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Patterns of care in a population based sample of soft tissue sarcoma patients in the United States

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Abstract

Purpose—Soft tissue sarcomas (STS) are relatively uncommon tumors. Data regarding the patterns of care of patients with STS and its consistency with available guidelines are relatively sparse. We conducted a detailed analysis of STS patients diagnosed in 2002 and sampled from the Surveillance, Epidemiology and End Results registries.

Methods—1369 patients with invasive sarcomas were sampled. Hospital records were re-abstracted and treating physicians contacted to verify therapy provided to each patient.

Results—The median age of patients was 60 years. There was a slight male predominance among the patients with non-gynecologic sarcomas. 50% of the patients had localized stage of sarcoma. Most patients received surgery but negative margins were obtained in only 50% of patients. Complete resection was less frequent in patients ≥ 50 years old. Radiation therapy was used in 53% of patients with extremity sarcomas but in only 20–30% of the patients with sarcomas at other sites. About 27% of all patients received chemotherapy. Tumor grade was significantly associated with the use of radiation and chemotherapy. Surgical resection, tumor grade, tumor size, use of radiation therapy and age significantly influenced survival.

Conclusions—Patterns of care of STS differ based on the site of the tumor. The patterns of care in extremity sarcomas are fairly consistent with the available recommendations but the patterns of care in other sites are less consistent. In addition to certain tumor characteristics, age of the patient was significantly associated with therapy and patient outcome.

Keywords

Soft tissue Sarcomas; SEER; Patterns of Care

Introduction

Soft tissue sarcomas (STS) are uncommon cancers representing less than 1% of all malignant neoplasms with an annual incidence of approximately 10,390 cases with about 3,680 deaths per year¹. Management of these tumors requires a multidisciplinary approach.

Guidelines for the management of STS have been published by different institutions, including the National Comprehensive Cancer Network (NCCN)². Separate management guidelines have been provided for different anatomic sites³. For extremity sarcomas the guidelines recommend surgery for low grade tumors with post-operative radiation recommended for tumors greater than 5 cm. In high grade tumors radiation with or without chemotherapy is recommended in addition to optimal surgical resection. Limb salvage is considered an important objective and generally guides treatment decisions.

For non-extremity sarcomas surgical resection is considered the primary therapy. Post operative radiation is recommended in patients with high grade sarcomas. In unresectable tumors multiple different approaches are suggested including observation, palliative surgery, radiation, and chemotherapy.

Management of STS can be challenging due to differences in anatomic sites and the rarity of the tumors. Treatment is provided by physicians from different disciplines increasing the variability in therapy. Data regarding patterns of care of STS from United States is relatively sparse⁴⁻⁵⁻⁶⁻⁷ and most data is from case series from major cancer centers with expertise in treating sarcomas⁸⁻⁹⁻¹⁰⁻¹¹. These datasets may not reflect the general patterns of care. In addition, many of the reports have presented analysis of all STS together or focused on extremity sarcomas.

We therefore conducted this analysis of STS patients using data from the population-based sample of the National Cancer Institute's (NCI) patterns of care study to determine the patterns of care and assess the outcomes of these patients by anatomic site.

Methods

The NCI's Surveillance, Epidemiology and End-Results (SEER) is a population-based cancer registry system that collects comprehensive information on demographics, tumor characteristics, therapy and maintains follow-up of patients for vital status on all cancers occurring in defined geographic region. Because data collection is primarily conducted in hospitals, surgical centers and radiation facilities the systemic therapy information is incomplete. The NCI annually conducts the patterns of care studies to obtain detailed information on therapy for selected cancers. In 2002 patients with invasive sarcoma, histology codes 8800–8991, 9040–9044, were identified by participating registries (the states of Connecticut, Iowa, New Mexico, New Jersey, Utah and Louisiana and the metropolitan areas of San Francisco/Oakland, San Jose/Monterey, Seattle/Puget Sound, Atlanta, Detroit, Los Angeles County, and the remaining area of the State of California). Patients less than age 20 years, diagnosed at autopsy or on the death certificate, or if this was not the first diagnosis of cancer, other than non-melanoma skin cancer, were ineligible. The remaining patients were stratified by registry, race/ethnicity, and sex and a random sample of cases was selected. We oversampled non-Hispanic black and Hispanic patients and selected all cases of Asians, Pacific Islanders, American Indians, and Alaskan Natives to obtain more stable estimates.

