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Case report

Primary prostate synovial sarcoma: A case report and review of literature

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ABSTRACT

Prostate synovial sarcoma (SS) is extremely rare. We report a case of prostate SS diagnosed using fine-needle biopsy. The following findings were found: The serum prostate specific antigen level was low, magnetic resonance imaging shows an irregular soft tissue mass in the right posterior part of the prostate, and computed tomography examinations did not reveal any tumor at other parts of the body. Microscopy showed that the tumor cell morphology was densely arranged by interwoven short strands of deep-stained nuclear spindle cells. Immunohistochemical tests were positive for SS18-SSX and SSX. Molecular testing showed that SS18 break-apart Fluorescence In Situ Hybridization (FISH) results were positive, and a comprehensive analysis of this case was performed. Nine cases of prostate SS reported in the English literature were reviewed. In addition, the differential diagnosis, clinical treatment, and clinical prognosis of prostate SS are comprehensively described.

1. Introduction and importance

Synovial sarcoma (SS) is a soft tissue sarcoma that occurs mainly in young adults and is often located in the para-articular region of the extremities. Prostate comply SS is extremely rare in clinical practice. The first case was reported by Iwasaki et al. in 1999 [1], and we retrieved nine cases in the English literature that were confirmed as primary SS of the prostate by molecular detection methods [1–10]. In the prostate biopsy, a case of prostate SS was found, which was confirmed to be prostate SS by immunohistochemistry and fluorescence in situ hybridization (FISH). This type of tumor arises from mesenchymal cells, but not epithelial cells, and the tumor cells appear as synovial cells under a microscope. Nine other cases of prostate SS retrieved in English were reviewed and summarized.

2. Case presentation

History taking: A 42-year-old male patient was admitted to the hospital with dysuria for more than 20 days, and the degree of dysuria gradually increased, accompanied by dysuria, interrupted urination, and an increased number of night awakenings. Laboratory results: Serum prostate-specific antigen (PSA) was 0.81 ng/mL. Radiological findings: In the magnetic resonance (MR) results, the prostate is abnormally enlarged, with a size of 6.7 × 6.6 × 5.8 cm; the central zone and the peripheral zone are not clearly demarcated; an irregular soft tissue mass was seen in the right posterior part of the prostate; the internal signal is uneven; and the local area is toward the contour of the prostate. It protrudes outward, closely related to the rectum to the rear, and involves the right seminal vesicle gland to the top; the prostatic urethra is compressed and moved forward (Fig. 1, MRI result of the prostate synovial sarcoma). Computed tomography (CT) did not reveal any other parts of the body occupying the space. Physical examination: Anal examination revealed a huge prostate mass, swelling, tough texture, and a spherical curved surface, which is different from the roughness of prostate cancer, which is as hard as stone. Needle biopsy was performed under ultrasound monitoring. Three pieces of prostate tissue were obtained for the pathological examination.

HE staining showed that the tumor cell morphology was densely arranged by interwoven short strands of nuclear deep-stained spindle cells; some of the short spindle cells were arranged in a weave-like staggered arrangement, and some were arranged in a cord-like arrangement. The cell morphology was relatively uniform, showing moderate atypia with round or oval nuclei, blue-stained nuclei, fine granular chromatin, inconspicuous nucleoli, sparse cytoplasm, unclear cell boundaries, and a high nuclear-cytoplasmic ratio. The cells were arranged in a solid-like arrangement and the division phase was difficult to observe. In some areas, spindle cells are arranged radially around the blood vessel, forming a hemangiopericytoma-like structure. Different amounts of collagen fibers can be seen between some of the spindle cells, and the interstitium is accompanied by mucus degeneration (Fig. 2, HE

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staining image 1400×; Fig. 3, HE staining image 2, 400×), and there was no epithelial appearance in this case. This tumor was diagnosed as a uniphasic synovial sarcoma and was not necrotic.

