

Histopathological Spectrum of Soft-Tissue Tumors with Immunohistochemistry Correlation and FNCLCC grading: A North Indian Experience

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Abstract

Introduction: Soft tissue tumors (STT) are mesenchymal neoplasms with a diverse spectrum and overlapping clinical, radiological and histological features. Histopathology and immunohistochemistry (IHC) are essential to make a diagnosis. Fédération Nationale des Centres de Lutte Contre le Cancer (FNCLCC) Sarcoma Group grading system based on tumour differentiation, mitotic rate and necrosis helps in predicting the tumour progression and treatment response. **Aims:** The goal of this study was to analyze the incidence, histological spectrum and IHC features of STTs and to grade sarcomas according to FNCLCC grading system. **Material and Methods:** This is a four year study conducted in the Department of Pathology of a tertiary care centre from July 2009 to June 2013. All histopathologically diagnosed STTs were evaluated for gross and microscopic appearance. IHC was done wherever needed and clinical correlation was attempted. Sarcomas were graded according to FNCLCC grading system. **Results:** Of the total 270 cases studied, benign, intermediate and malignant STTs were 67.0%, 7.0% and 25.9% respectively. Adipocytic, vascular and peripheral nerve sheath tumors (PNST) formed the bulk of overall STTs (34.1%, 18.5% and 11.1% respectively). Sarcomas not otherwise specified were found to be the most common soft-tissue sarcomas followed by smooth muscle sarcomas and tumors with uncertain differentiation (11.5%, 4.1%, and 3.3%, respectively). Benign STTs were seen two decades earlier and were superficial in location as compared to sarcomas. On FNCLCC grading, grade 3 soft tissue sarcomas were slightly higher in number than grade 2 (27 vs 24). On IHC a definitive diagnosis was reached in 33 malignant, all intermediate and nine benign cases. **Conclusion:** The incidence of intermediate and malignant STTs is increasing due to early detection and better diagnosis by ancillary techniques like IHC. FNCLCC grading helps to prognosticate the malignant STTs thus guiding further plan of action while in some tumors like MPNST and Angiosarcoma it has no prognostic significance.

Keywords: FNCLCC grading, immunohistochemistry, soft-tissue tumors, spectrum

INTRODUCTION

Soft tissue tumors (STTs) are a complex group of pathologically diverse childhood and adult neoplasms with differentiation towards mesenchymal tissue, which may arise almost anywhere in the body.¹ Soft tissue sarcomas seem to show an upward trend, possibly because of increase in incidence, rising interest in tumour and better diagnostic capabilities. Overlap between clinical, radiological and histological patterns of benign, malignant and non-malignant lesions makes careful histopathological examination with supportive investigations like immunohistochemistry (IHC) almost essential in many cases.² IHC is used to detect tumour-specific alterations which add significantly to

histological interpretation. Histologic grading of sarcomas by FNCLCC system based on tumour differentiation, mitotic rate and amount of tumour necrosis was developed as a predictive and prognostic marker in facilitating treatment decisions.³ In our study we have analyzed the incidence, histological spectrum and IHC features of STTs and graded them according to FNCLCC grading system.

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MATERIAL AND METHODS

A 4-years study was conducted between July 2009 to June 2013 (2.5 years retrospective and 1.5 years prospective) in the Department of Pathology, Dayanand Medical College and Hospital, Ludhiana, Punjab, India. All the cases diagnosed as STTs were analysed and correlated with the clinical findings including age, sex, history of recurrence, and site and size of the tumour. The gross findings and microscopic pathological findings were evaluated in detail on hematoxylin and eosin-stained slides. Histological sub typing was done according to W.H.O classification of STTs 2002. The sarcomas were further graded according to FNCLCC grading system in to grades 1, 2 and 3, respectively. Finally IHC was done where ever required and a final diagnosis was reached. All the nonmesenchymal tumours and the bone tumours were excluded from the study.

