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COMPARATIVE STUDY BETWEEN PLAIN RADIOGRAPHY AND COMPUTED TOMOGRAPHY IN DIAGNOSTIC EVALUATION OF CHRONIC MAXILLARY SINUSITIS

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ABSTRACT

The objective of the study was to compare the role of plain radiography and CT scan in diagnostic evaluation of chronic maxillary sinusitis. The study was conducted in ENT department of Santosh Medical College and Hospital from Feb 2011 to Mar 2012.This study involved 60 patients of both genders between 12-60 years of age group who were clinically diagnosed as chronic rhinosinusitis on the basis of history and physical examination and not responding to 3 week trial of medical treatment. Every patient underwent radiological examination by waters' view of paranasal sinuses and CT scan simultaneously. The findings in both the groups were co-related among themselves.

INTRODUCTION

The Paranasal sinuses are hollow, air filled spaces located within bones of the face and surrounding nasal cavity, a system of air channels connecting the nose with the back of the throat. Paranasal sinuses are lined by respiratory epithelium. Inflammation of this mucosa is called sinusitis[1]. Sinusitis is an age old disease afflicting the mankind, maxillary sinus being most common to be involved. There are number of factors which lead on to sinusitis, of which anatomic variants and patho-physiological conditions affecting mucociliary clearance are important, leading to stasis of secretions[2]. Chronic maxillary sinusitis is not a life threatening disease but it incapacitates the person because of its clinical features that are quite embarrassing and distressing i.e. nasal congestion or obstruction, nasal discharge, headache, facial pain or pressure, olfactory disturbances, mild fever and halitosis. When these symptoms persist for 2 months, this is labeled as chronic sinusitis[3].

Although diagnosis of chronic sinusitis is clinical but for proper management, radiological evaluation is prime investigation of choice. There are five techniques of radiological evaluation i.e. Plain-radiography, Sonography, Conventional tomography, Computed tomography (CT Scan) and Magnetic Resonance Imaging (MRI). Plain X-ray is still the most important, economical, easily available, reliable and comparatively less radiation hazards technique for radiological evaluation of chronic sinusitis. Waters' view provides the best view for maxillary sinus[4,5]. But at times, plain radiography may be inadequate for accurate diagnosis or it frequently reveals the changes only when the disease is too advanced[6].

While conventional plain radiography readily demonstrates maxillary and frontal sinus disease they provide limited views of the anterior ethmoid cells, the upper two thirds of the nasal cavity and the frontal recess[7]. CT imaging provides detailed information of the paranasal sinuses and is now well established as an alternative to standard radiographs[8]. CT demonstrates the anatomical details and true local extent of the disease, which is essential in choosing the appropriate treatment modality.

MATERIAL AND METHODS

The study consists of patients attending the outpatient department of ENT in SANTOSH MEDICAL COLLEGE AND HOSPITAL GHAZIABAD. A total of sixty (60) consecutive patients of either sex between the age groups of 12-60 years, who were clinically diagnosed as chronic rhinosinusitis on the basis of history and physical examination and not responding to 3 weeks of medical treatment were enrolled in the study. It is a prospective study. The patients of allergic rhinitis, previous nasal surgery, polyps on anterior rhinoscopy were excluded from the study.

All the patients who presented with nasal complaints of duration of at least 12 weeks were taken up for the study. Detailed history, clinical examinations and routine investigations of each patient were carried out. Every patient underwent radiological examination by waters' view of paranasal sinuses and CT scan examination. An informed consent was taken from all the patients .The clinical and radiological details were recorded as per the proforma in the case sheet for permanent record.

Parameters of evaluation were identification and delineation of normal anatomic structures of the sinuses, detection and assessment of abnormalities (opacification, hypertrophic mucosa and for fluid levels), analysis of bony septa.

