Monitoring referral and treatment in soft tissue sarcoma

Study based on 1,851 patients from the Scandinavian Sarcoma Group Register

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ABSTRACT – This report is based on 1.851 adult patients with soft tissue sarcoma (STS) of the extremities or trunk wall diagnosed between 1986 and 1997 and reported from all tertiary referral centers in Norway and Sweden. The median age at diagnosis was 65 years and the male-to-female ratio was 1.1:1. One third of the tumors were subcutaneous, one third deep, intramuscular and one third deep, extramuscular. The median size was 7 (1–35) cm and 75% were high grade (III–IV). Metastases at presentation were diagnosed in 8% of the patients. Two thirds of STS patients were referred before surgery and the referral practices have improved during the study. The preoperative morphologic diagnosis was made with fine-needle aspiration cytology in 81%, core-needle biopsy in 9% and incisional biopsy in 10%. The frequency of amputations has decreased from 15% in 1986–88 to 9% in 1995–1997. A wide surgical margin was achieved in 77% of subcutaneous and 60% of deep-seated lesions. Overall, 24% of operated STS patients had adjuvant radiotherapy. The use of such therapy at sarcoma centers increased from 20% 1986–88 to 30% in 1995–97. Follow-up has been reported in 96% of the patients. The cumulative local recurrence rate was 0.20 at 5 years and 0.24 at 10 years. The 5-year metastasis-free survival rate was 0.70.

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Soft tissue sarcomas of the trunk wall and extremities represent approximately 0.5% of all malignancies (Gustafson 1994). Due to the rarity of this tumor and its complex management, it is recommended that sarcoma patients should be referred to tumor centers for treatment by a multidisciplinary team including orthopedic surgeons, oncologists, radiologists, cytologists and pathologists (Rydholm 1983, Gustafson 1994, Wiklund et al. 1996). As pioneered by Bertil Stener (1978), the Scandinavian treatment policy rests on referral before biopsy or excision, local control being dependent on the surgical margin rather than radiotherapy. Specifically, this policy recommends that patients with deep-seated tumors or those with subcutaneous lesions larger than 5 cm should be referred before surgery.

In 1986, the SSG started a register of sarcoma patients referred to tumor centers in Finland, Norway and Sweden. The aim was to compile a database of patients treated during a limited period according to established guidelines. This would permit comparison with those not referred, assessment of how SSG treatment guidelines were implemented, and multi-center studies of rare tumor entities.

Table 1. Participating centers and number of patients reported

Center	STS, n
Norway	
Radiumhospital, Oslo [a]	453
Haukeland University Hospital, Bergen	120
Regional Hospital, Trondheim	83
Sweden	
Karolinska Hospital, Stockholm	470
University Hospital, Lund	291
Sahlgrenska Hospital, Gothenburg	279
University Hospital, Umeå	78
University Hospital, Linköping	77
Total	1,851

[a] includes 29 patients operated at Ullevål Hospital, Oslo

Table 2. Sex and age distribution

Age interval (yrs)	Male n	Female n	Total n	Total %
16–19	20	22	42	2
20–29	76	50	126	7
30–39	82	75	157	9
40–49	134	113	247	13
50–59	116	101	217	12
60–69	193	151	344	19
70–79	270	217	487	26
80–89	86	122	208	11
90–99	13	10	23	1
Total	990	861	1,851	100

Patients and results

This report is based on adult (16 years or more) patients with soft tissue sarcoma (STS) of the extremities or trunk wall diagnosed between March 1, 1986 and December 31, 1997 who were reported to the SSG Register. Patients with sarcomas located in the head and neck region, viscera or retroperitoneal space were not included, nor were patients with Kaposi's sarcoma or dermatofibrosarcoma protuberans. Data were reported from all sarcoma centers in Norway (3) and Sweden (5) (Table 1). The combined population of Norway and Sweden during the study period was 14 million. Patient data were from the various institutions and were entered into the database at the SSG secretariat in Lund, Sweden.

All reported data was checked for inconsistencies and corrected. For example, if the patient was reported as having been referred before surgery, but the first procedure had been done outside of a sarcoma center, the data had to be corrected by the reporting institution. In this way inconsistent entries regarding referral, site and location, biopsy and surgical treatment could be corrected. The data have also been validated and compared to patient charts when used for different in-depth studies (Skytting et al. 1999a, Trovik et al. 2000).

