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Efficacy of Ultrasound Examination in Diagnosing Maxillofacial Swellings

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Objective: *The aim of this study was to evaluate the efficacy of the ultrasonographic guided diagnosis in diagnosing maxillofacial swellings.*
Methods: *Fifty patients were randomly selected with oral and/or maxillofacial swelling, thorough case history and clinical examination were done, then ultrasound examinations were done for all of them and they were classified into five groups (Group I. inflammatory/space infection and abscess swellings), (Group II. cystic swellings), (Group III. lymph node swellings), (Group IV. benign swellings) and (Group V. malignant neoplastic swellings) according to their ultrasound features and features of every group was studied. Finally, the patients were subjected to histopathologic evaluation (the gold standard). Diagnostic accuracy of ultrasound and clinical examinations compared to histopathology was calculated to determine the ultrasound examination efficacy in diagnosing maxillofacial swellings.*
Study Results: *A high significant association (p value < 0.001) and contingency coefficient of 0.88 and 0.81 between ultrasonographic & histopathological diagnosis and between ultrasonographic & clinical diagnosis respectively, with diagnostic accuracy of 89% for ultrasonographic guided diagnosis and 66% for clinical examination when compared to histopathology. There is significant clinical correlation in terms of reported pain, tenderness and lymph nodes involvement to ultrasonographic features appeared were recorded. The ultrasonographic diagnosis accuracy reached 100% in lymph node and malignant swelling groups followed by 98% in inflammatory and benign swellings.*
Conclusion: *The use of ultrasonographic features with Doppler function in addition to the clinical aspects, greatly aid in reaching accurate final diagnosis for maxillofacial swellings. It significantly improves the evaluation of patients with various types of maxillofacial swellings. US examinations, which have relatively high sensitivity, specificity and accuracy, should be used to supplement clinical examination in patients with maxillofacial swellings to arrive at a final diagnosis.*

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I. Introduction

The maxillofacial region is a common anatomic site for the development of infections, cysts and tumors of odontogenic or non-odontogenic origin. During evaluation of jaw swellings, some cases such as chronic inflammation; clinical examination do not provide complete assessment of the exact origin and nature of swellings; such cases require radiological imaging tools.1-5

There are many reasons for requesting imaging information about a maxillofacial swelling as; determination of the nature of a condition, evaluate the extent of a lesion and monitor the progression or regression of a lesion over time. CT and MRI are recent imaging tools that often used to clarify maxillofacial lesions nature, extent, boundaries and effect on surroundings but they are still expensive examinations and have their limitations. The ultrasound (US) is one of these recent tools that overcome the disadvantages of CT and MRI.6-7

US used for the diagnosis of oral and maxillofacial swellings because it is a quick method, widely available, relatively inexpensive, painless, gives rapidly acquired images and can be repeated as often as necessary without risk to the patient. In areas where definitive diagnosis could not be established, the US features were able to at least categorize the swelling type. This directive analysis can justify the further investigations required and help initiate the appropriate treatment plan.

Little researches were done to evaluate the efficacy of US examination in diagnosing the maxillofacial swellings, so this study was aiming to evaluate the efficacy of US examination by assessing different features

appeared in the ultrasonographic examination of the maxillofacial swellings in correlation to clinical examination findings considering histopathology as gold standard. 8-12

II. Patients And Methods

Fifty patients with swellings in oral and/or maxillofacial region were randomly selected from the outpatient clinics of Minia University Hospital, Minia University Dental Hospital, and Minia General Hospital. Swellings caused by trauma and/or fracture or extended below the neck were excluded from the study. This study was approved by the (Research Ethics Committee) (REC) Faculty of Dentistry, Minia University before starting the research and all the entire patients had signed a standardized informed consent laid down by REC.

A comprehensive questionnaire was used to assess history and through extra-oral & intra-oral examinations was carried out and recorded on the basis of criteria reported by *Das.*[13] including inspection and palpation of swellings as; in inspection: situation, color, shape, size, border, surface and overlying skin over the swelling were assessed. In palpation: consistency, tenderness, temperature, fluctuance, compressibility and fixity of skin over the swelling. Clinical examination findings were recorded in terms of pain, tenderness and lymph nodes involvement to be correlated with US features.

