Original article

A CLINICOPATHOLOGIC STUDY OF NEOPLASTIC EPITHELIAL SALIVARY GLAND TUMOUR SEEN OVER 15 YEARS AT A NIGERIAN TERTIARY CENTRE

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ABSTRACT

OBJECTIVES: The aim of this study was to review the clinicopathologic characteristics of neoplastic epithelial salivary gland tumours (SGTs) and update current information available on clinicopathology of the SGTs based on WHO, 2017 classification.

METHODS: A 15-year retrospective review of the clinicopathology of specimens, using biopsy reports and histopathology slides neoplastic epithelial SGTs seen in the Oral Pathology unit of the Department of Oral Maxillofacial Surgery & Oral pathology, and the Department of Morbid Anatomy & Forensic Medicine, Obafemi Awolowo University Teaching Hospitals Complex Ile-Ife. The age, gender, site, histopathologic type and subtype of tumours were analysed.

RESULTS: A total of 125 (5.2%) SGTs were seen among 2,404 head and neck tumours seen over the study period. One hundred and twenty two (97.6%) of these were neoplastic epithelial SGTs. Most of the neoplastic epithelial SGTs were benign lesions (63.1%) consisting mostly pleomorphic adenoma (PA) accounting for 53.3% of all neoplastic epithelial SGTs. Mucoepidermoid carcinoma (MEC) and adenoid cystic carcinoma (AdCC) were the commonest malignant epithelial SGTs, each accounting for 14.8% of all the neoplastic epithelial SGTs. The mean age of the patients was 42.5±18.0 years. There was female predominance with a female to male ratio of 1.5:1. The major salivary glands (73.8%) were the commonest site with the parotid gland recording the highest occurrence (55.7%). The palate was the commonest intraoral site observed (16.4%).

CONCLUSION: This study observed that pleomorphic adenoma was the commonest neoplastic epithelial salivary gland tumour, followed by adenoid cystic carcinoma and mucoepidernoid carcinoma. The tumours were frequently seen in the parotid and females. Benign tumours occurred more between 3rd and 4th decades, while malignancies were seen more 7th and 8th decades.

Keywords: Neoplasm, Salivary gland, Epithelial tumour

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INTRODUCTION

The salivary glands are exocrine glands, which produce and secrete saliva. There are three major paired glands, the parotid, submandibular and sublingual glands as well as over 600 other minor salivary glands found in almost every part of the oral cavity except the gingival and anterior region of the hard palate[1].

These glands can be affected by various pathologic conditions, which can be reactive, obstructive, infective, immune-related and neoplastic[2]. The neoplastic conditions are majorly of epithelial origin and represent a variety of both benign and malignant types[3]. The salivary gland neoplasms consist of a group of heterogeneous lesions, which present complex clinico-pathological characteristics and distinct biologic behaviour[4].

Neoplastic diseases are rare in the salivary glands, constituting 0.15-1.3% of all the tumours of the body[5, 6], 3-10% of head and neck neoplasms[7, 8] and about 13.7% of all salivary gland lesions[9]. Geographic variations exist in the relative incidences of salivary gland tumours and this has been reported by various studies from different parts of the world[6, 9, 10].

Benign salivary gland tumours are commoner, accounting for 54-79% of the tumours[3, 5, 10, 11]. Pleomorphic adenoma is the most common tumour of the salivary glands and accounts for more than 50% of all salivary gland neoplasms and over 70% of the benign tumours. Adenoid cystic carcinoma and mucoepidermoid carcinoma have been reported by different studies as commonest of the malignant series [10-13]. These neoplasms occur more in the major salivary glands with parotid gland accounting for 64-80% of the salivary gland neoplasms, followed by the submandibular gland and less than 1% in the sublingual gland. The minor glands account for 9-23% of all the salivary gland neoplasms[5, 11, 12].

Salivary gland neoplasms occur between the 1st and 9th decades of life, with the peak incidence for benign neoplasms in the 3rd and 4th decades and 6th and 7th decades for malignant neoplasms[10-13]. They occur more frequently in women than in men[3, 5,12, 13]

The aetiology of salivary gland neoplasms is unknown; however several risk factors have been implicated. They include viruses, radiation, occupation (hairdressing, rubber manufacturing, plumbing, exposure to nickel), lifestyle (smoking, use of silica oil and kerosene for cooking) and nutrition[14, 15]. Increased relative risks of 3.5 for benign neoplasms and 11 for malignant neoplasms among survivors of the Hiroshima and Nagasaki bombing have been reported by long term follow-up studies. The risk was found to be directly related to the level of exposure to radiation[3]. Therapeutic radiations to the head and neck, dental radiography and ultraviolet rays have also been implicated[3, 16].

