

Original Research Article

Chronic rhinosinusitis: the correlation between symptom severity score and findings on plain radiographs of the paranasal sinuses

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ABSTRACT

Background: Chronic rhinosinusitis (CRS) is a common clinical problem with often refractory symptoms. Though computed tomography scan of the paranasal sinuses (PNS) is the radiological gold standard for confirming the diagnosis of CRS, it is not readily available and affordable in developing countries. Hence plain radiographs are heavily relied upon to confirm the diagnosis of CRS. The reliability and adequacy of plain sinus radiographs in combination with disease specific questionnaires in the management of CRS is still debatable. The objectives of the study were to determine the correlation between symptom severity score and findings on plain radiograph of the PNS in adult patients with CRS.

Methods: This was an eight month prospective cross sectional study (April-November, 2014) of Fifty- two consecutive newly diagnosed adult patients with CRS.

Results: Age of patients ranged from 19–91 years. Male to female ratio was 1:1.26. There was significant positive correlation between high and moderate symptom severity score (severe and moderate disease) with findings on plain radiograph of the PNS ($p=0.032$ and 0.048 respectively).

Conclusions: The overall symptom severity score of CRS correlates with findings on the plain radiographs of patients with CRS especially in severe and moderate disease.

Keywords: Chronic rhinosinusitis, Paranasal sinuses, Radiographs, Symptom severity score

INTRODUCTION

Chronic rhinosinusitis is an inflammatory process involving the mucosa of the nose and paranasal sinuses which persists for 12 weeks or longer.¹ It is a common clinical problem with considerable morbidity and often refractory symptoms, accounting for approximately 26.7 million office and emergency department visits in the United States (US).^{2,3} The aetiology of CRS is multifactorial, with different inflammatory mechanisms that can lead to the development of the disease.⁴ Risk factors include allergic rhinitis, non-allergic rhinitis, nasogastric intubation, smoking, anatomic obstruction in the osteomeatal complex.^{5,6} The diagnosis of CRS is

made with a combination of symptoms and the signs, radiological imaging and endoscopy findings. The major symptoms and signs being nasal obstruction, facial discomfort, nasal discharge, distortion of smell and minor symptoms and sign includes headache, fever, fatigue, dental pain, cough and ear pain.^{7,8} Although there is a general agreement that the accuracy of computed tomography scan is better than that of plain films in confirming the diagnosis of CRS, the argument in favour of the latter is that it is widely available and cost effective.⁹ In Nigeria, computed tomography scan is still not routinely applied in the diagnosis of CRS for obvious reason of high cost and moreover, the facility is not readily available in many developing countries including

Nigeria, consequently plain radiography is still in use in our practice for confirming the diagnosis of CRS.¹⁰⁻¹²

Based on this reality in environments like ours, it becomes imperative to ascertain the clinical merits in cost effective yet efficacious means of confirming the diagnosis of CRS, grading the disease and prioritizing treatment by combining plain radiograph scoring of a patients' disease with their overall symptom severity score. In rural areas where radiographic tools may not be available, questionnaire scoring of patients' symptoms can be an important predictor of the presence of lesion(s) on plain radiographs of the PNS. This study was aimed to determine the correlation between symptom severity score and findings on plain radiographs of the PNS in adult patients with CRS, as there is a paucity of literature on this subject.

METHODS

This was an eight month prospective cross-sectional study (April–November, 2014) of consecutive newly diagnosed adult patients with CRS presenting at the ENT clinic of Obafemi Awolowo University Teaching Hospitals complex, Ile-Ife, a tertiary institution in the southwestern region of Nigeria.

Ethical clearance was sought and obtained for this work from the hospital Ethics review committee after which a written informed consent was obtained from individual participants in this study.

Inclusion criteria

Inclusion criteria were adult patients from 18 years of age and above; patients who had not had prior medical or surgical intervention at a medical center before presentation; patients who were clinically and/or radiographically diagnosed with CRS.

