Original article

A CORRELATION OF CLINICAL PROFILE, COMPUTED TOMOGRAPHIC PATTERNS AND HISTOPATHOLOGIC TYPES OF ODONTOGENIC TUMOURS

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ABSTRACT

OBJECTIVE: There is dearth of literature on computed tomography (CT) patterns of odontogenic tumours in Nigerians. This study aims to determine and correlate the clinical findings and CT patterns with the histopathologic types of odontogenic tumours in a Nigerian tertiary hospital.

METHODS: A retrospective review of the clinical records, CT reports and available images, complemented with a review of the histopathological slides and reports of patients, diagnosed of odontogenic tumours over a 12-year period.

RESULTS: Twenty (20) patients were selected for this study based on the above selection criteria. The patients' mean age was 44 ±5.2 (S.E.) years and the peak age group was the 4th decade of life (n=7, 35.0%). There was equal male to female ratio (1:1), and the maxilla (n=8, 40.0%) was the commonest solitary clinical sites. Ameloblastoma (n=8, 40.0%) was the commonest clinical diagnosis. The CT findings were mostly ill-defined lesional margins (n=16, 80.0%) and solid CT density (n=12, 60.0%). Other CT findings were heterogeneous contrast enhancement (n=5, 25.0%), soft tissue involvement (n=11, 55.0%), bone and soft tissue infiltration (n=16, 80.0%). The most common histopathological diagnosis were ameloblastic carcinoma (n=6, 30.0%) and plexiform ameloblastoma (n=4, 20.0%). There was significant association of heterogeneous contrast enhancement and solid CT pattern/density with histological diagnosis of ameloblastic carcinoma (p=0.050) and plexiform ameloblastoma (p=0.025) respectively.

CONCLUSION: This study observed similar CT patterns of bone and soft tissue infiltration in malignant odontogenic tumours and some variants of ameloblastoma. This study also suggests that heterogeneous contrast enhancement and the solid CT patterns are predictive of histological diagnosis of ameloblastic carcinoma and plexiform ameloblastoma respectively.

Key words: Computed tomography, Histopathology, Odontogenic tumour

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INTRODUCTION

Odontogenic neoplasms are orofacial tumours that are derived from the tooth forming apparatus; they may be locally invasive and rarely metastasize depending on the histological type.[1]Odontogenic tumours constitute a small group of all tumours and tumour-like lesions of the jaws and oral mucosa in adults, with the reported incidence in Nigerians ranging from 12.9% to 32%, and a high incidence of ameloblastoma and a relatively low incidence of other odontogenic tumours is reported in Nigerians.[2-7] Furthermore, a recent study[7] reported a high prevalence of ameloblastoma, followed by odontogenic myxoma, keratocystic odontogenic tumour and ameloblastic carcinoma among histopathologic types of odontogenic tumours in a Nigerian population

Although imaging will not always provide a specific diagnosis, it is useful in narrowing clinical differential diagnosis.[8]Magnetic resonance imaging gives better soft tissue characterization than computed tomography (CT) scan, with a further advantage of being non-ionizing. However, CT is more readily available and bone destruction is better demonstrated with CT. Cross sectional imaging with CT is of value in the imaging of orofacial diseases including the orbits and its contents. Bony lesions causing proptosis are also better evaluated by CT.[9,10]

Amory et al.,[1] reported that the overall CT patterns for odontogenic tumours in canines included direct tooth association and association with multiple teeth, alveolar bone lysis, cortical bone lysis, contrast enhancement, mass-associated tooth displacement, and submandibular lymphadenopathy. Furthermore, some studies in humans[11-13] has described the CT characteristics of some odontogenic tumours such as ameloblastoma, keratocystic odontogenic tumours, and calcifying cystic odontogenic tumour (CCOT) described below.
Crusoe-Rebello et al.,[9] in their study reported that keratocystic odontogenic tumours show lower CT density than ameloblastomas and the heterogeneity of CT density in keratocystic odontogenic tumours is higher than in ameloblastomas. It was also reported that different CT densities are produced by different histologic subtypes of ameloblastoma. Radiographic analysis of maxillary ameloblastoma show severely ill-defined margins as the lesion rather than expanding the bone tend to grow along it.[14] CT has been used to demonstrate intraluminal mass arising within the cystic lesion in intraluminal unicystic ameloblastoma in the mandible.[15] In addition, the CT characteristic of CCOT showed radio-opaque bodies typically located in the periphery of the lesion and the shape of the radio-opaque bodies was linear and/or spotted.[13]

