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RESEARCH ARTICLE

Correlation between clinical Features and imaging findings in pediatric patients with Rhinosinusitis: A tertiary care hospital based study

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Abstract

Background: Rhinosinusitis (RS) is a common disease in children that is sometimes overlooked. . Pediatric sinusitis is a potential common end point of many predisposing conditions rather than a distinct clinical identity. It is a problem of mucosal defense rather than an anatomic obstruction in large majority of cases⁵.The current study is undertaken to study the correlation between clinical features and imaging findings in pediatric patients with Rhinosinusitis.

Aims and objectives: To identify clinical signs and symptoms in patients of pediatric sinusitis.Radiological evaluation of recurrent and chronic sinusitis in pediatric age group and to find the relationship between clinical signs and symptoms with imaging finding in chronic and recurrent sinusitis.

Materiel and methods: The study was conducted for a period of 20 months, between Feb 2013 and sep 2014 in the department of Pediatrics, G.B Pant Hospital GMC Srinagar.

Patients included were in age group of 3-15 years with symptoms of chronic paranasal sinus disease. After a detailed history and thorough clinical examination they were subjected to radiological imaging, X-Ray paranasal sinuses, adenoid X-Ray and CT scan nose and paranasal sinuses (axial and coronal sections).

Results: Most common complaint in this study was nasal obstruction 38 (93%), followed by nasal discharge 34 (83%), and PND 17 (41%) while as other symptoms like sleep disorder was seen in 14 (34%), recurrent sore throat in 10 (24%) of patients, headache in 8 (19%), cough in 9 (22%) of patients. History of allergy was present in 15 (36%) of patients. Nasal Septum was deviated in 41% of patients. Turbinates were hypertrophied in 70% of patient. 11 (27%) had middle meatal discharge. Only 7 (17%) patients had Otitis Media. It was found that 14 (34%) of antra were radiologically clear, 27 (66%) had disease on plain X-rays. Sensitivity of X-ray is 66%.The most common sinus involved on X-ray was maxillary sinus 25 (61%) of cases. Out of 41 patients of CRS 6 (15%) had normal CT findings while as disease was confirmed in 35 (85%) of patients. Sensitivity of CT is 85%. Maxillary sinus followed by ethmoid sinus were more commonly involved. Hence, there is a significant correlation of clinical sinusitis with CT Nose and PNS.

Conclusion: Nasal obstruction is most common symptom followed by nasal discharge.Recurrent sore throat, fetid breath, PND, and sleep disorder are other presenting symptoms.Non-obstructive DNS is an incidental finding in 41% of patients, Turbinates were hypertrophied in 70% of patients, 11 (27%) had middle meatal discharge. Sensitivity of X-ray is 66%.X-ray for adenoids showed adenoid hypertrophy in 18 (44%) and normal in 23 (56%) of

patients. Out of 41 patients of CRS, 6 (15%) had normal CT findings while as in 35 (85%) patients had sinus pathology on CT. Sensitivity of CT is 85%. There is a significant correlation of clinical sinusitis with CT Nose and PNS. It has not significant correlation with X-ray findings. 6 (15%) of patients had LM scoring 0 – 5 with no disease on CT while adopting cut off 5 to represent true disease.

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INTRODUCTION

Rhinosinusitis is defined as a symptomatic inflammatory condition of mucosa of the nasal cavity and paranasal sinuses, the fluids within these, and/or the underlying bone¹. The term sinusitis has been supplanted by “rhinosinusitis” due to evidence that the nasal mucosa is almost universally involved in the disease process².

Rhinosinusitis (RS) is a common disease in children that is sometimes overlooked. Children get average 6-8 upper respiratory viral illnesses with 0.5-5% of these progressing to acute rhinosinusitis (ARS). An undefined number of these children will progress to have chronic rhinosinusitis (CRS)³. Sinusitis more frequently results in complications in pediatric patients than in adults⁴. Pediatric sinusitis is a potential common end point of many predisposing conditions rather than a distinct clinical identity. It is a problem of mucosal defense rather than an anatomic obstruction in large majority of cases⁵.

As the signs and symptoms of pediatric rhino sinusitis are often subtle and the fact that the history is often limited to observations of the parents, with a physical examination dependent on the cooperation of the child, there is greater emphasis on newer diagnostic modalities in evaluating childhood rhino sinusitis (Kennedy)⁶.