Data were analyzed using the Mann-Whitney U-test and the chi-square test. For testing linear trends over time for dichotomous categorical variables, standardized S values with one-tailed p-values are given (Cochran 1954). To illustrate the differences, median values are given for patients treated 1986–1988, compared to 1995–1997. Patient survival was analyzed using the Kaplan-Meier technique with Greenwood confidence bands and Mantel-Haenzel log-rank tests.

Patient accrual

1,851 patients were registered with a median accrual of 153 (139–188) patients per year. There was a 6-fold difference among the centers in the number of patients reported: the smallest centers reported 77 patients and the largest 470.

Age and sex

The median age at diagnosis was 65 (10–99) years (Table 2). There was a bimodal age distribution with peaks in the fifth and eighth decades. The male-to-female ratio was 1.1:1. The male predominance was evident in all age groups, except among patients older than 80 years.

Site and location

The commonest sites were the thigh, trunk wall, and lower leg (Table 3). 35% of tumors were subcutaneous, 32% intramuscular and 32% deep, extramuscular. Tumor location was unclassified in 7 (0.4%) patients.

Metastatic status at presentation

Metastases at presentation were diagnosed in 8% of the patients. There was no difference in the median age of patients with or without metastases, but patients with metastases had larger primary tu-

Table 3. Tumor site

Site	n	%
Trunk wall	253	14
Shoulder	95	5
Gluteal	130	7
Groin	82	4
Upper arm	164	9
Lower arm	84	5
Hand	22	1
Thigh	752	41
Lower leg	205	11
Foot	64	3

Table 4. Relationship between presence of metastases at diagnosis of STS and histological malignancy grade (p < 0.0001)

Grade	No metastases	Metastases	
	n	n	%
I	124	0	0
II	236	9	4
III	560	38	6
IV	696	89	11
Total	1,616	136	8

Grade was not recorded in 99 patients.

Table 5. Histotypes

Type	n	%
Malignant fibrous histiocytoma	833	45
Liposarcoma	267	14
Leiomyosarcoma	153	8
Synovial sarcoma	128	7
Malignant schwannoma	90	5
Fibrosarcoma	66	4
Myxoid chondrosarcoma	38	2
Malignant pericytoma	26	1
Epithelioid sarcoma	26	1
PNET/Ewing of soft tissue	26	1
Rhabdomyosarcoma	24	1
Hemangiosarcoma	24	1
Osteosarcoma of soft tissue	21	1
Clear cell sarcoma	18	1
Alveolar cell sarcoma	8	–
Mesenchymoma	7	–
Others and unclassified	101	6
Total	1,851	100

mors, i.e., 11 versus 7 cm. The frequency of metastatic involvement increased with the histological malignancy grade (Table 4). Metastases were especially common in rhabdomyosarcoma (9/24), hemangiosarcoma (5/18), epithelioid sarcoma (4/21), and unclassified STS (20/101). Metastases were uncommon in liposarcoma (5/266) and extra-skeletal myxoid chondrosarcoma (1/38). Metastases at diagnosis were seen in only 3% of subcutaneous and 7% of intramuscular lesions but in 14% of extracompartmental lesions. This could not be explained solely by size. Subcutaneous lesions were smaller than deep-seated, but intramuscular lesions were equal in size to extracompartmental ones.

Size

Tumor size was judged from preoperative imaging or from pathological examination of fresh surgical specimens. The median recorded size was 7 (1–35) cm. The size increased with increasing patient age, e.g., from 6 cm among patients younger than 40 years to 8 cm in those older than 80 years (Standardized S-value 5.1, $p<0.0001$)

Histological type and grade

The histological types and malignancy grades presented were those reported by the different contributing centers according to Enzinger and Weiss (1995). The commonest histotypes were MFH (45%) and liposarcoma (14%) (Table 5). Histological grading, using a four-grade scale (Broders et al. 1939, Angervall et al. 1986) based on biopsy or surgical specimens, showed that 75% of STS were of high grade (III–IV). Liposarcomas were not subgrouped, but 59% were classified as low grade (I–II). The median age of patients with MFH and leiomyosarcoma was 70 years, with liposarcoma 57 years and synovial sarcoma 40 years.

