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Survival and prognostic factors among different types of liposarcomas based on SEER database

Jiaqi Zhao[1], WenLi Du[2], XiaoLiang Tao[1], AiAi Li[1], Yi Li[1] & Shuai Zhang[1]✉

The aim of this study is to elucidate the disparities in survival and risk factors among different subtypes of liposarcoma, through analysis of epidemiological and prognostic data. The study cohort consisted of 12,822 patients diagnosed with liposarcoma in the United States between 2000 and 2021, whose data were retrieved from the Surveillance, Epidemiology, and End Results (SEER) program. The prognosis for different subtypes of liposarcoma and the associated factors such as age, tumor stage, intervention, gender, tumor grade, location, size, chemotherapy and radiotherapy, were retrieved from the database. Well-differentiated liposarcoma demonstrated the most favorable prognosis, with 5-year and 10-year survival rates of 82% and 68%, respectively, followed by myxoid liposarcoma, pleomorphic liposarcoma and dedifferentiated liposarcoma, which exhibited the poorest prognosis. Advanced age, higher tumor stage, and the absence of surgical intervention were associated with inferior survival outcomes across all subtypes. Male gender, higher pathological grade, and primary tumor sites outside the extremities were identified as risk factors for the prognosis of subtypes other than pleomorphic liposarcoma. Larger tumor size was an indicator of a worse prognosis in subtypes other than well-differentiated liposarcoma. Chemotherapy was a risk factor for the prognosis of well-differentiated and myxoid liposarcomas but had no significant correlation with the prognosis of pleomorphic and dedifferentiated liposarcomas. Radiotherapy served as a protective factor for the prognosis of subtypes other than well-differentiated liposarcoma. Survival and prognostic factors vary among the major subtypes of liposarcoma, necessitating individualized analysis for each subtype. Poorer outcomes can be anticipated in the dedifferentiated and pleomorphic subtypes, while well-differentiated and myxoid liposarcomas exhibit relatively favorable prognoses.

Keywords Liposarcoma, Subtypes, Prognosis, SEER database

Liposarcoma accounts for approximately 20% of adult sarcomas and represents the most prevalent malignant soft tissue tumor in clinical practice. Previous investigations on liposarcoma have reported a wide range of patient outcomes, with the 5-year overall survival rate varying from approximately 57.2% to 93%[1,2]. According to the fourth edition of the International Classification of Diseases for Oncology (ICD-O), liposarcoma encompasses four distinct histological subtypes: atypical lipomatous tumor/well-differentiated liposarcoma (ATL/WDLPS), dedifferentiated liposarcoma (DDLPS), myxoid liposarcoma (MLPS), and pleomorphic liposarcoma (PLPS). ALT/WDLPS and DDLPS are the predominant subtypes, jointly constituting the largest subgroup of liposarcoma, accounting for approximately 40–45%, followed by myxoid liposarcoma. Each subtype can manifest in any anatomical location and exhibits disparate clinical behaviors and treatment sensitivities, sarcomas can occur also in the uterus, presenting as pelvic mass and should be distinguished from benign uterine tumors[3,4]. Although several risk factors for liposarcoma have been identified, including pathological grade, histological subtype, tumor size, radiotherapy, metastasis, and recurrence, the differential risk factors among distinct subtypes of liposarcoma remain unreported[1,2,5]. Additionally, although studies have documented the prognostic differences among the four histological subtypes, they are predominantly confined to single-institution inquiries[1,2,6–10]. Owing to the rarity of this disease, such studies typically involve a limited number of cases and possess a low level of evidence, with a paucity of further large-scale, multicenter case studies.

[1]Orthopedics Department, The First Affiliated Hospital of Army Medical University, Chongqing, China. [2]Emergency Department, Affiliated Hospital of Southwest Medical University, Sichuan Province, Luzhou City, China. ✉email: zhangshuai20030@163.com

The Surveillance, Epidemiology, and End Results (SEER) database compiles cancer incidence data from 18 national cancer registries, representing approximately 36.6% of the total population of the United States. Data collection commenced in 1973. The SEER database records comprehensive demographic information of patients and detailed characteristics of tumors, including but not limited to the primary tumor site, tumor pathological type, tumor size, and stage at diagnosis, as well as treatment and follow-up details. The extensive multi-institutional data collection of the SEER database endows it with the capacity to conduct studies on tumors, especially rare tumors such as soft tissue sarcomas, with adequate statistical power and population representativeness, yielding highly reliable results. To date, there is a dearth of sufficient and robust data to analyze the demographic predilections and prognostic disparities of different pathological subtypes of liposarcoma within the SEER database. Therefore, our objective was to compare the epidemiological and prognostic data of all pathological subtypes of liposarcoma and clarify the differences in survival outcomes among different subtypes, which will substantially contribute to our understanding and management of liposarcoma.

Methods

Study design and population

We conducted a retrospective cohort study of all patients diagnosed with liposarcoma over the past two decades (from 2000 to 2021) using the SEER database released in November 2023. Liposarcoma patients were extracted from the case list session of the database using the International Classification of Diseases for Oncology, Morphology code (ICD-O-3 codes 8850/3-8855/3, 8858/3). Round cell liposarcoma (8853/3) was classified as well-differentiated liposarcoma (8851/3). Patients with not otherwise specified (NOS) liposarcoma (8850/3) and mixed-type liposarcoma (8855/3) were excluded. Only patients with positive histological confirmation were included, and those diagnosed by autopsy were excluded. Patients were stratified by age, gender, and race at diagnosis. Age at diagnosis was categorized as less than 25 years, 25 to 50 years, and greater than 50 years. Pathological grade was classified as I–II, III, and IV. Tumors were stratified by size as less than or equal to 5 cm, 5 to 10 cm, and greater than or equal to 10 cm. Tumor stage was classified as local, regional, and distant. Surgical methods were categorized as local excision, wide excision, and amputation. Information regarding radiotherapy and chemotherapy was also extracted. In this study, all-cause mortality and tumor -specific mortality were designated as the study endpoints.

