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CLINICOPATHOLOGICAL ASSESSMENT OF SOFT TISSUE SARCOMA IN A SAMPLE OF ADULT AND ELDERLY IRAQI PATIENTS

Hiba Mohammad Selman Salem[1]*, Professor Dr. Alaa Ghani Hussein[2]

[1]M.B.CH.B.
[2]M.B.CH.B., M.Sc. Path., F.I.C.M.S (Path.)

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***Corresponding Author: Hiba Mohammad Selman Salem**

M.B.CH.B.

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ABSTRACT

Introduction: Although soft tissue sarcomas are rare, they represent a clinically important group of malignant tumors because of their aggressive potential and wide histological diversity. Their tendency for local recurrence, distant metastasis, and variable response to therapy makes accurate pathological classification essential, often requiring integration of histological features with immunohistochemical and molecular findings. **Method:** This was a retrospective study conducted over the period from January 2025 to December 2025, including 100 samples of soft tissue sarcoma collected from different pathology centers around Iraq. Histopathological reports and slides were reviewed, and clinical parameters were recorded from patient records. **Results:** In this cohort of 100 soft tissue sarcoma cases, the mean patient age was 46.5 years, with a nearly equal sex distribution (55% males, 45% females). The lower extremities were the most frequent tumor site, followed by the upper extremities and head and neck region. The mean tumor size was 8.4 cm. 58% were primary tumors, 34% were recurrences, and 8% had metastases. Histologically, Grade 3 tumors predominated (65%), followed by Grade 2 (30%) and Grade 1 (5%). Synovial sarcoma was the most common subtype (31%), followed by liposarcoma (18%) and undifferentiated pleomorphic sarcoma (13%), with other subtypes being less frequent. **Conclusion:** Soft tissue sarcoma in Iraqi adults mainly affected middle-aged and older patients, with a slightly younger mean age compared to international reports. The lower extremities were the most common tumor site, and most cases presented with large tumor size, suggesting delayed diagnosis and limited early referral. A high proportion of tumors were high grade (Grade 3). Synovial sarcoma was the most frequent subtype. Larger tumor size was associated with higher histologic grade, and the lungs were the most common site of metastasis.

KEYWORDS: soft tissue tumors, Iraq, synovial sarcoma, liposarcoma.

INTRODUCTION

Soft-tissue sarcomas (STS) are rare and aggressive malignant tumors originating from mesenchymal tissues, including fibrous tissue, deep layers of the skin, nerves, fat, and blood vessels. Soft tissue sarcomas (STS) account for less than 2% of all malignant tumors in adults. They include a wide range of different malignancies.[1][2] According to the Iraqi Cancer Registry Report 2023, soft tissue sarcomas (ICD-10: C49) accounted for 84 new cases in Iraq, with a crude incidence rate of 0.19 per 100,000 population. A slight male predominance was observed, with a male-to-female ratio of approximately 1.15:1 (45 males vs. 39 females), which was also reflected in crude incidence rates (0.21 per 100,000 in males versus 0.18 per 100,000 in females).[3]

Soft tissue sarcomas are capable of local destructive growth, recurrence and distant metastases, most often to lungs, liver, bone, soft tissue and brain.[4] Approximately 80% of both local and distant recurrences typically manifest within the first three years following initial treatment. Recurrences, however, can present after a longer period of remission.[5] with the risk of recurrence influenced by factors such as high tumor grade, deep tumor location, and regional lymph node metastasis.[6]

Although it can occur at any age, middle-aged adults are the most common population group in which it is diagnosed. Although they can occur anywhere in the body, most originate in the extremities.[7]Clinically, STSs often manifest as a growing mass, which can be challenging to differentiate from benign conditions due to the wide spectrum of histological presentations and often non-specific symptoms.[8] Prognostic factors influencing patient outcomes include the primary tumor site, size, histotype, tumor grade, age, and the stage at initial presentation.[9][10]

The aim of this study is to assess the clinicopathological features of soft tissue sarcoma in adult and elderly Iraqi patients in relation to several parameters.

PATIENTS AND METHODS

This was a retrospective study conducted over the period from January 2025 to December 2025, including 100 samples of soft tissue sarcoma collected from different pathology centers across Iraq. The samples were obtained from the Pathology Departments of Ghazi Al-Hariri Surgical Specialties Teaching Hospital, Al-Anbar Teaching Hospital, Al-Karamah Teaching Hospital in Al-Kut, Diyala Teaching Hospital, and the Educational Laboratories of Medical City in Baghdad.

The study titled was approved by the Institutional Review Committee of Research Projects (I.R.C.R.P), Scientific Council of Pathology, Iraqi Board for Medical Specialization. All patient data were kept confidential, and the collected samples were used solely for research purposes.

For each case, the histopathological reports were collected, and slide review was carried out to confirm the diagnosis. In addition, the clinical and pathological parameters such as age, gender, tumor size, tumor site, histological type, tumor grading according to the FNCLCC system, immunohistochemistry findings, and tumor outcome (whether primary, recurrent, or metastatic) were obtained from patients' admission records and pathology reports.

Inclusion criteria

- Adult and elderly patients with histopathologically confirmed soft tissue sarcoma
- Exclusion criteria
- Pediatric patients (younger than 18 years).
- Non soft tissue tumors (such as solid organ tumors, hematopoietic, lymphoid, and bone tumors).
- Benign soft tissue lesions.
- Incomplete clinical or pathological data in patients' records

Statistical Analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 22. Continuous data were expressed as means ± standard deviations, while categorical data were presented as frequencies. Analysis of variance (ANOVA) was used to compare continuous variables across more than two groups. The chi-square test was applied for comparisons among categorical variables, and Fisher's exact test was used when the expected cell count was less than five. A P-value ≤ 0.05 was considered statistically Results.

RESULTS

The study included 100 patients with soft tissue sarcoma, with a mean age of 46.5 ± 15.7 years (range 20–74). A slightly higher proportion of patients were male (55%) compared to females (45%). Most tumors occurred in the lower limbs (48%), followed by the upper limbs (14%) and the head and neck (8%). The average tumor size was 8.4 cm, ranging from 0.6 to 30 cm.

About 58% of tumors were primary, 34% were recurrences, and 8% had metastasized. High-grade tumors (Grade 3) were the most common (65%), with Grade 2 at 30% and Grade 1 at 5%. Synovial sarcoma was the most frequent subtype, accounting for 31% of cases. Liposarcoma (18%) and undifferentiated pleomorphic sarcoma (13%) were also frequent, while other subtypes such as Ewing sarcoma, leiomyosarcoma, rhabdomyosarcoma, MPNST, DFSP, ASPS, epithelioid sarcoma, and fibromyxoid sarcoma occurred less commonly.

Table 1: Characteristics of the studied sample.

