Title
A clinicopathologic study on SS18 fusion positive head and neck synovial sarcomas

Authors
Owosho, Adepitan A
Estilo, Cherry L
Rosen, Evan B
et al.

Publication Date
2017-03-01

DOI
10.1016/j.oraloncology.2016.12.021

Peer reviewed

HHS Public Access

Author manuscript

Oral Oncol. Author manuscript; available in PMC 2018 March 01.

Published in final edited form as:

Oral Oncol. 2017 March ; 66: 46–51. doi:10.1016/j.oraloncology.2016.12.021.

A clinicopathologic study on SS18 fusion positive head and neck synovial sarcomas

Adepitan A. Owosho[a], **Cherry L. Estilo**[a], **Evan B. Rosen**[a], **SaeHee K. Yom**[a], **Joseph M. Huryn**[a], and **Cristina R. Antonescu**[b,*]

[a]Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, United States

[b]Department of Pathology, Memorial Sloan Kettering Cancer Center, New York, United States

Abstract

Objective—To determine clinicopathologic factors on survival in patients with head and neck synovial sarcoma.

Patients and methods—We retrospectively identified patients with molecularly confirmed synovial sarcomas of the head and neck (SS-HN), either by the presence of *SS18-SSX* fusion transcript by RT-PCR or *SS18* gene rearrangement by FISH, who were managed at our institution over a 20-year period (1996–2015). Kaplan-Meier survival analysis and log-rank test were performed to evaluate variables related to disease specific survival (DSS). Fisher exact test was performed to evaluate variables related to local recurrence.

Results—Thirty-four patients (20 males and 14 females, mean of 31 years) with *SS18-SSX* fusion-positive SS-HN were identified. The parapharyngeal region of the neck was the most common site. The mean tumor size was 4.8 cm (0.8–10 cm). Two-thirds (n = 23) of cases had a monophasic histology. The 2, 5 and 10–year DSS rates were 97%, 79% and 68%. The 5-year DSS rates for the adult/pediatric cohort were 74%/88%. Recurrence showed significant effect on DSS (p = 0.021). There was no significant effect on DSS with age, therapy modality, tumor site, surgical margin, tumor size (≤5 cm vs. >5 cm) and histopathologic subtype. Tumor site (i.e. skull base/paranasal sinus region) was associated with local recurrence (p = 0.003).

Conclusion—In our cohort DSS rate was associated with recurrence. Tumors located in the skull base/paranasal sinus region were associated with a higher rate of local recurrence. Thus appropriate selection of high risk patients who can benefit from multimodality therapies might improve survival.

Keywords

Synovial sarcoma; Head and neck sarcomas; *SS18-SSX*; t(X;18)

*Corresponding author at: Department of Pathology, Memorial Sloan Kettering Cancer Center, 1275 York Ave, New York, NY 10065, United States. antonesc@mskcc.org (C.R. Antonescu).

Disclosure

All authors declare that there are no financial conflicts associated with this study and that the funding source has no role in conceiving and performing the study. This study was supported in part through the NIH/NCI Cancer Center Support Grant P30 CA008748, P50 CA140146-01

Introduction

Sarcomas of the head and neck are rare, accounting for only 1 % of all head and neck malignancies [1]. Synovial sarcomas (SS) comprise about 10% of all soft tissue sarcomas, with SS of the head and neck (SS-HN) representing less than 0.1% of all head and neck cancers [1,2]. SS represents less than 10% of all head and neck sarcomas and the head and neck region accounts for less than 10% of all cases of SS [1]. The lower limb accounts for majority of SS cases [3], while the most common head and neck site for SS is the para-pharyngeal neck region [4,5].

SS are aggressive malignant mesenchymal neoplasms, of potentially pluripotent mesenchymal stem cell derivation, unrelated to synovium [1,6]. Over 25% of patients with SS succumb to their disease within five years [2]. The 5-year overall survival rate for SS-HN varies from 66 to 85.5% [4,7,8]. Overall survival for SS-HN is related to tumor size, site, stage and extension into adjacent structures [4,7–9]. It has been reported that patients with SS-HN are at a greater risk of metastases compared to patients with SS in the extremities [10].

Histopathologically, SS can be divided into 2 main subtypes, monophasic and biphasic. Monophasic SS is the most common subtype, composed of monomorphic spindle cells arranged in long, intersecting fascicles. Biphasic SS are characterized by well-developed glandular epithelial structures in addition to the spindle cell component. Almost all SS have a recurrent t(X;18) chromosomal translocation, resulting in the fusion of *SS18* (at 18q11) with either *SSX1* or *SSX2* or rarely *SSX4* (all on Xp11) [11–14]. *SS18-SSX2* are found with predilection in monophasic SS, while biphasic SS show predominantly an *SSS18-SSX1* fusion [15,16]. Patients with *SS18-SSX1* have been reported to have a poor clinical outcome in some studies [15,16], but not confirmed in others [17]. In this study, we carried out a clinicopathologic analysis on survival including exclusively molecularly confirmed SS-HN patients managed at our institution over a 20-year period.

