

# Clinicopathological characteristics and prognosis of Chinese patients with sarcomatoid carcinoma of the bladder

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**Summary.** Objectives: The purpose of this study was to retrospectively analyze the clinicopathological features and prognosis of Chinese patients diagnosed with sarcomatoid carcinoma (SC) of the bladder.

Methods: 13 patients admitted to the General Hospital of People's Liberation Army (PLA) between 1999 and 2010 (study group) and 74 Chinese patients diagnosed between 1994 and 2010 and reported in one of two Chinese databases (literature group).

Results: The two groups were similar in all demographic and clinical characteristics except depth of tumor invasion. SC of the bladder was most common in older males and most patients had high-grade or late-stage disease at diagnosis. The 6-month, 1-year, 2-year, and 5-years survival rates were 78.9%, 42.7%, 28.0%, and 21.0%, respectively. Analysis of the association of demographic and clinical characteristics with prognosis indicated no significant effect of sex, age, lesion location, tumor diameter, tumor type, depth of invasion, type of surgery, gross hematuria, and urinary tract infection.

Conclusions: Our results suggest that the pathologic tumor stage was unrelated to prognosis. Early diagnosis and surgical intervention are preferred strategies for improvement of prognosis. The association between clinical stage and survival time requires further analysis.

**Key words:** Bladder, Sarcomatoid carcinoma, Diagnosis, Treatment, Prognosis

## Introduction

Sarcomatoid carcinoma (SC) of the urinary bladder is a biphasic, malignant, non-papillary tumor accounting for less than 1% of urinary bladder cancers. The tumors are frankly invasive, tend to metastasize, and have a poor prognosis. With both malignant epithelial and mesenchymal elements, SC must be distinguished from the more common transitional cell carcinoma of the bladder, as well as from squamous cell carcinoma and adenocarcinoma (Lopez Beltran et al., 2004; Amin, 2009; Wang et al., 2010; Cheng et al., 2011; Damjanov and Golubovič, 2011). The epithelial component of SC is typically a transitional cell carcinoma, sometimes with squamous or glandular differentiation, while the sarcomatous component can be a malignant fibrous histiocytoma, fibrosarcoma, leiomyosarcoma, rhabdomyosarcoma, osteosarcoma, or chondrosarcoma (Amin, 2009; Wang et al., 2010). The two components can grow and metastasize independently, sometimes even metastasizing to the other component.

Previous researchers have considered SC and carcinosarcoma as different forms of cancer, but WHO guidelines now recommend that both be referred to as SC (Lopez Beltran et al., 2004). The histogenesis of SC remains controversial (Cheng et al., 2011). However, the epithelial elements of SC express cytokeratins, and the stromal elements express vimentin (Wang et al., 2010; Cheng et al., 2011). More than 200 cases of SC of the

**Abbreviations.** SC, Sarcomatoid carcinoma; PLA, People's Liberation Army; WHO, World Health Organization; SEER, Surveillance, Epidemiology and End Results; KNS, Knowledge Network Service; VMIS, VIP Medical Information System; SD, Standard deviation; MyoD1, myogenic differentiation 1; EMA, epithelial membrane antigen.