RESULTS

Of the total 270 cases included in the study, 181 cases (67.0%) were benign, 70 cases (25.9%) were malignant, and 19 (7.0%) were classified under intermediate category. Among the total STTs, adipocytic tumors formed the largest group of tumors (34.1%), followed by vascular tumors (18.5%) and peripheral nerve sheath tumors (PNST) (11.1%). Among the benign tumors, a similar distribution was observed. Adipocytic tumors (29.3%) formed the bulk of benign tumors followed by vascular tumors (17.8%) and PNST (10%). Most common malignant STTs were Sarcomas not otherwise specified (NOS) ($n = 31$; 11.5%), followed by smooth muscle tumors (11 cases; 4.1%) and tumors with uncertain differentiation (9 cases; 3.3%) [Table 1]. Benign STTs were seen two decades earlier as compared to malignant STTs. Malignant STTs were most numerous in 51–60 years age group (28.6%). The mean age of patients with benign, intermediate, and malignant STTs was 36.6 ± 17.7 years, 46.0 ± 19.1 , and 44.6 ± 18.3 years, respectively ($P = 0.001$). The Tukey's test showed a significant correlation with age, thus implying that the frequency of malignant tumors increases with age. All benign, intermediate, and malignant STTs were more common in males with a male:female ratio of 1.2:1.

Individually benign, intermediate, and malignant STTs showed maximum predilection for head and neck, ($n = 55$; 20.7%), abdomen/retroperitoneum ($n = 4$; 1.4%), and lower limb ($n = 32$; 11.8%), respectively [Table 2]. Majority of the benign STTs were arising superficially from the dermis and subcutis. Intermediate and malignant STTs were deeper in location (arising from the muscle, retroperitoneum, or mediastinum). The number of encapsulated tumors was significantly lower in intermediate (0.37%) and malignant category (1.5%) as compared to benign category (19.3%).

Adipocytic tumors ($n = 92$, [34.1% of soft-tissue tumors])

Benign adipocytic tumors ($n = 79$) included mostly lipomas ($n = 64$) and angioliipomas ($n = 11$) and were located superficially in the limbs, head, and neck. Benign variants were seen two decades earlier compared to intermediate

Table 1: Distribution of total soft-tissue tumors, benign soft-tissue tumors, and malignant soft-tissue tumors according to tumor differentiation

Tumor differentiation	Number of cases in decreasing order of frequency (%)
Total	
Adipocytic	92 (34.1)
Vascular	50 (18.5)
PNST	30 (11.1)
Fibroblastic	19 (7.0)
Fibrohistiocytic	16 (5.9)
Smooth muscle	13 (4.8)
Pericytic	3 (1.1)
Skeletal muscle	3 (1.1)
Uncertain	12 (4.5)
Could not be classified	32 (11.9)
Benign	
Adipocytic	79 (29.3)
Vascular	48 (17.8)
PNST	27 (10.0)
Fibrohistiocytic	10 (3.7)
Fibroblastic	8 (2.9)
Pericytic	3 (1.1)
Uncertain	3 (1.1)
Smooth muscle	2 (0.74)
Could not be classified	1 (0.37)
Skeletal muscle	0
Malignant	
Sarcomas NOS	31 (11.5)
Smooth muscle	11 (4.1)
Uncertain	9 (3.3)
Adipocytic	5 (1.9)
Fibroblastic	4 (1.5)
PNST	3 (1.1)
Skeletal muscle	3 (1.1)
Vascular	2 (0.74)
Fibrohistiocytic	2 (0.74)
Pericytic	0

PNST: Peripheral nerve sheath tumors, NOS: Not otherwise specified

variants (atypical lipomatous tumor; $n = 8$) and malignant ones which included, liposarcoma NOS ($n = 3$), dedifferentiated, and round cell liposarcoma ($n = 1$ each). These were located in the mediastinum and retroperitoneum. On the FNCLCC grading, four tumors were graded as Grade 2 and one as Grade 1.

