

# Scrotum solitary fibrous tumor

## A case report and review of literature

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### Abstract

**Background:** A solitary fibrous tumor (SFT) is a rare clinical tumor, often manifesting as solitary nodules. It is a rare condition that occurs in the scrotum. Currently, no study has reported this condition.

**Case summary:** We reported a case of an SFT in a 77-year-old man, and discuss its diagnosis, differential diagnosis, and treatment. Clinical and histopathological features, as well as the EnVision 2-step method, were used to diagnosis the SFT. The results of imaging tests and surgery indicated that the SFT was located in the right scrotum with 2 connected tumor nodules and a clear perimeter. The larger one was 11.0 cm × 9.3 cm × 8.1 cm, and the smaller one was 3.1 cm × 2.0 cm × 2.0 cm. Pathological results indicated that in both tumor nodules, tumor cells were spindle-shaped with unclear cell boundaries. The nucleus was vacuolated with mild to moderate atypia. In the larger tumor nodule, there were many thin-walled blood vessels with vasodilation or branching. In the smaller tumor nodule, rich blood vessels were found, mostly with fibrous degeneration of the thick walls of blood vessels, and more collagen-like tissue in the interstitial layers. Immunohistochemical results demonstrated diffuse, strongly positive expression of CD34, CD99, Vim, and Bcl-2 markers. The expression of the new fusion gene, NAB2–STAT6, as an alternative tool specifically confirmed the diagnosis of SFT. This patient underwent lump resection without further treatment. The patient is alive after 18-month follow-up.

**Conclusion:** This case was diagnosed as a SFT according to its histopathological features, immunophenotype. The patient is still alive at 18 months follow-up after the lump resection.

**Abbreviations:** CD10 = cluster of differentiation 10, CD21 = cluster of differentiation 21, CD34 = cluster of differentiation 34, CD35 = cluster of differentiation 35, CD68 = cluster of differentiation 68, CD99 = cluster of differentiation 99, CD117 = cluster of differentiation 117, CDFI = color Doppler flow imaging, CR = calretinin, EMA = epithelial membrane antigen, HMB45 = Melanoma Marker Antibody, Ki-67 = Ki-67 protein, MC = mesothelial cell, MRI = magnetic resonance imaging, NAB2 = NGFI-A binding protein 2, SFT = solitary fibrous tumor, SMA = smooth muscle actin, STAT6 = activator of transcription 6, T1 = T1-weighted scans, T2 = T2-weighted scans, T2WI = T2-weighted image.

**Keywords:** case report, scrotum, solitary fibrous tumor

## 1. Introduction

An isolated fibrous tumor is a rare mesenchymal spindle cell tumor. It was first described by Klemperer and Rabin in 1931.<sup>[1]</sup> It is very difficult to diagnose, because of its extremely rare occurrence in the scrotum, and without a structure or model of growth for reference. Thus, it is very important to make a differential diagnosis with the help of immunohistochemistry examinations, and to identify benign and malignant scrotum

tumors with other conditions. Fortunately, Chmielecki et al<sup>[2]</sup> and Robinson et al<sup>[3]</sup> introduced a new fusion gene, NGFI-A binding protein 2 (NAB2)-activator of transcription 6 (STAT6), and STAT6 as specific markers for the diagnosis of solitary fibrous tumor (SFT) in 2013. Furthermore, subsequent studies have found that the nuclear expression of STAT6 detected with immunohistochemistry can be used as an alternative tool for examining NAB2–STAT6 fusion gene expression.<sup>[4,5]</sup> Presently, no other study has reported SFT. This study reported its diagnosis, differential diagnosis, and treatment.

## 2. Case presentation

The patient provided informed consent for this case report. It was approved by the Ethics Committee of The People's Hospital of Yan'an.