Patients and methods

The study was approved by the Institutional Review Board of Memorial Sloan Kettering Cancer Center (MSKCC), New York. The electronic records of the Department of Pathology at MSKCC were searched for SS diagnosed in the head and neck region from 1996 to 2015. The records of all cases were reviewed. The following clinical data was retrieved: gender, age at diagnosis, anatomic site, tumor size, imaging features, history of initial metastasis at diagnosis, histopathologic subtype, modality of initial therapy (surgery alone, surgery with radiotherapy and surgery with chemoradiotherapy), pathologic status of surgical resected margin, local recurrence, distant recurrence, vital status (alive or died of disease) and survival time (time in months from diagnosis to death related to the cancer disease). Follow-up was calculated up until June 30, 2016. Molecular reports were reviewed, documenting either the presence of an *SS18-SSX* fusion transcript by RT-PCR amplification or an *SS18* gene rearrangement by FISH. In cases where molecular testing was not done, unstained slides were obtained for FISH analysis of *SS18* gene abnormalities, as previously described

[18]. Cases without a positive molecular result or without available material for further FISH testing were excluded.

Statistical analysis

Statistical analyses were performed on an SPSS platform (version 24.0; IBM Corp., Armonk, NY). The disease specific survival (DSS) time was measured in months from the date of diagnosis to the date of death specific to cancer disease. Kaplan-Meier estimate was used to calculate the DSS, and the statistical significance of different clinicopathologic variables was assessed by log-rank analysis. Fisher exact test was performed to evaluate clinicopathologic variables (tumor site, tumor size and surgical margin) related to local recurrence. A $p < 0.05$ was considered as significant for all statistical analysis.

Results

Clinicopathologic features

A total of 34 HN-SS patients managed at our institution (MSKCC) spanning two decades (1996–2015) were identified. A summary of the clinical characteristics are presented in Table 1. There were 20 (59%) males and 14 (41%) females, with ages ranging from 1 to 75 years old, with a mean of 31 years. Twenty-five (74%) patients were of the adult age (>18 years). The neck (parapharyngeal, posterior triangle and suboccipital region) was the most common anatomic site, accounting for 50% of all head and neck sites. Other anatomic sites were upper aerodigestive tract (n = 12) (buccal mucosa, lip, soft palate, larynx, submandibular area, parotid/pre-auricular area) and skull base/paranasal sinus (n = 5) (infratemporal fossa, nasopharynx and maxillary sinus). The tumor size in 33 patients ranged from 0.8 to 10 cm, mean of 4.8 cm, twelve (36%) patients presented with tumor sizes >5 cm. The images (MRI) showed lesions of large sizes causing a mass-effect, erosion and destruction of nearby bony structures (Fig. 1). No patient presented with nodal involvement. Only one patient presented with initial metastasis pre-therapy to the lung. Twenty-three cases were histopathologically classified as monophasic SS and 11 cases were classified as biphasic SS. All cases were *SS18* fusion-positive. *SS18* fusion partner (*SSX1* or *SSX2*) identified in deceased patients were evenly split between *SSX1* (n = 2) and *SSX2* (n = 2). Tissue was not available to further characterize the *SS18* fusion partner in the remaining deceased patients.

Management approach

At our institution patients diagnosed with primary SS are generally managed by surgical removal alone. Adjuvant radiotherapy is employed in tumors >5 cm and for anatomic sites where local control may be difficult by surgery alone, such as head and neck. Patients with unresectable tumors receive chemotherapy, radiotherapy or a combination of both and subsequently evaluated for possible resection. Information on therapy was available in 32 patients. Majority (31/32) of the patients had surgical resection for their primary tumor, 7 patients had surgical resection alone, 10 patients received adjuvant radiotherapy alone, 12 patients received adjuvant chemoradiation therapy and 2 patients received adjuvant chemotherapy alone. The only patient who presented with metastasis at initial diagnosis received neoadjuvant chemotherapy alone. In 17 of the 28 patients with available

information, the pathologic status of surgical resection margins was positive for tumor. Fifteen of the 17 patients with positive pathologic margin received adjuvant therapy.

Follow-up data

Complete follow-up information (Table 1) was available for 32 patients, ranging from 7 to 232 months, median of 78.5 months. Fifteen (47%) patients developed recurrence following treatment: 5 patients developed local recurrence (LR), 5 patients developed distant recurrence (DR) to the lungs and 5 patients developed both LR and DR (lungs and liver). The lungs were the most common site for distant recurrence (10/10 patients). Eight (24%) patients died of disease (DOD) at a median survival time of 42.5 months (range: 13–106 months) and 26 (76%) patients are alive with no evidence of disease at a median survival time of 95.5 months (range: 12–232 months).