RESULTS

There were 39 males and 21 females in the age group of 12 to 60 years. The mean age of the patients was 26.71±11.62 years. Post nasal discharge was the most common symptom occurring in 45 cases (75%). Next in order being dull headache or heaviness of head in 30 cases (50%), nasal obstruction in 16 cases (26.67%), nasal discharge in 8 cases (13.33%), recurrent common cold in 6 cases (10%), recurrent sore throat in 5 cases (8.33%). In maximum number of cases (i.e. 35) the duration was between 1 to 5 years, whereas duration was one year or less in 13 cases and it was more than 5 years in 12 cases.

All the cases were examined radiologically by occipitomental view. Larger sinuses i.e. maxillary, frontal and to some extent sphenoid were easily depicted by plain radiography but no comment was possible about ethmoids and lateral nasal wall structures. Reporting was mainly concentrated to maxillary antrum. The amount of opacity varied from partial to completely opaque in one or both maxillary sinuses. Bilateral partial opacity was seen in 23 cases (38.33%),

unilateral partial opacity in 7 cases (5.83%), bilateral complete opacity in 16 cases (26.67%) and unilateral complete opacity was found in 12 cases (10%).

Haziness in all sinuses was reported in only one case (1.67%). In two cases sinuses were clear (3.33%). Frontal sinus was not pneumatized in 4 cases (Table 1).

TABLE 1

Waters' view findings of chronic sinusitis patients

S.No.	Waters view findings	No. of cases (n=60)	Percentage	No. of sinus sides involved (n=120)	Percentage
1.	Bilateral partially opaque	23	38.33%	46	38.33%
2.	Unilateral partially opaque	7	11.67%	7	5.83%
3.	Bilateral completely opaque	16	26.67%	32	26.67%
4.	Unilateral completely opaque	12	20%	12	10%
5.	Sinuses clear	2	3.33%	4	3.33%
6.	Deviated nasal septum	9	15%	_	-
7.	Polyps	6	10%	12	10%
8.	Frontal sinus not pneumatized	4	6.67%	8	6.67%

In CT examination. instead of giving long list of positive findings, a definite pattern, dividing the findings in five recognizable patterns of inflammatory sinonasal disease was followed[9].

The osteomeatal unit (OMU) pattern of the disease was seen in 33 cases (46.67%). The infundibular pattern of disease was found in 18 cases (19.17%). sinonasal polyposis (SNP) was present in 9 cases (15%), the sphenoethmoidal recess pattern of disease was found in 9 cases (9.17%) and sporadic or unclassified pattern of disease was seen only in 3 cases (5%), whereas in two cases all sinus were found clear (3.33%). (Table 2)

Anatomical variants that can predispose or cause chronic sinusitis were seen in 56.67% of the cases. Besides this, frontal sinus was not developed in 4 cases and poorly developed in one case. Among these 56.67% variations, deviated nasal septum was the most common finding i.e. in 15 cases (25%). Concha bullosa was present in 8 cases (13.33%), enlarged ethmoid bulla was present in 4 cases (6.67%) and paradoxical middle turbinate was found in 2 cases (3.33%). Polyps were found within the antrum in 9 cases and air fluid level was detected in 2 cases.

TABLE 2

CT Scan findings in chronic sinusitis patients

S.No.	Disease pattern	No. of Cases (n=60)	Percentage	No. of sinus sides involved (n=120)	Percentage
1.	Osteomeatal unit pattern Unilateral Bilateral	 10 23	 16.67% 38.33%	56	46.67%
2.	Infundibular pattern Unilateral Bilateral	 13 5	 21.67% 8.33%	23	19.17%
3.	Sphenoethmoidal recess pattern Unilateral Bilateral	 7 2	 11.67% 3.33%	11	9.17%
4.	Sinonasal polyposis	9	15%	18	15%
5.	Sporadic pattern	3	5%	6	5%
6.	Sinuses clear (Bilateral)	2	3.33%	4	3.33%

The findings of plain radiography and CT scan were compared as given below (Table 3)