Exclusion criteria

Exclusion criteria were patients who refused to participate in the study; previous medical/surgical treatment at a medical center prior presentation.

The patients were enrolled as they presented and were attended to at the outpatients' clinic. After the preliminary assessment with regards to the inclusion and exclusion criteria, a thorough clinical history was obtained and physical examination (ear, nose, throat, head and neck) was done. This was aimed at making a clinical diagnosis of CRS based on symptoms and signs of the diagnostic criteria for CRS.¹³ Sino-nasal outcome test score-22 (SNOT-22) questionnaire, the most adequate instrument to assess chronic rhinosinusitis and takes less than five minutes to complete was then administered to each patient.¹⁴⁻¹⁶ This was to estimate the overall symptom severity score and grade the disease. The maximum score obtainable from the SNOT-22

questionnaire was one hundred and ten (110) and the minimum score was zero (0). A low/mild symptom severity equates to a SNOT-22 score of 0 to 26 (mild disease), an intermediate/moderate severity score to 27 to 58 (moderate disease) and high/severe symptom severity score equates to 59 and above (severe disease).¹⁵ The SNOT-22 questionnaire was administered at the first clinic visit. Upon completion of the questionnaire, a plain radiograph of the paranasal sinuses was done for each patient and a positive radiographic examination criteria for rhinosinusitis was defined as a demonstration of abnormalities of one or more of the following;

- No opacification or <4 mm of mucosal thickening = Normal PNS
- ≥4 mm of mucosal thickening = partial opacification
- Total opacification of one or more sinuses = Complete Opacification
- Air-fluid level.¹⁷⁻²⁰

The following plain radiograph projections of the PNS were reported by the researchers and a two consultant radiologists on a viewing box (kenex-Electro medical Hd, Essex, England): occipitofrontal view (caldwell view), occipitomental view (waters view) and lateral view. The occipitofrontal view was used to evaluate the frontal and ethmoid sinuses, the occipitomental view was used to evaluate the maxillary sinus and the lateral view was used to evaluate the sphenoid sinus. Demonstrated abnormalities on the plain radiographs was scored for the right and left paranasal sinus based on Al- Azzawi et al classification of radiological findings of the maxillary sinus (Waters view);²¹

- Mucosal thickening <4 mm without polyp formation - 1 (+)
- Air- fluid level- 2 (++)
- Haziness/mucosal thickening ≥4 mm (partial opacification)- 3 (+++)
- Complete opacification- 4 (++++)

Thus the minimum score for each patient was eight (8) and the maximum score was thirty-two (32). The higher the plain radiograph score the worse the lesion(s) seen. Thus a mild disease corresponded to a score of 8 to 15; a moderate disease corresponded to a score of 16 to 23 while a severe disease corresponded to a score above 23. These scores were the representation of the findings on plain radiographs of the paranasal sinuses of these patients. These levels of symptom/disease severity scores obtained from the questionnaire were then correlated with the plain radiographs findings.

Data obtained was recorded and analysed using the statistical package for social sciences (SPSS) version 21. Demographic variables were represented using tables and charts while summary statistics was done using means and proportions. The correlation between symptom severity score and findings on plain radiographs of the PNS was done using Spearman correlation. Statistical level of significance was inferred at $p < 0.05$.

RESULTS

Fifty-two adult patients with CRS were recruited into this study, 23 (44.2%) males and 29 (55.8%) females, giving a male to female ratio of 1:1.26. Their ages ranged from 19–91 years (mean 45.0±5.5) as shown in Table 1.

Postnasal dripping (88.5%, n=46), nasal blockage (86.5%, n=45) and need to blow nose (80.8%, n=42)

were the most prevalent symptoms of CRS seen among patients in this study. The least prevalent symptom was dizziness at 34.6% (n=18).

The maxillary sinus was the most affected paranasal sinus on plain sinus radiographs. While an abnormal PNS (91.3%, n=95/104) was the most common radiological finding seen in the maxillary sinus, a complete opacification of the sinus was the commonest abnormal variant (50.0%, n=52/104) as shown in Table 2.

