SENSITIVITY AND SPECIFICITY OF ULTRASONOGRAPHY IN DIAGNOSIS OF MAXILLARY SINUSITIS AS COMPARED TO ANTRAL LAVAGE

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ABSTRACT

Objective: To compare the sensitivity and specificity of ultrasonography in the diagnosis of maxillary sinusitis as compared to antral lavage.

Study Design: Validation study

Place and duration: Otolaryngology Department Combined Military Hospital Rawalpindi from 1st march 07 to 28th February 2008.

Patients and Methods: Consenting 60 patients diagnosed clinically as a case of sinusitis, presenting in ENT OPD during the study period fitting the inclusion criteria were selected. Ultrasonography of maxillary sinuses focusing on fluid level was done of all the patients. After ultrasonography all the patients had an antral lavage with isotonic saline to look for mucopurulent discharge. Sensitivity and specificity of ultrasonography was evaluated in diagnosis of maxillary sinusitis.

Results: The sensitivity of ultrasonography in diagnosis of maxillary sinusitis taking antral lavage as Gold Standard was very low 35.89 %. The specificity of ultrasonography in diagnosis of maxillary sinusitis taking antral lavage as Gold Standard is good i.e. 80.95%.

Conclusion: Ultrasonography has low sensitivity but high specificity in diagnosis of maxillary sinusitis.

Keywords: Antral lavage, Maxillary sinusitis, Ultrasonography.

INTRODUCTION

Sinusitis is an inflammation of sinus mucosa due to allergic and non-allergic causes; being the latter infective or non-infective. Maxillary sinus is the most commonly involved sinus. Sinusitis can be described as acute if infection is less than 3 weeks or chronic when infection lasts for more than 3 months.

Maxillary sinusitis is one of the most common diseases diagnosed by primary care physicians and the leading cause of out patient antimicrobial therapy[1]. Sinusitis affects about 14% of the population yearly and 16 million annual office visits[2]. If untreated it leads to local complications like mucocele, osteomyelitis, and orbital complications[3].

Accurate diagnosis of maxillary sinusitis is difficult on the basis of clinical examination alone because signs & symptoms are non-specific. CT scan is currently the method of choice for sinus imaging[4] but the finding of infected secretion by direct sinus puncture is usually considered the gold standard for diagnosis of maxillary sinusitis[5]. Ultrasonography can also be used as a diagnostic modality. Newer modalities like MRI, Endoscopic sinus aspirates, static thermal and near infrared hyperspectal imaging[6], zonography[7] and radionuclide dynamic maxillary scintiography are still under trial.

CT scan of maxillary sinus has a limitation of cost effectiveness and is not a commonly performed procedure in our setup. Antral lavage is a commonly performed procedure in diagnosis of maxillary sinusitis in our setup. However it has limitation of discomfort and pain to the patient and minor bleeding. Ultrasonography is a rapid, inexpensive, convenient and readily available method for evaluation of maxillary sinuses. Sensitivity and specificity of ultrasonography is required to be evaluated in diagnosis of maxillary sinusitis.

PATIENTS AND METHODS

This was a validation study carried out in the ENT Department of Combined Military Hospital Rawalpindi from March 2007 to

February 2008. A series of 60 patients with clinical diagnosis of maxillary sinusitis (patients having three week duration of one to two of the following symptoms and signs: sinonasal congestion, facial pains, mucopurulent nasal discharge, fever and anosmia) age between 15-50 years were included through convenience sampling of non probability type. Patients having bleeding diathesis and acute febrile illness were excluded from the study.

Patients were inquired about their age, gender and address. History of present illness was recorded in terms of symptoms including fever, facial pains, sinonasal congestion, nasal discharge and anosmia. Investigations i.e. Blood CP, PT/PTTK were done for every patient. Ultrasonography of maxillary sinuses by Toshiba Aplio 50 machine, focusing on fluid level was done of all the patients. After ultrasonography, all the patients had antral lavage with isotonic saline to look for mucopurulent discharge. All the information was recorded on a specially designed proforma.