Based on initial therapy administered, patients who received surgery alone (n = 7) are all alive at a median survival time of 35 months (range: 23–150 months), none of them developed a recurrence, mean tumor size was 2.7 cm (range: 0.8–4.1 cm) and favorable tumor sites were buccal mucosa (n = 3), lip, soft palate, chin and pre-auricular area. Of the patients who received surgery with adjuvant RT alone (n = 10), 60% are alive at a median survival time of 59 months (range: 13–232 months), 70% developed recurrence, mean tumor size was 4.9 cm (range: 2.5–7 cm) and unfavorable tumor sites were neck (n = 6), parotid, submandibular, maxillary sinus and infratemporal fossa. Of the patients who received surgery with chemo-radiotherapy (n = 12), 75% are alive at a median survival time of 111 months (range: 12–183 months), 58% developed recurrence, mean tumor size was 5.3 cm (range: 3–8.3 cm) and unfavorable tumor sites were neck (n = 10), submandibular and infratemporal fossa. A flow chart of therapy provided is illustrated in Fig. 2.

Patients (n = 17) who did not develop recurrence are all alive. 60% of patients (n = 10) who developed a DR, succumbed of their disease at a median survival time of 41 months (range: 13–106 months) and 2 of 5 patients who developed LR alone died of disease at a survival time of 51 and 44 months, respectively.

Survival analysis

On survival analysis, the 2, 5 and 10–year DSS rates were 97% (95% confident interval 0.91, 1), 79% (95% confident interval 0.64, 0.95) and 68% (95% confident interval 0.5, 0.9) (Fig. 3). The 5-year DSS rate for the adult cohort was 74% (95% confident interval 0.56, 0.97) and for the pediatric cohort was 88% (95% confident interval 0.67, 1), there was no significant effect on DSS with age (adult vs. pediatric) ($p = 0.24$). There was no significant effect on DSS when comparing therapy modality (surgery vs. surgery with radiotherapy alone vs. surgery with chemo-radiotherapy; Fig. 4A; $p = 0.26$), tumor site (neck vs. upper aerodigestive tract vs. skull base/paranasal sinus; Fig. 4B; $p = 0.84$), surgical margin (positive vs. negative; $p = 0.26$), tumor size (≤5 cm vs.>5 cm; $p = 0.71$) and histopathologic subtype (monophasic vs. biphasic; Fig. 4C; $p = 0.99$). Recurrence (NR vs. LR vs. DR) showed significant effect on DSS (Fig. 4D; $p = 0.021$).

Local recurrence analysis

Data on local recurrence was available for 32 patients. Patient characteristics by local recurrence status are presented in Table 2. On analysis of clinicopathologic variables such as tumor site (neck vs. upper aerodigestive tract vs. skull base/paranasal sinus), tumor size (≤5 cm vs. >5 cm) and surgical margin (positive vs. negative) in relation to local tumor recurrence, tumor site was the only variable found to be significant ($p = 0.003$). Patients with tumors located in the skull base/paranasal sinus region were prone to be associated with local tumor recurrence.

Discussion

Synovial sarcomas of the head and neck (SS-HN) are rare, accounting for less than 0.1% of all head and neck cancers [1], and very few studies have analyzed the clinicopathologic features of SS occurring in this anatomic location [4,7–9]. This is the largest SS-HN study to date including only patients with documented molecular confirmation of the t(X;18) translocation, the genetic hallmark of SS [11,12]. The detection of *SS18-SSX* gene fusion is now considered the gold-standard in diagnosis of SS. Especially in the setting of monophasic SS, either the classic fascicular spindle cell variant or the less common poorly differentiated/round cell phenotype, the differential diagnosis is quite wide and a definitive subclassification relies on the presence of the *SS18-SSX* fusion. A number of other spindle cell fascicular soft tissue sarcomas resemble monophasic SS histologically, including high grade malignant peripheral nerve sheath tumor, spindle cell rhabdomyosarcoma, leiomyosarcoma, adult-type fibrosarcoma, etc. Furthermore, non-sarcoma pathologic entities, particularly common in the head and neck setting, such as spindle cell melanoma and spindle cell carcinoma may mimic a monophasic SS diagnosis. Moreover, poorly differentiated SS, showing a primitive and monomorphic round cell phenotype, can be indistinguishable from other round cell sarcomas, such as Ewing sarcoma and alveolar rhabdomyosarcoma, solid variant. Although more recently Transducin-like enhancer of split 1 (TLE1) immunohistochemical markers has gained popularity due to its high sensitivity in the diagnosis of SS, other studies have shown that is not entirely specific for this diagnosis and can be seen in other tumors [19,20].

