

Radiography in Diagnosis of Chronic Maxillary Sinusitis and the Common Pathogens Isolated

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Abstract

Background: To determine the role of conventional radiography (R.G) in diagnosis of chronic maxillary sinusitis (CMS) and the common pathogens involved.

Method: This cross sectional analytical study was conducted at Holy Family Hospital Rawalpindi over a period of two years. 25 out-door patients with signs and symptoms of CMS were included. X-Ray views of sinuses were obtained. Bilateral antral lavage (A.L) was done and the 50 sinuses evaluated. Mucopurulent irrigations were considered positive and sent for culture sensitivity. Results of antral lavage were compared with radiography. The patients were divided into four groups: True positive (T.P), False positive (F.P), True negative (T.N) and False negative (F.N). CMS was diagnosed if clinical features matched the positive A.L irrespective of R.G. Specificity of radiography (T.P and T.N results) was differentiated from its sensitivity. Most prevalent pathogens and their association with RG was determined.

Results: Forty (80%) out of 50 sinuses were positive on radiography (sensitivity of R.G). Thirty-four (68%) gave positive and 16 (32%) gave clear washouts. T.P results were 25 (50%), T.N results were 02 (4%), F.P were 14 (28%) and F.N were 9 (18%). 21 out of 25 patients showed positive antral lavage leading to confirmation of diagnosis in 21 (84%) cases. Specificity of radiography was 54%. Most prevalent pathogens found were anaerobes. The sinuses infected with anaerobes were either clear or showed mucosal thickening on R.G.

Conclusion: Diagnosis of CMS should not be based on conventional radiography alone. It may only be used as an adjunctive tool by correlating it with the patients' symptoms and signs and evaluation by antral lavage.

Introduction

Chronic sinusitis is inflammation of the lining of one or more sinus cavities for more than 12 weeks. Maxillary sinus (M.S) is most frequently involved

in chronic sinusitis^{1, 2}. Common etiological factors are allergy³ and infection. Diagnosis of CMS is dependent on history, clinical findings, conventional radiography, C.T scans, ultrasonography, antral lavage and sinuscopy⁴⁻⁷. Standard views of radiography for paranasal sinuses are occipitontal, occipitofrontal, lateral, submentovertical and oblique views.

Maxillary sinuses are clearly visible on occipitontal view⁵. Positive findings include mucosal thickening, opacity and air fluid level. Although the conventional radiography using standard projections does not provide a very high degree of specificity in diagnosis⁸ because of inaccurate results, it is still being used frequently due to its common availability, affordability and minimal radiation exposure. As the sinuses are inaccessible to clinical evaluation and radiology can permit pathological assessment of sinuses to some extent, we have to rely on R.G. However, results of RG should be cross checked by doing AL to confirm the diagnosis. A.L is an easy procedure and is usually done under local anaesthesia in out door patients. It has both diagnostic and treatment value. Combination of R.G and AL could lead to accurate diagnosis of CMS and these two modalities are the main-stay for diagnosis.

Aspirate of AL can be sent for culture sensitivity to find out exact causative agent^{9, 10}. Prior to FESS (functional endoscopic sinus surgery) anaerobes were considered to be more prevalent causative agents than aerobes but specimen taken via endoscopes during surgery proved that aerobic infection is more common¹¹. In chronic disease gram negative organisms are main pathogens.

A more recent, and still debatable, development in chronic sinusitis is the role of fungus. Fungus can be found not only in patients of chronic sinusitis but in healthy people as well. It remains unclear whether the fungus is a definite factor or not¹².

The objective of study was to analyze the specificity of conventional radiography in the

diagnosis of CMS and to find out the common pathogens involved in its aetiology.

Patients and Methods

This prospective study was conducted in ENT Department of Holy Family Hospital Rawalpindi. The study included 25 patients of different age groups who presented to ENT out-door department over a period of 2 years. Only those patients were selected who presented with at least three symptoms of CMS (post nasal drip, headache, nasal blockage, recurrent sore throat, desire to clear throat), where examination revealed at least two clinical findings (mucopurulent discharge in post nasal space, pus beneath middle turbinate, lateral pharyngeal bands) and where the duration of symptoms was more than three months.

