

# Correlation of Computed Tomography and Nasal Endoscopic Findings in Chronic Rhinosinusitis

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## SUMMARY

This is a cross sectional study of 40 patients diagnosed with chronic rhinosinusitis using the Lanza Kennedy diagnostic criteria based on nasal endoscopy (NE), and on computer tomography (CT) of the paranasal sinuses. The purpose of the study is to demonstrate the effectiveness and limitations of CT, and NE in the assessment of chronic rhinosinusitis. This study shows that CT was superior in detecting OMC involvement, presence of concha bullosa, paradoxical turbinate and nasal septal deviation. NE was better at detecting polyps.

## KEY WORDS:

*Computed tomography, Nasal endoscopy, Chronic rhinosinusitis*

## INTRODUCTION

Chronic rhinosinusitis is an inflammatory disease affecting the paranasal sinuses. It is a frequently encountered disease affecting nearly 50 million individuals every year, yet its diagnosis and treatment still poses a challenge<sup>1</sup>.

The understanding of mucociliary drainage pattern and pathophysiology of paranasal sinus disease are the keys to functional endoscopic sinus surgery (FESS). FESS has popularised the use of telescopes in surgery and has emphasised the importance of nasal endoscopy and computer tomography<sup>2</sup>. Currently, patients who had failed optimum medical therapy are suitable for FESS. Diagnostic nasal endoscopy and CT are performed to determine the extent of the disease prior to planning for surgery.

This study aimed to determine the pattern of chronic rhinosinusitis according to sinus involvement on CT as well as to determine CT abnormalities and nasal endoscopic findings.

## MATERIALS AND METHODS

The study was a cross-sectional study of 40 patients seen in ENT clinic HUKM over a period of 18 months. Only patients who are above 15 years old who have chronic rhinosinusitis by definition from Task Force on Rhinosinusitis and fulfilled the nasal endoscopic criteria established by the Lanza Kennedy, who have failed optimal medical treatment were included in the study. Lanza Kennedy criteria is used to grade nasal endoscopy findings looking at the presence of secretion,

oedema and polyps. Those patients who had previous facial trauma, paranasal sinus malignancy, extra paranasal sinus tumour involving the sinuses, clinical evidence of sinusitis of dental origin and previous major nasal surgery were excluded from the study.

Computed tomography was performed using a single slice Toshiba Xpress SX CT scan. The images were obtained in axial plane with reconstruction in sagittal and coronal images using the raw data. The images were displayed using wide window width at 2000HU and window level of -150HU. CT findings were considered positive for chronic rhinosinusitis when the Lund-Mackay score was more than one.

Nasal endoscopy was performed using Karlz Storz rigid endoscopic sets by the surgical medical officers. After instilling the nasal decongestion, the patient was examined gently and systematically using 0 and 30 degrees Karlz Storz rigid endoscope of appropriate diameter (2.7mm or 4mm). NE findings were considered positive when there was presence of either or combination of polyps, mucopus in the middle meatus or diseased mucosa.

## RESULTS

Table I shows the pattern of sinus involvement. Maxillary sinus was the commonest sinus involved seen in 34 patients, followed by anterior and posterior ethmoid, frontal and sphenoid sinuses. Of the forty patients studied, OMC involvement was seen in twenty four patients (60%). Table II shows the distribution of affected sinus in the presence of OMC involvement. The pattern of nasal endoscopic findings is summarized in Table IV. Polyp alone was the commonest presenting feature in endoscopic findings. All except for one had positive CT findings. Eighteen patients (45%) had concha bullosa detected on CT. Only 10 patients (25%) were detected to have concha bullosa on nasal endoscopy (Figure 1, 2). Three patients (8%) presented with paradoxical turbinate on CT all of which were not detected endoscopically (Figure 3). Seven patients were noted to have paradoxical turbinate on endoscopy. None of these patients had paradoxical turbinate seen on CT. Of these patients, five had concha bullosa and two patients had normal middle turbinate.

Eighteen patients (45%) had nasal polyps on endoscopy of which only five patients were reported to have polyps on CT

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(Figure 4, 5). The prevalence of nasal septal deviation with CT and NE is summarized in Figure 6. Ten patients (25%) were noted to have septal deviation on endoscopy (Figure 7). Of these patients, nine patients had nasal septal deviation of more than 5 mm from midline on CT (Figure 8).