Immunohistochemistry and FISH test results were as follows: The diffusely positively expressed antibodies in immunohistochemistry included vimentin, CD99 (Fig. 4, CD99 immunohistochemical staining results, 400×), Bcl-2 (Fig. 5, Bcl-2 immunohistochemical Staining result, 400×), SS18-SSX (Fig. 6 SS18-SSX immunohistochemical staining result, 400×), and SSX (Fig. 7 SSX immunohistochemical staining result, 200×). Immunohistochemistry for negative expression included S-100, CD34, CD117, SMA, desmin, WT-1, calretinin, EMA, CK, CAM5.2, CK7, CK19, MyoD1, and myogenin. FISH results were as follows: The SS18 break-apart test showed split-apart between the red centromeric and yellow-telomeric signals (Fig. 8 SS18 break-apart FISH test result).

The follow-up results included the following: After the patient was diagnosed by biopsy, owing to the large tumor size and invasion of the rectum, the risk in surgical resection was high. Considering the patient's economic status, palliative treatment was administered. After telephone follow-up for 12 months, the patient's tumor began to rupture, and the patient's family reported that the tumor leaked from the skin of the anus. At 18 months, the patient died.

3. Clinical discussion

SSs generally occur in the soft tissues of the limbs, especially in large joints. SSs that occur in the prostate are very rare. The earliest case of SS of the prostate was reported by Iwasaki et al. in 1999 in the American Journal of Surgical Pathology [1]. Through a literature search, we found that nine cases of prostate SS were clearly diagnosed by molecular studies in the English literature [1–13]. Together with our report, there were a total of 10 cases. We also searched Chinese journals and found that only three cases were diagnosed with SS, one of which reported that the SS18 fragmentation gene FISH test was negative and could not be clearly diagnosed as SS [12].

Analysis of these 10 patients with prostate SS showed that their ages ranged from 22 to 63 years, with an average age of 42 years.

The clinical manifestations in nine out of 10 patients were mainly urinary tract symptoms, including dysuria, urinary block, and hematuria.

One patient complained of back pain and constipation. The serum PSA level ranged from 0.345 to 2.91 to ng/mL, and the serum PSA level was low. The tumor size ranges from 5.5 to 14 cm. Tumors are generally larger than the prostate epithelial lesions. Owing to the high degree of malignancy of the tumor, the survival period of tumor patients is very short, and it usually progresses more rapidly. Seven of the 10 cases had