A 77-year-old man was admitted to the hospital on April 3, 2016, and complained of obvious pain on the right side of the scrotum with 2 tough tumor masses and clear perimeters. The larger one was 11.0 cm × 9.3 cm × 8.1 cm, and the smaller one was 3.1 cm × 2.0 cm × 2.0 cm. Six months prior, the patient inadvertently found the right scrotum swollen. In the past nearly 2 months, the tumors increased in size rapidly with obvious pain, but no other symptoms were found. Physical examination revealed that 2 tough tumor masses touched the right side of the scrotum, with clear perimeters and normal tumorous activity. The penis and testicles were normal in appearance, except the

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**Table 1**  
**Antibodies for immunohistochemistry.**

Antigen	Clone	Firm	Species
STAT6	Polyclone	Zeta (USA)	Rabbit
CD34	QBEnd/10	Maixin (China)	Mouse
CD99	O13	Covance (USA)	Mouse
Vim	V9	Maixin (China)	Mouse
MC	HBME-1	Dako (USA)	Mouse
CR	SP13	String (USA)	Rabbit
CD10	56C6	Maixin (China)	Mouse
Bcl-2	100/D5	Epitomics (USA)	Mouse
SMA	1A4	Maixin (China)	Mouse
Actin	HHF35	Maixin (China)	Mouse
Desmin	D33	Maixin (China)	Mouse
CD117	YR45	Maixin (China)	Rabbit
S-100	4C49	Maixin (China)	Mouse
HMB45	HMB45	Cell Marque (USA)	Mouse
CD68	KP1	Maixin (China)	Mouse
EMA	E29	Maixin (China)	Mouse
CD21	EP3093	Cell Marque (USA)	Rabbit
CD35	KuN241	Cell Marque (USA)	Mouse
Ki-67	MI-1	Maixin (China)	Mouse

CD10=cluster of differentiation 10, CD21=cluster of differentiation 21, CD34=cluster of differentiation 34, CD35=cluster of differentiation 35, CD68=cluster of differentiation 68, CD99=cluster of differentiation 99, CD117=cluster of differentiation 117, CR=calretinin, EMA=epithelial membrane antigen, HMB45=Melanoma Marker Antibody, MC=mesothelial cell, SMA=smooth muscle actin, STAT6=activator of transcription 6.

penis was compressed to the left side. An ultrasound examination found that there were 2 hyporesponsive areas with clear contours, full form, and the real echo was nonuniform at the right scrotum. In addition, color Doppler flow imaging (CDFI) showed a rich blood flow signal. After that, this patient received surgical resection to treat the 2 tumor nodules.

After surgery, the resected tumors were fixed in 10% neutral formalin solution, after which they underwent conventional dehydration and paraffin embedding. They were then sliced with a thickness of 4  $\mu$ m and then prepared for hematoxylin–eosin and immunohistochemical staining. The details of antibodies for immunohistochemistry are listed in Table 1. The primary antibodies included signal transduction and STAT6, cluster of differentiation 34 (CD34), cluster of differentiation 99 (CD99),

vimentin, mesothelial cell (MC), calretinin (CR), cluster of differentiation 10 (CD10), Bcl-2 protein, smooth muscle actin (SMA), actin, desmin, cluster of differentiation 117 (CD117), S-100 protein, Melanoma Marker Antibody (HMB45), cluster of differentiation 68 (CD68), epithelial membrane antigen (EMA), cluster of differentiation 21 (CD21), cluster of differentiation 35 (CD35), and Ki-67 protein (Ki-67). All reagents were purchased from the company as shown in Table 1. Of those, STAT6 was polyclonal rabbit antihuman antibody with concentrated reagent, and dilution ratio of 1:400.

