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REVIEW ARTICLE

Imaging of presacral masses—a multidisciplinary approach

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ABSTRACT

Our objective is to describe an approach for retrorectal/presacral mass evaluation on imaging with attention to imaging features, allowing for refinement of the differential diagnosis of these masses. Elaborate on clinically relevant features that may affect biopsy or surgical approach, of which the radiologist should be aware. A review of current literature regarding the diagnosis and treatment of retrorectal/presacral masses was performed with attention to specific findings, which may lend refinement to the differential diagnosis of these masses. Cases were obtained by searching through a radiology database at a single institution after Institutional Review Board approval. Recent advances in imaging and treatment methods have led to the increased role of radiology in both imaging and tissue diagnosis of retrorectal masses. Surgical philosophies surrounding the treatment of these masses have not significantly changed in recent years, but there are a few key factors of which the radiologist must be aware. The radiologist can offer refinement of the differential diagnosis of retrorectal masses and can elaborate on salient findings which could alter the need for neoadjuvant chemoradiation therapy, pre-surgical tissue diagnosis and surgical approach. This article presents an imaging approach to retrorectal/presacral masses with emphasis on findings which can dictate the ultimate need for neoadjuvant therapy and pre-surgical tissue diagnosis and alter the preferred surgical approach. This article consolidates key findings, so radiologists can become more clinically relevant in the evaluation of these masses.

INTRODUCTION

The presacral space is a site of totipotential cells with a combination of the embryologic hindgut and neuroectoderm, and the pathologies occurring in this space may thus have a single-tissue or multitissue origin from osseous, mesenchymal or neural tissues. While the smaller lesions are asymptomatic, with incidental detection during imaging for unrelated abdominal or pelvic symptoms, larger masses may manifest with pelvic symptoms or altered bowel habits. Imaging plays a crucial role in diagnosis (including image-guided tissue sampling) and can define the extent of a lesion to guide surgical planning. This article provides a review of the anatomy and pathologies of the presacral space, with emphasis on the role of imaging in diagnosis and treatment planning.

ANATOMY

The presacral space is an extraperitoneal potential space between the upper two-thirds of the rectum and the sacrum. The retrorectal/presacral space is bounded anteriorly by the rectum and mesorectal fascia, superiorly by the peritoneal reflection of the rectosigmoid colon, inferiorly by the rectosacral/Waldeyer's fascia, posteriorly by the presacral fascia and laterally by the iliac vessels and ureters (Figure 1).[1] The retrorectal space can be further divided into the anterior retrorectal and posterior presacral space, divided by the presacral fascia. Imaging allows limited differentiation of these spaces. A surgical approach to lesions in this region is discussed later.

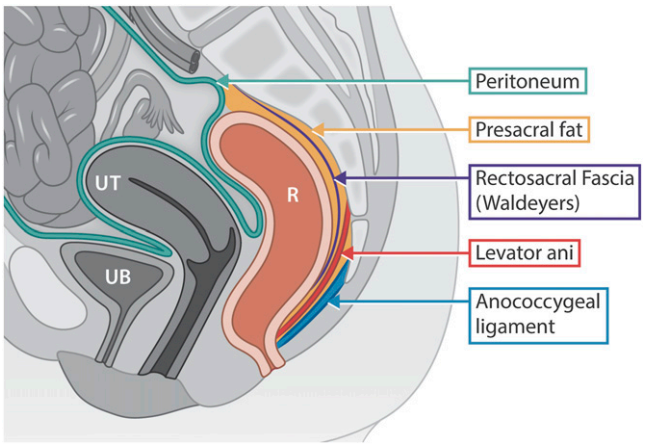
A classification of pathologies involving the presacral/retrorectal space based on the origin is presented in Table 1.

CONGENITAL

Cystic lesions

Congenital cystic lesions are commonly encountered presacral masses with a female predilection.[2] The majority of these lesions are benign, including developmental cysts (tailgut, rectal duplication, dermoid and epidermoid cysts) or anterior sacral meningoceles. Developmental cysts constitute approximately two-thirds of congenital presacral masses.[3,4] Among these, tailgut cysts, also known as retrorectal cystic hamartoma, are the most common asymptomatic retrorectal masses found in adults.[5] Tailgut cysts are often multiloculated cysts containing mucin and lack a muscular layer, a differentiating feature from rectal duplication cysts, which can be confirmed on endorectal

Figure 1. An Illustration demonstrating the presacral space. The boundaries are as follows: the rectum anteriorly, peritoneal reflection superiorly, levator ani muscle and anococcygeal ligament inferiorly, sacrum/coccyx posteriorly. R, rectum; UB, urinary bladder; UT, uterus.



ultrasound.[6–8] Up to 13% of these cysts may undergo malignant transformation, and for this reason, they are removed.[9] Rectal duplication cysts may be associated with other congenital abnormalities of the anorectal region and bladder/urethra.[7] Sacrococcygeal teratoma is the most common presacral mass in children containing all three germ-cell lineages.[10] Benign mature teratomas tend to be predominantly cystic containing fat, sebum, calcification and soft tissue from dermoid plugs.

On imaging, congenital developmental cysts are seen as well defined, unilocular or multilocular, cystic masses ranging from simple to complex in their internal contents (Figure 2). Thin wall calcifications may be seen with tailgut cysts. MRI is helpful in defining the anatomic relationship to adjacent structures and assessing for the presence of an enhancing or necrotic soft tissue favouring malignant transformation. Increased T_1 weighted signal intensity on fat-saturated images represents haemorrhage, mucin or proteinaceous content, suggesting complicated cysts (Figure 3). The presence of mural nodularity and post-contrast enhancement should be viewed with suspicion for malignant transformation in congenital cystic masses.

