Comparative study between CT Scan and Intraoperative Endoscopic Findings in Patients with Chronic Rhinosinusitis

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Abstract

Background:

Paranasal sinus diseases are one of the communest causes of patients visit to an Otolaryngologist. The symptoms are multiple and nonspecific, while inspection is often limited as sinuses cannot be examined directly. Anterior rhinoscopy gives little information about middle meatus and osteomeatal unit.

Objective: The study is carried out with an objective to compare the CT scan findings and diagnostic endoscopic findings with operative nasal endoscopy findings in patients with chronic rhinosinusits.

Methods: A cross sectional study dealt with 36 patients with chronic rhinosinusitis not responding to routine medical lines of treatment were selected and operated after being thoroughly investigated by means of CT scan and nasal endoscopy. All patients underwent bilateral surgery, a total of 72 events were carried out. Verdicts of both the CT scan as well as analytic nasal endoscopy were correlated with operative findings.

Results: In the current study, a high association was found between both the modalities of assessment i.e CT scan and operative nasal endoscopy. Indicative nasal endoscopy is found to be highly specific investigatory modality with mean specificity (87.5%), while it's mean sensitivity(79.5%).Whereas CT-scan was highly sensitive (92.5%), while it's specificity was (84.18%).

Conclusion : Both nasal endoscopy and CT-scan are objective measures that can increase the accuracy of chronic rhinosinusitis diagnosis. The use of symptoms, CT-scan, and nasal endoscopy may prove to be the most accurate approach for reaching the diagnosis of chronic rhinosinusitis.

Keywords: Paranasal sinus disease, CT scan, Diagnostic nasal endoscopy, Endoscopic sinus surgery.

Introduction

Aim of the study

To compare the radiological appearance (CT scan) and endoscopic findings in patients with chronic rhinosinusitis and to assess their accuracy.

The term 'sinusitis' refers to a set of disorders characterized by inflammation of the mucosa of the paranasal sinuses. Because the inflammation nearly always involves the nose, it is now generally accepted that 'rhinosinusitis' is the like better term to describe this inflammation of the nose and paranasal sinuses[(1)]. A widely accepted set of classifications or definitions was developed by the Rhinosinusitis Task Force of the American Academy of Otolaryngology Head and Neck Surgery[(2)]and reported by Lanza and Kennedy[(3).]

The newer definition Rhinosinusitis is a group of disorders characterized by inflammation of the mucosa of the nose and paranasal sinuses. Chronic rhinosinusitis is rhinosinusitis of at least 12 consecutive weeks' duration. Therefore, immedicable rhinosinusitis is a kind of disorders considered by inflammation the mucosa of the nose and paranasal sinuses of at least twelve consecutive weeks' duration[(4).]

Patients and Method

A cross sectional study of sinus diseases using diagnostic endoscopy and computed tomography was conducted in the ENT department, in AL-

Hilla general teaching hospital , involved 36 patients for the period from
November 2010 to August 2011.
All the patients attending the E.N.T. outpatient department, who had
chronic sinusitis for more than three months duration not responding to the
medical treatment and who were willing to undergo Functional Endoscopic Sinus Surgery, and all patients were followed up on two-weekly interval until the cavities were well healed.

Inclusion Criteria:

Altogether the patients with clinically proven chronic sinusitis not responding to routine medical treatment.

Exclusion Criteria:

Patients with acute attack of sinusitis. Patient with sinus malignancies. Patient whom were not willing to undergo FESS.

Methods of Collection of Data:

- The cases selected for the study were subjected to detailed history taking and examination.
- A routine hematological investigations (HB, BT, CT) and urine examination (albumin, sugar, microscopy), swab from middle meatus for culture sensitivity along with "X-ray para nasal sinuses were done for the patients.

Completely the patients in energetic stage of the disease were treated with progress of suitable antibiotic, systemic antihistamines and resident decongestants. They were also treated for medical conditions e.g diabetes mellitus, hypertension, and nasal allergy.
Each patient underwent a systematic diagnostic nasal endoscopy and computed tomography of nose and para nasal sinuses.

Stastical considerations

$$\text{Sensetivity} = \frac{\text{True (+ve) + false (-ve)}}{\text{True (+ve)}} * 100\%$$

$$\text{Specificity} = \frac{\text{Trur (-ve) + false (+ve)}}{\text{True (-ve)}} * 100\%$$

 In the current study, ESS was the gold standard . Hense, the false
(+ve) are those values were (+ve) on CT-scan or diagnostic
endoscopy and found to be (-ve) i.e. no abnormality during operative
intervention.
 The false (-ve) are those values were (-ve) on the CT-scan
or diagnostic endoscopy and found to be (+ve) i.e. abnormal
during operative intervention.
 The abnormality for which we are looking is either purulent
discharge or polyposis.

