Applications of ultrasonography in the diagnosis of soft tissue swellings of the cervicofacial region

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Summary

Purpose: **To determine the accuracy, sensitivity, specificity and prediction values of ultrasound as a means of diagnosis of cervico-facial soft tissue swellings.**

Materials and methods: **We carried out ultrasonographic evaluation of 76 consecutive cases of cervico-facial soft tissue swellings that presented at the Obafemi Awolowo University Teaching Hospital Complex, Ile-Ife, Nigeria from August 2002 to November 2003. The patients' demographics and relevant clinical information were obtained. Ultrasonographic evaluation was done using the B-mode transcutaneous ultrasonic imaging device with a transducer frequency of 5MHz. All the lesions were subjected to histopathological examination.**

Results: **There were 43(56.6%) males and 33(43.4%) females whose ages ranged from 2 weeks to 70 years (mean ± SD; 22 ± 19.7 years). Histologically, tumours constituted the highest percentage of swellings (35.5%), followed by cysts (26.3%). Males were more predominant in all classes of swellings except benign tumours. The accuracy of ultrasound in the diagnosis of pleomorphic adenoma was 80% and 100% for both adenocarcinoma and hemangioma. It was also 100% for majority of the cysts and HIV associated salivary gland swellings. The sensitivity of ultrasound in the diagnosis of pleomorphic adenoma was 80% and 100% for adenocarcinoma, hemangioma, all the cysts and HIV associated swellings. Ultrasound was also 100% specific in the diagnosis of monomorphic adenoma and hemangioma.**

Conclusion: **Ultrasound is a useful diagnostic tool for cervicofacial soft tissue swellings. The accuracy of diagnosis is enhanced by the characteristics of the probe and the experience of the sonologist.**

Key-words: ***Ultrasonography, Cervicofacial soft tissue swellings.***

Résumé

Objectif: Déterminer l'exactitude le caractère délicat, la spécificité et des valeurs de la prévision d'échographie comme une méthode d'un diagnostic des gonflements des parties charnues facial-cervico.

Matériels et méthodes: Nous avons effectué une evaluation ultrasonographique des 76 cas consecutifs de tuméfaction des parties charnues facial-cervico qui se sont présentées au centre hospitalier universitaire d'Obafemi Awolowo, Ile-Ife, Nigéria d'août 2002 au novembre 2003. Des informations clinique pertinentes et démographiques ont été obtenues. L'évaluation ultrasonographique a été effectuée à travers l'utilisation de B-mode imageur ultrasonique transcutané avec une fréquence transducteur de 5MHz. Toutes les lésions avaient subi a un examen histopathologique.

Résultats: Il y avait 43 soit 56,6% du sexe masculin et 33 soit 43,4% du sexe féminin dont la tranche d'âge était de 2 semaines au 70 ans (moyen ± SD : 22 ± 19,7 ans). Histologiquement, la tumeur contituait un pourcentage le plus élevé de cas des tuméfaction (35,5), suivi par kyst (26,3%). Patients du sexe masculin était le plus prédominant pour ce qui est de toutes les catégorie des tuméfactions sauf les tumeurs bénignes. L'exactitude d'ultrason dans le diagnostic d'adénome pléomorphique était 80% et 100% pour l'adénocarcinome et l'hémangiome les deux. Il était aussi 100% pour la plupart de kysts et VIH lié avec la tuméfaction salivaire. La sensibilité de l'échographie dans le diagnostic d'adénome pléomorphique était 80% et 100% pour adénocarcinome, hémangiome, et tous les kysts et VIH liés avec les tuméfactions.

L'échographie était aussi 100% spécifique dans le diagnostic d'adénome monomorphique et hémangione.

Conclusion: L'échographie est un outil diagnostic très utile pour la tuméfaction des parties charnues cervicofacial. L'exactitude du dignostic était améliorée par le trait caractéristique du sonder et plusieurs années d'expérience du sinologue.

Introduction

The cervicofacial region is a conspicuous part of the body divided anatomically into anterior and posterior triangles by the sternocleidomastoid muscle. Swellings can arise from virtually any structure in this region but the World Health Organization[1] broadly categorized them as: benign and malignant tumours, hamartomas and vascular malformations, cysts and inflammatory swellings. Soft tissue swellings of the cervicofacial region cause afflicted individuals' physical and psychological problems[2]. Some workers[2, 3] have documented the clinical presentation of the various lesions involving cervicofacial soft tissues.

