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Characterization of Soft Tissue Tumors by Magnetic Resonance Imaging: A Review

KEYWORDS: Soft tissue tumors; Magnetic Resonance Imaging; Characterization.

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ABSTRACT *Soft tissue tumors make up less than 1% of malignant tumours. They arise most commonly in the extremities, chest wall and retroperitoneum and are more common in older people and males, although age and gender vary for the various histological types. The primary goal for the imaging referral is to confirm the presence of a mass and to assess its extent for management plan. The utility of Magnetic Resonance Imaging (MRI) in the assessment of soft-tissue masses is predicated on the generation of diagnostic images of good quality. This study evaluates the role of MRI in the assessment of soft tissue tumors.*

INTRODUCTION

A soft tissue mass, also known as a soft tissue tumor is a neoplastic growth that forms in the non epithelial extraskeletal connective tissue, soft tissues of the body such as the muscles, tendons and blood vessels which usually mesodermal in origin.[1] Considered a rare condition, there are a variety of soft tissue masses which may be diagnosed in any part of the body. Despite the diversity associated with soft tissue tumor development, all diagnoses carry similar symptoms and treatment options.[2] 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.[3]

Soft tissue sarcomas make up less than 1% of malignant tumours. They arise most commonly in the extremities, chest wall and retroperitoneum and are more common in older people and males, although age and gender vary for the various histological types.[4] 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 tumors. Presently imaging provides a limited ability to reliably distinguish between benign and malignant soft-tissue lesions. Thus, the primary goal for the imaging referral is to confirm the presence of a mass and to assess its extent for management plan. In an important subset of cases, characteristic clinical and imaging information can help to narrow the differential diagnosis.[5] These characteristics include clinical history, lesion location, mineralization on radiographs and signal intensity (SI) characteristics on magnetic resonance (MR) images.

The advantages of MRI over CT include superior soft tissue contrast, absence of beam hardening artifacts, absence of ionizing radiation and ability to acquire images in multiple planes – axial, coronal, and sagittal or any degree of obliquity. MRI can also be used safely where CT is contraindicated - in patients who have history of reaction to iodinated contrast or have altered kidney function. These features combined with the variety of available scan types, lead to a highly sensitive and versatile imaging technique. As a result, MRI has become the principal imaging modality for evaluation of soft tissue tumors

Availability of higher magnetic strength magnets and superior coil technology has led to the development of highly sophisticated MR sequences that has boosted the potential of magnetic resonance imaging. From being a technique used primarily to demonstrate the structural and morphological details of bone and soft tissue, MRI is now being used to provide neuronal, metabolic (MR Spectroscopy) and functional spinal activity. The utility of MR imaging in the assessment of soft-tissue masses is predicated on the generation of diagnostic images of good quality. This study evaluates the role of MRI in the assessment of soft tissue tumors.

Patients and Methods:

The primary objective of this study was to study MRI characteristics of different soft tissue tumors.

- To assess the local tumor staging of soft tissue tumor.
- To assess operability by identifying osseous, neurovascular bundles and joint space involvement by soft tissue tumors.
- To asses accuracy of MRI in differentiation between benign and malignant lesion by different Intralesional tissue signal characteristic.
- To identifying purely benign soft tissue lesion so that unwanted biopsy and surgery will be avoided.
- To provide nearly pathological information regarding

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histology of bone tumors.

Relevant history of illness and significant clinical findings of all patients needs to be recorded. Previous investigations (x-rays, CT-Scans etc.) must be reviewed. Most of the patients were taken for examination without any pre-medication. In cases of non cooperative patients and young children sedatives were used under the supervision of the anesthetist. Relevant history regarding allergies and fitness for contrast study was obtained, the renal function tests were evaluated. For contrast injection the antecubital vein was cannulated with a 18 G intravenous catheter.

Consent:
All patients were subjected to scanning after explaining the entire procedure and the risks involved. All patients were subjected to sign on consent form. They were made aware of the methodology in their own language and their queries answered. All studies were done in the presence of a radiologist with standby anesthetic support.