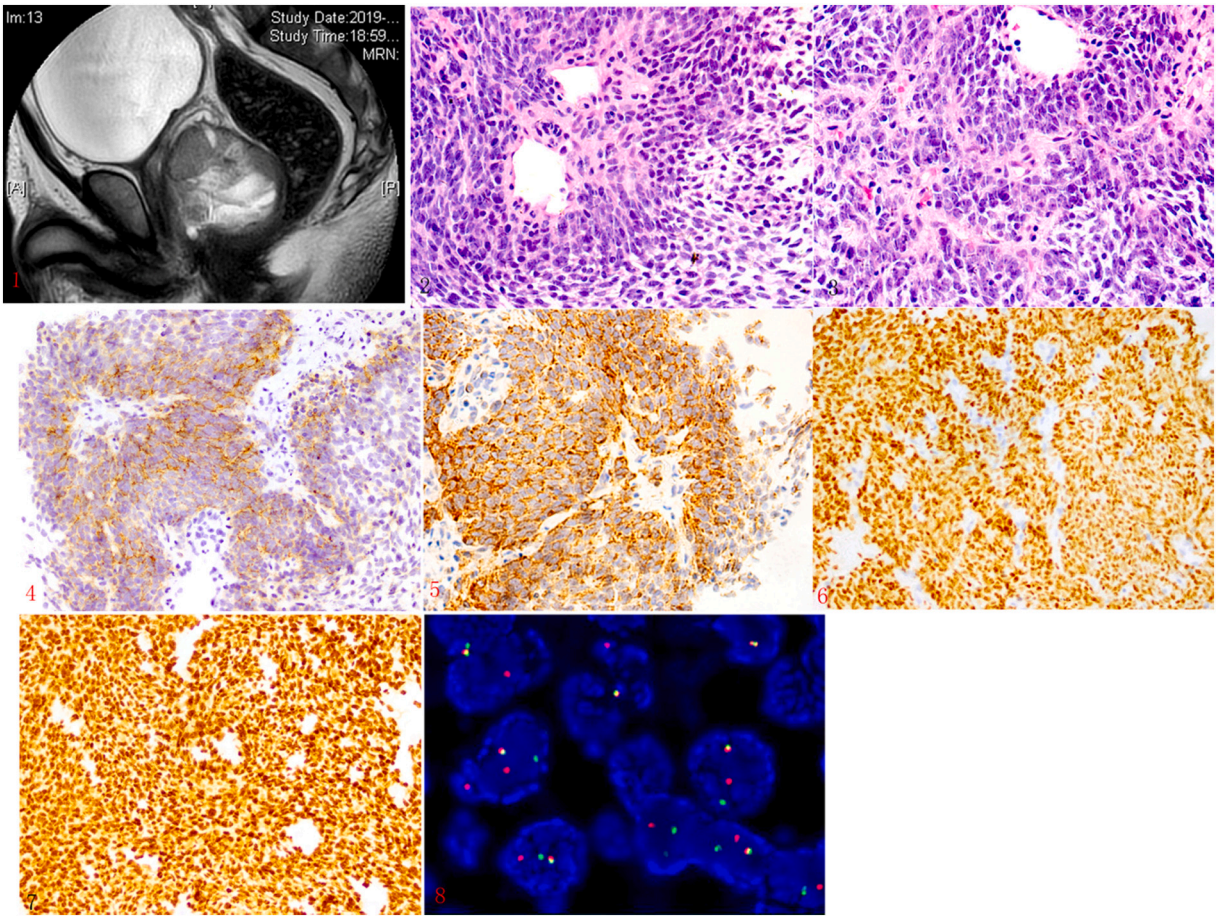

Fig. 1. MRI results of synovial sarcoma of the prostate. The prostate mass invades the rectum. Fig. 2. HE staining image with 400× magnification: the tumor tissue grows around blood vessels; it resembles a hemangiopericytoma with obvious cell atypia, has a fine chromatin, and is coarse-grained. Fig. 3. HE staining image 2, 400× magnification: the collagen fibers and mucus-like matrix can be seen in the interstitium of tumor cells. Fig. 4. CD99 immunochemistry result, 400× magnification: cytoplasmic staining was positive. Fig. 5. Bcl-2 immunohistochemical staining results, 400× magnification: it was diffusely positive, mainly positive for cytoplasmic staining. Fig. 6. SS18-SSX immunohistochemical staining result, 400× magnification: the antibody was diffusely positive. Fig. 7. SSX immunohistochemical staining result, 400× magnification: the antibody was diffusely positive. Fig. 8. SS18 break-apart FISH test results: A SS18 break-apart test showed a split between the red-centromeric and green-telomeric signals. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

varying degrees of invasion of the seminal vesicle glands, cavernous body of the penis, posterior bladder fat, and rectum. Invasion of the surrounding tissues can cause symptoms such as dysuria. One of the 10 cases of prostate SS had metastasis to the lymph nodes, liver, and lung organs (Table 1, Clinical data of 10 cases of prostate synovial sarcoma).