Parameters associated with prognosis

The parameters associated with prognosis include age, gender, race, pathological grade, tumor size, tumor stage, surgical method, and primary anatomical site. Age at diagnosis was categorized as less than 25 years, 25 to 50 years, and greater than 50 years. Pathological grade was classified as I–II, III, and IV. Tumors were stratified by size as less than or equal to 5 cm, 5 to 10 cm, and greater than or equal to 10 cm. Tumor stage was classified as local, regional, and distant. Surgical methods were categorized as local excision, wide excision, and amputation. Information regarding radiotherapy and chemotherapy was also considered.

Statistical analysis

The chi-square test and Fisher's test were employed to compare categorical variables such as age, gender, race, pathological grade, tumor size, tumor stage, surgical method, and primary anatomical site of each subtype, and pairwise comparisons were conducted. The P-value was adjusted using the Bonferroni method. The Kaplan–Meier analysis and log-rank test were utilized to estimate the survival and compare the survival differences between groups. The Cox proportional hazards regression analysis was applied to evaluate the hazard ratio (HR) and 95% confidence interval (CI). The estimated median survival time, 5-year survival rate, and 10-year survival rate of the four subtypes of liposarcoma were evaluated and compared. Variables with a statistically significant impact on survival were determined by univariate Cox regression analysis and two-way stepwise regression analysis methods and incorporated into the multivariate Cox regression analysis. The C-index value of the model was calculated, and the ROC curve were plotted. The time interval from diagnosis to the last follow-up or death was defined as the survival time. The significance level of all statistical tests was set at $p < 0.05$. All statistical analyses were performed using R software (R version 4.3.2).

Results

Population characteristics

A total of 15,857 cases were retrieved from the SEER database. 2,935 patients with uncertain pathological subtypes and mixed-type liposarcoma were excluded. Additionally, 100 patients without pathological diagnostic evidence were excluded. Consequently, a total of 12,822 cases were included in the study. All demographic data of the 12,822 patients are summarized in Table 1.

Survival rates among different subtypes of liposarcoma

The median survival time and 5-year and 10-year survival rates of each subtype of liposarcoma were investigated. The results indicated that WDLPS exhibited the most favorable prognosis, with 5-year and 10-year survival rates surpassing those of the other subgroups, which were 82% and 68%, respectively, and the median survival time was 16.17 years. MLPS followed, with 5-year and 10-year survival rates of 79% and 66%, respectively, and the median survival time was 20.42 years. PLPS had 5-year and 10-year survival rates of 52% and 38%, respectively, and the median survival time was 5.42 years. DDLPS demonstrated the poorest prognosis, with 5-year and 10-year survival rates of 48% and 31%, respectively, and the median survival time was 4.5 years. The Kaplan–Meier survival curves of the four subtypes are presented in Fig. 1. Moreover, in terms of tumor-specific survival rate, DDLPS still had the worst prognosis, with 5-year and 10-year survival rates of 60% and 48%, respectively, and

	WDLPS (N = 5272)	DDLPS (N = 3606)	MLPS (N = 2824)	PLPS (N = 1120)	Total (N = 12,822)
Age (years)					
< 25	29 (0.6%)	13 (0.4%)	218 (7.7%)	22 (2.0%)	282 (2.2%)
25–50	921 (17.5%)	405 (11.2%)	1302 (46.1%)	190 (17.0%)	2818 (22.0%)
> 50	4322 (82.0%)	3188 (88.4%)	1304 (46.2%)	908 (81.1%)	9722 (75.8%)
Sex					
Female	2136 (40.5%)	1172 (32.5%)	1161 (41.1%)	437 (39.0%)	4906 (38.3%)
Male	3136 (59.5%)	2434 (67.5%)	1663 (58.9%)	683 (61.0%)	7916 (61.7%)
Race					
Asian/Pacific Islander	475 (9.0%)	362 (10.0%)	198 (7.0%)	78 (7.0%)	1113 (8.7%)
Black	427 (8.1%)	212 (5.9%)	257 (9.1%)	107 (9.6%)	1003 (7.8%)
White	4276 (81.1%)	2986 (82.8%)	2316 (82.0%)	916 (81.8%)	10,494 (81.8%)
Other/unknown	94 (1.8%)	46 (1.3%)	53 (1.9%)	19 (1.7%)	212 (1.7%)
Grade					
I–II	3836 (72.8%)	401 (11.1%)	1348 (47.7%)	79 (7.1%)	5664 (44.2%)
III	102 (1.9%)	799 (22.2%)	194 (6.9%)	248 (22.1%)	1343 (10.5%)
IV	94 (1.8%)	912 (25.3%)	159 (5.6%)	359 (32.1%)	1524 (11.9%)
Unknown	1240 (23.5%)	1494 (41.4%)	1123 (39.8%)	434 (38.8%)	4291 (33.5%)
Tumor location					
Lower limb	1863 (35.3%)	464 (12.9%)	1799 (63.7%)	423 (37.8%)	4549 (35.5%)
Upper limb	294 (5.6%)	95 (2.6%)	142 (5.0%)	199 (17.8%)	730 (5.7%)
Peritoneum	1047 (19.9%)	1376 (38.2%)	167 (5.9%)	79 (7.1%)	2669 (20.8%)
Trunk	1547 (29.3%)	1217 (33.7%)	570 (20.2%)	345 (30.8%)	3679 (28.7%)
Other	521 (9.9%)	454 (12.6%)	146 (5.2%)	74 (6.6%)	1195 (9.3%)
Tumor size (cm)					
≤ 5	306 (5.8%)	178 (4.9%)	224 (7.9%)	141 (12.6%)	849 (6.6%)
5–10	559 (10.6%)	326 (9.0%)	459 (16.3%)	158 (14.1%)	1502 (11.7%)
≥ 10	1692 (32.1%)	1032 (28.6%)	737 (26.1%)	225 (20.1%)	3686 (28.7%)
Unknown	2715 (51.5%)	2070 (57.4%)	1404 (49.7%)	596 (53.2%)	6785 (52.9%)
Stage					
Localized	3357 (63.7%)	1490 (41.3%)	1709 (60.5%)	593 (52.9%)	7149 (55.8%)
Regional	972 (18.4%)	1312 (36.4%)	373 (13.2%)	203 (18.1%)	2860 (22.3%)
Distant	135 (2.6%)	416 (11.5%)	152 (5.4%)	90 (8.0%)	793 (6.2%)
Unknown	808 (15.3%)	388 (10.8%)	590 (20.9%)	234 (20.9%)	2020 (15.8%)
Type of surgery					
Marginal excision	2089 (39.6%)	715 (19.8%)	947 (33.5%)	373 (33.3%)	4124 (32.2%)
Radical resection	2314 (43.9%)	1903 (52.8%)	1397 (49.5%)	526 (47.0%)	6140 (47.9%)
Amputation	351 (6.7%)	381 (10.6%)	111 (3.9%)	63 (5.6%)	906 (7.1%)
None/other	518 (9.8%)	607 (16.8%)	369 (13.1%)	158 (14.1%)	1652 (12.9%)
Radiation					
Yes	854 (16.2%)	1258 (34.9%)	1455 (51.5%)	652 (58.2%)	4219 (32.9%)
No	4418 (83.8%)	2348 (65.1%)	1369 (48.5%)	468 (41.8%)	8603 (67.1%)
Chemotherapy					
Yes	183 (3.5%)	649 (18.0%)	415 (14.7%)	257 (22.9%)	1504 (11.7%)
No/unknown	5089 (96.5%)	2957 (82.0%)	2409 (85.3%)	863 (77.1%)	11,318 (88.3%)