Questionnaire formula

Name: age: address: occupation:
Phone no. : Operation:
case sheet /no. :
 Chief complaint:
 Duration
 History of present illness:
 Systemic review:
 Previous medical & surgical history:
 Social& family history:
 General examination:
 ENT examination:
Nose: anterior &posterior rhinoscopy, flexible &rigid endoscopy.

 Diagnostic endoscopy:

Nasal endoscopic findings :
1. Floor of the Nose: 2. Mucosal thickening: 3. Septum :
4. Inferior Turbinate : 5. Middle Turbinate : 6. Nasopharynx :
7. Sphenoethmoidal recess : 8. Hiatus Semilunaris 9. Bulla Ethmoidalis
10.Uncinate: 11.Nasal polyps: 12.Frontal Recess:
13.Anatomical Variations:
i. Agger Nasi Cells :
ii. Accessory Maxillary ostium:
iii. Bulla ethmoidalis:
iv. Uncinate Process:
v. Middle Turbinate:
vi. Septal Deviation:
vii. Onodi Cells

 Computed tomographic findings:

Plain / Contrast Axial / Coronal
1. Frontal Sinus

2. Infundibulum
3. Maxillary Sinus
4. Hiatal obstruction
5. Frontal recess
6. Anterior ethmoids
7. Posteriors ethmoids
8. Sphenoethmoidal recess
9. Sphenoid sinus
10.Agger nasi Cells
11.Haller Cells
12.Bulla Ethmoidalis
13.Uncinate Process
14.Middle Turbinate hypertrophy
15.Concha bullosa
16.Onodi Cells
17.Inferior Turbinate hypertroph y
18.Cysts
19.Septal Deviation
20.Polyps

Intraoperative fess findings:

1. Frontal Sinus
2. Infundibulum
3. Maxillary Sinus
4. Hiatal obstruction
5. Frontal recess
6. Anterior ethmoids
7. Posteriors ethmoids
8. Sphenoethmoidal recess
9. Sphenoid sinus
10.Agger nasi Cells
11.Haller Cells
12.Bulla Ethmoidalis
13.Uncinate Process
14.Middle Turbinate hypertrophy
15.Concha bullosa
16.Onodi Cells
17.Inferior Turbinate hypertrophy
18.Cysts
19.Septal Deviation
20.Polyps

Results and observations age distribution:

The age of the patient in our study Varied from 11yrs to 60yrs. Maximum number of patients were in 31 to 40 years of age group, therefore 33.3% of patients were in early 4th decade of age.

Age (Years)	***No of Patients***	***Percentage***
11-20	8	22.2
21-30	6	16.7
31-40	12	33.3
41-50	8	22.2
51-60	2	5.6
Total	36	100

Gender distribution:

Our study showed male preponderance i.e 61% male and 39% female patients. Thus male to female ratio was 1.6:1.

Sex	***No of Patients***	***Percentage***
Male	22	61
Female	14	39
Total	36	100

Symptoms:

Symptoms	***No. of patients***	***%***
Nasal obstruction	32	88.88
Running nose	30	83.33
Postnasal drip	26	72.22
Sneezing	25	69.44
Facial pain/ headache	19	52.77
Anosmia/hyposmia	12	33.33
Epistaxis	7	19.44

Signs:

Findings	***No./physical examination***	***%***
Bilateral nasal polyp	28	77.77
Post nasal discharge	26	72.22
Congested mucosa	18	50

Pale mucosa	12	33.33
Mucopus in nasal cavity	12	33.33
Hypertrophy of inferior turbinate	10	27.77
Septal deviation	9	25
Clear discharge	6	16.66
Normal mucosa	6	16.66
Paradoxical middle turbinate	-	-
Unilateral polyp	-	-
Abnormal uncinate proscess	-	-
Agger nasi	-	-

Preoperative endoscopic examination:

