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Local Recurrence Rate after Clear Margins in Wide Local Excision in Soft Tissue Sarcoma 2 Years after Index Surgery

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ABSTRACT

Soft tissue sarcomas include a diverse collection of uncommon, malignant neoplasms originating in mesenchymal tissues. Recent cancer studies indicate that they comprise around 1% of all malignancies globally. **Objectives:** To evaluate the incidence of local recurrence among patients who achieved clear surgical margins following wide local excision for soft tissue sarcoma. **Methods:** This cross-sectional retrospective study was conducted at the Orthopedic Department of Shifa International Hospital, Islamabad. Sixty patients participated in this investigation. In this investigation, patients who underwent wide local excision and attained clear surgical margins were enrolled after being diagnosed with histologically confirmed soft tissue sarcoma. **Results:** The study included 60 sarcoma patients (63.3% males, mean age 46.15 ± 22.74 years). Two-year recurrence occurred in 8 (13.3%) cases, mostly synovial sarcoma. Recurrence showed no significant association with histologic subtype, therapy type, surgical margin, or tumor grade ($p>0.05$). **Conclusions:** This study corroborates existing literature on the recurrence patterns of STS, emphasizing the significance of histological subtypes, comorbidities, and surgical margins in influencing patient outcomes. Continued research into the molecular underpinnings of STS and the development of targeted therapies are crucial for improving prognosis and reducing recurrence rates.

INTRODUCTION

Soft tissue sarcomas (STSs) are uncommon and infrequent neoplasms. STSs are a diverse category of infrequent and malignant neoplasms originating from mesenchymal tissue [1]. According to recent cancer statistics they account for approximately 1% of all cancers worldwide [2]. STSs arise most commonly in the deep soft part of the extremities. Still, they can also form in subcutaneous tissue, head and neck, trunk wall, intraabdominal, retroperitoneal, and pelvic areas [3]. Soft tissue sarcomas can arise at any site but they commonly tend to affect the extremities (60%). More than 150 subtypes of STS with different development, progression, and recurrence patterns have been identified by the researchers [4]. The tumor is difficult to diagnose and treat because of its rarity and the variety of histological subtypes [5]. Surgical excision along with adjuvant or neoadjuvant chemotherapy and radiation therapy is the cornerstone of the curative treatment for localized STSs [6]. The main goal of treatment is to achieve clear surgical margins for minimizing the recurrence and improving patient outcomes. The literature does not clearly define the length of surgical margin resection; for low-grade STSs, a marginal excision of less than 2 cm is adequate, but for high-grade STSs, a broad excision of more than 2 cm is necessary to reduce local and systemic recurrence [7]. Some researchers advise safety margins of up to 4 cm in

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various histological subtypes of STSs because a considerable percentage of these tumors, including angiosarcoma, dermatofibrosarcoma, and myxofibrosarcoma, can form microscopic finger-like extensions that can infiltrate the surrounding local soft tissue and fascial plane and change the rate of local recurrence even after the primary excision [8]. STSs mostly affect the extremities, most commonly the lower extremity. STSs in the extremity are prone to recurrence despite having the complete resection primarily [9]. Most STSs possess pseudo capsules throughout their peripheries, functioning as a reactive zone that delineates the tumor cells from adjacent healthy tissues. The most viable surgical method involves resection along the pseudo capsule borders; nevertheless, this leads to a comparatively elevated recurrence rate [10]. Widening the surgical plane to noncancerous tissue and beyond the pseudo capsule decreases the chances of local recurrence and improves clinical outcomes. In extremities and trunk wall sarcomas, widening of margins includes the surrounding subcutaneous fat, muscles, and skin [11]. Wound complications after the surgical resection of STSs depend on the location of the tumor, larger tumor volume, and perioperative treatment with radiation [12]. In extremities, the local recurrence incidence varies from 5% to 10%; however, it is not the primary cause of mortality, since it may be addressed with extensive reoperation or amputation when necessary. The primary focus of surgery should be limb-sparing and achieving the highest functional outcomes while respecting the appropriate margins [8]. Despite the advancements in surgical techniques and preoperative care, local recurrence is a major clinical concern, and it impacts not only the patient's survival but also the subsequent management and often requires secondary surgery [13]. The primary goal of the study is to analyze cases of local recurrence occurring within 2 years post-index surgery and help provide clinicians with valuable information to optimize treatment strategies and improve patient outcomes.