Parameter	Category	Number	%
Age (years)	Mean ± SD (range)	46.51±15.66 (20-74)	
Sex	Male	55	55
	Female	45	45
Site	upper extremity	14	14
	lower extremity	48	48
	head and neck	8	8
	thoracic cavity	8	8
	thoracic wall	6	6
	Trunk	5	5
	retroperitoneal	7	7
	abdominal cavity	1	1
	abdominal wall	3	3
Size (cm)	Mean ± SD (range)	8.38±5.63 (0.6-30)	

Tumor outcome	Primary	58	58
	Recurrence	34	34
	Metastasis	8	8
Subtype	Synovial sarcoma	31	31
	liposarcoma	18	18
	Undifferentiated Pleomorphic sarcoma	13	13
	Ewing sarcoma	7	7
	Leiomyosarcoma	7	7
	rhabdomyosarcoma	6	6
	malignant peripheral nerve sheath tumor	5	5
	Dermatofibrosarcoma protuberans	4	4
	alveolar soft part sarcoma	4	4
	Epitheloid sarcoma	3	3
	fibromyxoid sarcoma	2	2
Grade	Grade 1	5	5
	Grade 2	30	30
	Grade 3	65	65

The mean age ± SD of the studied patients was 46.5 ± 15.7 years, with a range of 20 to 74 years. As shown in Figure (4.1), the 50–59-year age group represented the largest proportion of cases (30%), followed by the 60–69 year group (20%). Patients aged 20–29 years and 30–39 years each accounted for 18% of the total cases, while the 40–49 year group represented 10%. Only 4% of patients were aged 70 years or older**.**

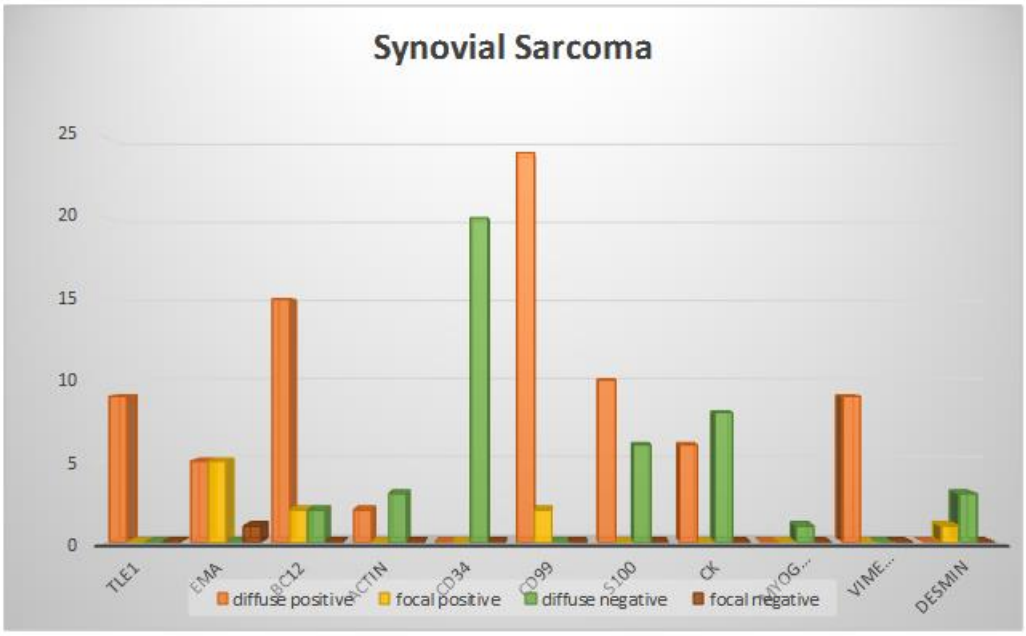

Figure (1): Distribution of the Studied Patients According to Age Group The immunohistochemical profiles of the six most common soft tissue sarcoma subtypes identified in this study are illustrated in Figures (2-6). Each figure demonstrates the characteristic staining patterns of key diagnostic markers for the respective tumor type.

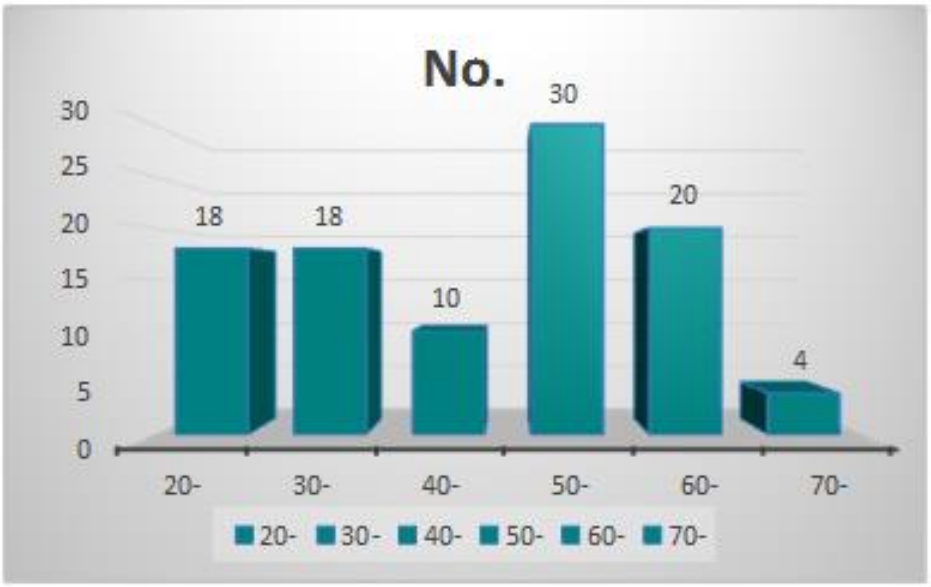

Figure 2: *Immunohistochemical expression profile of* synovial sarcoma: Most cases demonstrated diffuse positivity for **CD99** and **TLE1**, with variable focal expression of **EMA** and **Bcl-2**. A minority showed positivity for **vimentin** and **S100**, while other markers (actin, desmin, myogenin, and CD34) were largely negative. These findings support the characteristic diagnostic immunoprofile of synovial sarcoma.

