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Adult sacrococcygeal teratoma: a retrospective study over eight years at a single institution*

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Abstract: Objective: To determine the clinical, imaging, and histological features, and surgical resection modalities and outcomes of adult sacrococcygeal teratoma (SCT). Methods: Adult patients with histopathologically diagnosed SCT were enrolled in our hospital between August 2010 and August 2018. Each patient's characteristics and clinical information were reviewed. Results: There were 8 patients in the study (2 males, 6 females) with a median age of 34 years (range, 18–67 years). The time to clinical symptoms was 14 d to 35 years, with a median time of 4 years. Six patients presented with symptoms of sacrococcygeal pain, and four with signs of sacrococcygeal mass and ulceration in the sacrococcygeal region. Six patients were evaluated using a combination of computed tomography (CT) and magnetic resonance imaging (MRI). All patients showed a presacral tumor with heterogeneous intensity on CT images. All patients underwent surgical treatment, including 6 parasacral, 1 transabdominal, and 1 combined anterior-posterior surgery cases. Seven patients were histopathologically diagnosed with benign mature SCT, and have shown no recurrence. One patient had malignant SCT, with recurrence at 84 months after surgery. After a second surgery, the patient had no recurrence within 6 months follow-up after re-resection. Conclusions: Our retrospective study demonstrated: (1) adult SCT is difficult to diagnose because of a lack of typical clinical symptoms and signs; (2) a combination of CT and MRI examination is beneficial for preoperative diagnosis; (3) the choice of surgical approach and surgical resection modality depends on the size, location, and components of the tumor, which can be defined from preoperative CT and MRI evaluation; (4) most adult SCTs are benign; the surgical outcome for the malignant SCT patient was good after complete resection. Even for the patient with recurrent malignant SCT, the surgical outcome was good after re-resection.

Key words: Sacrococcygeal teratoma (SCT); Clinical features; Computed tomography (CT); Magnetic resonance imaging (MRI); Surgical resection modality
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1 Introduction

Sacrococcygeal teratoma (SCT) is a neoplasm arising in the intrapelvic space or sacrococcygeal region, and contains tissue derived from one or more of the three primordial germ cell layers (Varma et al.,

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2017). SCT is a rare tumor that presents predominantly in neonates with a prevalence of between 1 in 15000 and 1 in 40000 live births (Kremer et al., 2015). Most SCTs can be found in prenatal diagnosis, 50%–70% within a few days after birth, and about 10% after age 2 years (Luk et al., 2011). Adult SCT is extremely rare with a rate between 1 in 40000 and 1 in 63000, and with a female:male predominance of 3:1 (Sukhadiya and Das, 2015). Most SCTs are benign. The malignancy rate increases with age, and the incidence of malignant transformation in adults is 40%–50%.

Most SCTs are asymptomatic and often found only by physical examination. The symptoms of adult SCT depend on the compression effect of the tumor on surrounding tissues, resulting in corresponding defecation or urination symptoms, or pain or puffiness of the perineum or sacral tail. The diagnosis depends on physical examination and related diagnostic imaging. Complete surgical resection remains the preferred treatment modality for SCT. Incomplete or intralesional resection may increase the possibility of malignant transformation. Few institution case series regarding diagnostic imaging, surgical modalities, and surgical outcomes of adult SCT have been reported. Therefore, the aim of this study was to determine: (1) the clinical features of adult SCT; (2) the diagnostic imaging features; (3) surgical resection modalities; (4) histological features; (5) surgical outcomes, from our single institution experience over an 8-year period.

2 Patients and methods

This retrospective study was approved by the Institutional Ethics Review Board of Zhejiang University (Hangzhou, China). All patients reviewed were more than 18 years of age with SCTs histopathologically confirmed in our hospital between August 2010 and August 2018. Six of the eight patients were evaluated using a combination of computed tomography (CT) and magnetic resonance imaging (MRI). The other two patients were evaluated using CT without MRI. CT and MRI images were interpreted by a radiologist (Jing-peng LIU) with 15 years' experience in pelvic CT and MRI.

Each patient's characteristics (age, sex), clinical features (symptoms, signs, tumor markers, Altman classification (types I–IV)), diagnostic imaging features (CT, MRI), surgical resection modalities (single-stage resection, multi-stage resection, resection of coccyx, complete resection of tumor), histological features (mature, immature, malignant, primary tumor size), and surgical outcomes (recurrence, overall survival) were reviewed and recorded. According to the Altman Classification (Szyllo and Lesnik, 2013), SCT tumors are of four types: type I, predominantly external; type II, predominantly external, but have a small intrapelvic component; type III, predominantly intrapelvic, with a small external mass; and type IV, entirely internal, otherwise known as retrorectal or presacral teratomas.