Nasal endoscopic findings of mucosal oedema were detected in two patients (Figure 9). Figure 10 shows the CT findings of one of the patient with diseased mucosa. On CT, diseased mucosa, polyps and mucopus are non specific (Figure 11), findings which are better assessed on endoscopy.

## DISCUSSION

In the majority of cases of patients who present with symptoms of chronic rhinosinusitis have radiological evidence of the disease. In this study, the maxillary sinus was the commonest sinus involved either alone or with involvement of other sinuses. The narrowing of maxillary ostia contributes to the higher frequency of maxillary sinusitis as seen in all 34 patients with maxillary involvement. Anatomically, the most likely site of mucosal contact is in the narrow mucosa-lined channels of the middle meatus and the ethmoid infundibulum, which results in maxillary sinusitis.

In this study, OMC involvement was commonly associated with mucosal thickening in the maxillary, ethmoid and the frontal sinuses. This could be explained by the fact that the OMC is a common draining channel most commonly involved in chronic rhinosinusitis. The presence of minor swelling may cause the opposition of the mucosal layer that will lead to stenosis or obstruction. Obstruction to the flow of the intricate and narrow passages will in return causes mucociliary clearance disruption and thus causes stagnation of secretion in the maxillary, ethmoid and frontal sinuses which can be prone to infection. Recurrent bouts of infection will result in chronic inflammatory process. These observations were also seen in several other studies<sup>2-8</sup>.

The presence of polyps usually represents the manifestation of recurrent inflammation as reflected in this study. Another study found that polyps are the commonest findings in patients with chronic rhinosinusitis followed by mucosal abnormality<sup>9</sup>.

In one patient, the endoscopic finding (mucopus and polyp) was positive while the CT score was negative. CT has the limitation to assess the presence of mucopus and diseased mucosa as their feature is non specific. CT is known to be superior in terms of visualisation of deeper structures not visualised by endoscopy like maxillary ostia, infundibulum and the sinus contents. Endoscopy is limited to visualisation of anterior nasal cavity and middle meatal cleft. It can however, provide the ability to accurately assess for evidence of localised diseases or for anatomic defects that compromise ventilation and mucociliary clearance.

The middle turbinate variation can be assessed both by CT and endoscopy. CT is able to identify turbinate pneumatization accurately compared to nasal endoscopy as reflected in this study. Majority of the patients who were identified as having paradoxical turbinate on endoscopy were found to have concha bullosa on CT. The unfamiliarity of anatomy of the lateral nasal wall and the lack of experience of the examining surgeon could be the attributing factor in the low detection rate in these two common middle turbinate variations. In this study, multiple inexperienced endoscopists who were the ENT medical officers in speciality training, may have contributed to the low detection rate of concha bullosa, a normal variant that is commonly mistaken for paradoxical turbinate on nasal endoscopy. A single experienced rhinologist may yield a different result.

There is varying degree of nasal septal deviation; minor bony deviation can be seen on CT scan. In endoscopy, nasal septal deviation was documented only if it was moderate or severe or caused obstruction to the caudal zones (between the nasal vestibules and the superior and anterior origin of the middle turbinate) especially near the valve or nasal vestibule. This was reflected in this study where CT identified a higher frequency of nasal septal deviation due to over reporting as even minor deviation of less than 5mm was considered as nasal septal deviation. The nasal septal deviation detected on endoscopy correlated with a nasal septal deviation of more than 5mm on CT.

In this study, the features of polyps, diseased mucosa and mucopus in the middle meatus are non specific on CT (Figure 10, 11). This is the limitation of CT. The presence of local middle meatal inflammation, granulation, polypoid

**Table I: Pattern of Sinus Involvement in the Presence of Osteomeatal Complex Abnormality**

SINUS	NUMBER OF PATIENTS	PERCENTAGE
Frontal Maxillary Ethmoid	11	45%
Maxillary Ethmoid	7	30%
Maxillary	6	25%
TOTAL	24	100%

**Table II: Pattern of pathology detected on nasal endoscopy**

ENDOSCOPIC FINDINGS	NUMBER OF PATIENTS	PERCENTAGE
Polyps	10	45%
Diseased mucosa	2	9%
Mucopus Polyps	2	9%
Mucopus Diseased mucosa	2	9%
Diseased mucosa Polyps	5	23%
Polyps Diseased mucosa Mucopus	1	5%
TOTAL	22	100%

