Diagnosis and surgical treatment of patients with femoral vein compression from hip joint synovial cyst

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ABSTRACT

Objective: In this study, the diagnosis and treatment of patients with femoral vein compression from a synovial cyst of the hip joint were investigated.

Methods: A retrospective study was conducted to review hospital records from March 2010 to July 2017 of patients with femoral vein compression from a synovial cyst of the hip joint. The diagnostic procedure, duplex ultrasound results, computed tomography (CT), and magnetic resonance imaging (MRI) were recorded. The method and treatment outcomes were also documented.

Results: Fifteen patients with femoral vein compression resulting from a synovial cyst of the hip joint were identified. The mean age was 47.5 years, and nine of the patients (60%) were female. All patients had unilateral lower extremity edema. In 11 patients (73.3%), the mass in the groin area could not be palpated; 2 (13.3%) patients had venous insufficiency; and 2 (13.3%) patients had venous thrombosis. All patients received a duplex ultrasound examination, 4 (26.7%) patients received CT, and 11 (73.3%) patients received MRI. One patient received a duplex ultrasound-guided percutaneous needle aspiration; however, the cyst recurred 1 month later. The remaining 14 patients received surgical excision and had no cyst recurrence during the follow-up period (mean, 22.6 months).

Conclusions: Duplex ultrasound should be selected as the first choice for screening of synovial cyst of the hip joint with femoral vein compression. Moreover, it can be used as the first choice for follow-up of these patients. MRI or CT can provide more anatomic information for surgical treatment. Surgical excision of the cyst is the preferred treatment method, with a lower rate of cyst recurrence compared with needle aspiration. (J Vasc Surg: Venous and Lym Dis 2019;7:82-9.)

Keywords: Synovial cyst; Hip joint; Femoral vein compression; Venous thrombosis

Synovial cysts most often occur in the knee or wrist joint, whereas the hip joint is a rare site of synovial cyst formation. A synovial cyst of the hip joint can cause clinical manifestations, such as edema, paresthesia, varicose veins, cold feet, and deep venous thrombosis, especially when the cyst compresses the surrounding nerves and blood vessels.[1] The hip joint synovial cyst can be easily found by inguinal physical examination when the patient presents with a painful groin mass. However, a misdiagnosis can occur if the patient presents with unilateral lower extremity symptoms without obvious symptoms of the hip joint.[2-6] In this case, the hip joint and groin area require intensive examination, including a physical examination, duplex ultrasound, and computed tomography (CT) or magnetic resonance imaging (MRI). Needle aspiration or surgical excision to remove the cyst is recommended when the compression causes symptoms.[1] However, because a synovial cyst of the hip joint with femoral vein compression is rare, diagnosis and appropriate treatment of the disease remain unclear.

In this paper, we report the diagnosis, treatment, and prognoses of patients after both needle aspiration and surgical excision of synovial cysts of the hip joint.

METHODS

Study design and participants. We retrospectively reviewed hospital records of patients from a 7-year period, March 2010 to July 2017, and selected cases that fulfilled the following criteria: diagnosis of hip joint synovial cyst; evidence of femoral vein compression obtained from an imaging examination; and receipt of either needle aspiration or surgical excision as the treatment method. We documented basic characteristics, imaging examination results, surgical procedures, and follow-up outcomes of the patients. The study protocol was approved by the hospital ethics committee. Informed consent was not obtained or required on account of the retrospective nature of the study design.

Study protocol. All patients had a synovial cyst of the hip joint confirmed by CT or MRI before treatment. The time at disease onset and clinical symptoms were

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Author conflict of interest: none.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2213-333X

https://doi.org/10.1016/j.jvsv.2018.06.013

documented. The physician had discussed each case with the patient and decided which treatment method to employ: needle aspiration or surgical excision. The difference of thigh circumference between the affected side and the healthy side was measured at admission (the circumference at 15 cm above the upper margin of the patella was measured). On the seventh postoperative day, the same method was again used.

One patient received percutaneous puncture therapy guided by duplex ultrasound in accordance with the patient's decision. As soon as the needle tip reached the cyst, the fluid was aspirated until the cyst was emptied and collapsed. The aspirated cyst fluid was sent for pathologic examination.