Similar to other reported studies, our cohort of SS-HN showed a predominance for males [4,7,8], monophasic subtype [4,8,9], parapharyngeal neck region [4,9], predilection for lung as distant metastases [4]. Based on the National Cancer Institute's (NCI) SEER database, the 2, 5 and 10-year DSS rates for SS-HN were reported as 79%, 71% and 60% [7]. In a similar study from MD Anderson the 5-year DSS rate was 72% [4]. In our cohort, the 2, 5 and 10-year DSS rates were 97%, 79% and 68%. Although the 5-year DSS rate for children was 88%, compared to 74% in adult patients, it did not reach statistical significance.

There was also no statistical significant difference in the Kaplan Meier curve when comparing the different therapy modalities used in our cohort: surgery vs. surgery with radiotherapy alone vs. surgery with chemoradiotherapy. Similar studies from Mayo clinic and MD Anderson showed no significant difference between different therapy modalities [4,9]. Surgical resection with wide margins remains the mainstay of treatment for SS-HN. Adjuvant radiotherapy is added to improve local tumor control if resection is inadequate. Of

interest in our cohort, patients who underwent surgical resection alone are all alive with no evidence of recurrence. This may be accrued to the fact that all patients treated with surgery alone all had tumor in visible, easily surgical accessible sites and smaller tumor size. The role of adjuvant chemotherapy in the management of resectable soft-tissue sarcoma is controversial. A systematic meta-analysis of randomized controlled trial showed a marginal efficacy of chemotherapy in regards to LR, DR, overall recurrence and overall survival [21]. Another study showed that adjuvant chemotherapy was associated with improved survival in patients with extremity SS [22]. In contrast, the EORTC study 62931 showed no benefit in relapse-free survival or overall survival in patients with resected soft-tissue sarcoma who received adjuvant chemotherapy with doxorubicin and ifosfamide [23]. In our cohort, patients who received chemotherapy in addition to surgery and radiotherapy developed fewer recurrences and survived longer compared to patients who only received surgery and radiation, but the survival difference was not statistically significant. The former patients could be considered to be at a higher risk for recurrence and mortality based on the larger average tumor size and comparable tumor sites. A positive or a negative surgical margin showed no significant impact on the overall survival. Similar study from MD Anderson also showed no statistical significance of tumor margin status [4].

Prior studies have shown that the SS-HN tumor size is a statistically significant adverse factor of overall survival [4,7–9]. Tumor sizes >5 cm have been associated with poor overall survival and DSS rates [4,7,8]. In a Mayo clinic study, tumor size >4 cm was associated with poor survival, but this association was not significant when stratified into tumor groups of > 5 cm vs ≤5 cm [9]. Similarly, in our cohort there was no association with the tumor size >5 cm. Furthermore, we did not find any correlation between histopathologic subtypes and survival, in keeping with results from other studies [4,7,9]. Although, the *SSX1*/*SSX2* status was not available in all deceased patients, the 4 cases with available data showed an equal distribution of *SSX1* (n = 2) and *SSX2* (n = 2), most likely indicating no impact on survival of *SSX1*/*SSX2* status. Our analysis showed that the presence of recurrence was statistically significant for poor survival by Kaplan Meier curve. Patients without recurrence events are all alive, while 60% of patients who developed DR died of disease.

The study by MD Anderson showed a significant association between tumor extension into adjacent structures and local tumor recurrence, clinical variables such as histology, location, tumor size, initial therapy and surgical margins showed no statistical significance to local recurrence [4]. A similar study from Mayo clinic also showed no significant association between histology, lymph node status, tumor size or initial therapy and local tumor recurrence [9]. In our study, patients with tumors located in the skull base/paranasal sinus region were found to be significantly associated with local tumor recurrence. This may be likely due to the poor surgical accessibility.

We present the largest series of molecularly confirmed synovial sarcoma of the head and neck managed at a single, tertiary cancer center institution, over a 20-year period of time. The cohort showed a 79% 5-year DSS rate, with recurrence being the only significant factor affecting disease specific survival. Anatomic location, tumor size, status of surgical margins and histologic subtype were not associated with outcome. Tumors located in the skull base/ paranasal sinus region are more prone to local recurrence compared to other locations. Thus

multimodality therapy, such as adjuvant chemotherapy in addition to surgery and radiotherapy, might be beneficial in patients at high risk for local recurrence (tumor size >5 cm and surgically poorly accessible sites).