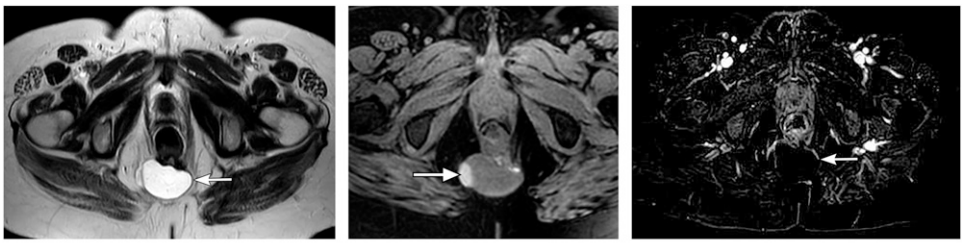
Anterior sacral meningocele

These are rare congenital lesions with female predominance and are associated with other congenital anomalies in 50% of cases.[11] Such anomalies include the spina bifida, tethered spinal cord, imperforate anus, uterine/vaginal duplications and presacral lipomas.[3,12,13] These lesions have a classic clinical presentation of headache during valsalva owing to increased cerebrospinal fluid (CSF) pressure transmitted via the

Table 1. Classification scheme for presacral masses

Origin	Benign	Malignant
Congenital	Cystic hamartoma	Immature teratoma
	Duplication cyst	Yolk sac tumour
	Dermoid cyst (mature teratoma)	
	Anterior sacral myelomeningocele	
Osseous	Aneurysmal bone cyst	Osteosarcoma
	Giant-cell tumour	Ewing's sarcoma
		Chondrosarcoma
		Plasmacytoma
		Metastasis
Mesenchymal	Myelolipoma	Fibrosarcoma
	Haemangioma	Gastrointestinal stromal tumour
	Fibroma	Lymphoma
	Hibernoma	
	Castleman disease	
Neurogenic	Neurofibroma	Chordoma
	Schwannoma	Malignant schwannoma
	Ependymoma	
	Dural ectasia	
Miscellaneous	Infectious	Desmoplastic round-cell tumour
	Inflammatory	Metastasis
	Post traumatic	

Figure 2. A 45-year-old-female with tailgut cyst. (a) Axial T_2 weighted, (b) fat-saturated pre-contrast and (c) fat-saturated post-contrast subtraction T_1 weighted images (T1WI) through the pelvis showing a presacral multiloculated cystic mass posterior to the rectum without post-contrast enhancement (arrows in a, c). High signal intensity on pre-contrast T1WI (arrow in b), suggesting haemorrhage or proteinaceous debris. Surgical resection confirmed tailgut cyst.



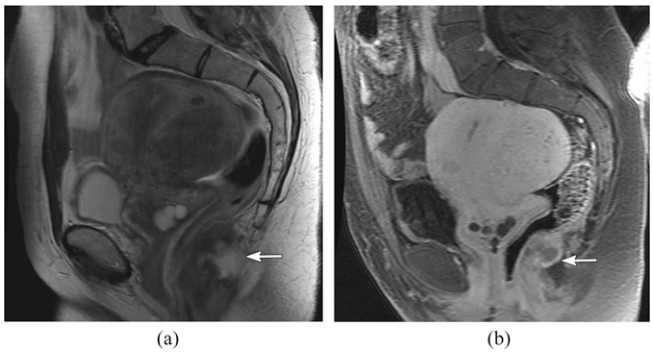
connection between the meningocele and subdural space.[7,8] Identification of this connection is important to imaging diagnosis and is critical to report because this defect must be closed during surgical resection.[14] On pelvic radiographs, a unilateral anterior sacral defect may be seen with a rounded, concave border with scalloping/destruction of the surrounding bone, often referred to as the "scimitar sign".[14] On MRI, the signal intensity of the content within the meningocele should parallel the CSF signal on all sequences (Figure 4). Biopsy and aspiration should not be performed, given the risk of introduction of pathogens directly into the spinal meninges, which can result in meningitis.[15,16] Surgical resection is curative as long as the dural defect is closed, and a posterior approach is generally taken, although large lesions may require an anterior approach.[11,14]

OSSEOUS

Aneurysmal bone cysts

Approximately 20% of aneurysmal bone cysts (ABCs) are located in the spine, and <20% of these spinal ABCs are seen in the sacrum.[17] Imaging appearance is that of an expansile lytic lesion sometimes with a thin calcific rim representing the surrounding bone. Multiloculated spaces with fluid–fluid levels seen on CT and MR are characteristic of ABCs corresponding to the blood-filled spaces.[18] Although these are benign lesions, they can be locally aggressive or highly symptomatic, given their spinal location *via* mass effect or pathologic fracture. While wide local resection has been described as a definitive treatment, embolization and sclerotherapy using alcohol-based sclerosants have been successful in treating the lesion.[19–21]

Figure 3. A 48-year-old female with rectal duplication cyst. (a) Sagittal T_2 weighted and (b) sagittal post-contrast fat-saturated T_1 weighted images show an incidentally detected small cystic mass (arrows) just posterior to the anorectal region without post-contrast enhancement.



Giant-cell tumour

Giant-cell tumour (GCT) is uncommon in the spine, but is the second most common sacral tumour after chordoma. GCT has a female predilection and generally presents between 15 and 40 years of age.[18,22,23] GCT is seen as an expansile, locally aggressive, lytic mass with internal haemorrhage and necrosis (Figure 5). A sclerotic rim, when present, is better appreciated on CT. MRI shows heterogeneous intermediate signal intensity on T_1 weighted and T_2 weighted imaging. GCTs are vascular tumours showing avid post-contrast enhancement.[2] Complete resection is the preferred treatment unless location precludes this, in which case, partial curettage

Figure 4. A 17-year-old-male with anterior sacral meningocele. Sagittal T_2 weighted image showing a sacral defect (black arrow) and a small anterior cystic mass with demonstrable direct communication with the dural sac (white arrow).

