Original article

Clinical and histopathological characteristics of soft tissue tumours at Hue University of Medicine and Pharmacy Hospital

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Received: 20/01/2026; **Accepted:** 10/04/2026; **Published:** .30/04/2026
DOI: 10.34071/jmp.2026.2.921

Abstract

Background: Soft tissue tumours represent a relatively common and heterogeneous group of lesions characterized by diverse yet nonspecific clinical manifestations. Although histopathology remains the diagnostic gold standard, the application of advanced techniques such as immunohistochemistry is indispensable to ensure the accurate diagnosis with the latest WHO classification.

Objectives: 1) To describe some clinical characteristics and the histopathological classification of soft tissue tumours; 2) To evaluate the expression of some immunohistochemical markers in the diagnosis and classification of difficult cases of soft tissue tumours.

Materials and methods: A cross-sectional study was conducted on 166 patients diagnosed with soft tissue tumours between 09/2025 and 01/2026 at Hue University of Medicine and Pharmacy Hospital.

Results: Malignant soft tissue tumours accounted for 21.1% of cases. The majority presented with a single lesion (91.6%), most commonly located in the superficial trunk (34.4%). Tumours smaller than 5 cm comprised 68.1% of cases. Adipocytic tumours were the most frequent (42.8%). Lipoma and hemangioma were predominant in the benign group (53.4% and 15.5%), fibrohistiocytoma in the borderline group (61.5%), and fibrosarcoma in the malignant group (22.7%). Immunohistochemistry revealed the expression of characteristic markers that supported the diagnostic classification, Vimentin (+) 100%, Desmine (+) 5/5 cases and SMA (+) 3/5 cases for smooth tumours, CD68 (+) 100% for fibrohistiocytic tumours, CD34 (+) for vascular and the other tumours.

Conclusion: Malignant soft tissue tumours accounted for 21.1% of cases. Besides histopathology, immunohistochemistry revealed the expression of characteristic markers that supported the key role for the classification of tumour types.

Keywords: *soft tissue tumours, histopathology, clinical characteristics, immunohistochemistry*

1. INTRODUCTION

Soft tissue tumours (STTs) are a group of lesions that are relatively common in clinical practice. They arise from extraosseous, non-epithelial tissues, predominantly of mesenchymal origin, including adipose tissue, fibrous tissue, muscle, and peripheral nerve sheaths [1]. The majority of STTs are benign, with an estimated annual incidence of approximately 3,000 cases per one million population. In contrast, malignant STTs are relatively rare, with an incidence of about 50 cases per one million population per year, accounting for less than 1% of all cancers throughout the body [2], [3].

The clinical presentation of STTs is highly variable. Lesions may be completely asymptomatic and incidentally detected through imaging modalities, or they may present with symptoms related to mass effect, local compression, or systemic manifestations. Certain clinical features - such as radiating pain, lesion color, growth rate, consistency, mobility, and the degree of demarcation - may suggest the nature of the tumour and the risk of malignancy. However, these features are generally nonspecific and lack diagnostic accuracy [4]. Consequently, histopathological examination remains the gold standard for the diagnosis of STTs.

However, even for pathologists, establishing a definitive diagnosis of STTs remains a significant challenge due to the overlapping histomorphological features among different tumour types as depending on only the histopathology. So the use of advanced diagnostic techniques to achieve accurate diagnoses for patients, one of which is immunohistochemistry (IHC) enables to determine the origin of differentiation of the tumour cells.

Based on the origin of differentiation and an improved understanding of the molecular biological mechanisms underlying tumourigenesis, the World Health Organization (WHO) has introduced updates in the latest classification of STTs (5th edition, published

in 2022). These updates include the introduction of new tumour entities, new classification groups, novel genetic alterations, and prognostic markers. Concurrently, several previously used terms such as malignant fibrous histiocytoma and perivascular cell tumours have been discontinued [5].

