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CLINICORADIOLOGICAL AND HISTOPATHOLOGICAL CORRELATION OF SOFT-TISSUE TUMORS AROUND THE KNEE: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Soft-tissue tumors around the knee comprise a heterogeneous group of lesions with variable clinical, radiological, and histopathological characteristics. Accurate diagnosis is important for appropriate management.

Objective: To evaluate the clinicoradiological profile of soft-tissue tumors around the knee and determine their correlation with histopathological diagnosis.

Methods: This cross-sectional study included 60 patients with soft-tissue tumors around the knee who underwent clinical evaluation, magnetic resonance imaging (MRI), and histopathological examination. Radiological findings were compared with the final histopathological diagnosis.

Results: Of 60 patients, 37 (61.7%) had benign and 23 (38.3%) had malignant tumors. MRI correctly classified 51 of 60 lesions as benign or malignant, while 6 lesions were considered indeterminate. The overall observed agreement between MRI classification and histopathology was 85.0%.

Conclusion: MRI demonstrated good clinicopathological correlation and was useful for characterizing soft-tissue tumors around the knee. Histopathological examination remained essential for definitive diagnosis.

Keywords: Soft-tissue tumor, knee, MRI, histopathology, sarcoma, radiological correlation

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INTRODUCTION

Soft-tissue tumors represent a diverse group of neoplasms with markedly different biological behavior and histological differentiation. Their classification has evolved considerably with advances in morphology, immunohistochemistry, and molecular genetics. The 2020 World Health Organization classification incorporated several newly recognized entities and molecular alterations that have improved diagnostic precision [1,2].

The knee is an important anatomical region for the evaluation of soft-tissue masses because lesions may arise in subcutaneous tissue, muscles, tendon-related structures, fascial planes, or periarticular soft tissues. Magnetic resonance imaging (MRI) provides excellent soft-tissue contrast and is particularly useful for determining tumor location, size, internal composition, local extension, and relationship with neurovascular structures and the joint [3,4].

Although certain MRI characteristics may suggest benignity or aggressive behavior, considerable overlap exists between different soft-tissue tumors. Large size, deep location, heterogeneous signal intensity, necrosis, and infiltrative margins may raise suspicion for malignancy, but these findings cannot reliably establish the exact histological diagnosis [5]. Histopathological examination therefore remains the definitive method for tumor classification, with immunohistochemistry and molecular testing providing additional diagnostic support in selected cases [1,2].

Clinicoradiological correlation with histopathology is consequently important for improving diagnostic confidence and treatment planning. The present study was undertaken to evaluate the clinical and MRI characteristics of soft-tissue tumors around the knee and determine their correlation with histopathological findings.

MATERIALS AND METHODS

This cross-sectional observational study was conducted in a tertiary-care hospital involving the Departments of Radiodiagnosis, Orthopaedics, and Pathology. The study included patients with clinically suspected or radiologically detected soft-tissue tumors around the knee. A total of 60 patients were evaluated.

Clinical Evaluation

Patients were evaluated for age, sex, duration of symptoms, presenting complaints, site of swelling, pain, increase in lesion size, and restriction of joint movement. On physical

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examination, the lesion was assessed for size, consistency, tenderness, mobility, and its relationship with adjacent structures.

Radiological Evaluation

MRI of the knee and surrounding soft tissues was performed using standard multiplanar sequences. Lesions were assessed for anatomical location, size, margins, signal characteristics, internal heterogeneity, hemorrhage, necrosis, contrast enhancement, involvement of adjacent muscles, neurovascular structures, and joint extension.

Based on the clinical and MRI findings, lesions were categorized as benign, indeterminate, or malignant. The radiological assessment was subsequently compared with the final histopathological diagnosis.

Histopathological Evaluation

Tissue diagnosis was obtained by core needle biopsy or excision biopsy according to the clinical and radiological characteristics of the lesion. Histopathological examination was performed using routine hematoxylin and eosin staining. Immunohistochemistry was performed when required for definitive tumor classification.