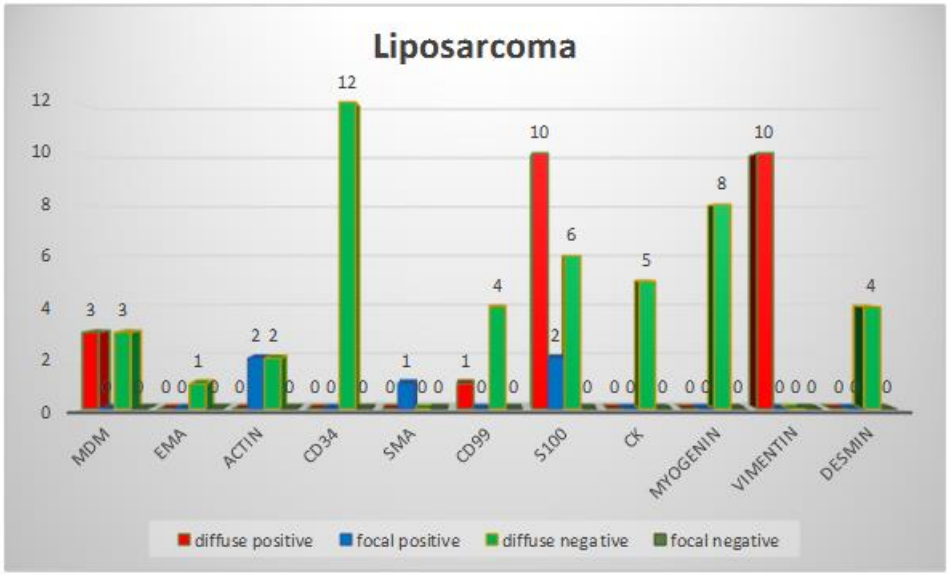

Figure 3: *Immunohistochemical expression profile of Liposarcoma cases.* Most liposarcoma cases exhibited strong diffuse positivity for **S100** and **vimentin**, consistent with adipocytic differentiation. A subset of cases showed **MDM2** positivity, supporting known amplification patterns characteristic of liposarcoma. **CK**, **EMA**, and **actin** showed variable or focal reactivity, while **CD34** and **desmin** were mostly negative

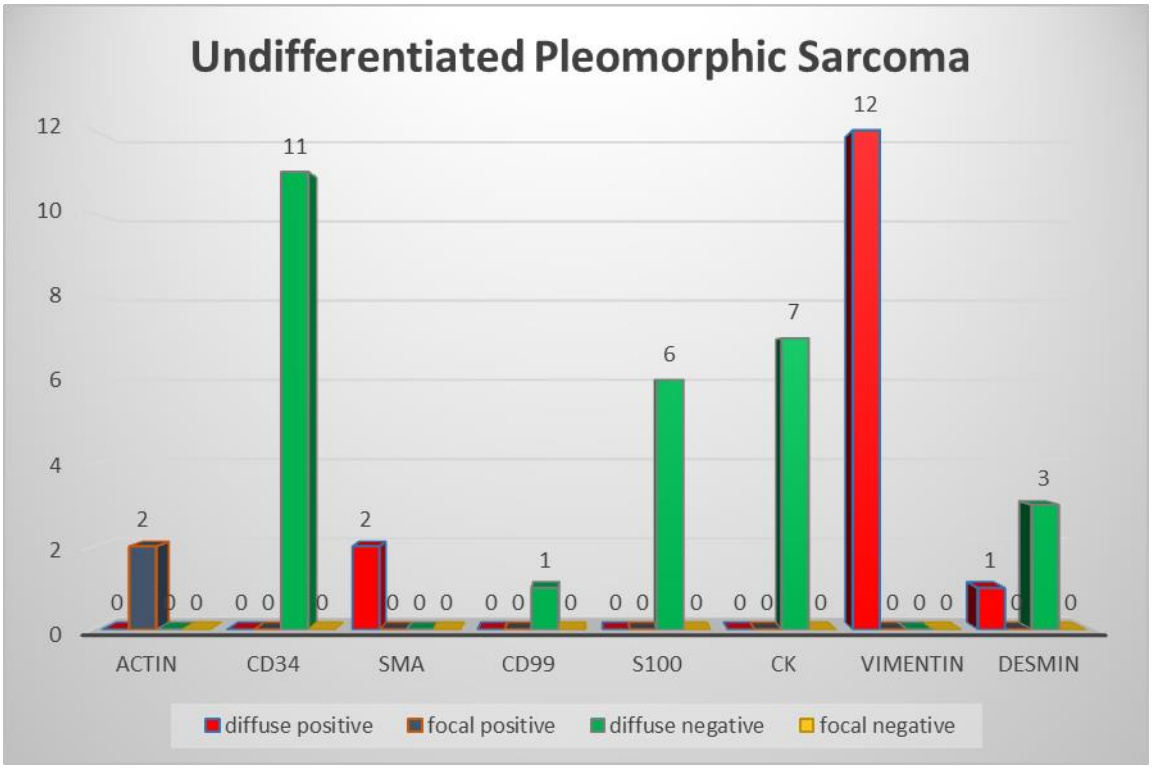

Figure 4*: Immunohistochemical expression profile of Undifferentiated Pleomorphic Sarcoma (UPS).* All UPS cases demonstrated diffuse **vimentin** positivity (12/13), confirming mesenchymal differentiation. **Actin** showed focal expression in two cases, while other markers such as **CD34**, **S100**, **CK**, and **Desmin** was largely negative. This staining pattern reflects the undifferentiated, high-grade pleomorphic morphology characteristic of this sarcoma subtype.

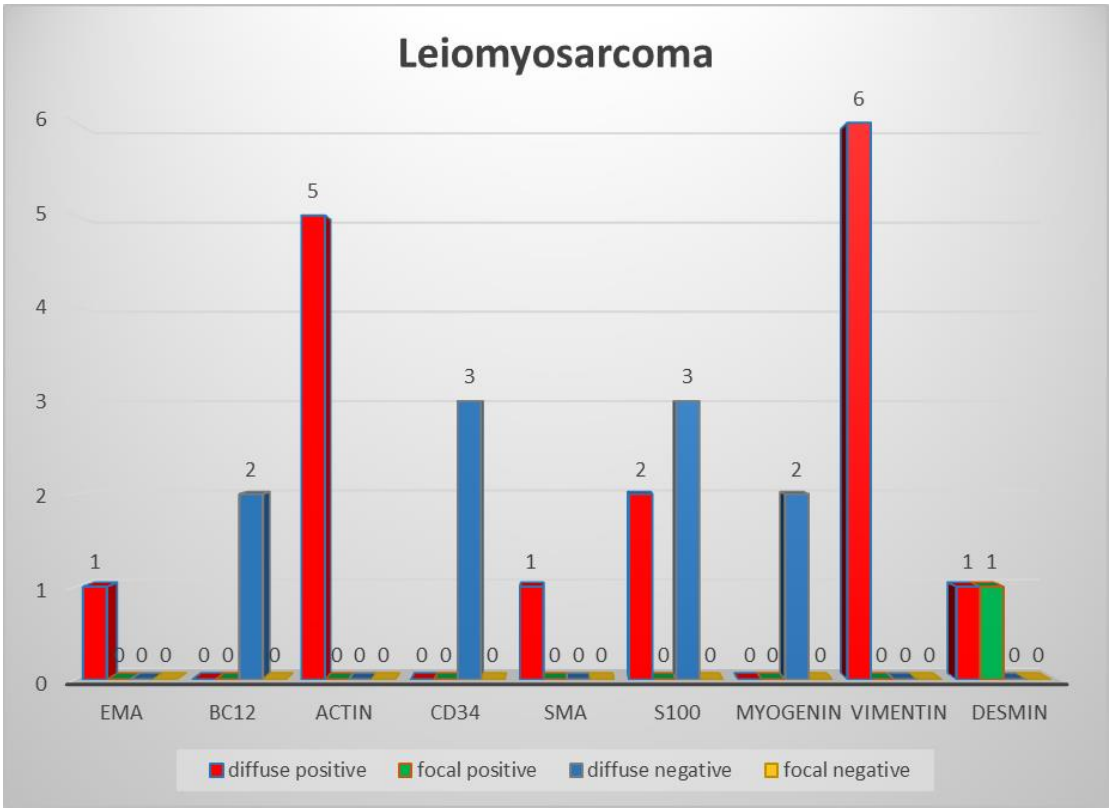

Figure (5): Immunohistochemical expression profile of *Leiomyosarcoma.* Most cases showed diffuse positivity for **Vimentin (6/6)** and **Actin (5/6)**, with focal or diffuse positivity for **Desmin (2/6)** and **SMA (1/6)**, confirming smooth muscle differentiation. Other markers, including **CD34, S100, and Myogenin**, were negative in the majority of cases.