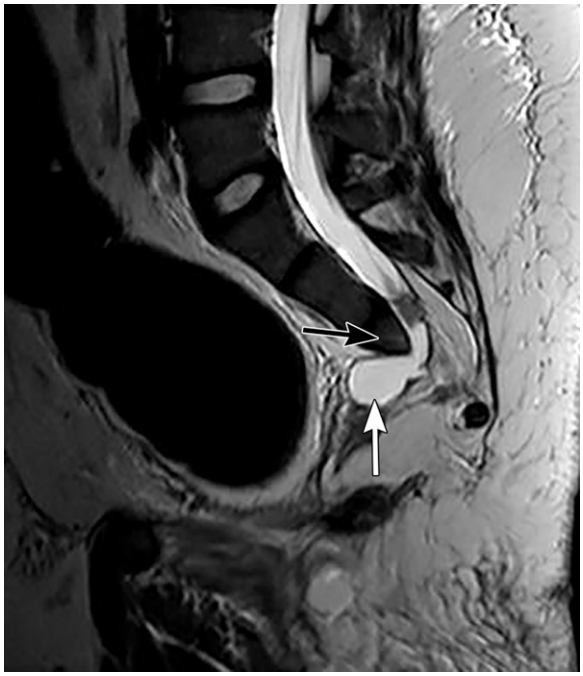
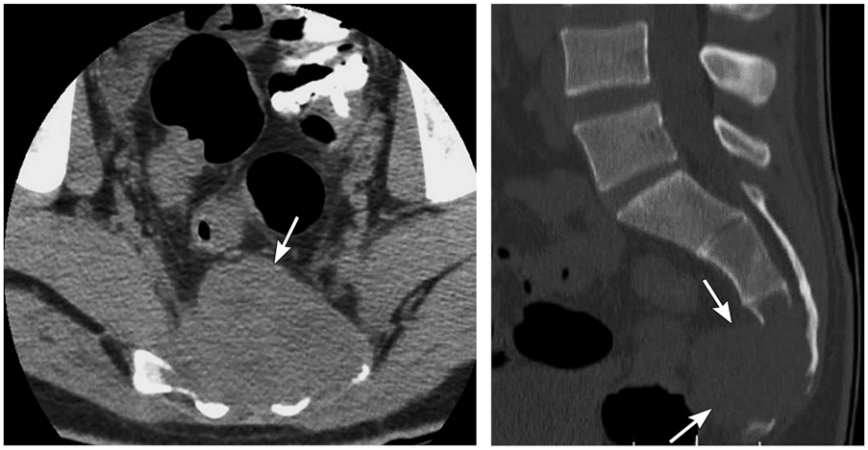


Figure 5. A 45-year-old male with sacral giant-cell tumour. (a) Axial non-contrast and (b) sagittal bone window CT image through the pelvis showing a large, expansile, lytic mass (arrows) with presacral soft-tissue extension.



and radiation therapy can be used.[23,24] Embolization has been used prior to surgery or in patients who cannot undergo surgery.[25] Recurrence rates of 40–60% have been reported for incompletely resected tumours.[25] Recently, denosumab (monoclonal antibody against receptor activator of nuclear factor k ligand) has been approved for use in patients with unresectable or metastatic GCT tumour of the bone with encouraging results.[26]

Osteosarcoma

Approximately 30% of the spinal osteosarcoma occurs in the sacrum, with male predominance and bimodal age distribution in the third and seventh decade.[2,27–29] Occasionally, these tumours may arise in the pagetoid bone or in previously irradiated bones.[2,4] Imaging is usually complementary between CT and MRI as the osseous matrix is best seen on CT, while MRI can better define the extent of soft-tissue tumour involvement. These neoplasms have a very aggressive appearance with bone destruction and periosteal new bone formation as well as surrounding soft-tissue mass. Total resection may be difficult owing to the large size at presentation and may have poor prognosis with 30–40% 5-year survival, despite the use of neoadjuvant chemoradiation therapy.[25,28,30,31]

Chondrosarcoma

While mostly seen in the thoracic spine, sacral involvement is rarely seen.[25] Chondrosarcoma may arise from a pre-existing osteochondroma, most commonly in patients with multiple hereditary exostoses.[2,4] Characteristic features of the chondroid matrix ("dense", "stippled" or "rings and arcs"), cortical destruction with soft tissue extension, and fluid attenuation on CT/fluid signal on MRI in non-mineralized regions of the mass are features that aid in imaging diagnosis.[2] Most lesions are low grade, allowing surgical cure and a mean survival of 5.9 years.[32] Chemotherapy is used for high-grade lesions, and metastatic lesions to the lung are uncommon.[2]

Sacral plasmacytoma

Solitary osseous plasmacytoma is a unifocal form of multiple myeloma. In the spine, the common location is the thoracic spine, with rare involvement of the sacral spine. It has male predilection, with age distribution between the fourth and sixth decade.[33] On imaging, they are seen as a expansile lytic mass with peripheral sclerosis. On MRI, plasmacytoma shows low signal intensity on the T_1 weighted image and high signal on T_2 weighted image with post-contrast enhancement (Figure 6). Treatment includes local excision with chemoradiation.

Small round-cell tumours

Ewing sarcomas, primitive neuroectodermal tumours and desmoplastic round-cell tumours are subsets of small round blue-cell tumours commonly occurring in older children and young adults between the first and third decade.[34] These

Figure 6. A 49-year-old-male with biopsy confirmed plasmacytoma. (a) Axial contrast-enhanced CT, (b) axial T_2 weighted and (c) fat-saturated post-contrast T_1 weighted images through the pelvis showing an expansile lytic soft-tissue mass (arrows) showing mild post-contrast enhancement.

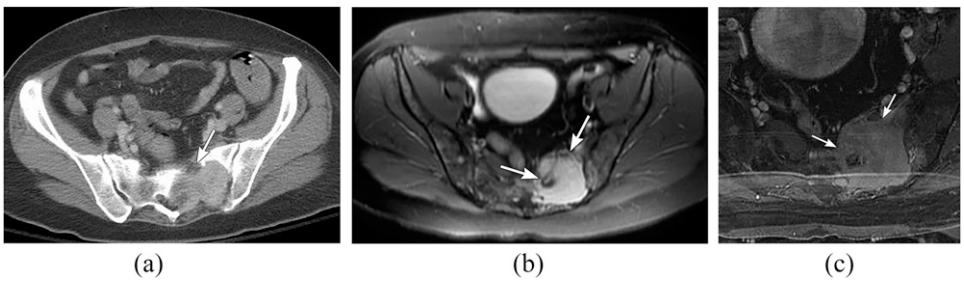
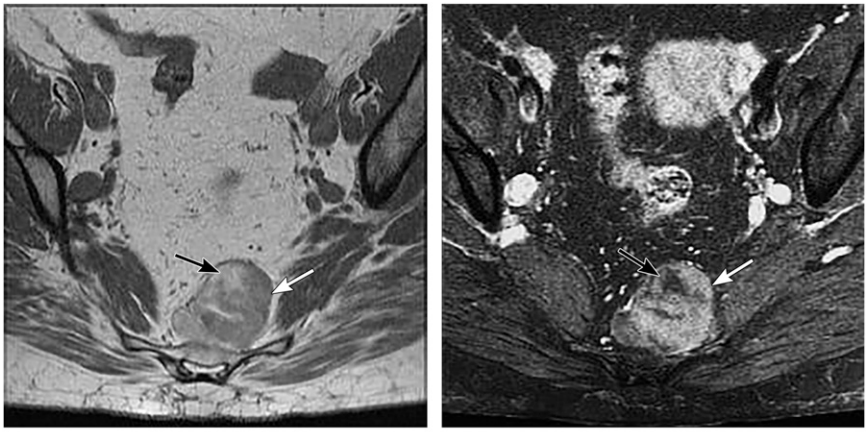