Contrast:
Patients were scanned on 0.4 Tesla Hitachi APERTO MRI Scanner. Contrast enhanced scans were performed in every cases. The contrast used in the study was Gadolinium-DTPA with dose of 0.1 ml mol/kg. In paediatric patients non ionic MR contrast agent Omniscan (Gadodiamide injection) was used as intravenous injection at a dose of 0.2 mL/kg

Patient inclusion and exclusion criteria:
All patients diagnosed as having soft tissue tumors were included in this study. These included lesions of primary neoplastic etiology of soft tissue of whole body.

Following subsets were excluded:
1. Soft tissue tumors with inconclusive or inappropriate histological diagnosis.
2. Patients who already had taken treatment.
3. Patients who had recurrent or residual lesion after surgery.
4. Soft tissue lesions not included in WHO classification, like ganglion, abscess, neurogenic tumours.

MR characteristics of different sequences including the contrast-enhanced sequences were noted and recorded. The management decision, follow up, outcome and histopathological diagnosis whenever available were recorded. The results of this study were analyzed and compared with other available studies in literature.

Technical Considerations for MR Imaging of Soft-Tissue Masses
Given the variety of sizes and locations of soft-tissue masses, it is difficult to prescribe a single imaging protocol. Nonetheless, a number of general principles were applied. The lesions were demarcated prior to imaging with the skin markers and care taken not to compress or distort the mass. Different sequences were obtained for lesion characterization. Images were obtained in the axial plane for compartmental anatomy and in a relevant longitudinal plane to assess the mass in relation to key anatomic landmarks.

Imaging Strategy
The first goal was to establish the presence of a mass. In some cases with small lesion comparison with opposite side was help to highlight the presence of a mass. These were particularly applied in the thighs, calves and shoulder girdle. However use of a large field of view generally translates into sacrificing spatial resolution. In cases where detailed assessment of the mass was needed to delineate its features and assess its proximity to surrounding structures, a smaller field of view was targeted to the lesion itself. In most cases, these two strategies were not mutually compatible. Therefore image strategy was applied according to the type and site of lesion.

Intravenous contrast Agents
For this application, intravenous gadolinium-DTPA contrast agent was administered in a nondynamic fashion. Contrast-enhanced images were also obtained with fat suppression to suppress fat and highlight the presence of the gadolinium contrast agent. For this purpose, several considerations were applied: 1) Images obtained before and those obtained after contrast agent administration were obtained with identical imaging parameters to allow adequate assessment of enhancement. In paediatric patients non ionic MR contrast agent Omniscan (Gadodiamide injection) was used as intravenous injection at a dose of 0.2 mL/kg (0.1 mmol/kg).

Imaging Planes and sequences.

SEQUENCES	TR(msec)	TE(msec)	MATRIX SIZE
Axial T1w SE non contrast	350-600	20-22	256x256
Axial T2w fast SE non contrast	3500-4500	100-120	256x256
Coronal and sagittal T1w SE non contrast	350-600	15	256x256
Coronal and sagittal STIR	3600-4500	20	256x256
Axial, coronal and sagittal post contrast T1w SE	350-600	20-22	256x256
Axial post contrast, fat suppressed T1w SE	600-700	20-25	256x256
Axial T2*w gradient echo	700-1000	10-15	256x256

Table 1: Table showing imaging plane and sequences of MRI.

Axial images were important for demonstrating relevant anatomy and helping to determine whether the mass confined to a single compartment and whether it invading or encasing surrounding structures. Images obtained in a longitudinal plane—coronal, sagittal, or oblique—help demonstrate the extent of the mass and its relationship to anatomical landmarks. If axial images are obtained first, they were used to select the longitudinal plane to demonstrate the relationship of the mass to bone, vessels, or other structures of interest.

Characterization consists of both grading and tissue-specific diagnosis. Whereas grading implies a differentiation between benign and malignant tumors and definition of malignancy grades, tissue-specific diagnosis implies pathologic typing. Although pathologic diagnosis is the gold standard in the diagnosis of soft tissue tumors, prediction of a specific histological diagnosis remains one of the ultimate goals of each new imaging technique.