In Vietnam, there are very few studies that have comprehensively classified STTs according to the latest WHO classification, and almost no authors have evaluated the expression of immunohistochemical markers in the diagnosis of STTs. Therefore, we conducted this study with two objectives:

1. To describe some clinical characteristics and the histopathological classification of soft tissue tumours.

2. To evaluate the expression of some immunohistochemical markers in the diagnosis and classification of dificult cases of soft tissue tumours.

2. MATERIALS AND METHODS

2.1. Participants

- Patients with STTs were diagnosed and treated at Hue University of Medicine and Pharmacy Hospital during the period from September 2025 to January 2026.

2.1.1. Sample selection criteria

- Patients with STTs who had undergone surgery or biopsy and had a histopathological diagnosis based on H&E staining and/or IHC in dificult cases (cell orgirin, benign or malignant…).

- Patients who consented to participate in the study.

2.1.2. Exclusion criteria

- Soft tissue lesions that were metastases or direct invasions from other organs.

- Patients who had previous surgery, chemotherapy, or radiotherapy.

2.2. Study method

2.2.1. Study design: A descriptive cross-sectional method was applied.

2.2.2. Place and time: At Hue University of Medicine and Pharmacy Hospital during the period from September 2025 to January 2026.

2.2.3. Study sample size: 166 patients satisfied the selection criteria based on the convenience sampling method.

2.2.4. Study techniques and variables:

- H&E staining was performed according to the protocols recommended by the Ministry of Health of Vietnam.

- IHC was performed using the BenchMark GX automated system from Ventana. Using basically the penal of markers following: Vimentin, Desmin, SMA, S100, CD34, CD68 and some other markers according to the cases needed such as CD117, HMB45, DOG1.1… Positve when the tumour cell (membrane, cytoplasm or nucleus) painted with brown colour according to each marker.

- The Results were concluded by at lest 2 sugical pathologists of Pathology Department of Hospital of Hue UMP

- Histopathological classification of STTs was based on the WHO 5th edition classification, published in 2022, which divides tumours into 12 main groups [5].

1. ADIPOCYTIC TUMOURS
2. FIBROBLASTIC AND MYOFIBROBLASTIC TUMOURS
3. VASCULAR TUMOUR
4. SO-CALLED FIBROHISTIOCYTIC TUMOURS
5. PERICYTIC (PERIVASCULAR) TUMOURS
6. SMOOTH MUSCLE TUMOURS
7. SKELETAL MUSCLE TUMOURS
8. GASTROINTESTINAL STROMAL TUMOUR (GIST)
9. CHONDRO-OSSEOUS TUMOURS
10. PERIPHERAL NERVE SHEATH TUMOURS
11. TUMOURS OF UNCERTAIN DIFFERENTIATION
12. UNDIFFERENTIATED SMALL ROUND CELL SARCOMAS OF BONE AND SOFT TISSUE

2.2.5. Data collection method

- Data were collected using a data collection form, with reference to medical records when necessary.

2.3. Data processing and analysis

- Data processing and analysis were performed using Microsoft Excel (Office 365) and SPSS version 20.0. Qualitative variables were presented as frequencies and percentages, while quantitative variables were expressed as mean ± standard deviation.

- Chi-square test was used for qualitative variables, independent two-sample t-test for normally distributed quantitative variables, and Mann-Whitney test for non-normally distributed quantitative variables.

- Differences were considered statistically significant at $p < 0.05$.

2.4. Study ethics

- The study will be conducted only after approval by the Research Ethics Committee and obtaining permission to carry out the research. All data will be collected with the patients' consent, kept confidential, and used solely for research purposes.