Medical records were re-abstracted and each patient's treating physician was asked to verify the therapy given. The physicians were also asked to identify any other provider who might have treated the patient. These providers were then contacted. A centralized training was

provided for the individual at each registry who was primarily responsible for conducting the study to ensure consistency of abstracting and coding of data. A 5% sample of case records were re-abstracted for quality control. Comorbid conditions documented in the hospital medical record at the time of the most definitive therapy were recorded and coded centrally by a single Registered Health Information Technologist. The data was analyzed separately based on tumor location, since this is known to influence therapeutic recommendations.

Data analyses were performed using SAS and SUDAAN (Research Triangle Institute, Research Triangle Park, NC) and were weighted to reflect the SEER population from which the data was obtained. We present adjusted percentages of patients receiving radiation or chemotherapy. Adjusted percentages were obtained from the estimates of the probability for each individual receiving treatment in the logistic regression models. These percentages were directly standardized to the distribution of the covariates among the entire weighted sample reference put at the end¹². Cancer cause mortality were analyzed using Cox regression models based on a follow-up through December 31, 2005. The statistical significance tests were assessed using the Wald-type F-statistics. All p-values were two-sided.

Results

A total of 1369 patients were selected, 345 extremity sarcomas, 304 gynecologic sarcomas, and 720 sarcomas of other sites (Table 1). The median age at diagnosis was 60 years. The tumor size was smaller in extremity sarcoma patients. Patients with gynecologic sarcomas more often had advanced stage and patients with extremity sarcomas more often had localized stage at diagnosis. Among patients who underwent surgery, lymph node dissections were performed in 4%, 24%, and 45% of patients with extremity, all other sites and gynecologic sarcomas, respectively.

Therapy

Most patients had surgery (Table 2). Radiation therapy was used more commonly in patients with sarcoma of the extremities. Doxorubicin was the most commonly administered chemotherapeutic agent for patients with sarcoma of the extremity and ifosfamide for gynecologic sarcoma, while imatinib was given to slight more than 10% of patients with sarcomas of other sites.

Localized and regional stage Extremity sarcoma

Treatments received varied by tumor characteristics (table 3). Overall, more than 42% of the extremity sarcoma patients had surgery only. Amputation was performed in 5% of the patients. Patients with clear margins were more often treated with adjuvant radiation than patients with other margin status. Patients with tumors at the margins were more often treated with adjuvant radiation plus chemotherapy. More than half of the patients with tumors ≤ 5 cm received surgery alone, while adjuvant radiation therapy and chemotherapy was used more frequently in patients with larger tumors. Patients with well or moderately well differentiated tumors were most often treated with surgery alone (57%), although 39% had radiation in addition. Patients with poorly or undifferentiated tumors had more intensive therapy with surgery and radiation (42%) or surgery, radiation and chemotherapy (31%).

Localized and regional stage Gynecologic sarcoma

In patients with localized or regional gynecologic sarcomas 56% with clear margins had no treatment beyond surgery. Nearly 29% of patients with tumor at the margins received adjuvant radiation and chemotherapy. Women with tumors of greater than 10 cm were more

often given adjuvant chemotherapy or radiation therapy, but only 1% of patients with large tumors received all three modalities. Striking differences were seen by tumor grade. More than 88% of women with well or moderately well differentiated tumors had surgery alone compared to only 38% patients with poorly or undifferentiated tumors.

