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RESEARCH ARTICLE

Evaluation of Surgical Quality in Extremity Soft Tissue Sarcomas

Ekstremite Yumuşak Doku Sarkomlarında Cerrahi Kalitenin Değerlendirilmesi

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ABSTRACT

Objective: The exact treatment of extremity soft tissue sarcomas is extended surgical excision with this chemotherapy and/or radiotherapy. Despite surgical resection with a negative margin and adjuvant radiotherapy, extremity soft tissue sarcomas tend to local recurrence. This study assessed surgical quality by examining short- and long-term local recurrence ratios with the prognostic factors affecting local tumor control.

Materials and Methods: A retrospective examination was made of 130 patients treated for a diagnosis of soft tissue sarcoma localized in an extremity. The parameters affecting local recurrence were evaluated, such as the surgical margin, sarcoma size, depth, histotype, grade, the adjuvant/neoadjuvant treatment protocol, and unplanned surgery.

Results: The mean follow-up period of the patients was 44 months (range,20-70 months). Of the 118 patients who underwent extremity-sparing surgery, R0 resection was applied to 96, and R1 resection to 32. In the 20-month follow-up period, the local recurrence ratio was 19% in surgical border-negative patients and 28% in surgical border-positive patients. The local recurrence rates during the 3-year follow-up period were 24% in patients undergoing R0 surgical treatment only, 21% in those with R0 surgery+radiotherapy(RT), 34% following re-resection in those with R1, and 38% in those with R1 applied with RT only.

Conclusion: The local recurrence-free period is the most important marker of surgical margin quality. To provide optimal surgical quality, sarcoma cases should be discussed in multidisciplinary tumor panels and treatments must be personalized according to the clinical and demographic characteristics of the patient and the histopathological type of the sarcoma. The treatment of extremity soft tissue sarcomas must be performed by a specialized team with good knowledge of the physiopathology of sarcomas for optimal surgical margin and local control. Primary care physician training should be planned beyond direct patient referral to the sarcoma center for early diagnosis and treatment and to avoid unplanned surgery.

Keywords: Extremity soft tissue sarcoma, surgical margin, local recurrence-free interval

ÖZET

Amaç: Ekstremite yumuşak doku sarkomlarının esas tedavisi geniş cerrahi eksizyon ve buna kombine edilen radyoterapi ve/veya kemoterapidir. Ekstremite yumuşak doku sarkomları negatif sınırlı cerrahi rezeksiyon ve adjuvan radyoterapiye rağmen lokal tekrarlama eğilimindedir. Çalışmada cerrahi kalitesinin değerlendirilmesi amacıyla yakın ve uzak dönem lokal nüks oranları belirlendi. Bu çalışmanın amacı, tümörün lokal kontrolünde etkili olan prognostik faktörler dikkate alınarak cerrahi kalitenin değerlendirilmesidir.

Gereç ve Yöntemler: Ekstremite yerleşimli yumuşak doku sarkomu tanısıyla tedavi edilen 130 hasta retrospektif olarak incelendi. Lokal nükse etki eden cerahi sınır, sarkom boyutu, derinlik, histotip, grad ve adjuvan / neoadjuvan tedavi protokolü, plansız cerrahi gibi parametreler değerlendirilmeye alındı.

Bulgular: Hastaların ortalama takip süresi 44 ay(20-70) idi. Extremite koruyucu cerrahi uygulanan 118 hastanın 96'sına R0 rezeksiyon, 32' sine R1 rezeksiyon yapıldı. 20 aylık takiplerinde lokal nüks oranları; cerrahi sınır negatif olanlarda % 19, cerrahi sınır pozitif olanlarda ise % 28'dir. 3 yıllık takiplerimizdeki lokal nüks oranları; R0 sadece cerrahi tedavi uygulananlarda % 24, R0 olanlarda cerrahi+RT uygulananlarda % 21 iken, R1 olanlarda re-rezeksiyon sonrası % 34, R1 olup sadece RT uygulananlarda % 38 olarak bulundu.