Genetic events have been associated with development of salivary gland neoplasms; however, there is no evidence of familiarity. Researchers have used cytogenetic studies to link salivary gland neoplasms to some molecular events, such as; rearrangement of chromosome 8q12 targeting the pleomorphic adenoma gene 1 (PLAG1) and chromosome 12q13-15 targeting the High Motility Group AT-hook-2 genes (HMG2) in pleomorphic adenoma, translocation of chromosome (11; 9)(q21; 13.1) in mucoepidermoid carcinoma, loss of heterozygosity of 6q23-25 in adenoid cystic carcinoma and carcinoma ex-pleomorphic adenoma[17-19].

Salivary gland neoplasms have been difficult to classify due to their rarity and morphologic diversity. Over the years several classifications have evolved, however, classification by WHO published in 1991 and 2005 has received global acceptance. This classification has recognised 40 salivary gland neoplasms based on the microscopic appearance of recognisable morphologic patterns. They are sub classified into epithelial and non-epithelial tumours with the epithelial grouped into benign and malignant tumours and the non-epithelial being lymphomas and sarcomas[3]. This has been recently modified with changes made to lesions like polymorphous low-grade adenocarcinoma where the grade of the lesion is being deemphasized[20].

Benign salivary gland neoplasms present as slow growing lesions, which do not ulcerate, having soft rubbery consistency with no nerve

involvement. While their malignant counterparts often exhibit rapid growth, nodular appearance, might cause ulceration of overlying mucosa or skin and invade surrounding tissues. They are firm to hard in consistency involving more commonly the minor glands and can cause nerve palsies[2, 3].

Various methods have been employed in the investigation of salivary gland neoplasm. These include: magnetic resonance imaging (MRI), computed tomography (CT), ultrasonography and CT sialography images. Fine needle aspiration biopsy (FNAB) for cytological examination is also a useful screening and diagnostic tool for rapid diagnosis[2, 3]. However the gold standard for diagnosis is surgical biopsy in which specimen is subjected to histopathologic examination[3].

This study intends to review the clinico-pathological characteristics of the epithelial salivary gland neoplasms seen between January 1998 and December 2013. In addition, update the current information available on the clinicopathology of salivary gland neoplasms based on the WHO 2017 classification of salivary gland neoplasms.

MATERIALS AND METHODS

This was a retrospective study conducted to determine the clinicopathological characteristics of epithelial salivary gland neoplasms seen at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife between January 1998 and December 2013 (15 years). The study was carried out in the Oral Pathology unit of the Department of Oral Maxillofacial Surgery & Oral pathology, and the Department of Morbid Anatomy & Forensic Medicine, Obafemi Awolowo University Teaching Hospitals Complex Ile-Ife, Osun State. Approval was obtained for the study from the Ethics and Research Committee of the Obafemi Awolowo Universities Teaching Hospitals Complex. (Ethical Reference Number: IRB/IEC/0004553).

Biopsy reports and histopathology slides were reviewed, including slides prepared from available paraffin wax blocks of specimens of all the cases of epithelial salivary gland neoplasms, obtained from the two departments which were re-cut and stained with Haematoxylin & Eosin. Clinical information regarding the age, gender, site of tumour as well as clinical and histologic diagnoses were retrieved.

Tumours were analyzed according to age, site, gender, histologic type and histopathologic subtype. The modified age grouping system recommended for morbidity in health by the Department of International Economic and Social Affairs of the United Nations was used[21].
Group 1= 0-19 years (children and adolescents)
Group 2= 20-39 years (young adults and adults)
Group 3= 40-59 years (middle aged)
Group 4= 60-79 years (elderly).

Data was analyzed using Statistical Package for Social Sciences version 20 (SPSS v.20; SPSS, Chicago, IL, USA). Descriptive statistics were carried out for socio-demographic variables such as age, sex, site of tumour, histopathological type and subtypes of tumour. Qualitative descriptive variables such as sex, site of tumour, histopathological types and subtypes of neoplastic epithelial SGTs were expressed as frequencies and percentages. Distribution of tumours within age group and gender were further compared using the likelihood ratio $\chi 2$ - square statistics. Level of significance was set at $p<0.05$.

RESULTS

A total of 2,404 head and neck tumours were seen during study period, among which 125 (5.2%) were salivary gland neoplasms (SGN). Out of the 125 salivary gland neoplasms, 122 (97.6%) were epithelial salivary gland neoplasms.

The ages of patients ranged between 6 and 76 years with a mean of 42.5±18.0 (median = 41.0) years. PA was observed between 9 and 76 years with a mean of 35.6±15.4 (median=31.0) years, while AdCC and MEC occurred between 19 and 75 years and 6 and 75 years, with mean ages of 56.7±13.9 (median =58.5) years and 49.3±22.3 (median=57.0) years respectively (Figure 1). Highest frequency of occurrence of neoplastic SGTs were observed in 20-39 and 40-59 years age groups (n=40, 33.6% each) , while least was

observed in the 0-19 years group (n=12, 10.1%). PA was most prevalent between 20 and 39 years (n=32, 49.1%), while AdCC and MEC were observed more within 40 to 59 years (n=9, 50.0%) and 60 to 79 years (n=8, 44.4%) groups respectively. There was a statistically significant association between occurrence of the neoplastic epithelial SGTs and age group at p<0.001 (Table 1).