A multidisciplinary approach was applied to manage each patient. Generally, the lesions need to be removed completely to achieve clear resection margins (R0). Tumors that extend above the third sacral body (S3) require an anterior approach (transabdominal), whereas those below S3 are removed using a posterior-only approach (parasacral). A combined anterior-posterior approach is used for large tumors that cannot be removed completely through a single incision. In addition, for patients with huge tumors, multi-stage resection can be used rather than single-stage resection (Sheng et al., 2015).

3 Results

Eight patients (Table 1) were identified, of whom six were female. The mean age was 34 years (range, 18–67 years). One patient, who had been operated on previously for sacrococcygeal teratoma, was offered resection for recurrent disease. Six patients presented with symptoms of sacrococcygeal pain, and four with signs of sacrococcygeal mass and ulceration in the sacrococcygeal region. The time to clinical symptoms was 14 d to 35 years, and the median time was 4 years. One patient was discovered incidentally without any symptoms or signs.

All patients showed a presacral tumor with heterogeneous intensity on CT images. CT images (Table 2) revealed fat tissue with characteristic CT values (−80 to −20 Hounsfield units (HU)) in all eight patients (Figs. 1a, 1b, 2a, and 3a), cystic components (both clear and hemorrhagic) in all eight patients (Figs. 1a, 1b, 2a, and 3a), and calcium with

characteristic CT values (80–300 HU) in two patients (Figs. 2a and 3a). The corresponding diagnostic imaging features of fat tissue (Figs. 1c, 1d, 2b–2e, and 3b–3e) and cystic components (Figs. 1c, 1d, 2b–2e, and 3b–3e) were also confirmed with MRI.

Seven patients underwent single-stage resection and one patient underwent multi-stage resection to achieve complete resection of the teratoma (Table 3). Six patients were treated with parasacral surgery, one with transabdominal surgery, and one with a combined anterior-posterior surgical approach. Three cases were resected with the coccyx, and two were resected with the fifth sacrum (S5). There were no perioperative deaths. Most patients were histopathologically diagnosed with benign mature SCTs (Figs. 2 and 3), and there has yet been no recurrence. One patient was histopathologically diagnosed with malignant SCT, and recurrence at 84 months after surgery. After a second surgery, the patient had no recurrence with 6 months of follow-up after re-resection.

Table 1 Clinical features of adult SCT patients

Case	Sex	Age (year)	Symptom	Sign	Duration	Altman's type
1	F	67	Sacrococcygeal pain	Sacrococcygeal mass and ulceration in the sacrococcygeal region	4 years	III
2	F	39	Sacrococcygeal pain	Sacrococcygeal mass and ulceration in the sacrococcygeal region	35 years	III
3	M	21	Sacrococcygeal pain	Sacrococcygeal mass and ulceration in the sacrococcygeal region	6 months	III
4	M	49	Sacrococcygeal pain	Constipation	2 weeks	II
5	F	21	Sacrococcygeal pain	Constipation	1 month	II
6	F	23	Dysuresia	Urinary retention	4 years	II
7	F	34	No symptom	Incidental note	2 weeks	IV
8	F	18	Sacrococcygeal pain	Sacrococcygeal mass and ulceration in the sacrococcygeal region	18 years	III

F: female; M: male

Table 2 Typical CT and MRI characteristics of adult SCT patients

Case	CT			MRI		
	Fat	Cyst	Calcium	Fat	Cyst	Calcium
1	+	+	−	+	+	−
2	+	+	−	+	+	−
3	+	+	+	+	+	−
4	+	+	−			
5	+	+	−	+	+	−
6	+	+	−			
7	+	+	−	+	+	−
8	+	+	+	+	+	−

+: positive imaging features; −: negative imaging features

Table 3 Surgical resection modalities, histological features, and surgical outcomes of adult SCT patients

Case	Single- or multi-stage resection	Surgical approach	Resection of coccyx	Resection of sacrum	Pathology	Surgical outcomes
1	Single-stage resection	Combined anterior-posterior approach	No	No	Malignant SCT	Recurrence at 84 months after surgery
2	Single-stage resection	Parasacral	Yes	Yes (S5)	Mature SCT	No recurrence
3	Single-stage resection	Parasacral	No	No	Mature SCT	No recurrence
4	Single-stage resection	Transabdominal	No	No	Mature SCT	No recurrence
5	Multi-stage resection	Parasacral	Yes	Yes (S5)	Mature SCT	No recurrence
6	Single-stage resection	Parasacral	Yes	No	Mature SCT	No recurrence
7	Single-stage resection	Parasacral	No	No	Mature SCT	No recurrence
8	Single-stage resection	Parasacral	No	No	Mature SCT	No recurrence

