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RESEARCH ARTICLE

ULTRASONOGRAPHY.....A DIAGNOSTIC TOOL FOR SUPERFICIAL SOFT

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ABSTRACT

The present study was undertaken to evaluate superficial soft tissue masses in 50 patients by gray-scale and color Doppler ultrasonography. In the study 30 males (60%) and 20 (40%) females were taken. Majority of cases (26%) were in 0-10 years age range. The swellings were mostly seen in the extremities (46%) and head and neck (22%). Out of 50 patients, there were 44 patients having benign masses and six patients with malignant masses. The benign masses were grouped as inflammatory, developmental, benign tumors and other masses. Inflammatory masses include pyogenic abscess (7), cold abscess (4), parasitic cyst (5) and foreign body (2). The developmental masses were cystic hygroma (4), haemangioma (4), dermoid (2), and throglossal duct cyst (1). Benign tumors were fibrolipoma(4), lipoma(2), neurogenic tumor(2), fibroma(1), sacrococcygeal tumor(1) and sweat gland tumor(1). In other benign masses haematoma(2) and Baker's cyst(2) were included. On ultrasonography masses were characterized as having cystic (anechoic), solid (hypoechoic, hyperechoic or isoechoic) or complex echopattern. Though the gray scale ultrasonography helped in characterization of superficial soft tissue masses, but the differentiation between benign and malignant masses were mainly possible by color doppler sonography. All the malignant masses were vascular and majority (83.3%) has central flow signal or a combination of central and peripheral flow signal. Significant difference was found in maximum systolic velocity among benign and malignant masses in our series.

INTRODUCTION

Superficial soft tissue swellings arising from skin, subcutaneous tissues, muscles, tendons, bones or joints are a frequent presentation in outpatient clinics affecting both sexes (Table 1) in different age groups and onset of presentations (Table 2, 3) and having varied distribution (Table 4). Some lesions are easily diagnosed clinically, but more often there is an element of doubt and here comes the role of imaging of soft tissues so as to confirm the presence of a suspected soft tissue mass, locate it accurately and to indicate its nature (Wilson DJ 1989, Lagalla R 1998). The roentgenographic examination of soft tissue masses is frequently inconclusive and non-specific. Gray scale and color Doppler ultrasonography, an established procedure to diagnose intra-abdominal and pelvic diseases, has gained wide acceptance in the evaluation of muscles, tendons and superficial soft tissues (Braunstein EM *et al* 1981, Fornage BD *et al* 1983). Now with the advent of higher frequency transducers, greater resolution particularly of soft tissue close to skin is possible (Fornage BD *et al* 1983, Harcke HT *et al* 1988, Holsbeech MV *et al* 1992, Pathria MN *et al* 1988, Walter JP 1985). Ultrasonography can detect the soft tissue lesion by the difference in acoustic impendence between it and surrounding normal tissue with distinct separating interfaces (Bernrdino ME *et al* 1981, Yeh HC *et al* 1982).

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It has advantage of being noninvasive, low cost, nonionizing, readily available, dynamic imaging modality which can efficiently detect, localize and characterize most soft tissue lesions (Bernrdino ME *et al* 1981,AbiEzzi SS *et al* 1995, Cardinal E *et al* 1998, Sintzoff SA *et al* 1992, Vincent LM 1988). Although ultrasonography has limited ability to assess bony changes and define detailed anatomic relationships as compared to computed tomography (CT) and magnetic resonance imaging (MRI), yet it usually demonstrates soft tissue masses with more definition than computed tomography and in certain instances may suggest the character and morphology of neoplasm (Vincent LM 1988). The present study aims at establishing the exact role and limitations of Gray scale and Color Doppler ultrasonography in evaluation of superficial soft tissue masses.

Aims and Objectives

- To study the ultrasonography features of superficial soft tissue masses, characterize their nature and correlate findings with the final diagnosis established by means of FNAC/ histopathological examination.
- To evaluate the role of color Doppler ultrasonography in diagnosis of superficial soft tissue masses.