Table 1. Demographic data and tumour characteristics of liposarcoma patients in SEER database. *Subcutaneous, other soft tis: trunk.

the median survival time was 8.8 years. WDLPS had the most favorable prognosis, with 5-year and 10-year survival rates exceeding those of the other subgroups, which were 92% and 88%, respectively. MLPS and PLPS followed, with 5-year and 10-year survival rates of 84% and 77%, and 63% and 55%, respectively. The Kaplan–Meier tumor-specific survival curves of the four subtypes are shown in Fig. 2.

Model validation

In the comprehensive analysis, univariate regression analysis showed that pathological type, age at onset, gender, ethnicity, pathological stage, tumor location, tumor size, clinical stage, surgical approach, and radiotherapy and chemotherapy significantly affected patient prognosis. The bidirectional stepwise regression analysis indicated that when all these variables were included, the model had the smallest AIC value.

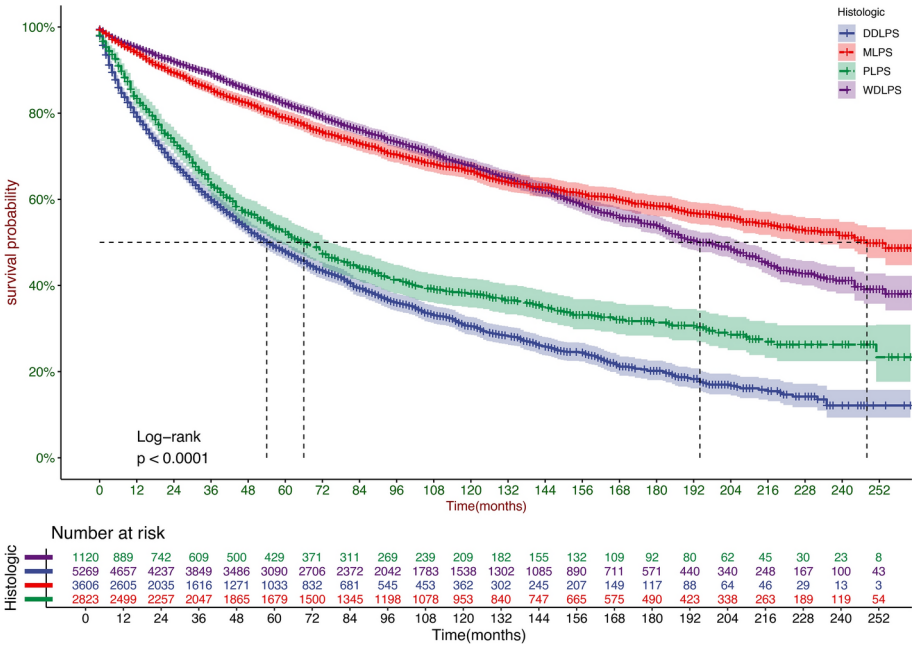

Fig. 1. Kaplan–Meier survival analysis of liposarcoma subtypes.