S5: fifth sacrum

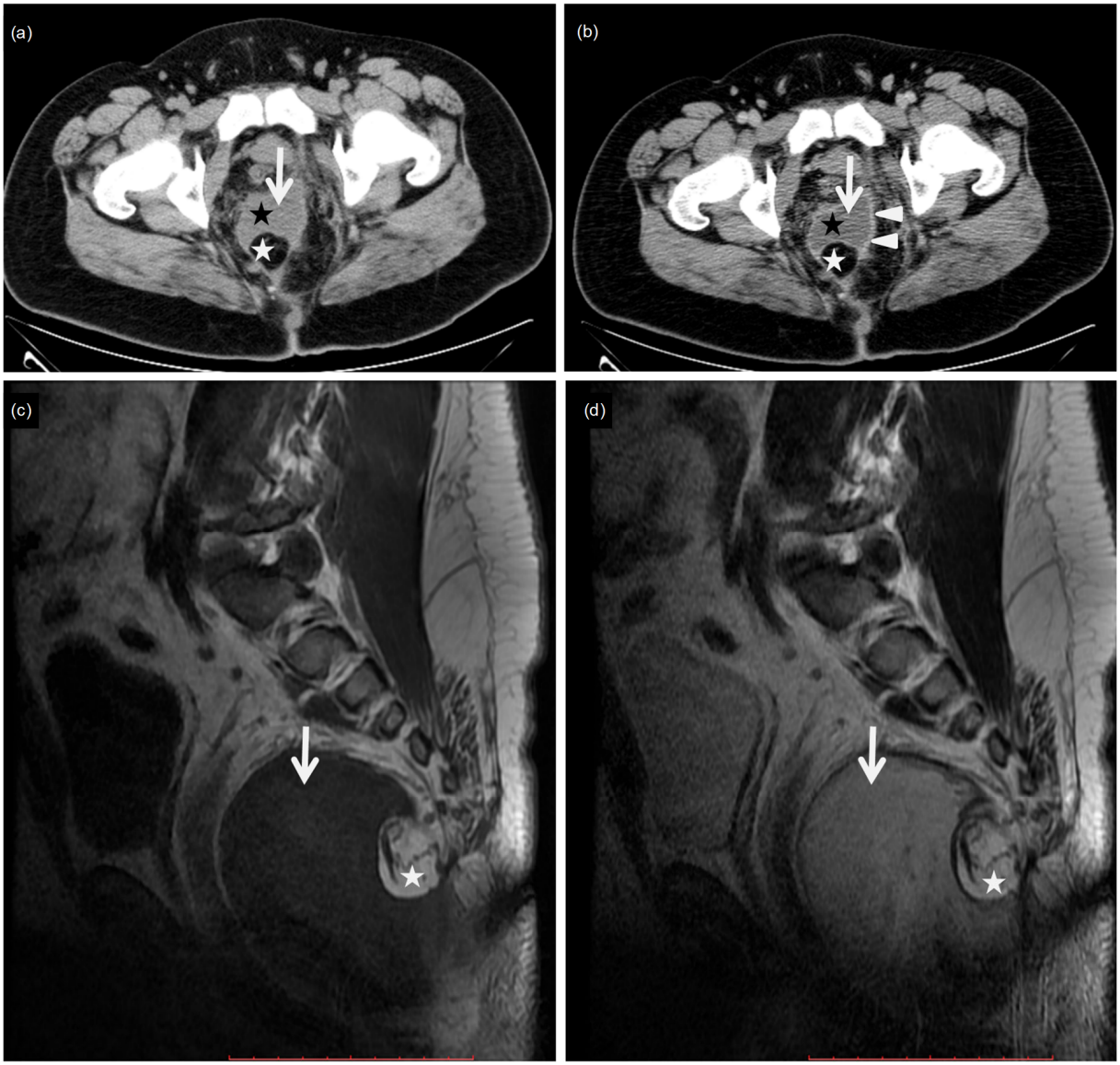

Fig. 1 Pelvic CT and MRI images of a 21-year-old male patient with a benign mature SCT

(a, b) Axial CT images of the pelvis show the mass (arrows) in the sacrococcygeal area, containing fat (white asterisks, CT values: −80 to −20 HU) and cystic components (dark asterisks). Axial enhanced CT image of the pelvis shows that the wall of the presacral mass (arrowheads) was slightly enhanced. (c, d) Sagittal MRI images of the pelvis show a large heterogeneous presacral mass (arrows) containing fat (white asterisks) with high signal intensity on T1-weighted image (c) and T2-weighted image (d), and cystic components (arrows) with low signal intensity on T1-weighted image (c) and high signal intensity on T2-weighted image (d)

4 Discussion

Adult SCT is relatively rare. We found only eight cases over eight years old who underwent surgery at our hospital. As in the study of Sukhadiya and Das (2015), we found a female:male preponderance of 3:1.

