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Original Research Paper

Radio-Diagnosis

"SOFT TISSUE, STRONG SIGNALS: THE VITAL ROLE OF MRI IN TUMOUR EVALUATION"

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ABSTRACT Soft tissue tumours, originating from mesenchymal tissues, include a wide spectrum of benign and malignant lesions involving muscle, fat, fibrous tissue, vascular components, and peripheral nerves. MRI is the preferred imaging modality for their evaluation due to its excellent soft tissue contrast. It plays a vital role in assessing tumour size, location, internal composition, and involvement of adjacent structures, thus aiding in staging and surgical planning. While MRI can help suggest malignancy based on features such as lesion size over 8 cm, T2 heterogeneity, necrosis, edema, and ill-defined margins, no single feature is fully reliable for differentiation. Clinical history, lesion location, and MRI signal characteristics allow for narrowing of the differential diagnosis in many cases. MRI also helps confirm the presence of a mass and evaluate its extent, making it an indispensable tool in the comprehensive assessment and management of soft tissue tumours.

KEYWORDS : Soft tissue tumours, Magnetic Resonance Imaging (MRI), Benign, Malignant.

INTRODUCTION-

Soft tissue is derived primarily from mesenchyme and consists of skeletal muscle, fat, fibrous tissue, and the serving vascular structures as well as the associated peripheral nervous system.

Despite the diversity associated with soft tissue tumour development, all diagnoses carry similar symptoms and treatment options. By systematically using clinical history, lesion location, mineralization on radiographs and signal intensity characteristics on magnetic resonance images, one can determine the diagnosis for the subset of determinate lesions that have characteristic clinical and imaging features and narrow the differential diagnosis for lesions that demonstrate indeterminate characteristics. If a lesion cannot be characterized as a benign entity, the lesion should be reported as indeterminate and the patient should undergo biopsy to exclude malignancy.

Soft tissue sarcomas make up less than 1% of malignant tumours. They arise most commonly in the extremities, chest wall and retro peritoneum and are more common in older people and males, although age and gender vary for the various histological types. [1]

Patients are commonly referred for imaging to evaluate a soft-tissue mass in the trunk or extremities. These lesions range from non-neoplastic conditions to benign and malignant tumours. Presently imaging provides a limited ability to reliably distinguish between benign and malignant soft-tissue lesions. Thus, the primary goal for management plan. for the imaging referral is to confirm the presence of a mass and to assess its extent.[2]

MATERIAL AND METHODS-

The present study was a hospital based cross-sectional observational study. Study was conducted in the Department of Radiodiagnosis and Imaging of our institute. The study was conducted on 85 patients presented to our radiology department with suspected soft tissue tumour.

Imaging was done with MRI GE 1.5 Tesla scanner and sequences were selected as required.

Contrast: Contrast enhanced scans were performed in every cases. The contrast used in the study was Gadopentate Dimeglumine with dose of 0.1 ml mol/kg.

Inclusion Criteria:

- All patients with clinical suspicion of soft tissue tumour.
- Cases of all age groups irrespective of sex

Exclusion Criteria:-

- Patient having history of metallic implants insertion, cardiac pacemakers and metallic foreign body in situ.
- Patients who had undergone surgery or had residual lesion after surgery.
- Soft tissue lesions not included in WHO classification, like ganglion, abscess, neurogenic tumours.

Consent- Informed consent was taken from each participant.

RESULTS

Out of Total 85 patients diagnosed with soft tissue tumour 57 (67%) were malignant and 28 (33%) were benign. Tumours are, more common in lower limb 59%. Both malignant and benign tumours are more common in lower limb, 60 % and 53 % respectively. Least common site is abdomen 1%.

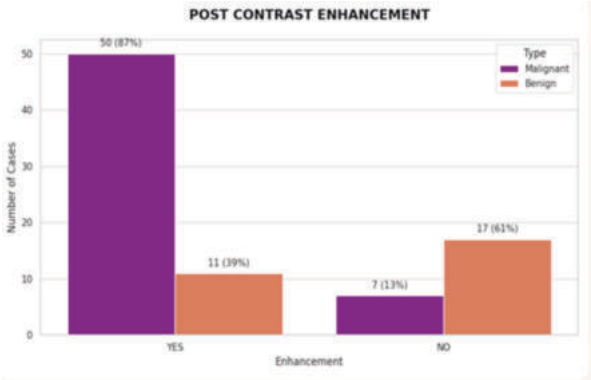
T2 HETEROGENOUS HYPERINTENSITY

Table 1. Shows 96% Of Malignant Lesions Show T2 Heterogenous Hyperintensity And 46% Of Benign Lesions

Show T2 Heterogenous Hyperintensity.

