Maxillary Sinus Ultrasound Versus Plain Radiography and Diagnostic Antral Washout in the Diagnosis of Maxillary Sinus Diseases.

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ABSTRACT:

BACKGROUND:

Maxillary sinus ultrasound has been found useful in diagnosis of maxillary sinus diseases.

OBJECTIVE:

Is to compare the usefulness of diagnostic ultrasound, radiography of the maxillary sinuses with the results of he diagnostic wash out in detection of the maxillary sinus diseases.

PATIENTS AND METHODS:

Fifty-five patients (109 maxillary sinuses) with suspected sinus diseases on clinical evaluation examined by ultrasonography, plain radiography and followed by diagnostic antral washout.

RESULTS:

The positive returns were 48.6% (53/109). The sensitivity of the ultrasonography and plain radiography were (92.5%), (90.5%) respectively. The specificity of the ultrasonography and the plain radiography were (55%, 41%) respectively. The accuracy of the ultrasonography was (73.4) while of the radiography was (65%).

CONCLUSION:

Sinus ultrasonography is harmless (no radiation), less expensive and can be used safely in childhood and pregnancy, and gives comparable results with plain radiography and antral washout in diagnosis of sinus diseases.

KEYWORD: Maxillary sinus diseases, ultrasound, plain radiography diagnostic washout.

INTRODUCTION:

Most patients presenting with nasal symptoms should have their sinuses investigated to exclude sinus diseases. Radiography is the commonest investigation used, but recently ultrasound has been advocated. The possibility of using ultrasonography in diagnosis of paranasal sinuses was first mentioned by Keidel in(1949)..Kitmura (1969) introduced the possibility of B-Mode (two dimensional - image) presentation in diagnosis of paranasal sinus disease.He found that air in the sinus reflects all the ultrasonic energy. In sinusitis the back wall seen after sonolucent area & in maxillary cancer the irregular rough echoes fill the` intermediate area. In 1976 B-Mode & A-Mode ultrasonography was included in the clinical routine at theORL-clinicof Freiburg. Mann (1977) published a study on the reliability of ultrasonography in published a study on the reliability of ultrasonography in maxillary sinus disease controlled by puncture & irrigation.

Issacson & Edell (1978) found a similar A-Mode examination useful in the evaluation of patients with suspected maxillary sinusitis. The possibility of differentiating secretion, blood, benign & malignant tissue by using three different levels of amplification was reported by Mann in (1979) Gianoli (1992) found that B-Mode ultrasonography was very accurate in diagnosing maxillary, frontal, ethmoid sinus cysts in comparison with CT Scanning. By using A-Mode, Zhong (1995) was able to diagnose cyst, benign & malignant tumors of the maxillary Sinus accurately.

PATIENTS AND METHOD:

PATIENTS:

Fifty five patients were examined at Otolaryngology -Head and Neck Surgery Unit, Basrah General Hospital (December 2002--2005), with symptoms suggesting an underlying sinus disease e.g.: facial pain, headache, mucopurulant rhinorrhea, nasal obstruction and postnasal drip. All patients had radiography (plain X-ray of maxillary sinuses-occipito mental view), ultrasonic examination of maxillary sinuses, then all patients had proof puncture except one patient (from the 55 patients) had only the right maxillary antrum washed out (109 sinuses).The results recorded, interpreted, and discussed.

Radiography:

X- ray of maxillary sinuses (occipito-mental view) were taken in erect position (Figure 1&2), the

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changes seen in the sinuses were classified as follows:
1-Normal (no evidence of pathology).
2-Mucosal thickening.
3-fluid present.
4-Others (opaque antrum, cyst)