Figure 7. A 58-year-old female with biopsy-proven presacral myelolipoma. (a) Axial T_2 weighted and (b) axial fat-saturated post-contrast T_1 weighted (T1W) images through the pelvis showing a presacral soft-tissue mass (white arrows) with intralesional macroscopic fat (black arrows) seen as loss of signal of the fat-saturated T1W image (b).



(a) (b)

tumours have an aggressive and permeative appearance, with osseous expansion and associated soft-tissue mass, but often without frank cortical destruction. These are often large at presentation with poor prognosis, especially desmoplastic tumours, which have poor prognosis despite therapy.[2] Up to 50% of the desmoplastic subtype manifest with metastases at the time of diagnosis to the peritoneum, lung, liver and bone.[2] In fact, sacrococcygeal *vs* non-sacral ewing sarcomas have long-term survival rates of 25% *vs* 86%, respectively.[2,34,35] The mainstay of therapy is chemoradiation, with local surgical debulking. Unfortunately, therapeutic options do not appear to improve survival rates.[36]

MESENCHYMAL

Myelolipoma

These are rare, benign retrorectal masses containing mature fat and haematopoietic cells similar to adrenal myelolipoma. These are usually incidentally detected but rarely manifest with pelvic or bowel symptoms owing to mass effect. Characteristic imaging features are the presence of macroscopic fat on CT or MR (Figure 7); however, this can sometimes be difficult to differentiate from other rare tumours like liposarcoma and histological confirmation from percutaneous or excisional biopsy may be required.[37] Occasional presence of intralesional haemorrhage due to the haematopoietic component may be seen.

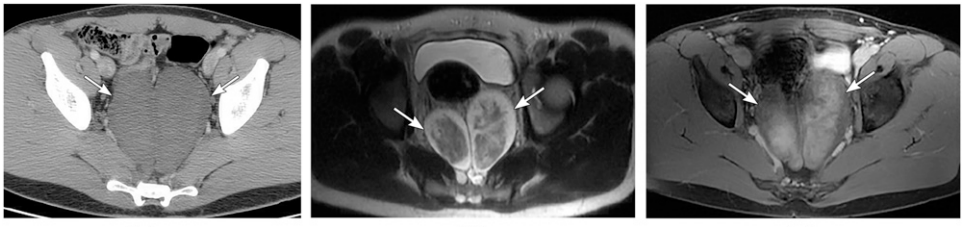
Solitary fibrous tumour

Solitary fibrous tumour is a rare, slow-growing tumour of fibroblastic and myofibroblastic origin, usually seen in middle-aged adults.[38] CT shows a well-defined soft-tissue mass with intense post-contrast enhancement. MR shows a low-to-intermediate signal intensity on T_1 weighted and T_2 weighted images, with decreased T_2 weighted signal intensity isointense to the muscle, helpful in differentiating this lesion as a fibrous tumour. Internal heterogeneity may be present secondary to necrosis, haemorrhage and cystic or myxoid degeneration.[36,38]

Gastrointestinal stromal tumour

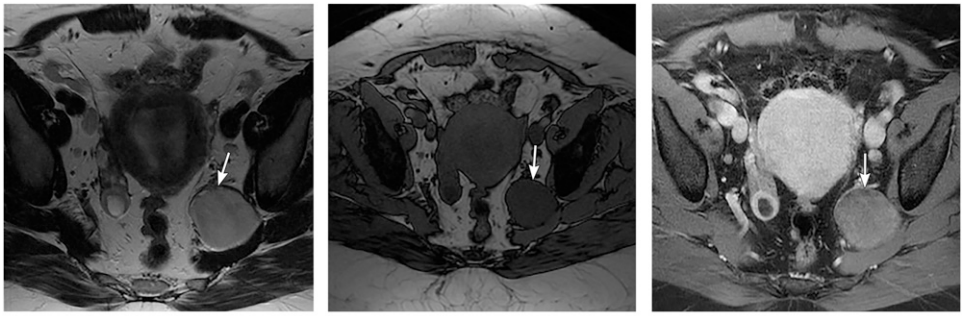
Gastrointestinal stromal tumour is the most common mesenchymal neoplasm of the gastrointestinal tract, most frequently seen in the stomach and small bowel, with rare occurrence in the anorectal region.[6] These neoplasms arise from the outer muscular layer and are typically exophytic. They may present with obstructing symptoms. While small lesions may not be detected on CT, larger lesions are seen as hypodense soft-tissue attenuation masses arising from the rectal wall. MR has higher sensitivity in detecting the lesion, which is seen as intermediate-to-low signal

Figure 8. A 39-year-old male with neurofibroma. (a) Axial contrast-enhanced CT, (b) axial T_2 weighted image and (c) axial fat-saturated post-contrast T_1 weighted image (T1WI) through the pelvis showing two soft-tissue masses in the presacral region (arrows). MR showing heterogeneous T_2 weighted signal intensity with central hypointensity and peripheral hyperintensity (b). Mild enhancement of the central collagenous matrix is noted on post-contrast T1WI (c).