References

1. Sturgis EM, Potter BO. Sarcomas of the head and neck region. Curr Opin Oncol. 2003; 15:239–52. [PubMed: 12778019]
2. Lewis JJ, Antonescu CR, Leung DH, Blumberg D, Healey JH, Woodruff JM, et al. Synovial sarcoma: a multivariate analysis of prognostic factors in 112 patients with primary localized tumors of the extremity. J Clin Oncol: Official J Am Soc Clin Oncol. 2000; 18:2087–94.
3. Cormier JN, Pollock RE. Soft tissue sarcomas. CA Cancer J Clin. 2004; 54:94–109. [PubMed: 15061599]
4. Harb WJ, Luna MA, Patel SR, Ballo MT, Roberts DB, Sturgis EM. Survival in patients with synovial sarcoma of the head and neck: association with tumor location, size, and extension. Head Neck. 2007; 29:731–40. [PubMed: 17274049]
5. Bukachevsky RP, Pincus RL, Shechtman FG, Sarti E, Chodosh P. Synovial sarcoma of the head and neck. Head Neck. 1992; 14:44–8. [PubMed: 1320596]
6. Carrillo R, Rodriguez-Peralto JL, Batsakis JG. Synovial sarcomas of the head and neck. Ann Otol Rhinol Laryngol. 1992; 101:367–70. [PubMed: 1314035]
7. Mallen-St Clair J, Arshi A, Abemayor E, St John M. Factors associated with survival in patients with synovial cell sarcoma of the head and neck: an analysis of 167 cases using the SEER (surveillance, epidemiology, and end results) database. JAMA Otolaryngol– Head Neck Surg. 2016; 142:576–83. [PubMed: 27100936]
8. Wushou A, Miao XC. Tumor size predicts prognosis of head and neck synovial cell sarcoma. Oncol Lett. 2015; 9:381–6. [PubMed: 25435996]
9. Crowson MG, Lalich I, Keeney MG, Garcia JJ, Price DL. Clinicopathologic factors and adjuvant treatment effects on survival in adult head and neck synovial cell sarcoma. Head Neck. 2015; 37:375–80. [PubMed: 24430934]
10. Mullen JR, Zagars GK. Synovial sarcoma outcome following conservation surgery and radiotherapy. Radiother Oncol: J Euro Soc Therapeutic Radiol Oncol. 1994; 33:23–30.
11. Turc-Carel C, Dal Cin P, Limon J, Li F, Sandberg AA. Translocation X;18 in synovial sarcoma. Cancer Genet Cytogenet. 1986; 23:93. [PubMed: 3017544]
12. Cihak RA, Lydiatt WM, Lydiatt DD, Bridge JA. Synovial sarcoma of the head and neck: chromosomal translation (X;18) as a diagnostic aid. Head Neck. 1997; 19:549–53. [PubMed: 9278765]
13. dos Santos NR, de Bruijn DR, van Kessel AG. Molecular mechanisms underlying human synovial sarcoma development. Genes Chromosomes Cancer. 2001; 30:1–14. [PubMed: 11107170]
14. Ladanyi M. Fusions of the SYT and SSX genes in synovial sarcoma. Oncogene. 2001; 20:5755–62. [PubMed: 11607825]
15. Ladanyi M, Antonescu CR, Leung DH, Woodruff JM, Kawai A, Healey JH, et al. Impact of SYT-SSX fusion type on the clinical behavior of synovial sarcoma: a multi-institutional retrospective study of 243 patients. Cancer Res. 2002; 62:135–40. [PubMed: 11782370]
16. Nilsson G, Skytting B, Xie Y, Brodin B, Perfekt R, Mandahl N, et al. The SYT-SSX1 variant of synovial sarcoma is associated with a high rate of tumor cell proliferation and poor clinical outcome. Cancer Res. 1999; 59:3180–4. [PubMed: 10397263]
17. Guillou L, Benhattar J, Bonichon F, Gallagher G, Terrier P, Stauffer E, et al. Histologic grade, but not SYT-SSX fusion type, is an important prognostic factor in patients with synovial sarcoma: a multicenter, retrospective analysis. J Clin Oncol: Official J Am Soc Clin Oncol. 2004; 22:4040–50.
18. Terry J, Barry TS, Horsman DE, Hsu FD, Gown AM, Huntsman DG. Fluorescence in situ hybridization for the detection of t(X;18)(p11.2;q11. 2) in a synovial sarcoma tissue microarray using a breakapart-style probe. Diagnostic Mol Pathol :Am J Surg Pathol. 2005; 14:77–82.

19. Terry J, Saito T, Subramanian S, Ruttan C, Antonescu CR, Goldblum JR, et al. TLE1 as a diagnostic immunohistochemical marker for synovial sarcoma emerging from gene expression profiling studies. Am J Surg Pathol. 2007; 31:240–6. [PubMed: 17255769]

20. Kosemehmetoglu K, Vrana JA, Folpe AL. TLE1 expression is not specific for synovial sarcoma: a whole section study of 163 soft tissue and bone neoplasms. Modern Pathology : An Official Journal of the United States and Canadian Academy of Pathology, Inc. 2009; 22:872–8.