The US investigations were carried out in the department of radiodiagnosis, Minia University Hospital using an US diagnostic modality (LOGIQ- P5) (GE Medical System, GYEONGGI-DO, KOREA) with color Doppler function by using a linear array transducer, operating at a frequency of (7.5–12 MHz). All examinations were performed over the swellings and compared to the contra-lateral/normal side whenever needed. All sonographic images were interpreted by an expert sonologist (15 years experience). US features were recorded according to given characteristic features reported by *Shimizu et al*.[14] including: shape, boundary, echo intensity, US architecture of lesion, posterior echoes, US architecture of tissues, vascularity, presence of necrosis, presence of calcification to extract ultrasonographic guided diagnosis (USGD). Patient's swellings were categorized into five groups according to their US features into: inflammatory/infection/abscess swellings (Group I), cystic swellings (Group II), lymph node swellings (Group III), benign swellings (Group IV), and malignant neoplastic swellings (Group V), and US features of each group were studied respectively and correlated with clinical examination findings.

Finally, patients were subjected to fine needle aspiration cytology (FNAC) or surgical intervention for histopathological examination to extract the final diagnosis. But in inflammatory swellings, final diagnosis was established by blood picture and the response of either surgical intervention or successful medical treatment. Comparison between diagnostic methods (USGD, clinical diagnosis and histopathological diagnosis) was done regarding the number of swellings in each group respectively. The contingency coefficient of USGD and the clinical diagnosis was evaluated considering histopathology as gold standard and the probability (P) value was calculated using Chi-square test. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of both the USGD and clinical diagnosis all were also done and values were recorded.

III. Results

Among the studied 50 individuals, there was 17 males (34%) and 33 females (66%) whom had oral and/or maxillofacial swellings. The minimum age was 8 years and maximum was 71 years with mean age ± standard deviation (SD) (35.3±17.1).

From clinical examination; 54% of cases reported pain and 62% of cases had lymph nodes involvement while 60% had no tenderness on palpation. (Bar chart 1)

During the comparison between the diagnostic methods and according to the final diagnosis, the inflammatory swellings (Group I) were finally diagnosed as; 4 cellulites, 3 dento-alveoalr abscesses, 2 spaces infection, 1 osteomyelitis and 1 Ludwig's angina. The cystic swellings (Group II) included; 4 radicular cysts, 2 dentigerous cysts, 2 nasolabial cysts, 1 epidermoid cyst and 1 calcifying epithelial odontogenic cyst. The lymph node swellings (Group III) included; 3 lymph node abscesses, 1 benign lymphadenitis and 1 metastatic lymph node. Benign swellings (Group IV) included; 1 ossifying fibroma, 3 sialolithiases, 3 pleomorphic adenomas, 2 brown tumor of hyperparathyroidisms, 2 ameloblastomas, 1 central gaint cell granuloma, 1 oral ranula, 1 sjogren syndrome, 1 arteriovenous malformation, 1 adenomatoid odontogenic tumor, 1 fibroma, 1 neurofibromatosis, 1 bony exostosis "torus mandibularis", 1 fibrous dysplasia and 1 cavernous hemangioma. The malignant neoplastic swellings (Group V) included 2 squamous cell carcinomas and 1 rhabdomyosarcoma that were confirmed by histopathology. (Table1)

Bar char 2: Showed the association between the USGD and histopathology is highly significant with Contingency coefficient of 0.88 and p value < 0.001. This association was 100% in groups III and V, followed by 94.7% in group IV and lastly 91% in groups I and II. Contingency coefficient was found to be 0.81 with p value < 0.001, which also shows the highly significant association between the USGD and the clinical diagnosis.

The results show the association between USGD and clinical diagnosis was 100% in groups II & V followed by 77.3 % in group IV, 52.9% in group I and lastly 50% in group III. (Bar chart 3)

Table 2: Showed that the US diagnostic accuracy was 100% in lymph node and malignant swelling groups followed by 98% in inflammatory and benign swellings with total diagnostic accuracy of 89% when compared to histopathology. The sensitivity of USGD was 100% in cystic, lymph node and malignant swellings followed by 91% in inflammatory swellings and 86% in benign swellings. The clinical diagnostic accuracy was 98% in malignant swelling followed by 94% in cystic swellings then 90 % in lymph node and benign swellings with total diagnostic accuracy of 66% when compared to histopathology. The highest sensitivity value of clinical diagnosis was 90.5% in benign swellings, while the highest specificity value was 100% in cystic and malignant swellings.

From table 3, the majority of inflammatory swellings (Group I) were characterized by 82% of irregular shapes, 91% of hypoechoic echogenicity, 82% with heterogeneous US architecture of the lesion and 63% with posterior enhancement. The cystic swellings (Group II) were characterized by 70% with very clear boundaries, 80% of homogenous lesion architecture, 90% with enhanced posterior echoes and 100% without neither vascularity nor necrosis. Most examined lymph nodes swellings (Group III) were characterized by 60% with ill-defined boundaries, 100% of homogenous lesion architecture, 80% of cystic tissue characteristics, 60% with posterior enhancement and 80% with central necrosis & calcifications but 100% with no vascularity were detected. Abnormal benign nodes were of hypoechoic or mixed echogenicity on US with reversible loss of central hilus and with increase in their short axis measurement. While in malignant node (20%), the central fatty hilum appeared destructed and the lymph node was more oval in shape with anechoic echogenicity.

