

Extraplinal findings on lumbar spine MR imaging

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Radiology Case. 2009 Aug; 3(8):5-13 :: DOI: 10.3941/jrcr.v3i8.213

ABSTRACT

Interpretation of radiologic studies requires vigilance on the part of the radiologist to identify findings and abnormalities outside the region of interest. In the case of routine lumbar spine MRI for low back pain, many extraplnal abnormalities can often be identified. Some of these findings may account for low back pain. Other findings are incidental, but may have significant clinical implications, and are important to recognize. We present twenty-four examples of incidental findings from lumbar spine MRI examinations. The findings involve various organ systems, covering a broad range of clinical urgency.

REVIEW ARTICLE

INTRODUCTION

Lumbar spine MR images were selected from examinations on twenty-three patients (one of which provides two extraplnal findings for discussion) ranging in age from 40 to 75 years of age. All of the examinations were done for the chief complaint of low back pain, with the majority of the prescriptions expressing the expectation of disk herniation or other manifestations of lumbar degenerative disease. All of the examinations followed a standard protocol for MR imaging of the lumbar spine, utilizing a 1.5 Tesla GE magnet with axial and sagittal T1 and T2 weighted sequences. Intravenous gadolinium was administered in some cases, for example if there was a history of recent surgery.

In this collection, there are examples of extraplnal abnormalities from various organ systems. These are addressed in several groups below.

Vascular:

Vascular extraplnal abnormalities include aortic dissection, aortic aneurysm and lymphatic anomalies. An aortic dissection

would present as a hypointense linear filling defect traversing the lumen of the aorta, which represents the intimal flap (Fig. 1). Abnormal dilatation of the infrarenal aorta is consistent with aneurysm (Fig. 2). Prominent lymphatic vessels may present as T2 hyperintense tubular structures in the retroperitoneal space, following the course of the iliac veins (Fig. 3). Retroperitoneal lymphadenopathy may appear as multiple rounded intermediate signal lesions, or more confluent abnormal soft tissue, depending on the underlying pathology (Fig. 4).

The findings of aortic aneurysm and dissection have potentially serious clinical implications. In contradistinction, it is important to recognize prominent lymphatics as a physiologic variant. Lymphadenopathy may be an unexpected finding, depending on the clinical scenario, and may alter staging and/or treatment options in patients with cancer.

Genitourinary:

Genitourinary extraplnal findings include adrenal masses, renal masses, renal infarct, hydronephrosis, renal cysts, developmental renal anomalies, and bladder anomalies.

Various uterine findings may be present, such as leiomyomas, adenomyosis, and gravid or postpartum uterus.

Adrenal masses may be often confirmed as adenomas by correlating with CT (Fig. 5). Renal cell carcinoma may present as a complex mass of variable size and signal characteristics (Fig. 6).

Patients with a history of prior discectomy may receive intravenous contrast for their lumbar MR examination (to help differentiate recurrent disc herniation from postoperative granulation tissue), which allows detection of some findings which would be occult with noncontrast technique. For example, renal infarct typically presents as a wedge-shaped region of absent enhancement, with capsular sparing (Fig. 7).

Abnormal dilatation of the renal collecting system, representing hydronephrosis, may be included in the field of view, most often on the axial images (Fig. 8), although the cause of the hydronephrosis may not be visible on the lumbar MRI study. Early detection of hydronephrosis may enable the clinician to identify and treat the underlying cause prior to permanent loss of kidney function.

Adult polycystic kidney disease ultimately manifests as innumerable bilateral renal cysts, which may even replace any visible normal parenchyma. The cysts may contain debris levels from prior hemorrhage, and, in some cases, a transplanted kidney may be visible in the pelvis on more caudal images (Fig. 9). Various developmental renal anomalies may be visible on lumbar MRI, such as horseshoe kidney (Fig. 10). Horseshoe kidneys have higher incidence of stone formation than normal kidneys, and put the patient at higher risk for traumatic injury to the kidneys.

A ureterocele will present as a round cystic mass in the bladder, at the expected location of the ureteral orifice (Fig. 11). Ureterocele may be associated with ureteral obstruction.

Incidental uterine findings are also commonly seen on routine lumbar imaging. One of the most common is a uterine leiomyoma (fibroid), which will typically present as a mural, subserosal or submucosal mass (Fig. 12). Adenomyosis appears as thickening of the uterine junctional zone (Fig. 13).