Table 1: Age distribution of the patients.

Age range (yrs)	Frequency (n)	Percentage (%)
10-19	1	1.9
20-29	13	25.0
30-39	12	23.1
40-49	4	7.7
50-59	9	17.3
60-69	5	9.6
70-79	4	7.7
80-89	3	5.8
90-99	1	1.9

Table 2: Distribution of plain radiograph findings within the PNS (N=104).

Radiological findings	n (%)	Characteristics of abnormal PNS: n (%)
Frontal sinus		
Normal	93 (89.4)	Nil
Abnormal	11 (10.6)	Partial opacification: 7 (6.7) Complete opacification: 4 (3.9)
Ethmoidal sinus	38 (36.5)	
Normal		Nil
Abnormal	66 (63.5)	Partial opacification: 54 (52.0) Complete opacification: 12 (11.5)
Maxillary sinus	9 (8.7)	
Normal		Nil
Abnormal	95 (91.3)	Air fluid level: 2 (1.9) Partial opacification: 41 (39.4) Complete opacification: 52 (50.0)
Sphenoid sinus	96 (93.3)	
Normal		Nil
Abnormal	8 (7.7)	Partial opacification: 6(5.8) Complete opacification: 2(1.9)

Table 3: Frequency Distribution of plain radiograph findings.

Radiological grades	Frequency (n)	Percentage (%)
Mild (8-15)	20	38.8
Moderate (16-23)	28	53.8
severe (>23)	4	7.7

Maximum score=28.0, minimum=8.0, mean=16.31, standard deviation=5.10

Table 4: Frequency distribution of overall symptom severity score/disease severity using SNOT-22.

SNOT-22 grades	Frequency (n)	Percentage (%)
Mild (0-26)	14	27.0
Moderate (27-58)	23	44.2
Severe (59 and above)	15	28.8

Based on radiological classification of lesion(s) seen on plain radiographs, 38.8% of patients had a mild disease while 53.8% and 7.7% had moderate and severe diseases respectively (Table 3).

The mean total SNOT-22 of the patients in this study was 38.67 with standard deviation of 17.20. The median was 41.50, mode was 42.00, minimum score was 4.0 and maximum score was 76.0. The total SNOT-22 score was not skewed but approximately normally distributed.

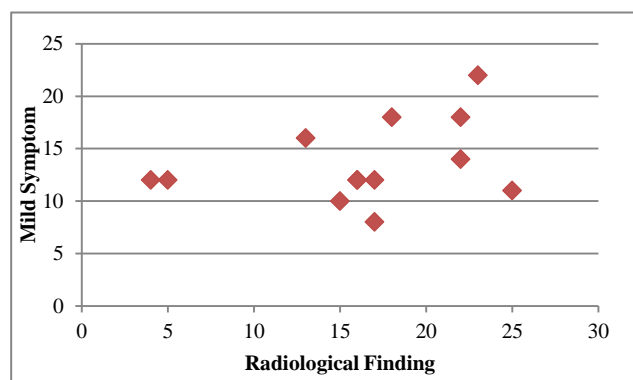


Figure 1: Scatter plot of low symptom severity (mild disease) and radiological findings (mild disease).

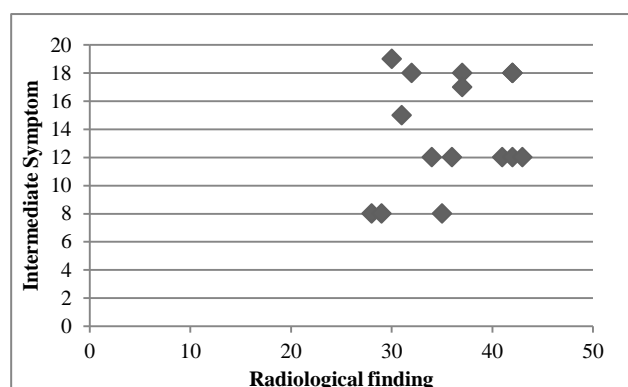


Figure 2: Scatter plot of intermediate symptom severity (moderate disease) and radiological findings (moderate disease).