Wide local excision with clear margins is the standard curative approach for soft tissue sarcomas, yet local recurrence remains a clinically significant problem despite apparently adequate surgery.There is limited and inconsistent evidence on the incidence and predictors of early local recurrence in patients with soft tissue sarcoma who achieve clear surgical margins, particularly within the first two postoperative years. To evaluate the incidence of local recurrence among patients who achieved clear surgical margins following wide local excision for soft tissue sarcoma. Specifically, the study focuses on cases occurring within the first 2 years after the index surgery, aiming to provide insights into the early recurrence patterns and potential predictors of disease control.This study aimed to assess the local recurrence rate and identify risk factors associated with recurrence in patients who underwent wide local excision for soft tissue sarcoma and achieved clear surgical margins.

METHODS

This cross-sectional retrospective study was conducted at the Orthopedic Department of Shifa International Hospital Islamabad, from September 2024 to August 2025 after approval from the Institute Review Board (Ref. No. 414-24). Meanwhile, the retrospective data was collected for the same duration, September 2023 to August 2024, after permission from the Medical Superintendent under the principles of the Helsinki Declaration. The sampling technique used was non-random, convenient sampling technique. Every patient's preoperative data was collected, including any comorbidities that they have. Pre-operative data were obtained by two means. The first method was obtaining patient Confident Medical Record (CMR) files from our hospital's Medical Records Department and extracting pre-operative and perioperative data and documentation from it. The second method was assessing patient's Electronic Medical Records (EMR) and obtaining the investigations, biopsy reports, and radiological investigation reports from it. Informed consent was obtained from all the patients. This study included 60 patients. The sample size was calculated using 4% prevalence of the local recurrence of soft tissue sarcoma, 95% level of significance and an 80% power of the study [14]. Patients were eligible if they met the criteria like, 1) Patients diagnosed with histologically confirmed soft tissue sarcoma and who underwent wide local excision and achieved clear surgical margins. 2) Patients with histologically confirmed clear surgical margins (defined as the absence of tumor cells at the inked resection margins). 3) Patients with a minimum follow-up period of 2 years post-index surgery. Patients were excluded if they did not followed certain criteria e.g., Risk factors in these patients were carefully sought from an extensive literature review. After a thorough evaluation, patients with evidence of metastatic soft tissue sarcoma at time of diagnosis, those who were missing data or had incomplete medical records, and those with a concurrent or prior history of other malignancies unless disease free and with no recurrence in the past 5 years were excluded. There was a thorough evaluation of the participants of this study and those that did not meet the rigorous criteria were excluded from the research. Defined as the reappearance of soft tissue sarcoma at or near the site of the original excision, confirmed by histological examination or imaging studies (e.g., MRI, CT scan). The make and model of Shifa International Hospital's CT scan machine is Toshiba

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Aquilion One 640-slice CT scanner. The MRI machine is a super-conducting 3-Tesla MRI system. Defined as the absence of tumor cells at the inscribed resection margins, as determined by medical records. All the data was collected from medical records of the patients. The surgical approach involves excising the soft tissue sarcoma along with a sufficient margin of healthy tissue to reduce the likelihood of local recurrence. The degree of excision may vary depending on the tumor's size, location, and the surrounding anatomical structures. Data analysis was conducted using SPSS version 23.0. Mean ± S.D was calculated for quantitative variables i.e., age, height, weight and BMI. Frequency and percentages were calculated for qualitative variables i.e., comorbidities, histologic subtype of sarcoma and recurrence within 2 years. Stratification was done for age, gender, histologic subtype of sarcoma, adjuvant therapy, surgical margin width and tumor grade. Post-stratification chi-square test was applied. A p-value of < 0.05 was taken as significant.

RESULTS

The mean age of the cases was 46.15 ± 22.74 years. There were 38 (63.3%) male and 22 (36.7%) female patients in this study. There were 15 (25%) hypertensive and 15 (25%) diabetic patients found in this study. The most prevalent type of sarcoma seen in this study was synovial sarcoma, found in 40 (66.7%) cases (Table 1).

