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Comparison of Intraoperative Findings and Computerised Tomographic Scan of Sinonasal Tumors with Suspected Intracranial Extension: Challenges for the Surgeon and the Radiologist.

*ISEH KR, **SAIDU SA,
Departments of *ENT and **Radiology, Usmanu Danfodiyo University Teaching Hospital Sokoto, Nigeria *Correspondence: Dr KR Iseh. Email:frobih@yahoo.com

ABSTRACT:
Background: Computerised tomographic scanning is a very important radiological tool in the diagnosis of the site, size and extent of sinonasal tumours and to exclude or confirm intracranial extension. Intraoperative findings may occasionally be at variance with the radiologic findings causing radiologic and surgical challenges .
Materials and Method: Cases of sinonasal tumours reported as having intracranial extension with computerized tomographic scan were compared with intraoperative findings in order to assess the accuracy of the radiologic report.
Results: Twenty nine consecutive cases were reviewed whose computerised tomograhic scan was radiologically reported from various centres as sinonasal tumour with intracranial extension over a nine year period(January 2000-December 2008). Twenty- four(82.8%) were males while five(17.2%) were females. Intraoperative finding of intracranial extension was only established in 10(34.5%) patients(5males ,5females) with an age range of 1 ½years to 60years and mean age of 34.1years. Nineteen (65.5%) cases did not have intracranial extension. Transfacial approach was used to resect the tumours in 24(82.8%) cases while combined transcranial and transfacial approaches were used to resect the tumour in 5(17.2%) cases. Cases of misdiagnosis of intracranial extension were most common when ethmoidal, nasopharyngeal and sphenoidal sinuses were involved. The examinations were done using conventional CT machines.
Conclusion: Computerized tomographic scan is crucial in evaluating intracranial extension of sinonasal tumours. However conventional CT machines may be associated with incorrect report of intracranial extension. The combined use of 3D CT and gadolinium-enhanced MRI will be more precise in assessing intracranial extension.

Keywords: Sinonasal tumors, intracranial extension, Computerised tomograhic scan, intraoperative findings,

INTRODUCTION:
Tumours of the nose and paranasal sinuses may be benign or malignant and may present both diagnostic and therapeutic problems. Sinonasal malignancies have an incidence of 0.5-1 per 100,000 per year, and account for 0.2-0.8 percent of all malignancies and 3 percent of upper aerodigestive tract neoplasms [1-3]. In Japan and in parts of Africa, the rates are more than twice that of USA and UK [4] .Because of the concealment of the nose and paranasal sinuses, tumours from these areas are usually not diagnosed early until there is considerable involvement of contiguous tissues causing facial assymmetry, epistaxis, nasal obstruction or loosening of the teeth amongst other symptoms [1-3] .They may extend beyond the boundaries of the nose and paranasal sinuses to the contiguous structures such as the orbit, nasopharynx, oropharynx and the cranial cavity .
Tumors of the nose and paranasal sinuses may extend intracranially and cause surgical challenge if they are to be removed. Apart from thorough clinical evaluation of the patient, including the central nervous system which should be carried out to determine the extent of intracranial spread, radiologic evaluation through computerized tomographic (CT) scan and gadolinium-enhanced Magnetic resonance imaging(MRI) are invaluable in showing the details of intracranial extension.[5-7] This guides the surgeon in the approach to resect operable tumours either transfacially, transcranially or in combinations..

Some tumours may demonstrate intracranial extension on CT evaluation,but this may not necessarily be so intraoperatively and there is need for confirmation with gadolinium-enhanced MRI. In this study we compared the accuracy of conventional CT in the diagnosis of intracranial extension of sino-nasal tumors using surgery as the gold standard. This does not underscore the importance of conventional CT scan as, it helps the surgeon to prepare for the worst scenario intraoperatively. Under such circumstances, where there is a CT report of intracranial extension neurosurgical support where necessary is usually planned for and a team approach carried out with the neurosurgeons if it cannot be handled solely by the otorhinolaryngologist versatile with craniofacial resection.

What are the challenges posed by this disparity particularly in sub-Saharan Africa where poverty, ignorance and inadequate manpower and health facilities have been identified as the underlying conditions contributing in making patients with sinonasal tumours to be characterized by late presentation?[8-10] The challenges to the surgeon and the radiologist based on CT report is the basis of this paper.