Sonuç: Cerrahi sınır kalitesinin en önemli belirteci lokal rekürrenssiz süredir. Extremite yumuşak doku sarkomlarının tedavisi optimal cerrahi kaliteyi sağlayabilmek için sarkom vakaları multidisipliner tümör kurullarında tartışılmalı ve tedaviler hastanın klinik ve demografik özelliklerine ve sarkomun histopatolojik tipine göre bireyselleştirilmelidir. Yumuşak doku sarkomlarının cerrahi tedavisi fizyopatolojisine hakim özelleşmiş bir ekip tarafından yapılmalıdır. Erken tanı ve tedavinin sağlanabilmesi ve plansız cerrahinin önüne geçilmesi için birinci basamak hekimler ve hastalar için eğitimler planlanılmalı ve sarkom merkezine doğrudan sevk sağlanmalıdır.

Anahtar Kelimeler: Ekstremitelerin yumuşak doku sarkomu, cerrahi sınırlar, lokal rekürrensiz interval

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INTRODUCTION

Soft tissue sarcomas are a rarely seen type of cancer of mesenchymal origin, which constitute 1% of all malignant tumours seen in adults (1). They originate from many tissues and cells that form connective structures, such as muscles, blood vessels, nerves and fatty tissue. The incidence of soft tissue sarcoma is <5 cases per 100,000 adults (2). There are more than 70 histological subtypes and the soft tissue sarcomas seen most often in adults are undifferentiated high-grade pleomorphic sarcoma (malignant fibrous histiocytoma), liposarcoma, leiomyosarcoma, rhabdomyosarcoma, synovial sarcoma, and malignant perpheral nerve sheath tumour (3).

The basic treatment for extremity soft tissue sarcomas is wide surgical excision and the combination of surgery and radiotherapy and/or chemotheerapy (4). Optimal surgery should be performed by a specialised sarcoma team with good knowledge of the physiopathology of soft tissue sarcomas, and it should be aimed to obtain high tumour control and good functional results with minimal morbidity (5). High-grade soft tissue sarcomas require "wide" excision (>2cm) to minimise the development of local recurrence (6). However, this margin may not always be able to be achieved as tumours show variability in size, localisaton, and biological aggression, which may lead to an increase in amputative surgical procedures (7).

Local recurrence is the most important marker showing the quality of the surgery in soft tissue sarcomas. The surgical margin quality (negative vs. positive, R0 vs. R1) is more valuable than quantity (mm) in the prediction of outcomes (8). For the evaluation of surgical margins in this study, intraoperative photographs were taken of the tumoural mass, the excision region, and the surgical margins, the places most likely to be close to the margins were marked on the specimens, and the pathology data of the patients were used. The aim of the study was to evaluate the quality of the surgery taking into consideration the parameters of surgical margin, and tumour grade, type, localization, and histopathological type, which affect local control of the tumour.

MATERIALS AND METHODS

The study included evaluations of 130 patients with a diagnosis of soft tisssue sarcoma localised in an extremity who were treated in th Orthopaedics and Traumatology Clinic of Dr Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital.

For the evaluation of surgical quality, short and long-term local recurrence rates were determined. Evaluations were made of the parameters affecting local recurrence, including surgical margins, sarcoma size, grade, and histopathological type, and adjuvant/neoadjuvant treatment protocols.

To be able to examine the effects on local recurrence in homogenous groups and to be able to make correct predictions of local recurrence in the long-term follow-up, primary cases and cases with sarcoma who presented with recurrence or residual mass after unplanned surgery in another centre, were evaluated separately.

After preoperative evaluation, the surgical technique performed on resectable masses was extremity-sparing wide resection, leaving a clean surgical margin of at least 1cm around the tumour, which would minimise functional losses. For a safe surgical margin, wide resection of the mass was performed with the fascia and bone cortex (in cases where necessary), which form major barriers. In primary cases, a neurovascular structure was accepted as high-risk margin, and vascular structures were dissected from the adventitia and nerves from the epineurium. Vascular allografting or autografting was performed in some patients. In primary cases that were not resectable, or cases presenting with recurrence or residual sarcoma, radical surgery was performed.

The R classification was used in the evaluation of surgical quality (Table 1) (9). The surgical margins were determined from the pathology data.

Patients with low-grade sarcoma were followed up every 3 months in the first year, every 6 months in the second year and then annually thereafter; high-risk patients with high-grade sarcoma who underwent unplanned surgery followed up with physical examination, regional ultrasonography (USG), chest radiography and tomography, bone scintigraphy, magnetic resonance imaging (MRI) and PET imaging when necessary, every 3 months for the first 2 years and every 6 months until the 5th year. The patients were followed up for mean 44 months (range, 20-70 months).