3. RESULTS

Table 1. Clinical characteristics

Characteristics		Malignant soft tissue tumours (n1,%)	Benign soft tissue tumours (n2,%)	Total (n,%)	P
Number of lesions	Single	32 (91.4)	120 (91.6)	152 (91.6)	> 0.05
	Multiple	3 (8.6)	11 (8.4)	14 (8.4)	
Location	Hand	3 (8.6)	27 (20.6)	30 (18.1)	> 0.05
	Foot	10 (28.6)	23 (17.6)	33 (19.9)	
	Superficial trunk	12 (34.3)	45 (34.4)	57 (34.3)	
	Retroperitoneum	5 (14.3)	3 (2.3)	8 (4.8)	
	Head and neck	4 (11.4)	33 (25.2)	37 (22.3)	
	Thoracic cavity	0 (0.0)	0 (0.0)	0 (0.0)	
	Abdominal cavity	1 (2.9)	0 (0.0)	1 (0.6)	
Size	< 5 cm	22 (62.9)	91 (69.5)	113 (68.1)	> 0.05
	≥ 5 cm	13 (37.1)	40 (30.5)	53 (31.9)	
	Mean (X ± SD)	4.5 ± 4.2	4.4 ± 3.8	4.4 ± 3.9	> 0.05

Most patients had a single tumour (91.6%). The superficial trunk was the most common site (34.3%), while the limbs and head/neck each accounted for about 20%, and other locations such as the thoracic cavity, abdominal cavity, and retroperitoneum were less frequent. Most tumours were smaller than 5 cm. There was no significant association between tumour number, location, or size and malignancy risk ($p < 0.05$).

Table 2. Histopathological characteristics by tissue origin

Histological origin	H.E Staining (n1,%)	IHC Staining (n2, %)
Adipocytic tumours	71 (42.8)	0 (0.0)
Fibroblastic/ myofibroblastic tumours	25 (15.1)	9 (36.0)
Vascular tumours	29 (17.5)	1 (4.0)
So-called fibrohistiocytic tumours	17 (10.2)	5 (20.0)
Pericytic (perivascular) tumours	0 (0.0)	0 (0.0)
Smooth muscle tumours	5 (3.0)	5 (20.0)
Skeletal muscle tumours	0 (0.0)	1 (4.0)
GIST	1 (0.6)	3 (12.0)
Chondro-osseous tumours	0 (0.0)	0 (0.0)
Peripheral nerve sheath tumours	12 (7.2)	0 (0.0)
Tumours of uncertain differentiation	5 (3.0)	0 (0.0)
Undifferentiated small round cell sarcomas	1 (0.6)	1 (4.0)
Total	166 (100%)	25 (100%)

On H&E-stained sections, adipocytic tumours were the most common (42.8%), followed by fibroblastic/ myofibroblastic tumours, and vascular tumours (15.1% and 17.5%, respectively). Among the 25 cases stained with IHC, fibroblastic/myofibroblastic tumours were most frequent (36.0%), followed by fibrohistiocytic and smooth muscle tumours (20.0%).

Table 3. Histopathological characteristics by tumour type

Histopathological type	H.E Staining		IHC Staining	
	n1	%	n2	%
Benign	**131**	**78.9**	**4**	**16.0**
Lipoma	70	53.4		
Haemangiomas	20	15.3		
Schwannoma	7	5.3		
Tenosynovial giant cell tumour	6	4.6	-	
Neurofibroma	5	3.8		
Arteriovenous malformation	5	3.8		
Fibroma	4	3.1	1	4.0
Dermatofibroma	4	3.1		
Nodular fasciitis	3	2.3	-	
Lymphangioma	2	1.5		
Angiofibroma	2	1.6	2	8.0
Leiomyoma	1	0.8	1	4.0
Myxofibroma	1	0.8		
Fibrohistiocytic tumour	1	0.8	-	
Borderline	**13**	**7.8**	**3**	**12.0**
Borderline fibrohistiocytic tumour	8	61.5	2	8.0
Inflammatory myofibroblastic tumour	4	30.8	-	
Borderline leiomyoma	1	7.7	1	4,0
Malignant	**22**	**13.3**	**18**	**72.0**
Fibrosarcoma	5	22.7	3	12.0
Dermatofibrosarcoma protuberans	3	13.6	2	8.0
Leiomyosarcoma	3	13.6	2	8.0
Undifferentiated sarcoma	2	9.1	2	8.0
Small round cell sarcoma	1	4.5	1	4.0
Epithelioid sarcoma	1	4.5	1	4.0
Clear cell sarcoma	1	4.5		
Synovial sarcoma	1	4.5	-	
Myxofibrosarcoma	1	4.5		
Low-grade fibromyxoid sarcoma	1	4.5	1	4.0
GIST	1	4.5	3	12.0
Liposarcoma	1	4.5	-	
Angiosarcoma	1	4.5	1	4.0
Rhabdomyosarcoma	0	0.0	1	4.0
Giant cell sarcoma	0	0.0	1	4.0