Table 1: Descriptive Statistics of Demographic and Clinical Variables

Variables	Category	Mean ± SD / N (%)
Age (years)	–	46.15 ± 22.74
Gender	Male	38 (63.3%)
	Female	22 (36.7%)
Height (cm)	–	165.12 ± 16.18
Weight (kg)	–	70.93 ± 20.75
BMI (kg/m^2)	–	21.37 ± 3.92
Comorbidities	Hypertension	15 (25%)
Histologic Subtype of Sarcoma	Diabetes	15 (25%)
	IHD	1 (1.7%)
	Synovial sarcoma	40 (66.7%)
	Pleomorphic sarcoma	3 (5%)
	Liposarcoma (left thigh)	8 (13.3%)
	Myxoid spindle cell sarcoma	2 (3.3%)
	Glioblastoma	2 (3.3%)
	Mucoid spindle cell squamous cell carcinoma	2 (3.3%)
	Myxosarcoma	1 (1.7%)
	Angioleiomyoma	1 (1.7%)
	Leiomyosarcoma	1 (1.7%)

In this study, recurrence within two years was observed in 8 (13.3%) patients. Histologic subtypes of Sarcomas were identified by microscopic examination based on their tissue of origin (Table 2).

Table 2: Frequency Distribution of Two-Year Recurrence

Recurrence within Two Years	Frequency (%)
Yes	8 (13.3%)
No	52 (86.7%)

The stratification of recurrence according to gender and age group showed insignificant results with p-values of 0.866 and 0.462, respectively (Table 3)

Table 3: Stratification of Recurrence Within Two Years with Respect to Age and Gender

Variables	Category	Recurrence within Two Years		p-Value
		Yes	No	
Gender	Male	6 (75%)	32 (61.5%)	0.866
	Female	2 (25%)	20 (38.5%)	
Age (years)	12–22	1 (12.5%)	11 (21.2%)	0.462
	23–33	2 (25%)	4 (7.7%)	
	34–44	1 (12.5%)	12 (23.1%)	
	45–55	1 (12.5%)	10 (19.2%)	
	56–66	1 (12.5%)	6 (11.5%)	
	67–77	1 (12.5%)	6 (11.5%)	
	78–88	1 (12.5%)	3 (5.8%)	

The stratification of 2-year recurrence with respect to histologic subtype of sarcoma showed insignificant results. Two-year recurrence was found in 7 cases of synovial sarcoma and in 1 case of pleomorphic sarcoma however, the p-value was > 0.05 (Table 4).

Table 4: Stratification of Recurrence Within Two Years with Respect to Histologic Subtype of Sarcoma

Variables	Recurrence within Two Years		p-Value
	Yes	No	
Synovial Sarcoma	7 (87.5%)	33 (63.5%)	0.833
Pleomorphic Sarcoma	1 (12.5%)	2 (3.8%)	
Liposarcoma (Left Thigh)	0 (0.0%)	8 (15.4%)	
Myxoid Spindle Cell Sarcoma	0 (0.0%)	2 (3.8%)	
Glioblastoma	0 (0.0%)	2 (3.8%)	
Mucoid Spindle Cell Squamous Cell Carcinoma	0 (0.0%)	2 (3.8%)	
Myxosarcoma	0 (0.0%)	1 (1.9%)	
Angioleiomyoma	0 (0.0%)	1 (1.9%)	
Leiomyosarcoma	0 (0.0%)	1 (1.9%)	

Recurrence occurred in 2 (25%) neoadjuvant and 6 (75%) adjuvant therapy cases (p=0.254). It was observed in 7 wide local excisions and 1 wide en bloc resection (R0) cases (p=0.973). Based on tumor grade, recurrence was found in 2 (25%) grade 1, 4 (50%) grade 2, and 1 (12.5%) each of grade 3 and 4 tumors (p=0.607) (Table 5).