All the patients were managed on outdoor basis. Routine tests included complete blood examination, routine urinary examination to rule out any systemic disease. Specific tests included occipitontal X-Ray view of sinuses and antral lavage. Radiographic positive findings included opaque maxillary sinuses, mucosal thickening greater than 5mm from bone margin and air fluid level. Bilateral AL was done as an outdoor procedure in all 25 patients irrespective of sinus involved on R.G. Antral lavage was considered to be diagnostic.

In this study each sinus was considered a separate entity, so total of 50 sinuses were evaluated. Irrigation was considered positive if mucopurulent or purulent material was obtained and negative if washouts were clear. Fluid was sent for culture sensitivity. Care was taken to avoid bacterial contamination by nasal flora during the collection of specimen. Microbiology department was especially requested for cultures that included anaerobes.

Results of AL were compared with results of R.G and patients were divided into four groups. Group 1 was called true positive (T.P), if the mucopurulent irrigation matched with positive findings on R.G. Group 2 was false positive (F.P), if the abnormalities were detected on R.G but irrigation was clear. Group 3 was true negative (T.N), if clear irrigation matched with clear R.G and the group 4 was false negative (F.N), if no abnormality was detected on R.G but irrigation was mucopurulent. A.L findings were correlated with clinical features, CMS was diagnosed if clinical features matched positive A.L irrespective of the radiographic findings, as A.L was considered to be diagnostic. Specificity of R.G in diagnosing CMS was found by calculating T.P and T.N results. Sensitivity of R.G in detecting CMS was differentiated from its specificity by calculating

F.P and F.N results. Specificity of RG (T.P+T.N) was compared with specificity of AL and paired t test was applied for statistical evaluation. Mean with standard deviation was calculated. Results were considered significant if p value was < 0.05. Most prevalent pathogen was found out and an association was also made between type of pathogen and radiographic finding.

Results

Out of 25 patients, 11(44%) were females and 14(56%) were male. Age ranged between 15-45 years. 80% of these were living in congested areas of Rawalpindi. Abnormalities on R.G were detected in 40(80%) of sinuses, 25(50%) sinuses were opaque and 15 (30%) had mucosal thickening. 10(20%) out of 50 sinuses were clear on R.G. Out of 50 sinuses, 34(68%) showed positive A.L, while clear return on irrigation was obtained in 16(32%). Out of these 34 sinuses, 25(50%) were T.P, as they also showed abnormalities on R.G and 9(18%) were F.N, as they were clear on R.G. 16 (32%) of sinuses gave clear A.L, out of which 2(4%) were T.N, as they were also clear on R.G and 14(28%) were F.P, as they showed abnormalities on R.G (Table 1). Out of 25 patients, 21 showed positive A.L either unilateral or bilateral leading to confirmation of CMS in 21(84%) patients.

Radiography detected abnormalities in 80% of sinuses showing its high sensitivity, but T.P results were 50% and only 4% of negative results of R.G matched with negative A.L, leading to specificity of only 54% (Table 2).

Microbiological results showed anaerobes in 14 washouts, staphylococcus in 9, pseudomonas in 7, streptococcus and proteus in 2 each. A strong correlation was found between positive radiographic findings and pseudomonas, streptococcus and proteus obtained after bacteriology of A.L. All sinuses infected with these organisms were opaque, sinuses infected by staphylococcus were either opaque or showed thickening of antral mucosa. A correlation was also noticed between false negative results of R.G and anaerobes, seven out of these 8 sinuses with false negative R.G revealed anaerobes on culture sensitivity.

Discussion

Chronic maxillary sinusitis is a common problem. The need for diagnosing the condition

cannot be overemphasized. Apart from detailed history and thorough clinical examination, conventional R.G is taken for diagnosis. However incomplete information is obtained in majority of cases⁸. Other modes of investigations are ultrasonography, computerised tomography and endoscopy¹³⁻¹⁵. A.L and direct examination of antral mucosa on antrostomy (middle meatal or inferior meatal) reveal whatever is present in maxillary antrum. These procedures are unpleasant to the patients and are seldom used in children. Diagnostic specificity of plain R.G could be calculated by comparing its findings with A.L findings.