As the local recurrence-free period was evaluated as the most important indicator of surgical quality, the parameters of distant metastasis, complications, and mortality were included in the analyses.

Statistical Analysis

The study data were obtained from examination of the patient records, face-to-face and telephone interviews, and the data were then analyzed statistically using SPSS vn. 13.0 software. Some of the data were shown in tables as number and percentage and where appropriate as mean ± standard deviation (SD) values. The Chi-square significance test was used for statistical analysis.

RESULTS

Evaluations were made of 130 patients, comprising 68 males and 62 females with a mean age of 49.4 years (range, 6-82 years). Complaints on presentation were pain and swelling

Table 1. Classification of surgical margins according to American Joint Committee on Cancer (AJCC) Guideline

R Classification	Microscopic surgical margin	Macroscopic surgical margin	Surgical treatment
R0	-	-	Wide resection
R1	+	-	Marginal resection
R2	+	+	Intralesional resection

in 120 cases, and ulcerated bleeding mass in 10. Tumour size was determined to be 0-5cm in 18 patients, 5-10cm in 35, and >10cm in 77. Sarcoma localisation was observed to be in the thigh in 68 patients, in a lower extremity in 28, the cruris in 13, gluteal region in 11, foot and ankle in 6, and in the knee and popliteal region in 4 (Table 2).

The sarcomas had deep localisation in 114 cases, and were high grade in 106. Histopathologically, the most frequently seen sarcomas were malignant mesenchymal tumour in 67 cases, liposarcoma in 24, and undifferentiated high-grade pleomorphic sarcoma in 10. Of the patients included in the study, 103 were treated and followed up because of primary sarcoma, and 27 because of recurrence or residual mass. Of the cases presenting with recurrence or residual mass, re-resection was performed in 25 cases, of which 21 were also administered adjuvant radiotherapy (RT) and 4 were monitored only. Local recurrence was observed in 10 patients of the re-resection group.

Extremity-sparing surgery was performed on 116 patients, radical surgery on 12, and palliative RT was applied to 2. R0 resection was applied to 96 patients and R1 resection to 32. Of the 96 patients with R0 surgical margin, 45 underwent surgery only, and 51 were treated with surgery + RT. The mean follow-up period of the patients was 44 months (range, 20-70 months).

As adjuvant treatment, neoadjuvant RT was applied to 18 cases with large volume, and postoperative RT to 83 cases. Chemotherapy was applied neoadjuvant to 6 cases with metastasis and postoperatively to 24 cases according to the histopathological type.

During the 20-month follow-up period of 130 patients, the local recurrence rates were found to be 19% in cases with negative surgical margin, and 28% in those with positive surgical margin. At the end of a 3-year follow-up period, local recurrence rates were 24% in R0 cases applied with surgical treatment only, 21% in R0 cases applied with surgery+RT, 34% in R1 cases after re-resection, and 38% in R1 cases applied with RT only (Table 3).

DISCUSSION

The main treatment for soft tissue sarcoma with extremity localisation is preoperative planning and a sufficient width of surgical resection (10). In this retrospective study, which examined 130 patients with soft tissue sarcoma with extremity localisation, the surgical quality and factors affecting that were evaluated. The 75% R0 resection rate within the mean 44-month follow-up period of this study was consistent with

Table 2. Patient characteristics and tumour size, grade, and histopathology

Characteristic	Number	Percentage (%)
Age (mean 49.4 years)		
<60 years	112	86.1
>60 years	18	13.9
Gender		
Male	68	52.4
Female	62	47.6
Complaints on presentation		
Pain, swelling	120	92.4
Ulcerated bleeding mass	10	7.6
Localisation		
Upper extremity	28	21.5
Lower extremity	102	78.5
Tumour size		
0-5 cm	18	13.9
5-10 cm	35	26.9
≥10 cm	77	59.2
Depth		
Superficial	16	12.3
Deep	114	87.7
Histopathology		
Malignant mesenchymal tumour	67	51.5
Liposarcoma	24	18.4
Pleomorphic sarcoma	10	7.6
Synovial sarcoma	9	6.9
Other	20	15.6
Grade		
High grade	106	81.5
Low grade	24	18.5

Table 3. Presentation type, surgical method, surgical margin, adjuvant treatment, and local recurrence of the cases in the study.