RESULTS
The signal intensity (SI) was described in relation to an internal standard. Masses that were higher in SI than skeletal muscle on T1-weighted images were considered to be hyperintense. Substances that are associated with T1 shortening include fat, methemoglobin, proteinaceous

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fluid and melanin (88,89). In the absence of gadolinium enhancement, the differential diagnosis for a mass characterized by T1 hyperintensity include a fat-containing mass, a hemorrhagic mass that contains methemoglobin, various fluid collections that contain an appropriate concentration of proteinaceous fluid. If the mass had areas of hyperintense T1 signal, the next step was to evaluate suppression on STIR images. If the hyperintense area was suppressed, then the lesion contains fat and the most likely diagnoses were lipoma, lipoma variant, liposarcoma and haemangioma were considered. If the mass was composed entirely of fat with only minimal thin septations and without non fatty nodular components, then a diagnosis of lipoma was made. If the lesion was greater than 10 cm in diameter, contains septa greater than 2 mm thick or globular or nodular non fatty components then a diagnosis of liposarcoma was made.

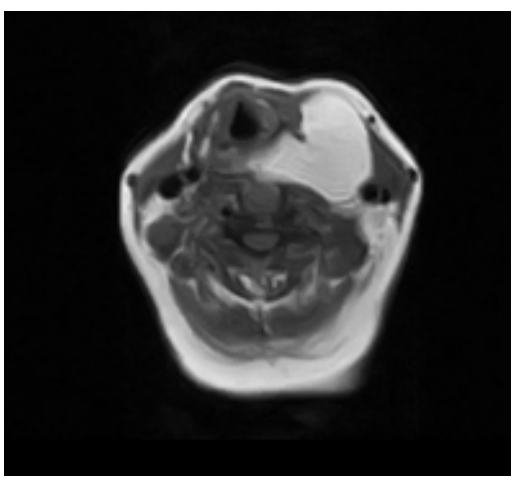

Figure 1: T1w axial image showing homogeneous hyperintensity suggestive of intramuscular lipoma

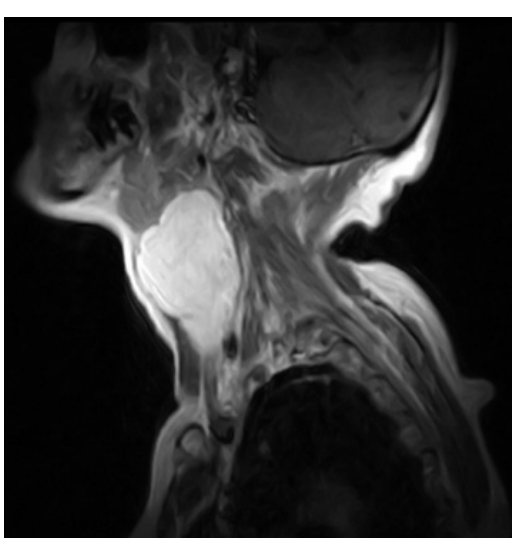

Figure 2: T1w axial image showing homogeneous hyperintensity suggestive of neck lipoma

T2 Hypointense Lesions

A mass that had lower in signal intensity (SI) than skeletal muscle on T2-weighted MR images was considered to be hypointense. Substances that appear hypointense on T2-weighted images include fibrosis, hemosiderin and calcification. Lesions with fibrotic components showed low T2 SI because of a relative lack of mobile protons associated with their hypocellular densely collagenous matrix. Hemosiderin, a nonspecific end-product from the breakdown of haemorrhage was T2 hypointense due to magnetic susceptibility and appeared more prominent (blooming) on gradient images. Calcifications are typically T2 hypointense because the protons are immobilized within a crystalline structure and not contribute to the signal. Some masses had hemosiderin in a portion of the mass because of bleeding but may not contain enough diffuse hemosiderin to have low T2 SI as in haemangioma but they showed uniformly low-SI mass on T2-weighted MR images. Some cases were correlated on plain x-ray for demonstration of calcification. If there were no calcifications on the radiographs, then a mass with low T2 SI were most likely the tumors with substantial fibrous content. If a nodular mass that was adjacent to the plantar fascia of the foot with low T2w SI diagnosis of plantar fibromas was made.