Vascular tumors ($n = 48$, [18.5% of soft-tissue tumors])

Hemangioma ($n = 44$) and lymphangioma ($n = 4$) were seen in the head and neck in young patients (mean age 28.6 years) as small swellings (<5 cm), while angiosarcoma ($n = 2$) were seen in elderly (mean age 57 years) as masses > 10 cm and involved extremities.

Peripheral nerve sheath tumors ($n = 30$ cases [11.1% of soft-tissue tumors])

Benign PNSTs ($n = 27$) included schwannoma ($n = 14$), neurofibroma ($n = 10$), and traumatic neuroma ($n = 3$). Benign

PNST were smaller (<5 cm) and involved spine followed by the head and neck, whereas malignant PNST (MPNST) were large masses (up to 18 cm) with areas of hemorrhage and necrosis. Few MPNSTs had a history of the long-standing benign neurogenic tumor.

Fibroblastic tumors (*n* = 19)

Benign cases (fibroma; *n* = 8) had size up to 8 cm and showed a propensity for the head and neck, while intermediate tumors (fibromatosis; *n* = 6 and myofibroblastic sarcoma; *n* = 1) having size up to 10 cm were seen in the trunk and fibrosarcoma (up to 15 cm) were found in the lower limb, retroperitoneum, and mediastinum. On FNCLCC grading, malignant fibroblastic tumors (MFT) were graded as Grade 2 (3 cases) and Grade 3 (one case). On IHC, vimentin positivity was a rule, and desmin, CD34, leukocyte common antigen (LCA), smooth muscle antigen (SMA) were negative [Table 3].

Fibrohistiocytic tumors (*n* = 16)

Benign fibrous histiocytoma (BFH) and giant cell tumor of tendon sheath (GCTT) (*n* = 6 + 4 = 10) and malignant

fibrous histiocytoma (MFH; *n* = 2) showed propensity for extremities, while intermediate ones (dermatofibrosarcoma protuberans [DFSP; *n* = 4]) were seen in the back, head, neck, and pelvis. MFH was graded as Grade 3 tumor on FNCLCC grading and on IHC showed CD34 and CD 68 positivity. IHC played a limited diagnostic role in MFH which was a diagnosis of exclusion.

Smooth muscle tumors (*n* = 13)

Leiomyosarcomas (LMS) formed the majority (*n* = 11; 84.6%) and were the second most common malignant STTs (4.07%). LMS involved the lower limb, abdomen, and retroperitoneum. Dermal leiomyomas (*n* = 2) involved the head and neck. On FNCLCC grading, Grade 2 (*n* = 6) and Grade 3 (*n* = 3) LMS were predominant.

Skeletal muscle tumors (*n* = 3)

These included pleomorphic (*n* = 2) and embryonal rhabdomyosarcoma (RMS) (*n* = 1) which involved the head and neck region and were diagnosed in the second decade of life. Microscopically, embryonal RMS showed round to oval hyperchromatic cells against a loose myxoid stroma.

Table 2: Distribution of STTs according to site and category of tumor [number of cases, (%)]

Site	Benign (<i>n</i> =181; 67.0%)	Intermediate (<i>n</i> =19; 7.0%)	Malignant (<i>n</i> =70; 26.0%)
Head and neck	55 (20.4)	2 (0.74)	5 (1.8)
Lower limb	26 (9.6)	3 (1.1)	32 (11.9)
Upper limb	48 (17.8)	2 (0.74)	6 (2.2)
Back	20 (7.4)	2 (0.74)	0
Abdomen	6 (2.2)	4 (1.5)	10 (3.7)
Spine	13 (4.8)	0	1 (0.4)
Chest and mediastinum	7 (2.6)	2 (0.74)	4 (1.5)
Retroperitoneum	0	2 (0.74)	11 (4.1)
Pelvis and genitalia	4 (1.5)	2 (0.74)	1 (0.4)
Multiple	2 (0.74)	0	0