**Table 1.** Profiles of all 87 enrolled subjects.

Case #	Study #	Sex	Age	Follow-up time (months)	Survival status	Tumor location	Tumor diam.(cm)	Epithelial components	Surgical type	Tumor stage	Gross hematuria	Urinary tract irritation
1	Current study	Male	47	14	Dead	3	4	TCC	3	pT4	Yes	Yes
2	Current study	Male	67	ND	Lost to follow-up	3	7	TCC	1	unknown	Yes	No
3	Current study	Female	64	7	Dead	3	6.5	TCC	3	pT3	Yes	Yes
4	Current study	Male	50	10	Dead	3	3	TCC	3	pT3	Yes	No
5	Current study	Male	45	7	Dead	1	4.5	TCC	3	pT3	Yes	No
6	Current study	Male	76	8	Dead	1	8	TCC	3	pT3	Yes	No
7	Current study	Male	84	ND	Lost to follow-up	3	3.4	TCC	3	pT3	Yes	No
8	Current study	Male	54	14	Dead	2	4	TCC	3	pT3	Yes	Yes
9	Current study	Male	41	6	Dead	4	7	AC	3	pT4	Yes	Yes
10	Current study	Female	81	17	Alive	3	10	TCC	2	unknown	Yes	No
11	Current study	Male	56	1	Alive	3	2	TCC	1	pT2	Yes	Yes
12	Current study	Male	62	3	Alive	3	4	TCC	3	pT2	Yes	No
13	Current study	Male	70	3	Alive	3	9	TCC	2	pT2	Yes	No
14	Previous study	Male	49	60	Alive	3	5	TCC	2	unknown	Yes	No
15	Previous study	Male	70	9	Alive	3	3	SCC	2	pT2	Yes	No
16	Previous study	Female	74	ND	Lost to follow-up	3	3	AC	0	unknown	Yes	No
17	Previous study	Male	65	12	Alive	3	4	TCC	3	pT2	Yes	Yes
18	Previous study	Male	70	6	Alive	3	3	TCC	3	pT2	Yes	Yes
19	Previous study	Female	25	2	Alive	4	2	TCC	3	pT2	Yes	No
20	Previous study	Male	59	1	Alive	1	9	SCC	3	unknown	Yes	Yes
21	Previous study	Male	13	ND	Lost to follow-up	1	5	SCC	2	unknown	No	Yes
22	Previous study	Male	60	30	Dead	7	ND	TCC	ND	unknown	Yes	No
23	Previous study	Male	36	8	Dead	3	3	TCC	2	unknown	Yes	No
24	Previous study	Male	71	ND	Lost to follow-up	6	5	SCC	3	pT2	No	Yes
25	Previous study	Male	29	6	Alive	7	5	TCC	2	unknown	Yes	No
26	Previous study	Male	61	6	Alive	3	3.6	TCC	2	unknown	Yes	No
27	Previous study	Male	72	12	Dead	5	3.5	TCC	2	unknown	Yes	No
28	Previous study	Male	72	12	Dead	3	4	TCC	2	unknown	Yes	No
29	Previous study	Male	61	6	Alive	3	4	TCC	2	unknown	Yes	Yes
30	Previous study	Female	66	10	Dead	4	6	TCC	2	unknown	Yes	No
31	Previous study	Male	66	16	Dead	4	3	TCC	2	unknown	Yes	No
32	Previous study	Male	70	6	Dead	5	3	TCC	2	unknown	Yes	Yes
33	Previous study	Male	66	1	Alive	3	8	TCC	2	unknown	Yes	Yes
34	Previous study	Female	67	24	Alive	5	6	TCC	3	pT2	Yes	No
35	Previous study	Female	70	5	Alive	4	4	TCC	2	unknown	Yes	No
36	Previous study	Male	36	6	Alive	2	11	TCC	1	unknown	No	No
37	Previous study	Male	72	24	Alive	3	3.5	TCC	1	unknown	Yes	Yes
38	Previous study	Male	80	8	Dead	3	6	SCC	2	unknown	No	No
39	Previous study	Male	64	4	Dead	1	6	TCC	3	unknown	Yes	No
40	Previous study	Male	89	5	Dead	7	13	TCC	3	pT3	No	Yes
41	Previous study	Male	27	10	Alive	3	4	TCC	0	unknown	Yes	No
42	Previous study	Male	81	8	Dead	1	5.5	TCC	3	pT2	No	Yes
43	Previous study	Female	79	11	Dead	3	3	TCC	3	pT2	Yes	No
44	Previous study	Male	65	44	Alive	7	8	TCC	3	pT3	Yes	Yes
45	Previous study	Male	72	ND	Lost to follow-up	1	ND	TCC	0	unknown	Yes	Yes
46	Previous study	Male	66	1	Dead	1	13	TCC	3	pT3	Yes	No
47	Previous study	Male	73	ND	Lost to follow-up	5	5	TCC	3	pT3	Yes	Yes
48	Previous study	Male	72	16	Alive	2	4	TCC	2	unknown	Yes	No
49	Previous study	Male	75	1	Alive	3	2.5	TCC	2	unknown	No	No
50	Previous study	Male	75	10	Dead	2	4	AC	3	pT2	Yes	No
51	Previous study	Male	50	3	Dead	2	10	TCC	3	pT3	Yes	No
52	Previous study	Female	60	7	Dead	3	4	TCC	2	unknown	Yes	No
53	Previous study	Male	75	10	Dead	2	4	AC	2	pT2	Yes	No
54	Previous study	Male	76	5	Dead	1	4	TCC	3	pT2	Yes	Yes
55	Previous study	Female	84	9	Alive	2	6	TCC	3	pT2	Yes	Yes
56	Previous study	Female	71	4	Alive	3	4.5	TCC	2	unknown	Yes	Yes
57	Previous study	Male	65	10	Dead	3	3	TCC	2	unknown	Yes	No
58	Previous study	Male	78	3	Dead	4	6	SCC	2	unknown	Yes	No
59	Previous study	Male	75	ND	Lost to follow-up	5	15	TCC	3	pT3	Yes	Yes
60	Previous study	Male	75	ND	Lost to follow-up	1	4	TCC	2	unknown	No	Yes
61	Previous study	Male	40	ND	Lost to follow-up	3	4	TCC	1	pT2	Yes	Yes
62	Previous study	Male	75	18	Alive	3	2	TCC	0	unknown	Yes	No
63	Previous study	Female	60	2	Dead	2	7	TCC	3	pT3	Yes	No
64	Previous study	Male	57	12	Alive	3	3	TCC	3	unknown	Yes	No
65	Previous study	Male	37	30	Alive	3	4.5	TCC	2	unknown	No	Yes
66	Previous study	Female	52	10	Dead	3	3.5	TCC	2	unknown	Yes	Yes
67	Previous study	Male	65	14	Alive	1	3	TCC	3	pT3	Yes	Yes
68	Previous study	Male	73	12	Dead	3	4	TCC	1	unknown	Yes	Yes
69	Previous study	Female	78	ND	Lost to follow-up	6	3.5	TCC	1	unknown	No	Yes
70	Previous study	Female	38	ND	Lost to follow-up	5	3	TCC	2	unknown	No	No
71	Previous study	Female	34	ND	Lost to follow-up	2	4	TCC	2	unknown	No	No
72	Previous study	Female	40	ND	Lost to follow-up	3	4	TCC	1	unknown	No	No
73	Previous study	Male	78	10	Dead	5	ND	TCC	2	pT3	Yes	No
74	Previous study	Male	72	8	Dead	3	ND	TCC	2	unknown	Yes	No
75	Previous study	Male	59	11	Dead	3	ND	TCC	3	pT3	Yes	No
76	Previous study	Male	69	ND	Lost to follow-up	3	5	SCC	3	pT3	Yes	Yes
77	Previous study	Female	78	ND	Lost to follow-up	6	3.5	TCC	2	unknown	No	Yes
78	Previous study	Male	65	ND	Lost to follow-up	3	5	TCC	3	pT3	Yes	No
79	Previous study	Male	67	3	Dead	3	3	TCC	3	pT4	Yes	No
80	Previous study	Male	83	16	Alive	4	4	TCC	2	pT2	Yes	No
81	Previous study	Male	77	3	Dead	3	4	TCC	2	pT2	Yes	Yes
82	Previous study	Male	19	ND	Lost to follow-up	3	4	TCC	0	unknown	Yes	No
83	Previous study	Male	62	10	Alive	3	3	TCC	3	pT2	Yes	No
84	Previous study	Male	79	5	Dead	3	8	TCC	3	pT2	Yes	Yes
85	Previous study	Male	56	3	Alive	3	4	TCC	3	pT2	Yes	No
86	Previous study	Male	71	5	Dead	3	6	TCC	3	pT2	Yes	No
87	Previous study	Male	66	10	Dead	1	2.5	TCC	3	pT2	Yes	No