There were 73(59.8%) females and 48 (39.3%) males giving a female to male ratio of 1.5:1. The gender of one patient was not documented. There was female predilection in virtually all the tumours except myoepithelioma (Myo) (Table 2). The gender distribution within the age group of cases also revealed more occurrences in females than males in all age groups except within the 60 to 79 years age group where higher male occurrence was observed (Figure 2).

Most (n=90; 73.8%) of the tumours were observed within the major salivary glands, while 31 (25.4%) were seen in the minor salivary glands. Site of one PA was not documented (Table 3). Parotid gland (n=68, 55.7%) was the site of predilection for both benign and malignant tumours followed by the submandibular gland (n=21, 17.2%), with the palate (n=20, 16.4%) being the commonest intraoral site. Only one tumour was seen in the sublingual gland, AdCCs (n=5, 4.1%) were the only tumours observed in the maxillary antrum (Table 4).

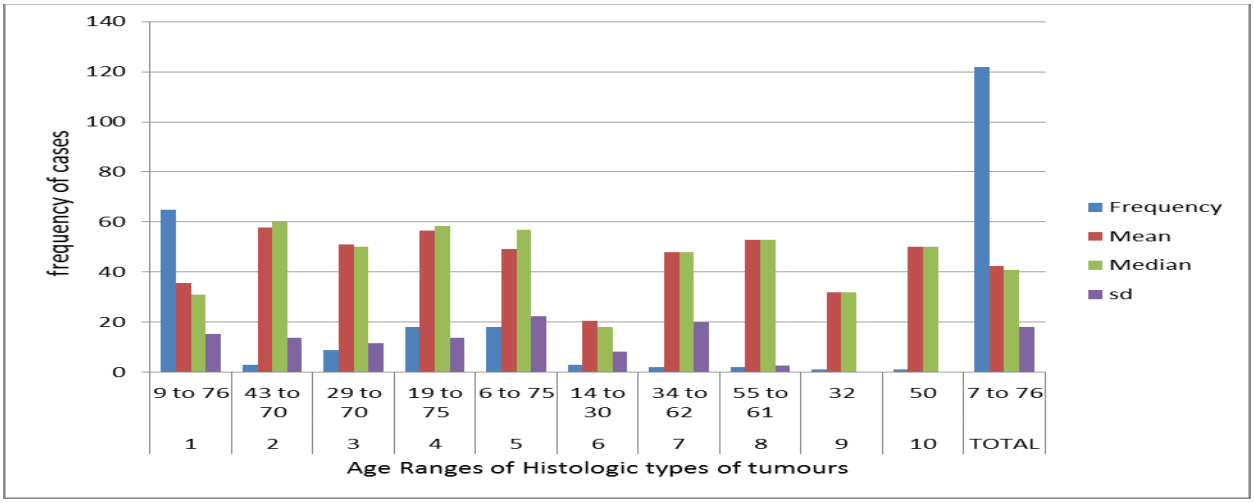


Figure 1: Age range, median and mean ages of histologic types of neoplastic SGTs

Key: 1 – Pleomorphic adenoma, 2 – Myoepithelioma, 3 – Basal cell adenoma, 4 – Adenoid cystic carcinoma, 5 – Mucoepidermoid carcinoma, 6 – Acinic cell carcinoma, 7 – Adenocarcinoma not otherwise specified, 8 – Carcinoma ex pleomorphic adenoma, 9 – Polymorphous adenocarcinoma, 10 – Basal cell adenocarcinoma

TABLE 1: Distribution of neoplastic SGTs within age groups

Age Group	PA	MyO	BCA	AdCC	MEC	AcCC	PLA	BCAca	AdenoNOS	Ca-Ex-PA	Total
0-19	7(10.8)	0(0.0)	0(0.0)	1(5.6)	2(11.1)	2(66.7)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	12(9.8)
20-39	32(49.2)	0(0.0)	1(11.1)	0(0.0)	4(22.2)	1(33.3)	1(100.0)	0(0.0)	1(50.0)	0(0.0)	40(32.8)
40-59	19(29.2)	1(33.3)	6(66.7)	9(50.0)	2(11.1)	0(0.0)	0(0.0)	1(100.0)	0(0.0)	2(100.0)	40(32.8)
60-79	7(10.8)	2(66.7)	1(11.1)	8(44.4)	8(44.4)	0(0.0)	0(0.0)	0(0.0)	1(50.0)	0(0.0)	27(22.1)
Missing	0(0.0)	0(0.0)	1(11.1)	0(0.0)	2(11.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(2.5)
Total	**65(100)**	**3(100)**	**9(100)**	**18(100)**	**18(100)**	**3(100)**	**1(100)**	**1(100)**	**2(100)**	**2(100)**	**122(100)**