A postpartum uterus will typically be enlarged, with heterogeneous signal and varying amounts of intrauterine fluid (Fig. 14). A gravid uterus may present with various partly visualized fetal parts (Fig. 15). Obviously, the patient and referring physician will be aware of the postpartum status, and it is important for the radiologist to recognize this appearance in order to avoid misdiagnosis. However, the presence of a fetus may require explicit communication, especially if additional imaging or intravenous contrast is needed.

Gastrointestinal:

Gastrointestinal extraspinal findings may include various pathology of the liver, biliary system, gallbladder, intestines or spleen. Colon cancer will often appear as an area of focal or segmental mural thickening (Fig. 16). Cholelithiasis will

typically manifest as multiple layering hypointense structures in the gallbladder (Fig. 17). Prominence of common bile duct may be visible at the level of the pancreatic head (Fig. 18). These findings illustrate the varying degrees of clinical urgency which may be associated with incidental findings on lumbar MRI. Again, it is also important to recognize normal variants such as an accessory splenule (Fig. 19), and the multiple tiny cystic structures seen in the liver in Fig. 20, consistent with benign biliary hamartomas (von Meyenberg complex).

Musculoskeletal:

Extraspinal findings in the musculoskeletal system may include abnormalities of the paraspinal musculature or the bony pelvis. Retroperitoneal hematoma may present as a complex heterogeneous intensity mass (Fig. 21). The presence of blood products, rapid onset of symptoms, and pertinent history (e.g. anticoagulation) may help to make the diagnosis. Skeletal metastases (Fig. 22) may or may not be an expected finding, depending on the clinical scenario. Similar to lymphadenopathy, staging and treatment options for oncology patients may be affected by this finding. Various benign bone lesions may present a diagnostic dilemma, and the associated clinical history is key. For example, brown tumors (Fig. 23) are more easily diagnosed once one is aware of the patient's underlying renal disease.

Situs Inversus:

This entity (Fig. 24) is a fitting reminder that all organs in the field of view may potentially be a source of incidental findings, including abnormal location. Careful scrutiny of the scanning technique is necessary to exclude errors of annotation due to unorthodox patient positioning.

DISCUSSION

As with all radiologic studies, images obtained for evaluation of the lumbar spine commonly include many organ systems outside the region of interest. The structures most commonly included are portions of the genitourinary and gastrointestinal systems. Incidental vascular and musculoskeletal findings are also common. Although many of the findings are incidental, many are often the cause of the chief complaint, namely low back pain. Some of the incidental findings represent potentially life threatening conditions which are asymptomatic. In some cases, the radiologist may be interpreting the images while the patient is still in the scanner. In such circumstances, detection of extraspinal pathology may prompt acquisition of additional sequences or imaging planes, or additional advanced techniques such as fat suppression. Adjusting the saturation block may allow improved visualization of the finding in question.

A study by Konnak et al (1) described an increased survival rate in patients with renal cell carcinoma that was incidentally detected, compared to tumors presenting with symptoms. The authors speculated that the detection of the lesions prior to development of symptoms was likely related to lower tumor stage at the time of diagnosis.

In a later retrospective study by Frager et al (2), of 1517 lumbar CT examinations, extraspinal pathology was demonstrated in 22 (1.45%) including retroperitoneal tumors and lymphadenopathy as well as vascular, urinary tract and gynecologic abnormalities. Although infrequent, some of the findings had serious clinical implications. In a more recent study, Wagner et al (3) described a large increase in the number of incidental findings described on lumbar MRI since the widespread use of picture archiving communications systems. Similar findings were described by Green (4). As would be expected, the lumbar spine is not the only anatomic region in which incidental findings have been increasingly detected with the advent of progressively advanced imaging techniques. A similar trend has also been described in brain imaging, for example, in an article by Vernooij et al (5).

In considering the impact of incidental findings on patient care, it is also important to remember the implications for the field of radiology. Currently, practitioners from many subspecialties are involved in the interpretation of radiologic studies, including cardiologists, vascular surgeons, and neurologists and neurosurgeons. Many of these specialists are skilled in interpreting their organ system of interest. However, the general training received by radiologists arguably makes them the best equipped to detect incidental findings. This article emphasizes the importance of making the incidental finding in the lumbar spine MRI, but the concept is universal to all imaging studies in radiology.

TEACHING POINT

Lumbar MRI obtained for low back pain may reveal findings within any of the organ systems included in the field of view. Vigilance on the part of the radiologist may aid in diagnosis of extraspinal causes of pain. Of equal importance is the detection of asymptomatic but clinically significant conditions.

