

# Sagittally Split Middle Turbinate : Morphology and Clinical Application

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**Abstract:** The nasal cavity is host to a number of variations, both normal and pathological. Sagittally split middle turbinates are rare and sparsely known among clinicians. We observed sagittally running whole thickness linear splits (clefts) bilaterally in the intermediate two-thirds of middle turbinates in two adult male cadavers. In the first case, the right split turbinate was associated with non-pneumatized bulla ethmoidalis and an accessory maxillary ostia, while the left side presented pneumatization of the upper segment. The second case presented non-pneumatized bulla ethmoidalis on both sides and a twin accessory maxillary ostia on the right side. A need was felt to study and record this entity due to its clinical importance and a lack of awareness of this condition among rhinologists and anatomists. On anterior rhinoscopy this can be mistaken for a polyp or tumor and could be responsible for causing ostiomeatal unit obstruction, thus making it imperative for endoscopic sinus surgeon to recognize this entity during surgery to prevent recurrent sinusitis.

**Key words :** middle turbinate, splitting, pneumatization, bulla ethmoidalis, ostiomeatal unit, endoscopic.

## Introduction

The middle turbinate, a vital landmark in endoscopic sinus surgery, is a scroll-like integral part of ethmoid bone covered with thick mucoperiosteum, soft tissue and pseudostratified ciliated columnar epithelium. Ventrally it is attached to the cribriform plate which forms the roof of the nasal cavity and dorsally to the lamina papyracea of the lateral nasal wall which forms the medial wall of the orbit. Its attachment traverses the entire ethmoidal labyrinth dividing the ethmoidal sinuses into anterior and posterior groups<sup>1,2</sup>. Middle turbinate hides various ostia of the anterior group of paranasal sinuses. For an endoscopic sinus surgeon it is important to be aware of the normal and pathological variants of this turbinate and understand their intranasal anatomy for successful performance of endoscopic procedures. Sagittally clefted middle turbinate is a rare anatomic variant among the better-known variations such as concha bullosa (pneumatized middle turbinate), triangular, L-shaped middle turbinate and paradoxically curved middle turbinate<sup>3</sup>. Surprisingly no reference of this condition was cited in anatomy or otorhinolaryngology textbooks, but for a couple of citations in ENT journals<sup>3,4</sup>.

## Case Report

Forty-eight formalin fixed adult cadavers (96 half-heads) were dissected of which two cadavers (4 half-heads, 4.2%) had bilaterally split middle turbinates.

### Case No. 1

A bilateral whole thickness linear sagittal split in the middle turbinates was seen in a male cadaver; each split was approximately in the middle two-third with the anterior and posterior parts unsplit. The split portion therefore had an upper segment and a lower segment. The upper was attached above and free below at the split while the lower segment was free both above and below forming the free margin of this turbinate.

The maximum lengths of right and left turbinates were 42 mm and 44 mm respectively, measured along their long axis and the maximum height of each was 12mm. Upon reflecting the turbinate on the right side, non-pneumatized bulla ethmoidalis and an accessory maxillary ostia were found (Fig.) The left one was associated with pneumatization (concha bullosa) of upper segment.

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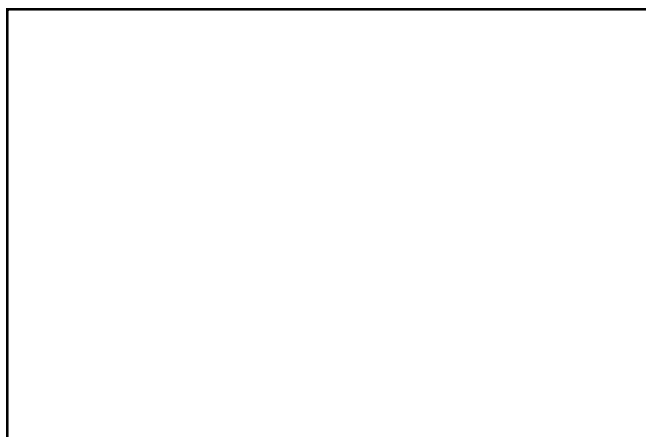


Fig. : sagittally split of right half-head middle turbinate show ... non-pneumatized bulla ethmoidalis (arrow head) and an accessory maxillary ostia (arrow).

### Case No. 2

A similar split in the middle two-thirds was seen bilaterally in another male cadaver. The maximum lengths and heights of right and left middle turbinates were 40mm and 11mm and 42mm and 12mm respectively. On reflecting the turbinates, non-pneumatized bulla ethmoidalis was seen on both sides. The right side presented with a twin accessory maxillary ostia. The upper or lower split segment did not show any pneumatization on either side.

## Discussion

With the turn of the twentieth century came a consensus among rhinologists that the morphology of the sinuses could be best understood by studying their embryogenesis and drainage patterns. This formed the basis of modern sinus surgery<sup>5</sup>. A sagittally clefted middle turbinate is seen in about 50% of five-month-old fetuses, 36% of neonates, 13% of children and 6% of adults<sup>6</sup>. We found splitting in 4.2% of adult cadavers. Zuckerkandl<sup>6</sup> demonstrated that the middle, superior and supreme turbinate, the uncinata and bulla ethmoidalis begin to develop by about 9th to 10th week of fetal life from six prominent ridges (ethmoturbinals) separated by furrows. Subsequently some of these ridges and furrows coalesce while others disappear partly or entirely to attain the normal adult morphology of the lateral nasal wall. The middle turbinate is formed from the third ridge, preceded by the formation of inferior turbinate and followed by uncinata process, bulla ethmoidalis and superior turbinate. The exact mechanism of its

formation is unclear; it perhaps results from an arrest in the maturation process of middle turbinate<sup>4</sup>. It is our conjecture that this present anomaly results because, besides the normal third ridge, part of the second one (which forms bulla ethmoidalis) may also have contributed to its formation; it is the non-fusion of the second and third ridge which has resulted in the splitting. This assumption is supported by the fact that the bulla ethmoidalis was inconspicuous and non-pneumatized in both cases.