T2 Hyperintense Lesions

Lesions were characterised as a homogeneous or heterogeneous hyperintense. Most of lesions were heterogeneously hyperintense and are difficult to specifically characterize and mostly observed in malignant lesions. There was a subset of lesions that was relatively homogeneously hyperintense and were further characterized. Not only cystic masses but some solid masses also appeared T2 hyperintense. Thus, the differential diagnosis for lesions that were predominantly T2 hyperintense includes lymphangioma, myxoma, myxoid sarcoma and small synovial sarcomas. Because of the relatively homogeneous hyperintensity seen in some of these solid lesions, they were mistaken for fluid-filled structures on only T2w images. Administering an intravenous gadolinium-based contrast agent was an important step to distinguish between true cysts and solid lesions.

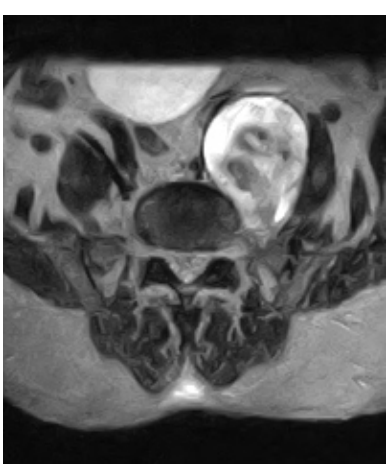

Figure 3: T2w axial image showing heterogeneous hyperintensity suggestive of desmoid tumor.

Gradient echo sequences

A T2*-weighted gradient-echo sequence were used as adjunct sequence for assessing the presence of hemosiderin whenever required. Hemosiderin causes local magnetic susceptibility effects that create accentuated low SI on T2*-weighted images as compared with that on standard T2-weighted images, an effect referred to as blooming. This effect was observed in some malignant tumor with Intralesional haemorrhage and in some haemangioma.

Sort tau inversion recovery (STIR) sequence

On STIR images the lesion were recorded as not suppressed, partially suppressed and completely suppressed.

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In Some small lesion the STIR sequence was first taken to highlight the mass to plane the other sequences. STIR sequence helped to identify the fatty component of the mass that were appears hyperintense on both T1w and T2w images. STIR sequence also used to identify osseous involvement. Increased signal intensity in the skeletal muscle surrounding a musculoskeletal mass on T2-weighted spin-echo MR images or other fluid-sensitive sequences (i.e., STIR) has also been suggested as a reliable indicator of malignancy.

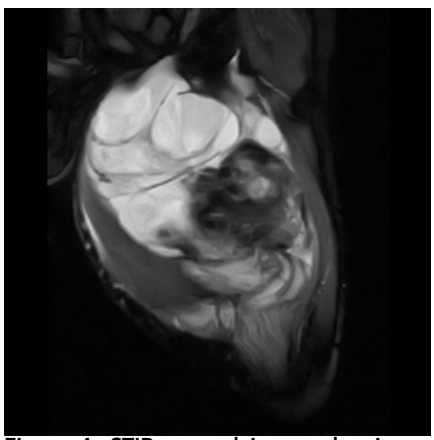

Figure 4: STIR coronal image showing partial suppression suggestive of intramuscular liposarcoma.

Contrast Enhancement

Contrast agent administration was useful for differentiating between cystic and solid lesions and for identifying tumor nodules in cystic lesions. The degree of enhancement correlate to the vascularity of the lesion so contrast enhancement were recorded as mild, moderate, strong and peripheral. Enhancement was not reliably useful to distinguish benign from malignant lesions.

Because of the high intrinsic soft-tissue contrast of MR images, soft-tissue masses were almost invariably visible on MR images without the use of intravenous gadolinium-based contrast agents. In the evaluation of soft-tissue masses contrast MR images were used to distinguish cystic from solid structures, to demonstrate the relative vascularity of the masses and occasionally to highlight tissue planes to aid in assessing the degree of invasion of a mass into vessels and other structures. Cystic lesions demonstrated a thin rim of peripheral enhancement. When the peripheral rim of enhancement is thick and irregular then necrotic tumor masses were considered. If Intramuscular masses that had uniform hyperintensity on non enhanced T2-weighted MR images but demonstrate internal enhancement on contrast-enhanced MR images the diagnosis of myxoma were considered. If an enhancing hyperintense lesion in para articular region, synovial sarcoma was considered.