TABLE 3

Comparative findings on X-ray PNS and CT scan in chronic sinusitis patients

X-ray	No. of cases	CT scan	No. of cases
Bilateral partially opaque	23	Osteomeatal unit pattern Infundibular pattern Sphenoethmoidal recess pattern Sinonasal polyposis sporadic pattern sinus clear	17 2 (4*) 1* 1 2 1
Unilateral partially opaque	7	Osteomeatal unit pattern Infundibular pattern Sphenoethmoidal recess pattern	3 4 2*
Bilateral completely opaque	16	Osteomeatal unit pattern Infundibular pattern Sphenoethmoidal recess pattern Sinonasal polyposis sinus clear	6 2(5*) 2* 7 1
Unilateral completely opaque	12	Osteomeatal unit pattern Infundibular pattern Sphenoethmoidal recess pattern Sinonasal polyposis	7 4 4* 1
Sinuses clear	2	Infundibular pattern sporadic pattern	1 1
Deviated nasal septum	9	Deviated nasal septum	15
Polyps	6	Polyps	9
Frontal sinus not pneumatized	4	Frontal sinus not pneumatized	4

* some of the cases showed multiple patterns on CT scan examination.

DISCUSSION

Plain radiography is predictive of maxillary sinusitis and helpful in diagnosing frontal and sphenoid sinusitis. The standard sinus views are insufficient for adequate evaluation of the ethmoid air cells, upper two third of the nasal cavity (i.e. osteomeatal complex, frontal recess) and anatomical variations predisposing for recurrent sinusitis. Role of ethmoid sinus disease in

the development of disease in other sinuses is often forgotten, perhaps because of poor visualization of ethmoid sinus on standard radiographs. Proctor[10] emphasised that ethmoids are the key to infection of sinuses. When sinus ostia are obstructed, mucociliary clearance becomes ineffective and sinusitis occurs[11,12]. Clinically, the need to evaluate the osteomeatal complex in patients with chronic and recurrent sinusitis further highlights the need for a systemic radiologic evaluation of this area with a technique other than and superior to plain radiography.

Certain anatomical and technical factors may modify the finding of the X-ray appearance. The various technical factors are soft tissue shadow of lip, moustaches containing radioopaque fixing material, undertilting of the radiographic base line, under or over exposure and overextension of the neck. Among the various anatomical factors are the relative thickness of the bony walls in relation to the size of the antral cavity; alteration in thickness of the vault bones, bony septa crossing the antral cavity and overlying soft tissue shadows[13].

Though the maxillary sinusitis is by far the most common amongst sinus ailments, there are numerous other pathological lesions like cyst, polyp and tumours which may produce uniform haziness on X-ray. It is evident by the present study that on plain radiography we were only able to detect the maxillary antrum haziness, deviated nasal septum, polyps (lying within maxillary antrum) and abnormalities of frontal sinus.

Proctor[10] has pointed out that the most common cause of failure in therapy directed at the major sinuses has been persistent ethmoid disease which frequently persists after traditional therapeutic approaches to sinus disease. In these patients, CT is mandatory because inflammatory changes in the middle meatus are poorly seen on plain radiographs. In this settings CT can establish the extent of surgery, help the clinician determine if full patency of the narrow passage has been reestablished. For functional endoscopic sinus surgery, CT is a prerequisite to know the "road map" for surgery[14].

CT with its excellent capability for displaying bone and soft tissues, is the current diagnostic modality of choice for evaluating the osteomeatal complex[14]. Furthermore, CT is effective in demonstrating predisposing causes of chronic sinusitis (anatomic variants) and provides precise guidance for therapeutic endoscopic instrumentation.

In the present study, the CT findings were a bit different than the previous reports[15]. Infundibular pattern of disease was seen in 19.17% (compared to 26%), OMU pattern in 46.67% (compared to 25%), SER pattern in 9.17% (compared to 8%), SNP pattern in 15% (compared to 10%) and sporadic pattern in 5% (compared to 25%). This indicates that there may be a wide variance in patterns of disease prevalence in different areas or population, In the present study, the anatomic variants were seen in 56.67% of cases which is almost 62% as reported earlier[16]. We observed deviated nasal septum as the commonest variant (25%) and concha bullosa (13.35%), whereas Bolger et al[120] also observed bony anatomic variations in 64.9% but they found septal deviation in 40% as compared to 25% in present study and concha bullosa in 14%, although we found the same in 13.35%.

