

Pictorial Review

Magnetic resonance spine localizers – The “forgotten” treasure

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ABSTRACT

Magnetic resonance imaging (MR) localizer images form a very small but important part of the MR of the spine. Often overlooked, these limited, low spatial resolution, and high field-of-view images enable the radiologist to diagnose additional pathologies in the thorax, abdomen, and pelvis, as well as in the soft tissue and bones. These are unsuspected but can be critical for patient management, reducing patient morbidity and probably mortality.

Keywords: magnetic resonance spine localizers, incidental, extraspinal, unsuspected

INTRODUCTION

Magnetic resonance (MR) of the spine remains a cornerstone imaging technique for the evaluation of low back pain. Due to ever-mounting pressures on the radiology departments to increase efficiency and through-put, there is pressure on the radiologists to reduce the reporting times. Some radiologists expedite their reporting times by omitting review localizer sequences, because of their suboptimal quality due to low resolution and saturation bands obscuring the images. Thick slices can also mean pathology and can sometimes only be seen on a single image. In addition to these, MR imaging evaluation and interpretation are a highly complex process, inherently error-prone due to a variety of cognitive and perceptual biases. They include under-reading (missed findings), the satisfaction of search or satisfaction of report, and location type error (key finding is missed because it lies outside of the area of interest) which can lead to incidental findings being neglected by the interpreter.^[1]

The majority of incidental findings are asymptomatic and not clinically significant, they can raise both ethical and legal issues, notably when omitted and subsequently proved to be clinically significant. Hence, identifying, characterizing, and reporting these potential incidental findings are the responsibility of the radiologist, with appropriate recommendations. This is probably of even greater significance when findings lie outside the field of expertise of the reporting radiologist or the clinician requesting the radiological.^[2] To evaluate the value of interpreting localizer images further, we have performed an audit of 100 cases at our tertiary orthopedic institute. Among 100 consecutive MRI whole spine localizer images, we found four renal cysts, one right-sided pleural effusion, one left lung consolidation, and one each with rib, acetabulum, and right femoral metastases. Hence, we think that the importance of localizer images analysis

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and interpretation is under-rated and they should be included in reporting checklist regularly.

Although MR localizer sequences vary significantly among different manufacturers and institutions, they are large slice thickness and poor spatial resolution images aimed at providing “rudimentary” images in three orthogonal, axial, sagittal, and coronal planes. They are used as scout images to localize and further interrogate different anatomic structures with detailed MR images. Even with reduced spatial resolution, the quality of these MR images can provide “sufficient” detail of incidental pathologies which can be investigated further with appropriate (clinical, biochemical, and imaging) investigations. Furthermore, MR parameters can be altered to improve the spatial resolution of the localizer images to improve diagnostic yield. For instance, acquiring single-shot fast spin-echo and balanced steady-state free precision localisation sequences instead of fast spoiled gradient echo can yield better image quality without a significant increase in acquisition time. These can be achieved by increasing the number of excitations, reducing slice thickness, or increasing the number of slices; however, these changes may result in increased acquisition time.^[3]

The localizers typically form <3% of the entire data set in terms of size and image numbers and take <30 seconds for evaluation. Although localizers form only a minuscule part of the entire examination, they are vital in terms of diagnostic yield. We recommend a checklist approach, akin to the remainder of the examination, for evaluation of the localizer.

Evaluation and interpretation of localizer images in MR spine are particularly important due to many reasons: (1) Incomplete history and clinical history available before imaging, (2) constant “consultation hopping” between various doctors which may lead to loss of important clinical information including MR films, and (3) lack of standard imaging protocols – although many imaging centers offer STIR coronal images as a part of “routine” MR spines not all. In addition, coronal sequences may be omitted in “screening” MR spine examinations leading to a lack of large FOV coronal sequence, and (4) high interpretation time-to-diagnostic yield ratio; as mention earlier, if used as a routine image evaluation checklist, localizers can provide numerous unsuspected pathologies with minimal expenditure of image interpretation time.