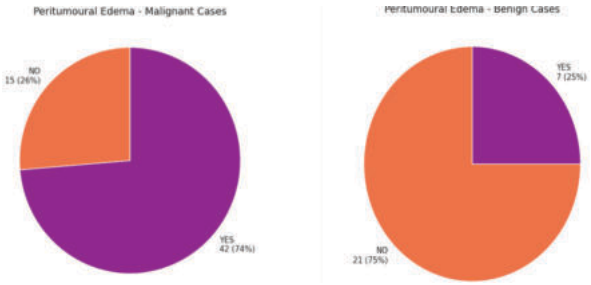
T2 Heterogenous Hyperintensity	Malignant	Benign
YES	55	13
NO	2	15
TOTAL	57	28
	96%	53%
	Sensitivity	Specificity

POST CONTRAST ENHANCEMENT



BAR DIAGRAM 1. shows 87% of malignant lesions show post contrast enhancement and only 11% of benign lesions show post contrast enhancement.

PERITUMOURAL EDEMA



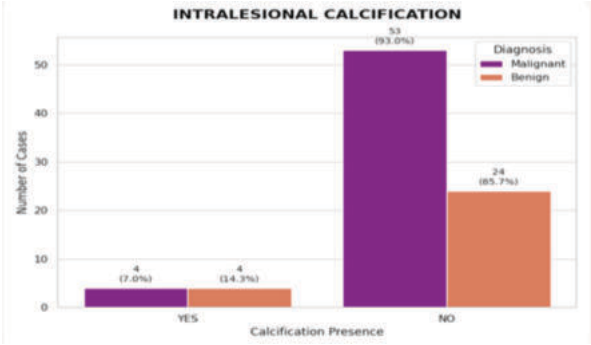
Pie Chart 1 And 2. Finding of peritumoural edema is seen much more commonly in malignant (74%) than in benign lesions (25%).

SIZE OF THE LESION

SIZE OF THE LESION	Malignant	Benign
>8cm	37 (65%)	7 (25%)
<8cm	20 (35%)	21 (75%)
TOTAL	57	28
	65%	75%
	Sensitivity	Specificity

TABLE 2 .shows 44 (52%) tumours were > 8cm in size and 41 (48%) were <8cm in size. Size of > 8 cm is frequently seen in malignant than in benign that are 65% and 25% respectively.

INTRALESIONAL CALCIFICATION



BAR DIAGRAM 2. shows 7% of malignant lesions show calcification and 14% of benign lesions show calcification .

Of the all-malignant lesions 12 showed osseous involvement and 21 showed neurovascular involvement whereas among benign lesions only 2 showed osseous involvement and 4 showed neurovascular involvement.

Total 23 cases showed intralesional hemorrhage 6 were benign and 17 were malignant.

Capsule was more commonly observed in benign than in malignant lesions, number of cases being 11 and 6 respectively.