MATERIALS AND METHODS:

CT scans of tumours of the nose and paranasal sinuses reported as having intracranial extension were reviewed and compared with intraoperative findings. Such patients were prepared surgically as for craniofacial resection. The CT scans were conventional ones whose views were both axial and coronal with contrast.

Clinical details of intracranial involvement were documented if any such as lateralizing signs, signs of raised intracranial pressures, cranial nerve involvement and or personality disorders.

Routine haematologic and biochemical investigations were carried out including grouping and cross matching of at least 2 pints of blood.

Ophthalmic consult was done preoperatively where there was evidence of orbital involvement. Neurosurgical opinion was also sought and discussed during combined meetings of the department of otorhinolaryngolgy and neurosurgery on various treatment modalities and surgical approaches. Informed consent was taken before any surgery. Common transfacial surgical approach was lateral rhinotomy with modifications to gain adequate view and access of the entire extent of the tumour (Figure 1a). Where intracranial involvement was evident, a bicoronal approach was carried out (Figure 1b).

Post operatively, patient was nursed head up, and placed on parenteral broad spectrum antibiotics for 72hrs before commencement of oral medications. However, when there was CSF leakage intraoperatively from dural tear , parenteral antibiotics was continued for one week.

RESULTS:

Twenty nine consecutive cases were reviewed whose computerised tomograhic scan was radiologically reported from various centres as sinonasal tumour with intracranial extension over a nine year period(January 2000-December 2008). Twenty-four(82.8%) were males while five(17.2%) were females. Intraoperative finding of intracranial extension was only established in 10(34.5%) patients(5 males, 5 females) with an age range of 1 ½years to 60years and mean age of 34.1years while 19(65.5%)cases were extracranial.

Out of the 10 cases combined transcranial and transfacial approaches were carried out in 5 cases while 5 cases were successfully resected transfacially (Figure 1a &b). Therefore a total number of 24(82.8%) cases were successfully resected transfacially. Misdiagnosis of intracranial extension occurred most often when ethmoidal, nasopharyngeal and sphenoidal sinuses are involved (Figures 2 & 3). The histological characteristics of the 10 resected sinonasal tumours with intracranial extension as shown in table 1 indicates that five were benign while five were malignant. The positive predictive value of conventional CT was 34.5% for sinonasal tumours with intracranial extension out of the 29 cases reported to have intracranial extension

Table 1: Histological characteristics of the ten patients with sinonasal tumours with intracranial extension

S/NO	Name (Initials)	Sex	Age (Yrs)	Diagnosis
1	A.A	F	45	Left Invasive Fungal Lesion
2	W.A	M	55	Right Epidermoid Carcinoma
3	M.A	F	40	Right Chondrosarcoma
4	H.M	F	47	Right Polymorphic Reticulosis
5	H.B	F	20	Left Granulomatous Lesion
6	A.M	M	15	Right Nasopharyngeal Angiofibroma
7	S.U	M	29	Right Granulomatous Lesion
8	M.M	M	1 ½	Frontonasal Mass – Harmatoma/Encephalocele
9	B.B	M	60	Right Squamous cell carcinoma
10	U.A	F	30	Right Haemangiopericytoma

DISCUSSION

CT scan if used alone is a versatile tool in evaluating the site,and extent of spread of the tumours of the nose and paranasal sinuses using both axial and coronal views when compared to plain x-rays [7,11-13]. However thorough clinical evaluation, should also be carried out to assess the level of involvement of the central nervous system. Knowledge of the anatomy and physiology of the nose, paranasal sinuses, orbit, the anterior cranial fossa, pituitary fossa, carvenous sinus is very crucial as alteration in normal function of these organs may be an indication of spread of the tumour to these organs.

In this study, intraoperative finding of intracranial extension was only established in 10(34.5%) patients(5males ,5females) with an age range of 1 ½years to 60years and mean age of 34.1years while 19(65.5%)cases were extracranial out of the 29 CT reported cases of sinonasal tumours with intracranial extension. Commonly CT and intraoperative finding disparities occurred when ethmoidal, nasopharyngeal and sphenoidal involvement by tumour were reported as intracranial extension due to superimpositions of the images on the brain tissues or partial volume effect. When the anterior cranial fossa is involved, the floor is usually breached.

