



A STUDY OF THE ROLE OF MRI IN EVALUATION OF SOFT TISSUE TUMORS: A HOSPITAL BASED STUDY

Radio-Diagnosis

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ABSTRACT

Background: Magnetic Resonance Imaging (MRI) offers superior anatomical resolution, making it an invaluable tool in medical diagnostics, particularly for soft tissue evaluation. Its ability to differentiate between various tissue types—such as fat, muscle, and fluids—enables detailed assessment of pathological changes, which is crucial for establishing a comprehensive differential diagnosis. MRI is particularly adept at local staging of diseases, allowing for precise visualization of a lesion's size, extent, and its spatial relationship to surrounding anatomical structures like fascia, bones, muscles, and neurovascular bundles. This detailed imaging helps in planning appropriate treatment strategies, such as surgical intervention or targeted therapies. **Objectives:** 1. To study MRI characteristics of different soft tissue tumors. 2. To assess accuracy of MRI in differentiation between benign and malignant soft tissue tumors by different intralesional tissue signal characteristics with histopathological correlation. **Materials And Methods:** This one year observational study was carried out in the Department of Radiodiagnosis, Silchar Medical College and Hospital. A total of 60 patients diagnosed with soft tissue tumors underwent MRI scan from September 2022 to August 2023 were screened for the study. The present study was initiated after getting the approval from Institutional Ethics Committee. Individual written consent was obtained before screening the patients. Patients who fulfill the inclusion and exclusion criteria were selected for the study. **Discussion:** In the present study, 73% cases were benign, and 27% cases were malignant. Parameters are most consistently associated with malignancy with higher sensitivity, specificity and PPV are T2w heterogeneous hyperintensity, size>8cm, heterogeneous post contrast enhancement, neurovascular involvement, peritumoral oedema, intralesional necrosis and ill-defined margins. **Conclusion:** In conclusion, MRI is the only non-invasive method for demonstrating soft tissue tumors and accurately defining their extent. In adults, benign tumors are typically small, well-circumscribed, and exhibit homogeneous signal intensity. In contrast, malignant tumors tend to be larger, heterogeneous, and poorly margined. Tumors with characteristics that fall between these extremes are challenging to classify as either benign or malignant. While MRI's role in tissue diagnosis is important, its primary value lies in staging the tumor.

KEYWORDS

Soft tissue lesions, benign soft tissue tumors, malignant soft tissue tumors, soft tissue sarcoma, MRI.

INTRODUCTION

Soft tissue is primarily derived from mesenchyme and includes structures like skeletal muscle, fat, fibrous tissue, vascular structures, and the peripheral nervous system.⁽¹⁾ Soft-tissue sarcomas are a diverse group of malignant tumors that originate from non-epithelial, extraskeletal tissues of mesodermal origin, excluding the reticuloendothelial system, glial cells, and supportive tissue of parenchymal organs. They primarily involve muscle, fat, fibrous tissues, the vessels supplying these tissues, and peripheral nerves.⁽²⁾ When malignancy is suspected, or if a lesion is incompletely evaluated, larger than 5 cm, deep, or located at a site of previous resection, MRI is recommended following an ultrasound.

MRI provides detailed anatomical images and characterizes soft tissues, which is crucial for forming a differential diagnosis and local staging. Advanced MRI techniques enhance soft tissue characterization. Proton magnetic resonance spectroscopy (PMRS) can indicate malignancy through elevated choline levels.⁽³⁾⁽⁴⁾ Susceptibility weighted imaging (SWI) detects specific materials like haemosiderin and melanin, aiding in the identification of conditions like metastatic melanoma.⁽⁵⁾ Diffusion-weighted imaging (DWI) usually shows lower apparent diffusion coefficient (ADC) scores in malignant tumors compared to benign ones, helping to tell them apart. ADC values can also differentiate between necrotic tumors and abscesses. Myxoid tumors generally have higher ADC values than non-myxoid tumors. Dynamic contrast-enhanced (DCE) imaging can further help distinguish between benign and malignant lesions based on how they enhance with contrast.⁽⁶⁾

Objectives:

1. To study MRI characteristics of different soft tissue tumors.
2. To assess accuracy of MRI in differentiation between benign and malignant lesion by different intralesional tissue signal

characteristic with histopathological correlation.

MATERIALS AND METHODS:

Source Of Data:-

The main source of data for this study were the patients with clinical diagnosis of soft tissue tumors in any part of the body from OPD and indoor patients referred from the Departments of Surgery, Dermatology and other departments of Silchar Medical College, Silchar. In all cases, a thorough history taking and physical examination were done based on the proforma attached below. Informed and written consent was obtained from the subjects before the commencement of the investigations after proper explanation of the procedure.