For patients deciding to undergo surgical excision, a longitudinal incision was made along the femoral artery at the center of the groin area under general anesthesia. After dissection of the subcutaneous tissue, a tough cyst without pulsation could be palpably located below the femoral vein and close to the hip joint, with varying degrees of compression on the femoral vein. When the cyst was removed, it was found to have had contact with the hip capsule. The connection was sutured after excision. Extrusion of the hip joint capsule and flexion of the hip joint were performed to confirm that there was no joint capsule fluid leakage. The intraoperative anatomic relationship is shown in Fig 1. All tissues resected during the surgical excision were sent for pathologic examination.

In addition to surgical excision of the cyst, great saphenous vein ligation and varicose vein stripping were performed in patients with great saphenous vein insufficiency. For patients with deep venous thrombosis, one patient received femoral venous thrombectomy. One patient initially had placement of a vena cava filter and catheter-directed thrombolysis treatment. The thrombus was almost completely resolved 3 days later. Surgical resection of the cyst was then performed.

Moderate activity by the patient was encouraged and began the day after the operation. All patients received low-molecular-weight heparin (LMWH) during hospitalization. Thirteen patients without deep venous thrombosis were switched to aspirin for 3 months after discharge. Warfarin was taken for 3 months, and the international normalized ratio was between 2 and 3. Aspirin was then taken for 3 months by two patients with deep venous thrombosis. Patients with lower extremity venous insufficiency received elastic pressure bandage compression therapy for 3 to 6 months.

The group of 15 patients was examined for rheumatoid immune biochemical indicators, positive indicators, or a history of rheumatism through consultation with the rheumatology department or orthopedics department. It was generally recommended to give eloricoxib tablets, glucosamine hydrochloride tablets, or methotrexate orally. Patients with osteoarthritis received eloricoxib tablets (30 mg/d orally) and glucosamine hydrochloride tablets (0.75 g twice daily orally) for 2 months. Patients with rheumatoid arthritis received eloricoxib tablets (30 mg/d orally) and methotrexate (15 mg/d orally). If the patient did not have pain, use of eloricoxib tablets could be stopped. The patient's liver and kidney function had to be regularly assessed, and the amount of methotrexate was adjusted until the maximum tolerated dose was reached.

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center retrospective cohort study
- **Take Home Message:** Fourteen patients with femoral vein compression by a hip joint synovial cyst, diagnosed with ultrasound, magnetic resonance imaging, or computed tomography, were treated with surgical excision with edema improvement and no recurrence at a mean of 22.6 ±18.2 months.
- **Recommendation:** We recommend magnetic resonance imaging for definitive diagnosis of a synovial cyst of the hip joint compressing the femoral vein and surgical excision of the cyst in symptomatic patients.

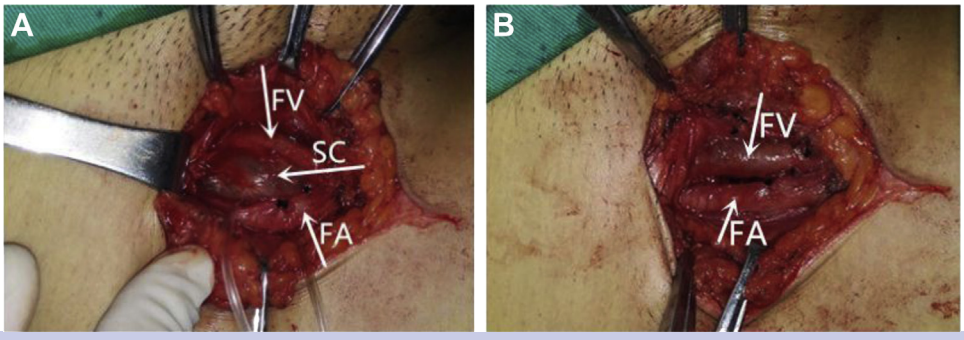

Fig 1. A, Intraoperative surgical field shows the anatomy of the synovial cyst (*SC*), femoral artery (*FA*), and femoral vein (*FV*), with the femoral vein compressed posteriorly by the synovial cyst. **B**, The anatomic relationship after cyst excision.