Localized and Regional stage sarcoma of all other sites (not extremity or gynecologic)

Nearly 70% of patients with tumors of other sites who had clear margins received only surgery. Even in patients with tumor at the margins 56% received only surgery. As the size or grade of the tumor increased the percentage of patients receiving surgery plus chemotherapy increased.

Radiation and Chemotherapy

The use of radiation varied by site and stage of disease (table 4). Patients with sarcoma of the extremity were more likely to receive radiation than were the other two sites. The use of chemotherapy increased as stage increased. In each of the sarcoma sites, patients with poorly or undifferentiated tumors were more likely to receive chemotherapy.

We used multiple logistic regression analysis to determine factors associated with radiation and chemotherapy by sarcoma site (table 5). Grade of the tumor was associated with the use of radiation therapy for all 3 sarcomas sites, while pathologic margin status and depth of tumor were not. Larger tumors were associated with less radiation use in patients with sarcomas of other sites. Age of less than 50 years was associated with significantly less radiation use for patients with extremity sarcomas; however the opposite was true for sarcoma of other sites.

Chemotherapy use in extremity sarcomas was associated with tumor depth, grade, age, and radiation. Women with gynecologic sarcomas were given chemotherapy more often if they had any residual tumor at the margins, large or poorly or undifferentiated tumors. Patients with sarcomas of other sites were treated with chemotherapy more frequently if they did not have a surgical resection, had large or poorly differentiated tumors. A Charlson Comorbidity score of one or more was associated with less chemotherapy in patients with gynecologic sarcomas and sarcomas of the other site. Patients with extremity sarcomas and sarcomas of other site who had radiation were more likely to receive chemotherapy.

Survival

The maximum follow up on these patients was 47 months. Survival was associated with tumor size, grade, pathologic margins, and age in all three sites of sarcomas (table 6). For all sites not being able to undergo surgical resection was associated with worse survival. Patients with tumors that were poorly or undifferentiated had poor survival as did patients age 50 or older. Radiation therapy was associated with improved survival in extremity and gynecologic sarcomas. However chemotherapy use was not associated with decreased risk of cancer death.

Discussion

This is the first study to examine treatment of sarcoma in a large population-based data set. Grade and size of the tumor are recognized prognostic factors and are important variables in determining the stage of STS. However in this dataset a high proportion of patients did not have the grade or size of the tumor reported. This was particularly true of gynecological sarcomas and sarcomas of other sites. These data are similar to a report from the National Cancer Database on STS, which reported unknown grade in > 50% of the patients and unknown stage in > 30% of the patients 7. The same dataset also reported a decline in the

percentage of patients with unknown grade from 1988 to 1993. It is possible that under reporting of grade and size of the tumor in STS, particularly in sites other extremities may be that this information has less impact on therapeutic decisions than on extremity sarcoma. Lymph node metastases in STS are known to be uncommon except for certain histologic subtypes such as rhabdomyosarcomas and lymph node sampling or dissection is not recommended. Lymph node assessment occurred more frequently in gynecological sarcomas than sarcomas of other sites.

In extremity sarcomas 62% of patients underwent surgery with complete resection. This is lower than the complete resection rate of 80% reported in a series from a single institution by Weitz et al 8. Limb salvage is an important objective of the management of extremity sarcomas and in this series only 5% underwent an amputation. However it is unclear if complete resection of the tumor was not pursued in some patients to achieve the objective of limb salvage.

Based on data from randomized trials adjuvant radiotherapy is recommended in most patients with extremity STS 13-14. The rate of radiation therapy in our data is similar to that reported in other series 15-16. Radiation was used more frequent for higher grade tumors and trended towards higher use in larger tumors but was not associated with margin status.