(a) (b) (c)

Figure 9. A 49-year-old female with schwannoma. (a) Axial T_2 weighted (T2W), (b) axial T_1 weighted (T1W) and (c) fat-saturated post-contrast T1W images through the pelvis showing a well-defined mass arising from the left hemisacrum with presacral extension (arrows). The mass is hyperintense on T2W, hypointense on T1W and shows mild post-contrast enhancement.



intensity on T_1 weighted imaging and heterogeneous increased signal intensity on T_2 weighted imaging with heterogeneous post-contrast enhancement.[2]

Lymphoma

Lymphoma can involve both the presacral space and sacrum primarily, although often it is a spectrum of systemic disease. Involvement of the presacral space manifests as a confluent homogeneous lymph nodal mass, with soft-tissue attenuation on CT and homogeneous post-contrast enhancement. These lymph node masses show low signal on T_1 weighted image and high signal on T_2 weighted image. Identification of the surrounding and distant lymph nodes can help suggest the diagnosis of lymphoma. Treatment consists of chemotherapy or radiation therapy based on the and grade of tumour, which is determined by biopsy.[2]

NEUROGENIC

Nerve sheath tumours

Schwannomas and neurofibromas are grouped together because they can be quite difficult to distinguish from one another by imaging. These tumours have a male predominance and generally present in the third–fifth decade, the exception being patients with neurofibromatosis-I in which they generally arise at a younger age.[39,40] While the majority of these tumours are benign, rarely, transformation to malignant peripheral nerve sheath tumour is possible. Neurofibromas consist of fibroblasts, Schwann cells and other neural elements infiltrating their originating nerve, in contrast to schwannomas, which are nerve sheath tumours and lie along the peripheral aspect of the nerve. Neurofibromas are classically bilateral and symmetric in continuity with spinal nerve roots expanding the associated neural foramen. If there is asymmetry or rapid growth, the possibility of malignant transformation should be raised. Neurofibromas tend to have lower CT attenuation than surrounding soft tissues (typically compared with the psoas muscle) and may mimic enlarged lymph nodes.[2] On MRI, they demonstrate high signal intensity on T_2 weighted image with central low signal signifying the fibrous tissue surrounded by myxoid contents, referred to as the "target" sign (Figure 8). Schwannomas may be more heterogeneous on CT and MR with areas of cystic degeneration.[2] A cystic structure with nodular enhancement arising from a peripheral nerve suggests schwannoma (Figure 9). Differential diagnosis includes a Tarlov or perineural cyst (Figure 10), which does not have enhancing elements and follows CSF signal on all sequences.

Dural ectasia

This is a benign condition that occurs owing to the weakening of elastic fibres in the dural sac resulting in chronic expansion of

Figure 10. A 44-year-old female with Tarlov cysts. Axial (a) and sagittal T_2 weighted image (b) showing a large well-defined left presacral cystic mass, isointense to the cerebrospinal fluid (white arrow in a) with widening of the multilevel sacral neural foramina (black arrows in a, white arrows in b).

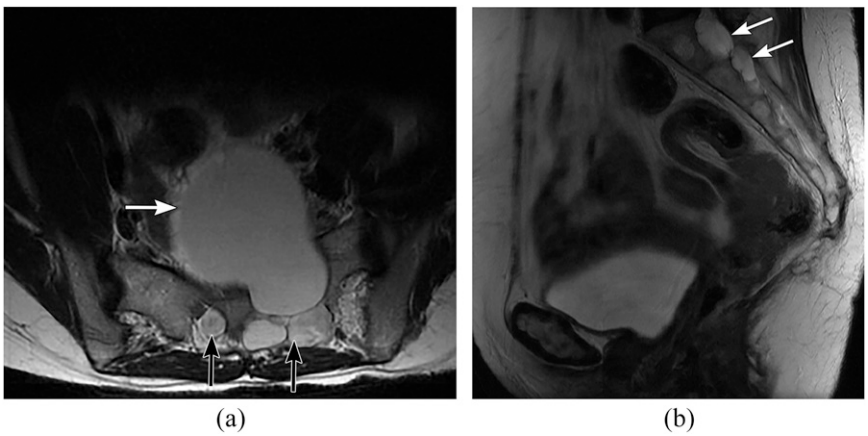
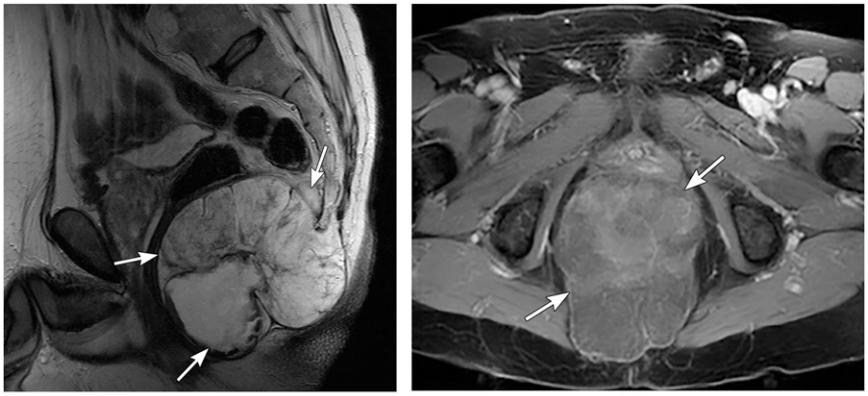


Figure 11. A 55-year-old female with sacral chordoma. (a) Sagittal T_2 weighted and (b) axial fat-saturated post-contrast T_1 weighted images through the pelvis showing a large lobulated mass in relation to the coccyx (arrows) with heterogeneous high signal on T_2 weighted and heterogeneous post-contrast enhancement.



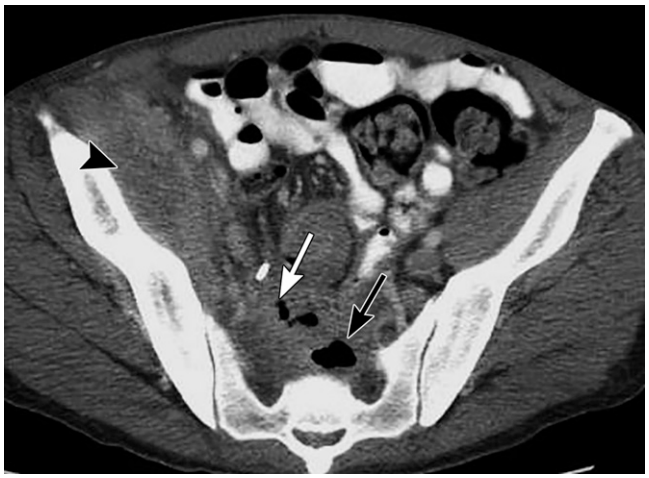
(a) (b)

the subdural space and osseous remodelling owing to increased CSF pressure.[39] There is increased incidence of dural ectasia in patients with Marfan syndrome.[39] On imaging, smooth remodelling and osseous expansion of the spinal canal is manifested as widening of the pedicular distance and posterior vertebral body scalloping.