Post contrast fat saturated sequence

These sequences were used to highlight the proper contrast enhanced mass by nullifying fatty tissue. This sequence particularly used to outline extent of tumor tissue. Marrow involvement is also well seen in this sequence.

The Indeterminate Lesion

Some lesion could not be properly characterised on MRI imaging so diagnosis of indeterminate lesion was made and subjected for further evaluation (eg. biopsy). The WHO recommends that "soft tissue masses that do not demonstrate tumor-specific features on MR images should be considered indeterminate and biopsy should always be obtained to exclude malignancy".

Discussion

Moulton et al (5) in a study of 225 soft tissue masses could detect 59% malignant tumors in intramuscular or mixed (intramuscular + subcutaneous) location, whereas 88% benign tumors were in the subcutaneous tissue. In the present study, majority of malignant lesions detected on MRI were deep in intramuscular location (83%). Two (9%) malignant tumors were found in the subcutaneous tissue predominantly, whereas 53% benign tumors were centered within the muscle and 12 cases (38%) were in the intermuscular fascial planes.By quantitative analysis, no single imaging feature or combination of features could reliably be used to distinguish benign from malignant lesions. For the subjective analysis, a correct and specific benign diagnosis could be made on the basis of MR imaging findings in 100 (44%) of the 225 tumors. For the entire cohort, the sensitivity was 78%, the specificity was 89%, the positive predictive value was 65%, and the negative predictive value was 94% for a malignant diagnosis. When the diagnostic benign tumors were excluded, the specificity and negative predictive value decreased to 76% and 86%, respectively, whereas the sensitivity and positive predictive value remained the same.

Berquist et al(16) The size (> 5 cm), maximal depth (> 8 cm), presence of T2 low signal matrix, fibrous tissue, calcification , necrosis, fat rim sign, septum, perifocal edema, and hemorrhage showed statistically significant differences between benign and malignant lesions. The sensitivity, specificity, positive and negative predictive values of individual MRI parameters are listed in Table 3. There were several situations tabulated as indeterminate, including 8 in fibrous tissue, 5 in myxoid tissue, 2 each in cyst, necrosis, vessels and fat rim, and 1 each in peritumoral edema and fat. Best combination of parameters in predicting malignancy was fibrous tissue calcification, necrosis, a fat rim, peritumoral edema and maximal mass diameter (Model 1). The combination of these parameters resulted in the most correct diagnoses, with a sensitivity of 84.2%, specificity of 64.0%, and accuracy of 74.8%. Model 2 yielded sensitivity of 64.5%, specificity of 78.2%, and accuracy of 70.9%. Component characterizing imaging parameters (Model 3) had a sensitivity of 81.1%, specificity of 66.7%, and accuracy of 74.3%.

Crim JR et al (15). retrospective review of 83 soft-tissue masses (49 benign and 34 malignant) was performed to evaluate the ability to distinguish benign from malignant soft-tissue masses with magnetic resonance (MR) imaging. The correct histologic diagnosis was reached in 31% of cases by one reader and in 16% of cases by the second reader. Mean sensitivity was 50% for benign masses and 80% for malignant masses. The majority of both benign and malignant masses had inhomogeneous signal intensity and at least partially irregular borders. Malignant masses uncommonly had smooth borders and homogeneous signal intensity. MR imaging can be used to evaluate the extent of soft-tissue masses, but most masses will require biopsy to determine if they are benign or malignant. Neurovascular bundle involvement in 4% benign and 18% malignant tumors.

Sen J et al (46) Fifty-five consecutive patients presenting with neoplastic (both benign and malignant) lesions diagnosed clinically and on ultrasound were studied and their MRI features were compared with the findings on surgical exploration and histopathologic

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examination. There were 32 (58%) benign and 23 (42%) malignant masses. Malignant masses were more common in patients older than 20 years (83%), and these had symptoms of less than 6 months duration (75%), as against benign lesions. The swelling was painful in 8 malignant masses and these were more common in the upper limbs (61%). Various features of malignant lesions were size more than 5 cm in 83%, change in signal intensity from homogenous on T1-weighted images to heterogenous on T2-weighted images in 74%, irregular margins in 74%, and heterogenous contrast enhancement in 91%. The accuracy of these features was 76%, 58%, 78%, and 60%, respectively. Most benign and malignant lesions were intramuscular in location. A significant number (38%) of benign lesions were located in the intermuscular facial plane. Definitive diagnosis was made in 42% of the lesions.