Table. Clinical characteristics of the patients

Case No.	Age, years	Sex	Causes	Symptoms
1	36	Female	Unknown	Edema
2	23	Female	Unknown	Edema
3	35	Female	Rheumatoid arthritis	Groin mass, edema
4	30	Female	Unknown	Edema
5	51	Female	Rheumatoid arthritis	Groin mass, edema
6	58	Male	Rheumatoid arthritis	Edema
7	51	Female	Osteoarthritis	Edema, varicose veins
8	42	Female	Osteoarthritis	Edema
9	57	Female	Unknown	Groin mass, edema
10	59	Male	Rheumatoid arthritis	Edema, venous thrombosis
11	61	Male	Unknown	Edema
12	58	Male	Rheumatoid arthritis	Edema, venous thrombosis, varicose veins
13	31	Female	Unknown	Edema
14	58	Male	Osteoarthritis, hip replacement	Edema
15	62	Male	Osteoarthritis, hip replacement	Groin mass, edema

CT, Computed tomography; *MRI,* magnetic resonance imaging.

Study outcomes. Follow-up of the patients was conducted at 1 month, 3 months, 6 months, and 12 months after discharge from the hospital, followed by an annual review. A duplex ultrasound examination was also performed to estimate the blood flow and venous thrombosis of the lower extremity. The circumference at 15 cm above the upper margin of the patella was measured (cure: difference of <1 cm in the affected leg and the contralateral leg; improvement: difference of 1-3 cm; no effect: difference of >3 cm).

RESULTS

Fifteen patients were identified. The mean age was 47.5 years (standard deviation, 13.3 years), and nine of the patients (60%) were female. Of the15 patients, 5 patients had rheumatoid arthritis, 4 patients had osteoarthritis, and 2 patients had hip replacement. All patients presented with clinical symptoms of lower leg edema and femoral vein compression based on a duplex ultrasound, CT, or MRI examination. Four patients could touch the mass in the groin area, two had venous insufficiency (Clinical, Etiology, Anatomy, and Pathophysiology [CEAP] class 3), and two had venous thrombosis. The patients' clinical details are listed in the Table.

At admission, the circumference difference of the 15 patients ranged from 2.5 to 9.2 cm, with an average of 4.7 cm. In none of the 15 cases was the circumference difference <1 cm; in one case, it was 1 to 3 cm; and in 14 cases, it was ≥3 cm. On the seventh postoperative day, of the 14 surgical patients, there were 13 cases with a difference of <1 cm and 1 case with a difference of 1 to 3 cm. The difference of the patient undergoing percutaneous puncture therapy was 2.7 cm.

Fourteen patients received surgical excision treatment and one received needle aspiration. The average follow-up time was 22.6 months (standard deviation, 18.2 months). All patients who underwent surgical excision had satisfactory prognoses with no recurrence of the clinical symptoms during the follow-up period. The duplex ultrasound examination conducted during the follow-up visits did not reveal venous thrombosis in these patients. The one patient who received needle aspiration had a recurrence of the leg edema symptom 1 month later. The leg circumference difference between the affected side and the healthy side was 4.8 cm (15 cm above the upper border of the patella). During this follow-up period, surgical excision was recommended but was declined. The following conservative treatments were employed: bed rest, wearing of an elastic compression stocking, taking LMWH, and injection of safflower and horse chestnut seed extract. The patient was discharged from the hospital when the clinical symptoms improved.

DISCUSSION

Femoral vein compression from a hip joint synovial cyst has a low incidence. According to a PubMed search, there are only 31 cases worldwide of a hip joint synovial cyst pressing on the femoral vein.[2-4,6,7] Synovial cysts

Table. Continued.

Confirmatory study	Treatment procedure	Follow-up period, months	Recurrence	Received special drugs
Duplex ultrasound, CT	Surgical excision	22	No	No
Duplex ultrasound, MRI	Surgical excision	24	No	No
Duplex ultrasound, CT	Surgical excision	10	No	Eloricoxib tablets, methotrexate
Duplex ultrasound, MRI	Surgical excision	25	No	No
Duplex ultrasound, MRI	Surgical excision	34	No	Eloricoxib tablets, methotrexate
Duplex ultrasound, MRI	Surgical excision	24	No	Eloricoxib tablets, methotrexate
Duplex ultrasound, MRI	Surgical excision	5	No	Eloricoxib tablets, glucosamine hydrochloride tablets
Duplex ultrasound, MRI	Surgical excision	6	No	Eloricoxib tablets, glucosamine hydrochloride tablets
Duplex ultrasound, MRI	Surgical excision	13	No	No
Duplex ultrasound, MRI	Surgical excision	39	No	Eloricoxib tablets, methotrexate
Duplex ultrasound, MRI	Surgical excision	52	No	No
Duplex ultrasound, MRI	Catheter-directed thrombolysis and surgical excision	19	No	Eloricoxib tablets, methotrexate
Duplex ultrasound, MRI	Surgical excision	2	No	No
Duplex ultrasound, CT	Surgical excision	63	No	No
Duplex ultrasound, CT	Needle aspiration	1	Yes	No