Likelihood ratio $\chi^2 = 62.9$ Degree of freedom = 27 p < 0.001*

KEYS: PA - Pleomorphic adenoma, Myo – Myoepithelioma, BCA - Basal cell adenoma, AdCC - Adenoid cystic carcinoma, MEC - Mucoepidermoid carcinoma, AcCC - Acinic cell carcinoma, Ca-Ex-PA - Carcinoma ex pleomorphic adenoma, Adeno NOS - Adenocarcinoma not otherwise specified, PLA - Polymorphous adenocarcinoma, BCA ca - Basal cell adenocarcinoma

Table 2: Frequency of histologic types of neoplastic epithelial SGTs within sexes

	PA	Myo	BCA	AdCC	MEC	AcCC	PLA	BCAca	AdenoNOS	Ca-Ex-PA	Total
Male	21(41.5)	2(66.7)	4(44.4)	7(38.9)	6(33.3)	1(33.3)	1(100.0)	0(0.0)	0(0.0)	0(0.0)	48(39.3)
Female	38(58.5)	1(33.3)	5(55.6)	11(61.7)	11(61.1)	2(66.7)	0(0.0)	1(100.0)	2(100.0)	2(100.0)	73(59.8)
Missing	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(5.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.8)
Total	65(100.0)	3(100.0)	9(100.0)	18(100.0)	18(100.0)	3(100.0)	1(100.0)	1(100.0)	2(100.0)	2(100.0)	122(100.0)

Likelihood ratioχ2= 8.165 Degree of freedom = 9 p = 0.518

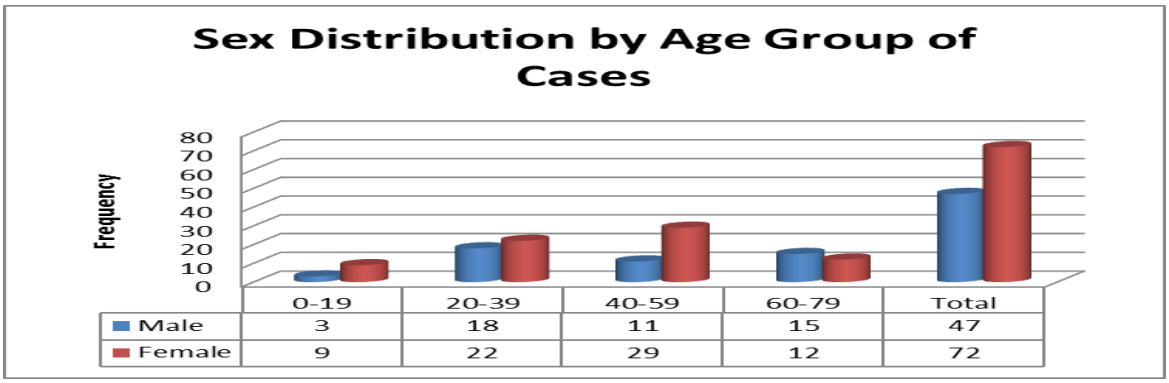


Figure 2: Gender distribution by age group of the patients

Table 3: Distribution of the neoplastic epithelial SGTs within the major and minor salivary glands

	PA	MYO	BCA	AdCC	MEC	AcCC	PLA	BCA ca	AdenosNOS	Ca-Ex-PA	TOTAL
Major Glands	53(81.5)	3(100.0)	7(77.8)	6(33.3)	14(77.8)	3(100.0)	0(0.0)	0(0.0)	2(100.0)	2(100.0)	90(73.8)
Minor Glands	11(16.9)	0(0.0)	2(22.2)	12(66.7)	4(22.2)	0(0.0)	1(100.0)	1(100.0)	0(0.0)	0(0.0)	31(25.4)
Missing	1(1.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.8)
TOTAL	65(100.0)	3(100.0)	9(100.0)	18(100.0)	18(100.0)	3(100.0)	1(100.0)	1(100.0)	2(100.0)	2(100.0)	122(100.0)

Table 4: Site distribution of histopathological types of the neoplastic epithelial SGTs

Site of tumour	PA	MYO	BCA	AdCC	MEC	AcCC	PLA	BCA ca	Adenos NOS	Ca-Ex-PA	Total
Parotid	38(58.5)	3(100.0)	6(66.7)	2(11.1)	13(72.2)	3(100.0)	0(0.0)	0(0.0)	1(50.0)	2(100.0)	68(55.7)
Submandibular gland	14(21.5)	0(0.0)	1(11.1)	4(22.2)	1(5.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	21(17.2)
Sublingual gland	1(1.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(50.0)	0(0.0)	1(0.8)
Buccal	3(4.6)	0(0.0)	0(0.0)	0(0.0)	1(5.6)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	4(3.3)
Labial	1(1.5)	0(0.0)	0(0.0)	1(5.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	2(1.6)
Palatal	7(10.8)	0(0.0)	2(22.2)	6(33.3)	3(16.7)	0(0.0)	1(100.0)	1(100.0)	0(0.0)	0(0.0)	20(16.4)
Maxillary Antrum	0(0.0)	0(0.0)	0(0.0)	5(27.8)	0(0.0)	0(0.0)	0(0.0)	0(100.0)	0(0.0)	0(0.0)	5(4.1)
Missing	1(1.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.8)
Total	65(100.0)	3(100.0)	9(100.0)	18(100.0)	18(100.0)	3(100.0)	1(100.0)	1(100.0)	2(100.0)	2(100.0)	122(100.0)

Of the ten histopathological types of the neoplastic epithelial SGTs observed, three types were benign while seven types were malignant (Table 5).

