Transcatheter arterial embolization of malignant pelvic solitary fibrous tumor: case report and literature review

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Abstract: Pelvic malignant solitary fibrous tumor (SFT) is a relatively rare disease, and literature on radical resection with transcatheter arterial embolization of pelvic SFT is lacking. In this work, we report on a 55-year-old man with a presacral mass who was hospitalized at our department. Computed tomography and magnetic resonance imaging indicated pelvic space-occupying lesions that were 12 cm × 10 cm in size and pelvic lesions that were not clearly demarcated from the right posterior wall of the bladder and the right ureter. This result suggested severe secondary hydronephrosis of the right renal pelvis. The patient underwent transcatheter iliac arterial embolization. Radical tumor resection was performed, and the results of pathological examination confirmed the diagnosis of malignant pelvic SFT. There was no SFT recurrence in this patient at 1-year follow-up. Herein, we report on the treatment of a patient with malignant pelvic SFT, a rare condition, who underwent successful radical resection after transcatheter arterial embolization. Transcatheter arterial embolization can block the blood supply of the SFT as much as possible and improve the possibility of tumor resection. In the future, pelvic SFTs can be considered improving the resection rate by transcatheter arterial embolization before surgery.

Keywords: Malignant solitary fibrous tumor; transcatheter arterial embolization; case report.

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Introduction

Solitary fibrous tumor (SFT) is a rare mesenchymal tumor mainly reported in the pleura (1). Recently, an increasing number of extrapleural SFTs, including pelvic SFTs, have been found in the clinical setting. Pelvic SFTs can be either benign or malignant. Malignant pelvic SFTs are extremely rare. The clinical diagnosis and treatment of malignant pelvic SFTs are sophisticated. Herein, we report on a case with malignant pelvic SFT and systematically reviewed the literature on pelvic SFTs. From our case, we put forward novel clinical experiment that transcatheter arterial embolization of malignant pelvic SFT could improve the tumor resection rate and prognosis. We present the following article in accordance with the CARE reporting checklist (available at https://dx.doi.org/10.21037/tcr-21-887).

Case presentation

A 55-year-old man presented to our hospital with persistent lower abdominal pain. The patient was otherwise healthy, with no family history of malignant tumors. Laboratory examination results were normal. Computed tomography
(CT) and magnetic resonance imaging (MRI) indicated significant necrosis and calcification in the tumor.

Abdominal enhancement CT results indicated that there was a large mass of abnormal density behind the bladder. The pelvic mass was about 12.4 cm × 10.1 cm in size, and the CT value was 40 HU. There were multiple calcifications in the pelvic mass. Enhanced CT examination results showed slight enhanced density at the edge of the lesion (Figure 1). The 3D reconstruction of the enhanced CT is shown in Figure 2.

Pelvic MRI indicated significant abnormal signal shadows between the posterior bladder and rectum, about 12.4 cm × 9.1 cm × 8.1 cm in size (Figure 3). Inconsistent signals

![Figure 1](image1.png)
**Figure 1** The CT examination results of different planes. (A) The sign of right hydronephrosis. (B-D) Different layers of the pelvic SFT. SFT, solitary fibrous tumor.

![Figure 2](image2.png)
**Figure 2** The three-dimensional reconstruction of the enhanced CT. (A) The CT three-dimensional reconstruction of pelvic SFT. (B) The CT three-dimensional reconstruction of pelvic SFT arteries. SFT, solitary fibrous tumor.
were seen on long T1 and T2 images, and short T1 and T2 signals were seen in the lesion. A linear low-signal envelope could also be seen around the lesion. The lesion showed markedly uneven enhancement on enhanced examination. The edge of the lesion was also significantly enhanced. The boundary between the lesion and the right ureter was unclear, and the right ureter was obviously expanded. No obvious enlarged lymph node was found in the pelvic cavity.

The patient underwent transcatheter iliac arterial embolization, which obstructed the blood supply of the tumor. Tumor resection was performed, and the malignant pelvic SFT was completely removed within 1 hour.

The tumor envelope was intact, with some necrosis and calcification inside (Figure 4A). Hematoxylin and eosin

Figure 3  The MRI examination results of different planes and angles. (A,B) Sagittal plane MRI figure. (C-F) Different planes of pelvic posterior coronal MRI figure.
staining confirmed that that pelvic tumor was a malignant SFT with significant infarction (Figure 4B). As shown in Figure 5, the immunohistochemical results exhibited vimentin (−), cytokeratin (CK)-pan (focal positive), CD34 (+), CD99 (+), S-100 (−), B-cell lymphoma-2 (Bcl-2) (+), Ki-67 (+10%), P53 (+20%), CD31 (−), smooth muscle actin (−), h-Caldesmon (−), desmin (−), CD117 (−), Dog-1 (−), ALK (−), and STAT6 (+). Immunohistochemical results further confirmed the diagnosis of malignant pelvic SFT. The patient recovered well after the surgery and did not require adjuvant therapy. The patient did not accept postoperative radiotherapy or chemotherapy. The patient was followed up at 1 year, and had no recurrence of malignant SFT or lower abdominal pain symptoms. The patient was able to perform activities of daily living normally without discomfort.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the ethics committee of the First Hospital of Jilin University and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Discussion