	Number	Percentage (%)
Type of presentation		
Primary	103	79
Recurrence-residual	27	21
Surgical method		
Extremity-sparing	116	89
Amputation	12	9
Palliative RT	2	2
Surgical margin		
R0	96	75
R1	32	25
Radiotherapy		
Adjuvant	83	63.8
Neoadjuvant	18	13.8
Chemotherapy		
Adjuvant	24	18.4
Neoadjuvant	6	4.6
Unplanned surgery		
Re-resection+adjuvant RT	21	16.1
Re-resection	4	3
Palliative RT	2	1.5
Local recurrence (20-month follow-up period)		
R0 resection	19	19.7
R1 resection	9	28.1
Local recurrence (44-month follow-up period)		
R0 resection	23	23.9
R0 resection+RT	21	21.8
R1 (re-resection cases)+RT	7	33.3
R1 (Palliative RT)	2	100

Table 4. Previous studies related to the effects of surgical margins on local recurrence of soft tissue sarcomas

Reference	Localisation	No of patients	Mean follow-up period (months)	Surgical quality			
				Margin marker	Surgical margin (%)	Margin distribution	According to surgical margin
Harati et al.2017; Oncology	Extremity	643	64	Pathological margin, microscopic	R0 R1	-	32,9% 63,9%
Bilgeri A. et al. 2020[23]	Extremity/ trunk	305	60	Pathological margin, microscopic	R0 R1	-	17% 34%
Kainhofer V. et al.2016[22]	Extremity	265	-	Pathological margin, microscopic	R0 R1	-	16,5% 36,7%
Le Vay et al. 1994; PMH	Extremity/ trunk	321	80	No data	Wide: 1-4cm Doubtful: <1cm Positive 0mm	No data	7% 17%
Keus et al. 1994; NCL/ALH	Extremity	143	114	Pathological margin, 2cm/RT	Wide Close+RT Incom plete+RT	18% 45% 37%	19% 8% 16%
Trovik et al. 2000; SSG[28]	Extremity/ trunk	559	89	Pathological margin, Enneking	Sufficient Insufficient	75% 25%	15% 32%
Stefanovski et al. 2002; CRO[21]	Extremity/ trunk	395	35	Pathological margin, microscopic	Negative Positive	68% 32%	20% 35%
Stojadinovic et al. 2002; MSKCC[20]	Extremity	1156	50	Pathological margin, microscopic	Negative Positive	81% 19%	18% 35%
Koea et al. 2003; MSKCC	Extremity	911	35	Pathological margin, 1mm	Negative Positive	83% 17%	13% 22%
Eilber et al. 2003; UCLA	Extremity	607	88	Pathological margin, microscopic	Negative Positive	98% 2%	Not significant
Zagars et al. 2003; MDA[22]	Extremity/ trunk	1225	114	Pathological margin, microscopic	Negative Uncertain Positive	66% 19% 15%	12% 26% 38%
McKee et al. 2004; RPCI/SUNY[16]	Extremity/ trunk	111	80	Pathological margin, 1mm	>10mm 1-9mm 0mm	47% 41% 12%	16% 42% 42%
Gronchi et al. 2005;I INSCT[19]	Extremity	642	107	Pathological margin, 1mm	Negative Positive	87% 13%	12% 26%
Dickinson et al. 2006; WMC[17]	Not stated	324	32	Pathological margin, 1mm	>=1mm <1mm	67% 33%	2-fold risk 3-fold risk
Stoeckle et al. 2006;IB	Extremity/ Trunk	200	53	Surgery/ Pathological consensus UICC	R0 R1	74% 26%	7% 30%
C.Yıldız et al. 2003; GATA	Extremity	40	58	Pathological margin, 1mm	Negative Positive	85% 15%	0% 83.3%
CURRENT STUDY	Extremity	130	44	Surgery/ Pathological margin+RT	R0+RT R1	74% 26%	21% 34%

data in the literature of a range between 66% and 87.7%, and the local recurrence rate of 21% was at the upper limit of the literature data of 9-20% (11,12) (Table 4).