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FIGURES



Figure 1: 57 year old man. Axial T2 weighted image through the infrarenal aorta demonstrates an intimal flap consistent with aortic dissection

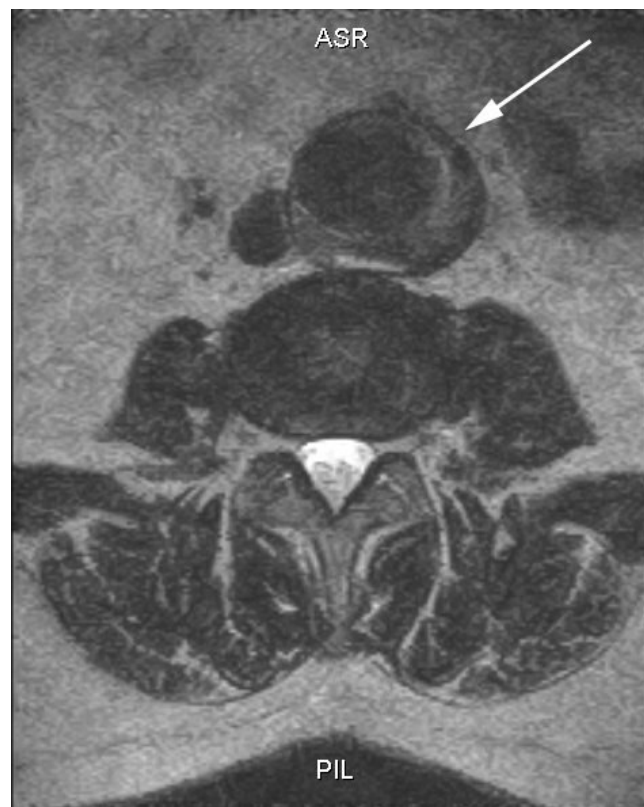


Figure 2: 87 year old man. Axial T2 weighted image through the infrarenal aorta demonstrates an approximately 4cm infrarenal aortic aneurysm.



Figure 3: 43 year old woman. Axial T2 weighted image at the level of the inferior renal poles demonstrates tubular hyperintense structures in the retroperitoneum consistent with incidental prominent lymphatics.

Figure 4 (middle row): Different appearances of retroperitoneal lymphadenopathy. In the left panel, a 59 year old man with bladder carcinoma. Axial T1 image at the level of the renal arteries shows aortocaval adenopathy with a confluent appearance. Lymphoma or retroperitoneal fibrosis may have a similar appearance. In the right panel, a 77 year old man with prostate carcinoma. Axial T2 weighted image at the level of the renal midpole shows discrete retroperitoneal masses consistent with aortocaval adenopathy.

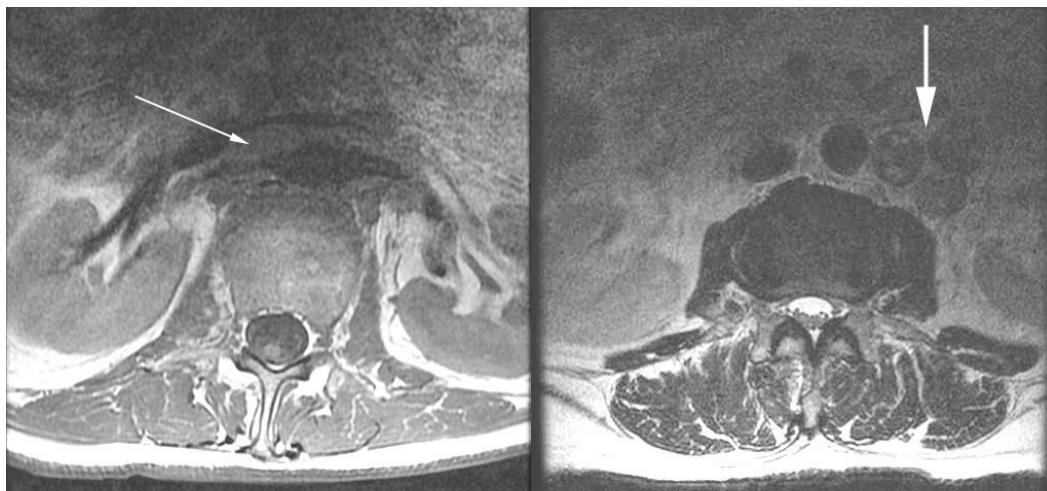
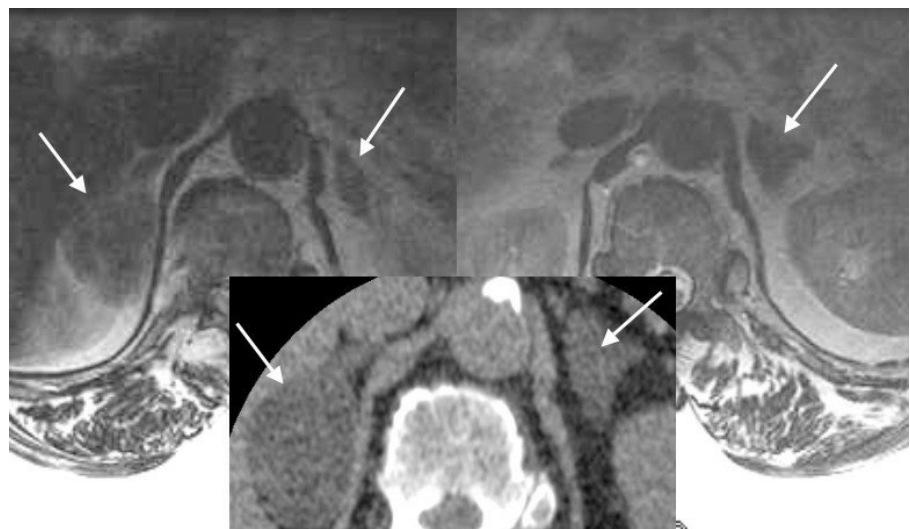