SFT, a rare mesenchymal tumor (2), was first reported in 1931 by Klemperer and Rabin (3). It was first described as a benign variant of mesothelioma (4). Although most SFTs are benign, about 20% of SFTs are malignant. The 2013 World Health Organization (WHO) classification of soft tumor defines SFTs as hypercellular, mitotically active tumors [>4 mitosis/10 high-power fields (HPF)], with cytological atypia, tumor necrosis, and/or infiltrative margins (5). The most effective treatment for SFT is complete resection. Furthermore, postoperative adjuvant chemotherapy for malignant SFT could prevent recurrence and metastasis.

The SFT can also exhibit various forms, including osteosarcomatous and chondrosarcomatous components (6), which makes the diagnosis of SFT challenging. Radiographic diagnosis is mainly dependent on CT and MRI. The CT values and MRI signal intensity of SFTs vary depending on the amount of collagen, vascular tissue, and myxoid and cystic degeneration in the tumor (7). Different types of SFTs exhibit varying manifestations on CT and MRI. However, Li et al. concluded that there was no difference in CT and MRI findings between malignant and benign SFTs (8); therefore, CT and MRI cannot be used to diagnose SFT. Fluorodeoxyglucose positron emission tomography (FDG-PET) can also be used as a supplementary examination for malignant or benign SFT. In previous cases, malignant SFTs showed increased FDG uptake, while the uptake of benign SFTs was negative (9). The clinical behavior of SFTs is hard to predict. Therefore, many SFTs are discovered after surgical treatment (10). Postoperative pathological diagnosis is the most reliable method for distinguishing SFT from other mesenchymal tumors and is the gold standard for the diagnosis for SFT. As a rare mesenchymal tumor, SFT exhibits as “patternless” ovoid and spindle cells, while it often has a unique immunohistochemistry staining results (positive for STAT6, CD34, CD99, and Bcl-2) (9). CD34, CD99, vimentin, and Bcl-2 constitute the basic pathological diagnosis of SFT (7), and most SFTs are positive for CD34, CD99, and Bcl-2 (2). The rearrangement of NGFI-A binding protein 2 (NAB2)–STAT6 can be found in almost all SFTs, which leads to
the positive expression of STAT6 (11). STAT6 detection can increase the accuracy of SFT diagnosis. Currently, the rearrangement of NAB–STAT6 is considered as specific histological diagnostic standard for SFT. SFTs can undergo dedifferentiation transformation, and this particular type of SFT is difficult to distinguish from Ewing’s sarcoma, therefore making SFT diagnosis difficult (12). Awareness of immunohistochemical and molecular biological characteristics can help to accurately diagnose SFT.

Malignant SFTs are rare, and there are no established criteria to diagnosis malignant SFTs (13). In their study, England et al. concluded the criteria for malignant SFTs (14). As shown in Table 1, malignant SFTs have the following characteristics: (I) hypercellularity (>4 mitoses/10 HPF), (II) nuclear pleomorphism, (III) necrosis, (IV) tumor infiltrative growth, and (V) tumor size >10 cm. Although there are obvious differences between benign and malignant SFTs, some SFTs are incorrectly characterized as benign. Retrospective studies have shown that patients with benign pathological SFTs may also have recurrence after resection (5). This can be attributed to the limitations of pathological diagnosis. For indistinguishable SFTs, total

Figure 5 The immunohistochemical results. (A) H&E result of pelvic SFT; (B) Ki-67 result; (C) Bcl result; (D) CD34 result; (E) CD99; (F) CK-pan result. Magnificent 200×. SFT, solitary fibrous tumor.
Table 1 The systematic review of pelvic SFT case reports

