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Postoperative Radiation Therapy in the Soft-tissue Sarcoma

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Purpose : The major goal of the therapy in the soft tissue sarcoma is to control both local and distant tumor. However, the technique of obtaining local control has changed significantly over the past few decades from more aggressive surgery to combined therapy including conservative surgery and radiation and/or chemotherapy. We retrospectively analyzed the treatment results of the postoperative radiation therapy of soft tissue sarcoma and its prognostic factor.

Materials and Methods : Between March 1983 and June 1994, 60 patients with soft tissue sarcoma were treated with surgery and postoperative radiation therapy at Kang-Nam St. Mary's hospital. Complete follow up was possible for all patients with median follow up duration 50 months (range 6 - 162 months). There were 28 male and 32 female patients. Their age ranged from 6 to 83 with a median of 44 years. Extremity (58%) was the most frequent site of occurrence followed by trunk (20%) and head and neck (12%). Histologically malignant fibrous histiocytoma (23%), liposarcoma (17%), malignant schwannoma (12%) constitute 52% of the patients. Daily radiation therapy designed to treat all areas at a risk for tumor spread upto dose of 4500-5000 cGy. A shrinking field technique was then used and total 55-65 Gy was delivered to tumor bed. Twenty-five patients (42%) received chemotherapy with various regimen in the postoperative period.

Results : Total 41 patients failed either with local recurrence or with distant metastasis. There were 29 patients (48%) of local recurrence. Four patients (7%) developed simultaneous local recurrence and distant metastasis and 8 patients (13%) developed only distant metastasis. Local recurrence rate was rather higher than of other reported series. This study included patients of gross residual, recurrent cases after previous operation, trunk and head and neck primary. This feature is likely explanation for the decreased local control rate. Five of 29 patients who failed only locally were salvaged by re-excision and/or re-irradiation and remained free of disease. Factors affecting local control include histologic type, grade, stage, extent of operation and surgical margin involvement, lymph node metastasis ($p < 0.05$). All 21 patients who failed distantly are dead with progressive disease at the time of this report. Our overall survival results are similar to those of larger series. Actuarial 5 year overall survival and disease free survival were 60.4 %, 36.6% respectively. Grade, stage (being close association with grade), residual disease (negative margin, microscopic, gross) were significant as a predictor of survival in our series ($p < 0.05$).

Conclusion : Combined surgery and postoperative radiation therapy obtained 5 year survival rate comparable to that of radical surgery.

Key Words : Soft tissue sarcoma, Postoperative radiation therapy, Multimodality therapy

scular bundle) (neurova- (connective tissue) fibrous histiocytoma) 14 (23%), (liposarcoma) 10 (17%), (malignant schwannoma) 7 (12%), (aggressive fibromatosis) 8 (15%)

가 (amputation) (radical compartmental resection)가 20%

1982 National Cancer Institute(NCI) prospective randomized trial¹⁾

20 (33%), 15 (25%), 12 (20%), 7 (12%)

Table 1. Tumor Histologic Subtype Versus Grade at Presentation

Histologic subtype	Grade				
	I	II	III	Unknown	Total
Liposarcoma	8		2		10
MFH	5	1	8		14
Malign. schwannoma	2	2		3	7
Leiomyosarcoma			1	1	2
Angiosarcoma			3		3
Fibrosarcoma	3	1			4
Rhabdomyosarcoma			3		3
Aggressive fibromatosis	8				8
Others	1		6	2	9
Total	27	3	24	6	60

multimodality treatment 가 multimodality treatment

Table 2. Tumor Size Versus Grade

Grade	Maximum diameter(cm)			Total
	Less than 5	5 to 10	More than 10	
I	12	7	8	27
II	1	1	1	3
III	10	7	7	24
Unknown	3	3		6
Total	26	18	16	60

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1. 1983 3 1994 6

60 Kaposi's sarcoma juvenile rhabdomyosarcoma(30) 0.9:1 44 (6-83) 25 (42%)

, AJC Table 1- 3

American Joint Committee on Cancer(AJCC)

I 26 (43%), II 3 (5%), III, IV가 18 (30%), 8 (13%) 5 grade I, II, III가 27 (45%), 3 (5%), 24 (40%) 6 80% (8/10) grade I 57% (8/14) 가 grade III (leiomyosarcoma), (angiosarcoma), (rhabdomyosarcoma) grade III (Table 1).