Table 5: Classification of the histopathological types of neoplastic epithelial SGTs

Histopathologic Type	Frequency	Percentage (within all tumours)	Percentage (within group)
Benign			
PA	65	53.3	84.4
Myo	3	2.5	3.9
BCA	9	7.4	11.7
Subtotal	**77**	**63.1**	**100**
Malignant			
AdCC	18	14.8	40.0
MEC	18	14.8	40.0
AcCC	3	2.5	6.7
Ca-Ex-PA	2	1.6	4.4
Adeno NOS	2	1.6	4.4
PLA	1	0.8	2.2
BCA ca	1	0.8	2.2
Subtotal	**45**	**36.9**	**100**
Total	**122**	**100**	**100**

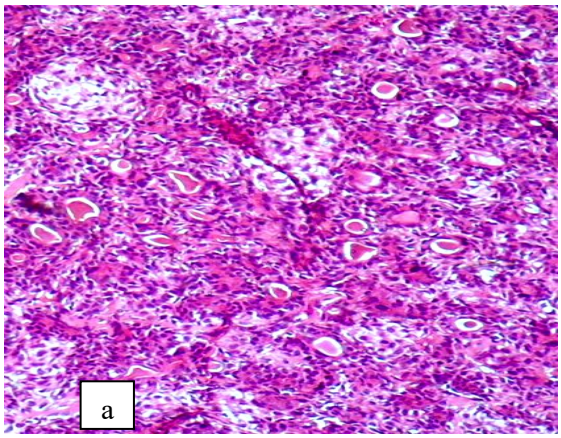
PA was the most common benign neoplasm accounting for 65 (84.4%) cases among 77 cases benign epithelial SGTs. Within the benign group, basal cell adenoma (BCA) was next in frequency accounting for 9 (11.1%) cases. MEC and AdCC were the most commonly observed malignant tumours; each accounting for 18 (40.0%) cases among 45 cases malignant epithelial SGTs (Table 5).

Of the three histopathological subtypes of PA observed the most prevalent was the stroma rich (27.7%), followed by cell rich (12.3%) subtype. The predominant histopathological variants of BCA observed were solid (n=2, 22.2%), tubular (n=2, 22.2%) and membranous (n=2, 22.2%) variants (Table 6)[Fig 3a-d].

Low grade MEC (38.9%) was the most prevalent subtype of MEC followed by high-grade tumour (27.8%). Only the cribriform (n=6, 33.3%) and solid (n=3, 16.7%) variants of AdCC were observed in this study. The 2 cases of carcinoma ex pleomorphic adenomas (Ca-Ex-PA) were recorded were poorly differentiated adenocarcinomas. Also singular cases of follicular acinic cell carcinoma (AcCC), trabecular polymorphous adenocarcinoma (PLA) and solid variant of basal cell adenocarcinoma (BCA ca) were recorded (Table 6) [Fig 4a-f].

Table 6: Frequency of Histopathological subtypes/variants of the neoplastic epithelial SGTs

Tumour	Number Within Variant	Percentage Within Variants
PA		
Stroma rich	18	27.7
Cell rich	8	12.3
Classic	7	10.8
Missing	32	49.2
Total	**65**	**100**
BCA		
Solid	2	22.2
Trabecular	1	11.1
Tubular	2	22.2
Membranous	2	22.2
Missing	2	22.2
Total	**9**	**100**
MEC		
Low grade	7	38.9
Intermediate	1	0.5
High grade	5	27.8
Missing	5	27.8
Total	**18**	**100**
AdCC		
Cribriform	6	33.3
Solid	3	16.7
Missing	9	50.0
Total	**18**	**100**
AcCC		
Follicular	1	33.3
Missing	2	66.7
Total	**3**	**100**