In another study[15] it was reported that deviated nasal septum may be present in 20% population and prevalence increases upto 33% in chronic sinusitis patients. Concha bullosa may be present in 4 to 15.7% normal population and in patients with chronic sinusitis prevalence increases upto 33%. In present study, paraxdoxical middle turbinate was reported in 3.33% cases while the previous reported incidence is 15%[16]. Partial compartmentalization of maxillary antrum by septae was found in this study in 8.33% of cases which can lead to infection and predisposes for recurrent sinustis[13] this variant was not found (or not included) in above studies[15].

In comparison, unilateral partially opaque maxillary sinus involvement was reported in 7 cases on X-ray whereas on CT scan examination, it was osteomeatal unit pattern seen in 3 cases and infundibular pattern was found in 4 cases. Bilateral partially opaque maxillary sinus involvement was reported in 23 cases on X-ray whereas on CT scan examination, it was osteomeatal unit pattern seen in 17 cases, infundibular pattern in 2(4*) cases, sphenoethmoidal recess pattern in 1* case, sinonasal polyposis pattern in one case, sporadic pattern in 2 cases and one case was reported to be sinus clear. Bilateral completely opaque maxillary sinus involvement was reported in 16 cases on X-ray whereas on CT scan examination, it was osteomeatal unit pattern seen in 6 cases, infundibular pattern in 2(5*) cases, sphenoethmoidal recess pattern in 2* cases, sinonasal polyposis pattern in 7 cases and one case was reported to be sinus clear.

Unilateral completely opaque maxillary sinus involvement was reported in 12 cases on X-ray examination whereas on CT scan examination, it was osteomeatal unit pattern seen in 7 cases, infundibular pattern in 4 cases, sphenoethmoidal recess pattern in 4* cases, sinonasal polyposis pattern in one case.

Two cases in which sinuses were reported clear on X-ray, one turned out to be of infundibular pattern and in second case only ethmoid sinuses were opaque on CT examination. In two cases on X-ray examination, one was reported to be bilateral partially opaque maxillary sinuses and in second it was bilateral completely opaque maxillary sinuses but on CT examination all sinuses were clear. In one X-ray all sinuses were reported to be hazy but on CT scan examination case was diagnosed to be of sino-nasal polyposis pattern of disease.

There was under reporting for deviated nasal septum on X-ray (9 cases), whereas on CT examination it was found in 15 cases. Exact site of deviation was also evident i.e. whether in cartilaginous part or bony part or at the junction of the two. Polyp present in maxillary antrum was diagnosed by X-ray in 6 cases whereas on CT examination it was found in 9 cases.

Non development of frontal sinus was also diagnosed equally by both techniques in 4 cases. But on CT scan poorly developed frontal sinuses were reported in one more case.

Anatomical variants like concha bullosa, paradoxical middle turbinate, enlarged ethmoid bulla, incomplete septae in maxillary antrum which predisposes for chronic sinusitis were not at all reported on X-ray examination while they were clearly seen on CT examination.

Thus, CT is now considered mandatory in the diagnostic evaluation of diseases of PNS and planning better management. It is referred to as gold standard imaging of PNS diseases.

CONCLUSIONS

Sinusitis was more common in young adult males and most common presenting symptom was post nasal discharge. Waters' view X-ray is a primary and important investigation but less sensitive than CT scan for demonstration of radiographic changes in chronic sinusitis especially in critical areas like osteomeatal complex.

For diagnostic certainty, more sensitive imaging technique i.e. CT scan of the sinuses is superior and it also helps in planning of surgery. Plain radiographs were once the mainstay of diagnosis of sinus disease and now have been replaced by high resolution CT scan for the evaluation of chronic sinusitis. Plain radiographs do not allow adequate evaluation of the osteomeatal complex or of the sphenoid and ethmoid sinuses because of overlapping anatomic structures. CT is the modality of choice for imaging chronic sinusitis and provides the surgeon with important information of the osteomeatal complex and normal variations, preoperatively.

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