The 10 prostate SS patients were all uniphasic SS. The tumor has the general characteristics of uniphasic SS, which is formed by weaving and staggered spindle cells with a uniform morphology. The typical morphology of a slit-like SS can be seen with local hemangiopericytoma-like characteristics. Immunohistochemistry: Tumor cells generally expressed CD99, BCL2, SS18-SSX, SSX, and vimentin; locally, EMA, CK, CAM5.2, and other epithelial markers were expressed. Nine specimens were tested for vimentin, and all nine samples were positive. Eight cases were tested for CD99, of which seven were positive. The seven cases tested for Bcl-2 were all positive. Among the six cases of EMA, two were focally positive and four were negative. S-100 is negative in most cases. The PSA level in the serum of 10 patients was measured, and the PSA level was found to be low (Table 2, Indicators and prognosis of 10 cases of prostate synovial sarcoma).

All of the 10 cases we collected were confirmed by molecular detection methods with the characteristic t(x;18)(p11.2;q11.2) chromosomal translocation of SSs. Both the SS18 (formerly SYT) break gene and SS18-SSX fusion gene were positive. The detection of t(x;18)(p11.2;q11.2) chromosomal translocation and/or the fusion gene SS18-SSX is essential for the diagnosis of SS. Chromosomal translocation occurs in >90% of SS cases. Gene fusion occurred in the SS18 gene (18q11.2), which fused with SSX1, SSX2, and the unusual SSX4 gene on Xp11.2, and the incidence of SS18-SSX1 fusion was approximately twice that of SS18-SSX2.

SS18 rearrangement by break-apart FISH is the gold standard for the diagnosis of SS. However, FISH is not widely available; it will miss variant chimeric transcripts, lack complete sensitivity, and may not identify cryptic rearrangements. Recently, a research done by Abdullah et al. showed that genetic analyses of undifferentiated small round cell sarcoma identified a novel sarcoma subtype with a recurrent CRTC1-SS18 gene fusion, which also showed SS18 split signals with FISH [14].

Recently, a novel SS18-SSX fusion-specific antibody was found to be highly sensitive (95%) and specific (100%) for SS, and an antibody to the SSX C-terminus was also highly sensitive (100%) but slightly less specific (96%). Immunohistochemistry (IHC) using SS18-SSX and SSX antibodies could replace molecular genetic or cytogenetic testing in most cases [15]. However, this IHC method also has its shortcomings; for example, there was a report of a primary renal SS with a SS18-NEDD4 gene fusion. This gene fusion was different from SS18-SSX, with this special SS18-NEDD4 gene fusion, the SS18 split FISH method could be effective for detecting this SS, but the SS18-SSX fusion-specific antibody IHC method and the SSX IHC will be useless [16]. According to the analysis of the detection method for the SS, in this research, we used both the IHC method, together with the SS18 split FISH molecular method, with all the results being positive. This confirmed that the diagnosis of primary prostate SS was correct.

Studies have shown that fusion of SS18 with different SSX genes corresponds to different types of SSs. For example, the morphology of SS of the SS18-SSX2 fusion type is generally monophasic, while the SS18-SSX1 fusion type is generally biphasic. Almost all reported cases of prostate SS have the SS18-SSX gene fusion. The histomorphology of the 10 cases of prostate SS was monophasic SS. We hypothesized that the fusion type of SS in the prostate was usually SYT-SSX2, not SYT-SSX1, which should be verified by further molecular research.