| Reference | Gender | Location | Age  | Pathology      | Treatment                                                                 | Author                  |
|-----------|--------|----------|------|----------------|---------------------------------------------------------------------------|-------------------------|
| (15)      | Female | Pelvic;  | 37   | Malignant      | Tumor resection, sub-extensive hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy with chemotherapy | Chen et al.             |
| (16)      | Female | Uterine cervix/ left parametrium | 45   | Benign         | Radical abdominal hysterectomy with bilateral salpingo-oophorectomy and pelvic lymphadenectomy | Nowakowski et al.       |
| (7)       | Male   | Seminal vesicle | 68   | N              | Laparoscopic seminal vesicle tumor resection                              | Zhao et al.             |
| (17)      | Male   | Bladder serosa | 41   | Malignant      | Partial cystectomy                                                        | Dozier et al.           |
| (18)      | Male   | Urinary bladder | 67   | Malignant      | Partial cystectomy and segmental resection                                | Cheng et al.            |
| (19)      | Female | Urinary bladder | 24   | Benign         | Partial cystectomy with total resection of the remaining tumour tissue    | Heinzelbecker et al.    |
| (20)      | Female | Urinary bladder | 59   | Benign         | Radical cystectomy                                                        | Tzelepi et al.          |
| (21)      | Male   | Urinary bladder | 60   | Benign         | Radical prostatectomy with complete tumor excision                        | Leite et al.            |
| (2)       | Male   | Urinary bladder | 49   | Malignant      | Complete surgical resection                                                | Prunty et al.           |
| (6)       | Female | Intra-Pelvic SFT | 70   | Malignant      | Complete surgical resection                                                | Kurisaki-Arakawa et al. |
| (3)       | Female | Presacral SFT  | 52   | Benign with focally malignant feature                                   | Laparoscopic surgical resection | Kim et al. |
| (22)      | Female | Pelvic mesorectum SFT | 27   | Malignant      | Trans-sacral tumor resection                                               | Soda et al.             |
| (23)      | Male   | Prostate    | 35   | Benign         | Radical prostatectomy with partial excision of the bladder wall           | Oguro et al.            |
| (24)      | Male   | Prostate    | 21   | Benign         | Epicystotomy                                                              | Grasso et al.           |
| (25)      | Male   | Seminal vesicle | 56   | Benign         | Complete surgical resection                                                | Funahashi et al.        |
| (4)       | Female | Uterine cervix | 68   | Benign         | Robotic-assisted radical hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymph node dissection | Rahimi et al.           |
| (26)      | Male   | SFT of Pelvic | 52   | Benign         | Embolization followed by surgical resection                               | Boe et al.              |
| (27)      | Male   | Pelvic peritoneum | 61   | Malignant      | Laparotomy tumor resection                                                | Vossough et al.         |
| (10)      | Male   | Prostate    | 46   | N              | Trans Urethral Resection Prostate then nerve-sparing retropubic radical prostatectomy | Yang et al.             |
| (28)      | Female | Pelvic SFT  | 53   | Benign         | Surgical resection                                                        | Zhao et al.             |
| (29)      | Male   | Pelvic SFT  | 52   | Malignant      | Radical excision                                                          | Yan et al.              |
| (30)      | Male   | Pelvic SFT  | 71   | Malignant      | Radical prostatectomy and partial rectal excision                          | Ando et al.             |
| (31)      | Male   | Pelvic SFT  | 64   | N              | Surgical resection                                                        | Tsushimi et al.         |
| (13)      | Male   | Prostatic urethra | 68   | Malignant      | Surgical resection                                                        | Tanaka et al.           |
| (32)      | Male   | Pelvic pre-rectal tumor | 69   | N              | Previous embolization and en bloc resection                               | Garcia-Amador et al.    |

Table 1 (continued)
Table 1 (continued)

| Reference | Gender | Location        | Age | Pathology | Treatment                          | Author         |
|-----------|--------|-----------------|-----|-----------|------------------------------------|----------------|
| (33)      | Female | Mesorectum      | 56  | Malignant | Laparoscopic tumor resection        | Kawamura et al.|
| (34)      | Female | Perianal tumor  | 56  | Benign    | Trans-sacral tumor resection       | Katsuno et al. |
| (35)      | Male   | Pelvic tumor    | 52  | Malignant | Pelvic tumor resection             | Gao et al.     |

N means not mentioned. SFT, solitary fibrous tumor.

Table 2 Criteria for malignant pelvic SFT

| Malignant SFT characteristic |                                    |
|------------------------------|------------------------------------|
| 1. Presence of hypercellularity (>4 mitoses/10 HPF) | |
| 2. Nuclear pleomorphism      |                                    |
| 3. Necrosis                  |                                    |
| 4. Tumor infiltrative growth |                                    |
| 5. Tumor size >10 cm         |                                    |

SFT, solitary fibrous tumor; HPF, high-power fields.

Pelvic SFT is a rare mesenchymal carcinoma. Here, we reported on a patient with a malignant pelvic SFT. The patient indicated the first symptom to be abdominal pain. The patient underwent internal iliac artery embolization in preparation for surgery, and the tumor was completely resected. Finally, the patient recovered well with no recurrence 1 year after transcatheter arterial embolization and surgery. The take-away concept provided in this case is that transcatheter arterial embolization could be effectively block blood supply of pelvic SFT. After transcatheter arterial embolization, the pelvic SFT is easier to be removed and the got better prognosis.
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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the ethics committee of the First Hospital of Jilin University and with the Helsinki Declaration (as revised in 2013). 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 editorial office of this journal.

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