Regarding histopathological subtypes, H&E-stained sections showed that among benign tumours, lipomas and vascular tumours predominated, accounting for 90% of cases. Borderline tumours were most frequently fibrohistiocytic tumour 61.5%) and inflammatory myofibroblastic tumours (30.8%), while malignant tumours were most commonly fibrosarcoma, dermatofibrosarcoma protuberans, and leiomyosarcoma. In IHC, the distribution of subtypes was relatively similar, with fibrosarcoma being the most frequent at 12.0%.

Table 4. Immunohistochemical expression in soft tissue tumours

Marker \ Tissue origin	Fibroblastic/ myofibroblastic tumours	Vascular tumours	Fibrohistiocytic tumours	Smooth muscle tumours	Skeletal muscle tumours	Gastrointestinal stromal tumour	Undifferentiated small round cell tumours
Vimentin	9/9	1/1	5/5	5/5	1/1	3/3	1/1
S100	0/9	0/1	0/4	0/5	0/1	0/3	0/1
SMA	0/7		0/2	3/5	0/1	0/3	
Desmin	0/6	0/1	0/3	5/5		0/3	0/1
CD34	3/9	1/1	2/4	0/4	0/1	2/3	
CD117			0/2	0/4	0/1	2/3	
DOG-1				0/1		0/1	
CD99	¼		0/1	0/1	0/1		1/1
BCl-2	1/1		2/2		1/1		
CD68	2/5	0/1	5/5	1/2	0/1		
HMB45				0/1			0/1
AE1/3	0/1		0/2	1/1		0/1	0/1
LCA							0/1
ChromograninA							0/1
CK19			0/1				
CD10			1/1	0/1			

In IHC, Vimentin was positive in all STTs. Desmin was positive in 5/5 cases, and SMA was positive in 3/5 cases of smooth muscle tumours. CD34 was expressed in tumours of various histological origins, while CD68 was positive in all 5/5 fibrohistiocytic tumours. CD117 and DOG-1 showed heterogeneous expression in GIST. Other markers used in STTs include LCA, AE1/3, HMB45, and others.

4. DISCUSSION

4.1. Some clinical characteristics

In our study, 91.6% of patients presented with a single tumour, with only 14 cases having multiple tumours. Patients with multiple STTs are often associated with genetic abnormalities or familial syndromes, such as neurofibromatosis type 1, Li-Fraumeni syndrome, familial multiple lipomatosis, or congenital myofibromatosis [8]. In our cohort, a few patients had multiple lipomas or neurofibromas, consistent with the epidemiological distribution of these conditions.

Regarding the anatomical distribution of STTs, in our study, apart from the abdominal cavity, thoracic cavity, and retroperitoneum, which had low frequencies, other sites—including limbs, trunk, and head/neck—accounted for roughly 20 - 30%, with the highest frequency in the superficial trunk. This pattern was similar in both benign and malignant tumour groups. Studies by Felix G. Gassert (2021) and Zhixun Yang (2019) reported that in both benign and malignant STTs, the limb region was more commonly affected than other sites [6], [10]. The aforementioned studies were conducted on large sample sizes, ranging from over 1,000 to several tens of thousands of patients, whereas our study involved a smaller sample, which may account for the differences observed between the studies.

Most patients had STTs smaller than 5 cm (68.1%), with similar distributions in both benign and malignant groups. The 5 cm threshold is commonly used in studies to assess prognosis. Many studies have shown that patients with tumours smaller than

5 cm have a better prognosis and longer survival compared to larger sarcoma tumours [11]. Currently, with improved diagnostic tools and greater patient awareness, tumours are often detected early, when their size is still relatively small. However, in our study, some patients had large tumours up to 16 cm, mostly lipomas, which had minimal impact on function or were located in less easily detected areas, such as the retroperitoneum.