21. Pervaiz N, Colterjohn N, Farrokhyar F, Tozer R, Figueredo A, Ghert M. A systematic meta-analysis of randomized controlled trials of adjuvant chemotherapy for localized resectable soft-tissue sarcoma. Cancer. 2008; 113:573–81. [PubMed: 18521899]

22. Eilber FC, Brennan MF, Eilber FR, Eckardt JJ, Grobmyer SR, Riedel E, et al. Chemotherapy is associated with improved survival in adult patients with primary extremity synovial sarcoma. Ann Surg. 2007; 246:105–13. [PubMed: 17592298]

23. Woll PJ, Reichardt P, Le Cesne A, Bonvalot S, Azzarelli A, Hoekstra HJ, et al. Adjuvant chemotherapy with doxorubicin, ifosfamide, and lenograstim for resected soft-tissue sarcoma (EORTC 62931): a multicentre randomised controlled trial. Lancet Oncol. 2012; 13:1045–54. [PubMed: 22954508]

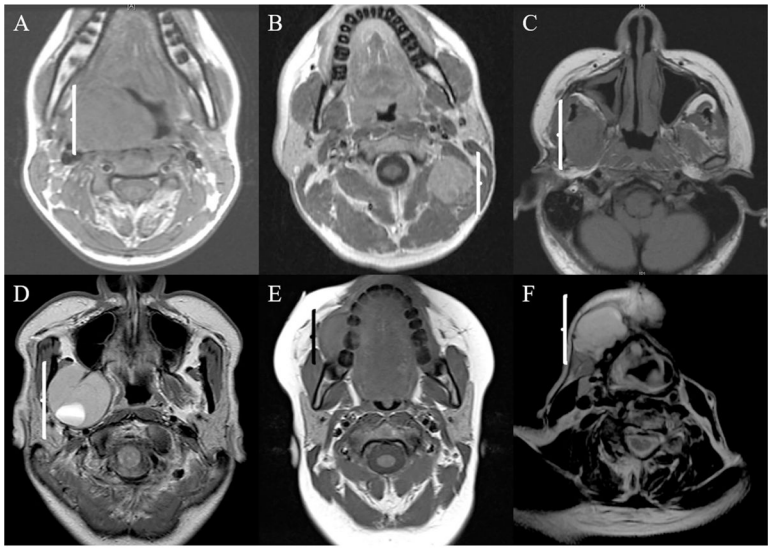

Fig. 1.

MRI findings of SS-HN. (A) pharynx, 17-yr old female, developed DR to the lung, deceased at 41 months, (B) posterior neck, 38-yr old male, alive at 146 months, (C) infratemporal fossa, 29-yr old female, developed LR and DR to the lung, alive at 129 months, (D) infratemporal fossa, 32-yr old female, developed LR, alive at 101 months, (E) buccal mucosa, 13-yr old female, alive at 64 months, (F) submandibular region, 54-yr old male, developed LR and DR to the lung, deceased at 95 months.

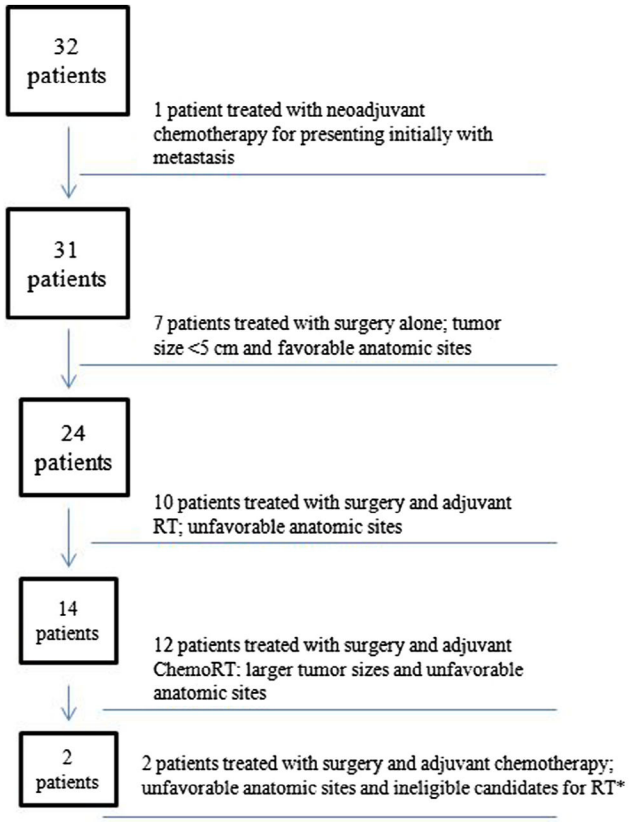

Fig. 2.

A flow chart of treatment modalities provided to our cohort of SS-HN patients. Favorable anatomic site were defined as locations where surgical resection alone can achieve local tumor control; in contrast unfavorable anatomic sites were defined as sites where surgery alone could not achieve local control (surgically poorly accessible sites). *2 patients ineligible for further radiotherapy: first patient had a prior history of RT, while the second patient was an infant.