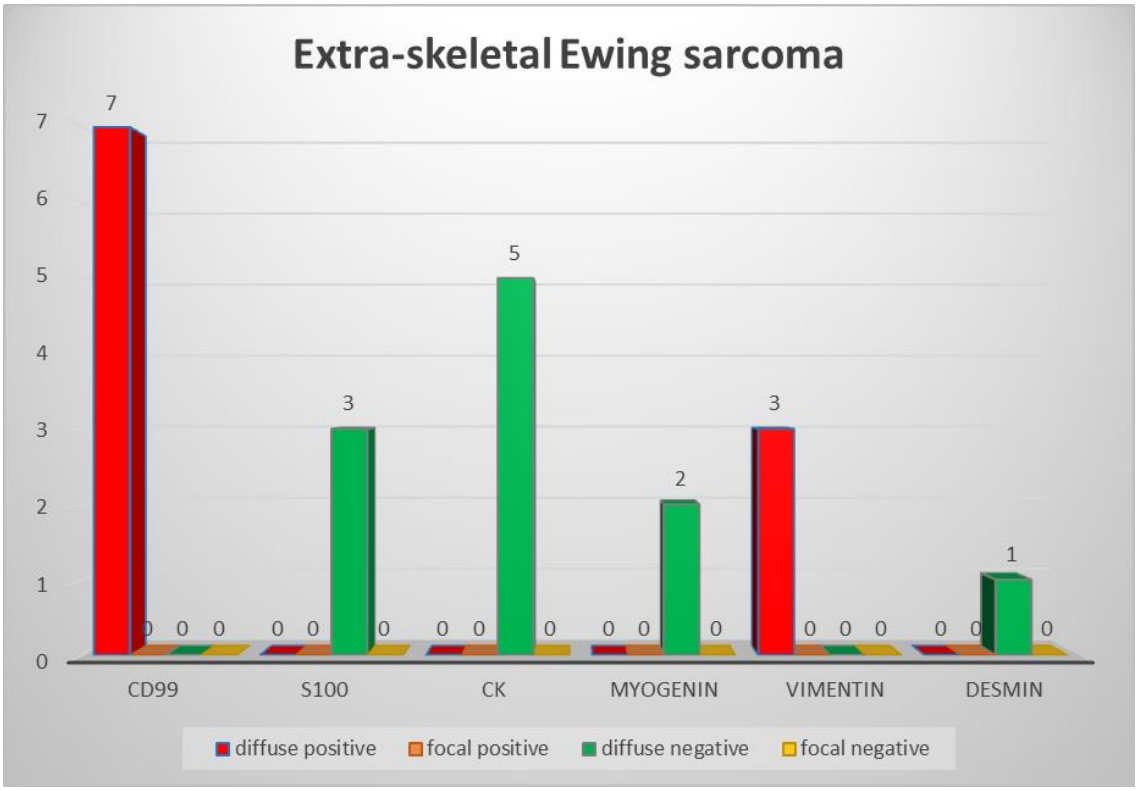

Figure (6): Immunohistochemical expression profile of *Extra-skeletal Ewing Sarcoma*.All cases demonstrated **diffuse CD99 positivity (7/7)**, which is the hallmark diagnostic marker for this tumor. **Vimentin** showed diffuse positivity in nearly half of the cases (3/7), while other markers including **S100, CK, Myogenin, and Desmin** were negative or only focally positive, supporting the diagnosis of Ewing sarcoma and excluding other differential entities.

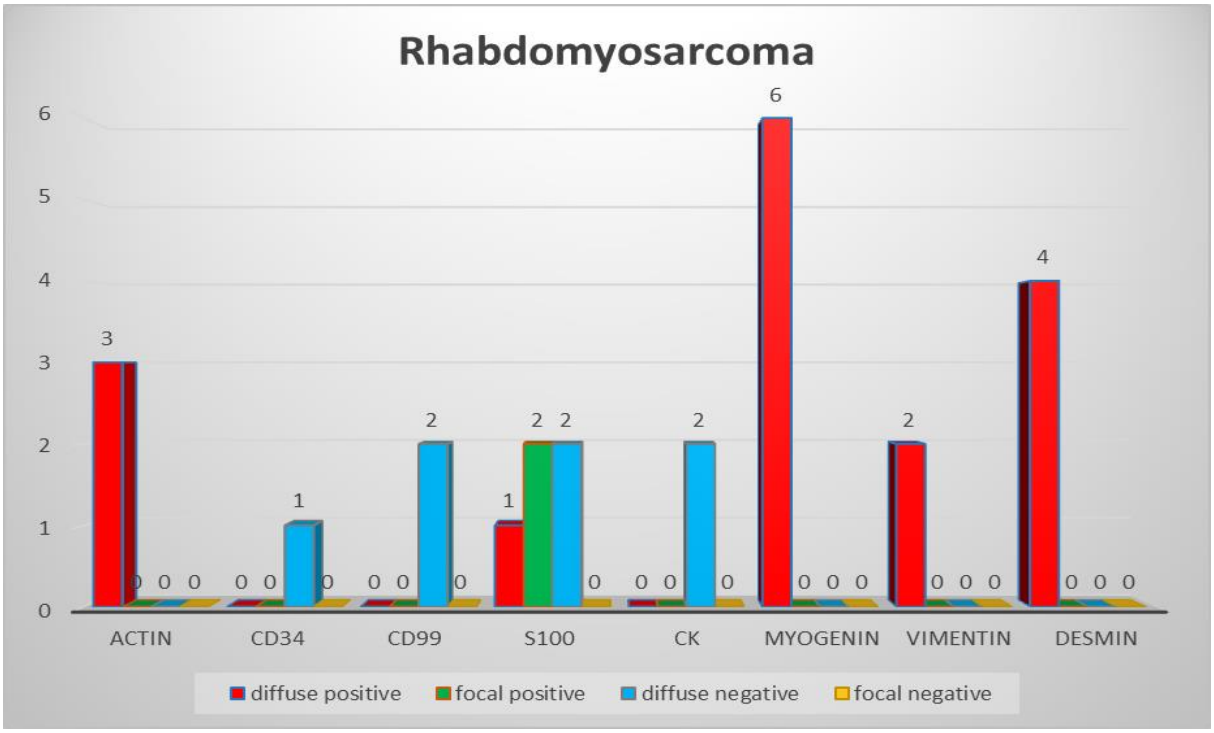

Figure (7): Immunohistochemical expression profile of *Rhabdomyosarcoma*. All cases showed **diffuse Myogenin positivity (6/6)** confirming skeletal muscle differentiation, with **Desmin** also strongly positive in most cases (4/6). **Actin** was diffusely positive in half of the cases (3/6), while **CD99, S100, CK, and Vimentin** showed variable or negative expression. This immunoprofile supports the diagnosis of rhabdomyosarcoma and helps exclude other spindle and round cell sarcomas.