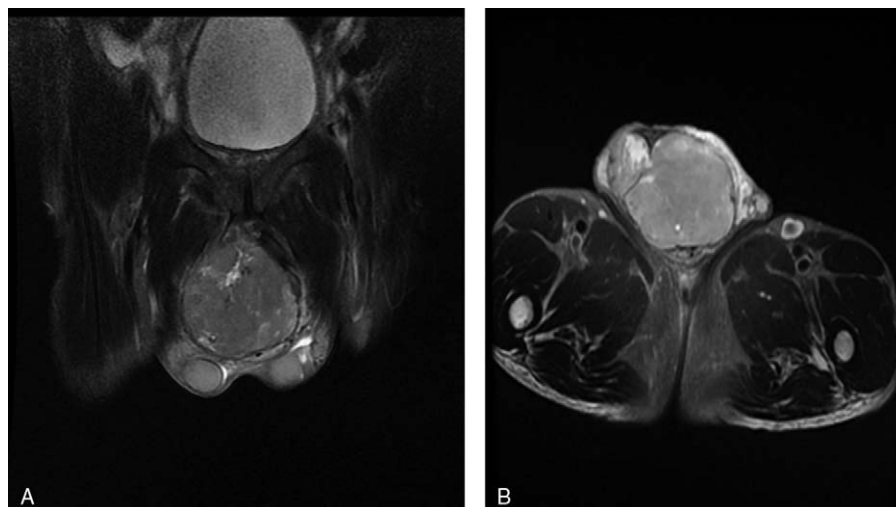
### 3. Results

Pelvic magnetic resonance imaging (MRI) results demonstrated that 2 groups of shadows with slightly longer T1-weighted scans (T1) and T2-weighted scans (T2) signals were found in the right scrotal area (Fig. 1A). The larger tumor appeared as a visible fissure with long T1 and T2 signals and patch double high signals (Fig. 1A). These signals were not uniform, and the penis was compressed to the left side. The bilateral testis and epididymis were also compressed, and bilateral epididymal T2-weighted image (T2WI) signal increased (Fig. 1B).

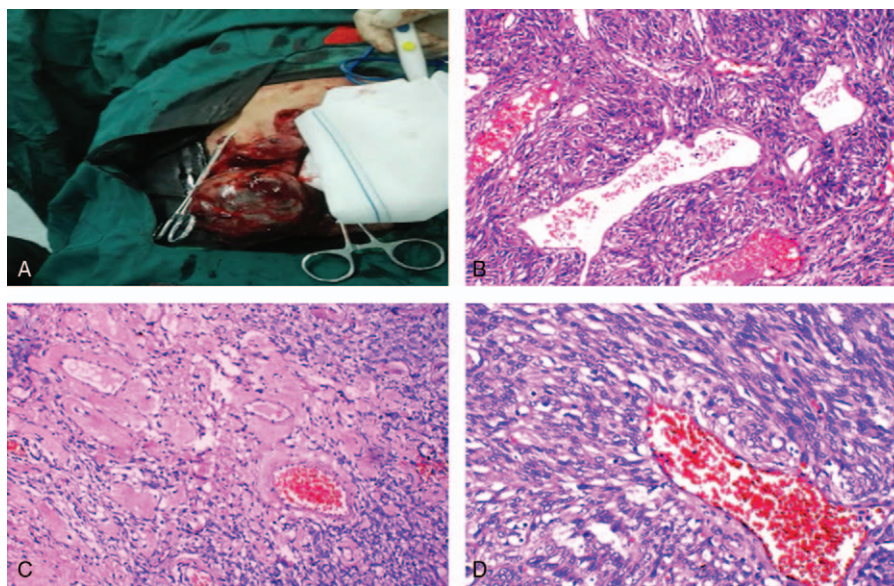
Surgery results found that 2 connected nodules located above the testis and epididymis in the right scrotum. The larger one was 11.0 cm  $\times$  9.3 cm  $\times$  8.1 cm, and the smaller one was 3.1 cm  $\times$  2.0 cm  $\times$  2.0 cm (Fig. 2A). The boundaries were clear among the nodules and the testis, epididymis, and spermine. They located at the converging junction of the abdominal oblique and transverse muscles.

Pathological results showed that there were 2 gray and red tumor nodules. The larger one was 11.0 cm  $\times$  9.3 cm  $\times$  8.1 cm, and its surface presented with a complete capsule with the delicate medium-gray surface of the resection. The smaller one was 3.1 cm  $\times$  2.0 cm  $\times$  2.0 cm without obvious surface coating. Its resection surface was gray and white, with calcification and a little luminal-like structure. The 2 tumors were connected with a small part of tissue. The smaller tumor nodule seemed to grow from the larger tumor nodule, but no adjacent tissue invasion could be observed.

Microscopic examination indicated that the 2 tumor nodules were mainly cell-rich areas, and the structure were not obvious in



**Figure 1.** Pelvic MRI scan. (A) Bulbous mass lesions at the right side of scrotum area. (B) Two connected mass-like lesions at the right side of scrotum area.



**Figure 2.** Surgical and pathological features. (A) Two tumor nodules at right scrotum area. (B) The pathological features of larger tumor. (C) The pathological features of larger tumor. (D) Tumor cells presentation with the nucleus vacuolated as mild to moderate atypia.