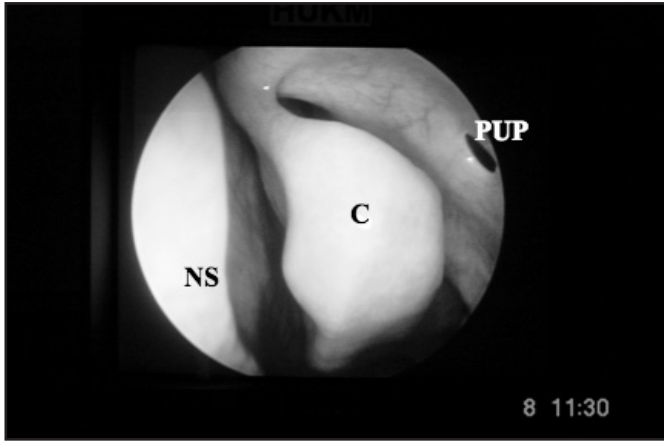


Fig. 1: Nasal endoscopy of the left middle meatus showing C=concha bullosa, NS=nasal septum, PUP=perforated left uncinate process.



Fig. 2: Coronal CT of the paranasal sinus at the level of OMC shows left concha bullosa (star). The non diseased concha bullosa does not cause obstruction to the left OMC.



Fig. 3: Coronal CT at the level of OMC shows bilateral paradoxical turbinates (star).

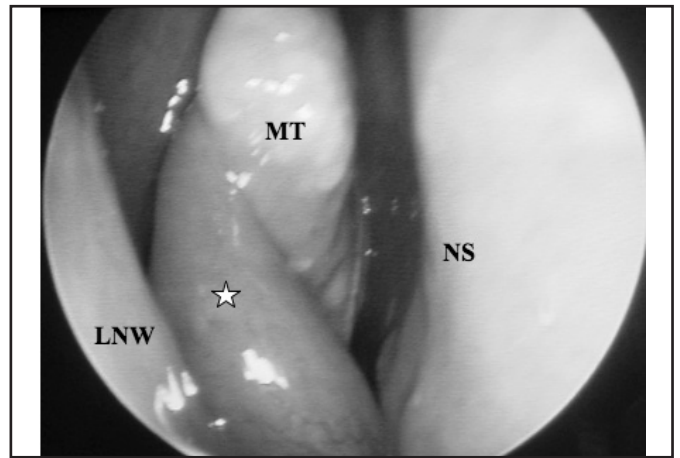


Fig. 4: Nasal endoscopy showing the presence of antrochoanal polyp (star). Nasal septum=NS, middle turbinate=MT, lateral nasal wall=LNW.



Fig. 5: Coronal CT of patient with polyp. Note the expansile lesion in the nasal cavity extending from the right maxillary sinus. There is widening of the right maxillary ostium (arrow).

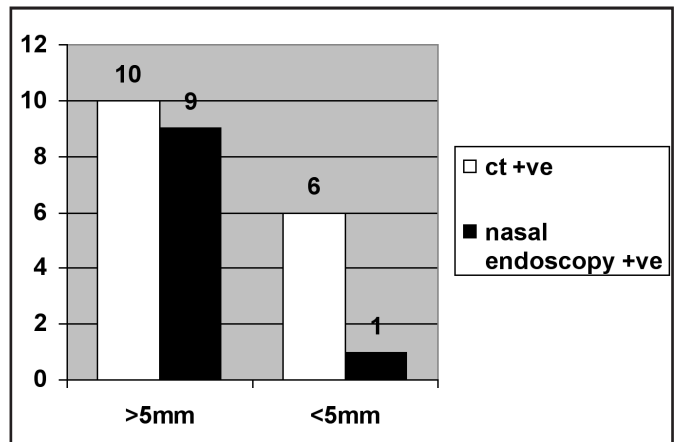


Fig. 6: Nasal septal deviation.

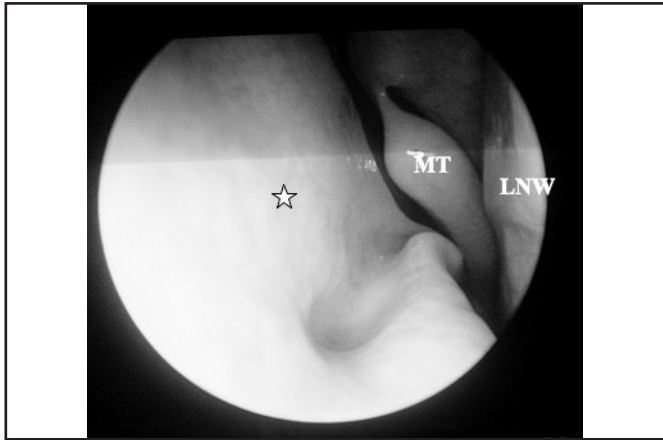


Fig. 7: Nasal endoscopy showing nasal septal deviation to the left. Nasal septum=star. Middle turbinate=MT, lateral nasal wall=LNW.