Most previous studies are in agreement on the point that the surgical margin is one of the strongest negative prognostic values for local control (13). Anatomic restrictions around the tumour make an actual wide resection impossible with a sufficiently safe margin without sacrificing critical anatomic

structures (eg., major nerves, blood vessels, bones and joints) (14). Azzarelli et al. demonstrated that it was almost impossible to obtain a 2 cm margin in all directions (15). McKee et al. reported that a surgical margin exceeding 1cm could only be obtained in 47% of patients (16), and Dickinson et al. were able to obtain a surgical margin >5mm in 54% of patients (17). In the current study, R0 resection was performed in 96 patients and R1 in 32, with 75% of the surgical margins reported to be negative and 25% positive. In contrast to the studies by Azzarelli (15), McKee (16), and Dickinson (17), which were based on the measured data of the surgical margin, the R classification was considered to be more effective and useful in the current study determination of surgical margin and evaluation of surgical quality rather than the evaluation of measurements. This was because there is no consensus on which tissues such as muscle tissue, fatty tissue, and neurovascular sheath and what width of excision of the sarcoma show that a safe surgical margin can be obtained (18).

The most important indicator of the quality of surgical treatment is local tumour control, which is determined primarily by the negativity of the surgical margin, tumour size, grade, localisation and histopathological type, adjuvant treatment combinations, and insufficient or unplanned surgery. In a study of 911 patients by Gronchi et al., local recurrence rates were reported to be 12% in the cases with negative surgical margin (87%) and 26% in cases with positive surgical margin (13%) (19). In another retrospective analysis of 2084 patients, Stojadinovic et al. determined recurrence rates in 15% of cases with negativity and 28% in those with positivity (20). In the current series of 130 patients, the local recurrence rates were determined to be 21% in R0 surgical resections and 34% in R1 resections. Although these rates were seen to be similar to those reported by Stefanovski (21), they were seen to be slightly higher in both R0 and R1 resections than the rates reported by Gronchi (19), Kainhofer (22), Bilgeri (23), and Stojadinovic (20). This was attributed to most of the current study patients having larger and higher grade sarcomas and that they presented late because of a low sociocultural level.

It has been reported that 70-80% of local recurrences occur within the first 3 years (24). To be able to make better comparisons between studies when reporting local results, the "local recurrence-free period" should be used. Short -term follow-up can overlook late recurrences associated with the tumour biology. Gronchi et al. found no difference between the local results of patients with positive and negative surgical margins in the short-term follow up, but a significant difference was determined at the end of the long-term follow-up period (19). As shown by Stojadinovic et al., while systemic risks are valuable in the early period, they become more important after local recurrence (20). The local recurrence rates in the current study were determined to be 19% in cases with negative surgical margin, and 28% in those with positive surgical margin in the 20-month follow-up period, and at the end of a 3-year follow-up period, 24% in R0 resections, 21% in those with R0 resection+RT, and 34% in R1 resections. The increase in local recurrence rates after 3 years compared to the short-term follow-up shows that long-term local recurrence results are more valuable, as stated by Gronchi (19) and Stojadinovic (20). In a study of 171 patients in the Royal Marsden Hospital (UK), Pitcher et al. explained local recurrence rates at the end of a 20-month follow-up period as 9% (15/171) isolated and 14% (24/171) immature (25). In the second reports, this rate was 20.6% (35/171) at the end of a 5.3-year follow-up period, and the actual local recurrence-free rate was stated to be 26% (37). As in those studies by Pitcher et al. (25, 26), a significant difference was determined in the long-term follow-up local rates in the current study between the cases with negative and positive surgical margins (R0 21%, R1 34%). This difference demonstrated that the system used is good in the determination of surgical quality

As size and grade together best define the biological aggression of soft tissue sarcomas, this is the most important prognostic factor for local control (4, 19, 27). In an analysis of 559 patients by the Scandinavian Sarcoma Group, a higher histological grade and surgical margin positivity were found to be independent risk factors for local recurrence (28). Localisation of the sarcoma has been found to contribute as much as size and grade to surgical success and therefore, local recurrence. The prognosis is always good in low-grade soft tissue sarcomas with superficial localisation (14). Rydholm and Rooser determined only 10% local recurrence in a minimum of 6 months of follow-up following wide resection in 48 patients with subcutaneous and intramuscular soft tissue sarcoma (29). As most of the cases in the current study had large sarcomas with deep localisation, local control was difficult. In a study by Simon and Enneking, the recurrence rates of soft tissue sarcoma after surgical resection were reported to be 38% in those with hip localisation, 48% in the thigh, and 58% in the foot and ankle (30). It is difficult to obtain surgical margin negativity in localisations such as the hand, foot and ankle, forearm, cruris, and popliteal region. Some of the current study cases with local recurrence despite extremity-sparing surgery + adjuvant RT were those with sarcoma localisation in the cruris, foot and ankle, forearm, and popliteal region. These results were consistent with the findings of the study by Simon and Enneking (30), stating that these localisations made R0 resection difficult, increased local recurrence and increased the need for amputation.