Figure 5 (right): 60 year old man. Two sequential axial T2 weighted MR images demonstrate bilateral hypointense adrenal lesions. A separate non-contrast CT axial image (inset) demonstrates low density adrenal lesions. In this case the adrenal masses measured less than 10 Hounsfield units in density (measurement not shown), which confirms adrenal adenomas.



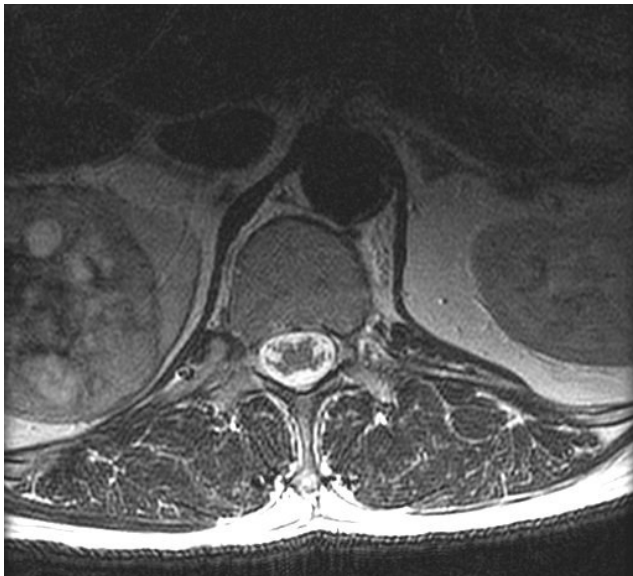


Figure 6: 57 year old man. Axial T2 weighted image at renal midpole level demonstrates a large heterogeneous right renal mass later proven to be a renal cell carcinoma.

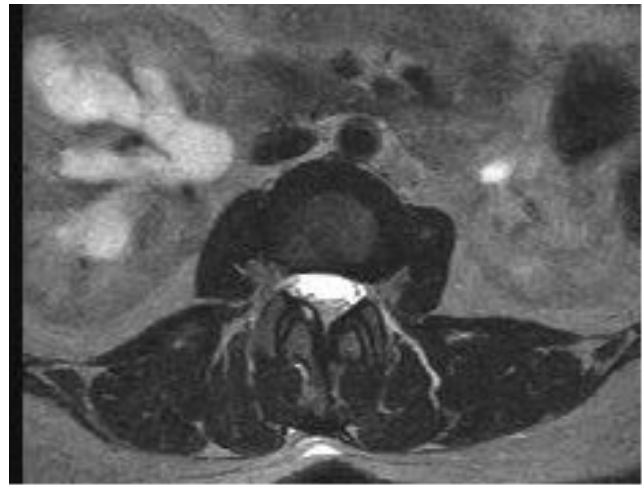


Figure 8: 72 year old woman. Axial T2 weighted image from an open magnet study demonstrates dilatation of the right renal collecting system, consistent with unilateral hydronephrosis.