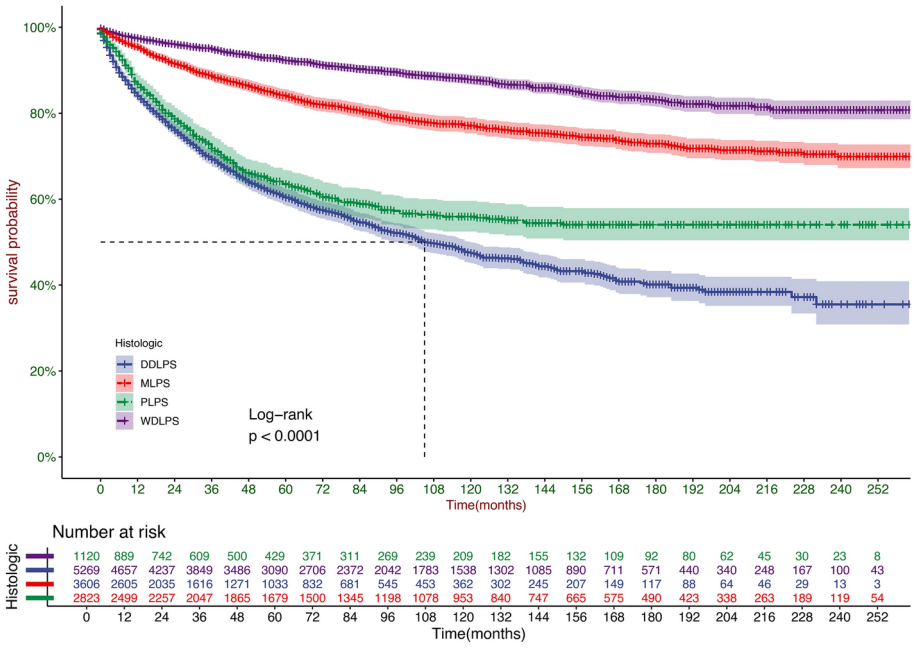

Fig. 2. Tumor-specific Kaplan–Meier survival analysis of liposarcoma subtypes.

For each subtype analysis, univariate regression analysis suggested ethnicity had no significant impact on prognosis. In DDLPS, MLPS, and PLPS, excluding ethnicity led to the smallest AIC value in the bidirectional stepwise regression analysis. In WDLPS, besides ethnicity, whether radiotherapy was given had no significant effect on prognosis. Excluding these two variables minimized the AIC value, but considering radiotherapy's importance in treating sarcoma patients, the radiotherapy variable was finally included in the model. Using 3-year, 5-year, and 10-year time points to plot the ROC curves of each model and calculate AUC values, all AUC values were greater than 0.5 (the minimum was 0.68), indicating good predictive performance of all models (Figs. 3, 4, 5, 6, 7).

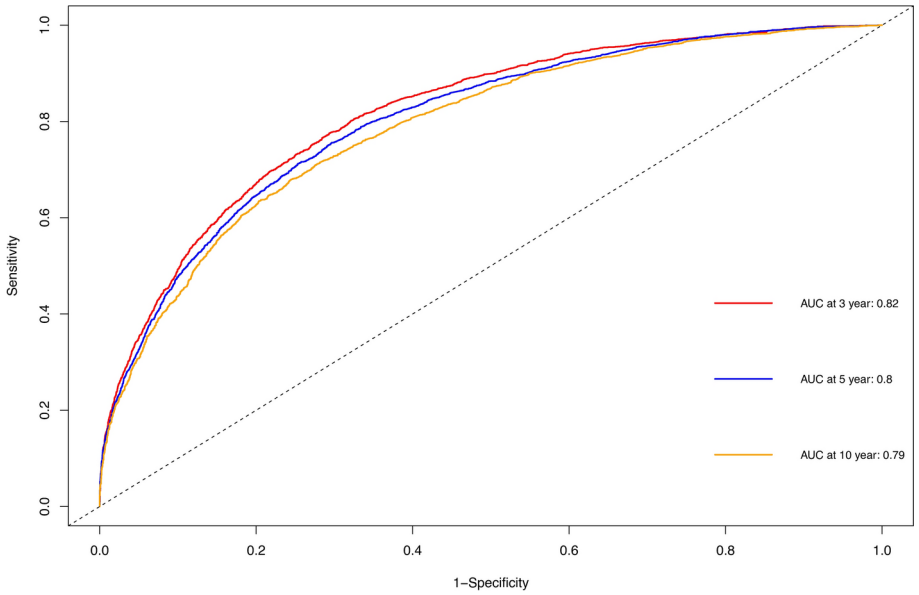

Fig. 3. ROC cure of multivariate Cox regression analysis on all combined subtypes of liposarcoma.

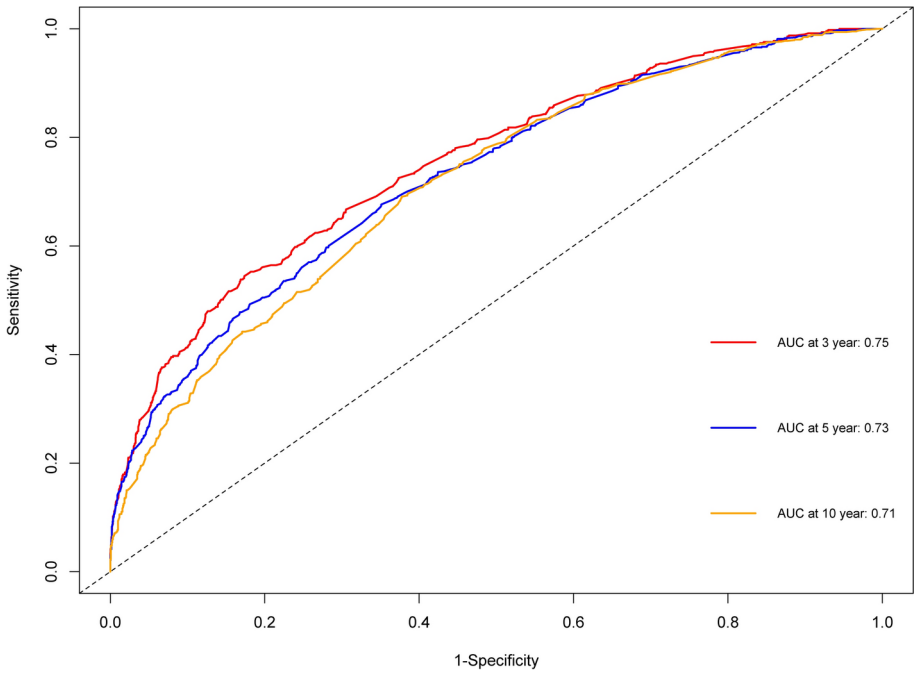

Fig. 4. ROC cure of multivariate Cox regression analysis on WDLPS.