Surgical staging

Since there were so many subcutaneous lesions, which are intracompartmental by definition, almost one half of the lesions were stage IIA (Table 6) (Enneking et al. 1980).

Referral

Only 63% of STS patients were referred before open biopsy or surgical excision (Table 7), and of

Table 6. Surgical stage according to the Surgical Staging System of Enneking et al. (1980) [a]

Stage	n	%
IA	256	15
IB	100	6
IIA	849	49
IIB	397	23
IIIA	56	3
IIIB	76	4

[a] Based on 1,734 patients.

Table 7. Status on referral to orthopedic oncology center

Referred after	Subcutaneous		Deep		Total	
	n	%	n	%	n	%
Untouched lesions	140	22	689	57	829	45
Fine-needle biopsy	68	11	186	15	254	14
Core-needle biopsy	22	3	49	4	71	4
Incisional biopsy	58	9	81	7	139	7
Excision	297	47	158	13	455	25
Local recurrence	53	8	44	4	97	5

Referral status was not recorded in 6 patients.

these, 18% had a fine- or core-needle biopsy prior to referral. Patients who had a biopsy or were operated on before referral to a sarcoma center had smaller lesions (5 vs 9 cm, p<0.001) and more than one half of these were subcutaneous (57% vs 20%, p<0.0001).

The referral practice has improved during the study. In the period 1986–1988, 57% were referred before surgery compared to 67% in 1995–1997 (Standardized S-value 3.8, p<0.0001). This improvement applies mostly to deep-seated lesions; 81% were referred before surgery in 1995–1997 compared to 70% in 1986–1988 (Standardized S-value 3.4, p= 0.0003). Although there was a trend towards an improved referral pattern of patients with subcutaneous STS (Standardized S-value 2.2, p= 0.02), only 4 of 10 patients were referred to a sarcoma center with untouched lesions in 1995–97.

Imaging studies of primary lesions

Among patients operated on sprimarily at a sarcoma center, 80% had a preoperative CT or MRI compared to 35% operated on before referral. Among the patients operated on primarily at a sarcoma center, 22% had neither an MRI nor CT during 1986–1988, but this had fallen to 4% during 1995–1997 (Standardized S-value 6.0, p < 0.0001). MRI has largely taken the place of CT for imaging of STS. However, in 1995–1997, 24% of STS were evaluated with both, presumably because CT was done before referral and MRI at the SSG center.

Biopsy

Among patients who were operated on for primary tumor before referral to a sarcoma center, 55% had no prior biopsy, but only 6% of those treated at a sarcoma center were operated on without a preoperative cytological or histological diagnosis (chi-square, p<0.0001).

At sarcoma centers, the proportion of unbiopsied patients has dropped from 8% in 1986–1988 to 3% in 1995–1997 (Standardized S-value 3.6, p= 0.0001). A preoperative morphological diagnosis was made with fine-needle aspiration cytology in 81%, core needle or true-cut biopsy in 9% and incisional biopsy in 10 %. In 1995–1997, only 2% of patients had an open biopsy as the first method of obtaining a preoperative diagnosis, but another 3% had an open biopsy after needle biopsy proved inconclusive.

Surgical procedures

Surgery was not used in 115 (6%) patients, half of whom had metastases at the time of diagnosis. The remaining 53 unoperated patients were older (median 72 years vs 64 years, chi-square, p= 0.001) and had larger (median 12 cm vs 7 cm, p<0.001) lesions than operated STS patients.

Among the 1736 operated patients, 1,173 (68%) were operated on primarily at a sarcoma center. Of the remaining 563 (32%) who were operated on outside, 383 were referred and had a second operation for primary tumor at a sarcoma center. Hence, only 180 (10%) patients had all surgical treatment for a primary tumor outside of a sarcoma center. 91 (51%) of these presented with subcutaneous lesions. At sarcoma centers, amputations for primary extremity sarcomas were performed in 11% of the patients. The frequency of amputations has decreased from 15% in 1986–1988 to 9% in 1995–1997 (Standardized S-value 2.4, p<0.008).