Ultrasound: Ultrasound machine (SINUSCOPE 4) by ATOMS was used with a probe of (10mm) operating at frequency of (3.5MHz).
The examination was carried out with patient in sitting position, by same clinician. .The machine is placed beside the head
of the patient, so that the display can be controlled continuously during the dynamic examination.
Using a coupling medium, the sound transducer is placed on the skin over the infraorbital nerve, during sinus examination, ultrasound is directed sector like in the anterior-posterior direction .
The main two parts of the sinus visualized by ultrasound are:
1-The wall; it appears as mildly thick (2- 3mm) echogenic line, mild irregularity of its inner surface is considered as normal variation in songraphic appearance and does not indicate mural pathology .
2- The cavity of the sinus; it looks hypoechoic with vary tiny and faint echoes**.** {Figure-4}. The results were coded as follows;
1-Normal antrum.
2-Mucosal thickening.
3-Fluid present.
4-Others e.g.; mass, cyst

Antral washout: Lavage was performed via the inferior meatus
According to the standard technique.Specimens were collected by
direct aspiration or on lavage with physiological saline and the
wash out return was classified as follows;
1-Clear return.
2-A few scanty flakes.
3-Pus appeared directly.
4- Mucus/ solid material on lavage.

Sensitivity, Specificity, Accuracy of radiographic and ultrasound appearance in relation to washout were extruded from these equation:

$$\text{Sensitivity} = \frac{\text{True positive} \times 100\%}{\text{All positive}} \quad (5)$$

$$\text{Specificity} = \frac{\text{True negative} \times 100\ \%}{\text{All disease free sinuses}}$$

$$\text{Accuracy} = \frac{(\text{True positive} + \text{True negative}) \times 100\%}{\text{Total number}}$$

RESULT:

The study showed predominate male gender (male: female 34-21), and the age range was 8-60 years, the predominated age was from 20-40 years (61.2%). {Table 1}. Over all only 53/109 (48.62%) of washout performed gave positive return, while 56/159 (51.37) gave clear return. (Table 2 }. The ultrasound examination showed normal sinuses (39/109 of patients,) while (30/109) of radiographs) were normal.
(table3,4). The clear return showed correlation with the normal
radiographic & ultrasound appearance in76.6% (23/ 30) &79.5 %
(31/ 39) sinuses respectively. (Table 3, 4).The sensitivity of radiographic, ultrasounds appearance in relation to wash out was
90.5 %(48/53), 92.5% (49/ 53) of sinuses respectively. (Table-5) While the specificity was 41% (23 / 56) and 55.3% (31 / 56) of radiographic and ultrasound appearance respectively. The accuracy of the radiographs in predicting the wash out was, 65.5 %(71/109) while Ultrasound was correct in 73.4 %(80-109). {Table-5}.
Sensitivity, Specificity, and accuracy of radiographic and ultrasound appearance in relation to washout{Figure-5} .

DISCUSSION:

Accurate diagnosis of maxillary Sinus disease is difficult on the basis of clinical examination only because the signs and symptoms are non-specific, so we need a simple ,non-invasive ,rapid, safe inexpensive and readily available , method for diagnosing maxillary sinus diseases [6]. Our study is to compare the sensitivity, specificity, accuracy and false positive of the ultrasonography, radiography (plain X – ray, occipto-mental view) examination of the maxillary sinus with the results of the washout. Plain
X-ray of sinuses is traditionally used as the first diagnostic test to evaluate the patient with suspected sinus diseases, but it is time consuming,costly [6] and expose the patient to

the risk of the radiation (as 4 projections of plain x-ray equal to 25 chest X- ray doses, or 10 weeks of back ground) [7].

So it is avoided in children and pregnant women, also there are difficulties in interpretation of the plain film[6]. On the other hand the ultrasound examination is a rapid, safe particularly in children and pregnant women (can be used to examine children and pregnant women), inexpensive, readily available, so it can be repeated without risk[9].

The limitation is the measurement of the distance from skin to the anterior wall of the sinus and mucosal thickening (1cm or less) [6].

The sensitivity of ultrasound, and plain film were same (92.5%, 90.6%) respectively. While the specificity was 41% for the radiography and 55% for the ultrasound .The accuracy of the radiographs in predicting the wash out was 65% and for the ultrasound was73.4 %(table 5 ,figure-4). The false positive findings in our study for the ultrasonography and , plain radiography were (37%, 52%) table(3,4).