5cm 26 (43%), 5- 10cm 18 (30%), 10cm 16

(27%) .
 (Table 2). 5 (8.3%)
 가 .
 2.
 55 (92%)
 (wide excision)가 19 (32%), (marginal
 excision)가 36 (60%) 5 (8%)
 (intralesional excision) .
 6MV X 가 (NEC, Nelac)
 4-6 ()
 1 1.8-2.0Gy 40-45Gy
 (shrinking field technique)
 가 (boost irradiation) 55-65
 Gy가 (28.8Gy- 80 Gy).
 25 (42%)
 가 (Table 4).3.
 6
 162 50 .
 60 가
 가 Kaplan-Meier method
 , , (distant
 metastasis free survival)
 aggressive fibromatosis 8
 52 . 13 ,
 (Logrank, Wilcoxon
 test)
 0.05 .

Table 3. Patients Characteristics

Characteristics	No. of Patients (%)	
Age	6 - 83 yrs (Median 44 yrs)	
Sex	male	28(47)
	female	32(53)
Presentation	primary	35(58)
	recurrent	25(42)
Site	upper extremity	15(25)
	lower extremity	20(33)
	trunk	12(20)
	retroperitoneum	6(10)
	head and neck	7(12)
Stage	I	26(43)
	II	3(5)
	III	18(30)
	IV	8(13)
	undetermined	5(8)
T Stage	T1	26(43)
	T2	34(57)
N Stage	N0	55(92)
	N1	5(8)
M Stage	M0	55(92)
	M1	5(8)

Table 4. Treatment Characteristics

Characteristics	No. of patients	(%)
Operation type	intralesional excision	5(8)
	marginal excision	36(60)
	wide excision	19(32)
Surgical margin	negative margin	23(38)
	microscopic(+)	21(35)
	gross residual	16(27)
Radiation dose	< 50 Gy	6(10)
	50-60 Gy	25(42)
	> 60 Gy	29(48)
Chemotherapy	yes	25(42)
	no	33(55)
	undetermined	2(3)

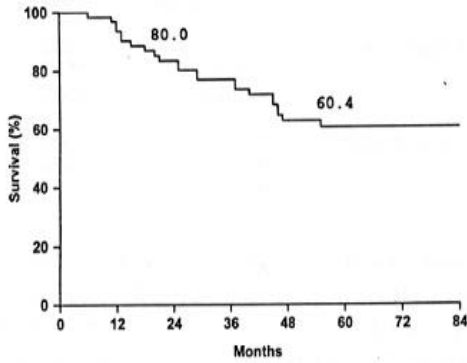


Fig. 1. Overall survival of 60 soft tissue sarcoma patients treated with postoperative radiation therapy.

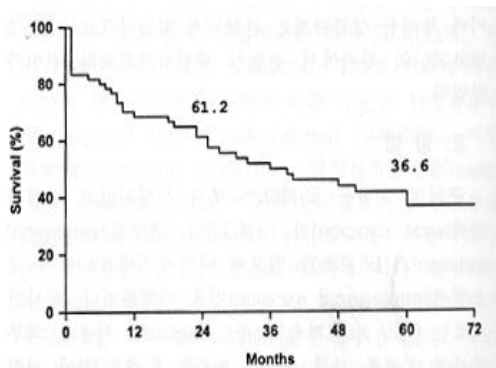


Fig. 2. Disease free survival of 60 soft tissue sarcoma patients treated with postoperative radiation therapy.

20 (33%),
 7 (12%),
 가 14 (23%) . 21 가
 2 , 2 , 1 , 13 , 3 ,
 . 5
 가
 1
 2.
 5 5
 60.4%, 36.6% 132
 (Fig. 1, 2). 40% (24/60)가
 10 (17%)가 43.3% (26/60)
 가

, AJCC , ,
 (surgical margin) ,
 M stage (Table 5).
 5 0%, 33.3% ,
 50%, 55.1%, 60
 % , 71.4%, 75% ,
 100% (p=0.0118).
 grade I, II, III 5 84.3% ,
 66.7%, 37.5% (p=0.0001).
 가 5
 가 5 37.5%
 (negative surgical margin)
 (microscopic positive margin)(70.3% vs 68.6%)
 5cm 5cm
 5 (72.5% vs 49.4
 % , p=0.1459).