Benign swellings (Group IV) were characterized by 67% of heterogenous US architecture of lesion, 57% with mixed tissue characteristics, 67% without vascularity, 90% without necrosis and 81% without calcifications. The malignant neoplastic swellings (Group V) were characterized by 100% of irregular shapes, 100% with heterogenous US architecture of lesion, 100% without vascularity and 100% without calcifications. (Table 3)

Bar chart 1: Clinical examination findings among the studied sample:

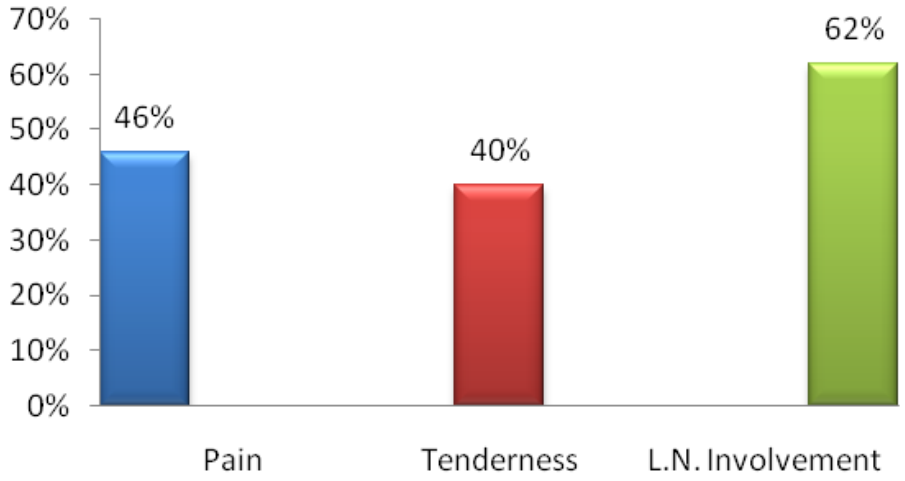
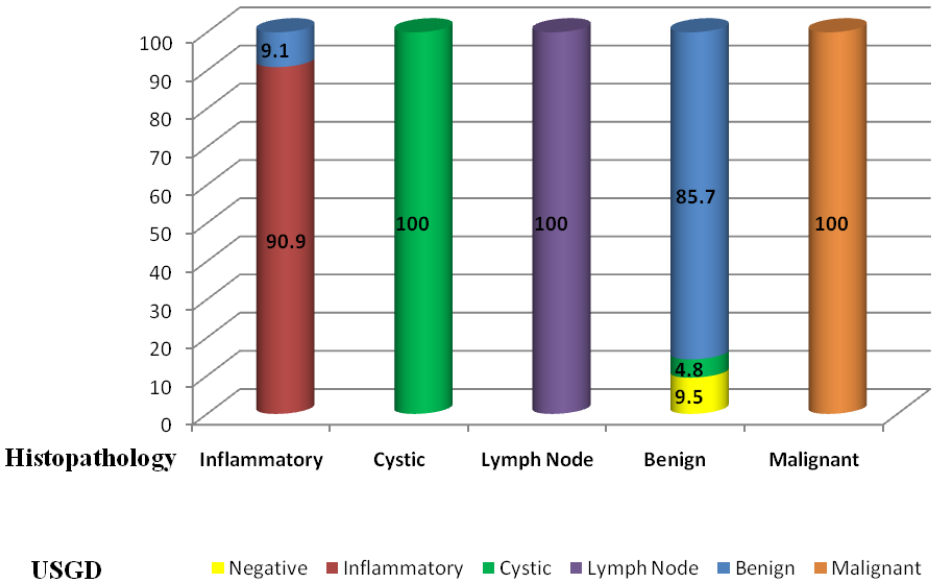


Table1: Comparison between the diagnostic methods showing the number of swellings in each group respectively:

Diagnostic Methods	Group I	Group II	Group III	Group IV	Group V	Negative	Total
Histopathology	11 (22%)	10 (20%)	5 (10%)	21 (42%)	3 (6%)	-	50 (100%)
USGD[1]	10 (20%)	11 (22%)	5 (10%)	19 (38%)	3 (6%)	2 (4%)	50 (100%)
Clinical Diagnosis	17 (34%)	7 (14%)	2 (4%)	22 (44%)	2 (4%)	-	50 (100%)

[1]USGD: Ultrasonographic Guided Diagnosis

Bar chart 2: USGD versus histopathological diagnosis:



Bar chart 3: USGD versus clinical diagnosis:

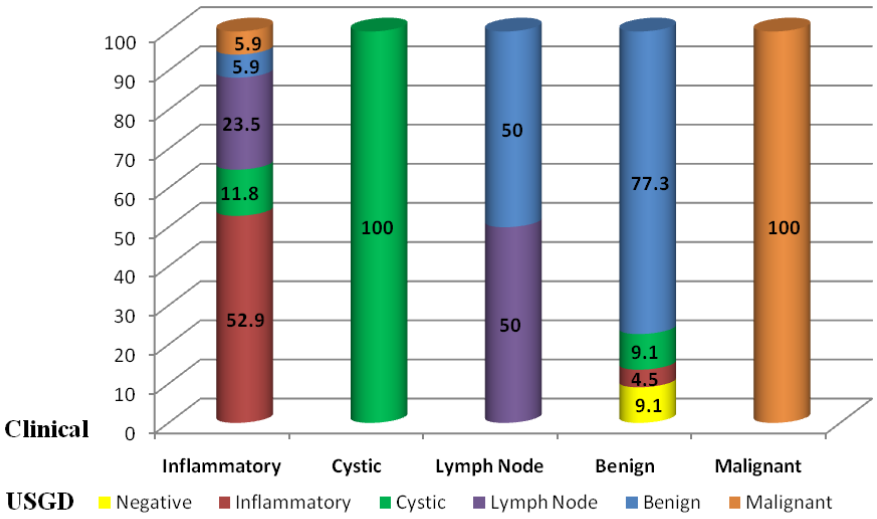


Table 2: Sensitivity, specificity, PPV, NPV and accuracy of USGD and clinical diagnosis in each group respectively:

USGD[1]	Group I	Group II	Group III	Group IV	Group V
Sensitivity %	90.9%	100%	100%	85.7%	100%
Specificity %	100%	97.5%	100%	96.6%	100%
PPV[2]%	100%	90.9%	100%	94.7%	100%
NPV[3]%	97.5%	100%	100%	90.3%	100%
Accuracy %	98%	98%	100%	92%	100%
Clinical Diagnosis					
Sensitivity %	81.8%	70%	20%	90.5%	66.7%
Specificity %	79.5%	100%	97.8%	89.7%	100%
PPV[2]%	52.9%	100%	50%	86.4%	100%
NPV[3] %	93.9%	93%	91.7%	92.9%	97.9%
Accuracy %	80%	94%	90%	90%	98%

[1]USGD:Ultrasonographic Guided Diagnosis
[2]PPV: Positive Predictive Value
[3]NPV: Negative Predictive Value

Table 3: US features of each group respectively:

Ultrasound features	characteristic features	Group I (n=11)	Group II (n=10)	Group III (n=5)	Group IV (n=19)	Group V (n=3)
Shape	Oval		4(40%)	1(20%)		
	Round	2(18.2%)	2(20%)		4(19%)	
	Lobular			2(40%)	4(19%)	
	Polygonal		3(30%)		1(4.8%)	
Boundary	Irregular	9(81.8%)	1(10%)	2(40%)	10(47.6%)	3(100%)
	Very clear	1(9.1%)	7(70%)		7(33.3%)	
	Relatively clear	1(9.1%)	2(20%)		9(42.9%)	
	Partially unclear	2(18.2%)	1(10%)	2(40%)	2(9.5%)	1(33.3%)
	Ill defined	7(63.6%)		3(60%)	1(4.8%)	2(66.7%)
Echo Density	Anechoic	1(9.1%)	2(20%)	1(20%)		
	Isoechoic				2(9.5%)	
	Hypoechoic	10(90.9%)	4(40%)	2(40%)	6(28.6%)	1(33.3%)
	Hyperechoic				2 (9.5%)	
	Mixed		4 (40%)	2 (40%)	9 (42.9%)	2(66.7%)
Lesion Architecture	Homogenous	2(18.2%)	8 (80%)	5 (100%)	5 (23.8%)	
	Heterogenous	9 (81.8%)	2 (20%)		14(66.7%)	3(100%)
	Unchanged	1 (9.1%)		2 (40%)	2 (9.5%)	1(33.3%)
Posterior Echo	Attenuated	3(27.3%)	1(10%)		7(33.3%)	1(33.3%)
	Enhanced	7(63.6%)	9(90%)	3(60%)	10(47.6%)	1(33.3%)
Tissue Characteristic	Cystic	5(45.5%)	9(90%)	4(80%)	1(4.8%)	1(33.3%)
	Solid	1(9.1%)			6(28.6%)	
	Mixed	5(45.5%)	1(10%)	1(20%)	12(57.1%)	2(66.7%)
Vascularity	Avascular	9(81.8%)	10(100%)	5(100%)	14(66.7%)	3(100%)
	Vascular	2(18.2%)			5(23.8%)	
Necrosis	No	10(90.9%)	10(100%)	1(20%)	19(90.5%)	1(33.3%)
	Eccentric	1(9.1%)				2(66.7%)
	Centric			4(80%)		
Calcification	No	10(90.9%)	8(80%)	4(80%)	17(81%)	3(100%)
	Small	1(9.1%)		1(20%)	1(4.8%)	
	Gross		2(20%)		1(4.8%)	