In this pictorial essay, we present a number of findings found on spinal MR localizers. Some of these may be unknown to the patient’s clinical team and could represent significant unsuspected findings which potentially expedite patient management and, in turn, decrease patient morbidity and mortality. Although the most of the systemic diseases shown on localizer images may be known to the treating clinical team, some of them may not be known to the treating clinicians and could represent significant unsuspected findings, which

potentially need expedited patient management leading to decreased patient morbidity and mortality. The central idea of the article is to highlight localizer images as potential “blind spots” in spinal imaging. To simplify, we have divided findings according to the anatomy into supradiaphragmatic (above the diaphragm including anatomical structures in the neck and thorax) and infradiaphragmatic (abdomen and pelvis structures), and musculoskeletal.

SUPRADIAPHRAGMATIC COMPARTMENT

MR localizer, especially those for the cervicothoracic spine, can provide a useful overview of the root of the neck, mediastinum, lungs, and thoracic soft tissues.

Mediastinum

A careful review of such localizer images may be helpful to find mediastinal pathologies such as cardiomegaly, mediastinal goiter [Figure 1], mediastinal lymphadenopathy [Figure 2] escalating management with for possible lymphoproliferative disorders, granulomatous disease, and potential malignancies as well as more sinister superior sulcus tumors.



Figure 1: (a and b) A 77-year-old female with recurrent falls and L1 midline tenderness. Being considered for vertebroplasty. Incidentally detected retrosternal goiter (arrow) as an unsuspected but clinical relevant finding, an anesthetic would want to know before administering anesthesia.

Lungs, thoracic cage, and chest wall

For thorax, localizer images may provide diagnosis of acute conditions such as pneumothorax, pleural effusion [Figure 3]; lung masses and their potential spread [Figure 4];

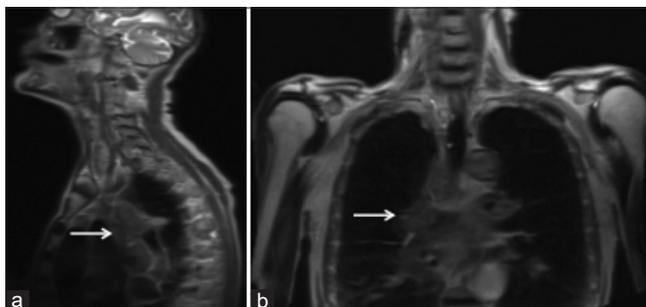


Figure 2: (a and b) A 84-year-old male with known lung malignancy complains of back pain and right leg weakness. Incidental detection of massive mediastinal lymphadenopathy (arrows).



Figure 3: Left-sided moderate pleural effusion (white marrow) incidentally detected in patient with chronic back pain undergoing whole spine MRI.



Figure 4: (a and b) A 68-year-old male with low back pain. Diagnosed with lung mass (short arrow) and vertebral metastasis (long arrows) on localizers.

thoracic wall lesions including chest wall pathologies and rib lesions [Figure 5]; and altered pulmonary parenchymal appearance due to the previous lung procedures, that is, post-pneumonectomy [Figure 6].

INFRADIAPHRAGMATIC COMPARTMENT

MR localizers are particularly helpful for intra-abdominal and pelvic pathology, which can be serendipitous findings, expediting relevant further investigation and can impact on patient outcome. These may include benign, indeterminate and malignant hepatic lesions, hepatomegaly, renal mass lesions, hydronephroureterosis, pregnancy, benign and malignant genitourinary and gastrointestinal tract malignancies, ascites, and pelvic lymphadenopathy.