Although several studies have reported CT patterns of odontogenic tumours, [1,11-13,16] there is dearth of literature on the CT characteristics of odontogenic tumours in Nigerians. This study aims to determine and correlate the clinical findings and CT patterns with the histopathologic types of odontogenic tumours in a Nigerian population by performing a 12-year retrospective review of cases seen in a Nigerian tertiary hospital.

MATERIALS AND METHODS

This study was a retrospective review of the clinical records, computed tomography (CT) reports and available images, complemented with a review of the histopathological slides and reports of patients among the 240 diagnosed cases of odontogenic tumour over a period of 12 years (January 2007 to December 2018), in the Departments of Radiology, and Oral Pathology / Medicine, University of Benin Teaching Hospital, Benin City, Nigeria. The CT machine used for the scans was either a Siemens 1994 Somatom ART or General Electric Bright Speed 2007.

The patients' age, gender, orofacial site, duration of lesions, clinical diagnosis, CT findings (lesional margin, size of lesion, lesional characteristics, contrast enhancement pattern, effect of the lesion on surrounding structures, and associated findings), histopathological types and classification of the odontogenic tumours were analyzed. The data was analyzed using the Statistical Package for the Social Sciences (SPSS version 23). Statistical correlation was performed using Pearson's Chi square test. The

confidence level was set at 95% and probability (P) values of <0.05 were regarded as statistically significant. Approval was obtained from the Hospital Ethical Committee for this study.

RESULTS

A total of twenty (8.3%) patients with CT report and complementary histopathological diagnosis among the 240 diagnosed cases of odontogenic tumours were selected for this study. The age range of the patients was 9 to 75 years with a mean age of 44±5.2(S.E.) years and the peak age group was the 4th decade of life (n=7, 35.0%) [Table1].

Table 1: Correlation of patients' age group and gender

Age group	Male	Female	Total (%)	
0-10	1	0	1	5.0
11-20	0	1	1	5.0
21-30	0	1	1	5.0
31-40	2	5	7	35.0
41-50	1	1	2	10.0
51-60	5	0	5	25.0
61-70	0	2	2	10.0
≥71	1	0	1	5.0
Total	**10**	**10**	**20**	**100**

There was equal male to female ratio (1:1), and the maxilla (n=8, 40.0%) was the commonest solitary clinical sites. The mean duration on presentation of the lesions was 32.6 ± 13.2 (S.E) weeks. Ameloblastoma (n=8, 40.0%) was the commonest clinical diagnosis (Table 2).

All the lesions were large (>3cm) on CT. The CT findings were mostly ill-defined lesional margins (n=16, 80.0%) and solid CT density (n=12, 60.0%). Other CT findings were heterogeneous contrast enhancement (n=5, 25.0%), soft tissue involvement (n=11, 55.0%), bone and soft tissue infiltration (n=16, 80.0%), and dental anarchy (n=3, 15.0%).

Histopathological diagnosis showed 12 (60.0%) benign and 8 (40.0%) malignant odontogenic tumours (Table 3). The most common histopathological types of odontogenic tumours were ameloblastic carcinoma (n=6, 30.0%) [Fig 1] and plexiform ameloblastoma (n=4, 20.0%) [Fig 2]. CT ill-defined lesional margins was not significant (p=0.240) in discriminating between the malignant and benign odontogenic tumours (solid and solid-multicystic variants of ameloblastoma). There was significant association of heterogeneous contrast enhancement with histological diagnosis of malignant odontogenic tumour (p=0.019) and ameloblastic carcinoma (p=0.050) [Figure 3]. Different CT densities were produced by the different histological subtypes of ameloblastoma including: solid, cystic, mixed (solid-cystic) densities. Solid CT density was significantly associated with histological diagnosis of plexiform ameloblastoma (p=0.025) [Table 4].