The physical examination of swellings in this region lacks the diagnostic accuracy that can facilitate precise management of these lesions[4]; hence various investigations have been introduced to evaluate these swellings with ultrasonography being one of the recent tools. Traditionally, it has been extensively used in the assessment of soft tissues in the abdomen and pelvis. However, its role in oral and maxillofacial surgery is less widely recognized[5].

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This study therefore focuses on the usefulness of ultrasound in the diagnosis of these swellings by determining the accuracy, sensitivity, specificity and prediction values of ultrasound as a means of diagnosis of the swellings.

Patients and methods

All consecutive patients who presented with cervicofacial soft tissue swellings including lymph nodes and salivary glands at the Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria between August 2002 and November 2003 constituted the study population.

Based on a questionnaire format, the following information were obtained: age, sex, duration of swelling, occupation, family/social history and drug history. Following clinical examination, the tissues or glands involved, the site, size, shape, consistency of the swellings were noted. Lymph node involvement, site, size and consistency of nodes, number of nodes involved in each site, fixation of node to surrounding tissues, matting of nodes and provisional diagnosis were also noted. Sonographic evaluation was done using the B-mode transcutaneous ultrasonic imaging device with a transducer frequency of 5MHz. The ultrasound investigations were done in conjunction with the radiologist. All patients were investigated in the supine position on a couch while a lubricating/ultrasonic transmission gel (Aquasonic 100) was applied on the surface of the swellings to remove air from the interphase between the skin/mucosa and probe. A stand off (500mls normal saline bag) was placed on some of the swellings in order to improve on the image quality. Doppler investigation was done in some cases to evaluate the vascularity. The following sonographic parameters were then recorded: presence of solid or cystic mass and extent of swelling in terms of size, shape and level of echogenicity. Others include marginal appearance (degree of delineation from adjacent tissues), local spread into surrounding tissues and regional extension into lymph nodes and distribution of echoes (Homogenous or mixed).

Eighty percent of pleomorphic adenomas were correctly diagnosed by ultrasound. These cases presented with either an oval or lobular shaped mass which are usually well-defined, mostly hyperechoic and heterogenous without posterior acoustic shadows. With regards to the cases of lipoma, consistent sonographic features of lobular shape, well defined, hyperechoic and homogenous solid mass without acoustic shadow were observed.

Ultrasound diagnosed sixteen malignant tumours. These diagnoses were based on the sonographic features of these swellings that are mostly polygonal in shape, poorly defined, hyperechoic or hypoechoic, heterogenous solid masses without posterior acoustic shadows. Ultrasound diagnosed six cases of hemangioma based on the sonographic features, which were mostly polygonal, poorly defined, hyperechoic and homogenous mass without posterior acoustic shadows. Two cases of neurofibromas were diagnosed by ultrasound; the sonographic features demonstrated polygonal, isoechoic, homogenous masses without posterior acoustic shadows and with varying boundaries. Ultrasound correctly diagnosed twenty cystic swellings. Virtually all the cases showed well-defined, oval or lobular shaped, anaechoic, homogenous cystic masses without posterior acoustic shadow.

The tuberculous lymphadenitis showed lobular, well or moderately defined, hypoechoic or isoechoic, homogenous or heterogenous solid masses without posterior acoustic shadow. One of the cases with calcific changes on histology showed hyperechoic mass. The cases of HIV salivary gland enlargement showed lobular, well-defined, hypoechoic and heterogenous solid masses without posterior acoustic shadow.

The swellings, with the exception of the inflammatory cases (57 in all) were then subjected to histopathological examination. In addition, microbiological, culture and sensitivity tests were carried out where necessary. Hence all patients diagnosed with infection were based mainly on clinical features.

To determine the positive and negative prediction of ultrasonography, the table below was applied:

In each case, when ultrasound and histological diagnoses were the same as clinical diagnosis, case fell under (a). When ultrasound diagnosis was positive and histological diagnosis was negative, case fell under (b). When ultrasound diagnosis was negative and histological diagnosis was positive, case fell under (c). When only ultrasound and histological diagnoses were similar but different from clinical diagnosis, case fell under (d).