The data thus obtained had been arranged and analyzed on SPSS version 12. Descriptive statistics were used to describe the data. Diagnostic measures were calculaed for ultrasonography using antral lavage as gold standard.

RESULTS

Sixty patients who fulfilled the study protocol were included and were further tested for confirmation by ultrasonography and antral lavage. Fifty six (93.34%) were males with a mean age of 32.68 years (SD=6.124). The majority of patients presented with mucopurulent discharge 85%, followed by sinonasal congestion 80% and facial pains 35%. Only 40% of patients had a history of fever.

The results in terms of true positive (23.33%), false positive (6.67%), false negative (41.67%) and true negative (28.33%) are shown in figure. The highest frequency was of false negative 25 (41.67%) results i.e. the patients who were positive on gold standard (antral lavage) but our test (ultrasonography) diagnosed them as negative. Similarly 2nd frequent result was true negative 17 (28.33%)

i.e. the patients who diagnosed as negative by the test were also found negative on gold standard.

The sensitivity of ultrasonography in diagnosis of maxillary sinusitis taking antral lavage as Gold Standard shows that the sensitivity is very low 35.89%, but ultrasonography is quite specific as specificity is high 80.95%. The overall accuracy of ultrasonography in diagnosis of maxillary sinusitis is 51.67%, with a positive predictive value of 77.77% and a negative predictive value of 40.47% as given in (Table).
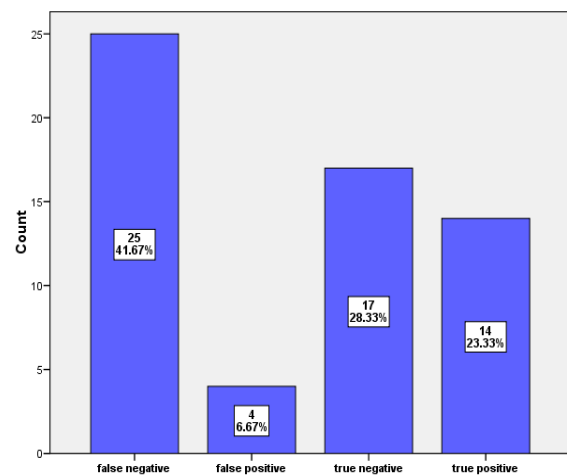

Figure: Description of false negative, false positive, true negative and true positive (n=60)

Table: Diagnostic mesures of ultrasonography taking antal lavage as gold standard (n=60)

Diagnostic Measurs	Ultrasonsgraphy
Sensitivity	35.89%
Specificity	80.95%
Negative predictive value	40.47%
Positive predictive value	77.77%
Accuracy	51.67%

DISCUSSION

Maxillary sinusitis is one of the most common diseases diagnosed by primary care physicians and a leading cause of outpatient antimicrobial therapy which are started empirically. Therefore, if the disease is properly diagnosed before start of treatment, antibiotics will be given to only those patients who

actually suffer from the disease. This will save a lot of money spent by the patients in purchase of costly antibiotics and USG is very good method for this purpose[17].

In general practice sinusitis is usually diagnosed on the basis of symptoms and signs, resulting in an incidence of 21 to 25 episodes per 1000 listed patients per year[8]. Radiography is used in 14% of episodes and referrals occur in 7%. Cacosmia and purulent secretions from the antral ostium have a high predictive value.

Five methods are available in diagnosis of maxillary sinusitis objectively: radiography, CT scan, MRI, ultrasonography, and invasive procedures. Of these methods, only ultrasonography is suitable for repeated use in clinical practice as part of a study. Ultrasonography does not affect the course of sinusitis and is easily available.

Some studies have shown that the diagnostic value of ultrasonography approximates that of plain film evaluation, although a wide range of sensitivities (from 29–100%) and specificities (27–98%) have been published by several authors. Other studies describe ultrasonography as being more sensitive than plain radiographs in the discrimination of fluid from thickened mucosa. Recent studies comparing ultrasonography and CT suggest possible applications of ultrasonography in emergency patients, children, and pregnant women. However, ultrasonography is generally limited to "accessible" sinus regions. The representation of disease in the maxillary sinuses is limited, and displays of the other sinuses are of relatively no value. Although one reason for the discrepancy in trial results could be the differences in equipment and/or technique used, the widely varying data as well as the display provided by ultrasonography preclude this technique as a preferred method for sinus imaging. Recently, therapeutic ultrasound was reported as a treatment for chronic sinusitis[9].