Yanagisawa and Weaver<sup>3</sup> found on endoscopy longitudinally clefted clinically asymptomatic middle turbinate. Rossiter<sup>4</sup> found a sagittally clefted anteriorly fused middle turbinate on endoscopy in an adult male patient with recurrent sinusitis. This was associated with concha bullosa of the larger medial segment. Interestingly in the two cadavers, we observed a bilateral linear sagittal split in the middle two thirds of the middle turbinates. Similar to the above mentioned endoscopic finding we observed concha bullosa of upper segment of the left middle turbinate.

Clinically the middle turbinate can present with an abnormal shape, pneumatization, polypoid mucosa or, rarely a split. Such turbinates can disrupt mucus flow, block sinus ostia or can even restrict endoscopy. A split turbinate may remain silent or be a cause of sinusitis. It can easily be missed during standard anterior rhinoscopy, or mistaken for a polyp, a tumor or enlargement of normal structures such as superior turbinate, bulla ethmoidalis or uncinate process, and may prove to be a potential factor for ostiomeatal unit obstruction<sup>4</sup>. Diagnosis is made by endoscopy,

CT scan or MRI and operative intervention alleviates suffering.

Knowledge of a split middle turbinate enables the endoscopic sinus surgeon to anticipate and treat such condition in an effective way and avoid recurrence of sinusitis. Association of clefted middle turbinates with concha bullosa and infundibular blockade leading to the formation of accessory maxillary ostia needs further study.

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## Literature Review

### Compiled by Dr. SNA Rizvi

#### Effect of blood pressure on early decline in kidney function among hypertensive men. Hypertension. 2003 Dec;42(6):1144-9. Epub 2003 Nov. 03.

Few Cohort studies have examined the longitudinal association between change in blood pressure and decline in kidney function among treated hypertensive patients without chronic kidney disease. We conducted a nonconcurrent cohort study to examine the effects of blood pressure on estimated glomerular filtration rate and early kidney function decline (rise in serum creatinine > or = 0.6mg/dL during follow-up) among 504 African-American and 218 white hypertensive patients. Our results showed that each standard deviation higher treated systolic (18mm Hg) and diastolic (10mm Hg) blood pressure was associated with an average annual decline (95% confidence interval [CI] in estimated glomerular filtration rate of -0.92 ([-1.49 to -0.36] P<0.001) and -0.83 ([-1.38 to -0.28] P=0.003) mLxmin (-1) x 1.73m (-2), respectively, after adjustment for race, age, education, income, use of anti-hypertensive drugs, body mass index, and history of diabetes and dyslipidemia. Likewise, each standard deviation higher systolic and diastolic blood pressure was associated with relative risks (95% CIs) of 1.81 ([1.29 to 2.55] P<0.001) and 1.55 ([1.08 to 2.22] P=0.046), respectively, for early kidney function decline. Compared with patients with a blood pressure level <140/90mmHg, those with a blood pressure level >or = 160/95mmHg had a -2.67 ([-4.01 to -1.32] P<0.001) mL x min (-1)x 1.73m (-2) greater annual decline in estimated glomerular filtration rate and a 5.21 - fold ([2.06 to 13.21] P<0.001) greater risk of early kidney function decline. Our study found that higher levels of treated blood pressure were positively and significantly related to early decline in kidney function among hypertensive men. These results

indicate that better blood pressure control might prevent the onset of chronic kidney disease among hypertensives.

#### Characteristics of treated hypertension in incident hemodialysis and peritoneal dialysis patients. Am J Kidney Dis. 2003 Dec;42(6):1260-9.

The US Renal Data System (USRDS) Dialysis Morbidity and Mortality Study Wave II cohort was analyzed. A total of 2,877 patients initiating hemodialysis or peritoneal dialysis in 1996 or 1997 and treated with antihypertensives were included in this analysis. Vital status was followed until November 2000. RESULTS: Calcium channel blockers were prescribed to 70.3% of patients. Only 31.5% and 27.0% of patients with cardiovascular disease were prescribed angiotensin-converting enzyme inhibitors and beta-blockers, respectively. Mono-double-triple and more than triple therapy were reported in 48.0%, 36.1%, 13.2% and 2.7% of the cohort, respectively. In multivariable, fully adjusted models, no individual class of antihypertensives was associated with changes in all-cause mortality. In all patients, nondihydropyridine CCBs (non-DHP CCBs) were associated with a reduced risk of cardiovascular death (hazard ratio, 0.78; 95% confidence interval, 0.62 to 0.97) and among end-stage renal disease patients with preexisting cardiovascular disease, dihydropyridine CCBs (DHP CCBs) and non-DHP CCBs were associated with reduced risk of all-cause and cardiovascular mortality. CONCLUSION : Calcium channel blocker use is widespread among hypertensive dialysis patients. Antihypertensive prescription patterns suggest a lack of consensus regarding treatment of hypertension. Multivariable analysis of associations between antihypertensive classes and mortality reveals results of uncertain clinical significance. Hypertension treatment trials in dialysis patients should be performed to appropriately inform treatment decisions.