Endoscopic examination	**Findings**		**F+ve**	**F-ve**	**Sensitivity %**	**Specificity %**
	N	A				
Frontal Sinus	0	0	0	0	0	0
Infundibulum	0	0	0	0	0	0
Maxillary Sinus	0	0	0	0	0	0
Hiatal affection	2	14	0	1	93.3	100
Frontal recess	0	0	0	0	0	0
Anterior ethmoids	0	0	0	0	0	0
Posteriors ethmoids	0	0	0	0	0	0
Sphenoethmoidal recess	9	7	1	3	70	90
Sphenoid sinus	0	0	0	0	0	0
Agger nasi Cells	11	5	1	2	71.4	91.7
Haller Cells	0	0	0	0	0	0
Bulla Ethmoidalis	10	6	4	2	75	71.4
Uncinate Process	15	1	1	0	100	93.8
Middle Turbinate hypertrophy	5	12	1	3	80	83.3
Concha bullosa	0	0	0	0	0	0
Onodi Cells	0	0	0	0	0	0
Inferior Turbinate hypertrophy	10	6	2	3	66.7	83.3
Cysts	0	0	0	0	0	0
Septal deviation	8	6	1	2	75	88.8

Diagnosis:

22.22% of the patients in our study suffered from chronic sinusitis without polyp whereas 77.78% presented with bilateral nasal polyposis.

Diagnosis	***No of Patients***	***Percentage***
Chronic rhinosinusitis (without polyposis)	8	22.22
Gross nasal polyposis	28	77.78
Total	36	100

Endoscopic operative procedures Performed:

Details	***no.***	***%***
Polypectomy	28	77.77
Uncinectomy	36	100
Middle meatal antrostomy	36	100
Decapping of bulla	36	100
Anterior ethmoidectomy	36	100
Posterior ethmoidectomy	26	72.22

Sphenoid opening	18	50
Agger nasi resection	18	50
Opening of concha bullosa	4	11.11
Septal surgery	4	11.11

Computed tomography findings:

CT-scan Parameters	***Detected abnormality***		**Normal**	**F+ve**	**F-ve**	**Sensitivity %**	**Specificity %**
	R	L	R+L	R+L	R+L		
Frontal Sinus	18	16	38	8	0	100	84.8
Infundibulum	18	18	36	6	0	100	85.7
Maxillary Sinus	30	28	8	2	4	93.5	80
Hiatal obstruction	30	26	6	2	8	87.5	75
Frontal recess	34	26	12	4	2	96.8	75
Anterior ethmoids	36	32	4	4	0	100	50
Posteriors ethmoids	24	24	24	4	2	96	85.7
Sphenoethmoidal recess	18	14	40	4	0	100	88.88
Sphenoid sinus	18	16	38	22	0	100	76
Agger nasi Cells	20	14	38	16	0	100	70.4
Haller Cells	2	2	68	1	0	100	98.6
Bulla Ethmoidalis	28	22	22	6	2	96	78.6
Uncinate Process	4	2	20	0	30	16.7	100
Middle Turbinate hypertrophy	26	18	28	4	2	95.7	87.5
Concha bullosa	6	4	62	6	0	100	91.2
Onodi Cells	0	0	0	0	0	0	0
Inferior Turbinate hypertrophy	18	12	42	2	2	93.75	95.5
Cysts	4	0	68	0	0	100	100
Septal deviation	10	8	54	2	4	81	96.42

Endoscopic sinus surgery findings:

ESS Findings	***Detected abnormality***		**Normal**
	R	L	R+L
Frontal recess*	14	12	46
Infundibulum	34	26	12
Maxillary Sinus	30	28	14
Hiatal obstruction	34	30	8
Anterior ethmoids	34	30	8
Posteriors ethmoids	26	20	24
Sphenoethmoidal recess	16	12	44
Sphenoid sinus	6	6	60
Agger nasi Cells	8	10	54
Haller Cells	2	1	69
Bulla Ethmoidalis	22	24	26
Uncinate Process	18	16	38
Middle Turbinate hypertrophy	22	20	30
Concha bullosa	4	0	68
Onodi Cells	0	0	0
Inferior Turbinate hypertrophy	16	14	42
Cysts	4	0	68
Septal deviation	6	10	56

*** it was examined by using 30˚ scope and the aid of antrum cannula.**

Discussion

This study was conducted in the E.N.T. department/ AL.Hilla General Teaching hospital for the period from November 2010 to August 2011.Our study included 36 patients suffering from signs and symptoms

related to the sinuses for more than three months who didn't respond to medical treatment and subjected to undergo functional endoscopic sinus surgery. All the 36 patients underwent bilateral endoscopic sinus surgery , so a total of 72 procedures were carried out.