Place And Period Of Study:-

The present study was carried out in the Department of Radiology, Silchar Medical College & Hospital, Silchar for a period of one year from 1st September 2022 to 31st August 2023.

Type Of Study: Prospective observational study.

Sample Size: 60 patients which is derived from the average number of diagnosed cases of soft tissue tumors for a period of one year at Silchar Medical College and Hospital.

Sampling Method: Simple random sampling.

Inclusion Criteria:

- Patients of any age group presenting with clinically palpable soft tissue swelling in any part of body where imaging revealed soft tissue tumor were included in.

Exclusion Criteria

- All cases presenting with primary bone pathology, infective and traumatic pathology were excluded. Those with visceral and

retroperitoneal soft tissue tumors were excluded from the study.

- Additionally, post operative and follow up cases were excluded from the study.
- Patient with general contradiction for MRI.
- Patient not giving consent for the examination.
- All patients with hypersensitivity to contrast agents.

Technique:

Patient Preparation:

Before the scans were performed, history of any metallic implant into the body was enquired from the patient or attendants. The patient was asked to have nothing orally for at least 4 hours preceding the scan.

MRI evaluation:

MRI evaluation was carried out on a conventional MRI which is a SIEMENS TIMAVANTO 1.5T SCANNER. All the scans were done in supine or prone position using a surface coil/bedcoil with size of the coil dependent on the size and location of the lesion.

MRI protocol: The scenario and length of the examination were explained to the patient in understandable terms. Anxiolytic medications were used in claustrophobic patients. The patients were positioned as comfortably as possible to minimize movement artefacts. Patients were given the emergency call button. Required contrast study was performed, after obtaining written informed consent from the patient, a standard Gd DTPA-dimeglumine solution was injected IV in a dosage of 0.1 mmol per kilogram body weight as a bolus and was followed by a saline flush. MRI images were acquired in sagittal, coronal and axial planes. The size of the anatomic structures under consideration and the location or type of the suspected pathology determines the necessary FOV (field of view).

Sequences used for evaluation of the lesions were:-

- Axial T1W (TR, 450-600 msec; TE, 15-20 msec),
- Axial T2W (TR, 3000-4000 msec; TE, 80-100msec),
- Axial STIR (TR 4000 msec; TE,60msec)/T2FS
- Coronal, sagittal or oblique longitudinal T1W (TR, 450-600 msec; TE, 15-20 msec)
- Coronal, sagittal or oblique longitudinal Axial T2W(TR, 3000-4000 msec; TE, 80-100msec)
- Coronal, sagittal or oblique longitudinal STIR(TR 4000 msec;TE,60msec)/T2FS
- Axial nonenhanced fat-suppressed T1-weighted SE(700msec; TE, 15msec)
- Axial contrast enhanced fat-suppressed T1-weighted SE(700msec;TE, 15msec)
- Coronal, sagittal or oblique longitudinal fat-suppressed T1-weighted SE(700msec; TE, 15msec)
- T2*-weighted gradient-echo* (TR600 msec;TE 20msec; Flip Angle 15)

Histopathological/FNAC Evaluation:

Histopathological / FNAC evaluation was done in the Department of Pathology, Silchar Medical College and Hospital, Silchar, Assam. MRI diagnoses were compared with histopathological results.

RESULTS AND OBSERVATIONS:

The results of this study have been presented in tabular and some in pictorial representation under different headings and observations are summarized accordingly.

Table 1: Nature Of The Lesions

| NATURE OF THE LESION | NUMBER (n) | PERCENTAGE (%) |
|----------------------|------------|----------------|
| Benign | 44 | 73 |
| Malignant | 16 | 27 |
| Total | 60 | 100 |

NATURE OF THE LESIONS



Fig 1: Nature Of The Lesions

Benign lesions were far more common comprising 73% of all cases. Malignant tumors accounted for only 27% of cases.