Adnan Hashim Ali (5) Varonen H et al [8] found that the sensitivity of ultrasound were (100%, 94%) respectively and the specificity of ultrasonogrphy (42%, 53%) and these results are comparable to our results (Figure-4) .Ali [5] Varonen H et al [8] they also found that the sensitivity of radiography were (85%, 87) respectively which are near to our findings, while they found that the specificity of the radiography were (62%, 62%) respectively. (Figure-4). Also Ali [5] False positive findings for ultrasonography and radiography were (58%, 38%) respectively. These variations may be either to technical differences or to number of patients included in the studies. Ali [5] found that the accuracy of ultrasonography, radiography was (67%, 72%) and these findings are similar to our results. We agree with (Varonen H. et al) that sinus ultrasound appears to have similar accuracy as that of sinus radiography (Figure-5), [8].

Ultrasound detects with high efficiency gross sinus disorders and namely secretions (77% correlation with proof puncture) than mild pathologies (18%),(Table 3), this is because mucosal thickening or scanty secretions disregarded by ultrasound due to a layer of aerated sinus lies between the transducer and the lesion impedes the ultrasound beam penetration to the deeper structures (air shadow phenomena) .This agrees with Adnan Hashim Ali [5] where the correlation of ultrasound with sever sinus secretion was (75%) while it is (24%) with mild pathologies.)

CONCLUSION:

Ultrasonography as compared to plain radiography and diagnostic washout in diagnosis of sinus diseases gives almost comparable results, but has the advantages of being safe (no radiation), so can be used safely in children and pregnant women and the machine used is less costly and portable.

Table 1: Age, gender distribution

Age(years)	No. of patients	Gender		%	
		Male	Female	Male	Female
0-10	2	2	----	3.6	----
11-20	11	9	2	16.3	3.6
21-30	15	11	4	20	7.3
31-40	17	8	9	14.5	16.4
41-50	7	4	3	7.3	4.8
50+	3	----	3	1.6	6.4
Total	55	34	21	61.8	38.1

Table 2:Results of proof puncture

Washout	No. of sinuses Total=109	%
Clear return	56	51.3
Scanty: few flakes of mucous	17	15.6
Pus appeared directly	27	24.8
Mucous on lavage	9	8.2
Total of positive return	53	48.6

Table 3: Correlation of washout and ultrasound

	Ultrasound of sinuses Total No.=109			
Washout	Normal No.=39	Mucosal thickening No.=40	Fluid No.=18	Others (mass, cyst) No.=12
Clean return	31	20	1	– – –
Scanty: few Flakes of mucus	2	10	1	2
Pus appeared directly	4	6	14	8
Mucous on lavage	2	4	2	2
% clean return	79.5	50	5.56	– – –

Table 4:Correlation of washout and radiology

	Radiology Total No.= 109			
washout	Normal No.=30	Mucosal thickening No.=45	Fluid No.=8	Others (mass, cyst) No.=26
Clear return	23	24	1	7
Scanty: few Flakes of mucous	4	11	2	– – –
Pus appeared directly	2	8	4	15
Mucous on lavage	1	2	1	7 `
% clear return	76.67	53.3	12.5	26.9

Table 5: Sensitivity; Specificity; and accuracy Of ultrasound and radiography

	Radiography		Ultrasound	
	No.	%	No.	%
Sensitivity	48/53	90.6	49/53	92.5
Specificity	2 3/56	41	31/56	55.4
Accuracy	71/109	65.1	8o/109	73.4

Figure -1:Occipitomental- view of paranasal sinuses, opaque left maxillary sinus

(Erect position) Figure- 2:Occipitomental- view of paranasal sinuses, right maxillary sinusitis; (fluidlevel) . (Erect position)