Chordoma

Chordoma is the most common primary sacral tumour that arises from the remnant of the embryologic notochord, presenting in the fourth–seventh decade with a male predilection.[41] Chordomas are slow-growing tumours and often large at the time of presentation, given the slow onset of symptoms. On imaging, sacral chordomas are seen as midline large heterogeneous masses with variable post-contrast enhancement and osseous destruction. Calcifications are present up to 90% of the time on CT, and intralesional haemorrhage is not uncommon.[25]

Figure 12. A 38-year-old female with confirmed pelvic actinomyces infection. Axial contrast-enhanced CT through the pelvis showing a complex collection involving the right iliacus muscle (black arrowhead) with gas and fluid collection extending to the presacral region (white and black arrows).



MRI generally shows low T_1 and high T_2 signal intensity with internal haemorrhage rendering regions of high signal on the T_1 weighted image (Figure 11). Given their local aggressive behaviour, chordomas are treated with resection and radiation therapy, which results in an 8–10-year average survival in sacrococcygeal lesions *vs* 4–5 years in other locations.[42]

MISCELLANEOUS

Infectious and inflammatory

Inflammatory and infectious conditions involving presacral spaces are often an extension of the pelvic process (Figure 12).

Figure 13. A 61-year-old female status post abdominoperineal resection for rectal cancer showing presacral abscess. Sagittal fat-saturated post-contrast T_1 weighted image showing heterogeneous enhancing soft tissue (arrow) and gas locules (arrowhead) in the presacral space consistent with abscess.

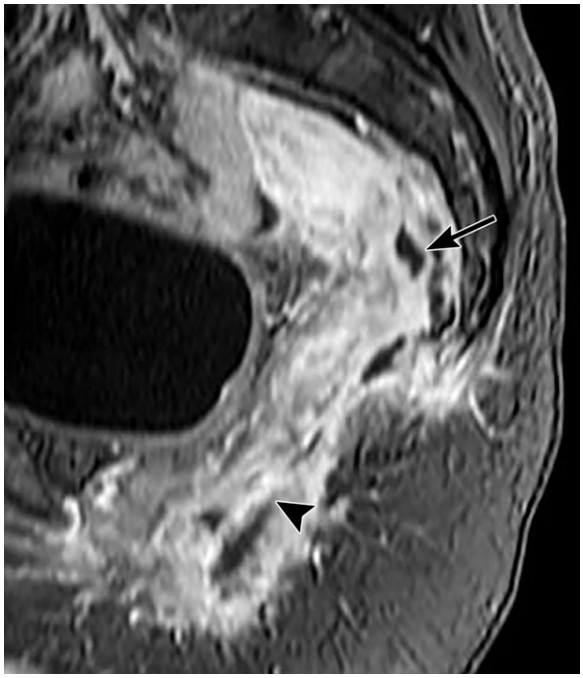
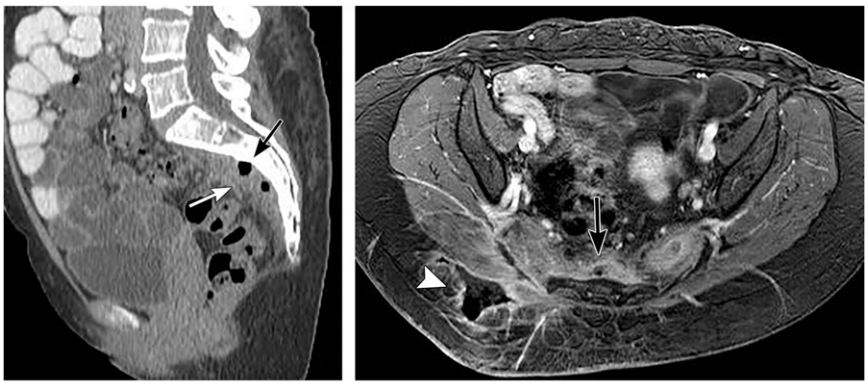


Figure 14. A 51-year-old male with sacral osteomyelitis and presacral abscess. (a) Sagittal reformatted CT, (b) axial fat-saturated post-contrast T_1 weighted image through the pelvis showing sclerosis of the sacrum (black arrow, a) with presacral soft tissue and gas (white arrow, a). MR showing phlegmonous changes in the presacral region (black arrow, b) with a fistulous track extending into the right gluteal region (white arrowhead, b).

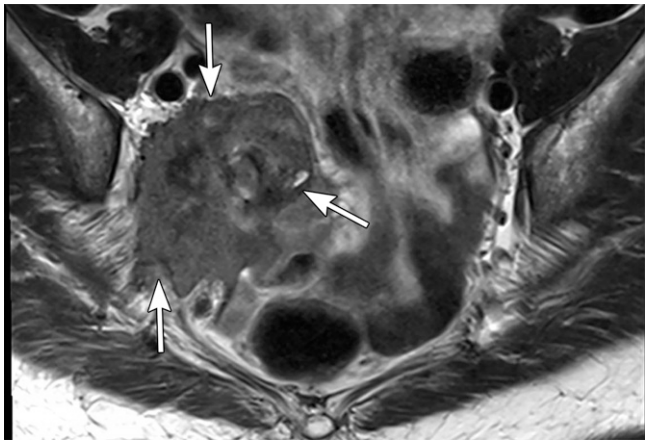


While reactive inflammatory changes are often seen as a sequela of therapy for pelvic malignancies, careful assessment for post-therapy complications like superadded infection with abscess formation or fistula should be made (Figure 13). A clinical history is the most helpful guide to this diagnosis. Osteomyelitis of the sacrum may be encountered in patients with decubitus sacral ulcers (Figure 14). MR is superior in the evaluation of suspected osteomyelitis for marrow changes, abscess and fistula, the given higher soft-tissue resolution.