To ensure that these areas are properly inspected to exclude their involvement,a transfacial approach through a lateral rhinotomy incision was used with modifications (figure 1) [10] . Where intracranial involvement was obvious the operation was converted to anterior craniofacial resection. CT scan report therefore should be interpreted with caution if gadolinium-enhanced MRI cannot be carried out to confirm intracranial involvement[5-7,11-14].This causes considerable challenges to the surgeon if he is to resect the tumour without this detailed confirmation of the extent of intracranial involvement. A combined transcranial and transfacial approach or craniofacial resection should be planned for from the beginning by the otorhinolaryngologist, after a combined otorhinolaryngological and neurosurgical departmental meeting.

In our centre the otorhinolaryngologist always proceeds first with the transfacial approach. With this approach neurosurgical intervention was not necessary in 24(82.8%) cases. Centers without neurosurgical backup may be unwilling to make an attempt in such cases. Centers with neurosurgical facilities without an otorhinolaryngological backup are also inadequate to handle such cases effectively. It is therefore ideal to tackle such cases where the facilities and manpower exist.

Should an otorhinolaryngologist want to tackle such tumours alone, he should be familiar with craniofacial resection. A surgeon without the knowledge of craniofacial resection, must be aware of possible dangers and complications in carrying out such procedure such as dural tear, CSF leakage, meningitis, inadvertent excision of brain tissue with the tumour without adequate knowledge of the difference between a normal brain tissue and tumour and the possibility of leaving some tumour load behind attached to the

dura and brain tissue. Where there are facilities for image guiding system precise location and extent of resection could be monitored but there is no one such facility in the west African subregion.

The challenge to the radiologist is to be as accurate as possible in making an accurate diagnosis of the site, size and correct details of extension to structures both extracranially and intracranially. The use of the three Dimensional(3D) CT or spiral CT for precision in diagnosis of intracranial involvement becomes very important since it more available in the country and cheaper than MRI .Most of the images of the patients involved in this study were taken with conventional CT machine whose images are lower in quality to those acquired by the more advanced helical CT machines. This is because the overlap of image formation in helical CT results in better images than in conventional CT in which formation of the images is done at small intervals, with resultant effect of loss of some details. Generally the CT protocol for neoplasia differs from that used for inflammatory disease and should be utilized whenever neoplasia is suspected.[5] CT shows sites of bone destruction and gadolinium-enhanced magnetic resonance (GdMR) shows soft tissue spread. MRI allows soft tissue differentiation between tumour, inflammation, retention of mucus and fibrosis as confirmed by studies comparing histological findings at craniofacial resection with preoperative imaging.[5-7] Using this protocol a correct correlation between spiral CT and histology was found in 85.2% of areas examined. The correlation of MRI with histological findings improves this figure to 94.1% and the addition of gadolinium DTPA increases the correlation to 98.4%. [5] However the microscopic relationship of the tumour to orbital periosteum and dura cannot be resolved by imaging alone and must rely upon frozen section at the time of surgery[5-7].

Frozen section is not routinely carried out in most tertiary health centres in Nigeria. High powered magnification is routinely used in our centre to differentiate normal tissue from areas infiltrated by tumour but cannot match the accuracy of frozen section.

Since MRI is better in the evaluation of soft tissue planes, it may be suggested additionally. Its main disadvantage, however, is that it is expensive in terms of initial cost and maintenance. MRI is only available in few tertiary health centers and may not be affordable by most patients in our subsaharan region. The cost of CT scan is a heavy burden on most patients who most of the time are unwilling to carry out additional investigation such as MRI particularly if they have to travel very long distances to centres that carry out the investigation.

Multidisciplinary team meeting between the radiologists, the otorhinolaryngologist, the pathologist and the neurosurgeons is also necessary. The experience of the surgeon intraoperatively will be invaluable in taking a second look at previous CT films for re-evaluation. This may guide the radiologists in future reports and for any other possible steps that will give more precise reports. The limitation of this study unfortunately is that not all radiologic reports emanated from one centre making exchange of experiences and ideas not very feasible to all. The experience of the radiologist who has been handling head and neck tumours including sinonasal tumours counts and may minimize such disparity in CT reporting.

In conclusion, as long as conventional CT scan is still being used by most tertiary health centres in the country, similar reports may continue to be a source of diagnostic and therapeutic challenge. Precision in diagnosis of intracranial involvement is most desirable for best surgical approach and management of such patients. This is best confirmed by using both CT and MRI . In the absence of these facilities, the surgical specialities should work as a team in the management of suspected sinonasal tumor complicated with intracranial extension.

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