Differential diagnoses:1. Metastatic SS. SSs in other parts of the body can metastasize to the prostate. A clinical diagnosis of prostate SS must first rule out the possibility of metastatic SS. In this case, the urinary system symptoms were the first symptoms. A comprehensive clinical examination, including a whole-body CT test, did not reveal any other tumor in the body. 2. Sarcomatoid carcinoma. The most common tumors of the prostate are prostate epithelial tumors, such as prostate acinar cell carcinoma. The possibility of sarcomatoid carcinoma must be considered when diagnosing sarcomatoid tumors. The immunohistochemical epithelial markers can be diffusely positive; moreover, compared with prostate cancer, prostate SS has a lower age of onset, and serum PSA levels are often low. SS has a rapid onset and progression and is often a large tumor, with a clear boundary with the prostate. In addition, physical examination in the anus to clinch the diagnosis is also very helpful in distinguishing prostate SS from prostate cancer. For sarcoma of the prostate, the mass is large and causes discomfort to patients due to tumor enlargement. 3. Other primary sarcomas and other sarcomas of the prostate in descending order are as follows: rhabdomyosarcoma, leiomyosarcoma, fibrosarcoma, malignant fibrous histiocytoma (pleomorphic undifferentiated sarcoma), malignant fibrous interstitial dermatoma, malignant peripheral nerve sheath tumor, prostatic stromal sarcoma, and solitary fibrous tumor. Therefore, differential diagnosis from other types of sarcomas is necessary. Differentiated from rhabdomyosarcoma, the latter mainly expresses myogenic markers, such as SMA, desmin, MyoD1, and myogenin, and the morphological characteristics of leiomyosarcoma are cytoplasmic red staining, immunohistochemical SMA, and desmin positivity; fibrosarcoma and pleomorphic undifferentiated sarcoma are not differentiated sarcomas and are mainly diagnosed by exclusion and generally do not have epithelial markers; malignant fibrous mesothelioma expresses mesothelial markers, such as WT-1 and CR. Malignant peripheral nerve sheath tumors express the

Table 1
Clinical data of 10 cases of prostate synovial sarcoma.

No	Case	Year	Age	Clinical symptoms	Serum PSA (ng/mL)	Tumor size (*cm*) and involved organs	Histopathology
1	Iwasaki et al [1]	1999	37	Dysuria, Hematuria	No data	10, invasion of prostate urethra and seminal vesicle glands, soft tissue behind bladder	Monophasic
2	Shirakawa et al [2]	2002	52	Dysuria	0.9	7, invasion of prostatic fascia	Monophasic
3	Williams et al [3]	2004	63	Dysuria	0.5	8.5, the central swelling growth of the prostate invades the cavernous body of the penis	Monophasic
4	Pan and Chang [4]	2005	44	Dysuria	2.91	6	Monophasic
5	Li Jun case 1[5]	2008	46	Dysuria	0.345	5.5, partial necrosis, invaded the pelvic peripheral soft tissues	Monophasic
6	Li Jun case2 [5]	2008	44	Dysuria	1.185	12, partial necrosis, invaded the pelvic peripheral soft tissues	Monophasic
7	lucio Olivetti [7]	2014	46	Dysuria	1.03	8.5, invasion of the prostatic fascia, invaded the pelvic peripheral soft tissues	Monophasic
8	Zhang Qi [6]	2014	22	Dysuria	1.2	14, invasion of the prostatic fascia. Inguinal lymph node metastasis, liver and lung metastasis	Monophasic
9	Sara Maleki [8]	2016	38	Back pain and constipation	0.58	9.5, invaded most of the prostate	Monophasic
10	Our case	2022	42	dysuria	0.81	7, involvement of the right seminal vesicle gland, rectum, and pelvic fat	Monophasic

Table 2
Indicators and prognosis of 10 cases of prostate synovial sarcoma.