ND, not derived. Tumor location: 1, trigone; 2, dome; 3, lateral wall; 4, anterior wall; 5, posterior wall; 6, neck; 7, unknown. Epithelial components: TCC, Transitional cell carcinoma; SCC, squamous carcinoma; AC, adenocarcinoma. Surgical type: 0, biopsy; 1, tumor excision; 2, partial cystectomy; 3, radical cystectomy.

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bladder have been reported in the English-language literature (Lopez-Beltran et al., 1998; Ikegami et al., 2000; Cappello et al., 2002; Ogishima et al., 2002; Lopez Beltran et al., 2004; Luo et al., 2006; Shi et al., 2006; Lu et al., 2007; Amin, 2009; Fan et al., 2010; Stamatiou et al., 2010; Wang et al., 2010; Yang and

Wang, 2010), but prognostic analysis is difficult because of the extremely low incidence and prevalence of bladder SC and because clinical management varies among institutions (Amin, 2009).

Using SEER data of the U.S. population, Wang et al. studied the clinical characteristics and prognosis of 221 patients with SC of the bladder (Wang et al., 2010). In the present study, we reviewed the clinicopathological characteristics and prognosis of 74 cases of SC reported in the Chinese medical literature between 1994 to 2010, as well as 13 patients with SC treated at the General Hospital of People's Liberation Army (PLA) (Luo et al., 2006; Shi et al., 2006; Lu et al., 2007; Fan et al., 2010; Yang and Wang, 2010). We sought to identify factors associated with the prognosis of urinary bladder SC and to compare our results with those of Wang et al. (2010).

**Table 2.** Demographic and clinical characteristics of subjects in the study group (n=13) and literature group (n=74) who were diagnosed with sarcomatoid carcinoma of the bladder from 1999 to 2010.