The accuracy of ultrasound in the diagnosis of these diseases and its sensitivity, specificity and positive/negative predictive values were determined as follows:

Accuracy was determined by the proportion of (positive and negative) results which agree with the final diagnosis {true positives + true negatives} / {total number of patients in the study} a+d / a+b+c+d.

The proportion of diseased patients who were reported as positive determined sensitivity. i.e.{true positives} / {true positives + false negative } a / a+c.

The proportion of disease free patients who were reported as negative determined specificity. i.e. {True negatives} / {true negatives + false positive} d / b+d.

Positive predictive value was {True positives} / {True positives + false positive} a / a+b.

Negative predictive value was {True negatives} / {True negatives + false negative} d / c+d. Only patients with swellings of more than 5mm in size were included in the study.

	(Histology) Disease Positive (+)	**(Histology) Disease Negative (-)**	**Total**
(Ultrasound) Test Positive (+)	True positive (a)	False (b) positive	a+b
(Ultrasound) Test Negative (-)	False negative (c)	True (d) negative	c+d
Total	a+c	a+d	

Excluded were patients not ambulatory, those in respiratory distress and poor clinical state. Ethical clearance was obtained from the hospital's ethics committee.

Data obtained was fed into an IBM compatible computer system using the software, Statistical Package for Social Sciences (SPSS) Version 11.0[6].

Results

Seventy six cases were diagnosed as 27(35.5%) tumours, 20(26.3%) cysts, 10(13.2%) hamartomas and 19 (25%) inflammatory lesions. Their ages ranged from 2 weeks to 70 years (mean±SD; 22±19.7 years). Patients in the first and third decades of life constituted 40.8% and 21.1% respectively of the study sample.

The ultrasonographic features are presented in Tables 1 to 3.

A comparison of the sonographic features and histopathological evaluation of the lesions demonstrated that there were 4 true positives of pleomorphic adenoma and 1 was false negative. One case each of monomorphic adenoma was true positive and true negative. Two cases of lipoma were true positive and 1 was false positive. One case each of adenocystic, mucoepidermoid, acinic cell, squamous cell carcinoma and the 2 cases of adenocarcinoma were true positive while 1 case of squamous cell carcinoma was false negative. Seven cases of lymphoma were true positive and 1 case was false positive. One case each of rhabdomyosarcoma was true positive and false positive. Similarly one each of retinoblastoma, Burkitt's lymphoma and nasopharyngeal carcinoma was false negative (see Table 4).

Five cases of hemangioma were true positive and 1 was true negative. Two cases of neurofibroma were true positive and 1 case was false negative. The only case of schwannoma was false negative (see Table 5).

All the cases of cystic swellings were true positives except for sebaceous cyst and mucus retention cyst that 1 case was true positive and 1 case was false positive (Table 6).

The cases of HIV associated salivary gland swelling, parapharyngeal space abscess, submasseteric space cellulitis, recurrent parotitis buccal space abscess, non-specific lymphadenitis and temporal subperiosteal cellulitis were true positives. Seven cases of tuberculous lymphadenitis were true positives, 2 were false positive and 1 false negative. One case each of mycosis, Mikulicz disease and Sjogren's syndrome was false negative (see Table 7).

The accuracy of ultrasonography in the diagnosis of pleomorphic adenoma and monomorphic adenoma was 80% and 50% respectively while lipoma was 66.7%. The sensitivity and positive prediction values of pleomorphic adenoma were 80% and 100%, the values for monomorphic adenoma were 100% and 100%. For lipoma the values were 100% and 66.7%.

The accuracy of ultrasonography in the diagnosis of lymphoma was 87.5%, and 50% for squamous cell carcinoma. It was also 50% for rhabdomyosarcoma and 100% for adenocarcinoma. The sensitivity and positive prediction values for lymphoma were 100% and 85.7%, the values for squamous cell carcinoma were 50% and 100%, while that of rhabdomyosarcoma were 100% and 50%. The values were both 100% for adeno-carcinoma. The values for adenocystic, mucoepidermoid, acinic cell, nasopharyngeal carcinomas, retinoblastoma and Burkitt's lymphoma, could not be