IV. Discussion

US was used in this study for the diagnosis of oral and maxillofacial swellings because it has a valuable aid to the oral and maxillofacial surgeon as it is quick method, widely available, relatively inexpensive, painless, give rapidly acquired images and can be repeated as often as necessary without risk to the patient. The US features were able to categorize the swelling type which can help to initiate the appropriate treatment plan. Also US could provide an alternative to radiography, especially in unilocular jaw bone lesions that are difficult to diagnose because of their similar radiographic appearance. [8-12]

In the present study, swellings owing to trauma or fracture were not included because provisional diagnosis of hematoma is not a problem as there is history of trauma and changes in skin color and mucous membrane.

In this study, the minimum age of the selected 50 individuals was 8 years and maximum was 71 years with mean age ± standard deviation (SD) (35.3±17.1). This is in agreement with other studies who concluded that, among 30subjects the minimum & maximum ages were 8 years & 65 years respectively and mean age ± SD (33.13± 5.36).[9]

In the present study the association between the USGD and histopathology showed a highly significant association with a Contingency Coefficient of 0.88 and p value < 0.001. The results show the association between USGD and histopathology was 100% in groups III and V, followed by 94.7% in group IV and lastly 91% in groups I and II. This is in agreement with other researchers results reported that a highly significant association was observed in US and histopathological diagnosis with a Contingency Coefficient of 0.934 and p value < 0.000. The US congruency with histopathology was 78% in abscess and infections, 100% in lymphadenitis, 75% in malignancies, 100% in cystic and 88% in benign tumors.[2]

In the present study and regarding the association between USGD and clinical diagnosis, the Contingency Coefficient was found to be 0.81 with a p value < 0.001, with association between the USGD and clinical diagnosis was 100% in groups II & V followed by 77.3 % in group IV, 52.9% in group I and lastly 50% in group III. This is in agreement with other researchers results reported that a highly significant association was observed between US and clinical diagnosis with a Contingency Coefficient of 0.81 with a p value < 0.001, which shows that the association between the clinical diagnosis and US is highly significant. The association between clinical diagnosis and US was 92% in case of cystic swellings, 78% in case of abscesses, 73% in case of malignancies, 100% in lymphadenopathies and 72% in case of benign tumors.[2]

From the results of this study, the diagnostic accuracy of US and clinical diagnosis was 89% and 66% respectively in comparison to histopathological diagnosis. These findings came in agreement with other study

findings stated that the diagnostic accuracy of US and clinical diagnosis was 88.9% and 71.1% respectively in comparison to histopathological diagnosis.[2]

In this study, in the group of inflammatory swellings, clinical diagnosis had a sensitivity and accuracy of 82% and 80% respectively, whereas USGD had a sensitivity of 91% and accuracy of 98%. This came in agreement to other researchers comparing the same group of inflammatory swellings, they reported that; the clinical diagnosis had a sensitivity and specificity of 85.7% whereas the USGD had a sensitivity of 97.1% and specificity of 100% which show the superior sensitivity of the USGD over the clinical diagnosis in diagnosing the inflammatory swellings.[3]

In this study, one case that was presented with a painless, small, nodular facial lump slightly below the right angle of the mandible and with no lymph node involvement, it was clinically diagnosed as submandibular lymphadenopathy. However, the US images showed a well defined, solid, hypoechoic lesion seen involving the inferior part of the right parotid salivary gland with intact associated intra-parotid lymph node. It was finally diagnosed as pleomorphic adenoma. (Fig. 1) This came in agreement with other study conducted by *Chandak et al*, reported that; a case which was diagnosed clinically as submandibular lymphadenopathy but the US images showed hyperechoic foci casting posterior acoustic shadowing and enlargement of the gland, duct dilation proximal to obstruction was seen but it was diagnosed as obstructive submandibular sialadenitis. This study results came in accordance with the study conducted by Chandak et al, in: one pleomorphic adenoma had a very clear boundary, was rounded in shape and had hypoechoic echo intensity associated with heterogeneous internal architecture. [3]

In the present study, the clinical diagnosis had a diagnostic accuracy of 66% distributed among different groups as; 98% in malignant swellings, 94% in cystic swellings and 90 % in lymph node and benign swellings with 100% specificity in cystic and malignant swellings. Whereas USGD had a diagnostic accuracy of 89% distributed among different groups as 100% in lymph node and malignant swellings and 98% in inflammatory and benign swellings. The sensitivity of USGD was 100% in cystic, lymph node and malignant swellings, 91% in inflammatory swellings and 86% in benign swellings.