Factors associated with prognosis in liposarcoma

Multivariate Cox regression analysis was conducted to identify survival-related variables. Results showed that DDLPS, MLPS, PLPS, along with increased age, male sex, certain races, higher pathological grade, tumors outside extremities, larger size, higher clinical stage, amputation, no surgery, and chemotherapy were linked to poorer survival (Fig. 8). Radiotherapy had a protective effect (HR 0.84, $p < 0.001$).For liposarcoma subtypes, Cox regression analysis determined specific prognostic factors (Fig. 9). In DDLPS, MLPS, PLPS, age, sex, grade, location, size, stage, surgical method, chemotherapy, and radiotherapy were significantly related to prognosis. In ATL/WDLPS, radiotherapy wasn't related to prognosis. Age: 25–50 years was adverse for MLPS prognosis; over 50 years for all subtypes. Sex and grade didn't affect PLPS prognosis but did for others. Tumor in trunk's soft tissue (vs extremities) meant worse survival in WDLPS, DDLPS, MLPS; not in PLPS. Peritoneum/retroperitoneum tumors led to worse survival in all.Tumor size: didn't impact WDLPS; larger size worsened prognosis in DDLPS, PLPS; ≥ 10 cm in MLPS affected survival. Higher stage implied worse survival in all.In

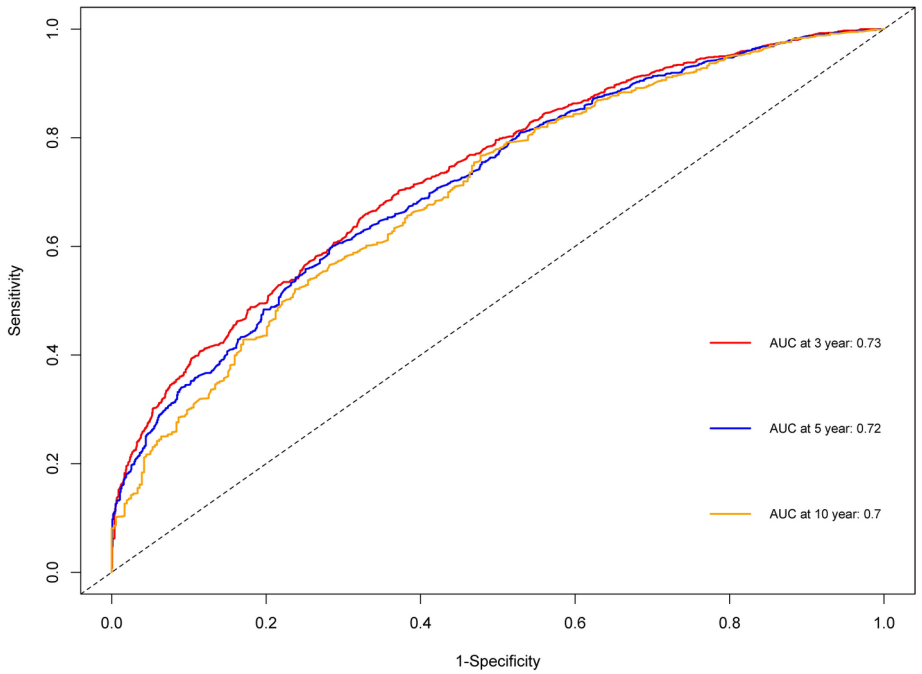

Fig. 5. ROC cure of multivariate Cox regression analysis on DDLPS.

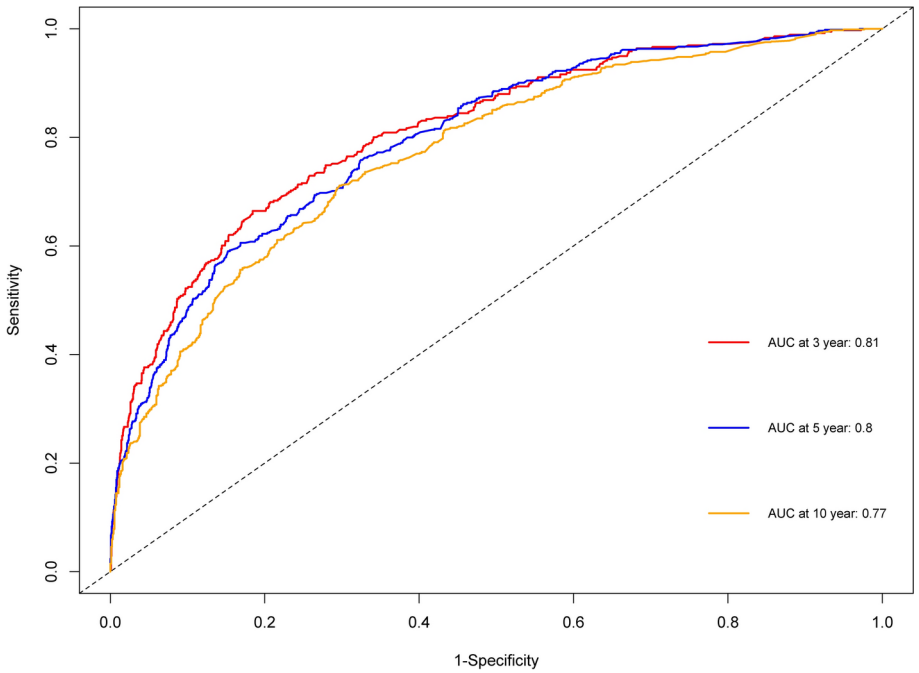

Fig. 6. ROC cure of multivariate Cox regression analysis on MLPS.

DDLPS, complete resection was better than marginal for prognosis. In other subtypes, surgical method didn't matter. Amputation was a risk for MLPS; no surgery for all. Chemotherapy related to poorer prognosis in MLPS, MDLPS but not DDLPS, PLPS. Radiotherapy protected subtypes except WDLPS.