Table 3: Immunohistochemistry features of various soft-tissue tumors

Tumor type	Positive markers	Negative markers
Well-differentiated liposarcoma, liposarcoma NOS	S-100 (focal), vimentin	-
Dedifferentiated liposarcoma	Desmin (focal), vimentin	-
Hemangioma, lymphangioma, angiosarcoma	Vimentin, CD31, CD34	-
Benign PNST	S-100 (diffuse)	
MPNST	S-100 (focal), vimentin (focal), CD 34 (focal)	
Fibrosarcoma	Vimentin	Desmin, CD34, LCA, SMA
Leiomyomas, leiomyosarcoma	Vimentin, SMA	S-100, CD 117, CD 34, myogenin
Rhabdomyosarcoma	Myogenin, vimentin	-
Myopericytoma	SMA, CD 34, vimentin	-
Primitive neuroectodermal tumor	CD 99	-
Synovial sarcoma	CK (glandular cells), vimentin (mesenchymal cells)	-
Desmoplastic small round cell tumor	CK, vimentin, desmin (dot-like intracytoplasmic)	-
Sarcoma NOS	Vimentin	Cytokeratin, CD34, LCA, SMA, desmin, myogenin, S-100, and CD 117

PNST: Peripheral nerve sheath tumors, NOS: Not otherwise specified, MPNST: Malignant peripheral nerve sheath tumors, LCA: Leucocyte common antigen, SMA: Smooth muscle antigen, CK: Cytokeratin

FNCLCC grading was not done because of scanty tissue. On IHC, myogenin and vimentin were positive.

Tumors of pericytic differentiation ($n = 3$)

These included glomus tumor ($n=2$) and myopericytoma ($n = 1$).

Tumors of uncertain differentiation ($n = 12$, 4.42% of soft-tissue tumors)

Benign category ($n = 3$) included myxoma and aggressive angiofibroma, while malignant category ($n = 9$) included synovial sarcoma ($n = 5$), primitive neuroectodermal tumour [PNET ($n = 3$)], and desmoplastic round cell tumor ($n = 1$). On FNCLCC grading, maximum cases belonged to Grade 3 ($n = 4$) followed by Grade 2.

Unclassifiable ($n = 31$; 11.4%)

Maximum sarcoma NOS were seen in the sixth decade of life, with a mean age of 45.4 years and involved lower limb ($n = 12$), followed by abdomen ($n = 6$). FNCLCC grading was done in 25 cases and maximum cases belonged to Grade 3 ($n = 17$) followed by Grade 2 ($n = 8$). On IHC ($n = 17$), vimentin was universally positive in all [Table 3]. Few other markers such as SMA, desmin, S-100, myogenin, CD 31, CD34, CD117, CD99, CK, LCA showed negative results. The whole panel of markers was not done due to various reasons (scanty tissue, limited availability of markers, and financial constraints).

FNCLCC grading

Out of the 70 cases, only 54 malignant tumors were graded which included 27 Grade 3 cases followed by 24 Grade 2 cases. In rest of the cases, tissue was either scanty or there was no prognostic significance of grading such as in MPNST and angiosarcoma.

Immunohistochemistry correlation

IHC was done in 49 malignant tumors, 7 intermediate category tumors, and 10 benign cases. The IHC positivity in different tumor groups is shown in Table 3. A definitive diagnosis was reached in 33/49 malignant, 7/7 intermediate, and 9/10 benign tumors ($P = 0.007$ which was highly significant). Thus, IHC played a significant role in making the diagnosis and determining tumor differentiation.

