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Soft Tissue Sarcomas: Epidemiologic Trends at King Abdulaziz University Hospital in Jeddah

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Abstract

Objectives: We aim to enhance the understanding of soft tissue sarcomas (STS) within the Saudi population, guiding better diagnosis, treatment strategies, and healthcare resource allocation for this rare but challenging cancer type.

Methods: Retrospective data of 160 patients at King Abdulaziz University Hospital (2013–2023) were examined for demographics, anatomical sites, and diagnoses of STS. Statistical analysis in RStudio (R v4.3.1) utilized Fisher's exact and chi-squared tests for categorical variables ($P < 0.05$), while continuous variables were summarized by medians and interquartile range.

Results: We included patients with STS, evenly split between males and females (median age: 47 years) Significant differences were observed between age groups: younger patients (<50 years) more commonly had rhabdomyosarcoma and synovial sarcoma, while older patients (≥50 years) showed higher rates of dedifferentiated liposarcoma, Kaposi sarcoma, and leiomyosarcoma. Sarcoma locations varied, with the thigh, retroperitoneum, and head and neck being prominent sites. Higher frequencies of Kaposi sarcoma and skin sarcomas were noted in males, and leiomyosarcoma and uterine sarcomas exclusively in females.

Conclusion: The study highlights significant sex and age disparities in the diagnosis and distribution of STS among Saudi patients. Rhabdomyosarcoma emerges as the most frequent subtype, influenced by factors such as genetic predisposition and advanced diagnostic capabilities. Understanding these demographic variations is crucial for developing targeted treatment strategies tailored to the unique needs of different patient groups. Further research into the underlying biological and environmental factors driving these disparities is essential for advancing sarcoma care and improving patient outcomes in Saudi Arabia.

Keywords: soft tissue sarcomas, epidemiology, cancer, Saudi Arabia.

Introduction

Soft-tissue sarcomas (STS) are a diverse group of cancers that pose significant treatment challenges. They account for only approximately 1% of all cancer cases and include more than 100 different histological and molecular subtypes. These tumors can originate in various tissues, including tendons, skeletal muscles, endothelial cells, and fat.[1,2]

Optimal management of sarcomas is typically achieved at dedicated specialist centers. Early referral of suspected cases is crucial for comprehensive assessment and evaluation by a multidisciplinary team. Surgery continues to be the primary treatment, augmented by the latest advancements in multimodal therapies, including chemotherapy and radiation.[3]

Soft tissue sarcomas (STS) represent a small percentage (1–2%) of all adult cancers but are relatively more common among adolescents and young adults, accounting for approximately 8% of cancer cases in this age group.[4,5] Adolescents and young adults are typically defined as individuals aged 15–39 years according to the standards set by the U.S. National Cancer Institute and the European Network for Cancer in Children and Adolescents.[6]

Globally, the incidence of soft tissue sarcomas is estimated to be approximately 1–5 cases per 100,000 individuals annually, with variations depending on geographical region and population.[7] The precise overall incidence of sarcomas remains uncertain, and the specific rates of different histological and molecular subtypes have not been accurately determined.[8] Many studies have traditionally separated sarcomas into adult and pediatric cases or distinguished between soft tissue and bone sarcomas. Population-based research suggests that sarcoma incidence might be underestimated, potentially because of the diagnostic challenges in distinguishing them from carcinomas affecting the same organ.[9] Worldwide, studies on soft tissue sarcomas have highlighted their diverse histological subtypes, varied clinical presentations, and the complexities involved in treatment outcomes.[10] Incidence rates vary significantly across different regions and populations, and are influenced by genetic predispositions and environmental factors. Multidisciplinary treatment approaches involving surgery, radiation therapy, and systemic therapies have been emphasized to achieve positive outcomes in patients with soft-tissue sarcomas.[11–13]