Metastasis

Metastasis in the presacral space may occur from direct, lymphogenous or haematogenous spread, typically from primary pelvic malignancy, with rectal cancer being the commonest. Local spread to the presacral space is most commonly seen, with primary rectal tumour extending beyond the mesorectal fascia (T3/T4).[43] Post-operative fibrosis or radiation-associated changes may also manifest as a presacral soft-tissue mass and may be difficult to differentiate from recurrence (Figure 15). Tissue sampling or positron emission tomography-CT scan may be helpful in confirming the nature of these lesions.[2,43]

Figure 15. A 48-year-old female with locally advanced cervical cancer. Axial T_2 weighted image showing a recurrence of cervical cancer which is invading the piriformis muscle through the greater sciatic foramen (arrows). More caudal images (not shown here) demonstrated invasion of the bladder and encasement of the vagina.



Retroperitoneal fibrosis

Retroperitoneal fibrosis is a chronic inflammatory process of the retroperitoneum, typically see in the lumbar region, but may extend caudally into the pelvis to involve the presacral region.[44] While the majority of the cases are idiopathic, one-third of the cases occur secondary to underlying pathology. Ill-defined plaque-like soft tissue with variable degree of surrounding inflammatory stranding is the typical CT manifestation. MRI signal characteristics are variable but include low

Figure 16. A 42-year-old male with known retroperitoneal fibrosis. Axial fat-saturated post-contrast T_1 weighted image through the pelvis showing a soft-tissue plaque-like mass in the presacral region (arrows) encasing the internal iliac vessels.

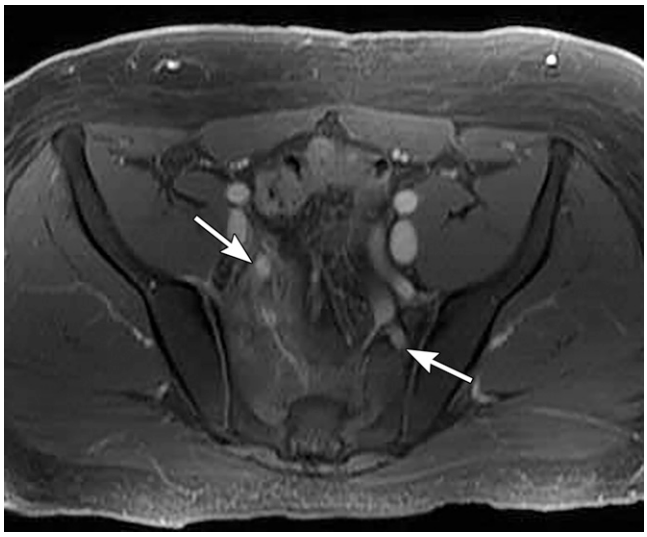


Table 2. Suggested MRI protocol for rectal cancer imaging on 3.0-T magnets

Sequence	Sagittal T2W TSE	Coronal T2W TSE	Axial T1W TSE	Axial DWI EPI	Oblique axial T2W TSE
TR/TE (msec)	3000–5000/100	3000–6000/80	350/shortest	Shortest/shortest	3000–5000/110
Flip angle	90	90	90	90	90
FOV (cm)	24	26	35	34	34
Slice thickness (mm)	3	3	1.5	3	3

DWI, diffusion-weighted imaging; EPI, echoplanar imaging; FOV, field of view; T1W, T_1 weighted; T2W, T_2 weighted; TE, echo time; TR, repetition time; TSE, turbo spin echo.

T_1 weighted and T_2 weighted signal intensity, as seen with the chronic fibrotic process (Figure 16), although the presence of high T2 WI and post-contrast enhancement suggest active inflammation.[2]

MANAGEMENT

The majority of the presacral/retrorectal mass will undergo surgical removal if the patient is able owing to the fact that this space is prone to contamination and even benign lesions may become superinfected and potentially lead to further complications such as inflammatory fistulae.

Three primary operative approaches have been described for managing presacral masses: anterior, posterior and combined.[45,46] The anterior or abdominal approach is taken if the lesion is completely contained at or above the S3 vertebral level.[47] This allows adequate visualization of the key anatomy (vascular and urinary) via mobilization of surrounding structures. Of note, the S3 level is the most cephalad palpable region able to be palpated during digital rectal examination. Anterior approach is only taken if there is no sacral invasion.

The posterior approach is taken for lesions below S3 (defined as S4 and below).[48] Coccygectomy is almost always performed, and sacrectomy of variable extent is performed as well. Posterior approach increases the risk of haemorrhage, given the poor visualization of vascular structures and decreased ability to control inadvertent vascular injury. However, this approach allows for better preservation of neurological structures.

Combined abdominoperineal approaches are taken for masses extending craniocaudally above and below S3 or masses with sacral, vascular, pelvic sidewall, ureteral or rectal invasion. The recovery and operating times are increased in these cases.[12,49]

Reporting

The imaging approach to evaluation of these masses is not standardized. However, given the range of pathologies and multiplicity of soft-tissue structures in the presacral lesions, as well as common involvement of the spine and pelvic bones, MRI is the preferred modality. Tables 2 and 3 outline the protocols used at the authors' institution for the evaluation of rectal and presacral masses.

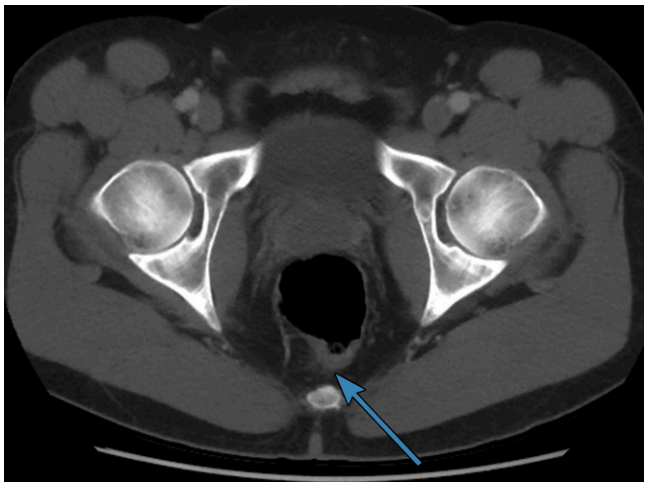
The value of radiology to the surgeon is not always in 100% accuracy for diagnosis. In the case of presacral masses, identifying salient features which could change the surgical approach is essential. First and foremost, the surgeon needs to know whether a mass is benign or malignant. Although not always clear-cut, the majority of presacral masses can be placed easily into one of these two categories. The exception may be sarcomatous tumours with a predominant fatty component or lymphoma which has a homogeneous imaging appearance often associated with benignity.