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Table 5: Stratification of Recurrence Within Two Years with Respect to Adjuvant Therapy, Surgical Depth, and Tumor Grade

Variables	Category	Recurrence within Two Years		p-Value
		Yes	No	
Adjuvant Therapy	Neoadjuvant	2 (25%)	28 (53.8%)	0.254
	Adjuvant	6 (75%)	24 (46.2%)	
	Total	8 (100%)	52 (100%)	
Surgical Margin Width	Wide Local Excision	7 (87.5%)	42 (80.8%)	0.973
	Wide En Bloc Resection (R0)	1 (12.5%)	7 (13.5%)	
	Limb-Sparing Surgery	0 (0.0%)	1 (1.9%)	
	Mohs Surgery Technique	0 (0.0%)	1 (1.9%)	
	Synovectomy	0 (0.0%)	1 (1.9%)	
	Total	8 (100%)	52 (100%)	
Tumor Grade	Grade 1	2 (25%)	13 (25%)	0.607
	Grade 2	4 (50%)	15 (28.8%)	
	Grade 3	1 (12.5%)	16 (30.8%)	
	Grade 4	1 (12.5%)	8 (15.4%)	
	Total	8 (100%)	52 (100%)	

DISCUSSIONS

A wide variety of rare malignant tumors that originate in mesenchymal tissues are collectively known as soft tissue sarcomas (STS). They represent about 1% of all malignancies worldwide, according to recent cancer studies. The recurrence rate after STS therapy ranges from 20% to 25% and typically appears within 2 to 3 years following primary surgery. The mean age of cases in our study was 46.15 ± 22.74 years, including 38 males (63.3%) and 22 females (36.7%). Among these, 15 (25%) patients had hypertension and 15 (25%) had diabetes. In a previous study, the average age was reported as 32.52 ± 18.17 years, with 49.3% male and 50.7% female participants [14]. In our study, synovial sarcoma was the most prevalent histologic subtype, observed in 40 (66.7%) cases. Similarly, fibrosarcoma (36%), rhabdomyosarcoma (26%), liposarcoma, and leiomyosarcoma were also reported as common histological types in earlier research. Rare malignancies (categorized as "Others") included neurofibrosarcoma, alveolar soft tissue sarcoma, myxofibrosarcoma, haemangiosarcoma, haemangiopericytoma, pleomorphic sarcoma, primitive neuroectodermal tumor (PNET), and malignant peripheral nerve sheath tumor [15]. In another investigation involving 951 patients with extremity sarcoma, liposarcoma, fibrosarcoma, and malignant fibrous histiocytoma (MFH) were the most frequent types [16]. Similarly, MFH and fibrosarcoma were the predominant forms reported in Nigeria [17]. Data from the Florida Cancer Registry (1981–2004) recorded malignant fibrous histiocytoma (31.5%), liposarcoma (19.0%), fibrosarcoma (6.0%), and leiomyosarcoma/gastrointestinal stromal tumor (43.5%) [18]. These variations highlight the importance of defining regional disease trends to identify epidemiological differences. In the present study, stratification of two-year recurrence according to histologic subtype showed no significant association. Recurrence was noted in 7 cases of synovial sarcoma and 1 case of pleomorphic sarcoma, with a $p>0.05$. Overall, recurrence within two years was observed in 8 (13.3%) patients, aligning with previously reported recurrence rates of 12–15% [19–20]. Another study reported that following initial resection, 36.7% of patients had positive margins, and 18.9% experienced local recurrence [21]. In our study, recurrence occurred in 2 (25%) cases receiving neoadjuvant therapy and 6 (75%) receiving adjuvant therapy; however, the difference was not statistically significant ($p=0.254$). Local recurrence rates after excision with positive margins have been reported between 80% and 90%, but recent advances in imaging, adjuvant and neoadjuvant radiotherapy, and improved surgical techniques have reduced these rates to 7–15% [22].

While this study provides valuable insights, it is limited by its single-center design and relatively small sample size. The inclusion of multiple histological types and anatomical sites may also introduce bias. Future multicenter studies with larger cohorts are needed to validate these findings. Additionally, integrating molecular and immunohistochemical analyses could help identify factors influencing recurrence and support personalized therapeutic approaches.

CONCLUSIONS

This study corroborates existing literature on the recurrence patterns of STS, emphasizing the significance of histological subtypes, comorbidities, and surgical margins in influencing patient outcomes. Continued research into the molecular underpinnings of STS and the development of targeted therapies are crucial for improving prognosis and reducing recurrence rates.

Authors' Contribution

Conceptualization: AI
Methodology: AI, LM, HA, SMA
Formal analysis: AI
Writing and Drafting: AI, ZN, SH
Review and Editing: AI, ZN, LM, SH, HA, SMA

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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