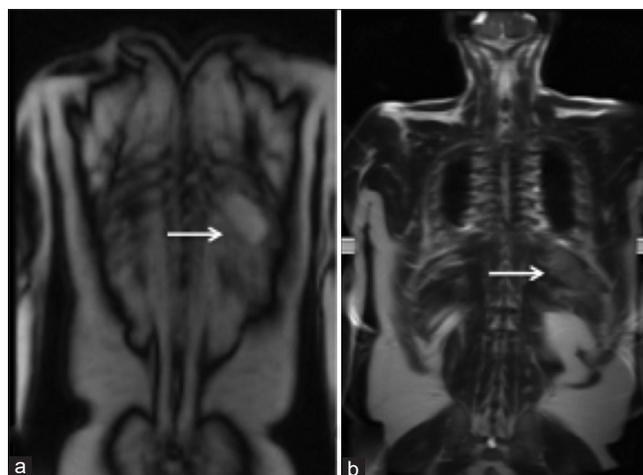


Figure 5: (a and b) A 50-year-old gentleman with known myeloma undergoes a whole spine MR for generalized bony pain. Plasmacytoma involving the posterior left 10th rib can be appreciated on the localizer (arrows).

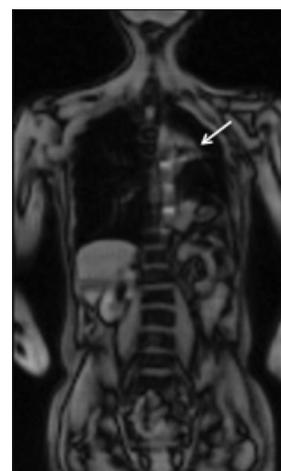


Figure 6: Lung mass mimicker on coronal localizer image. Post-lobectomy appearance (arrow) of the left upper lobe.

Liver

Numerous hepatic lesions including benign such as simple hepatic cysts [Figure 7], hepatic hemangioma and hepatomegaly [Figure 8] can be diagnosed easily using T2-weighted localizer images; however, indeterminate hepatic pathologies need to be investigated further with liver-specific examinations to distinguish between benign and malignant lesions. In addition to the hepatic parenchymal lesions, localizer can also demonstrate intrahepatic biliary duct dilatation [Figure 9] which may precede the onset of clinically significant disease.

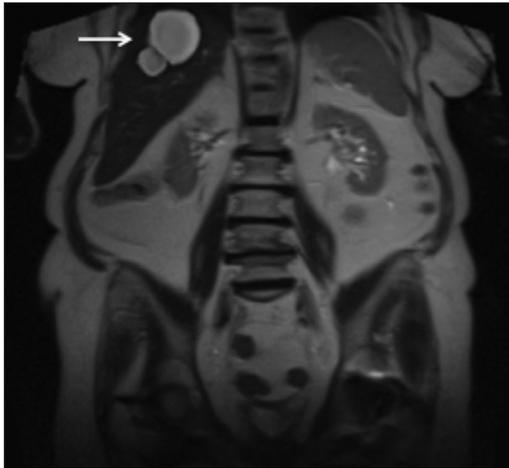


Figure 7: A 79-year-old gentleman presented with chronic back pain. Localizer image demonstrates incidentally detected right hepatic lobe simple cyst (arrow).

Kidneys

Similar to liver, in addition to benign renal cysts and polycystic renal disease [Figure 10], renal mass lesions including renal tumors [Figure 11] can be identified on MR localizer. As for hydronephrosis [Figure 12], localizer may not provide complete information about the cause of renal tract obstruction, diagnosis of its presence may prompt the clinician to treat the condition before renal function deterioration.^[4]

Vessels and lymph nodes

Incidentally diagnosed abdominal aortic aneurysm may be treated in its early phase to thwart more fatal presentations

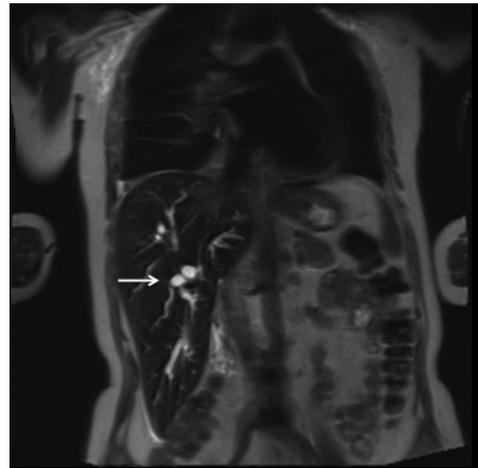


Figure 9: Localizer shows intrahepatic biliary radicles dilatations (arrow). An example to demonstrate necessity of further imaging investigations including ultrasound, CT, MRCP, and/or ERCP.