4.2. Histopathological characteristics

Based on tumour histogenesis, our study found that adipocytic tumours predominated (42.8%), followed by fibroblastic, myofibroblastic, and vascular tumours (15.1% and 17.5%). Tumours of nerve sheath and fibrohistiocytic origin accounted for 7.2% and 10.2%, respectively, while other tumour types were less common. These findings are consistent with previous studies by Hoang Mai Anh (2025), Hena PS (2017), and AH Agravat (2010) [12], [14], [15]. The histopathological classification of STTs according to WHO 2022 showed that among benign tumours, lipomas were the most common (53.4%), followed by vascular tumours (15.5%) and schwannomas (5.3%). These results are consistent with studies by Agravat AH (2010), Kim DH (2005), and MJ Kransdorf, who analyzed a very large cohort of over 30,000 STTs [16], [14], [8]. Among borderline STTs, our study identified borderline fibrohistiocytic tumours, inflammatory myofibroblastic tumours, and borderline smooth muscle tumours, accounting for 61.5%, 30.8%, and 7.7%, respectively. According to WHO, borderline tumours are currently classified into two groups: locally aggressive and rarely metastasizing [5]. These lesions, as defined in the classification, have the potential for local recurrence, invasive growth, and tissue destruction, or rarely metastasis (usually to lymph nodes or lungs, <2%). Surgeons should be aware of these diagnoses to perform wide excision and ensure close follow-up during treatment. In our study of 22 sarcoma cases, fibrosarcoma was the most common subtype (22.7%), followed by dermatofibrosarcoma protuberans (13.6%), leiomyosarcoma (13.6%), and fibrohistiocytic sarcoma – currently was defined as undifferentiated sarcoma (9.1%), with other subtypes represented by a single case each. These findings are similar to the study by Hoang Duc Tien (2024), but differ from studies by Yusuf Ibrahim (2013) and Emily Jonczak (2024), which reported liposarcoma as one of the most frequent soft tissue sarcomas, accounting for 13–20% of cases [17], [18]. In contrast, a large epidemiological study by Zhang L on over 1,000 soft tissue sarcoma patients reported that undifferentiated pleomorphic sarcoma was the most common histological subtype (24.0%), followed by leiomyosarcoma (12.3%), while fibrosarcoma accounted for only 1.3% [19]. This discrepancy is likely related to the study population and sample size. Our study included a limited number of soft tissue sarcomas, which may not fully reflect the distribution of histological subtypes in the population. Larger epidemiological studies are needed for further assessment.

Although histopathology remains the diagnostic gold standard, the application of advanced techniques such as immunohistochemistry is indispensable to ensure the accurate diagnosis in the controversial cases as cell origins, benign, bordeline or malignant…

4.3. Immunohistochemical characteristics

In our study, 25 patients required IHC for postoperative histopathological subtyping. Among these, 72% were diagnosed with sarcoma, 12% with borderline tumours, and 16% with benign tumours. Consistent with H&E staining, fibrosarcoma was the most common subtype, along with GIST at 12.0%, followed by dermatofibrosarcoma protuberans, undifferentiated sarcoma, and leiomyosarcoma (8.0%). As previously mentioned, morphological overlap among tumours of different differentiation origins poses challenges for pathologists, making the use of advanced techniques such as IHC essential for accurate histological subtyping. Our study of these 25 patients demonstrated that a wide range of IHC markers is applied in STTs diagnosis, and marker expression varies among different tumour groups.

Vimentin, an intermediate filament protein, is a marker indicating the mesenchymal origin of a tumour [20]. As previously defined, STTs arise from non-epithelial, extra-skeletal tissues (primarily mesenchymal). Accordingly, our study showed 100% of STTs were Vimentin-positive, demonstrating its consistent expression. This marker is essential, particularly when histological features are insufficient to distinguish mesenchymal differentiation from lymphoma, melanoma, or epithelial tumours.