Variable	Total (n=87)	Literature group (n=74)	Study group (n=13)	P-value
Sex				1.000
Males	69 (79.3%)	58 (78.4%)	11 (84.6%)	
Females	18 (20.7%)	16 (21.6%)	2 (15.4%)	
Age				0.288
<30 years	5 (5.7%)	5 (6.8%)	0 (0%)	
30-50 years	13 (14.9%)	9 (12.2%)	4 (30.8%)	
50-70 years	30 (34.5%)	25 (33.8%)	5 (38.4%)	
>70 years	39 (44.8%)	35 (47.2%)	4 (30.8%)	
Lesion location <sup>a</sup>				0.793
Trigone	12 (14.5%)	10 (14.3%)	2 (15.4%)	
Dome	9 (10.8%)	8 (11.4%)	1 (7.7%)	
Lateral wall	45 (54.2%)	36 (51.4%)	9 (69.2%)	
Anterior wall	7 (8.4%)	6 (8.6%)	1 (7.7%)	
Posterior wall	7 (8.4%)	7 (10.0%)	0 (0%)	
Neck	3 (3.6%)	3 (4.3%)	0 (0%)	
Tumor diameter <sup>a</sup>				0.309
<3 cm	19 (23.2%)	17 (24.6%)	2 (15.4%)	
3-6 cm	40 (48.8%)	35 (50.8%)	5 (38.5%)	
>6cm	23 (28.0%)	17 (24.6%)	6 (46.1%)	
Epithelial components				0.474
Transitional cell carcinoma	76 (87.4%)	64 (86.4%)	12 (92.3%)	
Squamous carcinoma	7 (8.0%)	7 (9.5%)	0 (0%)	
Adenocarcinoma	4 (4.6%)	3 (4.1%)	1 (7.7%)	
pT stage <sup>a</sup>				0.056
Muscularis (pT2)	23 (52.3%)	20 (60.6%)	3 (27.3%)	
Perivesical tissue (pT3)	18 (40.9%)	12 (36.4%)	6 (54.5%)	
Adjacent organ (pT4)	3 (6.8%)	1 (3.0%)	2 (18.2%)	
Surgical type				0.159
Biopsy	5 (5.7%)	5 (6.8%)	0 (0%)	
Tumor excision	8 (9.2%)	6 (8.1%)	2 (15.4)	
Partial cystectomy	34 (39.14%)	32 (43.2%)	2 (15.4)	
Radical cystectomy	39 (44.8%)	30 (40.5%)	9 (69.2%)	
Unknown	1 (1.1%)	1 (1.4%)	0 (0%)	
Gross hematuria				NA
Yes	73 (83.9%)	60 (81.1%)	13 (100%)	
No	14 (16.1%)	14 (18.9%)	0 (0%)	
Urinary tract irritation				0.960
Yes	34 (39.1%)	29 (39.2%)	5 (38.5%)	
No	53 (60.9%)	45 (60.8%)	8 (61.5%)	
Survival status				0.796
Dead	38 (43.7%)	31 (41.9%)	7 (53.8%)	
Survive	31 (35.6%)	27 (36.5%)	4 (30.8%)	
Lost to follow-up	18 (20.7%)	16 (21.6%)	2 (15.4%)	

Each variable is summarized as n (%). Differences between data sources were compared using Fisher's exact test. <sup>a</sup>: Lesion location was unknown in 4 subjects, tumor diameter was not reported in 5 subjects, and pT stage was not unknown in 43 subjects. NA, not assessed.

## Materials and methods

### Patients

The medical records of 13 patients with SC of the bladder (study group) treated at the General Hospital of People's Liberation Army (PLA) between 1999 and 2010 were reviewed. The records of an additional 74 Chinese patients with SC of the bladder (literature group) listed in two main Chinese databases (Knowledge Network Service [KNS] 5.0, www.cnki.net and the VIP Medical Information System [VMIS], vmis3.cqvip.com) between 1994 and 2010 were also analyzed. The clinical profiles of all 87 patients are listed in Table 1. The institutional review board of the PLA approved this retrospective study.

### Diagnostic criteria

The diagnosis and staging of SC of the bladder in the study group cases at the General Hospital of PLA was based on pathological examination, as described in the WHO guidelines of 2004 (Lopez Beltran et al., 2004). In particular, a bladder carcinoma was considered to be an SC variant if it had morphological and/or immunohistochemical characteristics of epithelial and mesenchymal cells (Lopez Beltran et al., 2004; Cheng et al., 2008). The same criteria were used for the diagnosis and classification of tumors in both the study and literature groups, but in the case of the latter, we relied on records. All patients were staged according to the depth of tumor invasion (pT-stage), but complete TNM staging was not possible because data on lymph node and distant metastases were incomplete for the literature group.