Another important factor affecting local tumour control is the histopathological type. Specific subtypes such as myxofibrosarcoma and undifferentiated pleomorphic sarcoma usually have an infiltrative growth pattern (31). The probability of local recurrence is high, independently of surgical margins (32). Therefore, evaluation specific for each histological subgroup is very important in surgical planning. In a homogenous myxofibrosarcoma series, Dadrass et al. reported that the local recurrence rates were higher in negative surgical margin resections than in other histological subtypes (33). A significant proportion of patients in the current series were found to have soft tissue sarcoma of a histological type with an infiltrative growth pattern, which could be one of the factors causing the higher rates of local recurrence in R0 and

R1 resections compared to the data in the literature.

Unplanned excision generally includes dissection along the tumour capsule and enucleation. Tumour tissue is left behind in 65% of these cases. Residual tumour is a risk factor for local recurrence and local recurrence can be seen in 75% of unplanned surgery cases (34). Of the 25 patients in the current study re-resection group, local recurrence was observed in 10. It has been previously reported that local recurrence is seen in 40% of patients in the re-resection group who present at the clinic following unplanned or insufficient surgery. In the MSKCC study by Lewis (35), the reason for a high rate of local recurrence was said to be that patients had undergone unplanned or insufficient surgery for a high grade soft tissue sarcoma with deep localisation and had been referred late to centres.

Radiotherapy combined with surgical treatment plays an important role in local tumour control of high-grade soft tissue sarcomas (36). In a series of 91 patients with high-grade soft tissue sarcomas, Yang et al. performed extremity-sparing surgery and adjuvant RT, and reported a decrease in local recurrence in the patients who had received RT (37). A retrospective study by De Laney et al. examined patients with gross and microscopic positive surgical margins who received RT for curative purposes, and concluded that if re-resection is possible without leaving a functional deficit, RT alone should not be selected (38). In the current study, the local recurrence rates at the end of a 3-year follow-up period were 24% in R0 cases receiving surgical treatment alone, 21% in R0 cases treated with surgery and RT, and 38% in R1 cases applied with RT only. Similar to the literature data of Yang (37) and De Laney (38), RT applied to cases in this series with R0 surgical margin reduced the rate of local recurrence, and there was observed to be an increase in local recurrence rates after the application of RT alone. In a retrospective study of 133 patientts, Khanfir et al. showed that when patients with a surgical margin <10mm received adjuvant RT, statistically significant local tumour control was achieved, and this was not obtained in patients with a surgical margin of ≥10mm (39). Similar results were reported by Baldini (40) and Sadoski (41). As stated in the studies by Khanfir (39) and Baldini (40), adjuvant RT in the current study was applied to high-risk nerve regions (neurovascular sheath) and to patients with a high probability of local recurrence, and there was observed to be a decrease in local recurrences (42).
This study had some limitations; first of all, besides being a retrospective study, the follow-up period is not very long. the number of patients is relatively small due to the low incidence of soft tissue sarcoma. in addition, the treatment of many sarcomas varies within itself and is not standardized. in addition, series that are completely homogeneous in terms of patient age, tumor types, sizes, grades and that include a large number of patients are only possible in multicenter studies. our study is a single center study.

In conclusion, for patients with soft tissue sarcoma with extremity localisation, the primary treatment option should be R0 resection protecting the extremity functions. The most valuable major indicator evaluating the quality of surgery of soft tissue sarcomas is the local recurrence-free interval. Therefore, importance must be given to the factors affecting local recurrence such as the surgical margin, size, grade, localisation and histopathological type of the tumour, and unplanned or insufficient surgery. In recent series the local recurrence-free rate varies between 9% and 20%. To be able to provide optimal surgical quality, sarcoma cases should be discussed in multidisciplinary tumour panels and treatments must be personalised according to the clinical and demographic characteristics of the patient and the histopathological type of the sarcoma. Training should be planned for primary care physicians and patients and patients should be referred directly to a sarcoma centre to enable early diagnosis and treatment and avoid unplanned surgery.

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