MATERIALS AND METHODS

The proposed study was carried on 50 patients with superficial soft tissue swellings referred for sonography and color Doppler ultrasonography from various OPD'S and wards to the department of Radio diagnosis. Clinical history of the patient was taken. General physical, systemic and local examination of patient was carried out. Relevant laboratory investigations including biochemical and haematological investigation were done. Ultrasound Examination of soft tissue lesions was done to localize the lesion and characterize it. Abnormalities predominantly confined to major joints, articular cartilage and tendons were not dealt. Sonographic examination was performed with Logiq-400/Logiq-500 (Wipro GE) scanner using a broad band (6-13MHz) linear array transducer for real time B-scan imaging which automatically switches to 6.7 MHz for color doppler study and wherever required convex probe (3-5MHz) was used to differentiate the lesion from deep tissues. Real time B-scan ultrasonography was done first and the site, size and sonographic morphologic features of the lesion were noted. Color doppler imaging was performed under standardized settings for maximum Doppler sensitivity (lowest velocity scale and lowest filter settings). The angle that gave the strongest signal was retained for the rest of the study. The color doppler imaging results were classified with regard to presence or absence of flow signals & presence of peripheral versus central flow. Multiple doppler samples were obtained from all parts of the tumor, including the margins. Only the artery showing highest maximum systolic flow velocity was used for statistical analysis. Doppler frequency spectra were analyzed for maximum systolic flow velocity (S), end diastolic flow velocity (D) and resistive index [RI=S-D/S]. The findings were recorded. Other radiological investigations like X-ray, CT scan were done wherever required. The results were correlated with the final diagnosis established by operative findings/ FNAC/ histopathological examination.

Observations

The data was collected and analyzed, and results were correlated with the final diagnosis established by FNAC/ histopathological examination.

Table 1. shows the distribution of patients according to sex (n=50)

Sex	Number (n)	Percentage (%)
Male	30	60
Female	20	40
Total:	50	100

There were 30 (60%) males and 20 (40%) females in the study sample.

Table 2. shows the distribution of patients according to age (n=50)

Age Group Years	Number of patients (n)	Percentage of patients (%)
0-10	13	26
11-20	11	22
21-30	8	16
31-40	6	12
41-50	9	18
>50	3	6
Total	50	100

Table VI shows the ultrasound diagnosis of different superficial soft tissue masses. The ultrasound diagnosis was based on both gray scale and color Doppler characterization. These were divided into the following categories- diagnostic, useful but not diagnostic and misleading.

Table 3. Shows distribution according to duration of the soft tissue swelling (n=50)

Duration of superficial soft tissue mass	Number of patients (n)	Percentage of patient (%)
Since birth	8	16
< month	11	22
➢ month	31	62
Total:	50	100

Table 4. shows the distribution of the masses according to different sites of occurrence (n=50)

Site	Number of patients(n)	Percentage of patients (%)
Head and neck	11	22
Axilla	2	4
Upper Limb	10	20
Lower limb	13	26
Chest wall	5	10
Abdominal wall	3	6
Back	6	12
Total	50	100