Surgical margins

A wide or compartmental margin was achieved in only 11% of patients operated on outside of a sarcoma center, as compared to 66% of those operated on at a center. The overall reported margins among center-operated patients were 7% intralesional, 27% marginal, 61% wide, and 5% compartmental. A wide or better margin was achieved in 77% of subcutaneous lesions and in 60% of deep-seated lesions. The proportion of patients in whom a wide or better surgical margin was reported remained unchanged during the accrual period (Standardized S-value 0.5, p= 0.3).

Adjuvant treatment

Adjuvant radio- or chemotherapy was recorded as pre-, per-, or postoperative. Hence, no details about drugs, dosage, radiation target volume or fractionation, or duration of treatment were noted. The SSG has had no recommendations or trials during the study on adjuvant chemotherapy in primary STS. The SSG study of adjuvant doxorubicin treatment was stopped before 1986 and showed no benefit of treatment (Alvegård et al. 1989). Overall only 4% of patients had received adjuvant chemotherapy.

Postoperative radiotherapy in STS has been recommended after a marginal excision. Radiotherapy was also indicated after an intralesional excision if the margin could not be improved by further surgery. Radiotherapy has not generally been considered indicated after wide or compartmental excisions (Alho et al. 1989). The recommended target absorbed dose was 50 Gy in 25 fractions with a 10/20 Gy boost after an intralesional margin.

Overall, 24% of patients managed by surgery had radiotherapy. Among patients with an intralesional or marginal excision, 45% had postoperative radiotherapy. Patients treated outside of sarcoma centers were seldom referred for radiotherapy, only 21% of patients with an intralesional or marginal excision receiving radiotherapy, compared to 54% treated at a sarcoma center.

The use of radiotherapy at sarcoma centers increased from 20% in 1986–1988 to 30% in 1995–1997 (Standardized S-value 3.0, p= 0.001). This increase applied not only to treatment after marginal surgery, because more patients with deep-seated STS also received adjuvant radiotherapy after a wide surgical margin, i.e., 19% in 1995–1997, compared to 9% before 1995 (Standardized S-value 3.1, p= 0.001). Regarding all operated patients, the proportion of patients who had marginal surgery and no radiotherapy was 17% and there was no improvement during the accrual period (Standardized S-value 0.8, p= 0.2).

Follow-up

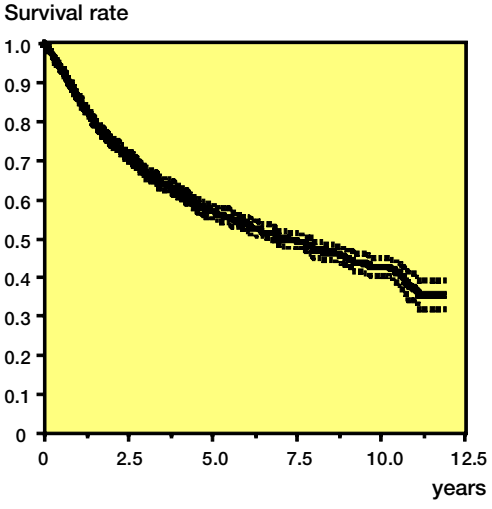
Follow-up has been reported in 96% of the patients. Of the 1,208 patients treated more than 5 years ago, in the period 1986–1993, 541 (45%) had no evidence of disease, 41 (3%) were alive with disease, 595 (49%) had died, and follow-up was not reported in 30 (3%). The median follow-up of 584 patients who are still alive was 7 years. Among the patients who had died, 74% died of disease, 3% with disease, 19% without evidence of disease, and in 4% the cause could not be established.

The cumulative local recurrence rate (Kaplan-Meier) was 0.20 at 5 years and 0.24 at 10 years among patients operated on for primary tumor at a sarcoma center. There was a tendency for lower local recurrence rates at 2 years for patients treated 1993–1997. compared to those treated 1986–1992, 0.10 vs 0.14 (p= 0.04 Mantel-Haenzel test). The 5-year local recurrence rate among patients treated by surgery outside a sarcoma center was 0.70.