Regarding sex Distribution of Soft Tissue Sarcoma Subtypes, the distribution of soft tissue sarcoma subtypes according to sex is presented in Table (2).

Table 2: Association Between Sarcoma Subtypes and Patient Sex.

Tumor Subtype	Sex		P value
	Male	Female	
synovial sarcoma	20	11	0.242
liposarcoma	9	9	
Undifferentiated Pleomorphic sarcoma	5	8	
Ewing sarcoma	4	3	
Leiomyosarcoma	4	3	
rhabdomyosarcoma	4	2	
malignant peripheral nerve sheath tumor	5	0	
Dermatofibrosarcoma protuberans	1	3	
alveolar soft part sarcoma	1	3	
Epithelioid sarcoma	1	2	
fibromyxoid sarcoma	1	1	

The distribution of soft tissue sarcoma subtypes according to anatomical site is presented in Table (3). There was no statistically significant association between tumor subtype and anatomical site (P = 0.431).

Table (3): Distribution of soft tissue sarcoma subtypes according to anatomical site.

Tumor subtype	Site									P value
	Upper limb	Lower limb	Head and neck	Thoracic cavity	Retro Peri toneal	Thoracic wall	Trunk	Abdo minal cavity	Abdomi nal wall	
synovial sarcoma	2	16	4	1	1	3	3	0	1	0.431
Liposarcoma	1	12	0	1	3	0	0	0	1	
Undifferentiated Pleomorphic sarcoma	2	5	0	2	2	0	2	0	0	
Ewing sarcoma	1	5	0	1	0	0	0	0	0	
Leiomyosarcoma	0	2	1	1	0	2	0	0	1	
rhabdomyosarcoma	3	0	1	1	1	0	0	0	0	
malignant peripheral nerve sheath tumor	1	2	1	0	0	1	0	0	0	
Dermatofibrosarcom a protuberans	2	2	0	0	0	0	0	0	0	
alveolar soft part sarcoma	1	2	0	0	0	0	0	1	0	
Epithelioid sarcoma	0	2	0	1	0	0	0	0	0	
fibromyxoid sarcoma	1	0	1	0	0	0	0	0	0	

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Table (4): Distribution of soft tissue sarcoma subtypes according to anatomical site.

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	Upper limb	Lower limb	Head and neck	Thoracic cavity	Retro Periton eal	Thora cic wall	Trunk	Abdo minal cavity	Abdomi nal wall	
synovial sarcoma	2	16	4	1	1	3	3	0	1	0.431
Liposarcoma	1	12	0	1	3	0	0	0	1	
Undifferentiated Pleomorphic sarcoma	2	5	0	2	2	0	2	0	0	
Ewing sarcoma	1	5	0	1	0	0	0	0	0	
Leiomyosarcoma	0	2	1	1	0	2	0	0	1	
rhabdomyosarcoma	3	0	1	1	1	0	0	0	0	

malignant peripheral nerve sheath tumor	1	2	1	0	0	1	0	0	0	
Dermatofibrosarcoma protuberans	2	2	0	0	0	0	0	0	0	
alveolar soft part sarcoma	1	2	0	0	0	0	0	1	0	
Epithelioid sarcoma	0	2	0	1	0	0	0	0	0	
fibromyxoid sarcoma	1	0	1	0	0	0	0	0	0	

The distribution of sarcoma subtypes across different age groups is shown in Table (5). Statistical analysis using the Chi-square test showed no significant association between sarcoma subtype and age group (P = 0.084).

Table 5: Distribution Between Sarcoma Subtypes and Age Groups.

Tumor subtype	Age groups						P value
	20-	30-	40-	50-	60-	70-	
Synovial sarcoma	8	9	4	5	5	0	0.084
Liposarcoma	3	1	2	7	4	1	
Pleomorphic sarcoma	0	5	1	4	2	1	
Ewing sarcoma	2	0	0	5	0	0	
Leiomyosarcoma	0	1	1	2	3	0	
Rhabdomyosarcoma	1	0	0	3	1	1	
Malignant peripheral nerve Sheath tumor	2	0	1	0	2	0	
Dermatofibrosarcoma Protuberans	1	2	1	0	0	0	
Alveolar soft part sarcoma	1	0	0	2	1	0	
Epithelioid sarcoma	0	0	0	1	1	1	
Fibromyxoid sarcoma	0	0	0	1	1	0	

The distribution of tumor size according to sarcoma subtype is presented in Table (6). Tumor size was classified into four categories: <5 cm, 5–9.9 cm, 10–14.9 cm, and ≥15 cm. There was no statistically significant association between tumor subtype and tumor size (P = 0.256).

Table 6: Association Between Sarcoma Subtypes and Tumor Size Distribution.

Tumor subtype	Size (cm)				P value
	<5	5-	10-	≥15	
synovial sarcoma	10	10	6	5	0.256
Liposarcoma	3	6	7	2	
Undifferentiated Pleomorphic sarcoma	2	4	5	2	
Ewing sarcoma	5	1	1	0	
Leiomyosarcoma	1	3	2	1	
rhabdomyosarcoma	3	0	1	2	
malignant peripheral nerve sheath tumor	0	4	1	0	
Dermatofibrosarcoma protuberans	1	2	1	0	
alveolar soft part sarcoma	3	0	1	0	
Epithelioid sarcoma	1	1	1	0	
fibromyxoid sarcoma	1	1	0	0	

The distribution of tumor outcomes according to sarcoma subtype is shown in Table (7). Statistical analysis using the Chi-square test showed no statistically significant association between sarcoma subtype and tumor outcome (P = 0.349)

Table (7): Distribution of Tumor Outcomes among Sarcoma Subtypes.

Tumor subtype	Tumor outcome			P value
	Primary	Recurrence	Metastasis	
synovial sarcoma	16	14	1	0.349
liposarcoma	11	6	1	
Pleomorphic sarcoma	9	2	2	
Ewing sarcoma	3	4	0	
Leiomyosarcoma	3	2	2	

rhabdomyosarcoma	5	0	1	
malignant peripheral nerve sheath tumor	3	2	0	
Dermatofibrosarcoma protuberans	3	1	0	
alveolar soft part sarcoma	2	1	1	
Epithelioid sarcoma	1	2	0	
fibromyxoid sarcoma	2	0	0	

The distribution of tumor outcomes according to tumor size is shown in Table (8). Statistical analysis using the Chi-square test showed no statistically significant association between tumor size and clinical tumor outcome (P = 0.769).