Table 2: Soft Tissue Tumours Found In Our Study

| Sl.No | Tumour Types | No. of Cases | Percentage (%) |
|-------|--------------------------------------|--------------|----------------|
| 1 | Lipoma and variants | 14 | 3 |
| 2 | Haemangioma | 7 | 11.6 |
| 3 | Lymphangioma | 3 | 5 |
| 4 | Neurofibroma | 6 | 10 |
| 5 | Schwannoma | 4 | 7 |
| 6 | Glomus tumor | 2 | 3 |
| 7 | Nodular fasciitis | 1 | 2 |
| 8 | Desmoid fibromatosis | 1 | 2 |
| 9 | Tenosynovial giant cell tumor (GCT) | 5 | 8 |
| 10 | Fibroma of tendon sheath | 1 | 2 |
| 11 | Subcutaneous metastasis | 2 | 3 |
| 12 | Synovial sarcoma | 2 | 3 |
| 13 | Myxoid fibrosarcoma | 2 | 3 |
| 14 | Malignant PNST | 2 | 3 |
| 15 | Rhabdomyosarcoma | 2 | 3 |
| 16 | Liposarcoma | 3 | 5 |
| 17 | Undifferentiated pleomorphic sarcoma | 3 | 5 |

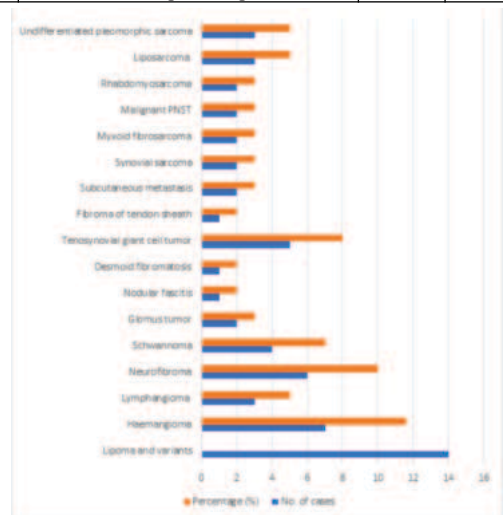


Fig 2: Distribution Of Soft Tissue Tumours Found In Our Study

Lipoma (23.3%) was the commonest soft tissue tumor in our study followed by haemangioma (11.6%) and neurofibroma (10%).

Table 3: MRI Signal Characteristics

| Image Sequence | Signal Intensity | Benign N (%) | Malignant N (%) | Total N (%) |
|----------------|-----------------------------|--------------|-----------------|-------------|
| T1 | Hypointense | 7 (15.9) | 3 (18.7) | 10 (16.6) |
| | Hyperintense | 14 (31.8) | 5 (31.2) | 19 (31.6) |
| | Isointense | 23 (52.3) | 8 (50) | 31 (51.6) |
| T2 | Hypointense | 0 (0) | 0 (0) | 0 (0) |
| | Homogenously Hyperintense | 25 (56.8) | 2 (12.6) | 27 (45) |
| | Heterogenously Hyperintense | 9 (20.4) | 11 (68.7) | 20(33.3) |
| | Isointense | 10 (16.6) | 3(18.7) | 13(21.7) |
| Post Contrast | Homogenous | 17 (38.6) | 5 (31.2) | 25 (41.7) |
| | Heterogenous | 12 (27.3) | 11 (68.8) | 20 (33.3) |
| | None | 15 (34.1) | 0(0) | 15 (25) |

Most tumors were hypointense on T1WI (51.6%), hyperintense on T2WI (78.3%). Majority (68.7%) of the malignant tumors were heterogeneously hyperintense on T2WI.

The chi square test for the association between other different intralesional MRI characteristics and malignancy in patients presenting with soft tissue tumors is found to be statistically significant in all the following parameters (p<0.05) presented below:

| Intralesional MRI characteristics | Sensitivity | Specificity | PPV | NPV |
|---|-------------|-------------|-------|-------|
| T2 Heterogenous Hyperintensity | 68.75% | 79.54% | 55 % | 87.5% |
| Post contrast heterogenous enhancement | 68.75% | 72.72 % | 47.8% | 86.4% |
| Margins | 91% | 75 % | 91% | 75% |
| Peritumoral edema | 91% | 77.2% | 58.3% | 94.4% |
| Intralesional necrosis | 81.25% | 75% | 54.2% | 91.6% |
| Neurovascular bundle involvement | 37.5% | 100% | 100% | 84.5% |
| Size of the lesion (> or =8 cm and <8 cm) | 75% | 84% | 63% | 90% |