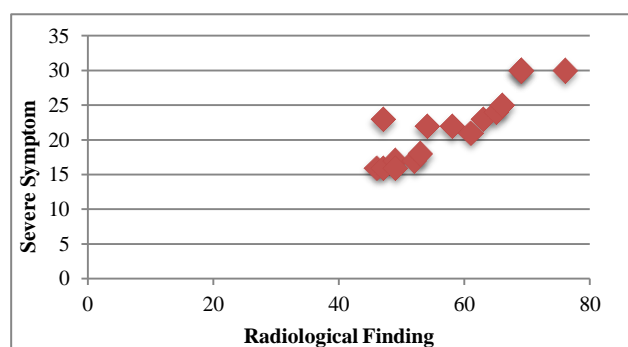


Figure 3: Scatter plot of high symptom severity (severe disease) and radiological findings (severe disease).

Using Spearman correlation test, there was a significant positive correlation between a high symptom severity score (severe disease) and findings on plain radiograph of the paranasal sinuses ($r=+0.598$, $p=0.032$), a significant positive correlation between intermediate symptom severity score (moderate disease) and findings on plain radiograph of the paranasal sinuses ($r=+0.421$, $p=0.048$) and an insignificant positive correlation between a low symptom severity score (mild disease) and findings on plain radiograph of the paranasal sinuses ($r=+0.336$, $p=0.240$).

DISCUSSION

The combination of radiological scoring of a patients' disease and the overall symptom severity score can provide a good and cost effective means of grading the disease, confirming the diagnosis and prioritizing treatment in CRS. This concept is particularly useful in developing countries where radiographs are still widely in use to confirm the diagnosis of CRS.¹⁰⁻¹²

This study found postnasal dripping, nasal blockage and nasal congestion as the three most prevalent symptoms of CRS. This finding is similar to what was reported in similar studies by Ologe et al and Da Lilly-Tariah et al.^{22,23}

The maxillary sinus was the most affected PNS with 91% of the maxillary sinuses studied having some form of abnormality (opacification). This finding is corroborated by Sogebi et al in a similar study but differed from a similar work by Kolo et al, who found normal radiological features as the commonest presentation in the maxillary sinus.^{24,25}

Although publications on the correlation of symptoms of CRS to CT findings exist in the literature, similar works using plain radiographs of the PNS are not as numerous.²⁶⁻²⁸

Da Lilly-Tariah et al in a similar study concluded that plain radiographs were useful in the diagnosis of chronic diseases of the paranasal sinuses while Kolo et al working in the northern part of Nigeria found the usefulness of plain sinus radiographs in the diagnosis of CRS questionable.^{25,29} He also reported a weak insignificant correlation between symptom severity scores and findings on plain radiographs of the paranasal sinuses. Our study found plain sinus radiographs to be very useful in the diagnosis of CRS as a significant number of patients who had diagnostic symptoms of the disease manifested abnormalities on their plain sinus radiographs, particularly in the maxillary sinus.

Furthermore, this study found a significant positive correlation between questionnaire scoring of a patients disease and findings on plain radiograph of the PNS in moderate and severe diseases (Moderate and High symptom severity scores). There was an insignificant

correlation in mild disease. This may be due to overlapping of rhinosinusitis symptoms with other benign rhinological condition such as rhinitis whose overall symptom score may not be as severe as that of rhinosinusitis hence triggering little or no changes in the sinus radiograph.

CONCLUSION

Plain radiograph of the PNS can be relied upon to confirm the diagnosis of CRS especially in maxillary sinus affectation. The combination of questionnaire scoring of the disease and plain radiographs of the PNS are relevant in the management of CRS, as scoring the overall symptom severity can help clinicians predict the findings on plain radiograph of the PNS.

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