are benign and fluid-filled pouches caused by the leakage of synovial fluid from the joint capsule to the surrounding tissue. Common causes include rheumatoid arthritis, osteoarthritis, and joint injury.[7,8] With persistent inflammatory stimulation in the joint cavity, excessive synovial fluid is secreted, and the pressure in the joint cavity gradually increases. The weakest part of the joint capsule ultimately bulges outward, forming a fluid-filled sac called a synovial cyst.

Patients affected by this disease present to the clinic with various symptoms. At the early stage of the disease, local groin swelling and pain may be the common chief complaints.[1] When the synovial cyst compresses the nerve, the patient can have radicular pain and burning sensations. With a synovial cyst compressing the femoral artery, lower extremity ischemia can develop. Byström et al[9] described a synovial cyst in the right hip of a 75-year-old woman that compressed her femoral artery, which caused pain and coldness in her right foot. These symptoms were accompanied by discomfort in the groin area. During operation of this patient, the cyst was found to be in contact with the hip capsule. The symptoms of the right foot were significantly improved after surgery. A synovial cyst compressing the femoral vein, lower extremity edema, varicose veins, and deep venous thrombosis can develop.

Besides the synovial cyst, other diseases, such as hemangioma, lymphangioma, femoral vein adventitial cyst, local malignant disease, and iliac vein compression syndrome (May-Thurner syndrome), can also cause compression of the nerves or vessels, resulting in clinical symptoms similar to those caused by synovial cyst of the hip joint.[10] Diagnostic tests for synovial cyst include CT, MRI, venography, and duplex ultrasound imaging studies. Duplex ultrasound may be selected as the first choice for screening for synovial cyst because it is inexpensive, accessible, and convenient. The most common symptom in patients with femoral vein compression is edema of the lower extremities. All patients in the study group had unilateral lower extremity edema, with the most necessary exclusion being the possibility of lower extremity deep venous thrombosis. By employing duplex ultrasound, the clinician can view the blood flow and wall of the femoral vein as well as check the external pressure compression.[11] At the same time, it is possible to exclude the formation of deep venous thrombosis of the lower extremities. When the femoral vein is compressed, it can be observed that the diameter of the tube is narrow, the blood flow velocity in the narrow tube accelerates, and the distal flow velocity is slower. The best criterion for detection by duplex ultrasound of >50% stenosis is a post-stenotic to prestenotic peak vein velocity ratio of 2.5.[11] Accordingly, the situation around the femoral vein can be visualized. However, it cannot clearly distinguish the specific anatomic relationship between external pressure tissue and the femoral vein. Venography can show the blood flow and stenosis of the vessel as well as visualize the function of the venous valve; however, it cannot identify the causes of the stenosis (Fig 2). CT and MRI not only show the cystic

Fig 2. Preoperative venography shows the contrast material filling defect (*arrow*), which is caused by compression from the adjacent synovial cyst.

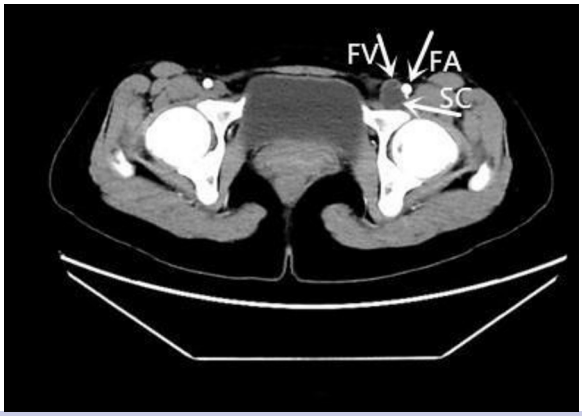

Fig 3. Preoperative computed tomography (CT) of the hip joint shows the relationship between the left synovial cyst (*SC*), femoral artery (*FA*), and femoral vein (*FV*), with the femoral vein compressed by the synovial cyst.