The chi square test for the association between other different intralesional MRI characteristics and malignancy in patients presenting with soft tissue tumors is found to be statistically insignificant in all the following parameters (p>0.05) presented below:

| Intralesional MRI characteristics | Sensitivity | Specificity | PPV | NPV |
|-----------------------------------|-------------|-------------|------|------|
| Intralesional haemorrhage | 23 % | 76% | 75 % | 38% |
| Intralesional fat | 28% | 70 % | 54% | 26% |
| Intralesional calcification | 15% | 82 % | 57% | 42% |
| Capsule | 54.5 % | 75% | 50% | 37.5 |
| Osseous involvement | 30 % | 80 % | 78 % | 32 % |
| Multiplicity of lesions | 18 % | 68% | 45% | 35% |

Table 4: Accuracy Of MRI To Distinguish Benign And Malignant Lesions

| MRI Diagnosis | HPE | | Total | |
|---------------|----------------------|-------------------|-------|-------------|
| | Benign | Malignant | | |
| Benign | 42 | 2 | 44 | PPV = 95.4% |
| Malignant | 4 | 12 | 16 | NPV=75% |
| Total | 46 | 15 | 60 | |
| | Sensitivity = 91.3 % | Specificity= 80 % | | |

In our study sensitivity, specificity, PPV and NPV of MRI were 91.3%, 80%, 95.4% and 75% respectively.

DISCUSSION

In the present study, 60 patients with soft tissue tumors were evaluated with Magnetic Resonance Imaging.

In the present study, MRI to predict the malignancy showed higher sensitivity, specificity, PPV and NPV of MRI were 91.3%, 80%, 95.4% and 75% respectively. In correlation of MRI diagnosis with histopathological diagnosis, MRI had diagnosed 12 cases out of 16 malignant cases. Similarly, 42 cases were diagnosed as benign out of 46 benign cases.

Statistical analysis using chi square test revealed that the **T2 Heterogeneous Hyperintensity** is significantly associated with malignant lesions (p value<0.05). All these results were in consistent with the reported studies conducted by **Sen J et al and Datir A et al**. Study conduct by **Sen J et al**⁽⁶⁾ reported that 67% of sensitivity, 50% of specificity, 58% of PPV and 59% of NPV. Similarly, **Datir A et al**⁽⁷⁾ reported the sensitivity of 100% and specificity of 50% respectively.

Statistical Analysis revealed that the **post contrast heterogeneous enhancement** is significantly associated in predicting malignant lesions (p value<0.05). This was similar to study by **Alex D et al and Sen J et al**. **Alex D et al** reported also higher sensitivity of 100%, specificity of 70%, PPV of 86% and NPV of 79% respectively⁽⁸⁾ and **Sen J et al** reported of about sensitivity of 91%, specificity of 38%, PPV of 51% and NPV of 86% respectively in predicting malignancy⁽⁶⁾.

In our study statistical analysis using chi-square test showed that there is significant association between **size of the lesion** and the malignancy (p value>0.05) which was similar to the existing literature of **Berquist et al**⁽⁹⁾ and **Moulton et al**⁽¹⁰⁾ in which higher sensitivity, specificity, PPV and NPV was reported.

Statistical analysis using chi square test revealed that the **ill defined margin** is significantly associated in predicting malignant lesions (p value<0.05). This was similar to study by **Chen CK et al**⁽¹¹⁾, **Alex D et al**⁽⁸⁾, and **Datir A et al**⁽⁷⁾.

The chi-square test revealed that there is significant association among

neurovascular involvement in predicting malignancy (p value>0.05). **Crim JR et al**⁽¹²⁾ reported neurovascular bundle involvement in 4% benign and 18% malignant tumors. **Berquist et al** found neurovascular bundle involvement in 78% malignant tumors⁽⁹⁾. In the present study, **peritumoral edema** was more common in malignant lesions and showed higher sensitivity in predicting malignancy and the chi-square test revealed that there is significant association between peritumoral edema and malignancy (p value<0.05). This study findings was not much correlated with other studies.

Intralesional necrosis was seen more in malignant than in benign. Statistical analysis revealed that there is significant association with Intralesional necrosis and malignancy (p value>0.05). Studies conducted **Rijswijk CS et al**⁽¹³⁾ and **Schepper AM et al**⁽¹⁴⁾ reported higher specificity and PPV which was consistent with our present study.

In the present study, we found that intralesional fat and calcification to predict the malignancy were not significant factors in prediction of malignant lesions. Similar findings were also founded the study conducted by **Chen CK et al**⁽¹¹⁾.

Statistical analysis showed that the **osseous involvement** is not significantly associated with malignant lesions (p value>0.05). This was similar to study by **Chen CK et al**⁽¹¹⁾ in contrast to **Alex D et al**⁽⁸⁾.