No	Author	Immunochemistry	Molecular test	Therapy	Prognosis
1	Iwasaki et al	Vim+,EMA局灶+,CK-,S-100-,CD34-, NSE-,Desmin-,SMA-, MSA-	t(X;18)(p11.2;q11.2),SYT rearrange (FISH)	Radical prostatectomy+chemotherapy	DOD (32 month)
2	Shirakawa et al	Vim+,SMA-,S-100-, Desmin-,EMA partly+	t(X;18)(p11.2;q11.2),SYT rearrange (FISH)	Prostatectomy+chemotherapy	NED (6 month)
3	Williams et al	Vim+,CK+, CAM5.2+,S-100+,CK7+,CK+,Calponin+, SMA-, Bcl-2+,CD117-,CD34-,CD99-,EMA-,Desmin-	SYT-SSX1(RT-PCR)	Preoperative radiotherapy+radical prostatectomy	NED
4	Pan and Chang	Vim+,CD99+,CK+, Bcl-2+++, Ema-, SMA-, HHF35-, Desmin-, CD34-, S100-	SYT-SSX2 (RT-PCR)	Prostatectomy	NED
5	Li Jun case 1	CK部分+, Vim+, CD99+, bcl-2+, *E*-cad+,S100-,Cal-desmin-,CD34-,CD117-,SMA-,Desmin-,PSA-	SYT-SSX2 (RT-PCR)	Prostatectomy+chemotherapy	NED (8 month)
6	Li Jun case2	Vim+,CK+,E-cad+,Bcl-2+,CD99+,CD34-,CD117-,SMA-, Desmin-,S-100-,Cal-desmin-,EMA-,PSA-	SYT-SSX2 (RT-PCR)	Untreated	DOD (8 months)
7	lucio Olivetti	CD56+++, CD99+++, BCL-2+++, CK灶+, S100-, SMA-, desmin-, CD34-	t(X;18)(p11.2;q11.2),SYT rearrange (FISH)	Tumor reduction+chemotherapy	AWD 3 months
8	Zhang Qi	Vim+++,CD99+++,SMA-,Desmin-,S-100-,	SYT-SSX2 (RT-PCR)	Untreated	DOD 3 months
9	Sara Maleki	EMA灶+, CK灶+, CAM5.2+, CK7+, CK19灶+, BCL2+++, Vimentin+++, CD99+++	t(X;18)(p11.2;q11.2),SYT rearrange (FISH)	Prostatectomy+chemotherapy	DOD (24 month, lung metastasis)
10	Our case	Vim+++, Bcl-2+++, CD99+++, CK-, Calponin-,EMA-	SYT break-apart FISH positive	No treatment	DOD (18 month)

NED, no evidence of disease; AWD, alive with disease; DOD, died of disease. Num, numbers.

neurogenic marker S-100, and CD34 positivity can be identified as prostatic stromal sarcoma. Gastrointestinal stromal tumors can occur in this area. Immunohistochemistry, such as CD117, Dog-1, and CD34, can confirm this diagnosis. Of course, the SS18-SSX gene fusion is a key indicator for the diagnosis of prostate SS.

For most of the cases reported, the main treatment method is radical surgical resection, supplemented with radiotherapy and chemotherapy according to the degree of the tumor. However, based on previously reported cases, it was found that the prognosis of prostate SS is generally poor, and the survival time of prostate SS is relatively short, with the longest survival time being 32 months. The 18 months reported in our case was relatively long. In terms of treatment, due to the extremely low incidence of SS of the prostate, there is still no consensus on the best treatment plan for prostate SS [9]. Thus, surgical resection remains a positive method. Whether chemotherapy can benefit patients remains unknown, and more cases are needed to establish a more scientific diagnosis and treatment plan [17].

4. Conclusion

SS originating in the prostate is extremely rare, and its diagnosis depends on clinical data, pathological morphology, immunohistochemistry, and molecular methods. Detection of the SYT fusion gene is critical for an accurate diagnosis. In terms of prognosis, due to the rapid progression of tumors and the poor prognosis, it is particularly necessary for a timely and accurate diagnosis of prostate SS.

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Ethical approval

Not applicable.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Research registration

None.

Guarantor

Dongsheng Hou.

CRediT authorship contribution statement

Dongsheng Hou collected the data, and submit the article for publication; Qiuyuan Xia performed the immunostaining experiment; Xiaotong Wang performed the FISH experiment; and Yuanyuan Zong organized the clinical data and experimental data, and served as the corresponding author of this paper.

Declaration of competing interest

None.