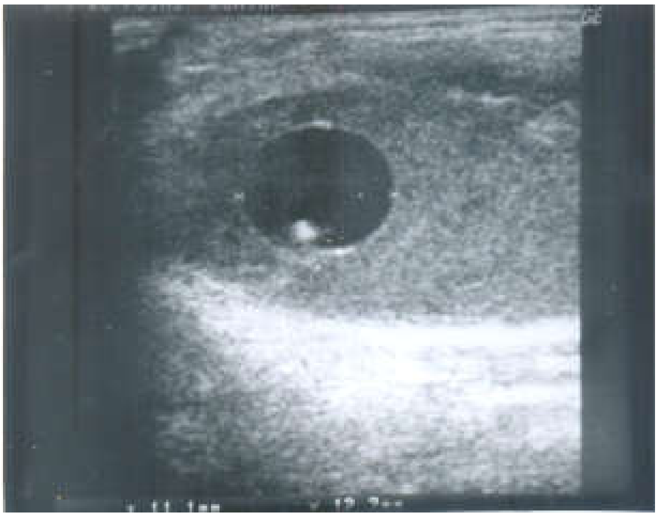

Figure 1. Showing cysticercosis

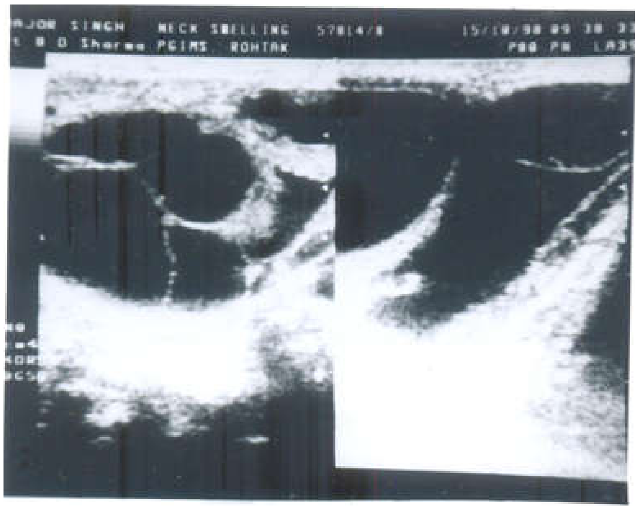

Figure 2. showing cystic hygroma

Table 5. Final diagnosis and ultrasonogoraphic echopattern of superficial soft tissue masses

Final diagnosis	Number of cases	cystic	Solid	Complex
Inflammatory Masses				
Pyogenic abscess	7	-	7	-
Cold abscess	4	-	4	-
Parasitic cyst	5	5	-	-
Foreign body	2	-	2	-
Developmental Swellings				
Cystic hygroma	4	3	-	1
Haemangioma	4	-	1	3
Dermoid	2	-	2	-
Thyroglossal duct cyst	1	1	-	-
Benign Tumors				
Fibrolipoma	4	1	3	-
Lipoma	2	-	2	-
Neurogenic tuor	2	-	2	-
Fibroma	1	-	1	-
Sacrococcygeal teratoma	1	-	-	1
Sweat Gland Tumor	1	-	1	-
Malignant tumors				
Metastasis	2	-	1	1
Mesenchymal Tumor	2	-	-	2
Rhabdomyosarcoma	1	-	-	1
Carcinoma with sq. differentiation	1	-	1	-
Others				
Haematoma	2	-	2	-
Baker's cyst	2	2	-	-
Total:	50(100%)	12(24%)	29(58%)	9(18%)

Table 6. Distribution of cases according to ultrasound diagnostic categories

Final diagnosis	No. of Cases	Final Ultrasound diagnosis(gray scale and color doppler)		
		Diagnostic	Useful but not diagnostic	Misleading
Inflammatory				
Pyogenic abscess	7	7	-	-
Tubercular abscess	4	3	1	-
Parasitic cyst	5	5	-	-
Foreign body	2	2	-	-
Develepental Swellings				
Cystic hygroma	4	4	-	-
Haemangioma	4	3	1	-
Dermoid	2	-	2	-
Thyroglossal duct cyst	1	-	1	-
Benign tumor				
Fibrolipoma	4	-	3	1
Lipoma	2	2	-	-
Neurogenic tuors	2	-	2	-
Fibroma	1	-	1	-
Sacrococcygeal tertoma	1	1	-	-
Sweat gland tumor	1	-	1	-
Malignant tumor				
Metastasis	2	-	2	-
Mesenchymal tumor	2	-	2	-
Rhabdomyosarcoma	1	-	1	-
Carcinoma with sq. diff.	1	-	-	1
Other				
Haematoma	2	-	2	-
Baker's Cyst	2	2	-	-
Total:	50(100%)	29(58%)	19(38%)	2(4%)