In another study reported by *Chandak et al,*and after considering the results of all 70 cases, they concluded that clinical diagnosis had a sensitivity and accuracy of 85.7% whereas ultrasonographic diagnosis had a sensitivity and accuracy of 98.5%.[3]

Eleven inflammatory swellings of this study were diagnosed as cellulites, dento-alveoalr abscesses, spaces infection, osteomylitis or Ludwig's angina. Ten cases were correctly diagnosed by US with diagnostic accuracy of 98%. This is in agreement with previous study who reported that out of 10 inflammatory swellings which included 3 cases of osteomylitis and 7 cases of space infections and abscesses, nine cases were correctly identified by US giving a diagnostic accuracy of 90%. [2-3,15]

In this study, the characteristic US features of the majority of inflammatory swellings were characterized by its irregular shapes, with ill defined boundaries, hypoechoic echogenicity and heterogenous US architecture of the lesion. This came in agreement to other studies which reported that inflammatory swellings were characterized by its irregular shapes, hypoechoic echogenicity and enhanced posterior enhancement. But in the other hand some researchers stated that the boundaries of inflammatory swellings were relatively clear with homogenous lesion architecture.[10]

Moreover, 82% of inflammatory lesions group in this study did not appear on Doppler examination. This is in contrast to others who reported that abscess appeared to have vascular supply on color Doppler examination.[16-17]

In this study although the majority of studied inflammatory swellings reported lymph node involvement and patients reported pain, there was not too much blood supply appeared during Doppler examination which may be a drawback of using USGD in diagnosis of inflammatory swellings. (Fig. 2)

One case of inflammatory swellings of this study was misdiagnosed by US as it appeared in US to be fibrous dysplasia but confirmed by histopathology as chronic suppurative osteomylitis. This might be due to inaccurate US features appeared from bone infection as it had a relatively clear boundary with mixed echogensities and mixed tissue characters in addition to the similar features appeared from both lesions.

In this study, the US accuracy in detecting cystic group was 98% with 91% sensitivity. These findings were in agreement with other studies finding who reported that the US sensitivity and accuracy in detecting cystic lesions were 92%.[2,18-19]

In (group II); the US features appeared from most cystic swellings were characterized by very clear boundaries, oval or round shapes and of mixed echogensity. The US architecture of lesions of cystic swellings was homogeneous, with enhanced posterior echoes and cystic US architecture of tissues with no evidence of internal vascularization.

This is in agreement with previous researches findings in that; most of cystic swellings were found to have very clear boundaries, round shapes and with anechoic echogensity. In addition to US architecture of cystic lesions was homogeneous, posterior echoes appeared enhanced and of cystic US tissue characteristic. Other

studies stated that odontogenic keratocysts are hypoechoic because of their dense content, while others reported that radicular cysts appeared as anechoic to hypoechoic, well contoured cavities surrounded by bony walls, filled with fluid and with no evidence of internal vascularization on color Doppler examination.[2,9,18-19]

Other study reported that cysts on the sonogram appear as anechoic with a very clear boundary and homogeneous echo texture. If the cysts become infected then the content of the lesion can produce some echoes, producing hypoechoic structures.[3]

In this study; one case was diagnosed by histopathology as plexiform ameloblastoma but misdiagnosed by USG diagnosis as dentigerous cyst, this can be due to mural ameloblastoma develop from a long standing dentigerous cyst associated the impacted tooth. In addition to their potential for attaining large size, follicular cysts are noteworthy for their tendency to develop neoplastic changes such as plexiform ameloblastoma and carcinoma within an isolated segment of the cyst wall. [6]

In a study conducted by *Pallagatti et al; 2012*, on 13 cases who diagnosed by histopathology as (3 odontogenic keratocyst, 1 dentigerous cyst and 9 radicular cysts), found that US identified 12 cysts correctly. And, this is in agreement with this study and can be due to the specific features of the cysts in US examination.[2]

In this study, the US detected all lymph node swellings accurately with 100% diagnostic accuracy which harmonizes with others findings who reported US accuracy of 93%, 96.5% and 100% respectively.[20]