S100 is a calcium-binding protein of the S100 family that helps identify the neural crest origin or neural differentiation of tumours [20]. In STTs, S100 can be expressed in peripheral nerve sheath tumours, adipocytic tumours, or melanocytic sarcomas (clear cell sarcoma). In our study, S100 staining was performed in 24 of 25 cases, but none were positive.

Desmin and SMA are commonly used markers to identify muscle differentiation in STTs. While

Desmin, an intermediate filament protein, is characteristic of both skeletal and smooth muscle, SMA is expressed only in smooth muscle or certain myofibroblastic cells [20]. The combined use of Desmin and SMA helps accurately determine the muscle differentiation of suspected tumours. In our study, these markers were positive only in tumours of smooth muscle origin, with Desmin positive in 5/5 cases and SMA positive in 3/5 cases.

CD34, a membrane glycoprotein, is used to identify the mesenchymal or vascular origin of tumours. Additionally, CD34 aids in the differential diagnosis of certain tumour groups, such as dermatofibrosarcoma protuberans and benign dermatofibroma. It is also commonly used to detect GISTs, with approximately 70% of cases being CD34-positive [20]. In our study, 3 of 9 fibroblastic/myofibroblastic tumours were CD34-positive, and 2 of 3 GIST cases showed CD34 positivity.

CD117 and DOG-1 are key markers in the diagnosis of GISTs. CD117 is mainly expressed in interstitial cells of Cajal in the gut and in some hematopoietic-derived cells. It is positive in over 90% of GIST cases and is considered a classic diagnostic marker. However, in CD117-negative cases, DOG-1 has been shown to increase diagnostic sensitivity to over 95% when combined with CD117 [20]. In our study, 2 of 3 GIST cases were CD117-positive. The CD117-negative case was subsequently stained for DOG-1 but remained negative. CD117 was not expressed in other tumour groups.

CD99, a cell membrane glycoprotein, is used to identify lesions in the small round cell tumour group, being positive in approximately 90% of Ewing sarcomas. It helps differentiate these tumours from morphologically similar lesions, such as rhabdomyosarcoma, neuroblastoma, or lymphoma [20]. In our study, 1 of 1 case in the undifferentiated small round cell tumour group was CD99-positive, and 1 of 4 cases in the fibroblastic/myofibroblastic tumour group also showed positivity.

CD68, a membrane and lysosomal glycoprotein, is expressed in monocytic phagocytes, macrophages, and histiocytes, making it important for identifying fibrohistiocytic tumours [20]. In our study, all fibrohistiocytic tumours were CD68-positive (5/5). However, CD68 was also positive in 2 of 5 myofibroblastic/fibroblastic tumours and 1 of 2 smooth muscle tumours, so pathologists must distinguish these from reactive histiocytic proliferation. Accurate diagnosis requires integration with H&E staining results and other morphological features.

Our study also demonstrated that, in addition to markers specific for each histological subtype, other immunohistochemical markers are frequently used: AE1/3 to differentiate from epithelial tumours, LCA and CD10 to distinguish lymphomas, Chromogranin A for neuroendocrine tumours, and HMB45 for tumours with melanocytic differentiation. Pathologists must be able to analyze and integrate these markers to select the appropriate panel and provide an accurate diagnosis for patients.

5. CONCLUSIONS

Among the 166 patients in our study, 21.1% were diagnosed with malignant soft tissue tumours.

Clinically, 91.6% of patients had a single tumour, with the most common location in both benign and malignant groups being the superficial trunk (34.4% and 34.3%, respectively). The majority of tumours were smaller than 5 cm (68.1%).

Adipocytic tumours were the most common (42.8%). Among benign tumours, lipomas and vascular tumours were the most frequent (53.4% and 15.5%, respectively). Fibrohistiocytic tumours were most common in the borderline group (61.5%), while fibrosarcomas were the most frequent in the malignant group (22.7%).

Immunohistochemistry is a modern technique that aids in distinguishing the histological subtypes of soft tissue tumours using specific markers such as Vimentin, S100, Desmin, SMA, CD34, CD117, DOG-1, CD99, and CD68. However, pathologists must be able to analyze and integrate these markers to select the appropriate panel and provide an accurate diagnosis for patients.

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