In 2020, the Saudi Cancer Registry (SCR) indicated that soft tissue sarcomas (STS) were not among the top ten most common cancers in Saudi Arabia. This suggests that the availability of incidence and prevalence data for STS in Brazil is limited. Comprehensive population-based data from the SCR, spanning from 1994 to the present, play a crucial role in accurately allocating healthcare resources and research funding for cancer management.[14] Given the scarcity of specific information on STS, further research is required to better understand its epidemiology, clinical characteristics, and outcomes in the Saudi population. This effort is essential for improving diagnostic and treatment strategies tailored to local needs and ultimately enhancing patient care and outcomes for individuals affected by this rare but significant type of cancer. However, the age and sex distributions and the histologic or anatomic site frequencies of STS have not yet been described. Furthermore, the impact of the provision of multidisciplinary sarcoma care and the STRAD guidelines on the surgical and survival outcomes of extremity and retroperitoneal STS in Saudi Arabia has not been assessed.

There is a significant gap in the epidemiological understanding of soft tissue sarcomas (STS) in Saudi Arabia. Despite being relatively uncommon compared to other malignancies, the incidence and specific characteristics of STS within the Saudi population remain poorly documented. By leveraging

comprehensive data from an oncology tertiary care center in Saudi Arabia spanning a decade, this research aims to provide crucial insights into the epidemiology of STS. Such data are essential for informing local and regional healthcare policies, guiding targeted screening programs, and optimizing resource allocation for the better management of this rare but clinically challenging cancer.

This study aimed to investigate the epidemiological trends of soft tissue sarcomas (STS) among Saudi Arabia, utilizing retrospective data from King Abdulaziz University Hospital from 2013 to 2023. Specifically, our objectives were to analyze the differences in sarcoma diagnoses and their respective anatomical locations across different age groups, as well as to assess variations in diagnosis and location based on sex. Furthermore, we sought to identify the most common anatomical site of soft tissue sarcoma occurrences within the studied population.

By systematically collecting epidemiological data on soft tissue sarcomas across different demographic groups, researchers can enhance diagnostic prediction strategies tailored to sex- and age-specific patterns, thereby improving clinical outcomes.

Methods

In this study, we employed a retrospective methodology utilizing data spanning a decade from 2013 to 2023, sourced from King Abdulaziz University Hospital in Jeddah. The dataset included information on patient demographics such as age and sex, as well as detailed records of the anatomical locations and specific diagnoses of soft tissue sarcomas. The study protocol underwent rigorous evaluation and approval by the Unit of Biomedical Research Ethics Committees within the Faculty of Medicine, King Abdul-Aziz University, with ethical clearance granted under reference number 206–24. This approach allows for a thorough analysis of the epidemiological trends and clinical characteristics of soft tissue sarcomas in Saudi Arabia, providing valuable insights into disease patterns and informing future health care strategies and interventions.

Statistical Analysis

Statistical analyses were performed using RStudio software (R version 4.3.1). Categorical variables were analyzed using Fisher's exact test and Pearson's chi-square test. Continuous variables were summarized using median and interquartile range (IQR). The significance level was set at $P < 0.05$.

Results

Demographic Characteristics of Patients

A total of 160 patients were included in the study, with an equal distribution of males and females (80 patients each, 50.0%). The median age of the patients was 47.0 years (IQR, 29.0 to 61.0). The age distribution of patients is shown in Figure 1. Patients were also categorized into two age groups: those under 50 years (83 patients, 51.9%) and those 50 years or older (77 patients, 48.1%). Sarcoma locations varied, with the most common sites being the thigh (32 patients, 20.0%), retroperitoneum (19 patients, 11.9%), and head and neck (18 patients, 11.3%). Diagnoses were diverse, with the most frequent being rhabdomyosarcoma (26 patients, 16.3%),