### Demographic and tumor factors analyzed

The gender, age, clinical manifestations, location of the cancer, surgical technique, tumor size, type of epithelial cancer, depth of cancer invasion, and lymph node metastasis of patients with SC of the bladder were

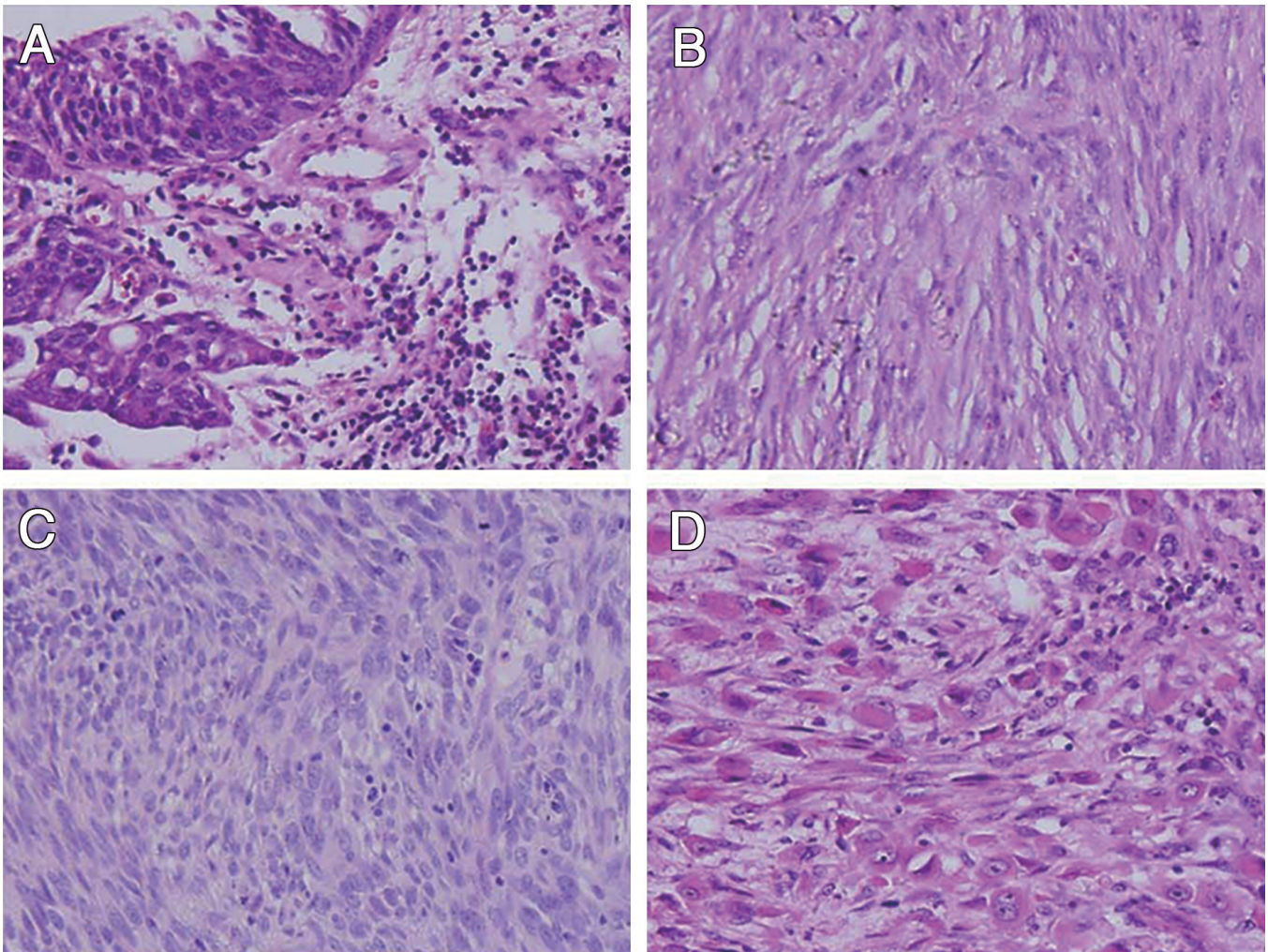
recorded. In addition, we analyzed the duration of follow-up and survival status.

#### Statistical analysis

The clinical and demographic characteristics of all patients in the two groups were compared using Fisher's exact test. A Kaplan-Meier curve was used to analyze survival during the follow-up period, and a log-rank test was used to identify the factors that were significantly associated with survival. All statistical assessments were two-tailed and considered significant if the p-value was less than 0.05. All statistical analyses were performed using SPSS version 15.0 (SPSS Inc, Chicago, IL, USA).

