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COMPARATIVE EVALUATION OF PLAIN RADIOLOGICAL FINDINGS AND COMPUTERISED AXIAL TOMOGRAPHIC SCAN FINDINGS IN EVALUATION OF PARANASAL SINUSES AND MASTOID AIR CELL

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SUMMARY

Although the computerized axial tomographic scan, has been around since 1973 and in University College Hospital (UCH) Ibadan since 1987, it is however a new addition to radiological investigation in this West African subregion that can only boast of less than 10 centres presently.

A comparative evaluation of the plain radiological findings known to have poor standardization is here evaluated against computerized axial tomographic scan findings. It was found that there is high specificity in diagnosis of paranasal and mastoid lesion with computerized axial tomography. The author, from his findings, arrived at the conclusion that plain radiology in evaluation of paranasal sinuses and mastoid air cells, should be viewed as a guide, for proper evaluation with CT Scan.

INTRODUCTION

The paranasal sinuses include the frontal sinuses, sphenoidal sinuses, maxillary antra, and the ethmoidal air complex cells. They lie within the facial bones, in a complex arrangement, and group around the nasal cavities. The nasal cavities contains the superior, middle and inferior turbinates bones on the lateral wall, and is connected to the auditory or Eustachean canal[6,7]. Hence, the inclusion of mastoid air cells in this study.

Paranasal sinuses and mastoid air cells evaluation in this subregion by plain radiology, in my view, has been very crude, because there is inadequate standardization to facilitate reproducibility and subsequent comparison.

This is lacking in virtually all the health centres. Hence, poor radiological report and result should be anticipated. This is due to poor economic planning to adequately take care of exigencies of high technology in medical practice.

This study was possible, following the installation of Shimadzu intellect C.T. scanner of the fourth generation in Westend Hospital, Warri (or Dr. Amadasun Hospital Ltd.). This made it possible to undertake a comparative evaluation of the plain radiological findings and computerized axial tomographic findings of paranasal and mastoid air cells as regard congestion, mass effect and bony erosion.

The use of congestion, mass effect, and bony erosion as feature of this study, is to define lesion effect rather than histopathological possible diagnosis which is not part of the aim of the study.

A previous retrospective study of paranasal sinuses and turbinate in 153 patients with age range of 10-70 years, in Lagos University Teaching Hospital, Lagos[9] suggested frequency of sinus infection on plain radiograph as follows, ethmoidal sinus 82%, frontal sinus 74.5%, maxillary sinus 17% and sphenoid sinus 14.4%[9]. This is highly subjective to the evaluating physician. These findings are in contrast to findings from other literature which indicate maxillary sinus as most frequent site.

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LITERATURE REVIEW

Since the discovery of x-ray by Wilhelm Roentgen in 1895, Computerized Axial Tomography (CAT) Scanner, discovered by Godfrey Hounsfield of the EMI Limited of Britain in 1972 has been acclaimed the greatest advancement in Radiology. CAT Scan has a multidirectional ability of scanning object[3,7]. However, before the CAT Scan, the plain or conventional tomographic radiographic views of paranasal sinuses and mastoid air cells were in use, but must be standardized as far as possible, to give adequate views and results, in addition to facilitating reproducibility and subsequent comparison[7]. This fault does not exist in use of Computerized Axial Tomography which has provided an important addition to radiographic investigation of the paranasal sinuses and mastoid air cells[7] and to a large extent has superseded conventional radiography and tomography as means of assessing tumours, mucoceles and other expanding lesions, in the sinuses[7]. Computerised axial tomography gives a better evaluation, of bone destruction and soft tissue extent of the disease. And thus, is the most accurate method of staging malignant tumour prior to radiotherapy, surgery, and most importantly post operatively to show recurrence of the tumour[7]. And also, C.T scan is sensitive in characterizing the soft tissue pattern, and calcification for possible differential diagnosis and occasionally may enable the radiologist to take a primary diagnosis of sinus malignancy and alert the clinicians the likely area for confirmatory biopsy[7].

METHOD AND MATERIAL

The subjects were either referred or were seen as in-patients. To complement comparative evaluation of the plain skull

radiograph and C.T scan of the skull, the subjects were not limited to only E.N.T referred cases but any other case of questionable paranasal lesion diagnosed by the radiologist. Hence, most skull C.T scan, routinely, had axial section taken parallel to Reid's base line[7] from the inferior margin of the maxillary antra. Reid base line is an imaginary straight line drawn through sphenoidal sinus to meet occipital protuberance, and nasium. The data were collected from January 1997 through October 1997. 40 patients were selected as subjects for the study. The criteria for plain radiography were as follows:

1. Clinical features of paranasal and mastoid lesions as referred by ENT surgeon.
2. Questionable recurrent nasal congestion.
3. Severe headache and clinical evidence of space occupying lesion.