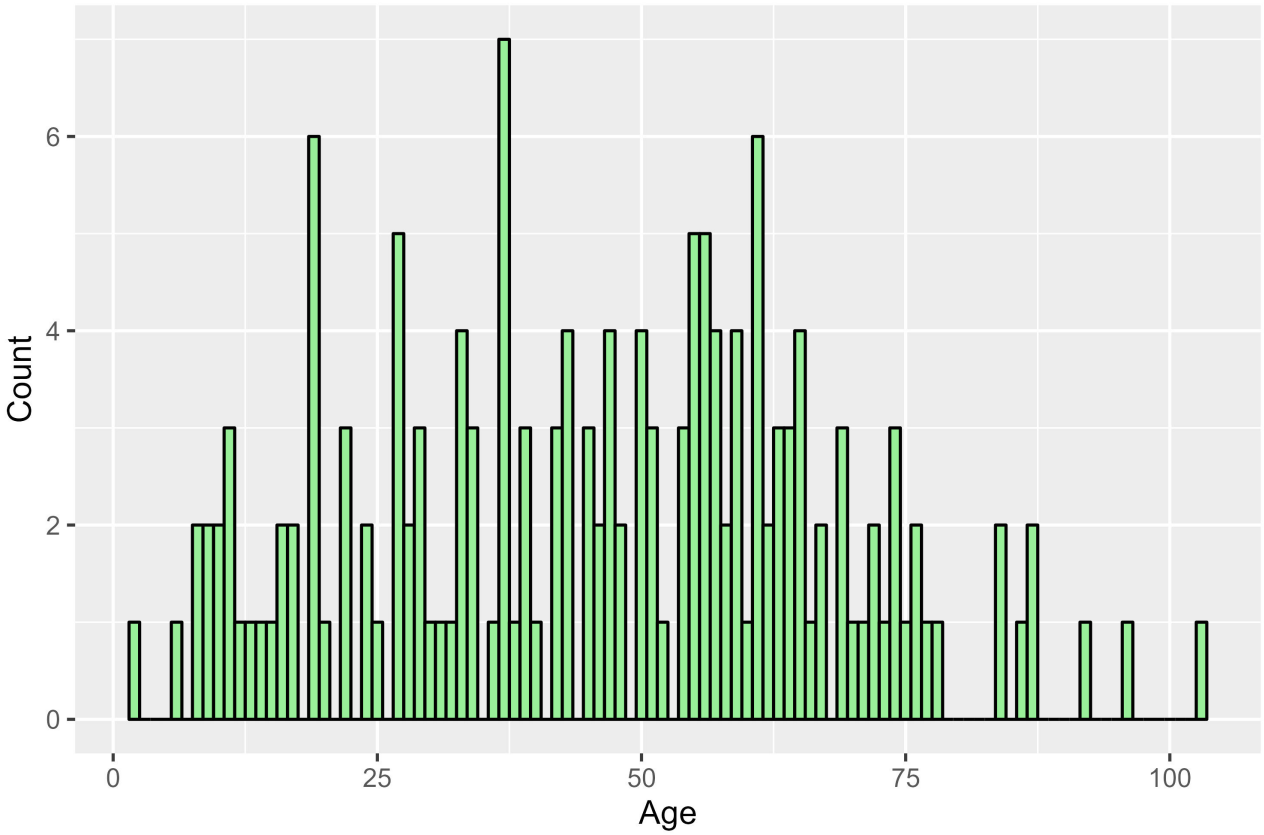

Fig. 1 **A histogram depicting the frequency distribution of participants' age.**

dermatofibrosarcoma protuberans (22 patients, 13.8%), and Kaposi's sarcoma (20 patients, 12.5%; Table 1).

Differences in Sarcoma Diagnoses and Locations by Sex

Our analysis revealed significant sex differences in the distribution of certain sarcoma diagnoses and locations. Kaposi's sarcoma was significantly more frequent in males (18.8%) than in females (6.3%; $P = 0.017$). Leiomyosarcoma was significantly more frequent in females (22.5%) than in males (1.3%; $P < 0.001$). Additionally, the frequency of sarcomas located in the skin was significantly higher in males (16.3%) than in females (3.8%; $P = 0.008$). Uterine sarcomas were exclusive to females (16.3%; $P < 0.001$; Figure 2 and Table 2).