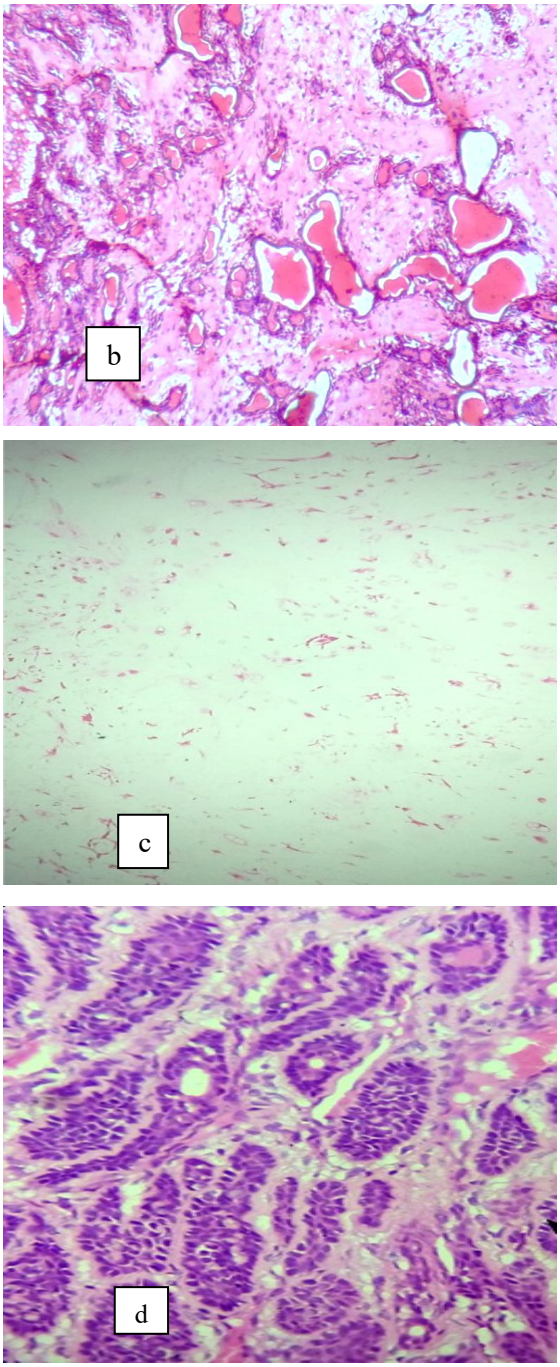


Fig 3a-d: Photomicrographs showing a) cell rich b) classic, c) stroma rich subtypes of pleomorphic adenoma of the salivary glands, and d) Solid subtype of basal cell adenoma of the salivary glands. (x40, H&E)

DISCUSSION

Salivary gland neoplasms (SGNs) comprised 5.2% of the head and neck tumours seen within the period of study. Epithelial SGNs, however, accounted for 97.6% of the SGNs seen. These findings are comparable to previous studies[3,22,23].

The overall wide age range of 7-76 years in this study is comparable with many studies from Nigeria, Uganda and Iran which reported 15-63 years, 6-98 years, 0.5-80 years and 8-85 years respectively[11,13,22,24]. Ladeinde *et al*[23] however observed a much shorter range of 21- 60 years which may be due to the predominance of malignancies recorded in their study, while a large UK series reported a wider age range of 11-95 years, which can be attributed to higher life expectancy and better healthcare seeking behaviour of elderly patients in the European population when compared with Nigerians[5,25]. The mean age of 42.5 years found in this study is comparable to those of Parkin *et al*[12], Lawal *et al* [22] and Shishegar *et al*[25] which are 46.2, 47.9 and 44.6 years respectively. Vuhahula *et al*[13], however recorded a lower mean age of 38.1 years.

Benign tumours were mostly found between the 3rd and 4th decades (43.4%), while malignancies were seen more within 7th and 8th decades (39.5%). The mean age for benign tumours was 38.1 years, while that of malignant tumours was 50.1years. This was relatively higher than the mean age of 33.5 years for benign and 43.1 years for malignancies, with a difference of 9.1 reported by Vuhahula *et al*[13] . Whereas, 37.0 and 43.50 years were recorded by Jude *et al*[26]. Pleomorphic adenoma was seen mostly within the 20-39 years age group, while basal cell adenoma was noticed at two decades above this (40-59 years). This is similar to findings by Fonseca *et al* [27] who reported a range of 31-40 years for PA and 51-60 years for Basal cell adenoma. MEC was seen mostly between 60-79 years age range, however AdCC was seen mostly at two decades lower than this (40-59years). In addition this study also documented five cases of MEC and AdCC within the first two decades of life. This finding is supported by the occurrence of these malignant epithelial SGTs in childhood[28]. Acinic cell carcinoma was seen more within the first two decades of life 0 to 19 years. This occurrence is at variance with the UK and

Brazilian reports with age ranges of 13 to 95 years and 31 to 70 years respectively[5,28].

The overall approximate female: male ratio in this study was 1.5:1. The female predominance is consistent with studies from UK, Ghana and Uganda, with ratios of 1.6:1, 1.4:1 and 1.3:1 respectively [5,12,13]. Although, Lawal *et al*[22], Ladeinde *et al*[23] and Shishegar *et al* [25] reported female preponderance of 1.02:1, 1.1:1 and 1.02:1 respectively, but their values are almost near equals, while Tian *et al*[10] demonstrated male predominance of 0.9:1, which is due to the high frequency of Warthin's tumour recorded in their study. Within the benign and malignant groups, there were female predilection of 1.3:1 and 1.9:1 similar to Brazilian studies with ratio 1.6:1 in both groups[6]. However considering individual tumours, myoepithelioma showed more male predominance in this study. While larger series by Jones *et al*[5] and Vuhahula *et al*[13] documented female predominance, the converse in this study may be explained by the fact that only three cases of myoepithelioma were seen. PA showed a female to male ratio of 1.4:1 while AdCC and MEC revealed 1.6:1 and 1.8:1 respectively similar to other studies[12,25].