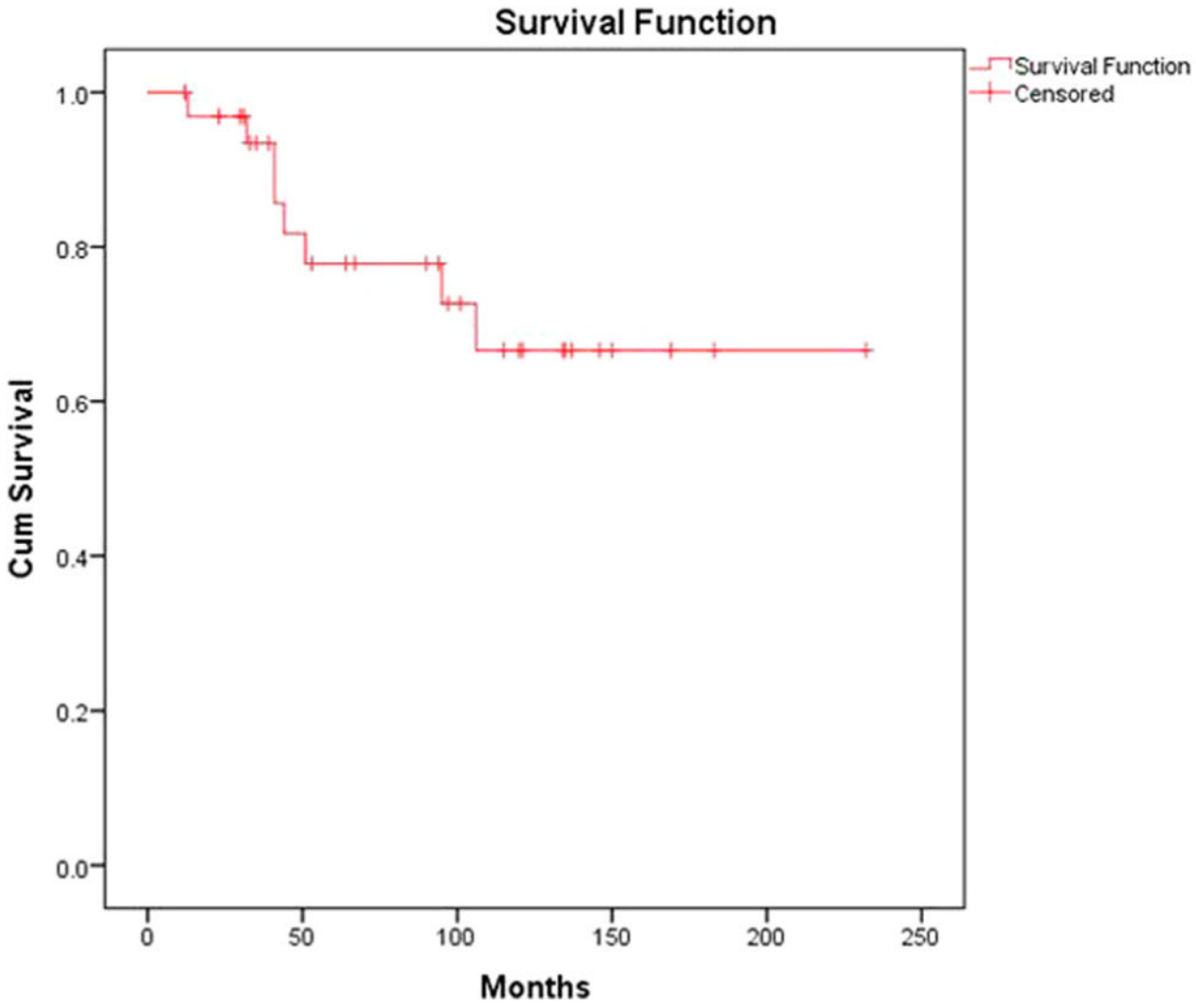

Fig. 3.

Kaplan-Meier curve of disease specific survival of the entire patient cohort of 34 SS-HN (2, 5 and 10-yr DSS: 97%, 79% and 68%).