As reported in the literature (Emoto et al., 2018), many SCTs in adults are asymptomatic and often found on physical examination or by chance during imaging studies. However, in our study most patients complained of sacrococcygeal pain, and only one patient had no symptoms. In other words, it is difficult to diagnose SCT without clinical symptoms and signs, especially for patients with a small tumor mass, or classified with type IV of the Altman classification, which is entirely internal. In our study, only one

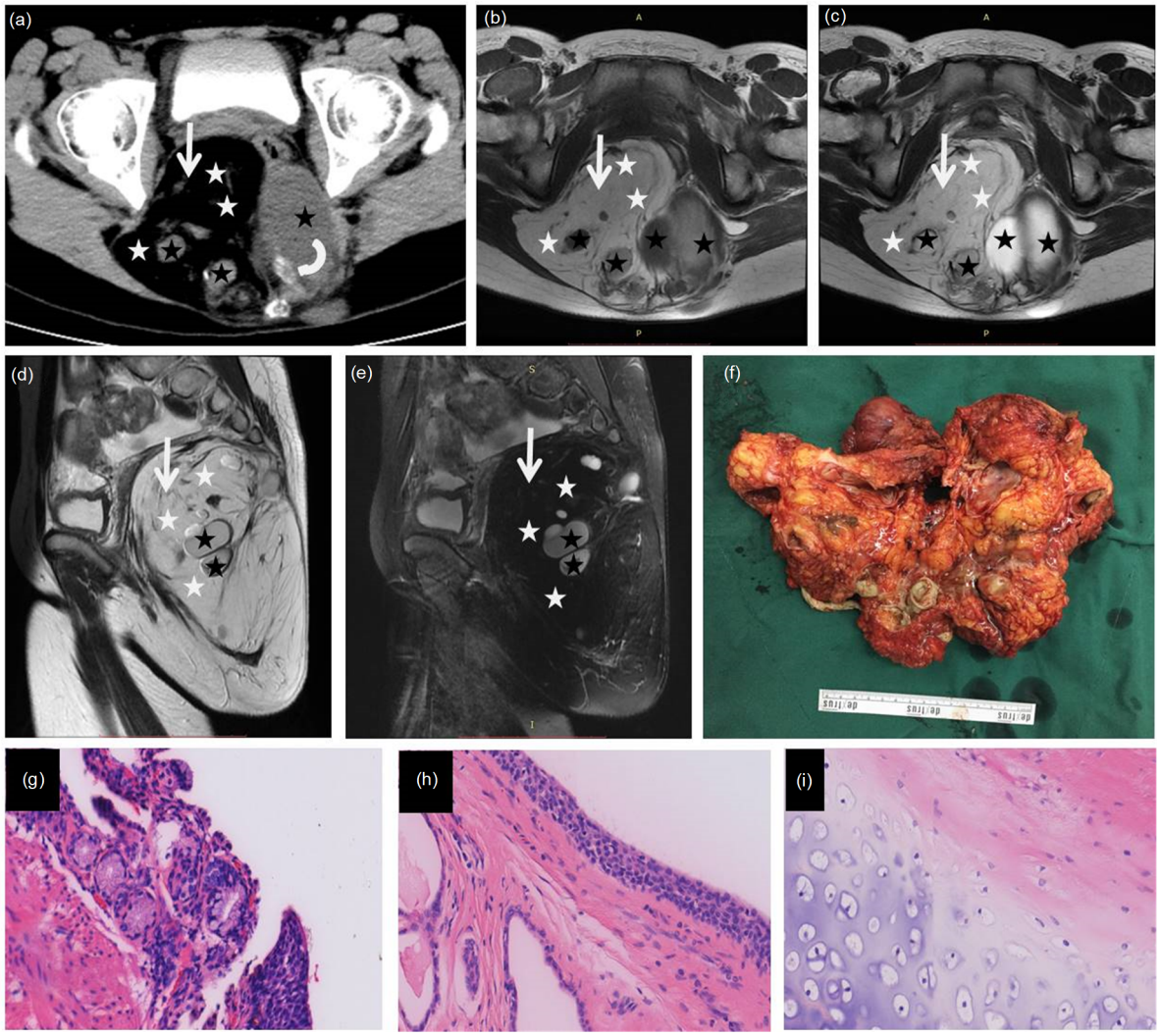

Fig. 2 Pelvic CT, MRI, and histology images of an 18-year-old female patient with a benign mature SCT