Age distribution: in our study the age distribution of patients varied between 11 – 60 years , with the maximum number of patients in 31 – 40 years category. These results were compared with other studies and were tabulated as follows:-

No.	Author	No. of patients	Age distribution in years	Most common age group in years
1	Joe J.k. et al[5]	119	6 – 94	37
2	Kulkarni N.H. et al(6)	50	21 -55	31 – 35
3	Saha K.L. et al (7)	60	13 – 69	21 – 40
4	Zojaji et al (8)	51	15 – 77	46
5	StanojkovicV (9)	40	/	41.2
6	Sheetal D.et al(10)	45	/	20 – 40
7	Nair S. et al (11)	90	16 – 71	34.8
8	Golam M. et al (12)	60	10 – 65	20 – 40
9	Current study	36	11 -60	31 – 40

Gender distribution:

In this study as shown in (Table 22) patients (61 %) were males, while 14 patients (39 %) were females. These results were comparable with the following studies :-

Author	Males	(%)	Females	(%)	Male:Female
Kulkarni N.H. et al (6)	32	64	18	36	1.8: 1
Stanojkovic V et al (9)	23	57.5	17	42.5	
Golam M. et al (12)	42	70	18	30	2.3: 1
Sheetal D.et al(10)	28	62	17	38	
Current study	22	61	14	39	1.6:1

Symptoms:

In the current study nasal obstruction were the commonest symptom which present in 32 patients (88.8 %). The next frequently occurring complaint was running nose in 30 patients (83.3 %). The other symptoms were noted ; postnasal dripping in 26 patients (72.2 %), sneezing in 25 patients (69.4 %), facial pain/ headache in 19 patients (52.7 %), anosmia/ hyposmia in 12 patients (33.3 %), and lastly epistaxis in 7 patients (19.4 %).While the other studies reported the above results as in the following table :-

Study	No. of patients	Nasal obstruction%	Running nose%	Postnasal drip%	Sneezing %	Facial pain/ headache %	Anosmia/ hyposmia %	Epistaxis%
Kulkarni et al (6)	50	84	70	44	30	84	6	6
Saha K.L. et al (7)	60	78	73	51	31.6	63.3	33.3	5
Zojaj et al (8)	51	100	90	/	73		29	/
Sheetal D. et al (10	45	/	80	/	/	90		/
Nair S. et al (11	90	85.5	55.7	40.3	/	45.3	15.8	/
Golam M. et al (12	60	70	50	33.3	25	65	13.3	/
Gulati & collegues(13)	30	83	76.6	33.3	73.3	16.6	/	/

Tan B.K. et al (14)	20	85	/	60	/	50	15	/
Current study	36	88.8	83.3	72.2	69.4	52.7	33.3	19.4

Signs :

In the current study the commonest clinical signs present were ; bilateral nasal polyposis in 28 patients (77.7%) , congested mucosa in 18 patients (50%), both pale mucosa and mucopus in the nasal cavity were in 12 patients (33.3%), hypertrophy of inferior turbinates in 10 patients (27.7%), and septal deviation in 9 patients (25%), and finally both clear discharge (serrous) and normal mucosa were in 6 patients (16.6%).In the study conducted by Vencatchalam V.P. et al (15)2000, clinical findings were hypertrophied inferior turbinates (10%), hypertrophied middle turbinates (17.14%), congested mucous membrane (15.71%), sinus tenderness (7.14%), and ethmoidal polyps in (12.8%).While in the study conductedby Kulkarni et al (6)2006, the commonest clinical sign was sinus tenderness in(36%), followed by edematous nasal mucosa in (34)%, nasal polyposis in (30 %), non purulent discharge in (30 %), purulent middle meatal discharge in (24%), and finally hypertrophied middle turbinate in (20%).

Diagnostic endoscopy (DE):

All the patients included in the current study underwent diagnostic endoscopy followed by CT-scan. On endoscopy in addition to gross findings such as pathologic discharge, subtle evidence of endoscopy was 79.5% and 87.5% respectively. From the obtained values, diagnostic endoscopy appears to be sensitive, but it is more specific diagnostic modality and this is supported by Stankiewicz S. -0. *'(16)2002 where sensitivity and specificity of endoscopy in confirming chronic rhinosinusitis were 46% & 86% respectively.This is also shown by Kulkarni etal(6)2006 were sensitivity and specificity were 87.4% and 89% respectively. While Cassian R(17)1997 show 84% sensitivity and 75% specificity.

disease in osteomeatal area may be identified. In our study, various parameters correlated were inferior turbinate, uncinate process, hiatus semilunaris, bulla ethmoidalis, sphenoethmoidal recess, agger nasi cells, & septal deviation. The sensitivity, specificity, false positive (abnormal DE + normal ESS), & false negative(normal DE + abnormal ESS) were calculated for nasal endoscopy as compared to operative findings for each parameter and tabulated.