Table 1. **Demographic characteristics of patients**

Characteristic	Description
Gender	
Male	80 (50.0%)
Female	80 (50.0%)
Age	47.0 (29.0–61.0)
Age	
< 50	83 (51.9%)
50 or more	77 (48.1%)
Location	
Abdominal wall	2 (1.3%)
Arm	5 (3.1%)
Back	4 (2.5%)
Bowel	5 (3.1%)
Breast	2 (1.3%)
Carotid body	1 (0.6%)
Chest cavity	2 (1.3%)
Chest wall	6 (3.8%)
Flank	1 (0.6%)
Forearm	13 (8.1%)
Head and neck	18 (11.3%)
Heart	1 (0.6%)
Leg	8 (5.0%)
Liver	2 (1.3%)
Lung	2 (1.3%)
Lymph node	1 (0.6%)
Mastectomy scar	1 (0.6%)
Perineum	1 (0.6%)
Retroperitoneum	19 (11.9%)
Skin	16 (10.0%)
Testis	1 (0.6%)
Thigh	32 (20.0%)
Urinary bladder	2 (1.3%)
Uterus	13 (8.1%)
Vagina	2 (1.3%)
Diagnosis	
Adult type fibrosarcoma	2 (1.3%)
Angiosarcoma	3 (1.9%)
Dedifferentiated liposarcoma	7 (4.4%)
Dermatofibrosarcoma protuberans	22 (13.8%)
Glomangiosarcoma	1 (0.6%)
Kaposi sarcoma	20 (12.5%)
Leiomyosarcoma	19 (11.9%)
Low-grade fibromyxoid sarcoma	3 (1.9%)
Malignant peripheral nerve sheath tumor	3 (1.9%)
Myxofibrosarcoma	5 (3.1%)
Myxoid Leiomyosarcoma	1 (0.6%)
Myxoid liposarcoma	6 (3.8%)
Rhabdomyosarcoma	26 (16.3%)
Synovial sarcoma	16 (10.0%)
Undifferentiated pleomorphic sarcoma	20 (12.5%)
Well-differentiated liposarcoma	6 (3.8%)

n (%); Median (IQR).

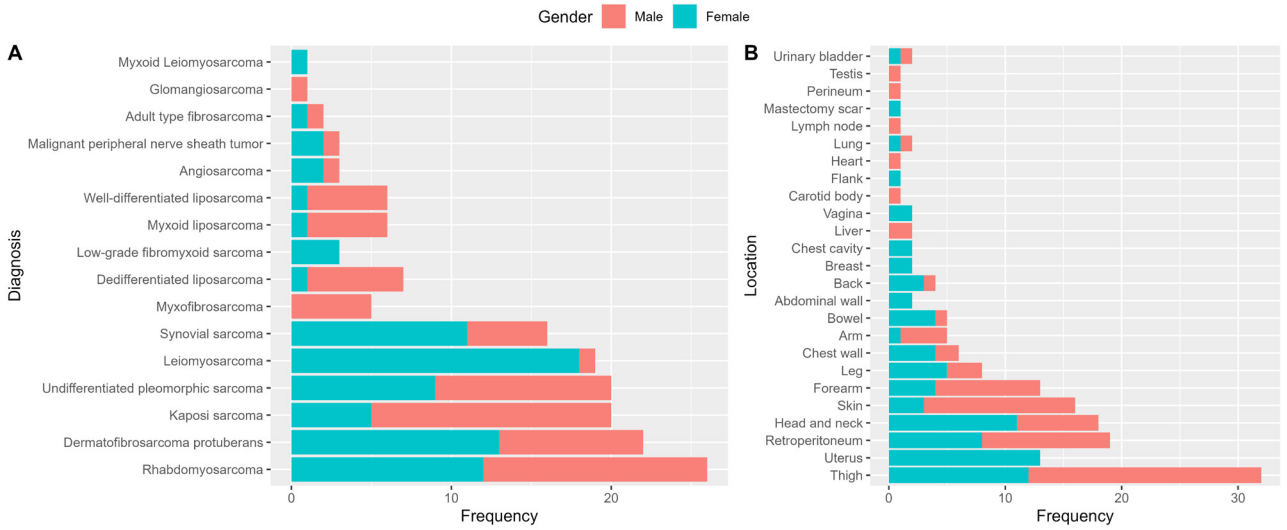

Fig. 2 **The frequencies of diagnoses and locations of sarcoma lesions across patients' gender categories.**