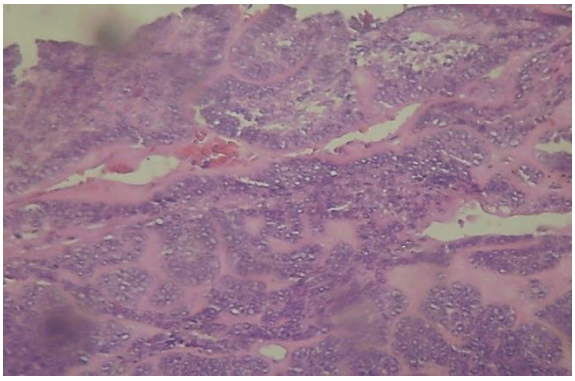

Fig 1: Photomicrograph of ameloblastic carcinoma showing islands and strands of dysplastic odontogenic epithelial cells with vacuolated nuclei and crowding of the peripheral cells in fibrovascular connective tissue stroma (H&E, X 100).

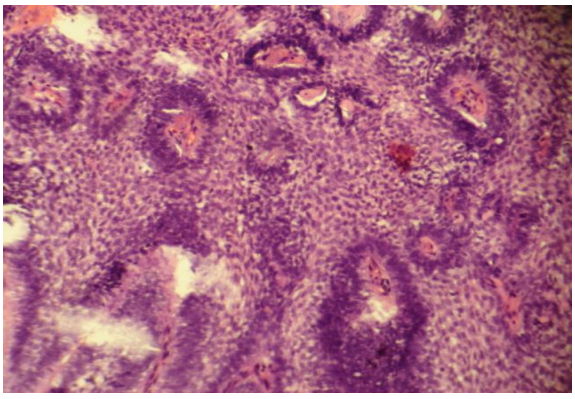

Fig 2: Photomicrograph of plexiform ameloblastoma showing sheet of odontogenic epithelium consisting of inner stellate cells and outer cuboidal (ameloblast-like) cells surrounding scanty fibrovascular connective stroma (H&E, 100)

Table 2: Site and clinical diagnosis of the odontogenic tumours

		Site							
		maxillary antrum	maxilla	parotid	mandible	maxilla and parotid	palate	parotid and temporal	Total %
Clinical diagnosis	**not specified**	1	1	0	2	0	0	0	**4 20.0**
	ameloblastoma	0	0	1	4	1	0	2	**8 40.0**
	pleomorphic adenoma	0	0	1	0	0	1	0	**2 10.0**
	antral mucocele or sinoantral carcinoma	2	0	0	0	0	0	0	**2 10.0**
	antra-choanal tumour / carcinoma	1	0	0	0	0	0	0	**1 5.0**
	benign mucosal cyst of maxillary antrum	2	1	0	0	0	0	0	**3 15.0**
Total		**6**	**2**	**2**	**6**	**1**	**1**	**2**	**20 100**

Table 3: Correlation of CT lesional margin, CT characteristics and histological class of the odontogenic tumours

			CT lesional margin				
Histological class			**well defined**	**Ill- defined**	**expansile**	**Total**	**%**
malignant	CT characteristics	solid	-	7	-	7	35.0
		mixed cystic and solid	-	1	-	1	5.0
	Total		**-**	**8**	**-**	**8**	**40.0**
benign	CT characteristics	cystic	2	3	-	5	25.0
		Solid	1	4	1	6	30.0
		Mixed cystic and solid	-	1	-	1	5.0
	Total		**3**	**8**	**1**	**12**	**60.0**
Total	CT characteristics	cystic	2	3	0	5	25.0
		solid	1	11	1	13	65.0
		mixed cystic and solid	-	2	0	2	10.0
	Total		**3**	**16**	**1**	**20**	**100**