For tumors measuring <5 cm, 17 cases were primary, 9 cases were recurrent, and 4 cases were metastatic. Tumors measuring 5–9.9 cm included 19 primary cases, 11 recurrent cases, and 2 metastatic cases. In tumors measuring 10–14.9 cm, 15 cases were primary, 9 cases were recurrent, and 2 cases were metastatic. Tumors measuring ≥15 cm included 7 primary cases and 5 recurrent cases, with no metastatic cases recorded.

Table 8: Distribution of Tumor Outcome across Tumor Size Categories.

Size (cm)	Tumor outcome			P value
	Primary	**Recurrence**	**Metastasis**	
<5	17	9	4	0.769
5-	19	11	2	
10-	15	9	2	
≥15	7	5	0	
Size (cm)	Tumor outcome			P value
	Primary	**Recurrence**	**Metastasis**	
<5	17	9	4	0.769
5-	19	11	2	
10-	15	9	2	

The distribution of histologic tumor grades according to tumor outcome is shown in Table (9). Statistical analysis using the Chi-square test showed no statistically significant association between tumor outcome and histologic tumor grade (P = 0.477). Among primary tumors, Grade 3 was recorded in 35 cases, Grade 2 in 19 cases, and Grade 1 in 4 cases. For recurrent tumors, 23 cases were classified as Grade 3, 10 cases as Grade 2, and 1 case as Grade 1. All metastatic tumors were classified as high-grade, with 7 cases recorded as Grade 3 and 1 case as Grade 2. No metastatic tumors were classified as Grade 1. Detailed distributions of histologic tumor grade according to tumor outcome are presented in **Table (9)**.

Table 9: Distribution of Histologic Tumor Grades Across Tumor Outcome Categories.

Tumor outcome	Tumor grading			P value
	Grade 1	**Grade 2**	**Grade 3**	
Primary	4	19	35	0.477
Recurrence	1	10	23	
Metastasis	0	1	7	

The distribution of tumor outcomes according to anatomical site is shown in Table (10). A statistically significant association was found between tumor outcome and anatomical site (P = 0.000). For primary tumors, the most common site was the lower limb (32 cases), followed by the upper limb (9 cases), head and neck (6 cases), and retroperitoneum (6 cases). Additional primary tumors were recorded in the thoracic wall (2 cases), abdominal wall (2 cases), and trunk (1 case). No primary tumors were recorded in the thoracic cavity or abdominal cavity. For recurrent tumors, the lower limb was also the most frequent site (15 cases). Other sites included the upper limb (5 cases), thoracic wall (4 cases), trunk (4 cases), head and neck (2 cases), thoracic cavity (2 cases), retroperitoneum (1 case), and abdominal wall (1 case). No recurrent tumors were recorded in the abdominal cavity. For metastatic tumors, most cases were recorded in the thoracic cavity (6 cases). Single metastatic cases were observed in the lower limb (1 case) and the abdominal cavity (1 case). No metastatic tumors were recorded in the upper limb, head and neck, retroperitoneum, thoracic wall, trunk, or abdominal wall.

Table 10: Association between Tumor Outcomes and Anatomical Sites.

Tumor outcomes	Site									P value
	Upper limb	Lower limb	Head and neck	Thoracic cavity	Retro peritoneum	Thoracic wall	Trunk	Abdominal cavity	Abdominal wall	
Primary	9	32	6	0	6	2	1	0	2	0.0001
Recurrence	5	15	2	2	1	4	4	0	1	
Metastasis	0	1	0	6	0	0	0	1	0	

The distribution of histologic tumor grade according to tumor size is shown in Table (4.9). Statistical analysis using the Chi-square test showed a statistically significant association between tumor size and histologic tumor grade (P = 0.044). For tumors measuring <5 cm, Grade 3 tumors accounted for 20 cases, followed by Grade 2 in 9 cases and Grade 1 in 1 case. Tumors measuring 5–9.9 cm included 18 Grade 3 cases, 11 Grade 2 cases, and 3 Grade 1 cases. In tumors measuring 10–14.9 cm, 15 cases were classified as Grade 3, 10 cases as Grade 2, and 1 case as Grade 1. All tumors measuring ≥15 cm were classified as Grade 3 (12 cases), with no cases recorded as Grade 1 or Grade 2.

Table 11: Distribution between Tumor Size and Histologic Tumor Grade.

Size (cm)	Tumor grading			P value
	Grade 1	Grade 2	Grade 3	
<5	1	9	20	0.044
5-	3	11	18	
10-	1	10	15	
≥15	0	0	12	

DISCUSSION

Soft tissue sarcomas represent a small but clinically significant portion of the overall cancer burden. Understanding their epidemiology in Iraq is particularly important given the recent rise in cancer incidence nationwide. In Iraq, the general cancer burden is steadily increasing, with 43,062 new cases reported in 2023, corresponding to a crude rate of 99.4 per 100,000 and an age-standardized rate of 171.6 per 100,000. This rise is linked to population aging, lifestyle changes, urban expansion, and increased exposure to carcinogenic factors. Despite this upward trend, detailed national data specific to soft tissue sarcomas remain limited. A recent Iraqi report from 2025 indicates an overall rise in cancer incidence, showing an age-standardized rate of 158.94 per 100,000 in 2022, but without providing detailed STS-specific epidemiology.[11]

These national patterns align with findings from the Middle East, where a 2024 study in Saudi Arabia reported that STS incidence is generally lower than in Western countries but comparable to other regional nations, while emphasizing the scarcity of detailed epidemiological data (**Aljuhani et al., 2024).**[1]

Globally, more than **96,200 new STS cases** were reported worldwide in 2021, with rising absolute numbers despite a slight decline in age-standardized incidence (**Zhou et al., 2025**).[12]

In the present study, the average age of STS patients was **46.5 ± 15.7 years**, ranging from 20 to 74 years. The largest proportion of cases occurred in the **50–59-year group (30%)**, followed by **60–69 years (20%)**. Patients aged 20–29 and 30–39 each make up 18%, while the 40–49-year group accounts for 10%, and only 4% of patients are 70 years or older.