Table 1 Ultrasound features of nine benign tumours and ten hamartomas

	Histological diagnosis					
Ultrasound features	**Pleomorphic adenoma (5)**	**Monomorphic adenoma (2)**	**Lipoma (2)**	**Heman-gioma (6)**	**Neurofi-broma (3)**	**Schan-noma (1)**
Shape						
Oval	2	2	0	0	0	0
Lobular	3	0	2	0	0	0
Polygonal	0	0	0	6	3	1
Boundaries						
Well-defined	4	2	2	0	1	0
Moderately-defined	1	0	0	0	1	1
Ill-defined	0	0	0	6	1	0
Level of echogeneity						
Hyperechoic	4	0	2	6	0	0
Anaechoic	0	0				
Hypoechoic	1	0	0	0	0	0
Isoechoic	0	2	0	0	0	1
Distribution of echoes						
Heterogenous	4	0	0	0	1	1
Homogenous	1	2	2	6	2	0
Acoustic enhancement						
Unchanged	5	2	2	6	3	1
Attenuated	0	0	0	0	0	0
Enhanced	0	0	0	0	0	0

*Key: *Parenthesis represents number of cases diagnosed histologically*

Table 2 Ultrasound features of eighteen malignant tumours

Ultrasound features	Histological diagnosis									
	Mucoepidermoid Ca (1)	Adeno cystic Ca (1)	Acinic cell Ca (1)	SCC (2)	Adenocarcinoma (2)	NPC (1)	LYM (7)	BL (1)	RHA (1)	RE (1)
Shape										
Oval	0	0	0	0	0	0	1	0	0	0
Lobular	0	0	0	0	1	0	4	0	0	0
Polygonal	1	1	1	2	1	1	2	1	1	1
Boundaries										
Well-defined	0	0	0	0	1	0	3	0	0	0
Moderately-defined	1	0	0	0	1	1	4	0	0	0
Ill-defined	0	1	1	2	0	0	0	1	1	1
Level of echogeneity										
Hyperechoic	0	0	0	0	2	1	4	0	1	0
Anaechoic	0	0	0	0	0	0	0	0	0	0
Hypoechoic	1	1	1	1	0	0	3	1	0	1
Isoechoic	0	0	0	1	0	0	0	0	0	0
Distribution of echoes										
Heterogenous	1	1	0	2	2	1	6	1	1	1
Homogenous	0	0	1	0	0	0	1	0	0	0
Acoustic enhancement										
Unchanged	1	1	1	2	2	1	7	1	1	1
Attenuated	0	0	0	0	0	0	0	0	0	0
Enhanced	0	0	0	0	0	0	0	0	0	0

*Key: *Parenthesis represents number of cases diagnosed histologically*

Table 3 Ultrasound features of twenty cysts

Ultrasound features	Histological diagnosis									
	Dermoid Cysts (6)	Cystic Teratoma (1)	Cystic Hygroma (5)	Thyroglossal Cyst (2)	Branchial Cyst (1)	MRC (1)	MEC (1)	SGC (1)	SEB Cyst (1)	MG Cyst (1)
Shape										
Oval	6	0	0	2	0	0	0	1	0	1
Lobular	0	0	1	0	1	1	0	0	1	0
Polygonal	0	1	4	0	0	0	1	0	0	0
Boundaries										
Well-defined	5	0	4	2	1	1	0	1	1	1
Moderately-defined	1	0	0	0	0	0	0	0	0	0
Ill-defined	0	0	1	0	0	0	1	0	0	0
Level of echogeneity										
Anaechoic	5	1	5	2	1	1	1	1	0	1
Hyperechoic	0	0	0	0	0	0	0	0	0	0
Hypoechoic	1	0	0	0	0	0	0	0	1	0
Isoechoic	0	0	0	0	0	0	0	0	0	0
Distribution of echoes										
Heterogenous	6	1	1	0	0	0	1	0	1	0
Homogenous	0	0	4	2	1	1	0	1	0	1
Acoustic enhancement										
Unchanged	6	1	5	2	1	1	1	1	1	1
Attenuated	0	0	0	0	0	0	0	0	0	0
Enhanced	0	0	0	0	0	0	0	0	0	0

*Key: *Parenthesis represents number of cases diagnosed histologically*

MRC = Mucus retention cysts
MEC = Mucus extravasation cyst
SGC = Subgaleal cyst
SEB = Sebaceous and
MG = Meningeal

Table 4 Positive and negative prediction of ultrasonography for benign and malignant neoplasms