Similarly, the same trend was observed in the intralesional hemorrhage also in predicting the malignancy. The analysis revealed that there is no significant association between them. **Kransdorf et al**⁽¹⁵⁾ opined that intratumoral hemorrhage is a rare finding, which can be observed in both benign and malignant lesions and is difficult to differentiate from nontumoral soft tissue hematoma. In a study by **Moulton et al**⁽¹⁰⁾ intratumoral hemorrhage was observed in 23 benign and in 5 malignant tumors among a total of 225 masses.

In our study Chi-square test revealed that there is no significant association between **capsule and malignancy** (p value >0.05) which was similar to the study conducted by **Bongartz et al**. **Bongartz et al**⁽¹⁶⁾ reported that aggressive sarcomas may have a pseudocapsule, whereas benign lesions, such as desmoid tumors 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.

Lipoma

Lipoma was the commonest soft tissue tumor in our study representing 23.3 % of all cases and 32 % of all the benign soft tissue tumors.

All the lesions in our study were well defined, and showed homogenous T1 and T2 hyperintensity, iso intense to subcutaneous fat. All the lesions showed homogenous suppression on fat suppressed images. (T2FS/STIR). **Bruce T. Rougraf, et al (1997)**⁽¹⁶⁾ and **Pang AK, et al (2000)**⁽¹⁷⁾ reported that benign lipomas show homogeneity on T1- and T2-weighted spin echo sequences and readily demonstrated full suppression at STIR images which related with our findings.

Murphey MD, et al (2004)⁽¹⁸⁾ reported that soft tissue tumors entirely consisting of adipose tissue and lacking contrast enhancement can be reliably diagnosed as lipomas using MR imaging which aligns with our findings.

Hemangioma

There were seven cases of hemangioma in our study, comprising 11.6 % of benign tumors.

Memis A, et al (1996)⁽¹⁹⁾ reported that on MRI hemangiomas showed intermediate or slightly high signal intensity on T1-weighted spin-echo images, and overall extremely bright signal on T2-weighted images. All hemangiomas in our study showed very bright signal on T2 weighted images and intermediate signal intensity on T1-weighted images.

Focal areas of fat signal intensity were found in 62.5% cases. Our findings correlated with those of **Jenner G, et al (1996)**⁽²⁰⁾ who found focal areas of fat signal intensity in 81.25% cases.

Lymphangioma

In our study there were 3 cases of lymphangioma. **EK Woo and SEJ**

Connor (2007)⁽²¹⁾ described that lymphangiomas typically appear on imaging as either a uniloculated or multiloculated cystic masses in the neck or face, with walls that insinuated between vessels and other normal structures. These observations were consistent with our study, where on MRI the lesions appeared multiloculated with imperceptible wall and insinuated between surrounding structures.

The lesions in our study had a hypointense signal on T1-weighted MR images and a hyperintense signal on T2-weighted MR images. **Eren, et al (2009)**⁽²²⁾ in their study reported a hypo- or hyperintense signal on T1-weighted MR images and a hyperintense signal on T2-weighted images in lymphangiomas.

Mittal, et al (2012)⁽²³⁾ described lymphangiomas as typically of low or intermediate signal intensity on T1-weighted images and hyperintense on T2-weighted images. Our findings correlated with both these studies.

In our study no contrast enhancement was noted in the lesion. Our finding collaborates with that of **Kern S, et al (2000)**⁽²⁴⁾ and **Yonetsu K, et al (1999)**⁽²⁵⁾ who reported similar findings.

Tenosynovial Giant Cell Tumor (GCT)

In our study there were five cases of GCT with age range from 11-40 years.

In our study the lesion was isointense to muscle on T1-weighted images and hyperintense to muscle but hypointense to fat on T2-weighted images.

Kitagawa Y, et al (2003)⁽²⁶⁾ reported that on MRI, the signal intensities of giant cell tumors of the tendon sheath (GCTTS) were consistently similar to those of skeletal muscle or fell between the intensities of muscle and fat on T1-weighted images. On T2-weighted images, the signal intensities typically ranged between those of muscle and fat. These observations were consistent with the results of our study.

In our study the lesion showed strong homogenous enhancement. Our findings correlated with those of **De Beuckeleer L et al (1997)**⁽²⁷⁾ who reported strong homogenous enhancement in GCTTS.

Nerve Sheath Tumors

In my study, together neurofibroma and schwannoma contributed to 22.7% of all benign tumors.

All lesions in our study were isointense on TIWI and 66.6% hyperintense on T2WI". Our findings correlated with those of **Cerofolini E, et al (1991)**⁽²⁸⁾ who found that 100% of neurofibromas were isointense to muscle on TIWI and all but one of the total 17 peripheral nerve sheath tumors were T2 hyperintense.