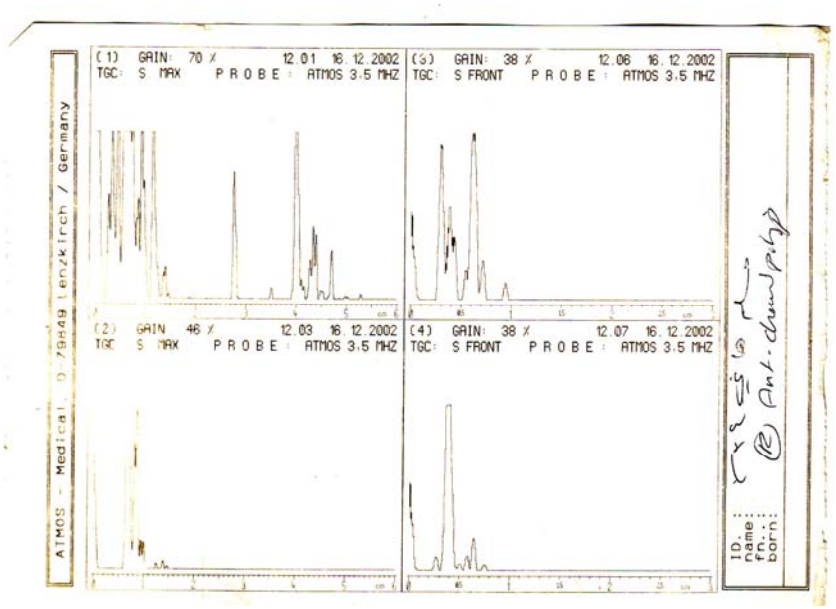

Figure -3:Printing paper of ultrasound shows multiple back wall echoes of right antrochoanal polyp while the left maxillary sinus is clear.

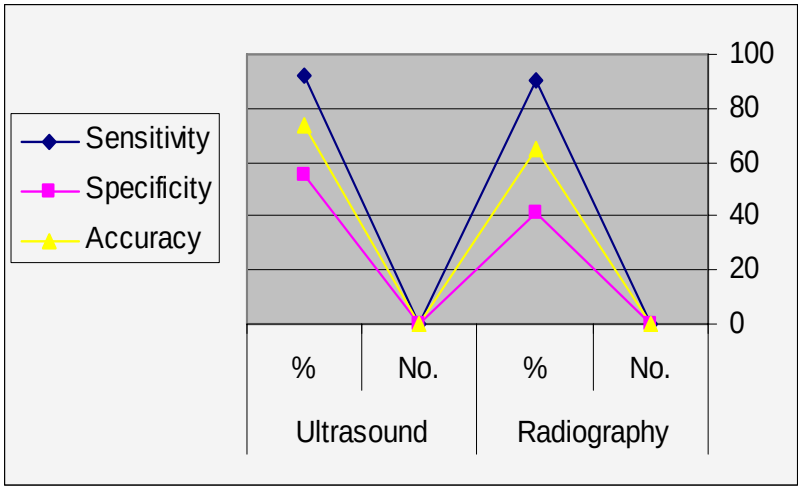

Figure-4

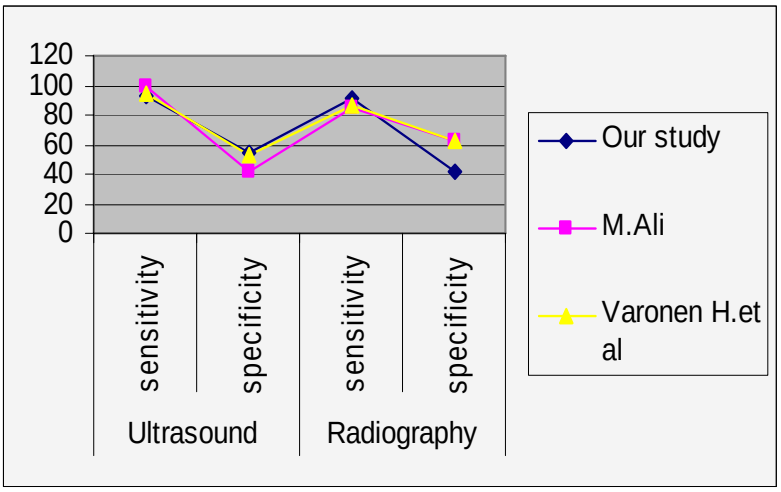

Figure-5

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