Tumours	True positive	False positive	True negative	False negative
Benign				
Pleomorphic adenoma	4	0	0	1
Monomorphic adenoma	1	0	1	0
Lipoma	2	1	0	0
Malignant				
Adenocystic carcinoma	1	0	0	0
Acinic cell tumor	1	0	0	0
Squamous cell carcinoma	1	0	0	1
Adenocarcinoma	2	0	0	0
Mucoepidermoid carcinoma	1	0	0	0
Burkitt's lymphoma	0	0	0	1
Lymphoma	7	1	0	0
Retinoblastoma	0	0	0	1
Rhabdomyosarcoma	1	1	0	0
Nasopharyngeal carcinoma	0	0	0	1
Total	**21**	**3**	**1**	**5**

Table 5 Positive and negative prediction of ultrasonography for hamartomas

Hamartomas	True positive	False positive	True negative	False negative
Hemangioma	5	0	1	0
Neurofibroma	2	0	0	1
Schwannoma	0	0	0	1
Total	**7**	**0**	**1**	**2**

Table 6 Positive and negative prediction of ultrasonography for cysts

Cysts	True positive	False positive	True negative	False negative
Cystic teratoma	1	0	0	0
Dermoid cyst	6	0	0	0
Cystic hygroma	5	0	0	0
Thyroglossal cyst	2	0	0	0
Branchial cyst	1	0	0	0
Subgaleal cyst	1	0	0	0
Sebaceous cyst	1	1	0	0
Meningocele	1	0	0	0
Mucus extravasation cyst	1	0	0	0
Mucus retention cyst	1	1	0	0
Total	**20**	**2**	**0**	**0**

Table 7 Positive and negative prediction of ultrasonography for inflammatory swellings

Inflammatory swellings	True positive	False positive	True negative	False negative
HIV	2	0	0	0
Submasseteric space cellulitis	1	0	0	0
Parapharyngeal space abcess	1	0	0	0
Tuberculous lymphadenitis	7	2	0	1
Mycosis	0	0	0	1
Buccal space abscess	1	0	0	0
Non-specific bacterial lymphadenitis	1	0	0	0
Temporal sub-periosteal cellulitis	1	0	0	0
Recurrent parotitis	1	0	0	0
Mikulicz disease	0	0	0	1
Sjogren's syndrome	0	0	0	1
Total	**15**	**2**	**0**	**4**

Table 8 Accuracy, sensitivity, specificity, positive and negative prediction values of ultrasonography for tumours, hamartomas and inflammatory swellings

Tumours	Accuracy (n%)	Sensitivity (n%)	Specificity (n%)	Positive prediction value (n%)	Negative prediction value (n%)
Benign tumours					
Pleomorphic adenoma	80.0	80.0	0.0	100.0	0.0
Monomorphic adenoma	50.0	100.0	100.0	100.0	100.0
Lipoma	66.7	100.0	0.0	66.7	0.0
Malignant tumours					
Squamous cell carcinoma	50.0	50.0	0.0	100.0	0.0
Lymphoma	87.5	100.0	0.0	85.7	0.0
Rhabdomyosarcoma	50.0	100.0	0.0	50.0	0.0
Adenocarcinoma	100.0	100.0	0.0	100.0	0.0
Harmatomas					
Hemangioma	100.0	100.0	100.0	100.0	100.0
Neurofibroma	66.7	66.7	0.0	100.0	0.0
Inflammatory lesions					
HIV	100.0	100.0	0.0	100.0	0.0
Tuberculous lymphadenitis	70.0	87.5	0.0	77.8	0.0

Table 9 Accuracy, sensitivity, specificity, positive and negative prediction values of ultrasonography for cysts

Cysts	Accuracy (n%)	Sensitivity (n%)	Specificity (n%)	Positive prediction value (n%)	Negative prediction value (n%)
Dermoid cyst	100.0	100.0	0.0	100.0	0.0
Cystic hygroma	100.0	100.0	0.0	100.0	0.0
Thyroglossal cyst	100.0	100.0	0.0	100.0	0.0
Branchial cyst	100.0	100.0	0.0	100.0	0.0
Sebaceous cyst	50.0	100.0	0.0	50.0	0.0
Mucus extravasation cyst	100.0	100.0	0.0	100.0	0.0
Mucus retention cyst	50.0	100.0	0.0	50.0	0.0