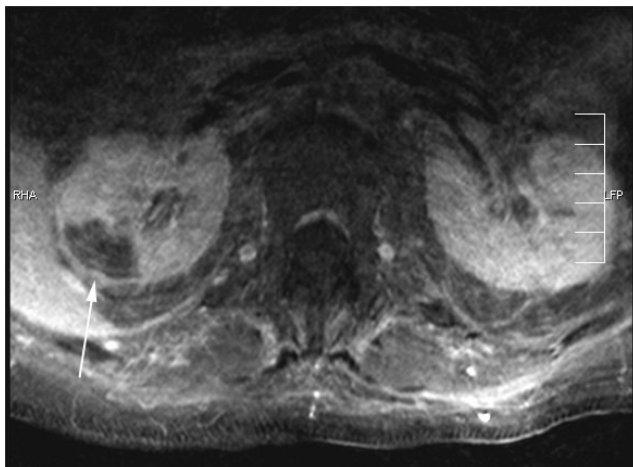
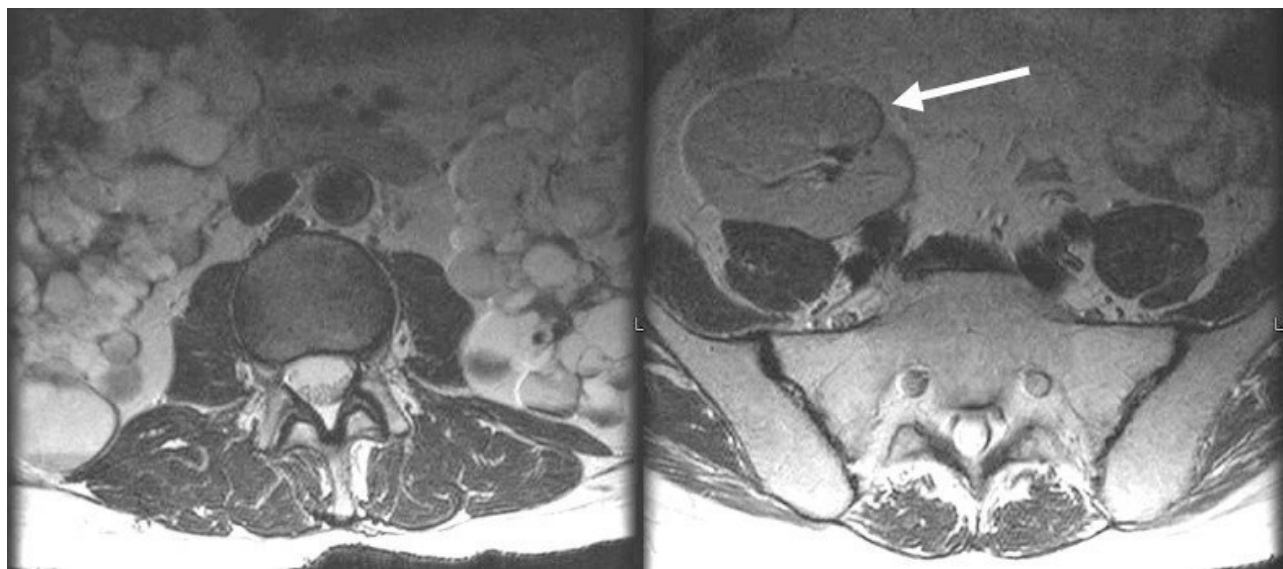


Figure 7 (left): 66 year old man. Axial post contrast fat suppressed T1 weighted image at level of renal hila demonstrates a wedge shaped region of absent enhancement in the right renal parenchyma with a rim of capsular sparing, consistent with a renal infarct.

Figure 9 (bottom): 47 year old man. Axial T2 weighted image at renal midpole level demonstrates bilateral hyperintense T2 lesions replacing the kidneys in a patient with autosomal dominant polycystic kidney disease (note multiple hematocrit levels). More caudally, a transplanted kidney is seen in the right pelvis (arrow).



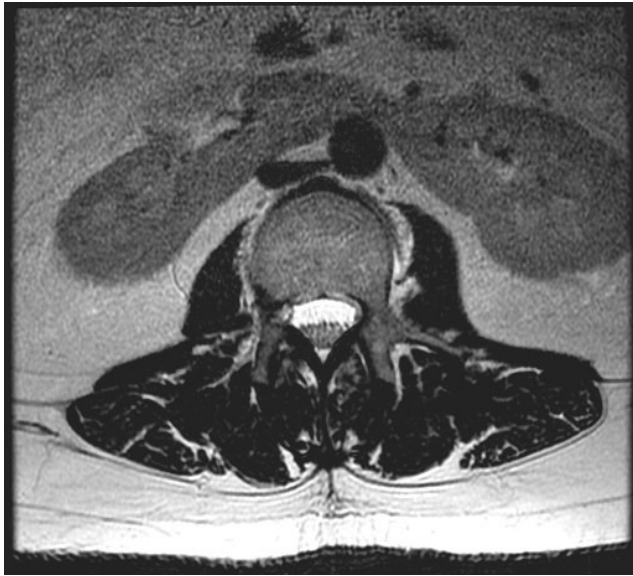


Figure 10: 33 year old woman. Axial T2 weighted image at the level of the inferior renal poles demonstrates fusion of the kidneys at the midline, consistent with a horseshoe kidney.