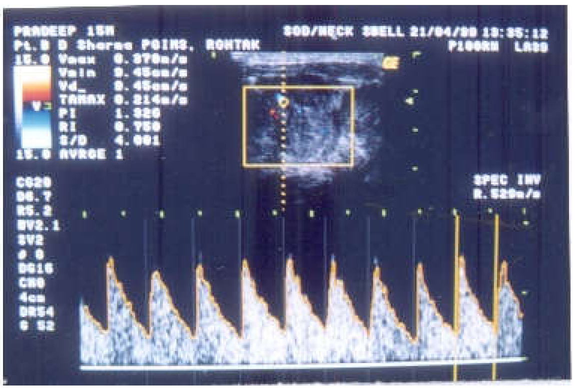

Figure 3. Showing rhabdomyosarcoma

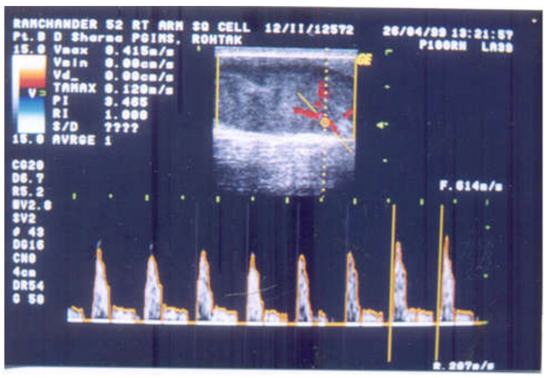

Figure 4. showing subcutaneous metastasis from squamous carcinoma

RESULTS

Though the gray scale ultrasonography helped in characterization of superficial soft tissue masses (figure1, 2), but the differentiation between benign and malignant masses was mainly possible by color Doppler sonography. All the malignant masses were vascular and majority (83.3 %) had central flow signal or a combination of central and peripheral flow signal. In total of 44 benign masses vascularity was seen in only 16 cases and majority of these (68.7 %) had peripheral flow signal only. There was significant difference in maximum systolic flow velocity among benign and malignant masses in our series. Mean maximum flow velocity was 36.3 cm/s for malignant masses and 10.7 cm/s for benign masses (Figure 3, 4). Study shows various final diagnoses of superficial soft tissue masses in our series and their gray scale ultrasonographic echopattern (table V) (Figure 3, 4). Inflammatory masses 18 (36%) were the most common swellings in our series .Twelve (24 %) of the swellings had cystic echopattern, 29 (58%) had solid echopattern and 9 (18%) had complex echopattern (table VI). Anechoic lesions were considered to be having cystic echopattern. Hypoechoic, hyperechoic or isoechoic lesions were considered to be having solid echopattern. Of the complex swellings four had both hypoechoic and hyperechoic echopattern, three cases of haemangioma had hypoechoic echopattern with anechoic areas in it, one case of cystic hygroma had anechoic areas with septae and internal echoes in it, and one case of sacrococcygeal teratoma had hypoechoic and cystic areas with areas of calcification in it.

DISCUSSION

Ultrasonography has capacity to differentiate solid from cystic lesions and has ability to identify subtle changes in soft tissue echotexture. These characteristics have led to its use in visualizing and localizing tumors, non-radiopaque foreign bodies, muscle tears and ruptures, abscesses, hematomas and simple cysts (Fornage BD *et al* 1985, Enterline HT 1981, Fornage BD *et al* 1987. Ultrasound was found to have diagnostic accuracy in soft tissue masses which are frequently due to ganglia, infection, hemorrhage, lipomata and incomplete muscle rupture. Less commonly lumps could be more aggressive soft tissue neoplasm, foreign body reactions and vascular malformation (Rubenstein SA *et al* 1986). Braunstein EM *et al* (Braunstein EM *et al* 1981) used Gray scale ultrasonography in 18 patents with superficial soft tissue extremity masses with normal or nonspecifically abnormal radiographs and found it to provide additional information. It was possible to distinguish fluid collections from solid masses, and recurrent venous thrombosis from hematoma in anticoagulated patients. Occasionally, specific diagnoses were suggested including soft tissue neoplasm, hematomas, aneurysms, synovial cysts, abscesses and lymphocele. Glasier CM *et al* (Glasier CM *et al* 1987) examined forty-two soft tissue masses in infants and children with high resolution ultrasonography. It was diagnostically specific in 17/42 (40%), useful but not diagnostic in 24/42 (58%) misleading in 1/42 (2%) of soft tissue masses. Lesions with diagnostic sonographic features included cystic hygroma, fibromatosis colli, lymphadenopathy with abscess formation, and one case of osteomyelities. Taylor KJW *et al* (Taylor KJW *et al* 1988) studied the correlation of Doppler US Tumor signals with neovascular morphological features in 47 patients with primary malignant tumors of liver, kidney, adrenals or pancreas. Abnormal Doppler Ultrasound signals were detected in 44 of 47 Patients (94%). Taylor GA *et al* (Taylor GA *et al* 1991) evaluated twenty-one tumors in 20 children with duplex and color Doppler imaging and suggested that color Doppler imaging is useful in detecting the origin and pattern of vascular supply and the degree of intratumoral blood flow in a variety of solid tumors in children.

Conclusion

Thus we conclude that sonography is considered modality of choice in superficial soft tissue masses. It is easily available, cost effective and carries no inherent radiation hazards. Gray scale ultrasonography helps in characterizing the lesions and in making etiological diagnosis many a times. The combined use of gray scale and color Doppler helps in differentiating between benign and malignant masses.

Conflict of interest

We confirm that we have no financial affiliation or involvement with any commercial organization with direct financial interest in the subject or materials discussed in this manuscript, nor have any such arrangements. Any other potential conflict of interest is disclosed.

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