Differences in Sarcoma Diagnoses and Locations by Age

Significant differences were also observed between the age groups. Dedifferentiated liposarcoma was more common in patients aged 50 or more (9.1%) compared to those under 50 (0.0%, P = 0.005). Kaposi sarcoma and leiomyosarcoma were more frequent in older age groups (19.5% vs. 6.0%, P = 0.010), as was leiomyosarcoma (20.8% vs. 3.6%, P < 0.001, respectively). Conversely, rhabdomyosarcoma (30.1% vs. 1.3 %, P < 0.001) and synovial sarcoma (15.7% vs. 3.9 %, P = 0.013) were more common in younger patients than in older patients. Sarcomas located in the head and neck were more prevalent in patients under 50 years (19.3% vs. 2.6%, P < 0.001), while skin sarcomas were more common in those aged 50 or more (15.6% vs. 4.8%, P = 0.023). Uterus sarcomas were significantly more frequent in the older age group (15.6% vs. 1.2%, P < 0.001, Figure 3 and Table 3).

Table 2. **Statistical differences in sarcoma diagnoses and location based on patients' gender**

Characteristic	Male N = 80	Female N = 80	*P*-value
Diagnosis			
Adult type fibrosarcoma	1 (1.3%)	1 (1.3%)	>0.999
Angiosarcoma	1 (1.3%)	2 (2.5%)	>0.999
Dedifferentiated liposarcoma	6 (7.5%)	1 (1.3%)	0.117
Dermatofibrosarcoma protuberans	9 (11.3%)	13 (16.3%)	0.358
Glomangiosarcoma	1 (1.3%)	0 (0.0%)	>0.999
Kaposi sarcoma	15 (18.8%)	5 (6.3%)	0.017
Leiomyosarcoma	1 (1.3%)	18 (22.5%)	<0.001
Low-grade fibromyxoid sarcoma	0 (0.0%)	3 (3.8%)	0.245
Malignant peripheral nerve sheath tumor	1 (1.3%)	2 (2.5%)	>0.999
Myxofibrosarcoma	5 (6.3%)	0 (0.0%)	0.059
Myxoid Leiomyosarcoma	0 (0.0%)	1 (1.3%)	>0.999
Myxoid liposarcoma	5 (6.3%)	1 (1.3%)	0.210
Rhabdomyosarcoma	14 (17.5%)	12 (15.0%)	0.668
Synovial sarcoma	5 (6.3%)	11 (13.8%)	0.114
Undifferentiated pleomorphic sarcoma	11 (13.8%)	9 (11.3%)	0.633
Well-differentiated liposarcoma	5 (6.3%)	1 (1.3%)	0.210
Location			
Abdominal wall	0 (0.0%)	2 (2.5%)	0.497
Arm	4 (5.0%)	1 (1.3%)	0.367
Back	1 (1.3%)	3 (3.8%)	0.620
Bowel	1 (1.3%)	4 (5.0%)	0.367
Breast	0 (0.0%)	2 (2.5%)	0.497
Carotid body	1 (1.3%)	0 (0.0%)	>0.999
Chest cavity	0 (0.0%)	2 (2.5%)	0.497
Chest wall	2 (2.5%)	4 (5.0%)	0.681
Flank	0 (0.0%)	1 (1.3%)	>0.999
Forearm	9 (11.3%)	4 (5.0%)	0.148
Head and neck	7 (8.8%)	11 (13.8%)	0.317
Heart	1 (1.3%)	0 (0.0%)	>0.999
Leg	3 (3.8%)	5 (6.3%)	0.719
Liver	2 (2.5%)	0 (0.0%)	0.497
Lung	1 (1.3%)	1 (1.3%)	>0.999
Lymph node	1 (1.3%)	0 (0.0%)	>0.999
Mastectomy scar	0 (0.0%)	1 (1.3%)	>0.999
Perineum	1 (1.3%)	0 (0.0%)	>0.999
Retroperitoneum	11 (13.8%)	8 (10.0%)	0.463
Skin	13 (16.3%)	3 (3.8%)	0.008
Testis	1 (1.3%)	0 (0.0%)	>0.999
Thigh	20 (25.0%)	12 (15.0%)	0.114
Urinary bladder	1 (1.3%)	1 (1.3%)	>0.999
Uterus	0 (0.0%)	13 (16.3%)	<0.001
Vagina	0 (0.0%)	2 (2.5%)	0.497