(a) Axial CT image of the pelvis shows the mass (arrow) in the sacrococcygeal area, containing fat (white asterisks, CT value: −80 to −20 HU), cystic components (dark asterisks), and calcification tissue (bow arrow, CT value: 180 to 250 HU). (b, c) Axial MRI images of the pelvis show a large heterogeneous presacral mass (arrows) containing fat (white asterisks) with high signal intensity on T1-weighted image (b) and T2-weighted image (c), cystic components (dark asterisks) with low to intermediate signal intensity on T1-weighted image (b), and high signal intensity on T2-weighted image (c). (d, e) Sagittal MRI images of the pelvis show a large heterogeneous presacral mass (arrows) containing fat (white asterisks) with high signal intensity on T2-weighted image (d), low signal intensity on T2-weighted fat suppression image (e), and cystic components (dark asterisks). (f) Excised SCT specimen. (g–i) Histology (hematoxylin and eosin (H&E), magnification, ×200) reveals a mature differentiated teratoma containing all three germ layers: mucous columnar epithelium and ciliated columnar epithelium (g), squamous epithelium (h), and differentiation of mature cartilage tissue (i)

patient was found with SCT by chance on imaging, due to the small tumor mass and type IV of the Altman classification. Generally, symptoms of sacrococcygeal pain, constipation, and frequent urination or urinary retention might be due to a large SCT developed in the intrapelvic space (Hambraeus et al., 2018a; Shatnawi et al., 2019). Sometimes SCT can be associated with infection, presenting as ulcers in the sacrococcygeal region that look like anal fistulas (Mengual-Ballester et al., 2014). In our study, there were three cases involving changes in the appearance of the anal fistula, and one case of recurrent skin infection and pigmentation. Furthermore, we found digital rectal examination (DRE) was beneficial for a