In the current study, the sensitivity of diagnostic nasal endoscopy was maximum for uncinate process (100%), hiatus semelunaris (93.3%), middle turbinate (80%), bulla ethmoidalis (75%), and septal deviation (75%). The sensitivity was comparatively lower for agger nasi (71.4%), sphenoethmoidal recess (70%), and inferior turbinate (66.7%).

The specificity of diagnostic endoscopy was maximum for hiatus semilunaris (100%), uncinate process (93.8%), agger nasi (91.7%), sphenoethmoidal recess (90%), and for septal deviation (88.8%). The specificity was comparatively less for middle turbinate (83.3%), inferior turbinate (83.3%), and for bulla ethmoidalis (71.4%). Similar observations were noticed by Kulkarni et al(6)2006.

Parameter	**Sensitivity %**	**Specificity %**	**Sensitivity %**	**Specificity %**
Uncinate process	92	79	100	93.8
Hiatus semilunaris	100	100	93.3	100
Bulla ethmoidalis	91	85	75	71.4
Agger nasi cells	95	96	71.4	91.7
Sphenoethmoid recess	75	83	70	90
Inferior turbinate	84	92	66.7	83.3
Middle turbinate	74.5	88	80	83.3
The mean	**87.4**	**89**	**79.5**	**87.5**

In the current study the mean sensitivity & specificity of diagnostic

with nasal polyposis while 8 patients (22.22%) with chronic rhinosinusitis but without nasal polyp. According to Nair S. et al (11), nasal polyposis are common presentations seen in patients with chronic rhinosinusitis and are considered to be associated with more sever forms of of the disease with poor post-treatment outcomes. EPOS document to consider nasal polyposis as a subgroup of chronic rhinosinusitis(11). there are another studies who fail to differentiate between them due to similar prognosis observed after treatment(11).This is comparable with the current study and other studies as shown in the following table :-

comparing our diagnosis with other studies

Study	No. of patients	CRS no.	%	CRS + POLYP no.	%
Toros et al (19)2007	86	37	43	49	57
Golam M. et al(12)2011	60	12	20	20	33.33
Saha K.L.(7)2008	60	22	36.67	31	51.67
Nair S.(11)2011	90	38	42.22	52	57.77
The current study	36	8	22.22	28	77.78

A study conducted by Bhattacharyya N. et al(18)2010 in studying 202 patients, for symptom criteria alone, the sensitivity and the specificity were 88.7% and 12.3% respectively for chronic rhinosinusitis. The addition of endoscopic detection to symptom criteria significantly improved the specificity to 84.1%.From the above, one can determine that in patients meeting current guideline symptom criteria for chronic rhinosinusitis, the inclusion of nasal endoscopy look up diagnostic accuracy and should be emphasized as an initial diagnostic implement. Diagnostic endoscopy may help decrease the use of CT- scan, reducing the cost and radiation exposure.

The diagnosis

In the current study, there were 28 patients (77.78%) with chronic rhinosinusitis

Conclusion

1. Improvement in diagnostic accuracy should improve clinicians′ ability to treat patients with chronic rhinosinusitis.
2. The diagnostic endoscopy was with mean sensitivity 79.5% and specificity 87.5%.
3. The computed tomography was with mean sensitivity 92.5% and specificity 84.18%.
4. The poor specificity of using patient symptoms alone makes this an inaccurate way to diagnose chronic rhinosinusitis.
5. The endoscopic observation of pus, polyp or other significant mucosal derangement helps to solidify the diagnosis.
6. CT-scan provides a view of the nasal and paranasal sinuses with accuracy not afforded by any other imaging modality
7. The use of symptom - based diagnosis to initiate medical therapy is more cost effective but less accurate.
8. A careful assessment of different subjective and objective measures together may prove to be the key to improving diagnostic accuracy.
9. Both nasal endoscopy and CT are objective measures that can increase the accuracy of chronic rhinosinusitis diagnosis.
10. The use of symptoms, CT scan, and nasal endoscopy may prove to be the most accurate approach but is less accessible for the non-otolaryngologist.

Recommendations

1. For the otolaryngologist tomake an accurate diagnosis and develope an effective treatment plan, one must be aware of the structure of the ostiomeatal complex and any disease that exist in this area.

2. CT-scan serves as a surgical “road map” for the surgeon performing FESS.
3. Anterior rhinoscopy can be used but nasal endoscopy is recommended for patient who don’t have obvious inflammation on anterior rhinoscopy.
4. CT scan is recommended if the symptoms suggest chronic rhinosinusitis but areas accessible to nasal endoscopy don’t show signs of inflammation.

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