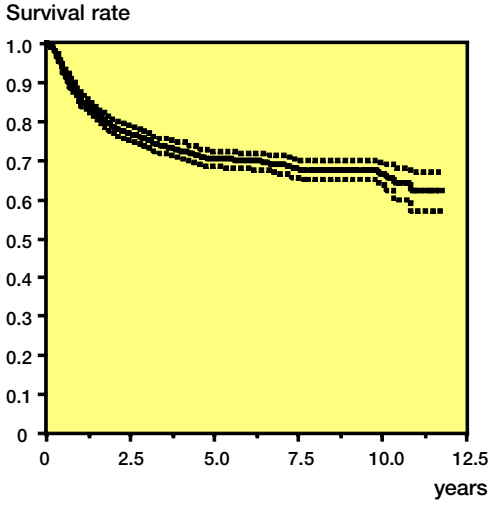
The overall survival rate for all reported STS patients, i.e., including those with metastases at diagnosis and those not treated, was 0.57 at 5 years and 0.43 at 10 years. The 5-year metastasis-free survival rate was 0.70 (Figure), and the 5-year survival rate for tumor-related death was 0.74, based on operated patients without metastases at diagnosis.

Comparison among centers

Comparison of data from participating centers revealed important differences in demographics and treatment (Table 8). All patients treated for STS in southern Sweden (1.5 million inhabitants), whether or not referred to the center, were reported from Lund, and their population-based data can be used as a basis for comparison (Rydholm 1983, Gustafson 1994). The patients from Lund were



A. Overall survival based on the whole series of 1851 patients including those with metastases at diagnosis and those not treated. Dotted lines denote the 95% CI.



B. Metastases-free survival based on 1646 operated patients without metastases at diagnosis.

Table 8. Key data from centers reporting more than 100 STS patients. Values are %

Center	n	Age >65 years	Referred before surgery		Metastases at diagnosis	Subcutaneous	Fine-needle biopsy [a]
			sc	deep			
Stockholm	470	50	43	79	8	35	84
Oslo	453	48	10	59	11	38	53
Lund	291	57	53	82	6	32	93
Gothenburg	279	49	49	80	6	34	90
Bergen	120	45	30	78	4	44	47

Center	Histotype MFH	Grade III–IV	Size >7 cm	Amputation [a]	Margin wide or better [a]	Radio-therapy [a, b]
Stockholm	41	80	42	8	56	61
Oslo	43	74	52	9	48	50
Lund	45	86	43	6	67	66
Gothenburg	50	81	52	17	80	23
Bergen	45	77	47	10	61	65

[a] For primary tumor at center
[b] After an intralesional or marginal margin

older than at other centers and the lesions were also smaller. Lund also had the best referral practices, with the highest rate of patients being referred before surgery. Fine-needle biopsy for cytological diagnosis was the preferred method at Swedish centers, but was not used as frequently in Norway. The proportions of MFH and of high-grade lesions were fairly equal in all centers. The amputation rate for primary lesions of extremities was twice as high in Gothenburg as in other centers and, conversely, Gothenburg reported better surgical margins and lower local recurrence rates.

Discussion

The SSG was formed in 1979 by orthopedic surgeons, oncologists, pathologists, and radiologists

specializing in treatment of patients with soft tissue or bone sarcomas. One of the main goals of the SSG was to centralize the care of sarcoma patients to a few specialized centers in each Scandinavian country. The members of the SSG agreed on common principles of diagnostic procedures and treatment, and initiated two treatment trials: SSG I (1981–1986) on adjuvant doxorubicin therapy in high-grade STS (Alvegård 1989) and SSG II (1982–1989) on osteosarcoma treatment (Saeter et al. 1991).

Based on this experience, the SSG members decided to start a register of both soft tissue and bone sarcoma patients in 1986. The purpose of the Register was to assess treatment and results in all sarcoma patients at SSG centers, not only those participating in clinical trials. Furthermore, we wished to determine how well SSG guidelines were followed and whether compliance would lead to better results, and, finally, to provide a large data bank for analysis of specific questions.

Patients were reported to the Register from SSG centers in Norway and Sweden but there was no compulsory participation. The Register is not population-based as patients never referred to SSG centers were not included. However, in both Sweden and Norway, all inhabitants were encompassed by the participating SSG centers. The SSG Register is based on voluntary reporting by dedicated specialists, unlike the Swedish National Cancer Register, which is based on compulsory reporting by any physician who diagnoses a malignant disease. Therefore, a direct comparison of their respective data contents may be misleading. The aim of the Swedish National Cancer Register is to act as an incidence register, recording all new cases of cancer occurring in the entire population, while the aim of the SSG Register is to analyze types of treatment and outcome at specialized centers.