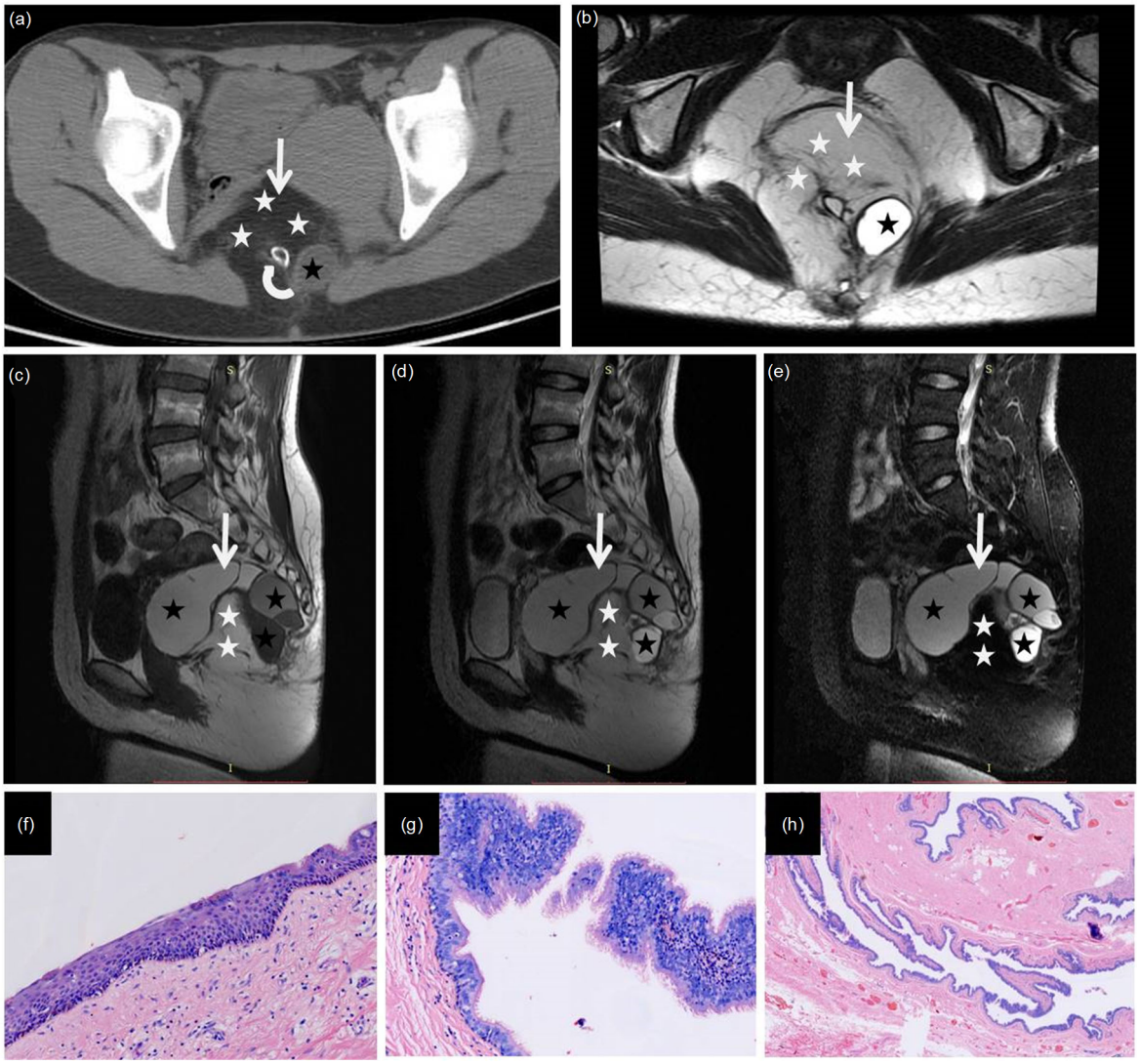

Fig. 3 Pelvic CT, MRI, and histology images of a 21-year-old male patient with a benign mature SCT

(a) Axial CT image of the pelvis shows the mass (arrow) in the sacrococcygeal area, containing fat (white asterisks, CT value: −80 to −20 HU), cystic components (dark asterisk), and calcification tissue (bow arrow, CT value: 180 to 250 HU). (b) Axial T2-weighted MRI image of the pelvis shows a large heterogeneous presacral mass (arrow) containing fat (white asterisks) with high signal intensity, and cystic components (dark asterisk) with high signal intensity. (c–e) Sagittal MRI images of the pelvis show a large heterogeneous presacral mass (arrows) containing fat (white asterisks) with high signal intensity on T1-weighted image (c) and T2-weighted image (d), and low signal intensity on T2-weighted fat suppression image (e), and containing cystic components (dark asterisks) with low to high signal intensity on T1-weighted image (c), high signal intensity on T2-weighted image (d), and T2-weighted fat suppression image (e). (f–h) Histology (hematoxylin and eosin (H&E), magnification, ×200) reveals the cyst wall covered with squamous epithelium and ciliated columnar epithelium (f), and ciliated columnar epithelium (g, h)

general evaluation of the size, texture, and invasion range of the tumor, and was helpful for differentiating SCT from anal fistulas.

Because of its anatomical characteristics, SCT is difficult to biopsy. Therefore, preoperative diagnosis is challenging. Ultrasonography remains the most important clinical imaging modality for routine screening during pregnancy. It is a widely available, cost-efficient, and safe method that allows a real-time examination of the fetus. However, ultrasonography includes a limited field of view and there are difficulties in penetrating bones which result in acoustic shadowing (Firszt et al., 2018). Therefore, to determine the structure, vascularity, exact location, and

components of a tumor and its relationship to the surrounding structures, CT and MRI are usually used for preoperative examination because they can overcome the limitations of ultrasound (Saba et al., 2014; Patel et al., 2016). Because of its better soft resolution, MRI clearly shows the relationship of the tumor to the surrounding organs, such as the bladder, ureter, rectum, gynecological viscera, and pelvic wall. In our study, all patients were examined by abdominal-pelvic CT, and six were examined by MRI. The SCTs were multilocular tumors consisting of soft tissue, fat, calcification, and liquid components in variable proportions. CT is good at detecting fat and calcification, because fat tissue and calcium have characteristic CT values of −80 to −20 HU and 80 to 300 HU, respectively. Fat tissue was found in eight cases and calcification in two cases of our study, with typical CT values. Each of these components can also be identified using MRI, based on signal intensity. The soft tissue component is characterized by intermediate signal intensity in both T1- and T2-weighted images. Fat is highly hyperintense in both T1- and T2-weighted images, and is suppressed in fat-saturation images. Cystic components always are T2-hyperintense and T1-hypointense, and sometimes are T2-hyperintense and T1-hyperintense for hemorrhagic or high protein cystic tissue. However, it is more difficult to detect calcifications in MRI images than in CT images. The adult SCTs were mostly benign. They lacked typical diagnostic imaging features that differentiate malignant from benign SCTs. The features of local invasion and regional lymph node enlargement might suggest underlying malignancy. However, our study included only one malignant case which did not present imaging features significantly different from those of the benign cases. It has been reported that serum tumor markers are helpful in differentiating malignant from benign tumors in postoperative follow-up (Hunter et al., 2009). In our study, the serum tumor markers of α fetoprotein (AFP), carcinoembryonic antigen (CEA), cancer antigen 199 (CA199), and CA125 were all normal in our seven cases of benign and one case of malignant SCT.