Discussion

Liposarcoma is a relatively uncommon malignant tumor, accounting for approximately 15%-20% of soft tissue sarcomas. Its precise incidence varies depending on factors such as geographical region and population characteristics, with a relatively low incidence in the general population, typically ranging from 2 to 3 new cases per million people per year[2,3]. For an extended period, it has been challenging for clinicians to conduct

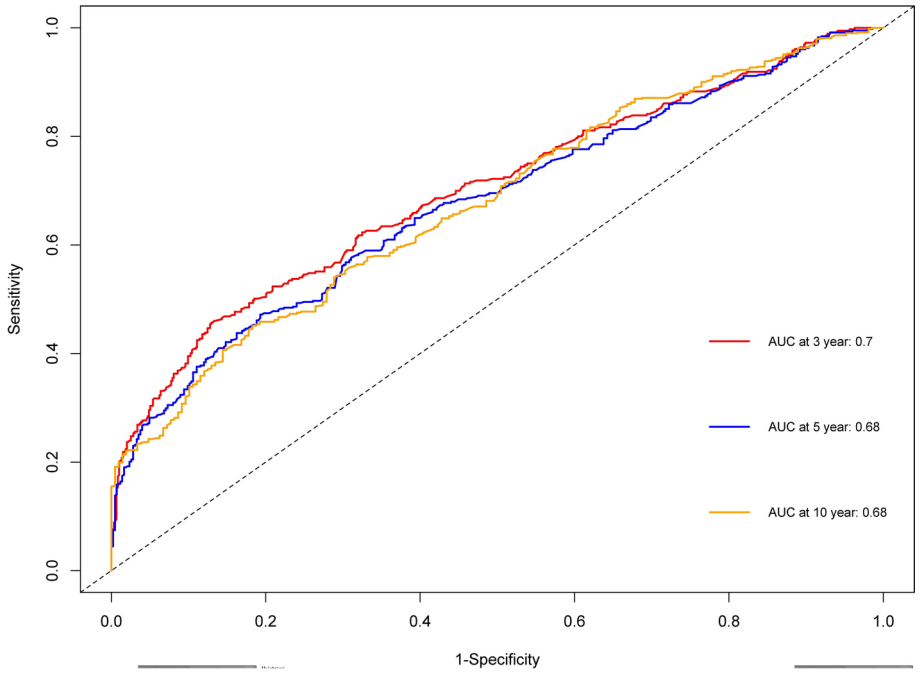

Fig. 7. ROC cure of multivariate Cox regression analysis on PLPS.

Characteristics	Number (%)	HR (95%CI)	P.value
Histologic			
WDLPS	5272 (41.1)		
DDLPS	3606 (28.1)	1.7 (1.6-1.9)	<0.001***
MLPS	2824 (22.0)	1.3 (1.2-1.4)	<0.001***
PLPS	1120 (8.7)	2 (1.7-2.2)	<0.001***
Year(years)			
<25	282 (2.2)		
25-50	2818 (22.0)	2.2 (1.5-3.2)	<0.001***
>50	9722 (75.8)	5.3 (3.7-7.6)	<0.001***
Sex			
Female	4906 (38.3)		
Male	7916 (61.7)	1.2 (1.1-1.3)	<0.001***
Race			
White	10494 (81.8)		
Asian/Pacific Islander	1113 (8.7)	0.85 (0.77-0.95)	0.0027**
Black	1003 (7.8)	1.1 (0.95-1.2)	0.32
Other/Unknown	212 (1.7)	0.76 (0.58-1)	0.052
Grade			
I-II	5664 (44.2)		
III	1343 (10.5)	1.5 (1.4-1.7)	<0.001***
IV	1524 (11.9)	1.7 (1.5-1.9)	<0.001***
Unknown	4291 (33.5)	1.4 (1.3-1.5)	<0.001***
Tumor Location			
lower limb	4549 (35.5)		
trunk	3679 (28.7)	1.5 (1.4-1.7)	<0.001***
Peritoneum	2669 (20.8)	1.7 (1.6-1.9)	<0.001***
upper limb	730 (5.7)	1 (0.91-1.2)	0.53
other	1195 (9.3)	1.3 (1.1-1.4)	<0.001***
Tumor Size (cm)			
5≤	849 (6.6)		
5-10	1502 (11.7)	1.2 (1.1-1.4)	0.0016**
≥10	3686 (28.7)	1.5 (1.3-1.7)	<0.001***
Unkonw	6785 (52.9)	1.2 (1.1-1.4)	0.0013**
Stage			
Regional	2860 (22.3)		
Localized	7149 (55.8)	0.69 (0.64-0.74)	<0.001***
Distant	793 (6.2)	2.3 (2.1-2.6)	<0.001***
Unknown	2020 (15.8)	0.8 (0.72-0.89)	<0.001***
Surg			
Marginal	4124 (32.2)		
Radical Resection	6140 (47.9)	0.9 (0.84-0.96)	0.0031**
Amputation	906 (7.1)	1.2 (1.1-1.4)	<0.001***
none/other	1652 (12.9)	2.1 (1.9-2.3)	<0.001***
Chemotherapy			
No/Unknown	11318 (88.3)		
Yes	1504 (11.7)	1.3 (1.2-1.4)	<0.001***
Radiation			
No	8603 (67.1)		
Yes	4219 (32.9)	0.84 (0.79-0.9)	<0.001***