DISCUSSION

Out of 270 STTs analyzed, benign tumors were maximum followed by malignant and intermediate tumors. This is in concordance with the study conducted by Agravat *et al.* and Stout.^{1,2} Benign STTs were common in younger population, whereas malignant STTs were commoner in the fifth and sixth decade. This finding was in concordance with the studies conducted by Agravat *et al.* and Wibmer *et al.*^{1,3} Like our observation (male: female – 1.2:1), Trojani *et al.*, Jemal *et al.*, Gustafson and Ducimetière *et al.* also found a male preponderance in STTs [Table 4].⁴⁻⁷

Head and neck was the most common site involved by benign STTs as a whole as well as benign vascular tumors (30/60 cases), whereas sarcomas commonly involved the lower limbs. Makino studied 651 STTs of the head and neck and found 96% of them to

be benign.⁸ Trojani *et al.*, Ducimetière *et al.*, Mastrangelo *et al.*, Coindre *et al.*, and Talati *et al.* also found lower limb (extremities) to be the most common site involved by sarcomas.^{4,7,9-11}

In our study, adipocytic tumors were the most common constituting 34.1%, followed by vascular tumors (18.5%) and PNSTs (11.1%). These observations were somewhat similar to the study conducted by Agravat *et al.* [Table 5].¹ Lipoma formed the bulk of benign adipocytic tumors constituting 29.3% of cases. Our findings are similar to findings by Agravat *et al.*, Stout, and Kransdorf, who reported 29%, 32.8%, and 16.1% lipomas in their respective studies.^{1,2,12} Well-differentiated liposarcomas were seen from the fifth to eighth decade of life with a predilection for the lower limb, mediastinum, and retroperitoneum in the present study. Tos and Pedeutour and Fisher *et al.* shared similar findings.^{13,14} Liposarcomas were the fourth most common of all malignant STTs with peak incidence in the sixth decade and affecting retroperitoneum. Enterline *et al.*, Sim *et al.*, Ahmad *et al.*, and Stout also found the sixth decade as the most common age group and lower extremity as the common site.^{2,15-17} When graded according to FNCLCC grading system, Grade 2 liposarcomas were more than Grade 1 (four and one, respectively). However, Coindre *et al.* and Ducimetière *et al.* found Grade 1 liposarcomas to be the more common than Grade 2 tumors.^{7,10}

Table 4: Comparison of male: female ratios in soft-tissue tumors in the previous studies

Study	Total cases	Males	Females	Memale:female
Trojani <i>et al.</i> (1984)	155	90	65	1.38:1
Gustafson P (1994)	508	288	220	1.3:1
Jemal <i>et al.</i> (2007)	9220	5050	4170	1.2:1
Ducimetiere <i>et al.</i> (2011)	433	245	188	1.3:1
Present study (2013)	270	149	121	1.23:1

Table 5: Comparison of incidence of soft-tissue tumors with the previous study

Tumor differentiation	Present study (2013)	Agravat <i>et al.</i> (2010)
Total number of cases	270	100
Adipocytic	92	33
Vascular	50	22
PNST	29	19
Fibroblastic	18	9
So-called fibrohistiocytic	16	5 of BFH + 7 cases of GCT of tendon sheath=12
Smooth muscle	13	1
Pericytic	3	0
Skeletal muscle	3	1
Uncertain	12	1
Could not be categorized	34	2

BFH: Benign fibrous histiocytoma, GCT: Giant cell tumor, PNST: Peripheral nerve sheath tumors

Vascular tumors were the second most common tumors (18.51%). Among them, hemangiomas were the most common ($n = 44$). This observation is in concordance with the studies conducted by Agravat *et al.*, Kransdorf, and Makino *et al.*^{1,8,12} Two cases of angiosarcomas were seen, each in extremities of patients in the fourth and eighth decade of life. Meis-Kindblom and Kindblom and Kransdorf also found angiosarcomas involving the lower limb.^{12,18} FNCLCC grading of angiosarcomas is not recommended as per the WHO, pathology and genetics of STTs.¹⁹