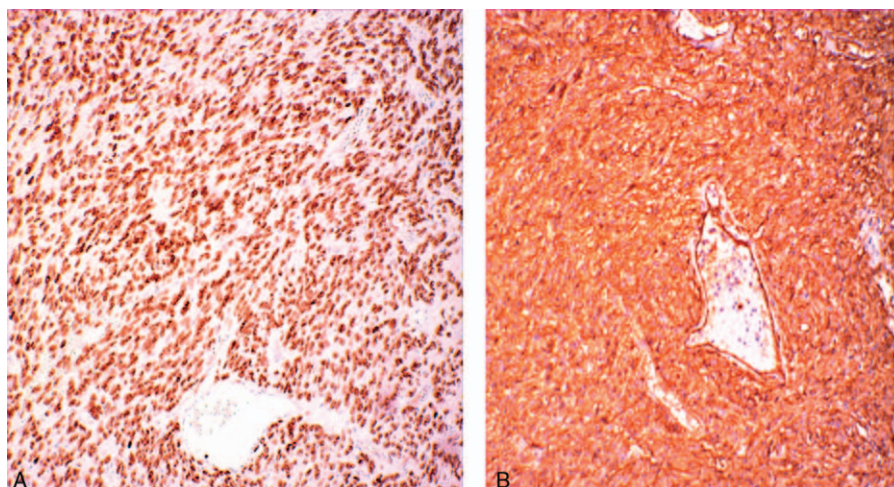
the cell-sparse area. The tumor cells were spindle-shaped with unclear boundaries. Two tumor nodules were diffusely distributed, with beam-like and seal arrangements. In the larger one, the vascular network was rich, as the thin-walled blood vessels presented with vascular dilation or branch-like expansion (Fig. 2B). In the smaller one, there were also rich blood vessels present with a small area of thin-walled vessels; most areas presented with obviously glassy degeneration, thick-walled vessels with vascular wall calcification, and more collagen-like degenerative tissue in the interstitial layer (Fig. 2C). The nucleus was vacuolated with mild to moderate atypia (Fig. 2D). The nuclear mitosis was approximately 50 HPF each.

Immunohistochemistry results demonstrated that STAT6, CD34 (Fig. 3), Bcl-2, CD99, and Vim were diffuse strong positive, while MC, CR, CD10, SMA, actin, desmin, CD117, S-100, HMB45, CD68, EMA, CD21, and CD35 were all

negative. STAT6 located in the nucleus, and Ki-67 index was as low as 1%.

#### 4. Discussion

It has been reported that SFT and hematological phenothelioma (HPC) belong to the same tumor type, because of their overlapping histology, histopathology, and clinical features.<sup>[6]</sup> In 2013, World Health Organization classified both SFT and blood vessel tumor neoplasms as SFT under the guise of bone and soft tissue tumor classifications.<sup>[7]</sup> Recent studies have further confirmed that both are the same type of tumor because of the following 2 reasons. First, almost all SFT cases display NAB2-STAT6 gene fusion.<sup>[2,3]</sup> Second, most hemangiopericytomas also display NAB2-STAT6 gene fusion and STAT6 immunohistochemical staining is localized in the nuclei of tumor cells.<sup>[8,9]</sup>



**Figure 3.** Immunohistochemical features. (A) Strong nuclear expression of STAT6 in tumor cells. (B) Strong positive expression of CD34 in tumor cells.



**Table 2****Differential diagnosis of SFT with other similar tumors.**

Tumors	Pathological morphology	Immunohistochemistry
Solitary fibrous tumor	Consists of the alternately distributed rich cell areas and sparse cell areas; no structural or no model of growth; obvious interstitial collagen fibers, rich blood vessels, vasodilatation or branching; collagen degeneration in part of the vascular walls	(+): STAT6, CD34, BCL-2, CD99 (–): desmin, calponin, SMA, calretinin, AE1/AE3, CD68
Leiomyoma	Spindle-shaped tumor cells, the core was rod-shaped, both ends blunt round with visible empty halo around nuclear	(+): Desmin, calponin, SMA; (–): CD34, S100, c-kit
Fibrous tissue proliferative mesothelioma	Bidirectional differentiation tumor cells with sarcomatoid mesothelioma background, and invasive growth; electron microscopy showed tumor cells with elongated microvilli	(+): Calretinin, MC, AE1/AE3; (–): CD34
Inflammatory myofibroblastoma	Consists of the proliferation of fat spindle cells with interstitial large number of mature inflammatory cell infiltration (including plasma cells, lymphocytes and eosinophils)	(+): SMA, desmin; (–): CD34, CD117, actin
Fibroblastoma	Consists of fibroblast-like cells and round tissue cell-like cells with seal arrangement; rare interstitial collagen fibers	(+): FXIIIa, CD68; (–): CD34, calponin, desmin

CD117=cluster of differentiation 117, CD34=cluster of differentiation 34, CD68=cluster of differentiation 68, CD99=cluster of differentiation 99, MC=mesothelial cell, SMA=smooth muscle actin, STAT6=activator of transcription 6.