Representative Cases

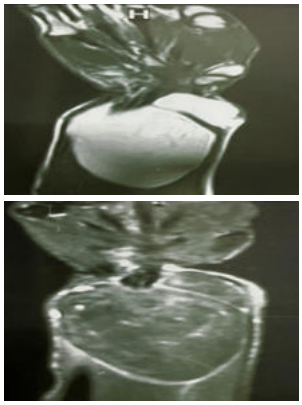


Fig 1 & 2. T1 Coronal And STIR Coronal Imageof Lipoma In Forearm

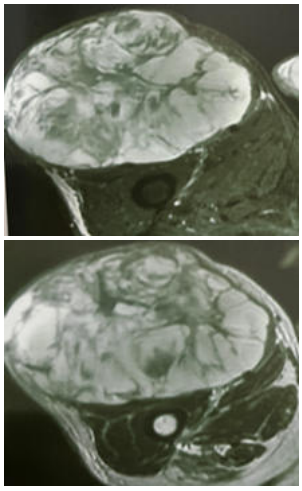


Fig 3 & 4. T1 Axial & STIR Axial Image Of Leiomyosarcoma In Thigh

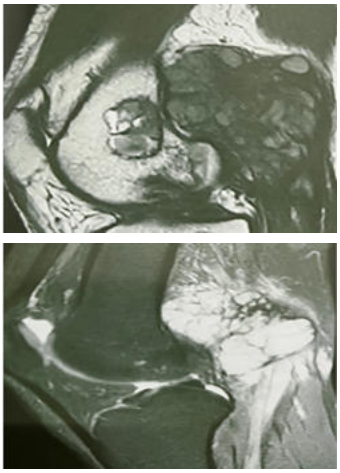


Fig 5 & 6. T1 Sagittal & T2 FAT SAT Sagittal Of Synovial Sarcoma In Lower Limb

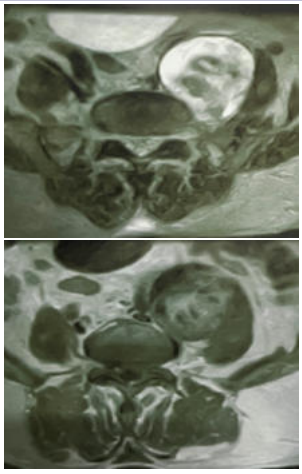


Fig 7 & 8. T2 Axial And T1 Post Contrast Axial Image Of Desmoid Tumour

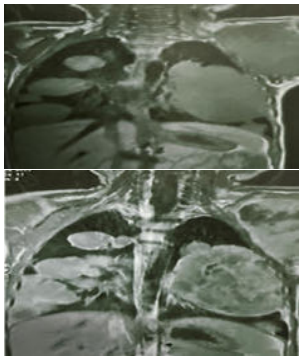


Fig 9 & 10. T1 Coronal Precontrast & Post Contrast Of Rhabdomyosarcoma

DISCUSSION

Kalayanarooj et al. found heterogenous signal on T2-weighted, perilesional edema or invasion, and necrosis in the masses to be statistically significant for differentiation between benign and malignant soft tissue masses.[3]

Schepper et al reported that although malignant tumours show increased vascularity and have large extracellular spaces, depending on tumoural activity or aggressiveness, there was no correlation between the degree of and pattern of enhancement and malignancy grade.[4]

Kransdorf et al reported Intratumoural hemorrhage is a rare finding, which can be observed in both benign and malignant lesions, and is difficult to differentiate from nontumoural soft tissue hematoma. In routine clinical practice, synovial sarcoma is frequently misinterpreted as benign at non enhanced MR imaging, perhaps because of its often small size, well-defined margins, and slow progression. However, these sarcomas will demonstrate early diffuse enhancement at dynamic contrast-enhanced MR imaging. Enhancement characteristics may, therefore, raise a red flag in benign-appearing lesions and allow less experienced radiologists to target lesions that need further work-up in a referral centre.[5]

Bongartz et al, Benign tumours are well delineated and, malignant tumours have rather ill-defined margins, however, reported that aggressive sarcomas may have a pseudocapsule, whereas benign lesions, such as desmoid tumours may invade neighboring tissues. They concluded that the margin (well-defined vs infiltrating) of soft tissue mass on MRI was of no statistical relevance in the prediction of malignancy.[6]

Datir et al. Current guidelines suggest that the most important variables for assessing the risk of malignancy in a soft tissue lesion include size, depth in relation to fascia, increasing size, and pain.[7]

Srinivasan et al. The mean of the largest dimensions of malignant lesions was more than 1.6 times that of benign lesions, measuring approximately 9.6 vs 5.8 cm,The mean of the average of the dimensions in the three planes of the malignant lesions was also more than 1.7 times that of benign lesions, measuring approximately 7.08 vs 4.11 cm.[8]

Ahlawat et al. review the updated WHO classification of soft tissue tumours, focusing on tumour behavior to aid diagnosis and management. They emphasize the role of MRI, particularly diffusion-weighted imaging, in evaluating soft tissue tumours. This advanced sequence improves assessment of tumour aggressiveness and supports more accurate clinical evaluation.[9]

Goyal et al. emphasizes the crucial role of MRI in evaluating soft tissue tumours and tumour-like lesions of the extremities. MRI provided detailed anatomical and tissue characterization, aiding in accurate diagnosis. It was effective in differentiating between benign and malignant lesions. The findings support MRI as a reliable, non-invasive diagnostic tool in clinical practice.[10]

CONCLUSION-

MRI is the preferred imaging modality for soft tissue tumours due to its near 100% sensitivity and excellent soft tissue contrast. It accurately assesses tumour location, extent, and involvement of adjacent structures, aiding in staging and surgical planning. MRI shows good sensitivity for identifying malignant (86.7%) and benign (90%) lesions. Features suggestive of malignancy include size >8 cm, T2 heterogeneity, contrast enhancement, necrosis, edema, and ill-defined margins. However, no single feature reliably distinguishes benign from malignant tumours, and histopathology remains essential for definitive diagnosis.

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