Other study concluded that US could identify one case of benign lymphadenitis and 2 metastatic cervical lymph nodes confirmed by histopathology. It reported 100% diagnostic accuracy of US examination in detecting benign lymphadenitis and metastatic lymph nodes.[2]

In group III, the characteristic US features appeared from abnormal benign lymph nodes were hypoechoic or with mixed echogensity, with ill defined boundaries and reversible loss of central hilum in addition to central necrosis. Reversible loss of lymph node hilum (appeared as mixed echogensity on US) might be due to pus spread in node which returned to normal echogensity when drained. While in malignant node, the destructed central hilum (appeared anechoic on US) didn't return to normal echogensity and had no evidence of necrosis. This is in agreement with other study who concluded that; abnormal nodes were hypoechoic on US with a loss of central hilum. With US, physicians can evaluate important parameters such as lymph node shape, margins, internal structure, and abnormal vascularization.[2]

The diagnostic accuracy of US was found 92% in diagnosing different benign swellings, with 86% sensitivity and 96.6% specificity. Other authors reported 100% sensitivity of US in diagnosing solid tumors, while others reported that US can characterize the flow of blood and can differentiate hemangiomas from other lesions.[2,18]

And the difference of accuracy in detecting benign tumors in this study from other studies can be attributed to, US was unable to identify two cases; the 1st was a submental salivary gland stone (sialoliathis) and the 2nd was a benign bony exostosis in the mandibular premolar-molar area (tours mandibularis). Presence of cortical bony plate overlying the swelling did not allow penetration of sound waves and made it difficult to visualize the internal structure of the swelling. Hence in some cases it was observed that efficacy of imaging can be limited due to anatomical considerations, and/or overlapping features of benign pathologies.[21-22]

In group IV of this study, most studied benign neoplasms had very clear boundaries, irregular shapes and hypoechoic echogensity. The US architecture of lesions of benign neoplasms was homogeneous, enhanced posterior echoes and with mixed US characteristics of tissues. These findings were similar to another study reported the same US features of benign swellings.[11]

In a study conducted by *Bhardwaj et al*, found a benign mass lesion in the left maxilla, demonstrated hypoechoic internal echo pattern with areas of calcifications and histopathologically diagnosed as desmoplastic ameloblastoma. And two cases were diagnosed histopathologically as lipomas appeared hypoechoic in internal echo pattern with homogenous echoes on US examination.

The group V constituted 3 cases which were diagnosed by histopathology as; two squamous cell carcinomas and one rhabdomyosarcoma. US could identify all of them correctly with 100% diagnostic accuracy, while the diagnostic accuracy of US in detecting malignancies in other studies was found to be 82%. Other study stated that the diagnostic accuracy of US in differentiating benign and malignant lesions to be 67% that came in contrast to this study and other studies which reported accuracy as high as 80-88%. [23-24]

From this study, the most studied malignant neoplasms had ill-defined boundaries, irregular shapes with mixed echogensity and mixed US characteristic of malignant tissues. Other authors concluded that; malignant tumors showed complex echo texture with heterogenous internal echo pattern and irregular boundaries. [10, 23,25-26]

US can predict malignancy in 89%of cases but various forms of malignancy cannot be differentiated. On ultrasounds of lower grade tumors, smaller lesions may appear as well defined and similar to a benign tumor. Larger lesions developed more overtly with malignant features, including irregular and poorly defined margins with heterogeneous internal architecture.

In the present study, in the group of malignant neoplasms, clinical diagnosis had a sensitivity of 66.7%% and specificity of 100%, whereas sonographic diagnosis had a sensitivity and specificity of 100%. This came in agreement with other study concluded that in the group of malignant neoplasms, clinical diagnosis had a sensitivity of 94.4% and specificity of 82.6%, whereas sonographic diagnosis had a sensitivity of 100.0% and specificity of 98.0%[3]