Chronic rhino sinusitis in children is a clinical diagnosis. It is based on clinical presentation as well as duration of symptoms. In the first 7-10 days it is usually a viral one except if symptoms worsen and a complication develops. If symptoms persist and are not improving by 10 days, then acute rhino sinusitis needs to be entertained⁷. CRS is when symptoms persist beyond 12 weeks. The physical examination of a patient suspected to have CRS involves direct visualization of the nasal cavity and associated structures. Anterior rhinoscopy with an otoscope is easy in children and should be a part of the initial evaluation. Nasal endoscopy in the older children or more cooperative child may be very helpful. Some authors have reported on the use of laboratory tests, including sedimentation rate, white blood cell counts and C-reactive protein levels, to help diagnose acute sinusitis. These tests appear to add little to the predictive value of clinical finding in the diagnosis⁸.

The radiographic signs of paranasal sinus disease include variable degree of opacification, mucosal thickening, air-fluid levels, bony erosion, mass lesion (solid or cystic), foreign body, calcification and fracture. Meaningful interpretation of these roentgenographic findings rests on correlation with the clinical signs and symptoms. Although the standard radiographs may be accurate in showing air fluid levels, the degree of chronic inflammatory disease is consistently and significantly underestimated⁹.

CT is currently the modality of choice in the evaluation of the paranasal sinuses and adjacent structures. Its ability to optimally display bone, soft tissue, and air provides an accurate depiction of both the anatomy and extent of disease in and around paranasal sinuses. In contrast to standard radiographs, CT clearly shows the fine bony anatomy of the osteomeatal channels⁹.

MATERIALS AND METHODS

The study was conducted for a period of 20 months, between Feb 2013 and Sep 2014 in the department of Pediatrics, G.B Pant Hospital GMC Srinagar. Patients included were in age group of 3-15 years with symptoms of chronic paranasal sinus disease. Patients with history of RTI, sinonasal malignancy were excluded in this study. 41 patients were selected from the outpatient department of Pediatrics, GB Pant hospital, Srinagar. Each patient parent was asked to fill questionnaire regarding symptoms of the disease.

History taking and examination:

A uniform history was documented for each patient, including nasal discharge, nasal obstruction, cough, post nasal discharge, recurrent sore throat, headache, facial pain, fever, epistaxis, hoarseness of voice, sleep disorder, itchy

eyes, watery eyes, itchy nose, mouth breathing, history of previous medical or surgical treatment of sinonasal disease.

Each patient was examined with nasal speculum and head mirror. In younger children nasal cavity was examined with otoscope.

Detailed local examination included: Rhinoscopy with an otoscope, otoscopy, examination of the mouth and oropharynx, endoscopy examination of the nasal cavity and sinuses and neck examination.

After a detailed history and thorough clinical examination they were subjected to radiological imaging, X-Ray paranasal sinuses, adenoid X-Ray and CT scan nose and paranasal sinuses (axial and coronal sections).

Imaging:

The Waters (occipitomeatal) view and the Caldwell (posteroanterior) view were obtained in each case in order to evaluate the maxillary, ethmoid, and frontal sinuses.

An abnormal sinus radiograph was defined as one that revealed total opacification or mucous membrane thickening greater than 4mm.

OBSERVATIONS AND RESULTS

During the period of 20 months of the study, 41 patients who fulfilled inclusion criteria were studied, out of which 29 were males and 12 were female. Out of 41 cases 29 (71%) were males and 12 (29%) were females with overall male to female ratio 2.41:1. Out of total number of 41 patients 3 (7.4%) were age group ≤ 5 years, 15 (36.6%) were in age group of 5 – 10 years and 23 (56%) were in age group of 11 – 15 years. The maximum incidence was found in age group of 5 – 15 years.

Table 1: Symptomatology Index

Symptoms	No. of Patients	%
Nasal obstruction	38	93
Nasal Discharge	34	83
Facial Pain	12	29
PND	17	41
Headache	8	19
Cough	9	22
Epistaxis	13	32
Rec. Sore Throat	10	24
Sleep Disorder	14	34
History of Allergy	15	36

Most common complaint in this study was nasal obstruction 38 (93%), followed by nasal discharge 34 (83%), and PND 17 (41%) while as other symptoms like sleep disorder was seen in 14 (34%), recurrent sore throat in 10 (24%) of patients, headache in 8 (19%), cough in 9 (22%) of patients. History of allergy was present in 15 (36%) of patients. (Table 1)

Table 2: Physical Signs in ENT Examination

Signs	No. of Patients	%
DNS	17	41
D/C from M.M	11	27
U/L Turbinate Hypertrophy	18	44
B/L Turbinate Hypertrophy	9	22
Otitis Media	7	17

Nasal Septum was deviated in 41% of patients. Turbinates were hypertrophied in 70% of patient. 11 (27%) had middle meatal discharge. Only 7 (17%) patients had Otitis Media. (Table 2)

