

Effectiveness of Diagnostic Nasal Endoscopy and Computed Tomography in the Diagnosis of Chronic Rhinosinusitis

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Abstract

Chronic rhinosinusitis (CRS) is a frequently encountered condition in clinical practice. Diagnostic endoscopy and Computed Tomography (CT) are imperative in the evaluation of CRS. The reliability of each of these to predict the operative findings in chronic sinusitis is important. *Method:* Cross sectional study in which 30 patients of CRS were included. 20 patients needed bilateral surgery. Hence, a total of 50 procedures were done. *Results:* Diagnostic endoscopy findings correlated very well with the operative findings for all parameters without any false positives or false negatives. Sensitivity of CT was found to be good for almost all the parameters except for anterior ethmoids. The specificity of CT was found to be good for all the parameters except maxillary sinus. *Conclusions:* Systematic diagnostic endoscopy is the best way forward to evaluate and objectively confirm CRS with CT scan being supplemented only in cases where gross anatomical/ pathological disease restricts visualisation of the disease.

Keywords: Chronic rhinosinusitis; Diagnostic nasal endoscopy; Computed tomography.

Introduction

Chronic rhinosinusitis (CRS) is a frequently encountered condition in clinical practice. It causes significant morbidity and thus affects the economic productivity of a country. Nearly 50 million people are affected each year and thus it is a frequently encountered challenge to most clinicians.¹

The symptoms of chronic sinus disease are multiple, often vague and non specific, while physical examination is limited as the sinuses cannot be examined directly. Thus the importance of a diagnosis plays a significant role in the management. In 2007, American academy of

Otorhinolaryngology—Head and Neck Surgery (AAO-HNS) published guidelines which involve a combination of symptom criteria and objective findings. Objective measures on endoscopy such as nasal polyps or purulence in the middle meatus and radiological evidence of mucosal disease are also important contributory aids.²⁻⁴ Anterior rhinoscopy reveals little information about the middle meatal cleft and no information regarding the infundibular opening and maxillary sinus orifice. Nasal endoscopy provides the ability to accurately access these areas for evidence of localized disease, or for anatomical defects that compromise ventilation and mucociliary clearance.

Computed Tomography provides a method for effectively demonstrating the mucosal changes and the various disease patterns in the sinuses in addition to complications. Subtle anatomical variations and imaging of the posterior ethmoid and sphenoid sinus are imaged with a level of clarity not afforded previously by standard sinus radiograph.

Nasal endoscopy helps in assessing the osteomeatal complex as well as anatomical variations which impair normal aeration and mucociliary clearance of the sinuses. Therefore both these tools are imperative in the evaluation and preoperative planning of a patient for functional endoscopic sinus surgery.⁵

Aims and Objectives

To determine the reliability of nasal endoscopy and computed tomography to predict the operative findings in the evaluation of chronic sinusitis.

Materials and Methods

Source of data: All patients attending the ENT out patient department of a tertiary care centre with proved upper respiratory tract infection with sinusitis for more than three months duration and not responding to the full course of antibiotics analgesics and decongestant. In addition to the above the patients were willing to undergo Functional Endoscopic Sinus Surgery and

participate in the study.

Sample Size: 30 patients. Out of these, 20 patients needed bilateral surgery Thus a total of 50 procedures were carried out.

Study type: Cross Sectional Study

Results

The correlation of diagnostic endoscopic, computed tomographic and operative findings is as shown in the tables (Table 1 and Table 2 respectively).

As the total number of procedures that were carried out in this study were 50 all the confirmed operative findings of 50 sides are available (and 47 sides for posterior ethmoid and 27 for sphenoids). Only the parameters confirmed at operation of being normal or abnormal were correlated with the diagnostic endoscopy and computed tomography scan.

The diagnostic endoscopy findings correlated very well with the operative findings for all parameters without any false positives or false negatives.

Diagnostic endoscopy was found to be the most sensitive investigation for hiatus semilunaris, sphenoid recess and frontal recess with sensitivity of 94.73%, 100% and 90% respectively. While the specificity of these parameters were 53.59%, 79.19% and 91.71%, and the negative predictive value are 93.75%, 100%, 93.93%

Table 1: Correlation of diagnostic endoscopic, computed tomographic and operative findings