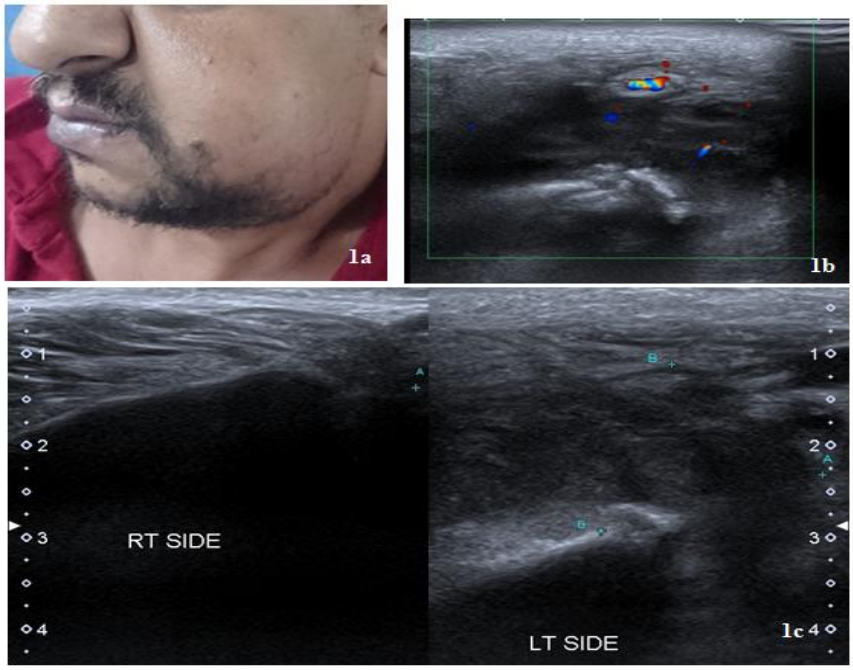


Figure 1: a case of chronic suppurative osteomylitis, male patient aged 46-year had a painless, hard, unilateral, left sided mandibular swelling with enlarged lymph nodes. (1a) US images revealed large hypoechoic lesion involving the left cheek and mandibular region with heavy internal echoes, edematous surrounding soft tissue and irregular erosion of the underlying mandibular bone. Little vascularity showed on color Doppler mode. The right cheek and mandibular region were normal. (1b&c)

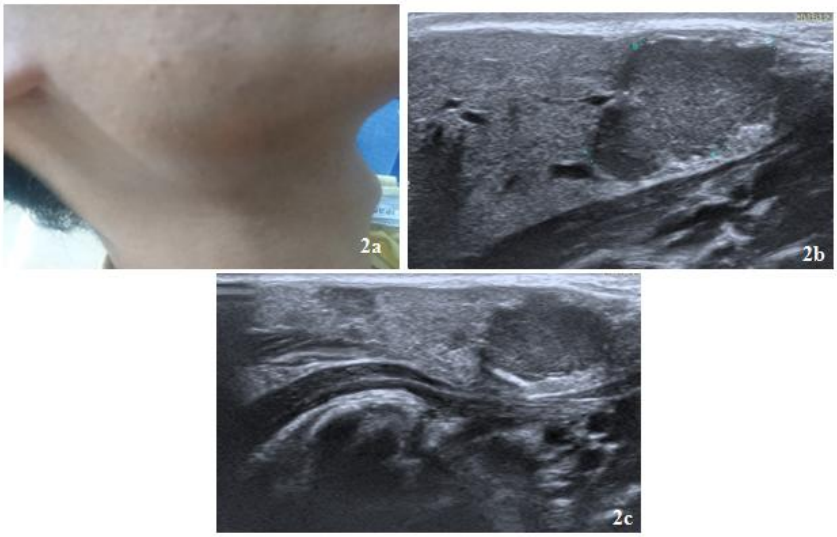


Figure 2: a case of pleomorphic adenoma, male patient aged 26-year presented with a small nodular facial lump above and slightly below the right angle of the mandible. Patient did not report and there was no lymph node involvement. (1a) US images revealed a well defined, solid, hypoechoic lesion involving the inferior part of the right parotid salivary gland (parotid tail) with homogenous texture. No calcifications or cystic degenerations were seen. (1b) No extraglandular extension and the associated intra-parotid lymph node was intact. (1c)

V. Conclusion

The differential diagnosis of maxillofacial swelling is broad and extensive. Accurate diagnosis of a maxillofacial swelling is of paramount importance. The use of real-time US with high frequency transducers can significantly improve the evaluation of patients with various types of maxillofacial swellings. US examinations, which have relatively high accuracy, sensitivity and specificity, should be used to supplement clinical examination in patients with maxillofacial swellings to arrive at a final diagnosis.[3]

From this study, we concluded that: If US features of maxillofacial lesion were of irregular shapes, hypoechoic, heterogenous lesion architecture and patient reports pain with obvious lymphadenitis: these are suggesting to inflammatory/infection lesion. Features of very clear boundaries, homogenous lesion architecture, enhanced posterior enhancement and the patients were without lymphadenitis or tenderness: these are suggesting of cystic lesion. Lymph node US features can be ill boundaries, homogenous lesion architecture and with centric necrosis. If US features were of heterogenous lesion architecture, mixed tissue characteristics with enhanced posterior echoes and of widely variable clinical signs and symptoms; they are suggesting to benign lesion. While, irregular shapes, heterogenous lesion architecture with eccentric necrosis and suggesting clinical signs of malignancy; are suggesting to malignant neoplasm. US features with Doppler function, greatly aid in reaching accurate final diagnosis for maxillofacial swellings.

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