

**Title:** Soft Tissue Sarcomas of the Hand: Size Matters

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**Background:** Soft tissue sarcomas of the hand are exceedingly rare. Prior studies are contradictory with regard to the most common subtype as well as prognostic variables.

**Purpose:** The aim of this study was to review our institution's experience with soft tissue sarcomas of the hand to identify factors affecting 1) overall survivorship, 2) disease specific survival, both local recurrence and distant disease, and 3) postoperative complications.

**Methods:** We retrospectively reviewed the records of 50 hand soft tissue sarcomas (STS) treated with definitive surgery at our institution between 1992 and 2013. Pertinent demographics as well as information regarding the surgical procedure, and disease status at latest follow-up were reviewed. Cox hazard ratios were used to assess prognostic variables. Disease free survival and overall survival were estimated using Kaplan Meier method. There were 25 males and 25 females, with a mean age at diagnosis was 38 years (4-77 years) with a mean follow-up of 57 months (range 12-251 months).

**Results:** The most common tumor subtypes were epithelioid (n=12) and synovial sarcoma (n=10). 60% were superficial in location. A majority of the tumors were superficial (n=30, 60%). At the time of presentation, four patients were noted to have distant metastases. The mean tumor volume was 47 cm<sup>3</sup> (range 0.4 – 658 cm<sup>3</sup>) at the time of tumor extirpation. The mean maximum dimension of the tumor was 2.7 cm (range 0.15-10.5 cm). Ultimately; negative margins were obtained in all cases. Forty-three (86%) patients underwent a limb salvage procedure and seven patients had an amputation, either transradial or below elbow. Limb salvage failed in 2 patients, necessitating amputation for local recurrence. The overall limb salvage rate was 82%.

Local recurrence was observed in 7 patients and distant metastases in 15 patients. Tumor size >2 cm, AJCC grade and location of the tumor were found to adversely affect the outcomes in terms of disease free and overall survival. Reexcision of an inadvertently excised tumor did not adversely affect outcomes. The 10-year overall and disease free survival was 71% and 70%.

Posttreatment complications associated with the treatment of a STS in the hand occurred in 8 (16%) patients. Posttreatment complications included fibrosis and contracture of the fingers (n=4), neuroma formation (n=2), skin necrosis requiring skin grafting (n=1) and superficial skin sloughing (n=1). In analyzing risk factors for postoperative complications it was found that patients having neoadjuvant (HR 4.44, P=0.03) and intraoperative radiation (HR 19.33, P=0.0003).

**Conclusion:** Local recurrence after a wide excision was observed infrequently, however distant disease was relatively common. Tumors that were >2 cm were associated with a worse disease free and overall survival, highlighting the aggressive nature of these tumors. We believe that further studies are needed to determine if a separate grading system is needed for soft-tissue sarcomas of the hand, which adequately reflects the aggressive nature of these tumors.

Table 1: Factors Associated with Development of Distant Disease and Overall Survival

Patient Factors	Distant Disease Hazard Ratio (95% CI)	P Value	Overall Survival Hazard Ratio (95% CI)	P Value
<b>Age</b>				
≤ 40 Years	0.51 (0.18-1.43)	0.20	0.26 (0.05-1.02)	0.05
> 40 Years	1.94 (0.69-5.55)	0.20	3.70 (0.97-17.67)	0.05
<b>Male Gender</b>	1.25 (0.44-3.59)	0.65	2.61 (0.68-12.42)	0.15
<b>Tumor Characteristics</b>				
<b>Location</b>				
Finger/Thumb	0.36 (0.09-1.06)	0.06	0.50 (0.10-1.91)	0.31
Hand/Wrist	2.75 (0.93-10.01)	0.06	1.98 (0.52-9.46)	0.31
Superficial to Fascia	<b>0.21 (0.06-0.64)</b>	<b>0.004</b>	0.51 (0.12-1.94)	0.31
Deep to Fascia	<b>4.59 (1.56-16.64)</b>	<b>0.004</b>	1.95 (0.51-7.95)	0.31
Metastatic Disease at Presentation	4.18 (0.61-17.61)	0.12	<b>9.27 (1.30-44.22)</b>	<b>0.02</b>
Low Grade (FNCCLC)	0.34 (0.07-1.13)	0.08	0.59 (0.12-2.46)	0.47
High Grade (FNCCLC)	2.90(0.88-13.00)	0.08	1.66 (0.40-8.19)	0.47
AJCC Grade I/II	<b>0.11 (0.03-0.38)</b>	<b>0.0008</b>	<b>0.02 (0.001-0.13)</b>	<b>&lt;0.0001</b>
AJCC Grade III/IV	<b>8.35 (2.57-26.37)</b>	<b>0.0008</b>	<b>46.45 (7.18-905.62)</b>	<b>&lt;0.0001</b>
Local Recurrence	3.63 (0.99-10.78)	0.05	2.66 (0.38-11.58)	0.27
<b>Tumor Size (Maximal Dimension)</b>				
< 2cm	<b>0.25 (0.08-0.72)</b>	<b>0.01</b>	<b>0.16 (0.02-0.68)</b>	<b>0.01</b>
≥ 2 cm	<b>3.87 (1.37-12.47)</b>	<b>0.01</b>	<b>6.06 (1.45-40.84)</b>	<b>0.01</b>
≥ 3 cm	<b>3.38 (1.12-9.45)</b>	<b>0.03</b>	<b>9.08 (2.36-43.54)</b>	<b>0.001</b>
≥ 4 cm	<b>3.38 (1.12-9.45)</b>	<b>0.03</b>	<b>9.56 (2.50-45.60)</b>	<b>0.001</b>
≥ 5 cm	<b>8.37 (3.11-22.91)</b>	<b>&lt;0.0001</b>	<b>13.48 (3.48-64.91)</b>	<b>0.0002</b>
<b>Surgical Considerations</b>				
Ray Resection	0.87 (0.29-2.42)	0.79	0.83 (0.20-3.16)	0.78
Limb Salvage	<b>0.11 (0.03-0.34)</b>	<b>0.0004</b>	<b>9.36 (2.26-36.46)</b>	<b>0.003</b>
Amputation	<b>9.06 (2.88-27.11)</b>	<b>0.0004</b>	1.02 (0.18-19.22)	0.98
Wide Resection	0.91 (0.24-5.85)	0.90	<b>0.17 (0.03-0.67)</b>	<b>0.01</b>
Reexcision of Unplanned Excision	<b>0.28 (0.01-0.80)</b>	<b>0.01</b>	2.66 (0.38-11.58)	0.27
<b>Adjuvant Treatment Considerations</b>				
Neoadjuvant Radiation	0.74 (0.20-2.18)	0.60	0.26 (0.01-1.42)	0.13
Adjuvant Radiation	2.25 (0.51-7.11)	0.24	1.84 (0.27-7.76)	0.47
Neoadjuvant Chemotherapy	0.70 (0.03-3.53)	0.72	-	-
Adjuvant Chemotherapy	<b>5.84 (1.86-17.19)</b>	<b>0.003</b>	<b>8.35 (2.18-34.13)</b>	<b>0.002</b>

Figure 1: Kaplan Meir Survival Curves for Local, Disease, and Overall Survival