Neurofibroma

There were six cases of neurofibroma, and majority occurred in males and presented in the age group of 20-30 years.

67% of the lesions in our study showed increased peripheral signal intensity and decreased central signal intensity. Our findings correlated with those of **Suh JS, et al (1992)**⁽²⁹⁾ who found a target pattern of increased peripheral signal intensity and decreased central signal intensity in 70% of neurofibromas, while **Bhargava R, et al (1997)**⁽³⁰⁾ reported the pattern in 100% of neurofibromas.

100% in our study showed well-defined margins. Our findings correlated with those of **Ogose A, et al (1999)**⁽³¹⁾ who found that majority of benign nerve sheath tumors showed a smooth tumoral margin.

Jee WH, et al (2004)⁽³²⁾ found central enhancement in 75% of neurofibromas. In our study central enhancement was found in 50%.

Schwannoma

There were four cases of schwannoma in our study. On post contrast studies it showed diffuse homogenous enhancement. Our findings correlated with those of **Jee WH, et al (2004)**⁽³²⁾ who found diffuse enhancement in 67% of schwannomas.

Malignant Peripheral Nerve Sheath Tumors (mpnst)

In our study there was two cases of malignant peripheral nerve sheath

tumor which occurred in thigh region in a male patient.

The lesion was T1 and T2 heterointense with a well-defined capsule , internal cystic changes and perilesional edema with peripheral enhancement on post contrast study. These findings were similar to the study of **Wasa et al (2020)**⁽³³⁾ who reported that certain features like heterogeneity on T1-weighted images, presence of a peripheral enhanced pattern on gadolinium-enhanced T1-weighted images, presence of a perilesional edema-like zone and intratumoral cystic changes helped in differentiating malignant peripheral nerve sheath tumors from neurofibroma.

Glomus Tumor

We found two cases of glomus tumors in our study. One patient was a male in 5th decade and the other patient was a female in 3rd decade. The lesions in our study were T2/STIR hyperintense which correlated with the study conducted by **Patel et al(2022)**⁽³⁴⁾ where they found all the lesions to be isointense to hyperintense lesions on T2-weighted images and hyperintense on STIR imaging.

Nodular Fasciitis

We got 1case of nodular fasciitis in male patient of 27 years of age in the upper extremity. The lesion was T1 isointense and T2 hyperintense. These findings were similar to the study of **Wu et al (2020)**⁽³⁵⁾ where they found that , most of the lesions displayed a homogenous and isointense signal in T1WI, compared to skeletal muscle and exhibited T2 hyperintensity compared to the adjacent tissue. The margins of all the lesions were sharply defined.

Desmoid Fibromatosis

There was one case of desmoid fibromatosis in our study seen in a female patient of 3rd decade.

Kransdorf MJ, et al (1990)⁽³⁶⁾ stated that lesions were typically round to oval in configuration and on T1-weighted spin echo MR images, the predominant signal intensity was either isointense or minimally hyperintense when compared with skeletal muscle. This collaborates with our study where the lesions were oval in configuration and isointense to skeletal muscle on T1- weighted sequences.

Liu QY, et al (2008)⁽³⁷⁾ stated that 90% of lesions showed moderate or intense enhancement after gadolinium administration. The findings are comparable to our study where both lesions (100%) showed moderate to intense enhancement.

Quinn S Fet, al (1991)⁽³⁸⁾ stated that 53.8% of lesions had well defined margins. The findings matched our study where both lesions had well defined margins.

Rhabdomyosarcoma

In our study there were two cases of rhabdomyosarcoma one involving the hip, groin and buttocks and another involving the lower extremity. Age of presentation was first decade in both the cases.

All cases were heterogenous on both T1WI and T2WI with ill-defined margins and surrounding oedema and showed strong heterogeneous contrast enhancement. Our findings correlated with those of **Zhang ZH, et al (2007)**⁽³⁹⁾ who stated that Rhabdomyosarcomas showed heterogenous signal intensity on TIWI & T2WI (100%), showed strong and heterogeneous enhancement (100%) and 65% of them showed ill-defined margins and surrounding edema.

Liposarcoma

There were three cases of liposarcoma in our study, two of them presented in the lower extremity(thigh) and one in abdominal region. Two of the patients were males in their 5th and 6th decades and clinical presentation was a painful swelling.