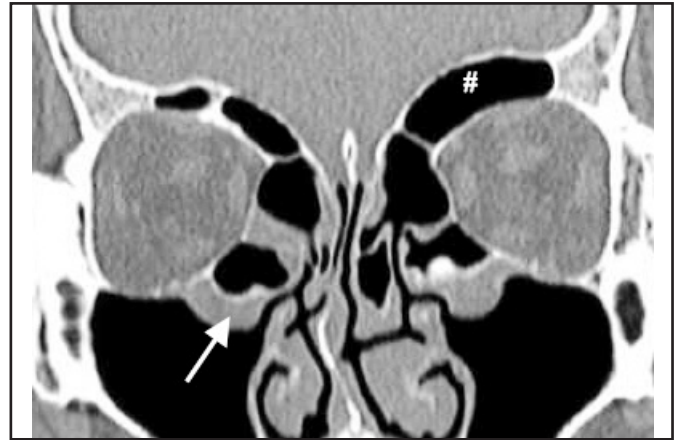


Fig. 8: Coronal CT showing nasal septal deviation to the right measuring more than 5mm. Note; the mucosal thickening lining the inferior aspect of the ethmoidal bulla (arrow) and pneumatization of the supraorbital ridge (#).

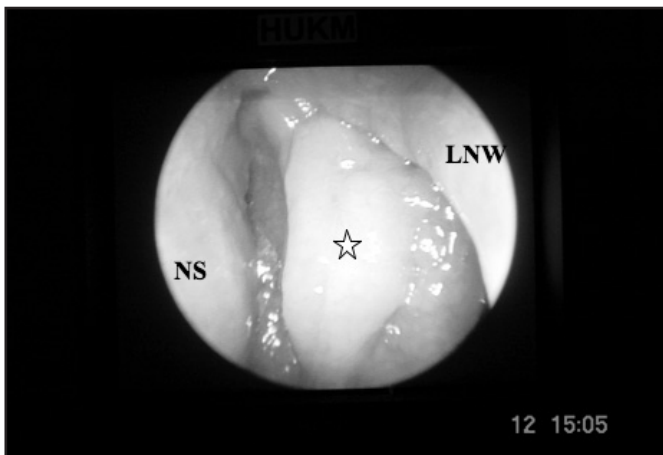


Fig. 9: Nasal endoscopy showing an oedematous left middle turbinate (star), nasal septum=NS, lateral nasal wall=LNW.



Fig. 10: Coronal CT of patient found to have diseased mucosa of the middle turbinate on endoscopy. CT shows non specific soft tissue density in both maxillary sinuses and both OMCs. No bony erosion is identified.



Fig. 11: Coronal CT of patient seen to have diseased mucosa, polyp and mucopus in the middle meatus. These findings which were seen on endoscopy showed non specific features on CT.



formation or sinus discharge can be identified by nasal endoscopy not by CT as reflected in this study. The features on CT, of the three patients who have polyps identified on both CT and endoscopy were expansile lesion in the nasal cavity, widening of the ethmoidal complex or ostia (Figure 5). Nasal septal deviation was seen in 40% of cases and this is comparable with other studies with variation ranging from 23% to 36% respectively<sup>3,10</sup>.

### CONCLUSION

From this study, it can be concluded that CT was superior in detecting OMC involvement, presence of concha bullosa, paradoxical turbinate and nasal septal deviation. Paradoxical turbinate was not easily detected on nasal endoscopy and was easily mistaken for concha bullosa by an inexperienced endoscopist. Concha bullosa was the commonest anatomical variation detected on endoscopy and has a higher degree of detection rate. This study also found that polyps, diseased mucosa and mucopus in the middle meatus have non specific features on coronal CT and endoscopy has an essential role in accurately diagnosing this pathology. An understanding of the disease process and its presentation in correlation to nasal endoscopic findings will assist radiologist in interpreting the CT findings. Functional interactive partnership between the radiologist and otolaryngologist is likely to yield a positive outcome that benefits both physicians and patients.

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