n(%); Fisher's exact test; Pearson's Chi-squared test.

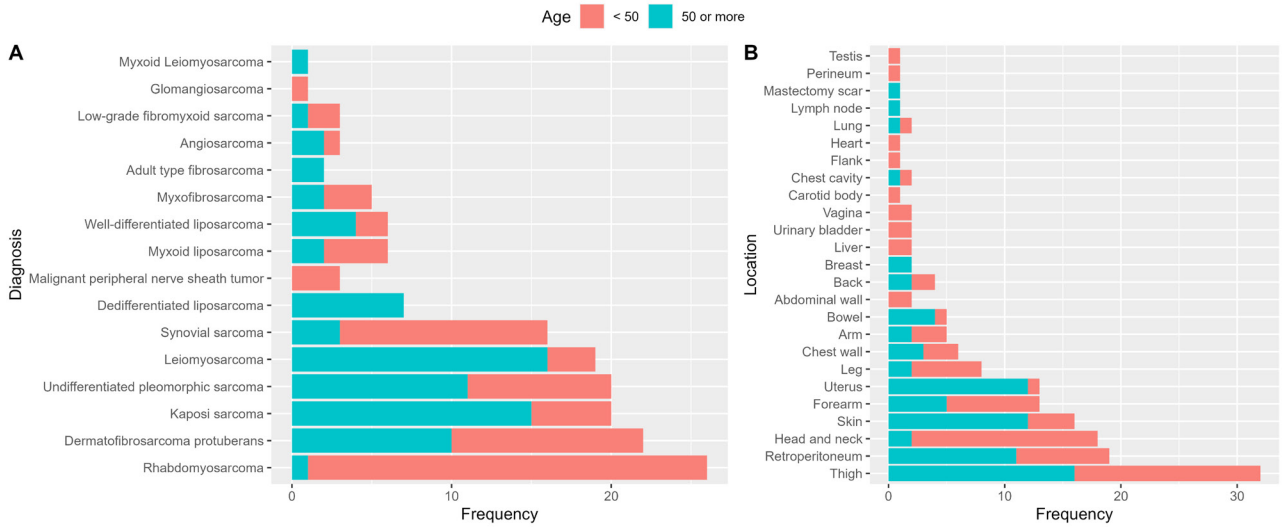

Fig. 3 **The frequencies of diagnoses and locations of sarcoma lesions across patients' age categories.**

Table 3. **Statistical differences in sarcoma diagnoses and location based on patients' age**