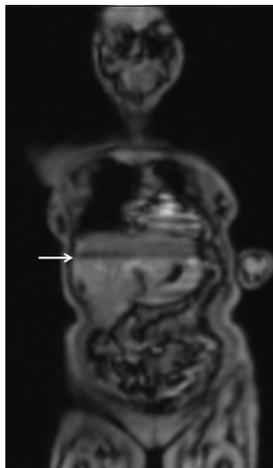


Figure 8: A 61-year-old female presents with 6 month lethargy, weight loss, and back pain. Extensive lymphadenopathy was noted on recent CT thorax, abdomen, and pelvis. Subsequent MR of the whole spine showed multilevel spinal metastasis. Hepatomegaly (arrow) was also evident on the coronal haste localizers.

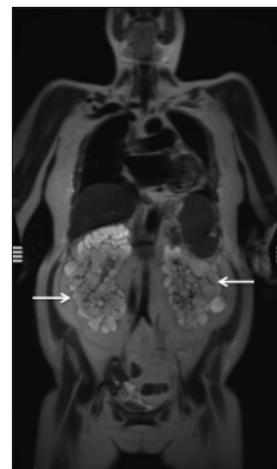


Figure 10: Bilateral polycystic renal disease (arrows). Sometimes localizer can demonstrated cystic lesion in abdominal viscera in vicinity to both kidney including liver, spleen, and pancreas.

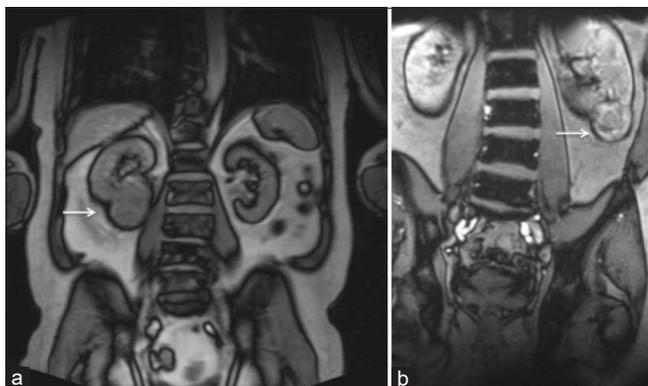


Figure 11: Renal masses in two different patients. (a) Right inferior pole region and (b) left inferior renal pole lesion.

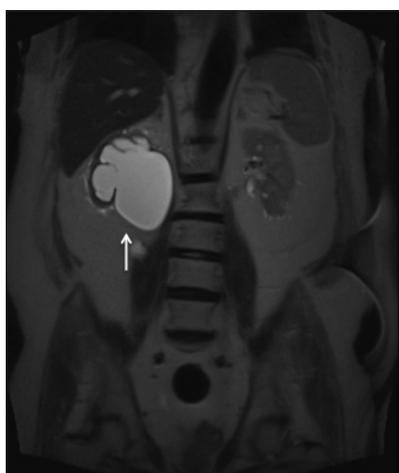


Figure 12: Incidentally detected right gross hydronephrosis (arrow). Appreciate remarkably thinned renal parenchyma, diagnosis of which is extremely important before complete loss of renal function. Further investigation is typically needed in such presentations to rule out distal renal tract obstructive lesion.