This age distribution is consistent with findings from Iraq, where the highest peak occurred in the **51–60-year age group** (**Obaidi, 2020**).[13] A similar pattern was observed in Saudi Arabia, where most STS patients were middle-aged (**Aljuhani et al., 2024**).[1] Globally, STS predominantly affects middle aged and elderly individuals, **which may be influenced by population aging and lifestyle changes** (**Zhu et al., 2025**).[12]

In this study, males represent **55%** of patients, while females represent **45%** indicating a mild male predominance. This finding aligns with an Iraqi study reporting **68% males and 32% females** (**Obaidi, 2020**).[13] In the Middle East, proportions were more balanced, although data variability remains due to limited regional reporting (**Aljuhani et al., 2024**).[1] Worldwide, STS is consistently reported as slightly more common in males (**Zhu et al., 2025**).[12]

Regarding the subtypes of soft tissue sarcoma, **synovial sarcoma is** the most prevalent, representing 31.0% of cases. It is followed by **liposarcoma** (18.0%) and **undifferentiated pleomorphic sarcoma** (13.0%). **Ewing sarcoma** and **leiomyosarcoma** each account for 7.0%, **rhabdomyosarcoma** 6.0%, and **malignant peripheral nerve sheath tumor** 5.0%. Less common subtypes include **dermatofibrosarcoma protuberans** and **alveolar soft part sarcoma** (4.0% each), **epithelioid sarcoma** (3.0%), and **fibromyxoid sarcoma** (2.0%). These distributions are summarized in Figure 4.3. When compared with regional studies, the subtype distribution shows notable differences. An earlier Iraqi study from

Mosul reported common subtypes including malignant fibrous histiocytoma, leiomyosarcoma, liposarcoma, synovial sarcoma, and malignant peripheral nerve sheath tumors (**Al-Irhayim & Lazim,2008**).[14]

A more recent Middle Eastern study from Saudi Arabia (with a median age of 37 years) identified synovial sarcoma (20%) as the most common subtype, followed by liposarcoma (13.6%) and undifferentiated pleomorphic sarcoma (12%) (Alshamsan et al., 2022).[15]

Globally, a systematic review from Latin America reported liposarcoma (23.2%) and synovial sarcoma (21.2%) as the most common types (**Cruz-Ramos et al., 2025**).[16]

Among 100 adult and elderly Iraqi patients, the lower extremities were the most frequently affected site, accounting for 48% of cases. The upper extremities followed with 14%.

These findings align with previous observations in Iraq and the Middle East. An earlier Iraqi study reported that the extremities were the most common site of involvement (Obaidi, 2020).[13] Similarly, a study from North Jordan found the extremities to be the most frequent anatomical location (40.1%), followed by the trunk (14.7%) and the head and neck (10.8%) (Alorjani et al., 2022).[17] In Saudi Arabia, the lower limbs (45%) and upper limbs (15%) were identified as the most common sites (Aljuhani et al., 2024).[1]

Globally, extremity involvement is consistently predominant. Worldwide, 50–60% of STS cases occur in the limbs, while the retroperitoneum is the second most frequent site at 19% (Zhu et al., 2025).[12]

In this study, the majority of soft tissue sarcomas (58%) were diagnosed as primary tumors. Recurrent tumors accounted for 34% of cases, while metastatic presentations were the least common at 8%. Comparable data from Iraq were limited, as most local studies such as Obaidi (2020) focused primarily on the initial histological diagnosis and did not report the pattern of presentation.[13] the regional level, a Middle Eastern study from Saudi Arabia reported a higher rate of metastatic disease at diagnosis, affecting 39% of patients (Alshamsan et al., 2022).[15] Globally**,** metastasis at initial diagnosis is reported in a small proportion of patients, around 11.9%, most often involving the lungs; therefore, the findings of the present study are generally in line with international reports (Liu et al., 2022).[18]

Regarding tumor Grading Distribution, soft tissue sarcomas were predominantly high-grade according to the FNCLCC system. Grade 3 tumors accounted for 65% of cases, followed by Grade 2 at 30%, and Grade 1 at 5%.

When compared with other studies, some patterns are seen. In Iraq, Al Obaidi (2020) reported that aggressive histological subtypes tend to have higher grades, which partially aligns with our findings despite the absence of exact percentages.[13] In the Middle East, studies from Saudi Arabia (Alshamsan et al., 2022) also note frequent high-grade sarcomas, though detailed distributions were not provided, partially agreeing with our results.[15] On a global scale, studies from Latin America (Cruz-Ramos et al., 2025) show a high prevalence of advanced, high-grade sarcomas due to delayed diagnosis and limited access to specialized care, consistent with our cohort.[16]

In this study, soft tissue sarcomas demonstrated characteristic immunohistochemical (IHC) profiles. Synovial sarcomas exhibited diffuse CD99 and high TLE1 positivity. Liposarcomas were positive for S100 and vimentin, with some cases expressing MDM2. Undifferentiated pleomorphic sarcomas mainly expressed vimentin, while Ewing sarcomas showed diffuse CD99. Leiomyosarcomas were positive for actin and vimentin, with variable desmin expression. Rhabdomyosarcomas displayed myogenin. Dermatofibrosarcoma protuberans were CD34-positive, and malignant peripheral nerve sheath tumors showed heterogeneous S100 and CD34 expression.

These findings align with (Al Obaidi, 2020) who demonstrated the central role of immunohistochemistry in the diagnostic evaluation of soft tissue sarcomas.[13] Some local reports focus more on morphological features or limited marker panels which differs from the more comprehensive diagnostic strategy adopted in this study. Regionally, (Alorjani et al., 2022) in Northern Jordan confirmed that IHC combined with FISH is crucial for accurate diagnosis, supporting our results.[17]

Several international studies continue to support the diagnostic value of immunohistochemistry in soft tissue and bone tumors (Anderson & Jo, 2021).[19] Recent reviews (Álava, 2024) have pointed to an expanding role for molecular diagnostics, particularly in genetically defined or diagnostically challenging sarcomas.[20]

In this study of 100 Iraqi patients, no statistically significant association was observed between patient sex and sarcoma subtype ($P = 0.242$). However, variation in sex distribution was noted among different sarcoma subtypes. Specifically, synovial sarcoma was more common in males, while undifferentiated pleomorphic sarcoma, dermatofibrosarcoma protuberans, alveolar soft part sarcoma, and epithelioid sarcoma showed a female predominance. Liposarcoma and fibromyxoid sarcoma were equally distributed between sexes.

A study from Iraq reported a male predominance in certain soft tissue sarcoma subtypes, which is consistent with the male predominance observed in the present study for subtypes such as synovial sarcoma and malignant peripheral nerve sheath tumor **(Obaidi,**

2020)[13] Another Iraqi study reported an equal male-to-female distribution among soft tissue sarcoma subtypes, which differs from the subtype-specific sex patterns observed in the present study **(Al-Irhayim & Lazim, 2008).**[14]

Studies from the Middle East have reported variable patterns of sex distribution in soft tissue sarcomas. A study from Northern Jordan described a higher frequency of soft tissue sarcomas among males, with liposarcoma, rhabdomyosarcoma, and leiomyosarcoma among the commonly reported subtypes, which is consistent with the male predominance observed in some subtypes in the present study **(Alorjani et al., 2022)**[17], and study from Saudi Arabia reported similar proportions of male and female adult patients with soft tissue sarcomas, with only a slight male predominance **(Aljuhani et al., 2024).**[1] Globally,(Karaca et al., 2023).[21]

In this study, no statistically significant association was observed between sarcoma subtypes and age groups (P = 0.084). Nevertheless, certain age-related patterns were noted. Rhabdomyosarcoma and Ewing sarcoma tended to occur in younger patients, synovial sarcoma was more common in young adults, while liposarcoma and undifferentiated pleomorphic sarcoma were more frequently observed in older adults.