The general topography in this study indicated that the parotid gland was the most frequent site of occurrence of the SGNs (55.7%) followed by the submandibular gland (17.2%) and then the palate (16.4%). Tumours were rare in the sublingual glands (0.8%). These findings are supported by studies in Europe [5,7], Brazil[6], China[10,] Nigeria[11] . However, another Nigerian study by Ladeinde *et al* [23] reported highest predominance of SGN in the palate and explained that the study was conducted at Departments of Oral Pathology and Oral and Maxillofacial surgery where intraoral tumours generally present.

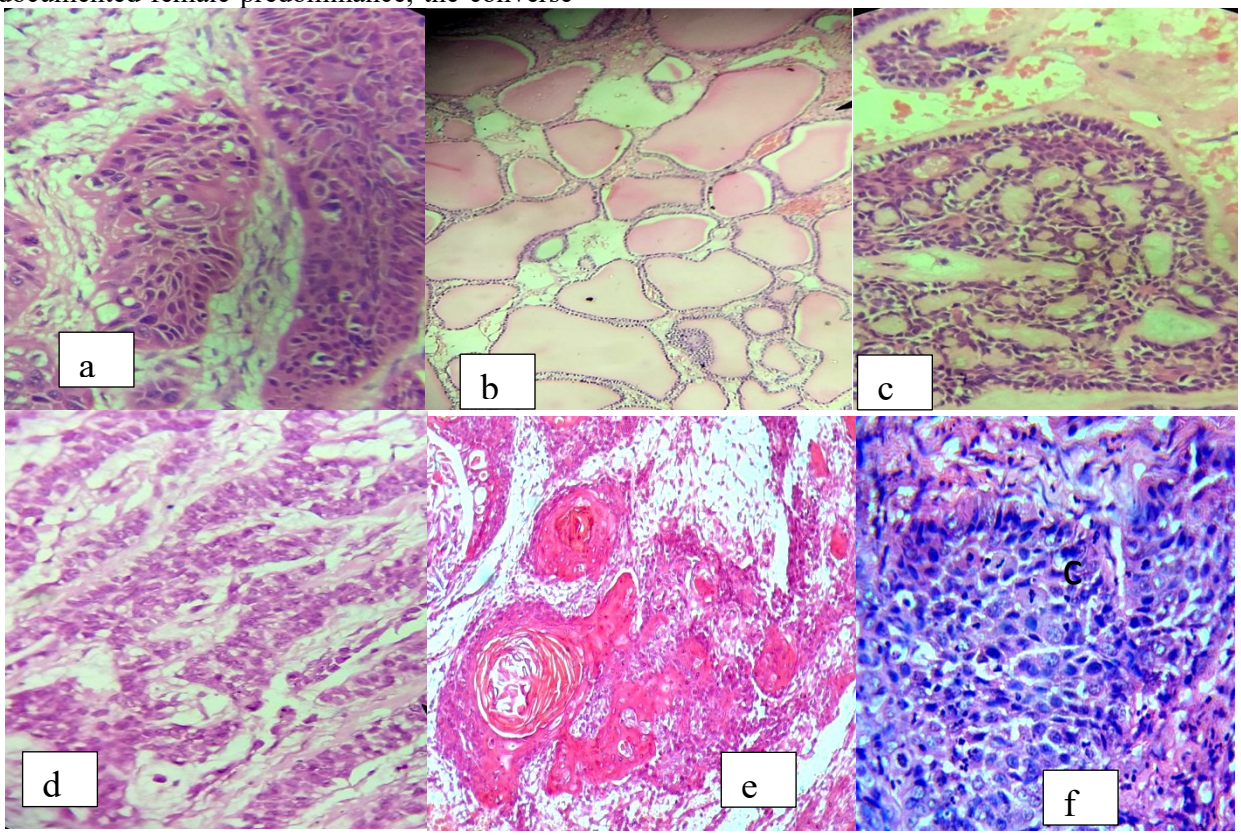


Fig 4a-f (x 100 magnification (H&E) photomicrograghs views showing a) High grade mucoepidermoid carcinoma b) Follicular subtype of acinic cell carcinoma (x40) c) Cribriform subtype of adenoid cystic carcinoma, d)Polymorphous low grade adenocarcinoma d) Carcinoma ex pleomorphic adenoma (x40), and f) Basal cell adenocarcinoma of the salivary glands (x400).