The plain radiographic views taken were straight PA skull view, submento vertical skull view, water's view and Town's views[7,9]. These views were meant to properly evaluate the paranasal sinuses and mastoid air cells[7,9]. The indication for computerized axial tomography scan were as follow

1. Plain radiological diagnosis of paranasal lesion.
2. Plain radiological appearance of mass effect.

DATA

(A)	CONGESTION OF SINUSES					
	Nasal Turbinate	**Maxillary**	**Ethmoidal**	**Frontal**	**Sphenoid**	**Mastoid**
Plain Radiograph	40	30	16	20	20	20
C. T. Scan	10	26	8	10	1	15
Total Differences	30	4	8	10	19	5
Percentage False Positive in plain Radiography	75%	13.3%	50%	50%	95%	25%

(B)	MASS EFFECT					
	Nasal Turbinate	**Maxillary**	**Ethmoidal**	**Frontal**	**Sphenoid**	**Mastoid**
Plain Radiograph	10	3	Nil	Nil	Nil	4
C. T. Scan	8	7	4	Nil	Nil	10
Total Differences	2	-4	-4	Nil	Nil	-6
Percentage False Positive in plain Radiography	20%	133%	400%	-	-	150%

(C)	BONY EROSION					
	Nasal Turbinate	**Maxillary**	**Ethmoidal**	**Frontal**	**Sphenoid**	**Mastoid**
Plain Radiograph	2	1	Nil	Nil	Nil	4
C. T. Scan	5	7	5	1	Nil	10
Total Differences	-3	-6	-5	-1	Nil	-6
Percentage False Positive in plain Radiography	150%	600%	500%	100%	Nil	150%

3. Unconfirmed cause of severe headache and clinical evidence of intracrainal space occupying lesion.

The C.T Scan sections were both axial and coronal sections[7]. This was done in order to facilitate thorough evaluation of paranasal sinuses and mastoid air cells and to compliment surgical plan in cases of need. Contrast enhancement was not routinely done except in cases of evaluation of associated tumours[7]

ANALYSIS OF DATA

The data has shown high tendency to false positive results in diagnosis of paranasal collection, ranging from 50% and above, except for maxillary sinuses with 13.3% false positive result. The false positive result in the evaluation of mastoid air cells ranges from 25% to above.

The bony detail evaluation of paranasal sinuses and mastoid air cell, with regard to mass effect and bony erosion, did show overwhelming false negative results ranging from 20% to 600%. Hence this finding suggest that detailed evaluation of paranasal sinuses and mastoid air cells, such as bony erosion, mass effect, and bony texture cannot be dependent on, only on plain radiographs. There were incidental findings only seen with C.T Scan evaluation. These were three cases of polypoid nasopharyngeal air way tumour, one case of intracranial collection from chronic mastoiditis and one case of intracranial air collection from trauma.

DISCUSSION

This study was done in this Subregion to demonstrate the value of C.T. Scan in evaluation of paranasal sinuses and mastoid air cells, in the environment where there is inadequate standardization of plain and conventional tomographic radiographic views. There were high percentage of false positive and false negative results. There are three different imaging techniques available for the evaluation of paranasal sinuses:

1. General (plain film) sinus radiographs.
2. Conventional tomography
3. Computerized axial tomography (C.T Scan).

The conventional plain x-ray has been the main method of investigation in this Subregion. This is possibly due to the easy availability, simplicity and cost. The question has always been, whether one is not over simplifying investigations, calling into question the efficacy in diagnosis, in a not so clinically accessible area as the paranasal sinuses and mastoid.

It has been established that standard paranasal sinus x-ray can readily demonstrate such maxillary and frontal sinuses disease, but, incompletely delineate ethmoid sinusitis, Weiss and lapayower, 1978[8], Carter, Bankoff and Fisk, 1983[2]. And Som, 1984[5].

In plain or conventional radiographs, all radiodense structures located between the x-ray tube and the film overlie each other and are thus all projected on to the film. It is true that by choosing various projection angles, this "overlay" effect can be reduced. But, this may be only the case in large paranasal sinuses, like the maxillary sinus. The delicate bony structures and mucosal linings in the area of the ethmoid and especially of the lateral nasal wall cannot be adequately visualized (Kopp, 1996)[4]. This may collaborate, our study which shows reduced false positive result of 13.3% in maxillary sinus, unlike the other paranasal sinuses and mastoid with high percentage false positive of above 25%.

In line with good detail anatomy of structure possible with C.T Scan and its medico-legal value, the use of plain radiograph in evaluation of paranasal sinuses should only be considered as a guide to proper evaluation with C.T Scan, when the need arises.

In addition there are other lesions impossible to detect with plain radiograph alone such as intracranial collection, intracranial mass and intracranial air collection.

The cost of C.T Scan not withstanding in final analysis, the benefit will reduce the cost of management and treatment of patient.

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