A large component of the lesion was isointense to fat on all MRI sequences and showed thick septae (>2mm) and nodular foci hypointense to fat. Most of the lesion showed suppression on STIR/T2FS images, except the thick septae. According to **Murphy MD, et al (2005)**⁽⁴⁰⁾ liposarcomas frequently demonstrated a diagnostic appearance on magnetic resonance (MR) images, with a largely lipomatous mass and nonlipomatous components in thick septa or focal nodules which correlated with our findings.

On post contrast studies, the septae showed marked enhancement,

which correlated with the findings of **Hosono M, Kobayashi H, Fujimoto R, et al** ⁽⁴¹⁾ and **Ohguri T, Aoki T, Hisaoka M, et al (2003)** ⁽⁴²⁾ that septae of liposarcoma were thick and showed strong enhancement in 100% as opposed to lipoma.

Synovial Sarcoma

There were two cases of synovial sarcoma in our study which presented in a young male patient of age 22 years and 28 years as a painful swelling in the knee joint (lower extremity).

Our findings correlated with those of **Murphey MD, et al (2006)** ⁽⁴³⁾ who reported heterogenous contrast enhancement on post contrast MRI which was diffuse when majority of the tumor was viable. Heterogenous and diffuse enhancement was also seen in our study.

Additionally, the lesion appeared heterogeneous on T2-weighted images, aligning with, who reported heterogeneous high signal intensity on T2-weighted images in synovial sarcomas.

The lesion was more than 5cm in size and showed low signal intensity on T1-weighted images and heterogenous triple signal intensity on T2-weighted images consisting of areas of low, intermediate and high signal intensity. The findings matched those of **Mahajan H, et al (1989)** ⁽⁴⁴⁾ and **Cho et al (2023)** ⁽⁴⁵⁾ who found that most synovial sarcomas manifest as prominently heterogeneous, multilobulated soft-tissue masses, displaying SI similar to or slightly higher than that of muscle on T1-weighted images and predominantly bright SI on T2-weighted images. The findings also correlated with those of **Bakri Amit, et al (2012)** ⁽⁴⁶⁾ who stated that synovial sarcomas might exhibit “triple signal intensity” pattern.

Myxoid Fibrosarcoma

In our study there were two cases of myxoid fibrosarcoma. The lesion was T1 iso to heterointense and T2 heterointense with the myxoid component showing T1 hypointensity and T2 hyperintensity whereas areas with high cell density show low signal intensity on T2 and isointense to muscle on T1. This finding correlated to the study conducted by **Robert A Lefkowitz, et al (2013)**. ⁽⁴⁷⁾

The lesion exhibited poorly defined, infiltrative margins and perifascial edema, which aligns with the findings of **Kaya et al (2008)** ⁽⁴⁸⁾, who observed perifascial edema with infiltrative margins along the fascial planes in the majority of their cases.

Cutaneous and Subcutaneous metastases

There were two cases of cutaneous and subcutaneous metastases in our study. Both cases were males with the primary being stomach and lung carcinoma respectively. This was similar to the findings of **Sittart and Senise (2013)** ⁽⁴⁹⁾ where they found that the most frequent cutaneous metastases in men originated from the lung followed by the stomach.

On MRI, the lesions were homogenously enhancing on post contrast studies as described by **Juan et al (2014)**. ⁽⁵⁰⁾

Undifferentiated Pleomorphic Sarcoma

We found 3 cases of Undifferentiated Pleomorphic Sarcoma in our study. Two of them in males in the 5th and 6th decades and were located in the lower extremities. The third case was a female patient presenting with an enlarged swelling in the lower extremity with lung metastasis.

On MR T1WI, they appeared intermediate in signal intensity, similar to adjacent muscle and heterogeneously hyperintense on T2WI with areas of necrosis. The lesion was ill defined with internal areas of haemorrhage and calcification.

Case 1: Tendon Sheath Lipoma

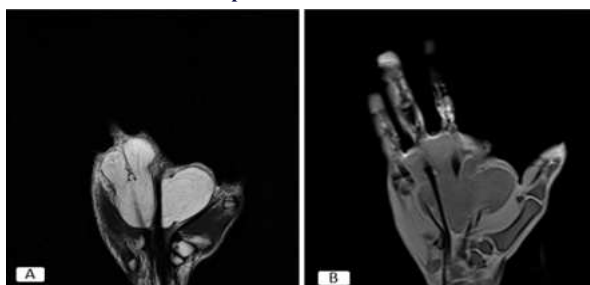


Fig 1: A 32 year old male patient presented with multiple swellings in right hand: (A) T2 coronal sections showing a well-defined lobulated T1/T2 hyperintense lesion in volar aspect of right hand involving thenar and mid palmar space with 360°encasement of flexor digitorum superficialis and profundus tendons of 4th and 5th digits (B) T1 FS coronal image showing suppression of the lesion.