#### Results

Table 2 summarizes the demographic and clinical characteristics of the study group and the literature group. The average age was 61.3 years (SD=13.9, range: 41 to 84 years) in the study group and 63.2 years (SD=16.4, range: 13 to 89 years) in the literature group. About 80% of patients in each group were at least 50 years-old. Transitional cell carcinoma was the most common epithelial component, followed by squamous carcinoma and adenocarcinoma. Nearly half of patients in the study group had perivesical tumor invasion, but less was known about the patients in the literature group. The demographics and characteristics were similar



**Fig. 1.** Representative pathological images of patients with sarcomatoid carcinomas of the bladder (Haematoxylin & Eosin staining). **A.** Well differentiated transitional carcinoma (left upper) with sarcomatoid differentiation in a 45-year-old male with a tumor at the bladder trigone (case 5). **B.** Cancer cells in the sarcomatoid region arranged in a bundle-like or braided manner in a 67-year-old male with a tumor at the bladder wall (case 2). **C.** Cancer cells in the sarcomatoid region arranged in a braided manner in a 70-year-old male with a tumor at the bladder wall (case 13). **D.** Rhabdoid cells with red cytoplasm and nuclear deviations in the sarcomatoid region of a 45-year-old male with a tumor at the bladder trigone (case 5). x 200

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between the study group and literature group.

The epithelial components of the SC cases were mostly transitional cell carcinomas (Fig. 1A). The sarcomatous components typically showed malignant spindly cells in bundles (Fig. 1B,C), but occasional tumors showed more unusual sarcoma components such as rhabdomyosarcomatous (Fig. 1D) differentiation. Of 75 cases, markers of sarcomatous differentiation were detected, including 67 positive for vimentin, 1 for MyoD1, and 4 for actin, indicating the sarcoma portion of SC; markers of epithelial differentiation were also detected, including 72 positive for cytokeratin, and 1 positive for EMA, indicating the epithelial component of SC. Immunohistochemistry findings were unclear in 12 patients, all from the literature group. Fig. 2 shows representative immunohistochemical staining results for vimentin and cytokeratin in the SC of the representative patients from the study group.

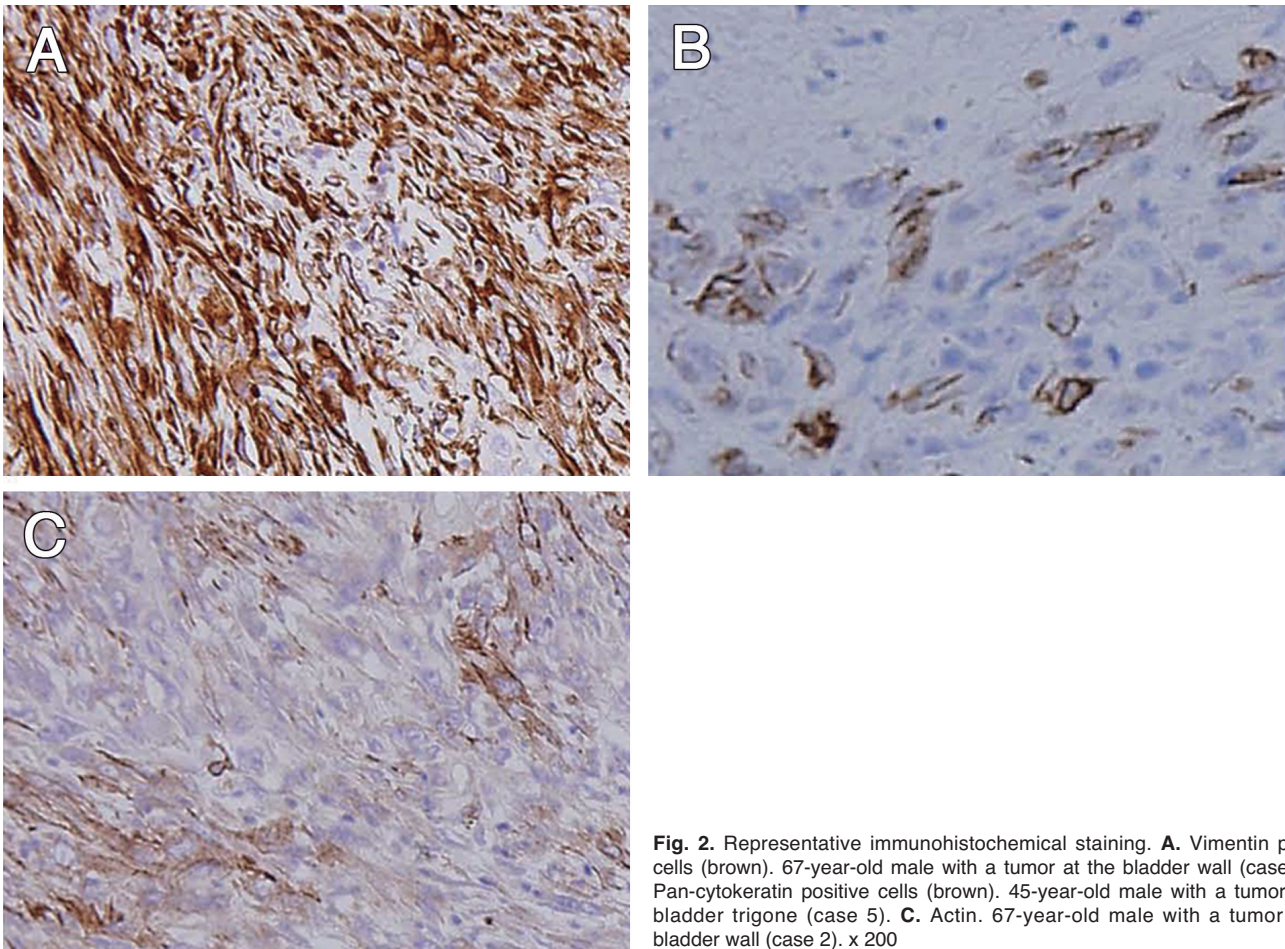
Fig. 3 shows our Kaplan-Meier analysis of cumulative survival over time for patients with SC of the bladder. The 6-month, 1-year, 2-year, and 5-year survival rates of the 87 subjects were 78.9%, 42.7%, 28.0% and