Inclusion Criteria

- Patients with a soft-tissue tumor located around the knee.
- Patients who underwent MRI evaluation.
- Patients with histopathological confirmation of the lesion.
- Patients with adequate clinical and radiological records.

Exclusion Criteria

- Patients with inadequate imaging or histopathological material.
- Previously treated or recurrent tumors without adequate pretreatment imaging.
- Tumor-like lesions without histopathological confirmation.
- Patients with incomplete clinical records.

Statistical Analysis

Categorical variables were expressed as frequency and percentage, while continuous variables were summarized as mean ± standard deviation. Agreement between MRI classification and

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histopathological diagnosis was assessed using the kappa statistic. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 60 patients with soft-tissue tumors around the knee were included in the study. The mean age of the study population was approximately 42 years, with a slight male predominance. Benign tumors were more frequent than malignant tumors. The clinical characteristics, histopathological spectrum, and MRI–histopathological correlation are presented below.

Table 1: Demographic and Clinical Characteristics of the Study Population (n=60)

Characteristic		Number (n)	Percentage (%)
Age group	≤20 years	8	13.3%
	21–40 years	21	35.0%
	41–60 years	19	31.7%
	>60 years	12	20.0%
Sex	Male	34	56.7%
	Female	26	43.3%
Presenting complaint	Painless swelling	29	48.3%
	Painful swelling	20	33.3%
	Pain with restricted movement	7	11.7%
	Other symptoms	4	6.7%
Duration of symptoms	<3 months	17	28.3%
	3–6 months	21	35.0%
	>6 months	22	36.7%

The largest proportion of patients belonged to the 21–40-year age group (35.0%), followed by the 41–60-year group (31.7%). Males constituted 56.7% of the study population. Painless swelling was the most common presenting complaint, reported in 48.3% of cases.

Table 2: Histopathological Spectrum of Soft-Tissue Tumors Around the Knee (n=60)

Histopathological diagnosis		Number (n)	Percentage (%)
Benign tumors	Lipoma	10	16.7%
	Schwannoma|	6	10.0%

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	Giant cell tumor of tendon sheath	6	10.0%
	Fibroma	4	6.7%
	Hemangioma/vascular tumor	4	6.7%
	Other benign peripheral nerve sheath tumor	3	5.0%
	Myxoma	2	3.3%
	Angiomyoma	2	3.3%
Malignant tumors	Synovial sarcoma	7	11.7%
	Undifferentiated pleomorphic sarcoma	5	8.3%
	Myxofibrosarcoma	4	6.7%
	Liposarcoma	3	5.0%
	Leiomyosarcoma	2	3.3%
	Rhabdomyosarcoma	1	1.7%
	Malignant peripheral nerve sheath tumor	1	1.7%

Benign tumors accounted for 61.7% of all lesions, while malignant tumors accounted for 38.3%. Lipoma was the most common individual tumor, representing 16.7% of all cases. Among malignant tumors, synovial sarcoma was the most frequent histological diagnosis (11.7%).

Table 3: Correlation Between MRI-Based Tumor Characterization and Histopathology

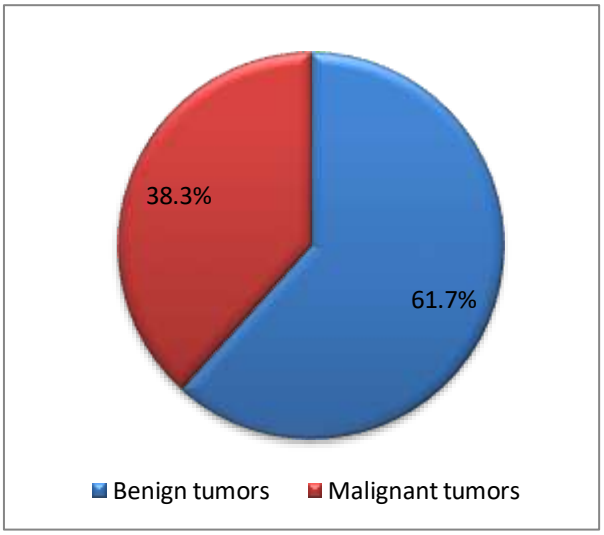
MRI characterization	Histopathology benign	Histopathology malignant	Total
Benign	33	2	35
Indeterminate	3	3	6
Malignant	1	18	19
Total	37	23	60

MRI categorized most histologically malignant lesions as malignant, with 18 of 23 malignant tumors correctly identified. Among benign lesions, 33 of 37 were categorized as benign. Overall,

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51 of 60 lesions were correctly classified as either benign or malignant on MRI, corresponding to an observed agreement of 85.0% with histopathology. Six lesions were considered indeterminate on MRI.