	Diagnostic Endoscopy					Computed Tomography				Operative findings	
	N	Abn	F +ve	F -ve	NV	N	Abn	F +ve	F -ve	N	Abn
Inferior Turbinate	43	7	0	0	0	43	7	0	0	43	7
Middle Turbinate	19	26	0	0	5	20	30	0	0	20	30
Septum	22	8	0	0	0	22	8	0	0	22	8
Inferior Meatus	45	5	0	0	0	45	5	0	0	45	5
Middle Meatus	14	33	0	0	3	12	38	5	0	17	33
Uncinate	14	29	0	0	7	14	34	0	0	14	34
Hiatus semilunaris	18	19	0	0	13	6	44	13	1	18	32
Bulla ethmoidalis	15	13	0	0	22	14	36	6	5	15	35
Sphenoethmoid recess	16	2	0	0	22	31	19	0	5	26	24
Frontal recess	25	18	0	0	7	27	23	3	5	25	25
Agger nasi cells	18	13	0	0	7	18	20	0	0	18	20
Haller cells	—	—	—	—	50	1	1	0	0	1	1
Accessory maxillary ostium	0	4	0	0	1	0	5	0	0	0	5
Anterior ethmoids	—	—	—	—	50	21	29	0	13	8	42
Maxillary sinus	—	—	—	—	50	10	40	3	2	11	39
Posterior ethmoids	—	—	—	—	50	25	22	2	1	26	21
Sphenoid	—	—	—	—	50	14	13	1	2	13	14

Legend: N- Normal Abn- Abnormal F +ve- False Positive F -ve- False Negative NV- Not visualised

respectively. As all the three parameters considered are the key areas where all the major sinuses drain, it can be inferred that diagnostic endoscopy can be definitely used as a very sensitive tool towards diagnosing the infection in the adjacent sinuses. These parameters were lower for the middle turbinate, middle meatus and bulla ethmoidalis. Although they did correlate with the CT findings but not as well as the frontal recess, hiatus semilunaris and sphenoid recess.

On Endoscopy, in addition to gross findings such as pathologic discharge, subtle evidence of disease in the osteomeatal area may be identified. Prolapsed mucosa in the infundibulum is evidence of disease in the anterior ethmoid. An inflamed bulla is also an evidence of disease in this area. Mucosal edema or polypoidal mucosa in the area of attachment of the middle turbinate anteriorly suggests disease in the frontal recess. In addition, the lateral nasal wall is thin in the area of the fontanelles and the infundibulum, and disease behind these structures

may be reflected in edema or erythema at these sites.

From Table 2, amongst various parameters that were correlated, the sensitivity was found to be good for almost all the parameters except for anterior ethmoids. The specificity was found to be good for almost all the parameters except for maxillary sinus.

Similarly, negative predictive value of CT scan was good for maxillary sinus, frontal recess, posterior ethmoids and sphenoid but not for anterior ethmoids. These values also suggest that the disease in the anterior ethmoids is much more than what is shown by CT.

Discussion

The computed tomography findings correlated well with the confirmed findings at operation but there were a significant number of false positives and false negatives. The coronal section CT scans

Table 2: Correlation of Computed Tomography (CT) findings with Operative (O) findings:

	Anterior Ethmoids	Maxillary Sinus	Frontal Recess	Maxillary Ostium	Posterior Ethmoids	Sphenoid Sinus
Normal [CT(N)+O(N)]	8	8	22	4	24	12
Abnormal [CT(A)+O(A)]	29	37	20	39	20	12
False Positive [CT(A)+O(N)]	0	3	3	3	2	1
False Negative [CT(N)+O(A)]	13	2	5	4	1	2
Sensitivity	69.04%	94.87%	80%	90.69%	95.23%	85.71%
Specificity	100%	72.72%	88%	57.14%	92.30%	92.30%
Positive Predictive Value	100%	92.5%	86.95%	92.85%	90.90%	92.30%
Negative Predictive Value	38.09%	80%	81.48%	50%	96%	85.71%

Legend: DE - Diagnostic Endoscopy CT - Computed Tomography A - Abnormal N - Normal O - Operative findings

Bullet Point Summary

- Nasal endoscopy provides the ability to accurately access critical areas for evidence of localized disease, or for anatomical defects that compromise ventilation and mucociliary clearance.
- Computed Tomography provides a method for effectively demonstrating the mucosal changes and the various disease patterns in the sinuses in addition to complications.
- Both these tools are imperative in the evaluation and preoperative planning of a patient for functional endoscopic sinus surgery.
- Disease in the anterior ethmoids is much more than what is shown by CT.
- Systematic diagnostic endoscopy is the best way forward to evaluate and objectively confirm the intranasal pathology with good sensitivity and specificity for diagnosing the disease with CT scan being supplemented only in cases of high index of suspicion of intrasinus pathology and in cases where variations and vital relations of the paranasal sinuses impede the visualisation of the disease completely.

provided most of the information required for an endoscopic clearance.