1.

41 (68%)
 29 (48%),
 8 (13%), 가 4 3.
 (7%) . 가 29 5 가 (2 5 68.0%
 가) 9 48.7% , 5 47.0%
 1 , 5 50.8%

Table 5. Analysis of Overall Survival

Variables	No. of patients	5YOSR [*]	Univariate	p value
Presentation	primary	35	62.5	0.5860
	recurrent	25	57.3	
Site	upper extremity	14	71.4	0.1417
	lower extremity	21	64.5	
	trunk	12	55.6	
	retroperitoneum	6	55.6	
	head and neck	7	14.3	
Histology	liposarcoma	10	60.0	0.0118
	MFH	14	55.1	
	malig.schwannoma	7	71.4	
	leiomyosarcoma	2	50.0	
	angiosarcoma	3	33.3	
	fibrosarcoma	4	75.0	
	rhabdomyosarcoma	3	0	
	A. fibromatosis	8	100	
Stage	I	26	87.5	0.0001
	II	3	66.7	
	III	18	50.0	
	IV	8	0	
Grade	I	27	84.3	0.0001
	II	3	66.7	
	III	24	37.5	
Tumor size	< 5 cm	26	72.5	0.1459
	5 - 10 cm	18	49.4	
	> 10 cm	16	55.6	
N stage	No	55	66.1	0.0002
	N1	5	0	
M stage	M0	55	66.5	0.0015
	M1	5	0	
OP type	intralesional excision	5	40.0	0.1260
	marginal excision	36	63.2	
	wide excision	19	61.8	
Surgical margin	(-)	23	68.6	0.0504
	(+)	21	70.3	
	gross residual	16	37.5	
RT dose	< 50 Gy	6	83.3	0.3833
	50 - 60 Gy	25	56.0	
	> 60 Gy	29	58.7	
OP- RT interval	< 6 wks	36	68.8	0.2630
	> 6 wks	22	49.6	
CmemoTx	yes	25	40.0	0.0004
	no	33	78.1	

* : 5 year overall survival rate

(p=0.3551).

, AJCC , , 88.9%, 75%,
 (surgical 57.1%, 50%, 28.6%
 margin) (Table 6). 5

Table 6. Analysis of Local Control

Variables	No. of patients	5YLCR*	Univariate	p value
Presentation	primary	35	53.9	0.3956
	recurrent	25	41.5	
Site	upper extremity	14	33.1	0.3551
	lower extremity	21	54.8	
	trunk	12	50.0	
	retroperitoneum	6	41.7	
	head and neck	7	21.4	
Histology	liposarcoma	10	88.9	0.0003
	MFH	14	28.6	
	malig.schwannoma	7	57.1	
	leiomyosarcoma	2	0	
	angiosarcoma	3	0	
	fibrosarcoma	4	50.0	
	rhabdomyosarcoma	3	0	
	A. fibromatosis	8	75.0	
Stage	I	26	72.7	0.0001
	II	3	0	
	III	18	37.5	
	IV	8	18.8	
Grade	I	27	73.1	0.0001
	II	3	0	
	III	24	27.4	
Tumor size	< 5 cm	26	50.8	0.7117
	5- 10 cm	18	42.9	
	> 10 cm	16	55.6	
N stage	No	55	53.5	0.0008
	N1	5	0	
M stage	Mo	55	52.5	0.0890
	M1	5	0	
OP type	intralesional excision	5	20.0	0.0015
	marginal excision	36	44.2	
	wide excision	19	66.4	
Surgical margin	(-)	23	68.1	0.0001
	(+) gross residual	21	49.1	
RT dose	< 50 Gy	6	83.3	0.4344
	50 - 60 Gy	25	48.8	
	> 60 Gy	29	40.6	
OP- RT interval	< 6 wks	36	60.0	0.1613
	> 6 wks	22	39.1	
CmemoTx	yes	25	24.1	0.0009
	no	33	66.7	