Complete surgical resection is the most important treatment for SCT. Generally, tumors that extend above the S3 require an anterior approach (transabdominal) (Hiller et al., 2015), whereas those below S3 are removed using a posterior-only approach (parasacral) (Saxena et al., 2015). A combined anterior-posterior approach is used for large tumors that cannot be removed completely (Wessell et al., 2018). Therefore, to choose the appropriate specific surgical path for resection of an SCT, preoperative CT and MRI examination, and even DRE, might be helpful in defining the location and surrounding infiltration of the SCT. In other words, CT and MRI are useful for determining the optimal surgical procedure. From our experience in this study, if the tumor is mainly cystic, it is not necessary to be restricted to S3. After exposing the tumor through the sacrum, the cystic fluid could be extracted, collapsing the tumor, which could then be completely resected using the posterior-only approach. Whether to resect the coccyx during the operation is controversial (Simpson et al., 2014). The main reasons for coccyx resection are based on the following considerations: (1) for a huge tumor, it may be necessary for exposure during the operation; (2) the SCT may originate from the pluripotent cells of the coccyx; (3) the tumor may tend to cling to the coccyx, and resection of the coccyx may prevent recurrence. In our study, the coccyxes of three cases were resected due to the huge size of the tumor. As for surgical resection, SCT resection is normally performed in a single stage. However, in our study, one patient with a huge tumor underwent multi-stage resection, and the coccyx and the S5 were resected. The surgical treatment of adult SCT patients is rarely reported in the literature and the long-term treatment outcomes remain unknown (Hambraeus et al., 2018b). In our study, most patients were histopathologically diagnosed with benign mature SCT, and no recurrence was found. For the patient histopathologically diagnosed with malignant SCT, the tumor recurred at 84 months follow-up after surgery. After a second surgery, the patient had no recurrence within 6 months of follow-up after re-resection. Therefore, the surgical outcome was good after complete resection, even for the malignant SCT patient. Also, even for a recurrent malignant SCT, re-resection of the lesion might contribute to a good outcome.

5 Conclusions

In summary, this retrospective study over eight years at our single institution demonstrated: (1) adult

SCT can be difficult to diagnose because of a lack of typical clinical symptoms and signs; (2) a combination of CT and MRI examination is beneficial for preoperative diagnosis; (3) the choice of surgical approach and surgical resection modality depends on the size, location, and components of the tumor, which can be defined from preoperative CT and MRI evaluation; (4) most adult SCTs are benign; the surgical outcome for the malignant SCT patient was also good after complete resection, and even after recurrence, the surgical outcome was good after re-resection.

Contributors

Xiang-ming XU and Xiao-kai YU designed this research. Xiang-ming XU, Feng ZHAO, and Xiao-kai YU wrote the main manuscript. Xiao-fei CHENG, Wei-xiang ZHONG, Jing-peng LIU, and Wei-qin JIANG collected samples and conducted statistical analysis. Xiang-ming XU, Feng ZHAO, Xiao-fei CHENG, Wei-xiang ZHONG, Jing-peng LIU, Wei-qin JIANG, Xiao-kai YU, and Jian-jiang LIN revised the manuscript.

Compliance with ethics guidelines

Xiang-ming XU, Feng ZHAO, Xiao-fei CHENG, Wei-xiang ZHONG, Jing-peng LIU, Wei-qin JIANG, Xiao-kai YU, and Jian-jiang LIN declare that they have no conflicts of interest.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5). Informed consent was obtained from all participants for being included in the study.

References

Emoto S, Kaneko M, Murono K, et al., 2018. Surgical management for a huge presacral teratoma and a meningocele in an adult with Currarino triad: a case report. *Surg Case Rep*, 4(1):9. https://doi.org/10.1186/s40792-018-0419-2

Firszt OP, Myga-Porosiło J, Pośpieszny K, et al., 2018. Radiological features of sacrococcygeal teratomas in fetal magnetic resonance imaging and computed tomography—a case report. *Pol J Radiol*, 83:e19-e23. https://doi.org/10.5114/pjr.2018.74861

Hambraeus M, Al-Mashhadi A, Wester T, et al., 2018a. Functional outcome and health-related quality of life in patients with sacrococcygeal teratoma—a Swedish multicenter study. *J Pediatr Surg*, in press. https://doi.org/10.1016/j.jpedsurg.2018.10.044

Hambraeus M, Hagander L, Stenstrom P, et al., 2018b. Long-term outcome of sacrococcygeal teratoma: a controlled cohort study of urinary tract and bowel dysfunction and predictors of poor outcome. *J Pediatr*, 198: 131-136.e2. https://doi.org/10.1016/j.jpeds.2018.02.031

Hiller DJ, Waters GS, Bohl JL, 2015. Incidence and operative excision of presacral masses: an institutional analysis. *Am Surg*, 81(12):1237-1239.