Only 24% of extremity sarcoma patients received chemotherapy and even among patients with distant stage sarcomas chemotherapy was used in less than 50% of the patients. In the series by Weitz et al, which focused on extremity sarcomas, chemotherapy use varied at different time periods from 9% to 32% 8. Chemotherapy use in extremity sarcomas was significantly influenced by tumor depth and tumor grade, as suggested by the guidelines. Chemotherapy was also associated with higher use of radiation, probably reflective of the use of chemotherapy in patients with adverse prognostic features. Data regarding benefits of adjuvant chemotherapy in STS patients is disparate. Results of two recent trials evaluating the combination of an anthracycline and ifosfamide differ regarding the benefits of adjuvant therapy 17-18. Previous meta-analysis have suggested disease free survival advantage from adjuvant chemotherapy and the most recent meta-analysis that included trials with ifosfamide based regimens showed both relapse free and overall survival 19-20. The guidelines do recommend consideration of adjuvant chemotherapy, particularly in high grade tumors. In advanced disease, data demonstrating the benefits of chemotherapy in STS are limited 21. The limited benefits of adjuvant chemotherapy and the paucity of data regarding the benefits of chemotherapy in advanced stage of STS may have contributed to the limited use of chemotherapy in these patients.

Age of the patient was significantly associated with radiation and chemotherapy in extremity sarcomas, with more radiation and less chemotherapy in older patients. The lower use of chemotherapy in elderly patients may be explained by the concerns about chemotherapy, particularly agents such as doxorubicin. However the reasons for age based disparity in the use of radiation are unclear. The current guidelines do not distinguish therapeutic recommendations based on age of the patient. The number of the patients with STS, that are older, is expected to rise in the coming years with the aging of the population. It is therefore imperative that available options for systemic therapy are applicable in the older patient population with STS.

Among patients with sarcomas of other sites, only 46% underwent complete resection and 18% had no surgery. Case series reports of retroperitoneal and deep trunk STS from different institutions report a negative margin resection rate of about 45% 11-22. Surgical resection at sites such as the retroperitoneum can be challenging due to the proximity of the tumors to surrounding vital organs and the large size of the tumors at diagnosis. Despite a

higher proportion of patients with sarcomas of other sites not undergoing surgery, radiation was used only in 23% of the patients. This lower use of radiation may also be related to difficulty in delivering radiation at these sites compared to the extremities, as suggested by the significantly lower use of radiation in patients with larger tumors. Local relapse rates are known to be higher in patients with sarcomas at other sites 22, probably due to limitations in delivering local therapeutic modalities. Some reports have suggested that pre-operative radiation, at sites such as the retroperitoneum, may be more feasible due to less toxicity 23·24. Intraoperative radiation has also been used in patients with retroperitoneal sarcomas to improve efficacy and reduce toxicity. However the availability of such techniques is limited to specialized centers.

The percentage of patients with sarcomas at other sites receiving chemotherapy are lower than that reported in single institution case series 10·22. Chemotherapy use in these patients was associated with poor prognostic features such as lack of resection and larger tumor size. In many patients, site and tumor size preclude surgery and radiation making chemotherapy the only therapeutic option. In recent years the introduction of imatinib mesylate has improved the outcomes of patients with Gastrointestinal Stromal tumors (GIST). However the response to chemotherapy in these sites is generally limited. Thus investigation of novel drugs for the management of these tumors is necessary since drug therapy may be the only option in these patient.

Gynecological sarcomas were analyzed as a separate category since the location of the tumors and the physicians involved in the care of these patients differs from the STS at other sites. Complete resection was achieved in 53% of the patients while 11% did not undergo resection. The available literature regarding complete resection of gynecological sarcomas is extremely limited, therefore we cannot determine if this complete resection rate is comparable to others. Thirty one percent of the gynecological sarcomas received radiation, a rate similar to reports on uterine sarcomas from single institutions 25·26. The only factor that predicted use of radiation was tumor grade. Tumor margin status was not significantly associated with radiation use. Adjuvant radiation has been shown to reduce local recurrence in retrospective reviews of uterine sarcomas and is recommended in resected patients. Data regarding use of chemotherapy is also limited though the guidelines do recommend its use in patients with high grade tumors and metastatic disease. In this analysis chemotherapy use was associated with adverse prognostic features such as residual tumor after surgery, larger and high grade tumors.