21%, respectively. Results show no significant difference in median survival time (95% CI) between the study and literature groups (8 months [3.842 to 12.158] vs. 10 months [8.043 to 11.957];  $p=0.474$ ). Table 3, which contrasts patients who died with those still surviving at the conclusion of the study shows that gender, age, and tumor characteristics are not significantly associated with patient prognosis (all  $p$ -values  $>0.05$ ).

## Discussion

We retrospectively analyzed the association of clinicopathologic features and prognosis of 87 patients from China who were diagnosed with SC of the bladder between 1994 and 2010. Similar to Wang et al's study in the United States, most patients were elderly and male and most had high-grade or late-stage disease at diagnosis (Wang et al., 2010).

SC has histological and/or immunohistochemical properties of both epithelial and mesenchymal components (Gorstein and Anderson, 1991; Torenbeek



**Fig. 2.** Representative immunohistochemical staining. **A.** Vimentin positive cells (brown). 67-year-old male with a tumor at the bladder wall (case 2). **B.** Pan-cytokeratin positive cells (brown). 45-year-old male with a tumor at the bladder trigone (case 5). **C.** Actin. 67-year-old male with a tumor at the bladder wall (case 2). x 200

et al., 1994). In recent years, molecular genetic studies have confirmed the monoclonal origin of the two components of SC (Halachmi et al., 2000; Volker et al., 2008; Armstrong et al., 2009). Thus, the current consensus is that SC and carcinosarcoma are classified together (Lopez Beltran et al., 2004). In our hospital, 3861 patients were diagnosed with urinary bladder cancer between 1999 and 2010, and only 0.34% (13 patients) had SC consistent with previous studies.

SC of the bladder is usually large at diagnosis, typically measuring 3-6 cm and more in diameter, and invasion tends to be deeper than the more common urothelial carcinomas (Amin, 2009; Cheng et al., 2011). When morphological examination indicates malignant

spindle-like cells or pleomorphic cells, multiple biopsies should be obtained from the transitional site between the tumor and normal tissues in a search for urothelial differentiation. When evidence of epithelial components is absent, detection of markers for epithelial cells by immunohistochemistry may be useful (Amin, 2009; Cheng et al., 2011).

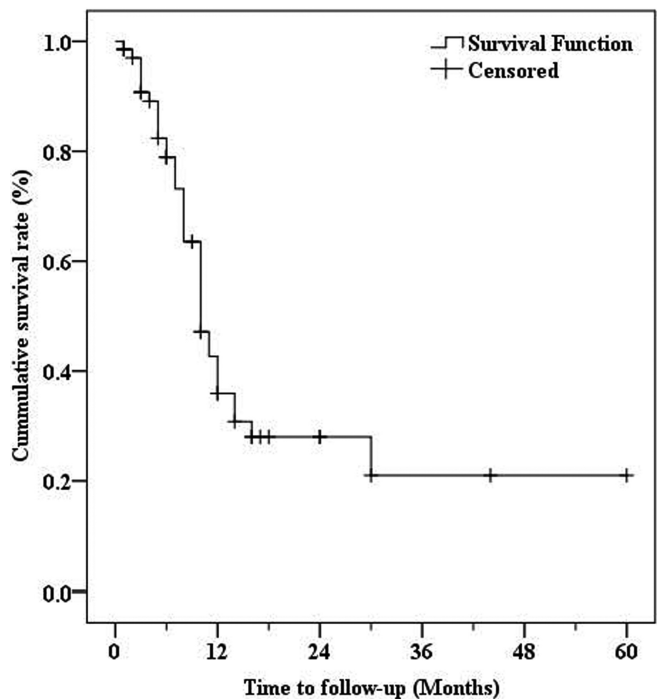
Radical resection of the SC is the initial treatment of choice (Wang et al., 2010). In addition, partial cystectomy and bladder irrigation followed by radiotherapy and/or chemotherapy are also recommended (Rogers et al., 2006; Hoshi et al., 2007; Sung et al., 2007; Wright et al., 2007; Wallach et al., 2009).