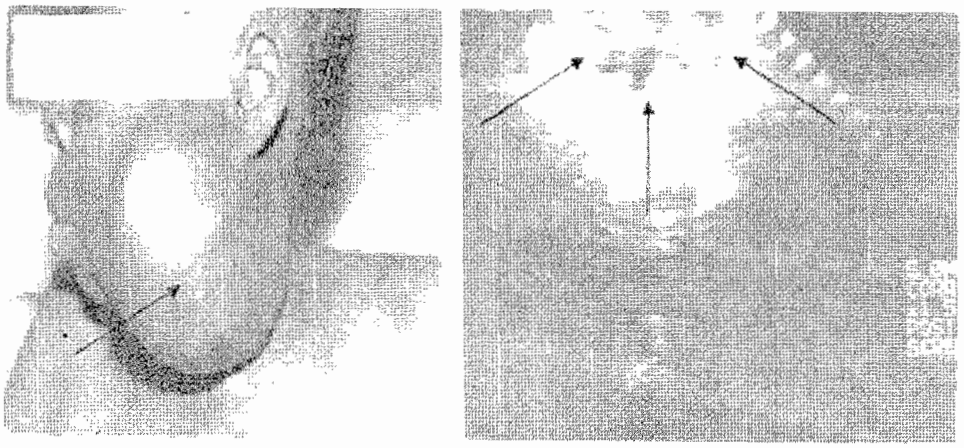

Fig. 1 *Clinical and ultrasonographic feature of a parotid mass*

determined statistically because only 1 case of each was seen. However, ultrasound was sensitive but not specific in the diagnosis of adenocystic, mucoepidermoid and acinic cell carcinoma. Ultrasound was neither sensitive nor specific in the diagnosis of nasopharygeal carcinoma; retinoblastoma and Burkitt's lymphoma (Table 8). The accuracy of ultrasonography in the diagnosis of hemangioma was 100% while that for neurofibroma was 66.7%. The sensitivity and specificity values of hemangioma were both 100%. The sensitivity and positive prediction values for neurofibroma were 66.7% and 100%. The values for schwannoma could not be statistically determined because only 1 case was seen. However ultrasound was neither sensitive nor specific in the diagnosis of schwannoma. The accuracy of ultrasonography in the diagnosis of dermoid, thyroglossal, branchial, mucus extravasation cysts and cystic hygroma was 100%. Their sensitivity and positive prediction values were both 100%. For sebaceous cyst and mucus retention cyst, the accuracy was both 50%, while the sensitivity and positve prediction values were 100% and 50% respectively. Cystic teratoma, subgaleal and meningocele were only 1 case each and ultrasound was sensitive but not specific in their diagnoses (Table 9).

The accuracy of ultrasonography in the diagnosis of HIV parotid gland swellings was 100% while that of tuberculous lymphadenitis was 70%. The sensitivity and positive prediction values for the HIV cases were both 100% while that of tuberculous lymphadenitis were 87.5% and 77.8%. The other swellings were 1 case each and ultrasound was sensitive but not specific for recurrent parotitis, submasseteric space cellulitis, temporal subperiosteal space cellulitis, non-specific lymphadenitis, parapharyngeal and buccal space abscesses. It was also neither sensitive nor specific for mycosis, Mikulicz disease and Sjogren's syndrome.

Discussion

Although various causes of cervico-facial swellings have been reported in literature, the results of this study showed that approximately 39.2% of the cases of cervicofacial swellings were tumours out of which 24.3% were malignant and 14.9% were benign. Cysts constituted 25.6% of the swellings while inflammatory swellings from various causes and hamartomas constituted 20.3% and 14.9% respectively. These figures differ a little from those obtained in other studies where both genetic and environmental factors have been found to predispose to the various swellings[7].

More swellings were recorded in males than females except for benign tumours, where a ratio of 1:1.4 was obtained. This is similar to the results obtained in other studies[2,8]. The preponderance of males over females may be due to the fact that males are more exposed to various occupational and environmental hazards as a result of being engaged in more outdoor activities than females. In addition, genetic alteration has been found to affect male children more often than females[9]. However, the reason for female preponderance over males in benign tumours affecting salivary glands is not known.