In a study done by Jens et al[20] to predict acute maxillary sinusitis in a general practice population they found that the median age was 35 years and 70% were females. Main symptoms and signs of sinusitis were nasal congestion 73%, cough 62%, maxillary pain 87% and purulent nasal discharge in 29%.

Our study also validates some of these statistics. Mean age in this study was 33 years but there was a male predominance i.e. 94%. Male predominance is seen because majority of our patients were serving military persons. Main symptoms and signs of sinusitis were purulent nasal discharge in 85%, nasal congestion 80%, fever 60%, maxillary pain 35%.

Haapaniemi et al[10] compared the sensitivity and specificity of ultrasonography in diagnosis of maxillary sinusitis as compared to antral lavage. The sensitivity of ultrasonography to find maxillary sinus secretion was 77% and the specificity 49%. In our study sensitivity is 36% and specificity 82%.

Risavi et al[11] found that ultrasonography can be used as a diagnostic method in the early diagnosis of sinus diseases. Compared to radiographic and sinusoscopic findings, it showed a high agreement in negative and positive findings, i.e., a high sensitivity and specificity. In comparison to sinusoscopic examination, sensitivity of ultrasonography was 93% and specificity 74%. In our study the sensitivity was very low i.e.36% in comparison with this study.

Savolainen et al[12] found that USG and radiology were equally reliable in diagnosing fluid levels and sinusitis, when the results were compared with the findings of the sinus puncture.

Lichtenstein et al[13] found that ultrasound may be proposed in first-line diagnosis of radiological maxillary sinusitis.

Peng et al[14] found that the diagnostic ultrasound of sinus has high accuracy; the control is easy, the cost is relatively lower, it can be used repeatedly and does no harm the patient's health.

Savolainen et al[15] found that both USG and radiology were equally reliable in diagnosing fluid retention and sinusitis, when the results were compared with the findings of the sinus puncture. USG and radiology gave false

positive findings almost equally (*p*>0.05). On the other hand, when the volume of secretion was slight (< 1 ml), US gave a fluid echo finding more often than radiology showed fluid retention.

Only half of patients with a clinical diagnosis of AMS have sinusitis in ultrasound examination[16]. Furthermore he found that symptoms and clinical examination were not reliable in AMS diagnosis. If the criterion for AMS diagnosis were fluid in maxillary sinuses in ultrasound instead of clinical impression, the number of antibiotic prescriptions would be reduced by half in primary care[17].

Puhakka et al[18] found that the high specificity of ultrasonography indicates that a positive ultrasound finding can be regarded as evidence of maxillary sinusitis. The addition of plain-film radiography in cases of negative ultrasound findings increases the diagnostic sensitivity to clinically acceptable levels without loss in specificity. Active use of ultrasonography would substantially decrease the need for radiological imaging of the sinuses and also help reduce unnecessary antibiotic treatment in primary care. The sensitivity of ultrasonography for detection of maxillary sinusitis was 64% (specificity, 95%).

Kaups et al[19] found that sinus ultrasound is a simple, efficient method for determining the presence of maxillary sinus fluid in the surgical intensive care unit.

In the present study sensitivity of USG was found to be low, while specificity was high. Low sensitivity is mainly due to the fact that USG is operator dependent procedure. As USG is not commonly used for the detection of sinusitis in our setup, so the radiologists are not fully confident about its detection. With more usage and practice USG can become a very useful tool for the diagnosis of maxillary sinusitis.

CONCLUSION

Although ultrasonography is not a very sensitive test but this is still highly specific investigation. So the number of false positive subject can be very efficiently reduced. Therefore, the number of patients receiving costly antibiotic on false clinical diagnosis of maxillary sinusitis can be very significantly controlled.

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