Kransdorf et al (5) Malignancies, by virtue of their very nature and potential for autonomous growth, are generally larger and more likely to outgrow their vascular supply with subsequent infarction, necrosis, and heterogeneous signal intensity on T2-weighted spin-echo MR imaging. Consequently, the larger a mass is, the greater its heterogeneity, the greater is the concern for malignancy. Only 5% of benign soft-tissue tumors exceed 5 cm in diameter. In addition, most malignant tumors are deep, whereas only about 1% of all benign soft-tissue tumors are deep. Although these figures are based on surgical series, these trends are likely still valid for radiologists. When sarcomas are superficial, they generally have a less aggressive biologic behavior than do deep lesions. As a rule, most malignancies grow as deep space-occupying lesions, enlarging in a centripetal fashion [57], pushing rather than infiltrating adjacent structures (although clearly there are exceptions to this general rule). As sarcomas enlarge, a pseudocapsule of fibrous connective tissue is formed around them by compression and layering of normal tissue, associated inflammatory reaction, and vascularization [57]. Generally, they respect fascial borders and remain within anatomic compartments until late in their course [57]. It is this pattern of growth that gives most sarcomas relatively well-defined margins, in distinction to the general concepts of margins used in the evaluation of osseous tumors.

Chen et al (13) study of 118 histologically proven soft tissue masses show T2 low signal matrix, fibrous tissue, calcification, necrosis, septum, fat rim sign, Peritumoral edema, and hemorrhage showed statistically significant differences between benign and malignant masses ($p < 0.05$). The positive predictive value of necrosis for malignancy was 84.8%, and its specificity was 90.9%. In multivariate analysis, the best model for predicting malignant masses was the combination of necrosis, maximal mass diameter, Peritumoral edema, and absent fibrosis, absent calcification, and lack of fat rim. The combination of these parameters resulted in the most correct diagnoses of malignancy, with a sensitivity of 84.2%, specificity of 64.0%, and accuracy of 74.8%, whereas the accuracy of models consisting of component character and morphologic feature were 74.3% and 70.9%, respectively.

Datir et al (6) among the morphological characteristics, size criteria of >6 cm and >8 cm yielded a sensitivity of 95% and 75% respectively. However, size criteria of >8 cm had a specificity of 76% while >6 cm had a specificity of 57%. Irregular and lobulated shapes of the tumors had a sensitivity and specificity of 83% and 76% respectively. Irregular and infiltrative margins had a sensitivity and specificity of 91% and 65% respectively. In their study, 'Heterogeneous appearance' of the tumour had a sensitivity and specificity of 100% and 50% respectively. 'Presence of peritumoral edema' had a sensitivity and specificity of 95% and 50% respectively. These characteristics are highly sensitive, but the specificity is too low to be considered reliable differentiating factors.

Chang et al (32) Twenty patients with extremity soft tissue tumors were prospectively evaluated with magnetic resonance imaging (MRI) and computed tomography (CT) scans with subsequent anatomic correlation of surgical findings. MRI and CT had a similar percentage of accuracy in assessing tumor relationship with major neurovascular (80% and 70%, respectively) and skeletal (80% and 75%, respectively) structures. MRI was significantly better than CT in displaying contrast between tumor and muscle when using the T2 weighted spin echo (SE) (p2 less than 0.002) and inversion recovery (IR) (p2 less than 0.005) pulse sequences. MRI and CT were comparable in demonstrating contrast between tumor and fat. The contrast between tumor and vessel was better displayed by MRI compared with CT when using the T1 weighted SE (p2 less than 0.001) and T2 weighted SE (p2 less than 0.001) pulse sequences. T1 and T2 values were measured on fresh tumor and normal tissue samples and were used to predict relative contrast on different MRI pulse sequences using isosignal contour plots. MRI appears to offer several advantages over CT in the evaluation of extremity soft tissue tumors.