Interpretation of the survival analysis is limited to the available follow up time for these patients. Surgical resection, tumor size and grade were associated with cancer specific survival in each of the sites. These are recognized prognostic factors for STS, although tumor grade has not been consistently shown to be associated with survival in sarcomas at sites other than the extremities 11·27. Age > 50 years was also a significant factor in cancer related death for sarcomas at all sites. Patient age has been reported as a factor for local control and disease specific survival in other series 9·16. Specific reasons for this age related difference in outcomes of patients with STS are unclear. In this analysis age did influence use of different treatment modalities and therefore may have resulted in inferior survival in these patients.

Radiation was associated with improved survival in patients with extremity and gynecological sarcomas. Previous results have shown that radiation does decrease local recurrence but does not increase survival in extremity sarcomas 13. However patients with local recurrence are known to be at a higher risk of developing distant metastases, an important cause of death. Therefore, improved local control observed with radiation may influence long term survival. The rate of complete resection in clinical trials and in

retrospective reviews from centers with expertise in treating sarcomas may be higher than the complete resection rate in this analysis. It is possible that use of radiation may influence cancer related survival in patients who have less than adequate surgery and therefore in this analysis use of radiation was associated with improved survival. Use of radiation did not influence survival in patients with sarcomas from other sites.

There are certain limitations of these data. Although SEER is an integration of population-based, quality controlled registries that cover 26% of the US population, the data from SEER is still only a sample of adult sarcoma cases occurring in the United States. The SEER program is comparable on measures of poverty and education, but is slightly more urban and has more foreign-born individuals than the general US population. The registry does contain all sarcomas occurring in a defined geographic area and therefore may better reflect the sarcoma patient population than hospital based registries, which are susceptible to referral patterns. We therefore believe that this data set is a good reflection of the actual patterns of care of sarcoma patients in the United States.

In summary this analysis reveals that patterns of care for STS differ significantly based on the site of the tumor. For extremity sarcomas the patterns of care are fairly consistent with the recommendations but the patterns of care in other sites are less consistent. In addition, age of the patient was a significant factor in determining therapy and outcome. Educational efforts directed towards adherence to management guidelines for physicians treating sarcoma might improve outcomes. Referral of patients with sarcoma to centers of excellence with a multidisciplinary team might further improve outcomes of these patients.

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Table 1

Clinical and Non-Clinical Characteristics by Site of Sarcoma for Patients Diagnosed in 2002

	All Other			
	Extremity	GYN	Sites	Total
Number of Cases	345	304	720	1369
Age				
Mean	57.0	61.1	60.5	59.8
Median	56	60	61	60
Sex				
Male	54.3	-	53.4	40.9
Female	45.7	100	46.6	59.1
Race				
NH White	70.7	65.8	69.1	68.7
NH Black	10.8	17.3	12.6	13.2
Hispanic	13.7	10.9	10.7	11.5
Asian/Pacific Islander	4.1	5.8	7.4	6.2
AI/AN	0.7	0.1	0.2	0.3
Histology				
Fibrosarcoma	9.2	0.2	2.8	3.8
MFH	30.1	0	7.2	11.3
Liposarcoma	22.1	0.3	14.1	12.8
Leiomyosarcoma	11.9	26.7	13.9	16.5
GIST	0	0	25.8	13.1
Synovial	7.4	0	1.3	2.5
Dermatofibrosarcoma	10.8	0.3	10.4	8.1
Mullerian mixed	0	27.0	0.1	6.5
Other histology code	8.5	45.5	24.6	25.5
SEER historic stage				
Localized	63.7	45.7	47.5	51.1
Regional	25.5	24.3	27.1	26.0
Distant	9.8	26.1	18.5	18.1
Unstaged	1.1	4.0	6.9	4.7
Grade				
Well or Moderately differentiated	27.9	18.3	24.5	23.9
Poorly or Undifferentiated	43.1	49.3	27.9	36.8
Not stated or N/A	29.0	32.5	47.5	39.3
Lymph Nodes Status				
No node dissection done	94.4	59.3	78.9	78.1
All nodes examined negative	3.7	31.0	15.4	16.2
Positive nodes	1.8	9.0	3.7	4.5
Unk/Not stated	0	0.7	2.1	1.2
Size of Primary Tumor				