Figure 1: Distribution of Benign and Malignant Soft-Tissue Tumors Around the Knee



Benign tumors were more common than malignant tumors, accounting for nearly two-thirds of the study population.

DISCUSSION

Soft-tissue tumors around the knee comprise a heterogeneous group of lesions with different biological behavior and histological characteristics. In the present study, benign tumors constituted 61.7% of cases, while malignant tumors accounted for 38.3%. The predominance of benign lesions highlights the broad differential diagnosis of soft-tissue masses encountered in clinical practice, although suspicious clinical or imaging findings warrant further evaluation [6]. MRI is central to the evaluation of soft-tissue tumors because of its superior soft-tissue contrast and ability to demonstrate lesion extent, compartmental involvement, and relationships with adjacent muscles, neurovascular structures, and the joint. Radiologic-pathologic correlation is particularly important in sarcomas because imaging findings can vary considerably among histological subtypes [6]. Recent MRI-pathology studies have further demonstrated associations between quantitative diffusion parameters and pathological markers such as Ki-67, supporting the potential value of advanced MRI techniques in biological characterization [7].

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In the present study, MRI correctly classified 51 of 60 lesions as benign or malignant, giving an observed agreement of 85.0% with histopathology. This finding supports the usefulness of MRI for initial characterization of soft-tissue tumors around the knee. However, six lesions were considered indeterminate on MRI, highlighting the potential overlap in imaging appearances and the importance of histopathological confirmation. Imaging features such as lesion heterogeneity, necrotic components, and peritumoral abnormalities may provide useful information regarding tumor behavior, but they do not consistently establish the definitive histological diagnosis [8,9].

Advanced imaging may provide additional information regarding tumor biology. DCE-MRI parameters have demonstrated associations with histological grade and pathological characteristics, suggesting that functional imaging can complement conventional morphological assessment [10]. Nevertheless, these techniques remain adjunctive, and tissue diagnosis continues to be essential when definitive tumor classification is required.

The importance of standardized imaging assessment has been emphasized in recent European Society of Musculoskeletal Radiology recommendations, which provide updated algorithms for the characterization and staging of soft-tissue tumors [11]. Current sarcoma guidelines also emphasize appropriate imaging followed by tissue biopsy and management within specialized multidisciplinary teams. Such an approach helps integrate radiological, pathological, surgical, and oncological information for treatment planning [12].

In our study, synovial sarcoma was the most frequent malignant tumor. The variable imaging appearance of soft-tissue sarcomas makes histopathological confirmation particularly important in lesions with atypical or aggressive features. The combination of MRI and pathological assessment therefore provides a more reliable diagnostic pathway than either modality alone.

The study has limitations, including the relatively small sample size and single-center design. The frequency of individual tumor subtypes may also vary among institutions. Larger multicentric studies incorporating standardized MRI protocols and advanced imaging parameters may provide stronger evidence regarding radiological-pathological correlation.

CONCLUSION

Soft-tissue tumors around the knee show a broad clinicoradiological and histopathological spectrum, with benign lesions being more frequent than malignant tumors. MRI demonstrated substantial agreement with histopathology in differentiating benign from malignant lesions and

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provided useful information regarding tumor extent and local involvement. However, overlap in imaging characteristics may occur, particularly among aggressive or histologically diverse lesions. Histopathological examination therefore remains essential for definitive diagnosis. A combined clinicoradiological and histopathological approach can improve diagnostic accuracy and assist in appropriate treatment planning.

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