Table 3: Radiographic appearance of X-ray paranasal sinuses

X-ray findings	No. of Patients	%
Normal X-ray	14	34
Abnormal X-ray	27	66

Maxillary Sinus Involvement	25	60
Maxillary sinus plus others	9	22
Frontal sinus involvement	4	9

It was found that 14 (34%) of antra were radiologically clear, 27 (66%) had disease on plain X-rays. Sensitivity of X-ray is 66%. The most common sinus involved on X-ray was maxillary sinus 25 (61%) of cases. (Table 3)

Table 4: NCCT Nose and PNS

CT findings	No. of Patients	%
Abnormal CT	35	85
Normal CT	6	15
Maxillary Sinus involvement	26	63
Ethmoid Sinus involvement	25	61

Out of 41 patients of CRS 6 (15%) had normal CT findings while as disease was confirmed in 35 (85%) of patients. Sensitivity of CT is 85%. Maxillary sinus followed by ethmoid sinus were more commonly involved. Hence, there is a significant correlation of clinical sinusitis with CT Nose and PNS. (Table 4)

Table 5: X-ray Adenoids

X-ray findings	No. of Patients	%
Adenoid hypertrophy	18	44
Normal	23	56
Total	41	100

X-ray soft tissue neck for adenoids showed adenoid hypertrophy 18 (44%) and normal in 23 (56%) of patients.

DISCUSSION

The diagnosis of pediatric rhinosinusitis is usually based on a combination of the history, physical examination, laboratory investigations, and radiological findings. The physical examination in pediatric patients with rhinosinusitis is often unrewarding. The physical examination is limited by the inaccessibility of the paranasal sinuses as well as the uncooperative nature of the pediatric patient. Evaluation on anterior rhinoscopy may reveal a mucopurulent discharge from the osteomeatal complex; however this assessment is difficult to perform on a child¹⁰.

Younger patient may tolerate evaluation by an otoscope which may demonstrate nasal mucosal edema, erythema, or possibly purulent discharge in the nose. Examination in the oropharynx may reveal moderate injection of the oropharyngeal wall with postnasal drainage in the posterior pharynx. Occasionally there may be tenderness with palpation over the paranasal sinuses. Assessment of the face may reveal appreciable periorbital edema or dark discoloration of the lower eyelids. Flexible and rigid endoscopy may provide a more complete evaluation in an older, more cooperative child. The most specific findings for acute rhinosinusitis in a child include mucopurulence from the middle meatus (after topical vasoconstriction), periorbital swelling, and facial tenderness¹¹.

Age is clearly one of the most significant factors in pediatric sinusitis. The younger the child, the higher the incidence of sinusitis and the more likely the maxillary sinus will be diseased. Younger children appear to be at a great risk of sinusitis because of their smaller anatomical structures, more frequent viral infections, increased exposure to indoor allergens and irritants and immature immune system. Hence greater care and attention is needed for diagnosis and appropriate management of these patients.

We selected 41 patients in age group of 3 – 15 years with symptoms of chronic paranasal sinus disease. They were subjected to radiological imaging, X-ray paranasal sinuses, adenoid X-ray and CT scan nose and paranasal sinuses (axial and coronal sections).

The findings were noted, tabulated, compared. The results of the present study are discussed with those of the previous studies.

Sex Incidence:

In the studies of McNeil et al., Matti Revonta et al., Arruda et al., higher incidence was seen in women. But as in Kurien et al.,'s study. In the present study there were 29 males and 12 females in our study giving a male to female ratio of 2.4:1

In a study done by Orapan Poachanukoon, Sira Nanthapisal and Utairat Chaumrattanakul male to female ratio was 2:1¹².

Another study conducted by Po-Hung Chang the male to female ratio was 1.4:1.0. Hence males are slightly more affected as compared to females. We also found male predominance in our study.

Age Distribution:

In our study, we found most of the patients (56%, 23 patients) in the age group of 11 – 15 years. The second most commonly affected age group of patients in our study was 5 – 10 years (15 patients, 36.6%).

In a study conducted by Rande H Lazar et al, they also found the most commonly affected age group as 10 – 16 years (60%)¹³. These results are similar.

Symptomatology:

In the studies by Hinde¹⁴ and Arruda¹⁵ et al., nasal obstruction was the main complaint followed by headache. In Nayak¹⁶ et al.'s study, the commonest symptom was nasal discharge followed by headache and nasal obstruction.

In the present study, the most common symptom was nasal obstruction 38 (93%), followed by nasal discharge 34 (83%) PND 17 (41%), while as other symptoms like sleep disorder was seen in 14 (34%), recurrent sore throat in 10 (24%) of patients, headache in 8 (19%), cough in 9 (22%) of patients. History of allergy was present in 15 (36%) of patients.