We recently compared the SSG Register with the Swedish National Cancer Register for the year 1995. 90% of all sarcomas of the trunk wall and extremities were found in the SSG Register. The remaining 10% were mostly small subcutaneous lesions or were diagnosed in patients with other severe diseases or at death. Hence, the SSG Register can be regarded as population-based since there are no major areas of Sweden or Norway that do not report to the Register and there are no other hospitals that have organized care for sarcoma patients. The high proportion, 35%, of patients with subcutaneous sarcomas, who are less likely to be referred to a sarcoma center as they often pose a less serious clinical problem, also testifies to the completeness of the accrual. In a study of all extremity STS patients treated in Gothenburg 1956 through 1976 only 20% were subcutaneous (Berlin et al. 1990). Furthermore, only 8% of the patients had metastases at diagnosis, but in a similar study from the USA, 23% had metastases (Lawrence et al. 1987). This implies that in the USA, mostly patients with advanced disease are referred to specialized centers whereas others are treated at local hospitals.

One major concern regarding tumor registers is the quality of the data. This has been ensured by consensus on terminology in the SSG and retrospective comparison of entered data with patient charts. In 1994, the data entry forms were simplified and the amount and detail were reduced. As part of the SSG I protocol of adjuvant doxorubicin treatment in STS, all surgical and pathology reports were discussed by participating SSG surgeons for classification of surgical margin and the pathology slides were reviewed by SSG pathologists (Alvegård 1989). This careful discussion was an important educative process and led to a consensus in terminology. In fact, the classification of surgical margins according to Enneking et al. (1980) was applied stringently and the misnomer "contaminated wide margin" was not used. Such procedures were classified as intralesional or marginal. The quality of reported data also improved during the SSG I study. Part of the Register has been reviewed in preparation for in-depth studies and there has been a good agreement between reported data and patient charts (Skytting et al. 1999a, Trovik et al. 2000).

The referral of sarcoma patients before surgery was adhered to more closely in Sweden than in Norway. In Norway, there remained important differences in referral patterns between various parts of the country. It was encouraging to see that the referral pattern improved. In fact, 81% of patients with deep-seated lesions were referred before surgery in 1993–95. The referral practice in the Scandinavian countries compares favorably to that of

the USA. In a study of referral practices in 1992 from the American Musculoskeletal Tumor Society, less than half of STS patients were referred before biopsy (Mankin et al. 1996). Interestingly, they found no improvement compared to a similar study performed in 1982 (Mankin et al. 1982)

1 of 3 patients were operated on without prior diagnostic imaging by MRI or CT. Patients operated on outside of a SSG center seldom had a proper diagnostic work-up, probably because the surgeon did not expect a sarcoma. Our results compare favorably to a study of the management of soft tissue sarcoma patients in a health region in the London area where 2 of 3 were operated on without MRI or CT (Clasby et al. 1997). MRI is replacing CT, but many patients underwent both procedures although this is seldom indicated.

A complete peer review of the pathological material has not been completed so the histological diagnoses provided were those made at the various centers. In a retrospective analysis of 1000 sarcomas, by the SSG Pathology Board, the diagnosis of sarcoma was retained in 90%, but in 2% non-sarcomatous malignancy was diagnosed, in 1% a borderline lesion was considered and in 2%, the material was not diagnostic. The lesions were regarded as benign in 5%, all except 1 had been diagnosed primarily as low-grade MFH or liposarcoma. The peer review only changed the grading from high to low or from low to high in 5%, although the histological subtype was changed in 20%. The greatest changes concerned lesions primarily diagnosed as MFH, but the lowest incidence of revised diagnoses concerned synovial sarcoma (Meis-Kindblom et al. 1999). The better diagnostic accuracy of synovial sarcoma is probably due to the fact that this entity is better defined than MFH (Skytting et al. 1999b). This peer review compares favorably with previous similar studies, presumably because in most cases a pathologist at a sarcoma center was involved in the primary diagnosis. Morphological review seems essential for prognostic analysis of specific histological subgroups, but not for overall analysis of treatment and recurrences.