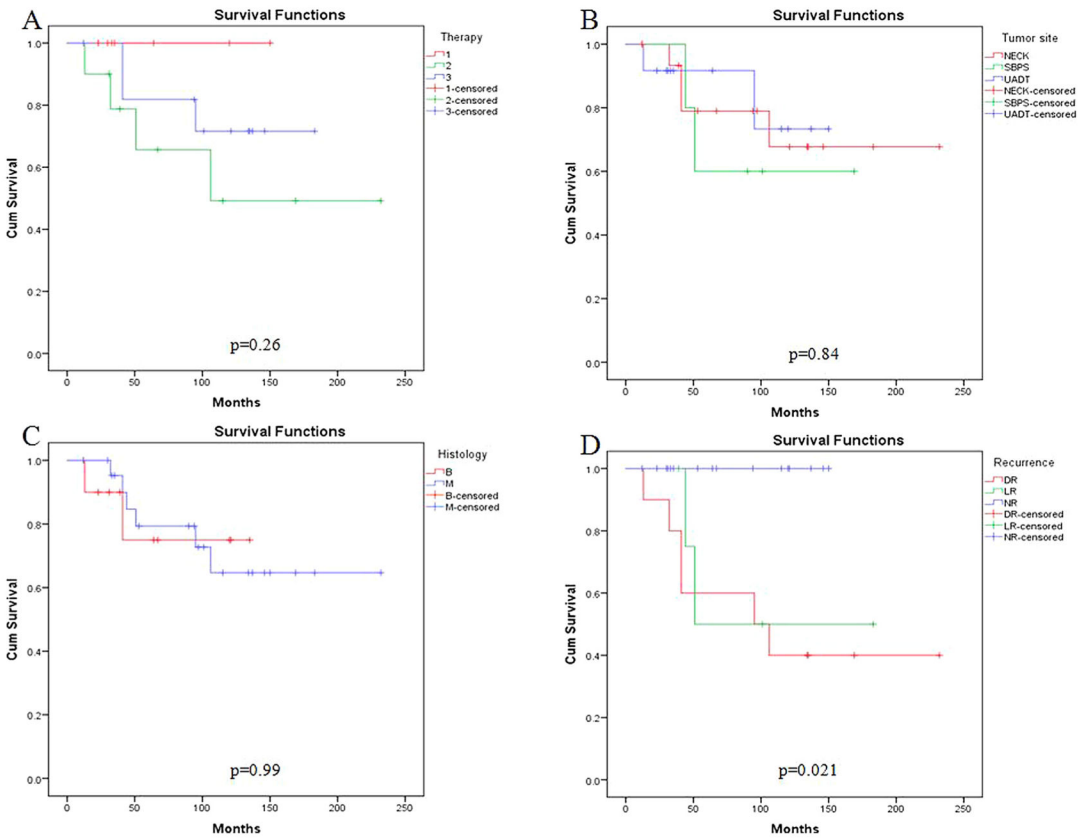

Fig. 4.

Kaplan-Meier curve of disease specific survival of SS-HN patients based on therapy modality, tumor site, histologic subtype and recurrence. (A) DSS as a function of therapeutic modality (p = 0.26) [1 – surgery alone, 2 – surgery with radiation therapy alone, 3 – surgery with chemoradiation therapy], (B) DSS as a function of tumor site (p = 0.84), (C) DSS as a function of histologic subtype (p = 0.99) [B – biphasic, M – monophasic], (D) DSS as a function of recurrence (p = 0.021).

Table 1

Clinicopathologic characteristics of head and neck *SYT*-fusion positive synovial sarcoma patients.

Clinical characteristics			(%)	Total number
Gender				34 (100%)
	Male	20	58.8	
	Female	14	41.2	
Age (years)	Mean	30.6		34 (100%)
	Median	29		
	Max.	75		
	Min.	1		
Age group	Adult	25	73.5	34 (100%)
	Pediatric	9	26.5	
Tumor site	Upper aerodigestive tract	12	35.3	34 (100%)
	Neck	17	50	
	Skull base/paranasal sinus	5	14.7	
Tumor size	Mean	4.8		33 (97%)
	Median	4.0		
	Max.	10.0		
	Min.	0.8		
Histopathologic type	Monophasic	23	68	34 (100%)
	Biphasic	11	32	
Recurrence	Local	5	15.6	32 (94%)
	Distant	5	15.6	
	Local & distant	5	15.6	
	None	17	53	
Therapy	Surgery	7	21.8	32 (94%)
	Surgery + RT	10	31	
	Surgery + CRT	12	37.5	
	Surgery + CT	2	6.2	
	Chemotherapy (only)	1	3.1	
Vital status	Alive	26	76.5	34 (100%)
	Deceased	8	23.5	
Follow-up duration (months)	Mean	83.7		34 (100%)
	Median	78.5		
	Max.	232		
	Min.	12		

NOS – not otherwise specified, RT – radiation therapy, CT – chemotherapy, CRT – chemoradiation therapy.

Table 2

Patient characteristics by local recurrence status.

Characteristic	Totals (%)	Number (%)		P
		No LR (n = 22)	LR (n = 10)	
Tumor site (n = 32)				0.003
Neck	16 (50%)	11 (68.7%)	5 (31.3%)	
UADT	12 (37.5%)	11 (91.7%)	1 (8.3%)	
SBPS	4 (12.5%)	0 (0%)	4 (100%)	
Tumor size (n = 32)				0.22
≤5 cm	22 (68.7%)	17 (77.3%)	5 (22.7%)	
>5 cm	10 (31.3%)	5 (50%)	5 (50%)	
Surgical margin (n = 28)				0.42
Positive	17 (60.7%)	11 (64.7%)	6 (35.3%)	
Negative	11 (39.3%)	9 (81.8%)	2 (18.2%)	

P-values calculated with Fishers exact test.

LR – local recurrence, UADT – upper aerodigestive tract, SBPS – skull base/paranasal sinus.