Characteristic	< 50 N = 83	50 or more N = 77	*P*-value
Diagnosis			
Adult type fibrosarcoma	0 (0.0%)	2 (2.6%)	0.230
Angiosarcoma	1 (1.2%)	2 (2.6%)	0.609
Dedifferentiated liposarcoma	0 (0.0%)	7 (9.1%)	0.005
Dermatofibrosarcoma protuberans	12 (14.5%)	10 (13.0%)	0.787
Glomangiosarcoma	1 (1.2%)	0 (0.0%)	>0.999
Kaposi sarcoma	5 (6.0%)	15 (19.5%)	0.010
Leiomyosarcoma	3 (3.6%)	16 (20.8%)	<0.001
Low-grade fibromyxoid sarcoma	2 (2.4%)	1 (1.3%)	>0.999
Malignant peripheral nerve sheath tumor	3 (3.6%)	0 (0.0%)	0.246
Myxofibrosarcoma	3 (3.6%)	2 (2.6%)	>0.999
Myxoid Leiomyosarcoma	0 (0.0%)	1 (1.3%)	0.481
Myxoid liposarcoma	4 (4.8%)	2 (2.6%)	0.683
Rhabdomyosarcoma	25 (30.1%)	1 (1.3%)	<0.001
Synovial sarcoma	13 (15.7%)	3 (3.9%)	0.013
Undifferentiated pleomorphic sarcoma	9 (10.8%)	11 (14.3%)	0.511
Well-differentiated liposarcoma	2 (2.4%)	4 (5.2%)	0.429
Location			
Abdominal wall	2 (2.4%)	0 (0.0%)	0.498
Arm	3 (3.6%)	2 (2.6%)	>0.999
Back	2 (2.4%)	2 (2.6%)	>0.999
Bowel	1 (1.2%)	4 (5.2%)	0.196
Breast	0 (0.0%)	2 (2.6%)	0.230
Carotid body	1 (1.2%)	0 (0.0%)	>0.999
Chest cavity	1 (1.2%)	1 (1.3%)	>0.999
Chest wall	3 (3.6%)	3 (3.9%)	>0.999
Flank	1 (1.2%)	0 (0.0%)	>0.999
Forearm	8 (9.6%)	5 (6.5%)	0.467
Head and neck	16 (19.3%)	2 (2.6%)	<0.001
Heart	1 (1.2%)	0 (0.0%)	>0.999
Leg	6 (7.2%)	2 (2.6%)	0.279
Liver	2 (2.4%)	0 (0.0%)	0.498
Lung	1 (1.2%)	1 (1.3%)	>0.999
Lymph node	0 (0.0%)	1 (1.3%)	0.481
Mastectomy scar	0 (0.0%)	1 (1.3%)	0.481
Perineum	1 (1.2%)	0 (0.0%)	>0.999
Retroperitoneum	8 (9.6%)	11 (14.3%)	0.364
Skin	4 (4.8%)	12 (15.6%)	0.023
Testis	1 (1.2%)	0 (0.0%)	>0.999
Thigh	16 (19.3%)	16 (20.8%)	0.812
Urinary bladder	2 (2.4%)	0 (0.0%)	0.498
Uterus	1 (1.2%)	12 (15.6%)	<0.001
Vagina	2 (2.4%)	0 (0.0%)	0.498

n (%); Fisher's exact test; Pearson's Chi-squared test.

Discussion

Soft tissue sarcomas are relatively rare, with 12,020 new cases and 4,740 deaths reported in the United States in 2014. These cancers represent approximately 1% of all cancer cases and account for approximately 2% of cancer-related deaths.[15]

Sarcomas can occur in various locations within the body, with the thigh being the most common site of occurrence. In our cohort, 20% of sarcoma cases were found in the thigh, which is consistent with data reported in Vodanovich and Choong (2018). Sarcomas are typically classified based on their anatomical location. When occurring in the extremities, they are more frequently found in the proximal limb, with the thigh being the predominant location, accounting for 44% of cases. The extremities are the most common sites for soft tissue sarcomas, with the lower limbs being more frequently affected than the upper limbs, at a ratio of 28% to 12%.[16]

Our study revealed significant disparities in sarcoma diagnosis and locations based on sex and age. Kaposi's sarcoma is more prevalent in males, whereas leiomyosarcoma and skin sarcomas are more common in females. Kaposi's sarcoma is more prevalent in males, as evidenced by studies showing a higher incidence rate in men than in women.[17,18] Data from Johannesburg, South Africa, indicate that the incidence rates of Kaposi's sarcoma have doubled in men but have increased seven-fold in women, reducing the sex ratio from 7:1 (males vs. females) in 1988 to only 2:1.[18] This finding suggests a higher prevalence of Kaposi's sarcoma among males. Furthermore, this study highlights the challenge of studying clonality in Kaposi sarcoma owing to its strong prevalence in males.[19] In contrast, leiomyosarcoma and skin sarcomas, such as cutaneous leiomyosarcomas, are found to be more common in females in other studies as well.[20–22]