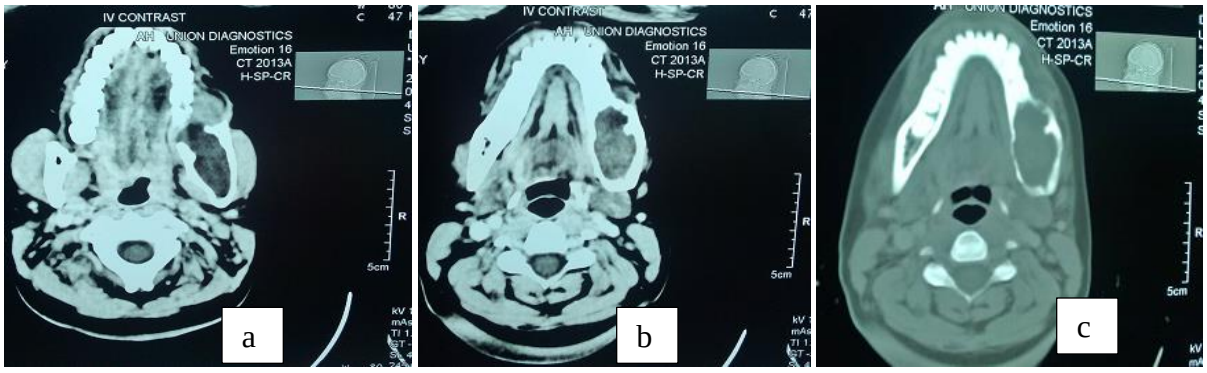

Figure 2. Ameloblastoma: Axial contrast enhanced computed tomographic images of soft (a and b) and bone window (c); show a large lytic soft tissue lesion of the right hemimandible with buccolingual expansion and cortical thinning. There is also cortical breach and soft tissue extension anteriorly (a and c).

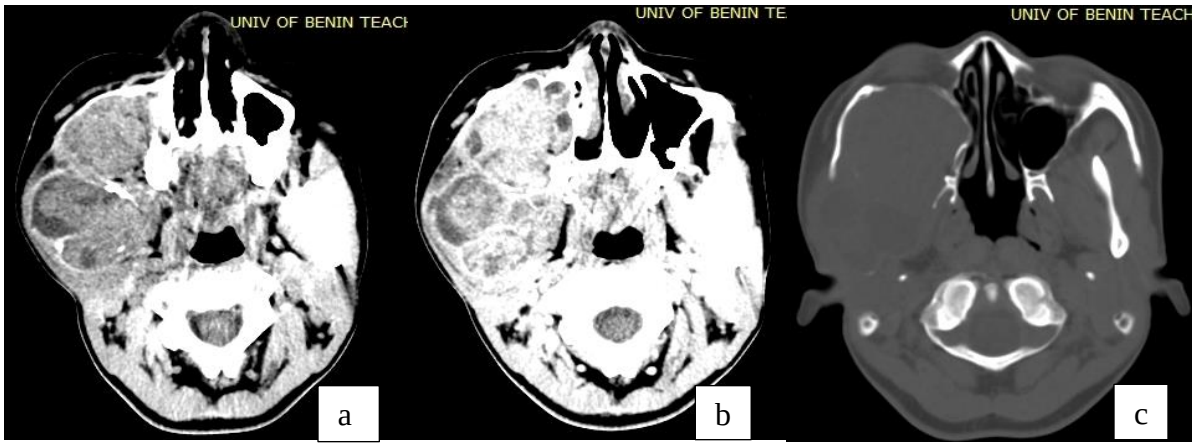

Figure 3. Ameloblastic carcinoma: Axial unenhanced (a) and contrast enhanced (b) computed tomographic images show a large ill-defined, predominantly solid heterogeneously enhancing mass with lytic destruction of the right maxilla. There are multiple hypoattenuating areas suggestive of necrosis. The lytic destruction of the right maxilla and mandible is well depicted on bone window level (c).

Table 4: Correlation of CT lesional margin, CT characteristics and histological types of the odontogenic tumours

Histological diagnosis			CT margin			Total	%
			well defined	Ill-defined	expansile		
Ameloblastic carcinoma	CT characteristics	solid	-	5	-	5	25.0
		mixed cystic and solid	-	1	-	1	5.0
	Total		-	6	-	**6**	**30.0**
Carcinosarcoma	CT characteristics	solid	-	1	-	1	5.0
	Total		-	**1**	-	**1**	**5.0**
plexiform ameloblastoma	CT characteristics	solid	1	2	1	4	20.0
	Total		1	2	1	**4**	**20.0**
clear cell odontogenic carcinoma	CT characteristics	solid	-	1	-	1	5.0
	Total		-	**1**	-	**1**	**5.0**
Luminal unicystic ameloblastoma	CT characteristics	cystic	1	-	-	1	5.0
	Total		**1**	-	-	**1**	**5.0**
Mural unicystic ameloblastoma	CT characteristics	cystic	1	-	-	1	5.0
		mixed cystic and solid	-	1	-	1	5.0
	Total		**1**	**1**	-	**2**	**10.0**
acanthomatous /kerato ameloblastoma	CT characteristics	solid	-	2	-	2	10.0
	Total		-	**2**	-	**2**	**10.0**
solid-multicystic ameloblastoma	CT characteristics	cystic	-	3	-	3	10.0
	Total		-	**3**	-	**3**	**10.0**
Total	CT characteristics	cystic	2	3	0	**5**	**25.0**
		solid	1	11	1	**13**	**65.0**
		mixed cystic and solid	0	2	0	**2**	**10.0**
	Total		**3**	**16**	**1**	**20**	**100**