lesion but can also identify its relationship with surrounding soft tissues, including femoral nerves and vessels.[12] CT can reveal that the cyst has a lower attenuation than the muscle, and the attenuation is easily discernible from fatty tissue (Fig 3). Furthermore, CT scan with intravenous administration of contrast material can show the wall of the cyst with enhanced density.[13] MRI is superior to other imaging modalities for soft tissue abnormalities, especially for demonstrating the exact location and extent of the lesions around the cyst.[1,14] An MRI scan with T2-weighted images is a better diagnostic choice because it can provide better and detailed images on the structure of the cyst and surrounding anatomy without radiation exposure (Fig 4). Accordingly, a circular or oval cyst with moderate to low signal intensity on a T2-weighted image can be observed.[13,14] The specific diagnosis of the disease is shown in Fig 5.

The definitive diagnosis of a synovial cyst of the hip joint depends on the pathologic examination of the excised cystic tissue (Fig 6). Differential diagnosis should be made to ensure that it is not the result of hemangioma, lymphangioma, or malignant disease. In addition, histologic examination cannot distinguish the synovial cyst and the adventitial cyst because both diseases have a common tissue origin.[15] The differentiation between these two diseases can be made during the surgical operation. The synovial cyst is usually connected to the hip joint capsule, and it is easily separated from the femoral vessels. The adventitial cyst is connected to the femoral vessels, and reconstruction of the femoral vessels is commonly required after removal of the adventitial cyst. In this study, all of the synovial cysts were found to be connected to the hip joint capsule. No femoral vessel reconstruction was required.

We conclude that there are four aspects to be given attention in diagnosis of the disease.

1. The patient's medical history is generally slightly longer and has sudden symptoms, such as edema or pain.
2. The clinical manifestations of patients are often unilateral limb swelling.
3. Some of these patients have other chronic diseases, such as rheumatoid arthritis and osteoarthritis. Alternatively, they have a history of a hip replacement.
4. MRI or CT auxiliary diagnosis is required.

Management of synovial cyst of the hip joint depends on the size of the cyst, the clinical symptoms, and the patient's comorbidities. Routine clinical follow-up is recommended for patients with no symptoms.[16] If the patient has symptoms of local swelling and pain from the synovial cyst caused by rheumatoid arthritis, prednisone and methotrexate could be used to decrease the inflammation and to relieve the symptoms.[17,18] When the synovial cyst enlarges and starts to compress the nerve, vessels, and ureter, causing clinical symptoms, needle aspiration or surgical excision is usually required. Among the 27 cases summarized by Colasanti et al,[2] 8 patients were treated with aspiration and the remaining 19 patients were treated by surgical removal of the cyst. Of the eight patients, three (37%) had recurrence of the lower extremity symptoms, whereas only one case of surgical treatment (5%) had a relapse. In this study, 14 patients who

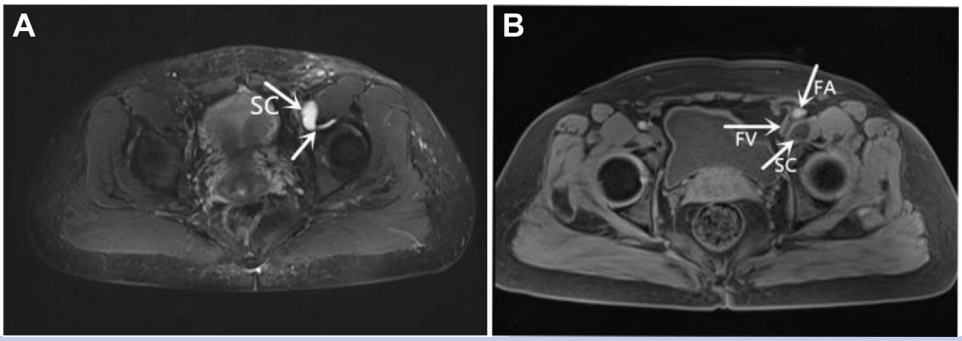

Fig 4. Preoperative magnetic resonance imaging (MRI) of the hip joint. **a,** Relationship between left synovial cyst (*SC*) and hip joint capsule. The synovial cyst shows high-density signals in T2 images. The *arrow* without a label shows the tear in the joint capsule. **b,** Relationship between the left synovial cyst (*SC*), femoral artery (*FA*), and femoral vein (*FV*), with the femoral vein compressed by the synovial cyst.

received surgical excision had no cyst recurrence during the follow-up period (average, 22.6 months). The one patient who received needle aspiration had cyst recurrence 1 month after the procedure. The cause of recurrence was the formation of cystic fluid in the synovial cyst. This suggests that surgical excision is a better treatment option for patients with clinical symptoms due to the synovial cyst.