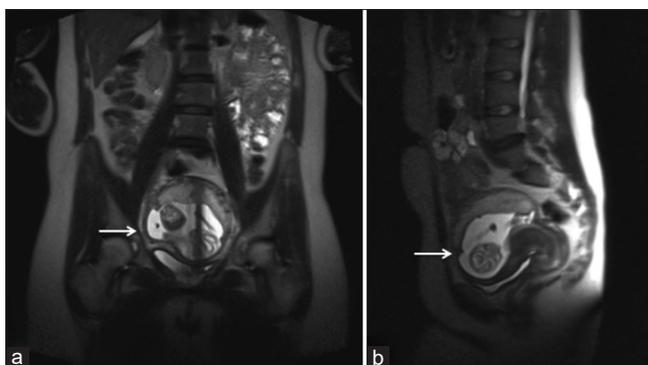


Figure 13: (a and b) A 27-year-old female with back pain, left leg pain, and urinary incontinence. MR localizer demonstrated an intrauterine gestation of approximately 15 weeks.

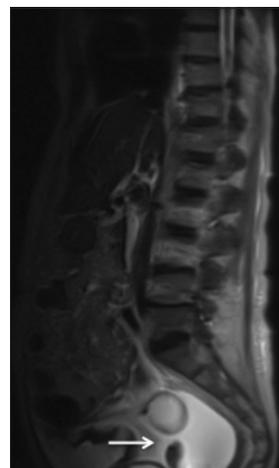


Figure 14: A 80-year-old female with the previous metastatic breast cancer presented with lower back pain and abdominal swelling. Incidentally detected pelvic ascites (arrow) triggers further investigation to rule out metastatic spread as a cause.



Figure 15: Incidentally detected lateral abdominal wall intramuscular lipoma (arrow) without any sinister features on localizer (a) and ultrasound (b).

such as aneurysmal leak or rupture.^[5] Enlarged lymph nodes detected as a part of primary lymphoproliferative disorder or metastatic spread may alter tumor staging and potentially alter treatment options.

Pelvis

Pelvic tumors, whether genitourinary or gastrointestinal, when diagnosed before the clinical onset of the disease, may lead to escalation of management with probable decrease in morbidity.^[6] In addition to pelvic pathologies, localizer images may incidentally detect physiological states such as pregnancy [Figure 13] or pelvic free fluid [Figure 14].



Figure 16: Patient with the left lower limb and hip pain. Incidentally detected clinical relevant left hip osteonecrosis (arrow).

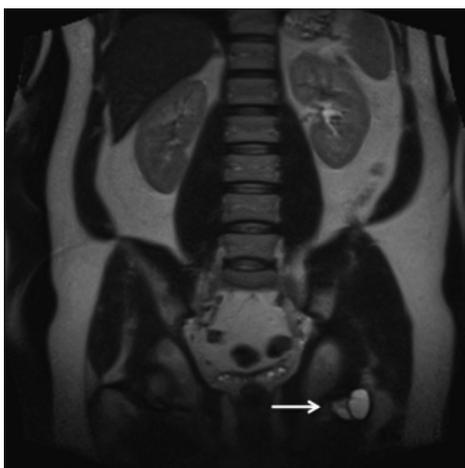


Figure 17: A 45-year-old gentleman who described an 8 month history of lower back/buttock pain and right-sided sciatica. Radiographs were normal. Localizer shows incidental left iliopsoas bursa (white arrow).

EXTRASPINAL MUSCULOSKELETAL FINDINGS

Localizer can provide critical information about the presence of unsuspected soft tissue and bone tumors which can further be evaluated by more detailed imaging enabling radiologists to differentiate benign [Like, Lipoma – Figure 15], indeterminate, primary, or metastatic lesions. In addition, these images can provide information about a plethora of

joint pathologies, including hip joint effusion, osteonecrosis [Figure 16], degeneration, iliopsoas bursitis [Figure 17], pelvic, and sacral lesions. Diagnosing such conditions may have a significant impact on patient morbidity.

CONCLUSION

Careful examination of localizer images following a checklist approach is recommended to identify and further investigate unsuspected but clinically important extraspinal pathologies.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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