomy and nasal mucosa lies below this layer

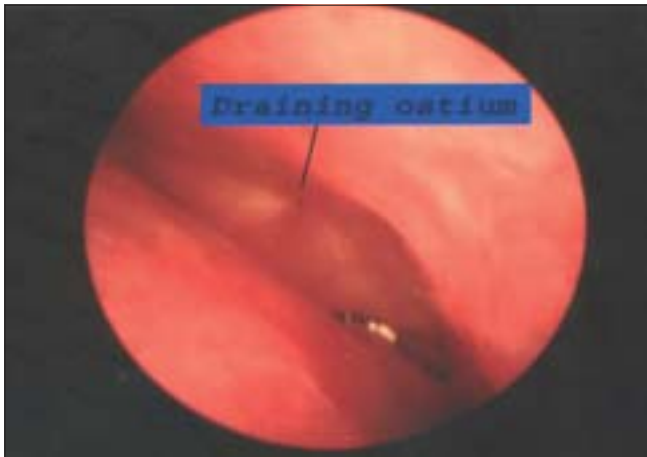
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**Figure 2:** (A) Break in continuity of orbital margin on left showing site of dacryocystorhinostomy osteotomy (red line). Additional bar of bone (uncinate process - superior end) is seen to be attached the nasal roof (blue line). (B) Another view showing the thickened uncinate process arising from the maxillary sinus wall and inserting into the roof of the nasal cavity. (C) A more posterior view showing the posterior part of the agger nasi cell, the uncinate process and the middle turbinate. (D) 3D view of the above



**Figure 3:** A patent ostium is seen on the lateral wall and a prominent lateral ridge in the left nasal cavity- an endoscopic view

Nasal endoscopes help provide better assessment of the nasal cavity. Factors like deviated nasal septum or hypertrophied nasal turbinates may narrow the space available in the nasal cavity and also result in a greater incidence of postoperative adhesions.

With endonasal DCRs becoming a popular option for patients, the nasal anatomy acquires even greater significance. The external DCR has well-defined steps and landmarks<sup>8,9,12,13</sup> but this is not so for endonasal DCR with different surgeons choosing different surgical approaches to the lacrimal fossa (for example, some surgeons perform unciformectomy and some don't) and diverse technical variations.<sup>12-16</sup> The underlying bony anatomy is revealed only after removing the overlying nasal mucosa. Also, in endonasal surgery, the surgeon works towards the orbit and hence there is a greater chance of encountering the delicate orbital structures.

## Anatomy

The uncinate process is a curved bone arising from the anteroinferior part of the ethmoidal labyrinth and usually commences just behind the lacrimal bone [Figures 4A and B]. It passes across the maxillary antrum, reducing its size. The cleft formed between the uncinate process and the ethmoidal bulla (which is situated above it) is termed the hiatus semilunaris. The infundibulum is the space bounded by the uncinate process anteromedially, the ethmoid bulla posterolaterally and the lamina papyracea anterolaterally. The infundibulum is connected to the middle meatus through the hiatus semilunaris. The frontal sinus often ends in the upper part of the infundibulum. The maxillary sinus drains into this as also the anterior and middle groups of ethmoidal air cells. The entire area of the bulla, hiatus semilunaris, infundibulum, uncinate process and the ostium of the draining sinuses - maxillary, frontal, and anterior and middle ethmoidal cells is termed the osteomeatal unit [Figures 5A and B].<sup>2,4</sup>

The superior part of the uncinate process may have one of few possible sites of attachment [Figure 6].<sup>6,7</sup> In one study of 144 patients,<sup>17</sup> the variations in superior attachment were as follows: 52% to the lamina papyracea, 18.5% to the posteromedial wall of the agger nasi cell, 17.5% to the lamina papyracea and the junction of the middle turbinate with the cribriform plate, and other less common attachments.