In the present study, majority of the cystic swellings and hamartomas occurred in the first decade while majority of tumours occurred in the third and sixth decades. This is comparable to other published reports[2], where most of the swellings due to genetic alterations manifest at birth or childhood while those swellings due to environmental factors manifest later in life.

Eighty-eight percent of the swellings recorded in this study were correctly diagnosed clinically based on the associated features documented in previous literatures[2,8].

In this study, ultrasound diagnoses were based on the sonographic features of the lesions. The heterogenous nature of most of the pleomorphic adenomas in this study is similar to that reported by Bialek et al.[10] where 73% of the pleomorphic adenomas were heterogenous. However, Shimizu et al[11] reported that most pleomorphic adenoma showed lobular, moderately demarcated, slightly hypoechoic, homogeneous masses. In addition, other studies have demonstrated homogeneity as the characteristic feature of this tumour[12]. These differences have been attributed to the different constituent cells and tissues, which may be present

in pleomorphic adenoma and the level of histological differentiation of the tissues[10, 13]. We believe that high-resolution probes and tissue harmonic imaging will reveal more adequately, the true and complex histopathologic structure of these lesions. It is noteworthy that the pleomorphic adenomas involving the palatal salivary gland in this study were assessed with a transcutaneous probe due to unavailability of an appropriate size intraoral probe[14, 15]. However, the two cases of monomorphic adenoma of the parotid gland demonstrated sonographic features consistent with those of Shimizu et al[11]. The sonographic features of malignant lesions in this study are consistent with other reports[16, 17]. In this series, ultrasound was able to differentiate between benign and malignant swellings. The criteria were similar to those documented by Bialek et al[10]. These include irregular shape, ill-defined margin, heterogenous pattern and abnormal lymph nodes without an echogenic hilum or with narrowed hilum, heterogenous with abberant vessel pattern. However, lymph nodes in metastatic cases were further subjected to colour Doppler sonography and ultrasound guided fine needle aspiration biopsy that is not available in our centre.

The ultrasound features of hemangiomas and neurofibromas in this study are similar to those of Oates et al[18]. In contrast, ultrasound could not diagnose the only case of schawannoma that was seen. This may be attributed to the low frequency and linear shape of the probe, as well as the site of the lesion that was the orbit, causing poor accessibility[18]. A 3D-ultrasound machine would have allowed better visualization of the orbit [19,20].

In the same vein, the features of cystic swellings on ultrasound scanning are similar to previous reports[21]. The only case of cystic teratoma showed polygonal, moderately defined, heterogenous mass, due to the different morphological and histological types of tissue[21].

Seventeen inflammatory swellings were also correctly diagnosed. Ultrasound findings in HIV associated salivary gland disease are consistent with those of other workers[22]. Although, the ultrasound diagnosis of Sjogren's syndrome was a false negative result (salivary gland cyst), the ultrasound features in this study were consistent with that of Mandel and Orchowski[23]. Shimizu et al[24] used a 7.5 MHz probe to analyse recurrent parotitis in children, the sonograms showed heterogenous hypoechoic pattern. This differs from the heterogenous and isoechoic image of recurrent parotitis observed in the present study. The differences could be attributed to the varying frequency of probe used in this study. Probes with higher frequency and resolution produce images of better quality. In addition, the stage of inflammation is also a possible reason for the differences observed[24]. Siegert[25] compared the physical and sonographic diagnosis of inflammatory swellings and showed a slightly higher sensitivity for sonography. However, with regards to specific diagnosis of abscesses, he observed that sonographic evaluation was superior to clinical diagnosis.

It should be noted that the accuracy of ultrasonography in the diagnosis of benign (50 – 80%) and malignant (50 – 100%) tumours is comparable with the figure (80%) recorded by Jank et al[26]. The accuracy of ultrasound in diagnosing hemangiomas and cystic swellings were also similar to the values documented by Graamans et al[21]. Jank et al[26] in his study on the diagnostic value of ultrasonography to detect occult lymph node metastasis in patients with squamous cell carcinoma, reported a sensitivity of 71% and specificity of 87% with ultrasound.

This study reviewed the usefulness of ultrasonography as a diagnostic tool in patients with cervicofacial soft tissue swellings and found it very useful in differentiating cystic and solid swellings. The shape, size, frequency and resolution of the probe and the experience of the sonologist will greatly enhance the accuracy of diagnosis.

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