(Al Obaidi, 2020) reported a peak incidence of soft tissue sarcomas in the 51–60 year age group, partially differing from our broader analysis.[13]

In the Middle East, (Aljuhani et al., 2024; Saudi Arabia)[1] described subtype specific age trends that are comparable to those observed in the present cohort. Conversely, (Alorjani et al., 2022; Jordan) reported increasing rates of soft tissue sarcomas with advancing age, suggesting a statistically significant association that contrasts with the non-significant finding in our study.[17]

In our study of 100 Iraqi patients, there was no statistically significant association between sarcoma subtypes and tumor size (P = 0.256). However, subtype-specific size patterns were observed. Synovial sarcoma ranged from small to very large tumors, liposarcoma was mostly intermediate to large in size, undifferentiated pleomorphic sarcoma was predominantly intermediate, Ewing sarcoma was generally small, leiomyosarcoma spanned a wide range of sizes, rhabdomyosarcoma showed variable sizes, and malignant peripheral nerve sheath tumor was mostly intermediate in size.

(Al Obaidi, 2020) described tumor sizes between 1–20 cm without providing subtype-specific size distributions, partially differing from our subtype-focused analysis.[13] In the Middle East, (Aljuhani et al., 2024; Saudi Arabia)[1] noted that liposarcomas are often large and that synovial sarcomas show wide size variability, findings that are consistent with our results. In contrast, (Alorjani et al., 2022; Jordan)[17] reported average tumor sizes for their cohort without analyzing size by individual subtypes, differing from our more detailed observations.

In this study of 100 Iraqi patients, no statistically significant association was observed between sarcoma subtypes and tumor outcomes (P = 0.349). Synovial sarcomas were mostly primary or recurrent, with rare metastatic cases. Liposarcomas were primarily primary tumors, with few recurrences and one metastatic case. Undifferentiated pleomorphic sarcomas were mainly primary, with some recurrences and two metastatic cases, whereas Ewing sarcomas showed more recurrent than primary cases and no metastatic disease. Leiomyosarcomas were distributed across primary, recurrent, and metastatic categories. Other less common subtypes, including rhabdomyosarcoma, malignant peripheral nerve sheath tumor, dermatofibrosarcoma protuberans, epithelioid sarcoma, alveolar soft part sarcoma, and fibromyxoid sarcoma, were predominantly primary tumors with low rates of recurrence or metastasis.

In the Middle East, variable outcomes related to tumor grade and stage were reported for common sarcoma subtypes (Aljuhani et al., 2024; Saudi Arabia), supporting the biological behavior patterns observed in the present cohort. In contrast, general outcome data without subtype-specific analysis were reported in another regional study (Alorjani et al., 2022; Jordan).

In this study of Iraqi patients, tumor size shows no significant association with clinical outcome (P = 0.769). Primary tumors predominated across all size categories, and no metastatic cases were observed among tumors ≥15 cm.

Iraq: An Iraqi study reported no clear association between tumor size and outcomes due to limited metastatic cases (Salih et al., 2023)[3], agreeing with our findings. In contrast, another local report suggested that larger tumors might be linked to worse outcomes, although the analysis was not stratified by size (Alorjani et al., 2022).[17]

A regional review concluded that there is insufficient evidence to confirm tumor size as an independent prognostic factor (Aljuhani et al., 2024)[1], supporting our results. Conversely, a Saudi study found that larger tumors significantly worsened survival (Alshamsan et al., 2022), differing from our observation.[15]

Internationally, a Chinese study indicated that tumor size alone may not reliably predict outcomes unless considered with tumor grade and depth (Lv et al., 2024)[11], agreeing with our findings.

Overall, the absence of a significant association in our Iraqi population likely reflects the low number of metastatic cases, referral patterns favoring primary tumors, and the heterogeneity of sarcoma subtypes,

which together reduce the independent prognostic value of tumor size.[140]

In the cohort of 100 Iraqi patients, tumor size was significantly associated with histologic grade, with a p-value of **0.0044**. This indicates that larger tumors in our population are more likely to be high-grade, reflecting the aggressive biological behavior of these sarcomas.

In the Iraqi context, our findings are supported by) Salih et al.,2023,[3]) who reported a positive association between larger tumor size and higher grade. Regionally, studies from Saudi Arabia (Aljuhani et al., 2024;[1] Alshamsan et al., 2022).[15]

In this cohort, histologic tumor grade was not significantly associated with clinical tumor outcome (P = 0.477). Similar findings were reported in Iraq, where histologic grade was not identified as a significant predictor of outcome (Salih et al., 2023).[3] Another Iraqi study described tumor grade as a key indicator of tumor aggressiveness, suggesting an important prognostic role for histologic grade (Al Obaidi, 2020).[13]

Regionally, studies from Saudi Arabia reported that survival was mainly influenced by factors such as age, tumor size, and metastatic status, while histologic grade did not play a major role (Alshamsan et al., 2022). In contrast, a study from Jordan emphasized that histologic grade is a reliable predictor and an important component of soft tissue sarcoma staging and prognosis (Alorjani et al., 2022 In our cohort of 100 Iraqi patients, tumor outcomes were significantly associated with anatomical sites (P = 0.000). Primary tumors were most common in the lower limbs, with fewer cases in the upper limbs, head/neck, and retroperitoneum. Recurrences mainly occurred in the lower and upper limbs, thoracic wall, and trunk. Metastases were predominantly observed in the thoracic cavity.

In Iraq, frequent involvement of the extremities has been reported, which is consistent with the distribution observed in the present study (**Salih et al., 2023**). However, detailed site-specific outcome data were not provided in some local studies, limiting direct comparison (**Al Obaidi, 2020**).

Regionally, studies from Saudi Arabia indicated that superficially located tumors tend to have a better prognosis compared to deeply seated tumors, supporting the influence of anatomical site on clinical outcome (**Aljuhani et al., 2024**). Other regional reports mainly presented general outcome data without detailed analysis according to tumor location.

CONCLUSIONS

Soft tissue sarcoma in Iraqi adults mainly affected middle-aged and older patients, with a slightly younger mean age compared to international reports.

The lower extremities were the most common site, and most tumors presented with large size, suggesting delayed diagnosis and limited early referral.

A high proportion of tumors were high grade (Grade 3), indicating a significant burden of aggressive disease.

Synovial sarcoma was the most frequent subtype, and immunohistochemistry was essential for accurate diagnosis and subtype classification.

Larger tumors were associated with higher histologic grade, and the lungs were the most common site of metastasis, highlighting the need to improve sarcoma care in Iraq.

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