Figure 12: 44 year old woman. Sagittal T2 weighted image demonstrates multiple hypointense uterine masses consistent with mural and subserosal leiomyomas.



Figure 11: 26 year old woman. Sagittal T2 weighted image demonstrates a thin walled cystic mass within the inferolateral aspect of the urinary bladder, consistent with a ureterocele.



Figure 13: 37 year old woman. Sagittal T2 weighted demonstrates widening of the hypointense uterine junctional zone, consistent with adenomyosis.

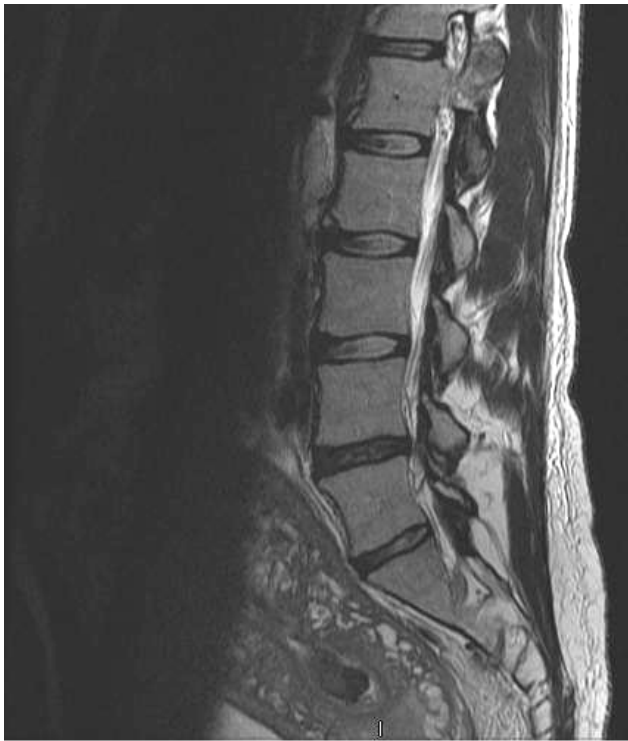


Figure 14: 21 year old woman. Sagittal T2 weighted image demonstrates an enlarged uterus with areas of myometrial signal hyperintensity, in a postpartum patient.



Figure 15: 22 year old woman. Sagittal T2 weighted image demonstrates a partially imaged gravid uterus with a visible fetal brain.

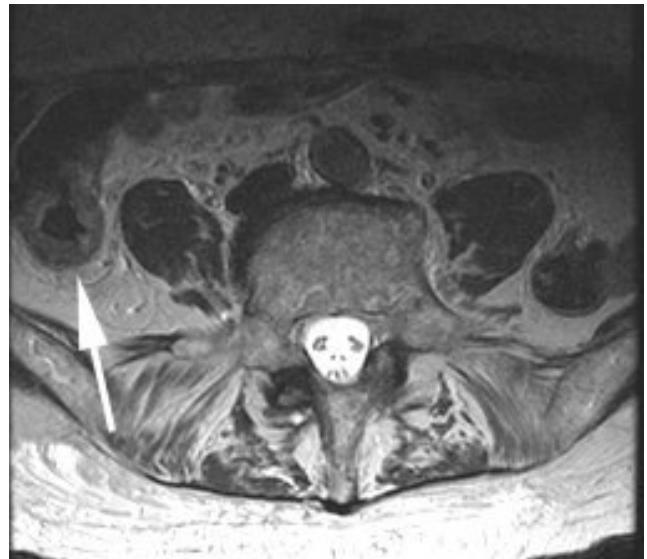


Figure 16: 80 year old woman. Axial T2 weighted image at the L5 level detects concentric colonic wall thickening in the right lower quadrant, later confirmed to be carcinoma.