Although the overall survival of bladder SC patients has improved in the past decade, the prognosis remains poor. In the present study, the median survival time of 87 Chinese patients was only slightly lower than those reported by Wang et al. In addition, Wang et al. reported that gender, age, ethnicity, tumor location, and histological grade were unrelated to prognosis, findings we also observed, but that clinical T-stage was related to prognosis (Wang et al., 2010). However, in apparent disagreement with the results of Wang et al., our results suggested that the pathologic tumor stage was unrelated to prognosis. This may be because surgical techniques were different or because information on the pT stage

**Table 3.** Association of survival status with demographic and clinical characteristics of patients with sarcomatoid carcinoma of the bladder.

Variable	Dead (n=38)	Survived (n=31)	P-value
Sex			0.976
Males	32 (56.1%)	25 (43.9%)	
Females	6 (50%)	6 (50%)	
Age			0.700
<30 years	0 (0)	3 (100%)	
30-50 years	6 (66.7%)	3 (33.3%)	
50-70 years	14 (51.9%)	13 (48.1%)	
>70 years	18 (60%)	12 (40%)	
Lesion location			0.301
Trigone	7 (77.8%)	2 (22.2%)	
Dome	5 (62.5%)	3 (37.5%)	
Lateral wall	17 (45.9%)	20 (54.1%)	
Anterior wall	4 (57.1%)	3 (42.9%)	
Posterior wall	3 (75%)	1 (25%)	
Neck	2 (50%)	2 (50%)	
Tumor diameter <sup>a</sup>			0.054
<3 cm	8 (47.1%)	9 (52.9%)	
3-6 cm	13 (48.1%)	14 (51.9%)	
>6cm	13 (61.9%)	8 (38.1%)	
Epithelial components			0.256
Transitional cell carcinoma	33 (53.2%)	29 (46.8%)	
Squamous carcinoma	2 (50%)	2 (50%)	
Adenocarcinoma	3 (100%)	0 (0%)	
pT stage <sup>a</sup>			0.126
Muscularis (pT2)	9 (42.9%)	12 (57.1%)	
Perivesical tissue (pT3)	11 (84.6%)	2 (15.4%)	
Adjacent organ (pT4)	3 (100%)	0 (0%)	
Surgical type			0.166
Biopsy	0 (0%)	2 (100%)	
Tumor excision	1 (25%)	3 (75%)	
Partial cystectomy	15 (51.7%)	14 (48.3%)	
Radical cystectomy	21 (63.6%)	12 (36.4%)	
Gross hematuria			0.860
Yes	35 (55.6%)	28 (44.4%)	
No	3 (50%)	3 (50%)	
Urinary tract irritation			0.772
Yes	26 (57.8%)	19 (42.2%)	
No	12 (50%)	12 (50%)	

Data indicate n (%) for the subjects with different survival status. <sup>a</sup>: 43 patients with unknown pT stage were not included into this analysis. P-value was calculated by the Log-rank test.



**Fig. 3.** Kaplan-Meier analysis of 87 subjects diagnosed with sarcomatoid carcinoma of the bladder from 1999 to 2010. The 6-month, 1-year, 2-year, and 5-years survival rates were 78.9%, 42.7%, 28.0% and 21%, respectively.

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was available in only 14 patients, the sample size was too small to analyze. Thus, future studies need to assess the depth and extent of cancer invasion and its relationship to survival.

Partial cystectomy of urinary tract tumors has been thought to increase the risk for incomplete removal of malignant tumors, increasing the risk of recurrence and/or metastasis (Wright et al., 2007), leading some investigators to recommend radical cystectomy. However, Wang et al. (2010) found that surgical technique was not associated with the survival time of patients with bladder SC, which we were able to confirm.

The present study has certain limitations. First, this was a retrospective study that involved meta-regression analysis of individual data. The diagnoses were made by multiple pathologists over 16 years (1994 to 2010), and the pathologic material from the literature cases could not be reviewed.

In conclusion, our analysis of 87 Chinese patients with SC of the bladder indicated no significant association of prognosis with age, sex, lesion location, tumor diameter, epithelial components, pT stage, type of surgery, gross hematuria, and urinary tract infection. The lack of an association between pT stage and survival requires further study.

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