In a study conducted by Gungoor et al, purulent nasal discharge was found almost universally in all their patients¹⁷. We also found this symptom in 83% of our patients.

Orapan Poachanukoon, Sira Nanthapisal and Utairat Chaumrattanakul⁶³ in a study of pediatric rhinosinusitis found that nasal discharge 96%, cough PND 82% Recurrent sore throat 38% facial pain 11%, fever 16%, otalgia 26%, Snoring 70%.

Parson and Philips et al, in their study found seven cardinal symptoms of chronic rhinosinusitis in their patients^{18,19}. These were nasal obstruction in all the patients (100%), purulent nasal discharge in (90%), cough in (71%) and fetid breath in (67%), Postnasal drip in (63%). The less frequent symptoms found in their study were recurrent sore throat, sneezing insomnia, epistaxis and otalgia; all these symptoms contributing to about 20% of their patients. All these results are in accordance with the results found in our study.

Physical Signs / co-morbid conditions:

In the study by Arruda²⁰ et al., swelling of the nasal mucosa was present in 60% of cases. Similarly, Jun Kim et al 24 found the incidence of inferior turbinate hypertrophy to be 31%.

In this present study, most common sign found was hypertrophied turbinates (66%) followed by deviated nasal septum (41%).

On the basis of co-morbid conditions / predisposing factors, we found 15 (36%) patients with allergy, Deviated Nasal Septum in 17 (41%) patients and adenoid hypertrophy in only 18 (44%) patients. We could not found foreign body in any of our patients.

Rodney P. Lusk et al, in their study found allergic inflammation as a precursor to chronic rhinosinusitis in approximately 20% of their patients^{19,21}. They reported allergies in 40% of their patients having Chronic rhinosinusitis. Philip Fireman in another study reported that 10 – 15% of children experience seasonal or perennial allergic rhinitis by 16 years of age.

Radiological appearance of paranasal sinuses:

In our study we found that 14 (34%) of antra were radiologically clear, 27 (66%) had disease on plain X-rays. Sensitivity of X-ray is 66%. The most common sinus involved on X-ray is 66%.

The most common sinus involved on X-ray was maxillary sinus 25 (61%) of cases.

Out of 41 patients of CRS, 6 (15%) had normal CT findings while as disease was confirmed by CT in 35 (85%) of patients. Sensitivity of CT is 85%. Maxillary sinus followed by ethmoid sinus were more commonly involved.

McAlister et al. prospectively compared the usefulness of plain radiographs with coronal CT scans in pediatric patients with symptoms of chronic rhinosinusitis. Forty-five percent of children with normal plain films demonstrated abnormalities on CT scans and 34% of the children with abnormal plain radiographs had normal CT scans.

Eryilmaz et al²² found that the most commonly involved sinuses were anterior ethmoid and maxillary sinuses followed by posterior ethmoid, sphenoid and frontal sinuses.

Tantimongkolsuk et al²³ found that, in 100 paediatric patients clinically diagnosed with sinusitis, all paranasal sinus radiographs were abnormal, with the maxillary sinus being the most commonly involved sinus (99%) followed by the ethmoid sinus (91%). The majority of patients had involvement of more than one sinus.

The following Flow chart shows the study of comparison of plain radiograph, coronal CT, intraoperative findings in children with chronic sinusitis.

The study was conducted by Rande H Lazar, Ramzi T Younis, Louis S Parvey.

CONCLUSION

The most common age group who suffered chronic rhinosinusitis in pediatric population is 11 – 15 years being more common in male children as compared to female children. Nasal obstruction is most common symptom followed by nasal discharge. Recurrent sore throat, fetid breath, PND, and sleep disorder are other presenting symptoms. Non-obstructive DNS is an incidental finding in 41% of patients, Turbinates were hypertrophied in 70% of patients, 11 (27%) had middle meatal discharge. Less common symptoms found in pediatric patients are fever, facial pain, headache, cough, epistaxis, epiphora, otalgia, sleep disorder and sneezing. Plain radiography confirmed sinus pathology in 27 (66%) while as 14 (34%) of antra were radiologically clear. Sensitivity of X-ray is 66%. X-ray for adenoids showed adenoid hypertrophy in 18 (44%) and normal in 23 (56%) of patients. Out of 41 patients of CRS, 6 (15%) had normal CT findings while as in 35 (85%) patients had sinus pathology on CT. Sensitivity of CT is 85%. There is a significant correlation of clinical sinusitis with CT Nose and PNS. It has not significant correlation with X-ray findings. 6 (15%) of patients had LM scoring 0 – 5 with no disease on CT while adopting cut off 5 to represent true disease.

Conflicts of interest: None.

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