Some authors have suggested that an intravascular stent can be placed inside the compressed vessels in these patients. However, the stent could further slow the blood flow in the lower extremity vessels and increase the risk for thrombosis. In addition, the intravascular stent placement cannot remove the extravascular compression from a cyst. With disease development, the cyst would increase, which could cause restenosis

Fig 5. Procedure for diagnosis of the disease. *CT,* Computed tomography; *MRI,* magnetic resonance imaging.

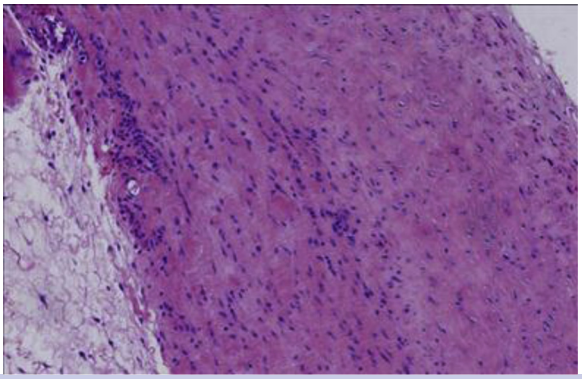

Fig 6. Microscopic examination of the cystic wall structure composed of fibrous connective tissues, which was considered to be the synovial cyst (hematoxylin and eosin stain, magnification ×100).

of the vessels.[19] Thus, we do not recommend intravascular stent placement.

During surgical excision, we recommend that particular attention be given to four aspects.

1. The cyst should be gently separated from the adjacent tissue to avoid damaging the surrounding nerves and vessels.
2. After cystic resection, the tear of the hip joint capsule should be repaired to prevent a recurrence.
3. For patients with lower extremity deep venous thrombosis, thrombolysis could be applied before surgical excision.
4. In patients with lower extremity venous insufficiency, saphenous vein ligation and varicose vein stripping can be simultaneously performed during the surgical cyst excision to decrease the length of the hospital stay and thus to reduce the medical expense (the CEAP class is ≥3).

In our study group, one patient who received needle aspiration had a recurrence of the leg edema symptom 1 month later. We recommend surgical excision; however, the patient declined. We therefore employed conservative treatments: bed rest, wearing of an elastic compression stocking, taking LMWH, and injection of safflower and horse chestnut seed extract. The safflower injection significantly prolonged activated partial thromboplastin time in normal human plasma in vitro. However, it had no obvious influence on prothrombin time with respect to its efficacy in promoting blood circulation in dissipating blood stasis.[20] Horse chestnut seed extract has anti-inflammatory properties, promotes venous return, and reduces swelling and pain in affected limbs.[21] The patient was discharged after the edema of his lower limbs improved. Thus, we recommend these conservative treatments for patients who have surgical indications but refuse surgery.

CONCLUSIONS

We suggest that clinicians rule out femoral vein compression from synovial cyst of the hip joint in patients with unilateral lower extremity edema, venous insufficiency, or thrombosis, especially in patients with a medical history of rheumatoid arthritis, osteoarthritis, or joint trauma. Duplex ultrasound can be used as the first choice for screening of such diseases. It also can be used as the first choice for follow-up of these patients. MRI or CT can provide an effective guide for surgical treatment. Surgical excision should be the first treatment option in these patients because postoperative clinical symptoms improved and the recurrence rate of cysts was low. The limitations of this study include its inherent biases from the retrospective analysis, the small sample size, and the single-center study.

AUTHOR CONTRIBUTIONS

Conception and design: YY, CZ, NC, BS, XG
Analysis and interpretation: YY, CZ, DZ, SW, XG
Data collection: YY, CZ, DZ
Writing the article: YY
Critical revision of the article: YY, CZ, DZ, NC, BS, SW, XG
Final approval of the article: YY, CZ, DZ, NC, BS, SW
Statistical analysis: DZ, NC
Obtained funding: Not applicable
Overall responsibility: XG
YY and CZ contributed equally to this article and share co-first authorship.

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Submitted Nov 7, 2017; accepted Jun 7, 2018.