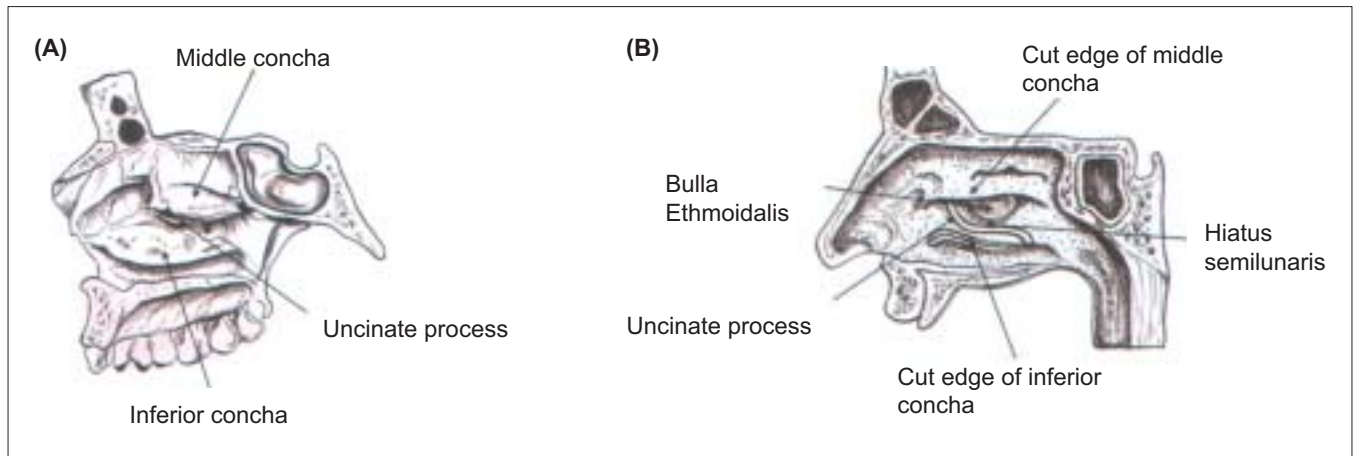
The inferior border of the uncinate classically attaches to the posterior edge of the inferior turbinate. However, it may also attach along the anteroinferior margin of the inferior concha, and then it is very closely approximated to the lacrimal bone.<sup>7</sup>

The anterior tip of the uncinate may be free or articulate with superior structures. The posterior tip may be prolonged and articulate with the palatine bone.<sup>7</sup>

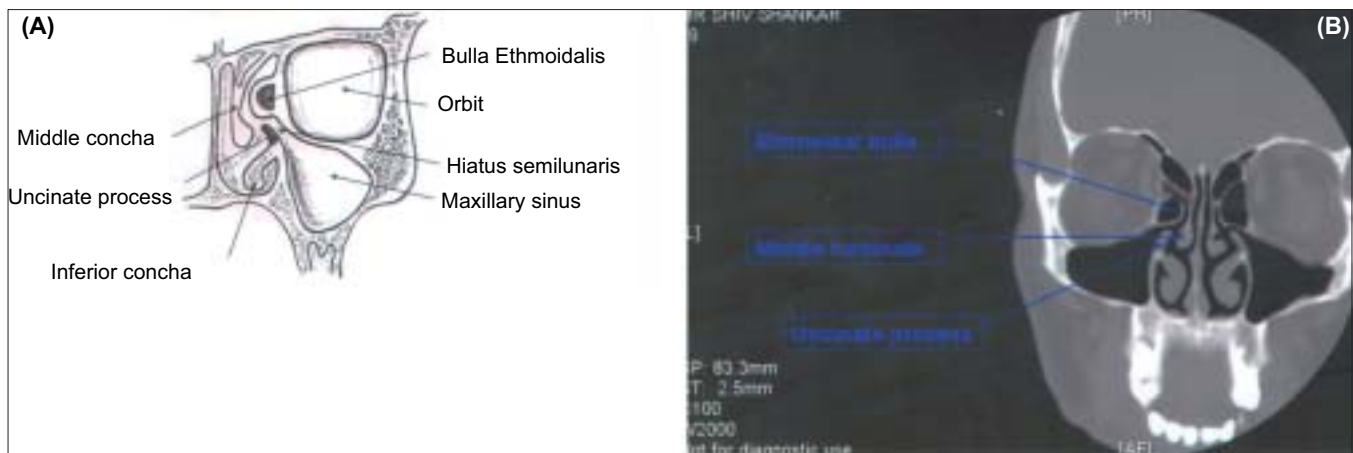
Various studies have measured the distances between the important intranasal structures.<sup>17-20</sup> One study<sup>19</sup> found that the uncinate process was more frequently posterior (32%) or adjacent (45.5%) to the lacrimal fossa at the lower part of the lacrimal fossa. The uncinate process was adjacent to the maxillary bone [i.e. further forward on the lacrimal fossa] (55.8% cases) at the middle and adjacent to the middle turbinate (61%) at the upper levels of the lacrimal fossa. Hence in many cases of endonasal DCR it is necessary to perform an unciformectomy<sup>16,19</sup> to actually reach the lacrimal fossa.