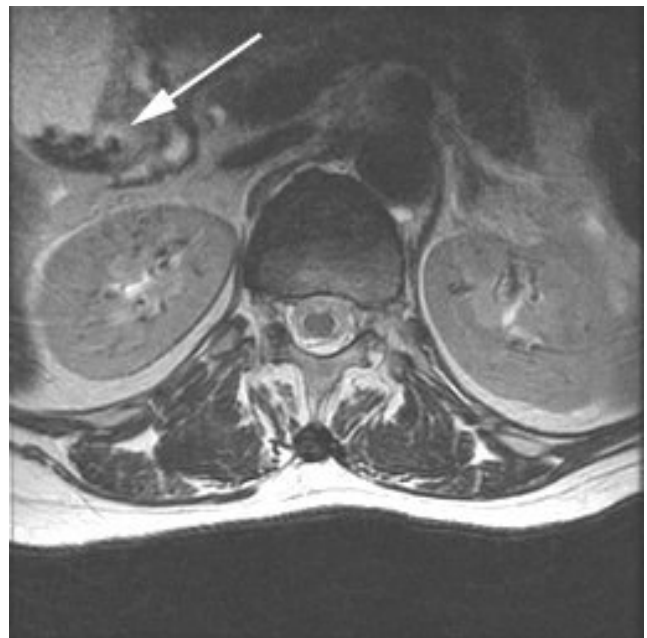


Figure 17: 44 year old woman. Axial T2 weighted image at the level of the pancreas demonstrates multiple hypointense structures layering dependently within the gallbladder, consistent with gallstones.



Figure 18: 49 year old woman. Axial T2 weighted image at renal midpole level demonstrates a hyperintense structure in the region of the pancreatic head, consistent with a prominent distal common bile duct.



Figure 19: 52 year old man. Axial T2 weighted image at the level of the superior renal poles demonstrates a lesion slightly higher than muscle intensity in the left upper quadrant, consistent with an accessory splenule.

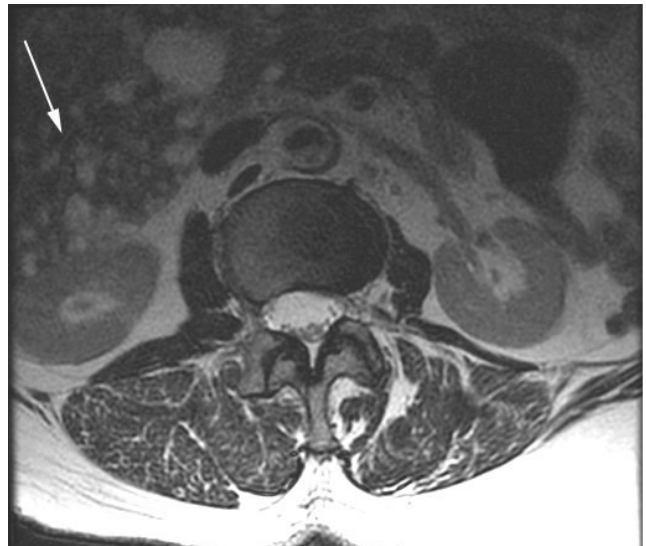


Figure 20: 67 year old man. Axial T2 weighted image at the level of the superior renal poles demonstrates multiple small cystic lesions in the liver, consistent with biliary hamartomas (von Meyenberg complex).

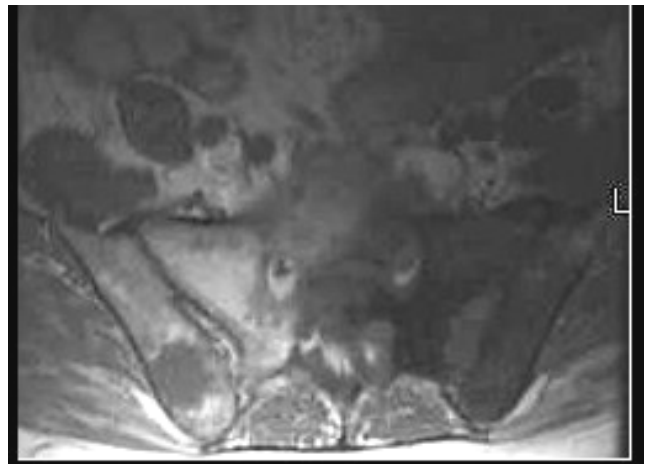


Figure 21: 77 year old man, same patient as in the right panel of figure 4. Axial T1 weighted image at the level of S1 shows abnormal areas of signal hypointensity in the sacrum and iliac crests, consistent with metastatic disease in this patient with prostate carcinoma.