Older patients have higher rates of dedifferentiated liposarcoma, Kaposi's sarcoma, and leiomyosarcoma. In contrast, younger patients are more prone to rhabdomyosarcoma and synovial sarcoma, consistent with the findings by Sultan et al. (2009).[23]

Understanding these sex and age disparities in sarcoma diagnosis is crucial for developing effective treatment strategies. Research into these differences could lead to sex-specific treatments for sarcomas, considering the unique vulnerabilities observed across different demographic groups.[24] Further investigations into the biological, environmental, and genetic factors influencing the varying incidence rates of sarcomas among different sexes and age groups are warranted owing to the complexity of these disparities.

Diagnoses among our study group were diverse, with the most frequent being rhabdomyosarcoma (26 patients, 16.3%), a soft tissue sarcoma that exhibited a higher prevalence among our study subjects, which can be attributed to various factors. Firstly, the high rate of consanguinity in Saudi Arabia increases the likelihood of genetic mutations that predispose individuals to this type of cancer. Consanguineous marriages are common in this region, leading to a higher incidence of genetic disorders. Additionally, the advanced healthcare infrastructure in Saudi Arabia enables more frequent and accurate diagnoses, potentially contributing to the higher reported rates of rhabdomyosarcoma. The younger demographic profile of the country also plays a role, as rhabdomyosarcoma is more common in children and adolescents. The population structure of Saudi Arabia, with a significant proportion of young

individuals, contributed to the observed higher incidence of rhabdomyosarcoma.[25]

Understanding these subtypes is crucial for the development of diagnostic and treatment strategies. Rhabdomyosarcoma can be classified into different subtypes, with embryonal rhabdomyosarcoma (ERMS) and alveolar rhabdomyosarcoma (ARMS) being the two prevalent subtypes.[26] In another study, rhabdomyosarcomas were identified as having several distinct morphological subtypes, including alveolar, embryonic, pleomorphic, and spindle cell/sclerosing.[27] This diversity highlights the complexity of rhabdomyosarcoma and underscores the need for tailored management.

Conclusion

Understanding the epidemiology of soft tissue sarcomas in Saudi Arabia requires consideration of the unique demographic, genetic, environmental, healthcare, and sociocultural factors that shape the disease landscape in the region. This understanding is essential for developing targeted prevention, screening, and treatment strategies to mitigate the STS burden on the Saudi population. By meticulously gathering epidemiological data on soft tissue sarcomas, researchers in Saudi Arabia can significantly enhance their ability to predict diagnoses within specific demographic categories such as sex and age groups. This comprehensive approach not only aids in understanding the incidence and prevalence rates but also facilitates the identification of potential risk factors associated with different populations.

To achieve this goal, epidemiologists and medical researchers rely on various resources and methodologies. These include population-based registries, hospital records, and longitudinal studies tracking the progression of soft tissue sarcomas across diverse demographics. By analyzing these data sources, patterns and trends can be identified, allowing for more targeted diagnostic strategies and personalized treatment plans.

Furthermore, the expansion of data collection efforts ensures a more nuanced understanding of how soft tissue sarcomas manifest differently across sexes and age brackets. This information is crucial for healthcare providers to effectively tailor screening protocols and early detection methods. Ultimately, the integration of epidemiological insights into clinical practice will improve diagnostic accuracy and enhance patient outcomes in the management of soft tissue sarcomas.

The insights gained from this study can inform healthcare policies and resource allocation, ultimately enhancing the quality of care and survival rates of individuals affected by STS in Saudi Arabia. Lastly, a comprehensive understanding of STS epidemiology contributes to global knowledge, facilitating comparisons with international data and potentially uncovering unique genetic, environmental, or sociocultural factors influencing disease prevalence and management outcomes in the Saudi population.

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Conflict of Interest

The author declares no conflicts of interest related to this study.

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