Weekes et al (49) Twenty-seven patients with soft-tissue tumors were examined with a Picker 0.15-tesla resistive magnet and by computed tomography (CT). In all but one patient, MRI was better than or equal to CT in defining the anatomic extent of the tumor. We could determine whether major vascular structures were engulfed by the tumor in 80% of the MRI examinations but only in 62% of the CT scans. MRI and CT were equally effective in determining the presence or absence of bony invasion. The MRI images of all the tumors showed increased signal intensity relative to normal muscle when spin-echo (SE) pulse sequences with long repeat times were used (SE: echo time [TE], 60 ms; repetition time [TR], 2,000 ms). When T1 weighted pulse sequences were used (SE: TE, 30 ms; TR, 500 ms or inversion recovery: inversion time, 500 ms; TE, 40 ms; TR, 2,000 ms) the malignant tumors showed decreased signal intensity compared to normal muscle. Only lipomas showed high signal intensity on both T1 and T2 weighted pulse sequences.

Daniel et al (50) Features associated with benign diagnosis in a large percentage of cases, are size less than 8 cm, sharp margination, homogeneous T2 signal, absence of oedema, necrosis, calcification and fluid-fluid levels. Similarly, malignant tumours are commonly associated with presence of irregular margins, inhomogeneous signal intensity, oedema, necrosis, haemorrhage, fascial penetration, bone changes and neurovascular involvement. A correct histological diagnosis is reached on the basis of imaging studies alone in 65% to 75% of cases. The sensitivity for a MRI diagnosis of malignant tumour was 95% and specificity was 84%.

Srinivasan et al (41) study of 40 patients To determine if a distinction could be made between benign and malignant masses on MR imaging features. The mean of the largest dimensions of malignant lesions was more than 1.6 times that of benign lesions, measuring approximately 9.6

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vs. 5.8 cm, which was statistically significant (P≤0.028). The mean of the average of the dimensions in the three planes of malignant lesions was also more than 1.7 times that of benign lesions, measuring approximately 7.08 vs. 4.11 cm, which was highly statistically significant (P≤0.004). Only 9 of 27 (33%) benign lesions were heterogeneous on the T1-weighted sequence, whilst 10 of 13 (77%) malignant lesions were heterogeneous on the T1-weighted sequence (Fig. 1a), and this difference was statistically significant (P = 0.017). The majority of the benign lesions (18 of 27) were homogeneous on T1-weighted sequences. Thirteen of 27 (48%) benign masses and 10 of 13 (77%) malignant masses demonstrated heterogeneity on T2-weighted or fluid-sensitive MR images, but the difference was not statistically significant (P=0.10). The majority of the benign lesions were homogeneous on T2-weighted/fluid-sensitive sequences (14 of 27) , and only 3 of 13 malignant lesions were homogeneous on fluid-sensitive sequences (Figs. 1b, 6a). Lobulation was seen in 16 of 27 (59%) benign and 10 of 13 (77%) malignant masses, and the difference was not statistically significant (P=0.32). Twenty-four of 27 (89%) benign lesions were well-defined and 12 of 13 (92%) malignant lesions were well-defined and there was no statistically significant difference (P=1.00). Except for one malignant lesion, all the other masses were deep to the superficial fascia. The majority of lesions (78% of benign and 85% malignant masses) were located in the lower limb. Perilesional oedema was seen in 13 of 27 (48%) benign and 5 of 13 (32%) malignant lesions (Fig. 6a), but this difference was not statistically significant (P=0.74)

Conclusions:

Magnetic resonance (MR) imaging is imaging modality of choice for the detection and local staging of soft-tissue tumors. MRI is highly accurate in determining the location, nature and characteristics of the soft tissue lesions. Besides, MRI is excellent modality to assess operability by identifying osseous, neurovascular bundles and joint space involvement by soft tissue tumors. Sensitivity of MRI to diagnose malignant lesions as malignant is 86.7% and sensitivity of MRI to diagnose benign lesions as benign is 90%. In this study MRI has slightly higher sensitivity to diagnose benign lesion as benign.

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