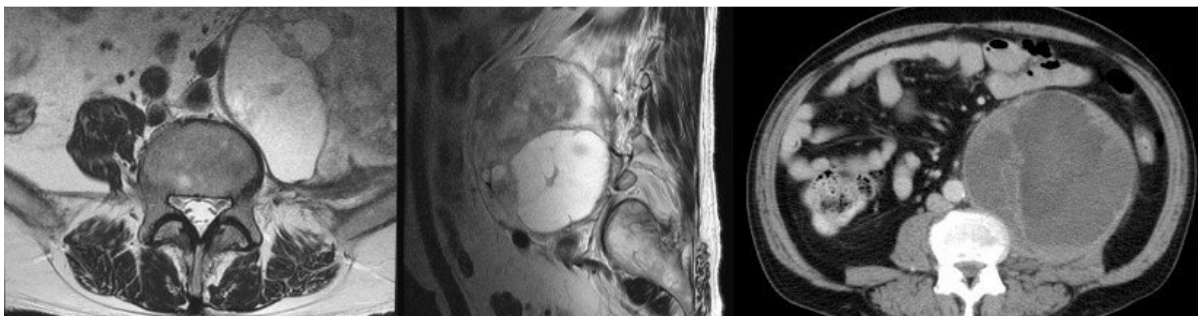


Figure 22 (bottom): 68 year old man. Axial and sagittal T2 weighted images (left and center panel) demonstrate a large heterogeneous mass in the left psoas region with complex internal septations, consistent with a retroperitoneal hematoma. Corresponding axial CT image (right panel) at this level shows additional finding of a small hematocrit level.

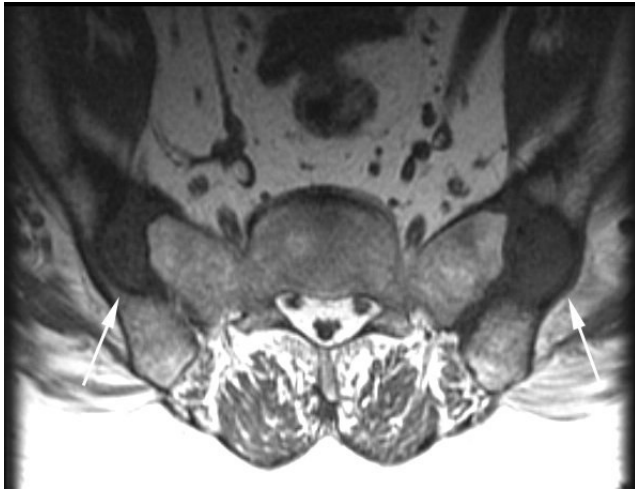


Figure 23: 38 year old man. Axial T1 weighted image at the level of the iliac crests shows bilateral well defined expansile iliac masses, consistent with Brown tumors in a man with chronic renal disease.

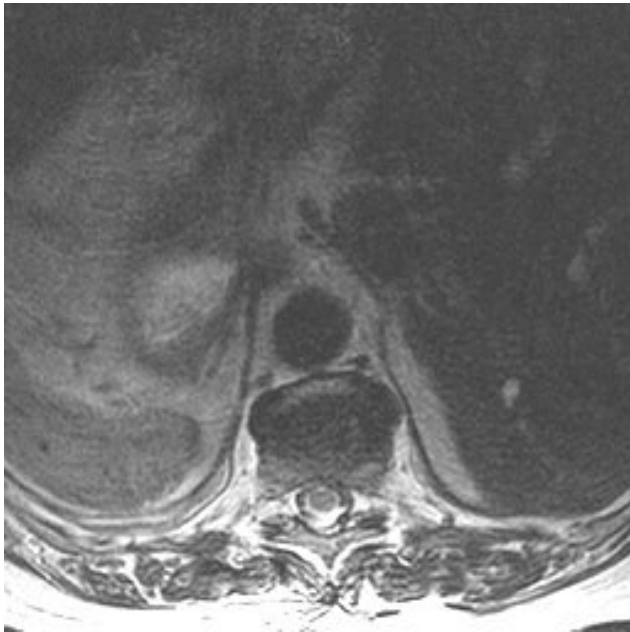


Figure 24: 73 year old woman. Axial T2 weighted image at the level of the diaphragm shows stomach and spleen on the right, liver and inferior vena cava on the left, consistent with situs inversus.

ABBREVIATIONS

CT = Computed Tomography
MRI = Magnetic Resonance Imaging

KEYWORDS

Incidental, findings, lumbar, MRI

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