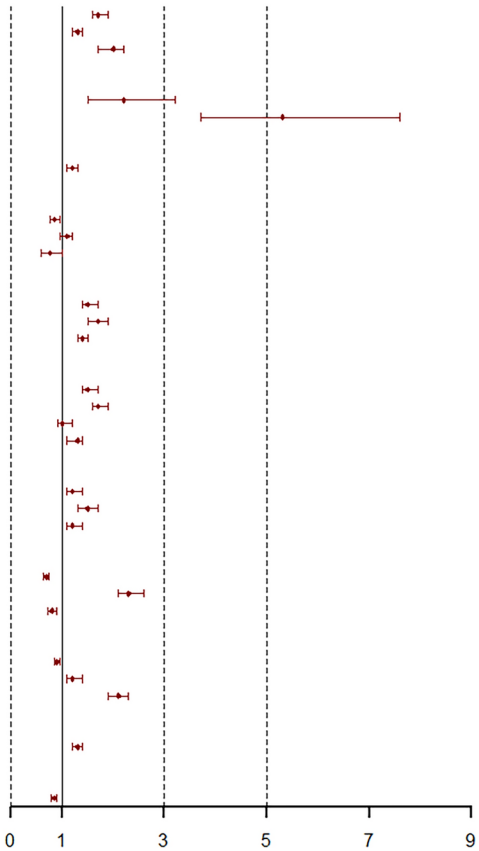

Fig. 8. Multivariate Cox regression analysis on all combined subtypes of liposarcoma; Cindex:0.761, Logrank $P < 0.001$.

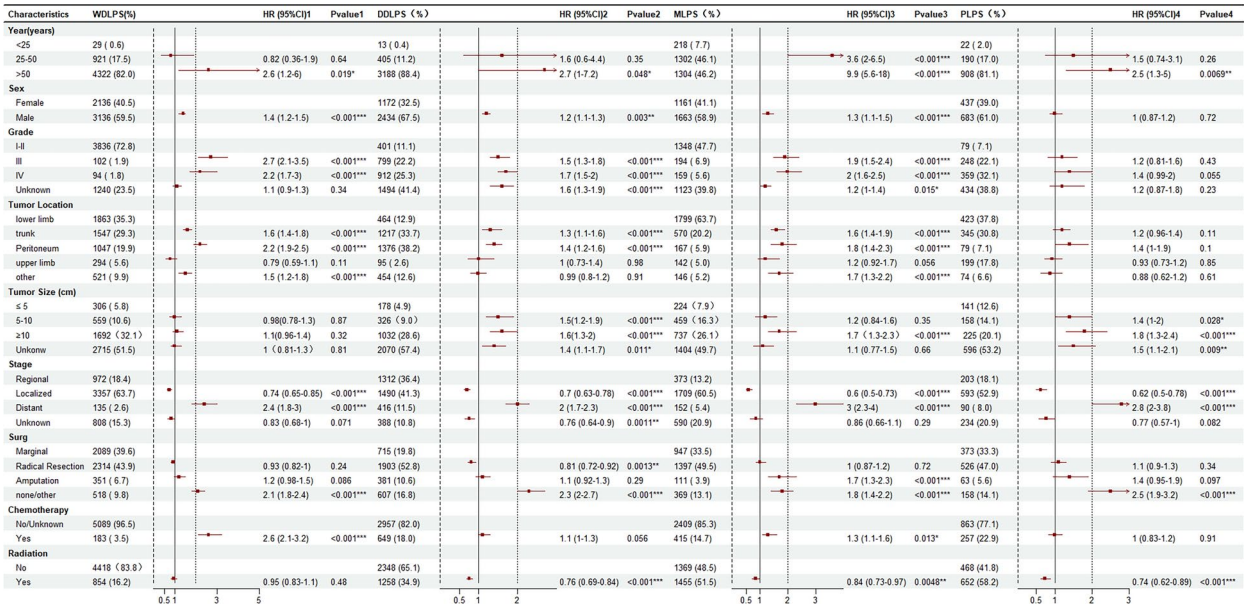

Fig. 9. Multivariate Cox regression analysis of different liposarcoma subtypes. WDLPS (Cindex:0.714, Logrank P < 0.001), DDLPS (Cindex:0.705, Logrank P < 0.001), MLPS(Cindex:0.779, Logrank P < 0.001), PLPS (Cindex:0.700, Logrank P < 0.001).

comprehensive studies on this disease due to the limited number of patients. The advent of the SEER database has enabled a more comprehensive and efficient analysis of rare tumors. Existing studies on liposarcoma using the SEER database have predominantly focused on the primary tumor site or various risk factors and their associations with patient prognosis. Although several prognostic variables have been identified, a comprehensive comparison of the prognosis of different subtypes of liposarcoma has been lacking.

To the best of our knowledge, this study represents one of the largest investigations to date analyzing the survival outcomes and prognostic factors of subtypes of liposarcoma. Our study has revealed significant differences in survival and prognostic factors among the four subtypes of synovial sarcoma. The estimated median survival times of different subtypes of synovial sarcoma vary substantially. The median survival time of well-differentiated liposarcoma is approximately four times that of dedifferentiated liposarcoma. Comprehensive analysis indicates that as patient age increases, prognosis deteriorates significantly. However, when analyzing each subtype separately, we found that in the subtypes of WDLPS, DDLPS, and PLPS, this difference is statistically significant only when the patient's age exceeds 50 years. In MLPS the threshold is 25 years. When the patient's age is greater than 50 years, the survival situation deteriorates markedly. Correspondingly, we observed that in myxoid liposarcoma, the proportion of patients aged 25–50 years is comparable to that of patients aged over 50 years, while in the other three subtypes, the proportion of patients over 50 years is over 80%, suggesting a relatively younger age of onset for MLPS. In all subtypes, the proportion of male patients is significantly higher than that of female patients, and in the comprehensive analysis of the four subtypes, male patients generally have a poorer prognosis than female patients. However, when analyzing each subtype individually, gender is not correlated with the prognosis of patients with pleomorphic liposarcoma. The comprehensive analysis results suggest that racial differences may influence patient prognosis, with no significant difference between white and black races, yet both being identified as risk factors for patient prognosis. However, when analyzing the four subtypes, through univariate Cox regression analysis and two-way stepwise regression analysis, we found that race is not significantly correlated with the prognosis of patients of each subtype. Previous studies have demonstrated that the pathological grade of the tumor is a significant risk factor for the prognosis of patients with soft tissue sarcoma, and our study corroborates this finding[11,12]. However, unexpectedly, in the subtype of PLPS, no significant impact of the pathological grade of the tumor on patient prognosis was observed.