	All Other			
	Extremity	GYN	Sites	Total
<=5 cm	38.2	15.6	27.4	27.3
5.1 – 10 cm	26.4	28.3	24.0	25.6
>10 cm	22.1	26.1	27.8	25.9
Not stated	13.4	30.1	20.8	21.1
Anatomic Depth of Tumor				
Superficial	35.7	10.3	14.2	18.7
Deep	48.3	63.1	53.3	54.4
Unknown, not stated	16.0	26.6	32.5	27.0

Table 2

Therapy for Patients Diagnosed with Sarcoma by Site of Sarcoma for Patients Diagnosed in 2002

		All Other		
	Extremity	GYN	Sites	All
Any Surgery				
Yes	96.8	89.0	82.8	87.8
No	3.2	11.0	16.9	12.0
Unknown	0	0	0.3	0.2
Pathological Margins				
No resection	3.2	11.0	16.9	12.0
Margins free of tumor	61.9 [/]	53.2	46.4	51.9
Tumor at margins	23.3	9.0	18.7	17.6
Unknown, not stated	11.7	26.7	17.9	18.5
Radiation				
Yes	53.1	31.3	23.2	32.7
No	46.6	68.4	76.1	66.8
Unknown	0.3	0.3	0.7	0.5
Any Chemotherapy*				
Yes	23.7	26.7	28.6	26.9
No	76.3	73.2	70.5	72.6
Unknown	0	0.1	1.0	0.5

[/] 5% of the patients underwent amputation

* Most Common agents used were Doxorubicin (10%), Ifosfamide (10%); Platinum analogs were used in 12% of patients with gynecological sarcomas; Imatinib was used in 10% of Sarcomas of All Other sites

Table 3

Therapy for Patients Diagnosed with Local or Regional Stage Sarcoma by Site, Pathologic Margin Status, Size and Tumor Grade

EXTREMITIES											
Therapy	Pathologic Margins			Tumor size				Grade			
	No Resect	Clear	Tumor Margin	Not stated	≤5 cm	5.1–10	>10 cm	Well or Mod	Poorly Undif	Unkn	All
None	37.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	1.7	0.5
Surgery Only	0.0	40.9	45.4	51.7	54.5	21.7	32.8	62.5	56.6	19.4	42.5
Chemo Only	19.2	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.6	0.3
Radiation Only	13.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.6	0.0	0.2
Surgery + Rad	0.0	39.6	29.7	26.3	31.7	47.1	40.1	15.0	38.8	41.7	35.4
Rad + chemo	30.7	0.0	0.0	0.0	0.0	0.7	1.2	0.0	0.0	1.4	0.4
Surgery + Chemo	0.0	3.6	2.3	7.8	1.3	6.3	4.5	5.7	0.0	6.9	3.8
Surg, rad + chemo	0.0	15.9	22.7	14.3	12.1	24.3	20.2	12.6	4.0	31.4	17.0
GYNECOLOGIC											
Therapy	Pathologic Margins			Tumor size				Grade			
	No Resect	Clear	Tumor Margin	Not stated	≤5 cm	5.1–10	>10 cm	Well or Mod	Poorly Undif	Unkn	All
None	34.6	0.0	0.0	0.0	0.0	0.0	2.2	2.2	1.8	0.7	1.1
Surgery Only	0.0	55.9	41.5	52.2	61.1	57.5	34.4	53.7	88.3	38.1	52.4
Radiation Only	65.4	0.0	0.0	0.0	0.0	1.5	0.0	5.3	0.0	4.4	2.0
Surgery + Rad	0.0	29.8	17.5	25.6	27.7	26.8	37.7	19.2	10.7	34.0	27.1
Surgery + Chemo	0.0	10.2	12.6	9.1	6.5	4.7	24.7	6.9	0.0	15.5	8.1
Surg, rad + chemo	0.0	4.2	28.5	13.2	4.7	9.5	1.0	12.6	1.1	6.1	7.8
ALL OTHER SITES											
Therapy	Pathologic Margins			Tumor size				Grade			
	No Resect	Clear	Tumor Margin	Not stated	≤5 cm	5.1–10	>10 cm	Well or Mod	Poorly Undif	Unkn	All
None	41.0	0.0	0.0	0.0	0.9	3.2	4.7	3.8	1.6	4.1	2.9
Unknown if surg	0.0	0.0	0.0	1.0	0.0	0.3	0.0	0.7	0.0	0.4	0.2
Surgery Only	0.0	69.7	56.5	56.2	62.1	58.5	50.5	75.4	65.5	37.7	59.8
Chemo Only	15.2	0.0	0.0	0.0	1.0	0.8	1.5	1.0	0.0	3.3	1.1
Radiation Only	12.4	0.0	0.0	0.0	0.6	1.5	0.0	2.2	0.0	2.3	0.9