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References

[1] H. Iwasaki, M. Ishiguro, Y. Ohjimi, H. Ikegami, T. Takeuchi, M. Kikuchi, et al., Synovial sarcoma of the prostate with t(X;18)(p11.2;q11.2), Am. J. Surg. Pathol. 23 (1999) 220–226.
[2] T. Shirakawa, M. Fujisawa, A. Gotoh, H. Okada, S. Arakawa, S. Kamidono, Complete resection of synovial sarcoma of prostatic fascia, Urology 61 (2003) 644.
[3] D.H. Williams, V.N. Hua, A.A. Chowdhry, W.B. Laskin, J.A. Kalapurakal, G. A. Dumanian, et al., Synovial sarcoma of the prostate, J. Urol. 171 (2004) 2376.
[4] C.C. Pan, Y.H. Chang, Primary synovial sarcoma of the prostate, Histopathology 48 (2006) 321–323.
[5] L. Jun, S. Ke, W. Zhaoming, X. Linjie, Y. Xinru, Primary synovial sarcoma of the prostate: report of 2 cases and literature review, Int. J. Surg. Pathol. 16 (2008) 329–334.

[6] Q. Zhang, H. Wang, L. Ren, X. Qi, F. Liu, D. Zhang, Primary synovial sarcoma of the prostate metastatic to the liver and lung: a case report, World J. Surg. Oncol. 12 (2014) 194.
[7] L. Olivetti, L. Benecchi, S. Corti, C. Del Boca, M. Ferrari, P. Sergio, et al., Monophasic synovial sarcoma of prostatic fascia: case report and literature review, Case Rep. Urol. 2015 (2015), 419180.
[8] S. Maleki, A. Cajigas, J. Moss, K.H. Ramesh, S. Khader, Fine-needle aspiration biopsy of prostate synovial sarcoma: a case report and review of the literature, Diagn. Cytopathol. 45 (2017) 168–172.
[9] A.M. Olofson, K. Linos, Primary intraprostatic synovial sarcoma, Arch. Pathol. Lab. Med. 141 (2017) 301–304.
[10] H. Kim, D.Y. Kim, Y.M. Seol, J.Y. Ku, K.U. Choi, Y.J. Choi, Primary malignant peripheral nerve sheath tumor of prostate in a young adult: a case report, Medicine 97 (2018), e12040.
[11] H.J. Porter 2nd, I. Damjanov, P. Arnold, J.B. Thrasher, Synovial sarcoma metastatic to the penis and prostate, J. Urol. 166 (2001) 605.
[12] J. Li, Y.Y. Li, X.D. Teng, L.M. Xu, Clinicopathologic analysis of primary synovial sarcoma of prostate, Zhonghua Bing Li Xue Za Zhi 38 (2009) 479–480.
[13] M. Sohn, T. Kwon, I.G. Jeong, S. Hong, D. You, J.H. Hong, et al., Histologic variability and diverse oncologic outcomes of prostate sarcomas, Korean J. Urol. 55 (2014) 797–801.
[14] A. Alholle, M. Karanian, A.T. Brini, M.R. Morris, V. Kannappan, S. Niada, et al., Genetic analyses of undifferentiated small round cell sarcoma identifies a novel sarcoma subtype with a recurrent CRTC1-SS18 gene fusion, J. Pathol. 245 (2018) 186–196.
[15] E. Baranov, M.J. McBride, A.M. Bellizzi, A.H. Ligon, C.D.M. Fletcher, C. Kadoch, et al., A novel SS18-SSX fusion-specific antibody for the diagnosis of synovial sarcoma, Am. J. Surg. Pathol. 44 (2020) 922–933.
[16] P. Argani, L. Zhang, Y.S. Sung, C. Bacchi, D. Swanson, B.C. Dickson, et al., Novel SS18-NEDD4 gene fusion in a primary renal synovial sarcoma, Genes Chromosom. Cancer 59 (2020) 203–208.
[17] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, SCARE Group, The SCARE 2020 guideline: updating consensus Surgical CAse REport (SCARE) guidelines, Int. J. Surg. 84 (2020) 226–230, https://doi.org/10.1016/j.ijsu.2020.10.034.