Furthermore, numerous studies have indicated that soft tissue sarcomas located in the extremities are associated with better survival outcomes[13,15–17]. Our study also confirms this observation. Liposarcoma commonly occurs in the extremities, subcutaneous soft tissue of the trunk, retroperitoneum, or abdominal cavity. Comprehensive analysis reveals that tumors located in the extremities have the most favorable prognosis, while those in the retroperitoneum or abdominal cavity have the poorest prognosis. However, when analyzing each subtype, we found that in the subtype of pleomorphic liposarcoma, similar to the pathological grade, patient survival is not affected by the location of the tumor. Xiong et al.[13] reported that in their analysis of the survival and prognosis of subtypes of synovial sarcoma, they found that tumors located in the upper extremities in the biphasic subtype were more conducive to patient survival than those in the lower extremities. In our study, regardless of whether it is a comprehensive analysis or an individual analysis of each subtype, there is no significant difference in the survival situation of patients with tumors in the upper and lower extremities. Tumor size has been identified as an independent prognostic factor for patients with liposarcoma in previous

studies[18–20]. Interestingly, our comprehensive analysis reached a similar conclusion, indicating that as tumor volume increases, patient prognosis deteriorates. However, when analyzing the four tumor subtypes, significant differences emerged. In WDLPS, patient prognosis is not significantly correlated with tumor size. In myxoid liposarcoma, patient prognosis significantly declines only when the tumor is greater than or equal to 10 cm. In dedifferentiated and pleomorphic liposarcomas, larger tumors are independent risk factors for patient prognosis. Unsurprisingly, both comprehensive and subtype-specific analyses consistently demonstrated that local spread and distant metastasis of tumors are associated with progressively worsening survival outcomes. Surgeons should always strive for R0 resection of sarcoma in order to improve survival rates[21]. However, in clinical practice, corresponding adjustments may need to be made according to the condition of each individual patient. Matsuoka et al.[14] proposed that amputation surgery is a risk factor for the prognosis of patients with localized soft tissue sarcoma of the extremities. Our study also found that, in the comprehensive analysis, compared with marginal resection, amputation surgery significantly reduces patient prognosis. However, in the individual analysis, the relationship between different surgical methods and the prognosis of patients with each subtype varies. In well-differentiated and pleomorphic liposarcomas, patient prognosis does not significantly differ with different surgical methods. In PLPS, wide excision is more beneficial for patient survival than marginal resection, and there is no significant difference in prognosis between amputation and marginal resection. In MLPS, there is no significant difference in prognosis between wide excision and marginal resection, but amputation surgery leads to a worse survival outcome. Finally, regardless of whether it is a comprehensive analysis or a subgroup analysis, the prognosis of patients with liposarcoma who did not undergo surgery is significantly worse than that of those who did.

The application of perioperative radiotherapy and chemotherapy in the treatment of soft tissue sarcoma has been a subject of debate for many years. Radiotherapy is generally considered to be associated with better survival. In our overall data analysis, we also found that patients who received radiotherapy tended to have better survival. However, our subgroup analysis results indicated that in WDLPS, the presence or absence of radiotherapy is not significantly correlated with patient prognosis. In addition, although chemotherapy is widely used in cancer patients, there are few studies on its application in patients with liposarcoma, and its efficacy in the treatment of liposarcoma remains controversial. In this study, our comprehensive analysis results suggest that the prognosis of patients who received chemotherapy is significantly worse, indicating that chemotherapy may have an adverse effect in the treatment of liposarcoma patients. Further subtype analysis revealed that in dedifferentiated and pleomorphic liposarcomas, there is no significant difference in the prognosis of patients who received chemotherapy and those who did not, while in well-differentiated and myxoid liposarcomas, chemotherapy is a risk factor for patient prognosis. Therefore, we believe that chemotherapy for liposarcoma patients may need to be administered more cautiously.

In conclusion, although liposarcoma is typically characterized by pain symptoms and slow growth, it has a potentially fatal nature, and the prognosis and prognostic factors of each subtype of liposarcoma vary. It is necessary to conduct separate analyses for each subtype. Poorer outcomes can be expected in the dedifferentiated and pleomorphic subtypes, while well-differentiated and myxoid liposarcomas have relatively favorable prognoses. Surgery can significantly improve patient prognosis, chemotherapy has no significant survival benefit and may even be harmful, and radiotherapy is not related to the prognosis of patients with MDLPS but is clearly beneficial for the survival of patients with the other subtypes. This study can assist clinicians in better understanding the prognostic information of each subtype of liposarcoma and guide appropriate treatment strategies.

Our study has several limitations. First, certain factors in the SEER database, such as surgical margins, comorbidities, and treatment parameters, are unavailable. These factors may provide valuable information for predicting patient outcomes. In addition, the data records of chemotherapy and radiotherapy in the SEER database are incomplete. The coding for patients who did not receive chemotherapy and those with unknown chemotherapy status is the same, and detailed chemotherapy regimens and radiation doses during radiotherapy are lacking. Future prospective cohort studies are needed to confirm the specific effects of these factors on patient prognosis.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author and the SEER database (https://seer.cancer.gov/).

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Author contributions

JQ-Z, WL-D, XL-T: proposed the research questions; was responsible for drafting and revising the manuscript; reviewed and approved the final version of the paper. AA-L, Y-L: was responsible for collecting and analyzing data; reviewed and approved the final version of the paper.S-Z: was responsible for drafting and revising the manuscript; reviewed and approved the final version of the paper.All authors reviewed the manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The SEER database can be accessed publicly and provides patient data without specific identification, so ethics approval and informed consent were not required.

Additional information

Correspondence and requests for materials should be addressed to S.Z.

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