DISCUSSION

Studies on odontogenic tumours among Nigerians [2-7] suggest variable gender predilection and a predilection of these tumours for the third decade of life and the mandible. The clinical profile of the patients in this study was not unique for predicting histopathologic diagnosis of odontogenic tumours. However, the preponderance of the tumours in older adults and the jaws may be reason for the frequent clinical diagnosis of ameloblastoma (40%) before CT evaluation and confirmatory histopathologic diagnosis was performed for 20 (8.3%) cases among the odontogenic tumours reviewed in this study.

The CT characteristics reported in canines with odontogenic tumours include: alveolar and cortical bone lysis, contrast enhancement and mass-associated tooth displacement. [1] Similarly, heterogeneous contrast enhancement, bone and soft tissue infiltration and dental anarchy were observed in this study. Recent report by Ogbeide et al, [17] observed that ill-defined lesional margins and heterogeneous contrast enhancement were associated with malignant oral and maxillofacial tumours including ameloblastic carcinomas. However, ill-defined lesional margins was not useful for discriminating between the benign (solid and solid-multicystic variants of ameloblastoma) and malignant odontogenic tumours in this study. This may be due to the local infiltrative behaviour of ameloblastoma[1] which mimics malignant odontogenic tumours; hence both lesions showed ill-defined lesional margins. Heterogeneous contrast enhancement was significantly associated with the malignant odontogenic tumours, mainly ameloblastic carcinoma. This appears to be a useful CT characteristic for differentiating ameloblastic carcinoma from ameloblastoma.

Furthermore, Crusoe-Rebello et al., [9] reported that different CT densities are observed in different histologic subtypes of ameloblastoma. Similarly, this study observed variation of CT densities including solid, cystic and mixed (solid-cystic) densities among the histological subtypes of ameloblastoma. There was significant association of solid CT density with plexiform ameloblastoma, which agrees with previous report.[17] Also, cystic and mixed (cystic and solid) densities were observed in unicystic ameloblastoma and solid-multicystic ameloblastoma respectively in this study. This also supports previous report of a cystic CT density associated with a mass growing into the lumen of intraluminal unicystic ameloblastoma in the mandible.[15] There is also a report of a mixed CT density consisting of peripheral radio-opaque bodies in a cystic lesion diagnosed as CCOT.[13]

The limitations of this 12-year retrospective study include: preferential use of CT for evaluation of orofacial tumours, particularly in patients with extensive maxillary lesions; the high cost and inaccessibility to CT, which prevented its routine use in clinical evaluation during the period under review; and the small sample size analyzed was because only patients (n=20, 8.3%) with complementary histopathologic diagnosis of odontogenic tumour were selected for this study. In contrast to a relatively larger sample (40 cases) previously reported in a 10-year study of oral and maxillofacial diseases in this Centre. [17]

Currently, there seems to be an increasing awareness of the need to utilize CT for evaluation of orofacial tumours in different treatment Centres in Nigeria. Therefore, review of a larger sample size from a multi-Centre Nigerian study of the CT characteristics of odontogenic tumours including those not analyzed in this study is recommended.

In conclusion, this study observed similar CT patterns of bone and soft tissue infiltration in malignant odontogenic tumours and some variants of ameloblastoma. This study also suggests that heterogeneous contrast enhancement and the solid CT patterns are predictive of histological diagnosis of ameloblastic carcinoma and plexiform ameloblastoma respectively.

Competing Interests: The authors declare absence of any competing interests

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