The diagnosis of SFT in the scrotum is more difficult, mainly due to the rarity of SFT in the scrotum and the broadness of SFT tissue morphology. In this study, we reported SFT in the scrotum, with imaging tests revealing 2 connected tumor nodules, which is different from the usually reported single solitary nodule. Thus, the possibility that SFT in the scrotum can exhibit multinodular growth attracted our attention. Although its tissue looks like a typical SFT, it is still difficult to diagnose because the SFT has an unstructured growth pattern.

Immunohistochemistry is very important for the diagnosis of SFT. CD34 has a high sensitivity to SFT. The expression of CD34, BCL-2, and CD99 has played an important role in the diagnosis of SFT, although CD34 is not a specific marker of SFT. It has been reported that approximately 5% to 10% of typical SFT do not express CD34.<sup>[10]</sup> In 2013, Chmielecki et al introduced a novel fusion gene, NAB2–STAT6, as a marker for the diagnosis of SFT.<sup>[2,3]</sup> Subsequent studies have found that nuclear expression of STAT6 by immunohistochemistry can be used as an alternative tool for examining the expression of the NAB2–STAT6 fusion gene.<sup>[4,5]</sup> Several recent clinical data also showed that STAT6 is specific for the diagnosis of SFT.<sup>[4,5,11–14]</sup> Although the specificity of immunohistochemical markers CD34, BCL-2, and CD99 is not strong, combined STAT6 with MC, CR, CD10, SMA, actin, desmin, CD117, S-100, HMB45, CD68, EMA, CD21, and CD35 expression can be used to identify many tumors (Table 2). In this case report, more than 90% of the STAT6 nuclear, CD34, BCL-2, and CD99 expression were strongly positive, which was consistent with the expression in SFT reported in other parts of the body. The diagnosis and differential diagnosis of SFT mainly rely on histopathology and immunohistochemistry results. As for the difficult diagnosis cases, expression of the NAB2–STAT6 fusion gene can help to diagnose this condition. In this study, the combination of the pathological morphology and immunohistochemistry results are typical for SFT diagnosis. Thus, we did not conduct the NAB2–STAT6 fusion gene test.

It is reported that 80% of SFT are benign and without clinical symptoms. Of them, 20% to 30% of resected SFT specimens contain malignant components, and the greater the tumor size, the higher the possibility of tumor malignancy.<sup>[15,16]</sup> Thus, it is very important to distinguish between benign and malignant tumors. SFT with the following histological features is typical for malignancy or for SFT with aggressive clinical behavior:

increased cell density, and moderate to severe atypia in the focal zone; mitotic figures  $\geq 4/10$  HPF and/or margin infiltration; necrosis<sup>[6,5,17]</sup>; and largest tumor size with diameter  $\geq 10.5$  cm<sup>[18,19]</sup> or  $\geq 10.0$  cm.<sup>[16,20]</sup> In this study, the larger tumor nodule had a diameter of 11.0 cm, which is  $>10.5$  cm, accompanied by increased cell density and mild to moderate atypical hyperplasia. Thus, this case was diagnosed as a low-grade scrotal SFT.

SFT mostly follow benign clinical processes, with good prognosis. However, there still exists slight malignancy. In addition, although occasionally part of the histomorphology is benign, some SFT can exhibit recurrence or metastasis with unpredictable biological behavior<sup>[6,21]</sup> several years after surgery. The current treatment of SFT mainly involves surgical resection. Due to the clinical rarity of SFT, the effect of chemotherapy is still unclear for treating SFT. Additionally, no report has been published on SFT in the scrotum, and there is a lack of treatment experience. Therefore, in this study, we performed tumor resection without any additional interventions. No recurrence was detected at the 18-month follow-up. We will continue our follow-up of this case, and continue to pay attention to the development of the disease.

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