The ethmoid sinuses consist of an anterior and posterior group of ethmoid cells separated by the ground lamella of the middle turbinate. Ethmoid cells may migrate from their normal location and lie aberrantly. The agger nasi is the most anteriorly placed ethmoid cell lying below the lacrimal fossa. Agger nasi cells are believed to represent the remnant of the superiormost nasoturbinal concha. The word "agger nasi" comes from the Latin word for nasal mound. Depending on the degree of pneumatization, agger nasi cells can be bounded anteriorly by the frontal process of the maxilla, anterolaterally by the nasal and lacrimal bones, posterolaterally by the lamina papyracea, superiorly by the frontal sinus, inferolaterally by the uncinate process, and posteriorly by the anterior ethmoid complex.

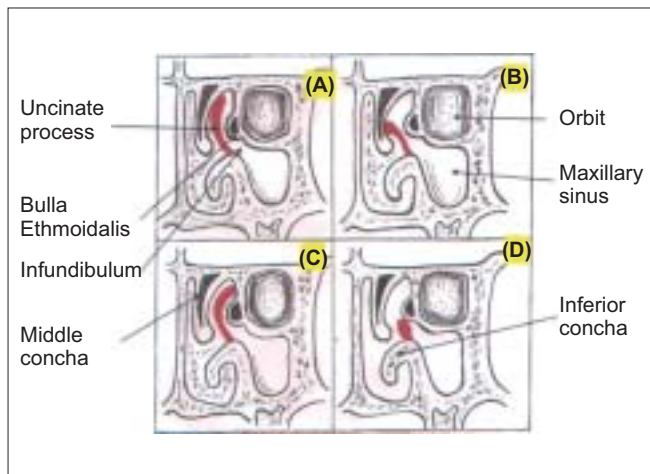
Knowledge of intranasal anatomy is very important when performing a DCR, especially from the endonasal route. Ethmoid air cells extend to the lacrimomaxillary suture in 32% cases and completely across the fossa in 54%.<sup>21</sup> One study found



**Figures 4:** (A) and (B) The anatomy of the uncinete process and its surroundings (Hand-drawn; from Grays Anatomy)<sup>23</sup>



**Figures 5:** (A) and (B) The osteomeatal complex in the middle meatus of nose coronal views



**Figure 6:** Variations in superior attachment of the uncinete process (red color) (A) nasal roof (B) middle concha (C) lamina papyracea of the orbit (D) ending as a free stump

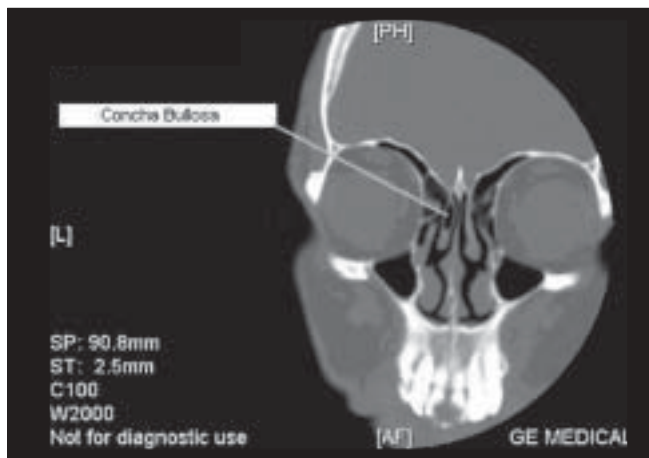
that the lacrimal bones had underlying ethmoidal cells in 93% cases.<sup>22</sup> Hence they are commonly encountered during DCRs while fashioning the osteotomy.

In our patient, the other possibilities considered as to what structure the parallel plate of bone could be were:

- a. Unusually thick and large agger nasi cell
- b. the outer wall of the concha bullosa

The first option was a distinct possibility because the CT scan did indeed show a large agger nasi cell on the right side. However, the structure we encountered arose from as far below as the antero-superio-medial wall of the maxillary sinus and was inserted on the floor of the frontal sinus. The wall of the agger nasi does not arise so low nor is the insertion so superior. However, it is a well-established fact that the uncinete process contributes to the wall of the agger nasi cell, especially the inferolateral part. This seems to be the case in this patient. The likely possibility is that a large, thick, uncinete process arose from its usual site, formed a part of the wall of the agger nasi (large space between two bones encountered at surgery) and then was inserted into the floor of the frontal sinus. The agger cell was unusually large and the mucous lining was perhaps too thin to be noticeable separately. These findings are very unusual because both the agger nasi cell and the uncinete are normally composed of very thin, easily breakable, fine bones.

The second option (b) was ruled out because this structure was found intact on the CT scan [Figure 7].



**Figure 7:** The left nasal cavity shows a pneumatized middle concha (concha bullosa)

Therefore, the most likely possibility was that the structure was the uncinata process of the ethmoid bone. It must be mentioned that the uncinata process normally is of very thin consistency. However, our patient had an uncinata process that was not only placed far anteriorly but was also unusually thick.

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