Table 3. Suggested MRI protocol for pelvic mass imaging (including presacral masses) on 3.0-T magnets

Sequence	Coronal T2W TSE	Axial DWI EPI	Sagittal T2W TSE	Axial IP/OP	Axial 3D TFE dynamic post gadolinium	Axial 2D TFE delayed post gadolinium
TR/TE (msec)	3000–5000/100	Shortest/shortest	3000–6000/shortest	180/1.5/2.3	Shortest/shortest	Shortest/shortest
Flip angle	90	90	90	55	7	10
FOV (cm)	To fit	To fit	To fit	To fit	To fit	To fit
Slice thickness (mm)	5	5.5	6	5.5	2	2

2D, two dimensional; 3D, three dimensional; DWI, diffusion-weighted imaging; EPI, echoplanar imaging; FOV, field of view; IP, in-phase; OP, opposed-phase; T2W, T_2 weighted; TE, echo time; TR, repetition time; TFE, turbo fast echo; TSE, turbo spin echo.

Figure 17. Transgluteal approach is preferred for the majority of presacral masses (arrow). The medial and inferior approach avoids injury to the sciatic nerve and superior and inferior gluteal vessels and avoids traversal of the piriformis muscle, which can be painful. This is ideally performed in the prone position.



Next, the origin of the mass should be elucidated. Masses of the presacral space originate from anterior structures—primary rectal origin; primary retrorectal area origin; or sacrum with anterior extension. Masses of rectal origin are most commonly gastrointestinal stromal tumour or rectal cancer, and colorectal surgeons should be the primary operators. Masses arising from the sacrum with close proximity to CNS structures require orthopaedic spinal or neurosurgery lead. Primary retrorectal origin is generally within the comfort zone of colorectal surgery, but the involvement of adjacent vascular, genitourinary or osseous structures warrants a multidisciplinary approach.

As with any mass, the extent of local invasion must be described. Invasion or contact (>180°) with adjacent structures indicates the need for the primary surgeon to consider collaboration with a surgeon specializing in the involved anatomy.[45,46]

Biopsy

In the past, biopsy was almost never undertaken because of risk of infection and injury to critical structures and generally poor sampling efficacy. However, the combination of improved technique and improved pre-operative treatment of several of the lesions outlined has increased the utility of tissue sampling prior to therapy. In particular, presacral lesions arising primarily from osseous structures will always undergo biopsy at our institution because their imaging appearance is not sufficiently specific. Ewing sarcoma, osteosarcoma, lymphoma and solitary fibrous tumour are some examples of lesions which could benefit from neoadjuvant therapy and require tissue sampling to determine malignant *vs* benign nature.[47] Use of clinical and imaging parameters to suggest one of these lesions could point a radiologist towards suggesting tissue sampling. Three general approaches can be taken: transgluteal, anterolateral extraperitoneal and transsacral (Figures 17, 18).[50,51]

The transgluteal, approach is preferred by most radiologists, as this can be done by staying "low and medial" adjacent to the sacrum, below the superior gluteal artery, medial to the inferior gluteal artery and sciatic nerve. In addition, if seeding of the biopsy tract occurs, this is less of a problem because this region will likely be resected during surgery.[12,51] Unfortunately, some patients cannot tolerate this approach because of the requirement for prone positioning.

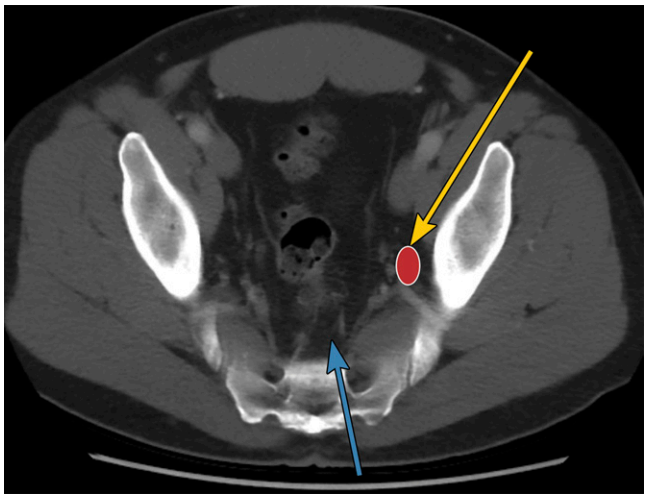
Anterolateral extraperitoneal approaches essentially follow the course of the iliopsoas muscle to reach the presacral space, avoiding the bladder, bowel and vasculature, while remaining below the peritoneal lining to avoid infectious introduction.

The transsacral, transosseous approach commonly used for osseous lesions requires appropriate devices as well as adds the risk of neurologic injury; however, the bladder and bowel are well removed from the biopsy tract.

CONCLUSION

The presence of myriad embryologically distinct types of tissues in the retrorectal/presacral space accounts for the various lesions seen on imaging studies. While some masses have distinct clinical presentations or imaging appearances, it is more important for the radiologist to identify and report key findings that will affect management decisions than speculate on histology. Knowledge of the relevant anatomy and surgical approaches helps the radiologist make a clinical contribution to the care of patients with presacral pathology. In addition, if image-guided biopsy is required, the radiologist should be aware of critical anatomical and pathological considerations that may alter the biopsy approach.

Figure 18. Transsacral (light blue arrow) approach is usually reserved for osseous lesions, which may extend to the presacral space. The approach is medial to the neural foramen and lateral to the spinal canal. The extraperitoneal anterolateral approach (yellow arrow) can target a pelvic sidewall lymph node or mass (red oval) with a course through the iliacus muscle. For colour image see online.



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