Table 1: Comparison between Antral Lavage and Radiography

Findings	Positive		Negative		Specificity
	T.P	F.P	T.N	F.N	
RG	25	14	2	9	54%
AL	34	-	16	-	84%

T.P = true positive, F.P = false positive,
T.N = true negative, F.N = false negative

In this study the commonest abnormality detected on R.G was opacity. 25 (50%) of sinuses were opaque as compared to 15(30%) of sinuses which showed mucosal thickening. In a previous study¹⁶ mucosal thickening was the most common finding. This difference may be either because of proper interpretation of our R.G or due to insufficient number of cases in our study. If we consider only the clinical features and not the A.L findings, the R.G diagnosed 80% of sinuses but before conferring such a high degree of specificity of R.G, one should keep a previous study in mind where 804 sinuses of asymptomatic individuals were examined

radiologically and 23% showed abnormalities¹⁶. 80% of X-Rays in our study showed abnormalities in maxillary sinuses but only 50% (T.P) revealed positive irrigations. In that study, R.G showed fluid retention in 76% of sinuses, 53% of these revealed fluid retention with positive A.L (T.P) and 23% with negative A.L (F.P). There is no statistical significant difference between two studies. Another study showed 80% sensitivity of R.G but specificity was quite low¹⁷. Inaccurate positive results of R.G may be due to osteal blockage, thick facial bones and shadow of upper lip. Contributory factors for the F.N results may be due to lapse of time between presentation and investigations or may be due to allergic phenomenon.

An association was found between type of abnormality on R.G and A.L. Positive irrigations were usually obtained in opaque sinuses on R.G, while sinuses with mucosal thickening were almost clear on irrigation. Mucosal thickening in sinuses may be misleading for diagnosis of CMS.

Depending on our criteria for CMS, clinical

features matched the positive A.L in 21 patients and CMS of either side was diagnosed in 84% of the patients irrespective of radiographic findings. In our study clinical features and A.L directed to correct diagnosis in 21(84%) cases that is comparable to a previous study⁶, in which clinical features diagnosed only half of cases, so that the statistical difference is significant.

The positive R.G matched the positive A.L in 50% of sinuses while negative R.G matched the negative A.L in only 4%. Hence true results were only 54%. Although the sensitivity of R.G in detecting sinus disease is high but its specificity is quite low. In our study its sensitivity in detecting CMS was 80% but its specificity in detecting CMS was 50% and in excluding it was only 4%. The results are also comparable with a study that showed 77% sensitivity of R.G in diagnosing CMS with 37% specificity¹⁸.

Table 2: Statistical Evaluation of Results with paired Sample t Test

	Paired differences					t	df	sig (2-tailed)
	Mean	Std deviation	Std error mean	95 % confidence interval of the difference				
				lower	upper			
pair 1 RG-AL	-30.00	2.83	2.00	-55.41	-4.59	-15.00	1.00	0.42

AL = *antral lavage*, RG = *radiograph*

While considering the bacteriology of CMS, the results of our study are also comparable with the previous studies. 41% of A.L isolates were anaerobes in our study, it is comparable to the 51% of a previous study¹⁹. Staphylococcus and pseudomonas were isolated in 26% and 21% of cases respectively. In one of the previous studies staphylococcus was the most prevalent organism¹⁹. This difference may be due to care taken while collecting the specimen in our study to prevent contamination by nasal flora. Streptococcus and proteus were obtained less frequently in our study, 6% each. Our results do not correlate with the results of a single study in totality but these are comparable with different studies. In previous studies; pseudomonas, anaerobes and staphylococcus had been the most prevalent microorganisms^{19, 20} as also in our study. In another study published

in 2003, aerobes (86.8%) were more prevalent than anaerobes (13.2%)¹¹. Complete absence of Haemophilus influenzae indicates it either is the least prevalent organism in CMS, or number of cases in our study may be insufficient.

In our study a strong correlation was found between opaque sinuses and streptococcus, pseudomonas and proteus obtained after culture sensitivity of A.L. A correlation was also noticed between F.N results of R.G and anaerobes. Sinuses infected with anaerobes were either clear or showed mucosal thickening on R.G. The pus in the sinuses infected with pseudomonas, streptococcus and proteus may contain some radio dense material that appeared opaque on R.G as seen in maxillary aspergillosis in previous studies^{21, 22}. Conversely, the pus with anaerobes may contain some radiolucent material. For this conclusion chemical analysis of pus

is required.

In a certain number of cases R.G and A.L may be misleading and may require evaluation of results by doing FESS^{8, 23} (functional endoscopic sinus surgery). Sinuscopy is the only certain method to detect exact pathology in the sinus and should have been the gold standard of the study.

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