Schwannoma ($n = 14$) and neurofibroma ($n = 10$) were the most common benign PNST similar to the studies by Kim *et al.* and Gabhane *et al.*^{20,21} In our study, MPNSTs affected the lower limb ($n = 2$) and mediastinum ($n = 1$) with tumor size up to 18 cm. Kar *et al.* shared similar findings in their study of 24 cases of MPNSTs.²² FNCLCC grading has no prognostic significance for MPNSTs.¹⁹ On IHC, all MPNST were focally S-100 positive. Guo *et al.* concluded that S-100, CD56, and PGP 9.5 are sensitive markers for PNSTs. S-100, which is traditionally regarded as the best marker for MPNST, is positive in only about 50%–90% of the tumors.²³

Fibroblastic tumors were the fourth most common similar to studies by Agravat *et al.* and Myhre-Jensen.^{1,24} In our study, fibroma involved head and neck and fibromatosis involved abdomen. We found a case of low-grade myofibroblastic sarcoma (LGMS) affecting the lower limb in an 8-year-old male. Kransdorf found involvement of trunk in majority of fibromatosis cases, while Myhre-Jensen found palm to be the most commonly affected site.^{12,24} Mentzel *et al.* analyzed 18 cases of LGMS and found the oral cavity ($n = 5$) to be the most commonly affected site followed by the lower limb.²⁵ MFT in our study included fibrosarcoma NOS ($n = 2$), low-grade fibromyxoid sarcoma ($n = 1$), and myxofibrosarcoma ($n = 1$). Wibmer *et al.* found fibrosarcoma, NOS as the most common MFT in their study, while Mastrangelo *et al.* reported myxofibrosarcoma to be the commonest MFT, followed by fibrosarcoma NOS.^{3,9} Owing to small sample size, grading of MFT could not be discussed.

We found BFH and GCTT as the most common fibrohistiocytic tumors with a wide range of age distribution (18–70 years) and upper extremity involvement. Our findings are in concordance with the studies by Myhre-Jensen and Kransdorf.^{12,24} Oliveira-Soares *et al.* and Mastrangelo *et al.* found female predominance in DFSP similar to our study.^{9,26} We found only two cases of MFH, while Wibmer *et al.* and Sim *et al.* reported MFH to be the fourth and third most common soft-tissue sarcoma, respectively.^{3,16} MFH was originally believed to be of histiocytic lineage, but now, it has been established that they lack true histiocytic differentiation. Since then, the integrity of MFH as a diagnostic entity has progressively diminished.²⁷ The diagnosis of MFH was made by evaluation of H and Estained sections. IHC primarily serves as a means to exclude anaplastic carcinoma and sarcoma, which may bear a resemblance to MFH. Histiocytic markers such as alpha-1-antitrypsin,

alpha-1-antichymotrypsin, lysozyme, and CD68 play no useful role in their diagnosis.

LMS were the second most common malignant STTs ($n = 10$; 4.1%). Wibmer *et al.* and Mastrangelo *et al.* also observed LMS to be the second most common sarcomas.^{3,9} We found more Grade 2 smooth muscle sarcomas (60%) than grade 3 (30%). Shah H *et al.* studied 205 LMS cases and found 56.6% cases of Grade 2, followed by 16.6% of Grade 1 and 8.5% of Grade 3.²⁸

RMS comprised only three cases of all STTs. Occurrence of RMS as compared to other soft-tissue sarcomas is quite low. Hare and Cerny opined that it is apparently due to the fact that striated muscle cells are completely differentiated and do not undergo cellular division in postnatal life as other tissues.²⁹ All the three cases were seen in the head and neck region and were diagnosed in the second decade of life. This observation was similar to the studies of Hare *et al.* and Kransdorf who also observed head and neck to be the most common site.^{9,29} On IHC, tumor cells were found to be myogenin positive. Expression of myogenin has been demonstrated to be extremely specific for rhabdomyoblastic differentiation.³⁰