Hunter CJ, Ford HR, Estrada JJ, et al., 2009. Alpha-fetoprotein levels correlate with the pathologic grade and surgical outcomes of pediatric retroperitoneal teratomas. *Pediatr Surg Int*, 25(4):331-336. https://doi.org/10.1007/s00383-009-2321-2

Kremer MEB, Dirix M, Koeneman MM, et al., 2015. Quality of life in adulthood after resection of a sacrococcygeal teratoma in childhood: a Dutch multicentre study. *Arch Dis Child Fetal Neonatal Ed*, 100(3):F229-F232. https://doi.org/10.1136/archdischild-2014-307589

Luk SY, Tsang YP, Chan TS, et al., 2011. Sacrococcygeal teratoma in adults: case report and literature review. *Hong Kong Med J*, 17(5):417-420.

Mengual-Ballester M, Pellicer-Franco E, Valero-Navarro G, et al., 2014. Presacral tumor as a differential diagnosis of recurrent pilonidal sinus. *Cir Cir*, 82(5):567-572.

Patel N, Maturen KE, Kaza RK, et al., 2016. Imaging of presacral masses—a multidisciplinary approach. *Br J Radiol*, 89(1061):20150698. https://doi.org/10.1259/bjr.20150698

Saba L, Fellini F, Greco FG, et al., 2014. MRI evaluation of not complicated Tailgut cyst: case report. *Int J Surg Case Rep*, 5(10):761-764. https://doi.org/10.1016/j.ijscr.2014.02.014

Saxena D, Pandey A, Bugalia RP, et al., 2015. Management of presacral tumors: our experience with posterior approach. *Int J Surg Case Rep*, 12:37-40. https://doi.org/10.1016/j.ijscr.2015.05.015

Shatnawi NJ, Khammash MR, Omari AH, 2019. A giant sacrococcygeal teratoma in adult female: a case report. *Int J Surg Case Rep*, 54:47-50. https://doi.org/10.1016/j.ijscr.2018.11.039

Sheng QS, Xu XM, Cheng XB, et al., 2015. Multi-stage resection and repair for the treatment of adult giant sacrococcygeal teratoma: a case report and literature review. *Oncol Lett*, 10(1):425-429. https://doi.org/10.3892/ol.2015.3249

Simpson PJ, Wise KB, Merchea A, et al., 2014. Surgical outcomes in adults with benign and malignant sacrococcygeal teratoma: a single-institution experience of 26 cases. *Dis Colon Rectum*, 57(7):851-857. https://doi.org/10.1097/DCR.0000000000000117

Sukhadiya MV, Das U, 2015. Laparoscopic approach to type IV sacrococcygeal teratoma in an adult. *Indian J Surg*, 77(Suppl 1):62-63. https://doi.org/10.1007/s12262-014-1130-6

Szyllo K, Lesnik N, 2013. Sacrococcygeal teratoma—case report and review of the literature. *Am J Case Rep*, 14:1-5. https://doi.org/10.12659/AJCR.883727

Varma AV, Malpani G, Agrawal P, et al., 2017. Clinicopathological spectrum of teratomas: an 8-year retrospective study from a tertiary care institute. *Indian J Cancer*,

54(3):576-579.

Wessell A, Hersh DS, Ho CY, et al., 2018. Surgical treatment of a type IV cystic sacrococcygeal teratoma with intraspinal extension utilizing a posterior-anterior-posterior approach: a case report. *Childs Nerv Syst*, 34(5):977-982. https://doi.org/10.1007/s00381-018-3718-9

中文概要

题　目：成年骶尾部畸胎瘤的诊治：单中心 8 年经验回顾

目　的：探讨成人骶尾部畸胎瘤的临床表现、影像学特点、组织学特征、手术方式及预后。

方　法：回顾分析2010年8月至2018年8月在我院收治经组织病理学诊断为骶尾部畸胎瘤患者的临床资料。

结　果：本组患者病例 8 例（男 2 例，女 6 例），中位年龄 34 岁。6 例患者表现为骶尾部疼痛，4 例表现为骶尾部肿块和溃疡。采用计算机断层扫描（CT）和磁共振成像（MRI）相结合的方法进行评估，所有患者均进行手术治疗。7 例经病理诊断为良性畸胎瘤，术后无复发。1 例为恶性畸胎瘤，术后 84 个月复发，二次手术后随访 6 月无复发。

结　论：（1）由于缺乏典型的临床表现，成人骶尾部畸胎瘤难以诊断；（2）CT 和 MRI 检查相结合有利于术前诊断；（3）手术入路和手术切除方式的选择取决于肿瘤的大小、位置和组成，可以通过术前的 CT 和 MRI 来确定；（4）大多数成年骶尾部畸胎瘤是良性的，恶性畸胎瘤手术切除效果良好。即使对于复发性恶性畸胎瘤，再次手术效果良好。

关键词：骶尾部畸胎瘤；临床表现；计算机断层扫描；磁共振成像；手术切除方式