Surgery + Rad	0.0	14.6	25.7	10.5	20.6	17.4	11.1	5.2	24.6	17.6	7.6	15.1
Rad + chemo	31.4	0.0	0.0	0.0	1.7	3.1	1.8	3.0	0.0	6.4	1.3	2.2
Surgery + Chemo	0.0	9.1	7.2	15.1	4.5	9.5	16.4	4.5	6.4	9.5	10.5	9.0
Surg, rad + chemo	0.0	6.7	10.6	17.3	8.6	5.7	14.0	4.3	1.9	19.1	7.3	8.7

Table 4

Percentage of Patients with Sarcoma Diagnosed in 2002 Receiving Radiation or Chemotherapy by Stage, Grade and Anatomic Site

RADIATION				
	Localized	Regional	Distant	All
Extremity	52.2	54.9	60.0	0 53.1
GYN	34.7	40.9	19.6	11.0 31.3
All other	22.0	35.7	13.9	7.2 23.2
	Well/Mod	Poor/Undiff	Unknown	All
Extremity	42.7	71.8	35.3	53.1
GYN	10.5	34.7	37.8	31.3
All other	24.7	35.6	15.1	23.2
CHEMOTHERAPY				
	Localized	Regional	Distant	All
Extremity	16.8	32.8	47.1	0 23.7
GYN	9.0	33.6	54.7	3.5 26.7
All other	17.6	27.2	60.6	23.2 28.6
	Well/Mod	Poor/Undiff	Unknown	All
Extremity	3.9	42.1	15.3	23.7
GYN	2.6	33.7	29.7	26.7
All other	10.3	44.7	28.5	28.6

Table 5

Predicted Probability of Receipt of Radiation or Chemotherapy by Sarcoma Site

	RADIATION						CHEMOTHERAPY					
	Extremity		GYN		Other		Extremity		GYN		Other	
	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value
Tumor Depth		0.44		0.77		0.92		0.006		0.99		0.002
Superficial	51%		37%		21%		12%		26%		14%	
Deep	57%		30%		24%		32%		27%		32%	
Unknown	49%		33%		23%		18%		26%		28%	
Pathological margins		0.85		0.89		0.61		0.39		0.007		<0.0001
No resection	53%		25%		23%		35%		22%		48%	
Margins clear	56%		33%		21%		22%		20%		23%	
Residual tumor	50%		35%		28%		23%		54%		18%	
Unknown	48%		30%		24%		30%		31%		33%	
Size		0.07		0.67		0.001		0.70		0.04		0.007
<=5cm	50%		33%		36%		20%		21%		22%	
5.1 - ≤10	63%		34%		23%		24%		19%		29%	
> 10cm	58%		24%		19%		27%		26%		40%	
Not stated	38%		35%		14%		27%		39%		22%	
Grade		0.05		0.004		0.0002		0.0001		0.0003		0.0002
Well/Mod	48%		8%		28%		5%		2%		11%	
Poor/Undiff	64%		38%		33%		37%		35%		40%	
Unknown	44%		37%		15%		17%		31%		31%	
Comorbidity		0.77		0.94		0.50		0.30		0.002		0.01
0	53%		31%		24%		25%		30%		30%	
1+	55%		31%		21%		18%		12%		18%	
Age at Diagnosis		0.01		0.76		0.006		0.04		0.25		0.43
<50	43%		29%		32%		31%		34%		31%	
50+	58%		32%		20%		21%		25%		28%	
Race/ethnicity		0.31		0.87		0.39		0.75		0.09		0.35