* : 5 year local control rate

(p=0.0003).
 5 grade I, II, III† 73.1%, 5 . 가
 0%, 27.4% (p=0.0001). 가 (intralesional excision) 가

Table 8. Analysis of Distant Metastasis Free Survival

Variables	No. of patients	5YDMFSR [*]	Univariate	p value
Presentation	primary	31	73.7	0.0416
	recurrent	21	41.7	
Site	upper extremity	13	61.5	0.7289
	lower extremity	18	53.9	
	trunk	9	45.0	
	retroperitoneum	5	50.0	
	head and neck	7	68.6	
Histology	liposarcoma	10	64.3	0.0003
	MFH	14	53.6	
	malig.schwannoma	7	85.7	
	leiomyosarcoma	2		
	angiosarcoma	3		
	fibrosarcoma	4	75.0	
	rhabdomyosarcoma	3	0	
	others	9	53.6	
Stage	I	18	83.5	0.0001
	II	3		
	III	18	45.8	
	IV	8	0	
Grade	I	19	78.9	0.0546
	II	3		
	III	24	36.5	
Tumor size	< 5 cm	23	66.3	0.4581
	5 - 10 cm	16	55.5	
	> 10 cm	13	51.9	
N stage	No	47	64.8	0.0005
	N1	5	20.0	
M stage	Mo	47	67.6	0.0001
	M1	5	0	
OP type	intralesional excision	5	80.0	0.9451
	marginal excision	30	63.0	
	wide excision	19	51.5	
Surgical margin	(-)	22	63.1	0.3607
	(+)	16	58.6	
	gross residual	14	60.2	
RT dose	< 50 Gy	6		0.1097
	50 - 60 Gy	21	64.2	
	> 60 Gy	25	45.7	
OP-RT interval	< 6 wks	30	57.7	0.6754
	> 6 wks	20	60.0	
CmemoTx	yes	25	46.6	0.1343
	no	25	69.1	

* : 5 year distant metastasis free survival rate

5 48.7% Lindberg⁵⁾ 가 27% (16/60)
 5 70-80% 가
 . 42% (25/60) , ,

가 , AJCC , Ueda⁹⁾ .

가 가 가

가 32% (19/60) 가

48% 2 NCI¹⁰⁾ MGH⁶⁾ 5cm

T1 5cm T2 5

72.5% 51.7% ($p=$

0.0640)

MGH Sui,⁶⁾ Pao⁷⁾ 가 Pao,⁷⁾ Potter¹⁰⁾ 가

Pao⁷⁾ 가 (5

grade I 80% (8/10) 70.3%, 68.6%).

5 37.5%

가

2.14%, 4.17%, 50.0% . 40.7%

가 ($p=0.3551$)

Lindberg⁵⁾ UCSF Leibel⁸⁾ 가

Herbert³⁾ . Sui Tepper

35% (21/60) Linberg⁵⁾ 10-20%

20-40% .¹¹⁾

가 ,

가 , M stage .

5

0%, 53.6% 가

가 grade III 가

100% (3/3), 57.1% (8/14) .

Leibel⁸⁾ Herbert³⁾ .

가 NCI randomized trial¹⁾

grade III doxorubicin, cyclophosphamide

53% grade I, II 7% . (95% ,

grade III 5 74%) (92%, 60%) 가가 .

36.5% grade I, II 78.9%, 100%

Sui⁶⁾ 가

가 가

2.5cm 6%, 15-20cm 60%, 20 cm grade III,

80%가

5cm , 5-10cm, 10cm 5 high LET

66.3%, 55.5%, 51.9% 가

가

가

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	1983	1994	60	가
(20%),	50		가 35 (58%)	가 12
10 (17%),	7 (12%)		6	
가	grade I, II, III가	27 (45%), 3 (5%), 24 (40%)		
19 (32%)	, 36 (60%)	, 5 (8%)		
	28.8-80Gy	25		
:			20 (25%),	7 (12%),
	가 14 (23%)			
	5			2 5
68.0%	48.7%			
	, AJCC			
	($p < 0.05$)		5	5
60.4%, 36.6%		89		
	, AJCC			

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