Case 2: Fibrolipomatous Hamartoma Of Median Nerve



Fig 2 (A): Coronal T2WI on the left showing fusiform thickening of the median nerve (orange straight arrow) with serpiginous low intensity structures representing nerve fascicles and lipomatous tissue interdigitating between prominent fascicles with a “coaxial cable” like appearance.” (B)Coronal T1WI on the right showing macrodystrophy (blue straight arrow) of the index finger with fibrofatty soft tissue hypertrophy. (C) Coronal PDFS showing fat suppression. (D) Axial US scan showing enlarged and hypoechoic nerve fascicles surrounded by echogenic fat tissue giving cable-like appearance on transverse images and no vascularity on color Doppler study. (D) Axial US scan showing enlarged and hypoechoic nerve fascicles surrounded by echogenic fat tissue giving cable-like appearance on transverse images

Case 3: Synovial Haemangioma

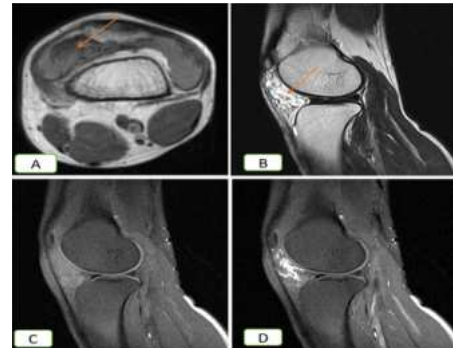


Fig 3 (A) displays a low signal on sagittal T1WI showing low signal (B) is high signal Sagittal T2WI showing hyperintense signal, with low-signal-intensity linear structures(orange arrows) within lesion representing most likely fibrous septa or vascular channels. Fig C is Sagittal T1FS precontrast showing suppression of fat component (D) Sagittal T1FS post contrast shows heterogenous enhancement.

Case 4: Rhabdomyosarcoma

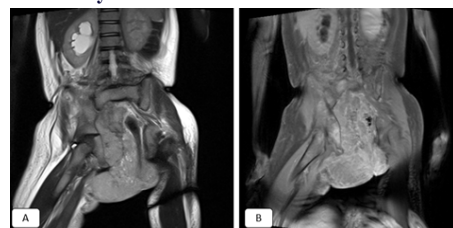


Fig 4: An eight year old boy of a case of Rhabdomyosarcoma presenting with progressively enlarging swelling in the buttocks and thigh region (A): Coronal T2WI showing heterogeneously hyperintense mass and (B)T1FS post contrast sequence showing heterogenous enhancement of the mass.

Case 5: Liposarcoma

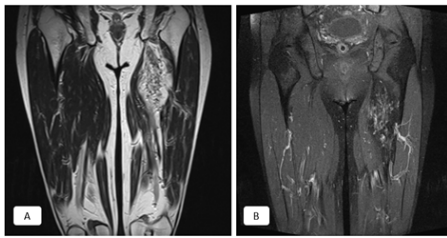


Fig 5: A case of liposarcoma in a 65 year old female who presented with a painful swelling in the left lower thigh. (A) Coronal T2WI on the right shows a partially defined T2 heterogeneously hyperintense mass occupying the anterior compartment of thigh (B) shows fat suppression of the fat component

CONCLUSION

Based on the present study, we conclude that Magnetic Resonance Imaging (MRI) offers several advantages, including determining the origin of lesions, defining their extent and relationship to adjacent structures, and assessing operability by identifying involvement of bone, neurovascular bundles, and joint spaces by soft tissue tumors. Therefore, MRI can be considered the preferred modality for evaluating soft tissue tumors, given its high sensitivity in detection. While MRI may provide a specific diagnosis for a limited number of tumors, it is important to note that it cannot fully differentiate between benign and malignant lesions. When radiologic findings are nonspecific, any lesion that lacks the characteristics of a benign entity should be presumed malignant until proven otherwise. Advanced MRI techniques, such as spectroscopy, perfusion, and diffusion-weighted imaging, may enhance soft tissue characterization. Referral for biopsy is recommended when there is reasonable suspicion of malignancy, for any superficial lesion greater than 5 cm, any deep lesion regardless of size, or in cases with indeterminate findings.

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