	RADIATION						CHEMOTHERAPY					
	Extremity		GYN		Other		Extremity		GYN		Other	
	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value	Pred prob	p-value
NHW/white	54%		31%		23%		23%		26%		29%	
NHBlack	42%		30%		26%		27%		32%		31%	
Hispanic	58%		38%		25%		28%		13%		22%	
A/PI	52%		32%		17%		24%		35%		33%	
Sex		0.34		NA		0.78		0.06		NA		0.81
Male	56%				23%		28%				29%	
Female	50%				24%		18%				28%	
Chemotherapy or Radiation		0.002		0.21		0.001		0.0001		0.23		0.001
No	48%		34%		19%		13%		29%		25%	
Yes	72%		25%		35%		30%		22%		41%	

Table 6

Cox Proportional Hazards Models for Cancer Deaths by Anatomic Location of Sarcoma

	Extremity			GYN			All other		
	p-value	Hazards	95% CI	p-value	Hazards	95% CI	p-value	Hazards	95% CI
Tumor size	0.001			<0.001			<0.001		
<5 cm		1.0			1.0			1.0	
5.1 - <=10 cm		5.8	1.7		1.0	0.5		1.7	0.9
>10 cm		12.13	3.0		3.0	1.6		2.0	1.1
Not Stated		10.8	3.3		1.2	0.6		2.6	1.5
Grade	<0.0001			<0.001			<0.001		
Well/Mod		1.0			1.0			1.0	
Poor/Undiff		21.8	3.8		6.5	2.0		4.1	1.8
Unknown		4.2	0.7		3.3	1.0		2.0	1.0
Pathologic margins	<0.0001			<0.0001			<0.0001		
No Resection		1.0			1.0			1.0	
Margins clear		0.1	0.0		0.1	0.0		0.2	0.1
Residual tumor		0.2	0.1		0.3	0.1		0.4	0.2
Unknown		0.1	0.0		0.1	0.1		0.3	0.2
Charlson Score	0.41			0.12			0.30		
0		1.0			1.0			1.0	
1+		1.4	0.6		1.4	0.9		1.3	0.8
Age	0.004			0.02			<0.0001		
<50		1.0			1.0			1.0	
50+		3.1	1.4		2.1	1.1		2.6	1.7
Race/ethnicity	0.39			0.47			0.96		
NHW		1.0			1.0			1.0	
NHB		0.9	0.4		0.9	0.5		0.9	0.6
Hisp		1.8	0.9		1.1	0.6		1.0	0.6
A/PI		0.8	0.3		1.4	0.8		0.9	0.6
Sex	0.62			NA				0.56	
Male		1.0						1.0	
Female		0.8	0.4		1.8			1.1	0.8

	Extremity					GYN					All other		
	p-value	Hazards	95%	CI	p-value	Hazards	95%	CI	p-value	Hazards	95%	CI	
Radiation	0.04				<0.001				0.31				
No/Unk		1.0				1.0				1.0			
Yes		0.4	0.2	0.97		0.5	0.3	0.8		1.3	0.8	2.1	
Chemotherapy	0.24				0.36				0.96				
No/Unk		1.0				1.0				1.0			
Yes		1.6	0.7	3.8		1.3	0.8	2.1		1.0	0.6	1.5	