Fine-needle biopsy for cytological diagnosis of soft tissue lesions was developed and popularized in Sweden and is now used oftener in Norway (Åkerman et al. 1985). An increasing use of fine-needle biopsy at local hospitals may be one reason for the high referral before surgery to SSG centers in Sweden. Swedish surgeons refrain from open biopsies or excisions without a cytological diagnosis. In the study of treatment patterns in the USA. 1983–84, one half of the diagnoses were made after excisional biopsy and needle biopsy was used in only 9% of their cases (Lawrence et al. 1987). Interestingly, in the study from the Musculoskeletal Tumor Society, open biopsy performed outside of a sarcoma center entailed greater risk of detrimental effects than needle biopsy (Mankin et al. 1996). In the study from London, only one third of the patients had had a biopsy, the remainder were operated on without prior knowledge of the histological diagnosis (Clasby et al. 1997).

Overall, a wide or compartmental surgical margin was achieved in only 6 of 10 patients. The margins have not improved during the accrual period, but the amputation rate has decreased so that now less than 10% of patients with sarcoma of an extremity are treated with amputation. The best way to improve margins is education of the medical community to change their referral routines. Margins can also be improved, without increasing the amputation rate, by applying advanced techniques for soft tissue reconstruction. At many centers, radiotherapy is given routinely for high-grade malignant lesions to all patients with deep-seated and most with subcutaneous soft tissue sarcoma (Tanabe et al. 1994, Lewis and Brennan 1996, Yang et al. 1998, Whylie et al. 1999). In Scandinavia, only 20% had radiotherapy during the first years of study, but this number had increased to 30% during the last years. Despite this limited use of radiotherapy, the overall local recurrence rates were comparable to those reported from other centers with much wider indications for radiotherapy (Coindre et al. 1996, Pisters et al. 1996, Fleming et al. 1999). Hence, in the majority of STS patients, local control can be achieved by surgery alone, and the group that would benefit from radiotherapy, despite a wide surgical margin, needs to be defined.

Many patients are still not given radiotherapy after intralesional or marginal surgical margins. This poor of compliance applied not only to patients treated outside of a SSG center, but also to

those operated at a center. Common reasons for abstaining from radiotherapy were low histological grade, old age or concomitant disease, difficult anatomic location and wound problems (Bauer et al. 1997). In only 11 of 82 patients was there no obvious reason for non-compliance. The proportion of patients having marginal surgery without radiotherapy at sarcoma centers has remained at 17%, but more patients now receive radiotherapy after a wide excision. It is anticipated that the overall local recurrence rates will drop as the referral practices continue to improve. There was a tendency to lower recurrence rates in patients treated at sarcoma centers during the last years of accrual.

There remains uncertainty about the role of adjuvant chemotherapy in soft tissue sarcoma, such that during the accrual period 1986–1997, no treatment was recommended by the SSG. Following a recent meta-analysis of studies on adjuvant chemotherapy in STS (Tierney et al. 1997), chemotherapy is now recommended in selected patients considered to have a high risk of developing metastases, i.e., those with large lesions, necrosis and vascular tumor invasion (Fernberg et al. 1999).

The overall local recurrence rate was 0.7 in patients operated on outside of a sarcoma center and 0.2 in those treated primarily at a center. The comparison is somewhat biased because many patients treated locally will be referred because of the local recurrence whereas those who have no recurrence will not be referred. However, the non-center-treated patients had smaller and more often subcutaneous lesions that are easier to treat. The inadequacy of local treatment outside of sarcoma centers was shown in a population-based study of all synovial sarcomas diagnosed in Sweden 1986–1994 (Skytting et al. 1999a). Only 5 of 16 patients treated outside had adequate local treatment as compared to 74 of 88 treated at a sarcoma center. Not surprisingly, the corresponding local recurrence rates were 0.6 and 0.1, respectively.

Our aim is to achieve a 10-year follow-up of all patients for local recurrence, metastases and death rates. Accrual of new patients, validation of reported data, and continuous follow-up will be ensured if the SSG Register is used as a basis for future clinical studies of musculo-skeletal neoplasia.

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