Of the SGNs seen in the parotid, 69.1% were benign while 30.9% were malignant, similar to reports of Tian *et al* [10] and Parkin *et al* [12] . However in the palate 55% of tumours were malignant, while 45% were benign. All the neoplasms seen in the maxillary antrum were malignant. The minor salivary glands tumours (58.1%) were malignant, a finding supported by previous African, Asian and European studies, which reported higher prevalence of malignancies in the minor salivary glands[5, 10, 23].

There are reported variations in the prevalence and frequencies of the different types of the SGNs. Previous European, Asian and African studies have reported benign SGTs to be more frequent representing 54% - 79% of all SGNs [3, 5, 10,11]. The prevalence of 63.1% for benign tumours in this study conforms to this range of figures. Lawal *et al* [22] and Ladeinde *et al* [23] reported higher prevalence of 53.5% and 60.8% of malignant tumours contrary to 36.9% in this study.

Pleomorphic adenoma was the most commonly diagnosed SGN representing 53.3% of all SGNs and 84.4% of benign SGNs. This finding is almost similar to reports of studies done by Ochicha *et al*[13], Ito *et al* [30] and Jones *et al*[5] with prevalence of 48.7%, 54.2%, and 65.0% of all SGNs respectively. Ladeinde *et al*[23] however found a lower prevalence of 29.2%, consequent upon their study being carried out at the Departments of Oral pathology/Oral Biology and Oral and Maxillofacial surgery where higher number of intraoral salivary gland tumours presented.

Basal cell adenoma was the second most common benign SGN constituting 7.4% of all SGNs and 11.7% of benign SGNs in this study. Previous studies in support of this finding include Jones et al[5] and Adebiyi *et al*[29], while it is at variance with other studies from Uganda, Brazil and China in which myoepithelioma and Warthins tumour respectively were reported as the second most common benign SGN[11,14]. No case of Warthins tumour was found in this series, buttressing previous reports of the relative rarity of Warthins tumour in the black population. Reason for this is not well established, however, some authors have attributed it to lack of genetic predisposition to development of Warthin's tumour in blacks while others have attributed it to lower level of smoking in blacks [3,22]. Myoepithelioma was the third most commonly diagnosed tumour with a prevalence of 2.5% and 3.9% of all SGNs and benign SGNs respectively. This is similar to the study of Jones *et al* [5] which reported a prevalence of 2.5%. Accurate comparisons of the range and prevalence of basal cell adenoma and myoepitheloma is however difficult as older studies combined these tumours into a single entity (monomorphic adenoma).

Considering the quantity of epithelial and stroma components of PA, three histopathological subtypes namely stroma rich (27.7%), cell rich (12.3%) and classic (10.8%) were seen in this study. The predominance of stroma rich and cell rich subtypes agrees with the report of Stennert *et al*[31] who also documented predominance of stroma rich PA (51%) followed by cell rich (35%), but slightly differs from the finding by Seifert et al[32] who reported a predominance of stroma rich PA (55%) followed by classic subtype. This slight variance may be explained by the numerous changes that have been made to the adenomas and newer entities that have been classified. The four histopathological variants of BCA were seen in varying proportions in the tumours. The four variants had been reported by Nagao *et al*[33] but in proportions different from the observation in the present study. This could be a possible pointer to geographic variations in the histopathological variants of this tumour. However, it is of note that solid, tubular and membranous occurred in the same proportions (22.2% each).

Malignant epithelial SGTs comprised 36.9% of the epithelial SGNs in this present study. MEC and AdCC were the most prevalent malignancies, each having an equal prevalence of 14.8% of all SGNs and 40% of the malignant SGNs. This observation is similar to a large series report from China which also recorded equal prevalence of the two malignancies[10], while other studies reported either MEC or AdCC as the most common malignant SGNs. It is evident that either mucoepidermoid or adenoid cystic carcinoma has consistently been

reported as most common salivary gland malignancy in most studies[5,6,10,11].

Low, intermediate and high grade MECs were recorded accounting for 38.9%, 27.8% and 0.5% of the Mucoepidermoid carcinomas encountered respectively. Kolude *et al* [34] also documented low grade tumour (61.7%) as the most common presentation of MEC. Only two variants of AdCC were recorded, with the cribriform variant predominating and constituting 33.3%, while the solid variant constituted 16.7% of this group of SGNs. Although the number of cases seen in this study was few, the finding is comparable to available literature on the predominance of the cribriform variant [2]. The two cases of Ca-Ex-PA seen in this study were poorly differentiated adenocarcinomas, a feature which had been previously reported [3, 35]. Only one case each of PLGA and BCA ca were seen in this series. These are relatively rare tumours and their rarity has been documented in the literature [36, 37].

In conclusion, salivary gland tumours constituted 5.2 % of the head and neck tumours in this study. The most frequent neoplastic SGT observed was pleomorphic adenoma, followed by adenoid cystic carcinoma and mucoepidermoid carcinoma. Parotid gland was the commonest site of occurrence. There was female predilection in all the tumours except myoepithelioma. Benign tumours occurred more between 3rd and 4th decades, while malignancies were seen more 7th and 8th decades.

Competing interests

The authors declare no competing interests

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