Tumors of uncertain differentiation constituted 4.45% ($n = 12$) of all STTs. Similar to studies by Kransdorf and Silver *et al.*, we found two cases of myxomas affecting lower extremities in elderly patients.^{12,31} Aggressive angiomyxoma is a rare tumor with predilection for the perineum and genital region of the reproductive females.^{32,33} In the present study, only one case of aggressive angiomyxoma was diagnosed in the vulva of a 40 years female. Haldar *et al.* and Wei *et al.* studied aggressive angiomyxoma and found female predilection with pelvic and perineal involvement.^{32,33} Only five cases of synovial sarcoma were diagnosed in the present study which commonly affected lower limbs in females in fifth decade. Similarly, Spillane *et al.* also found these tumors in adults with a predilection for the limb.³⁴ In the present study, three cases belonged to Grade 3 and two were Grade 2. This observation is in agreement with Coindre *et al.* who observed maximum number of Grade 3 tumors ($n = 69$), followed by 56 tumors of Grade 2 in their study of 1240 STTs.¹⁰ PNET ($n = 3$) involved the lower limb, pelvis, and spine in young males (15–26 years). These findings are similar to the study done by Kransdorf.¹²

Those tumors in which a definitive diagnosis could not be ascertained were labeled as sarcomas NOS. Wibmer *et al.* and Coindre *et al.* reported good number of sarcoma NOS cases.^{3,10}

Role of immunohistochemistry

It helped in making a definitive diagnosis in 9/10 benign, 7/7 intermediate, and 33/49 malignant STTs. These inferences are similar to the study done by Talati and Pervez on the role of IHC in the diagnosis and subcategorization of STT sarcoma.³⁵ Coindre opined that IHC is considered necessary in the diagnosis of some sarcomas, because the IHC profile is a part of the definition of the tumor and/or because of the therapeutic implications.³⁶ This holds true for RMS, epithelioid sarcoma, clear cell sarcoma, desmoplastic small round cell

tumour (DSRT), and gastrointestinal stromal tumor.³⁶ IHC is also decisive in diagnosing some forms of other sarcomas, such as synovial sarcomas and malignant vascular tumors.

Thus, STTs include a large family of tumors with very few studies conducted on the whole spectrum and grading like FNCLCC. Our study highlights the importance of affected age group, sexual predilection, location, size, histopathology, and IHC features in diagnosing STTs. STTs located superficially in young males were more likely benign, while larger tumors located deep in lower extremity or abdomen and retroperitoneum or mediastinum of older patients would be having high or intermediate malignant potential. However, RMS, PNET, and LGMS showed predilection for younger population and involved the head and neck. Males were affected more than females though aggressive angiomyxoma and DFSP were seen more in females. FNCLCC grading helped in prognostication of malignant STTs and IHC helped in diagnosing cases which shared histopathological features with other sarcomas and carcinomas. Some tumors which were initially diagnosed as NOS were reclassified as LMS, MFH, and synovial sarcoma after IHC. However, tumors of uncertain differentiation were even difficult to categorize using IHC. Hence, a good histopathological expertise with a panel of large number of IHC markers and cytogenetic and molecular studies may be needed to accurately diagnose these tumors.

Limitations

The main limitation of our study was less amount of tissue in many small tissue biopsies to perform the FNCLCC grading in malignant tumors. Second, due to financial constraints of patients and unavailability of many IHC antibodies, extended panel of IHC markers were not done and thus tumors were categorized into unclassifiable category.

CONCLUSION

STTs, especially with malignant and intermediate potential and uncertain differentiation pose a diagnostic challenge for histopathologist. A wide spectrum with histomorphological variability increases difficulties for the pathologist and hence for the treating surgical and medical oncologists. IHC and FNCLCC grading are two important tools which help in solving the diagnostic dilemma and prognosticate the tumor, thus guiding further plan of action.

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Conflicts of interest

There are no conflicts of interest.

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