After the correlation of the state of sinuses in CT scans with the operative findings, it was noted that in some cases the sinuses showed presence of disease when CT scan showed normal sinuses (False negatives). Possible reasons could be the variable nature of sinus disease, time lag between the CT imaging and the surgery where in the patient might have had another episode of acute sinusitis in this period, inability of the CT to recognize minimal changes in the mucosa window and possibly width in our study which was 5 mm.

A few cases showed no disease at surgery while CT showed an abnormal sinus (False positive). Possible explanation could be remission of the disease as all patients received preoperative medical therapy. Another possibility would be the inability of the CT to differentiate between fibrous tissue and inflammatory mucosal disease.

These were also observed by Katsantomis et al.⁶ in cases of revision surgery. Havas⁷ et al. found mucosal abnormalities in atleast one of the paranasal sinuses in 42.5% of patients. Bolger⁸, Butzin Parsons found that in patients scanned for non sinusitis reasons, the maxillary sinus was the most frequently affected region.

Considering all the above factors, a well controlled coronal plane CT investigation of subjects who lack evidence of sinus disease by a standard comprehensive history and nasal endoscopic examination is needed to understand more clearly the background prevalence of mucosal abnormalities on CT scan.

Regardless of the cause, the high prevalence of mucosal abnormalities noted on scan must be considered when evaluating patient with chronic sinus complaints to avoid a false positive diagnosis of sinusitis. It is imperative that a thorough evaluation be conducted, which includes a detailed clinical history as well as a nasal endoscopic examination. The CT scan should not be used exclusively to diagnose chronic sinusitis or to determine the need for surgery, rather, it should be used to provide supplementary clinical data to the history and endoscopic examination, and assist in directing surgical treatment to the affected areas.

Diagnostic endoscopy was found to be most sensitive investigation for the hiatus semilunaris, sphenoethmoid recess and frontal recess. Since these are the key areas where most of the sinuses drain, it can be inferred that diagnostic endoscopy can be definitely used as a very sensitive tool

towards diagnosing the infection in the adjacent sinuses, the only limitation being the presence of gross pathology or severe anatomical abnormality that makes it impossible to pass the endoscope beyond a certain point.

Rosbe and Jones⁹ in 1998 compared nasal endoscopy, CT scan and a symptom questionnaire and found that in 91% of patients in whom endoscopy revealed presence of disease, the computed tomography was also suggestive of CRS.

In a study done by Stankiewicz and Chow¹⁰ on 78 patients with CRS in 2002, the correlation between nasal endoscopy, computed tomography and symptoms was done and it was found that the sensitivity of endoscopy as compared with CT was 46%, specificity was 86%, PPV was 74%, and NPV was 64%. There was a stronger association between a negative endoscopy and CT findings, showing a 78% correlation with CT that was negative or showed minimal sinus disease.

In a study done by Bhattacharyya and Lee¹¹ in 2010, 202 patients of CRS were prospectively evaluated. Endoscopy also improved the positive predictive value from 39.9% to 66.0%, and negative predictive value from 62.5% to 70.3%. In addition to this, endoscopy also significantly improved the specificity from 12.3% to 84.1% respectively.

The associations between symptom based criteria as well as endoscopy and CT results was evaluated by Ferguson et al.¹² The sensitivity of endoscopy was 24% and specificity was 100%. Hence, it was concluded that endoscopy is a useful tool for the confirmatory diagnosis and not for ruling the disease out.

The importance of nasal endoscopy is further reiterated by the study done by Vining et al.¹³ wherein it was observed that in cases with positive computed tomography findings, nasal endoscopy was useful in getting a clear picture of the type of soft tissue blocking the middle meatus. Further, in patients wherein a computed tomography showed no significant findings, nasal endoscopy demonstrated deviated nasal septum, middle meatal edema as well as hypertrophied adenoids and turbinates.

Conclusion

Diagnostic nasal endoscopy was found to be a very good tool for the evaluation of patients of CRS with a very good sensitivity and specificity for all parameters studied except those areas which could not be accessed due to gross anatomical/pathological changes.

Computed tomography was also effective for evaluation of CRS with very good sensitivity for all sinuses except the anterior ethmoids and specificity was good for all sinuses except for the maxillary sinus.

Hence, both diagnostic endoscopy and computed tomography imaging of the paranasal sinuses are important preoperative evaluation tools in detecting pathology and both are complementary to each other. Systematic diagnostic endoscopy is the best way forward to evaluate and objectively confirm the intranasal pathology with good sensitivity and specificity for diagnosing the disease; with CT scan being supplemented only in cases of high index of suspicion of intrasinus pathology and in cases where variations and vital relations of the paranasal sinuses impede the visualisation of the disease completely.

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Ethical Approval: The permission was taken from Institutional Ethics Committee prior to starting the project. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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