

Extraspinal Malignancies Found Incidentally on Lumbar Spine MRI: Prevalence and Etiologies

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ABSTRACT

The lumbar spine magnetic resonance imaging (MRI) is the commonly used image modality for evaluation of patients with low back pain or sciatica. Some extraspinal malignancies are found incidentally on routine lumbar spine MRI studies which are more important than the spinal findings.

Between January 2010 and December 2011, we screened 5104 patients who experienced low back pain or sciatica and underwent routine non-enhanced MRI examinations, and 215 of them also received CT scans within one year. Patients with extraspinal malignancies seen in both CT and MRI were enrolled and analyzed. A total of 26 patients and 28 extraspinal malignancies were enrolled (17 male and 9 female, age range: 33-84 years old, mean age: 55.7 years old). The incidental extraspinal malignancies included 9 paraaortic lymphadenopathies, 7 renal tumors, 5 iliac bony lesions, 4 adrenal tumors, 2 liver tumors, and 1 colon tumor. The prevalence of newly diagnosed extraspinal malignancies was 0.5%. Among the 26 patients with newly diagnostic extraspinal malignancies, 12 (46%) of them did not have coexisting spinal metastases and the most common etiologies were renal cell carcinoma and iliac bony metastases. The possible reason may be due to these lesions induce back pain similar to degenerative spinal disease.

Extraspinal structures should be carefully and systemic evaluated on routine lumbar spine MRI, especially if the spinal findings cannot explain the symptoms of the patients.

A lumbar spine magnetic resonance imaging (MRI) is the commonly used image modality for evaluation of patients with low back pain or sciatica. After picture archiving and communication system (PACS) were implemented for image evaluation in most hospitals, an increased number of incidental findings in routine lumbar spine MRI were observed [1-6]. Most of these incidental findings are benign. Investigating benign findings may lead to unnecessary medical costs and anxiety in patients [7-8]. However,

extraspinal malignancies are sometimes found incidentally on routine lumbar spine MRI and often overlooked in initial reports because the lesions are outside the region of the initial clinical interest. To our knowledge, no prior study has focused on incidental extraspinal malignancies on lumbar spine MRI. The purpose of this study was to determine the prevalence and location of possible extraspinal malignancies, and to suggest a systematic approach to find these lesions.

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MATERIALS AND METHODS

Case selection

We retrieved the radiology information from our hospital between Jan. 2010 and Dec. 2011, from which we selected patients who received non-enhanced lumbar spine MRI for low back pain and/or radiculopathy with clinically suspected spinal stenosis, and also received computed tomography (CT) within one year in our hospital. We reviewed their CT findings first to find out the extraspinal malignancies, and then checked these findings were also visible in lumbar spine MRI or not. Only patients with abnormalities seen in both CT and MRI were enrolled. Patients with previously known malignancy were excluded.

Image analysis

The MRI examinations were interpreted and independently reviewed by three radiologists with more than 7 years of experience in reading spine MRI. Their decisions were reached by consensus. The radiologists evaluated the MRI examinations for the presence of extraspinal malignancies. The spines were also examined for bone marrow signal and mass lesions to classify the spinal findings as degenerative spinal disease or spinal metastases. We also analyzed the relationship between the spinal findings and the extraspinal malignancies.

MRI Parameters

The MRI examinations were performed on a 1.5-T magnet (Siemens Magnetom Vision and Philips Medical System Gyroscan Intera) and a 3-T magnet (GE Medical System Discovery MR 750 and Siemens TrioTim). All examinations included T1- and T2-weighted spin-echo images on both axial and sagittal planes, and 27 examinations included short T1 inversion recovery (STIR) on the coronal plane.

Figure 1

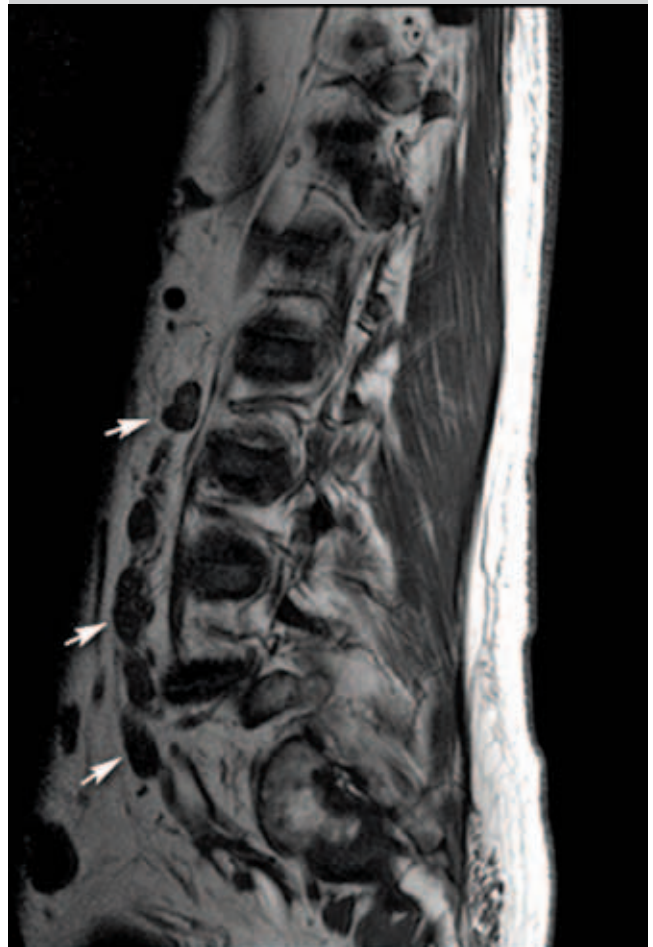


Figure 1. A 80-year-old male suffered from low back pain. The sagittal T1-weighted image demonstrated multiple enlarged paraaortic LNs. The patient was proven to be prostate cancer with lymph nodes and bony metastases.

Figure 2

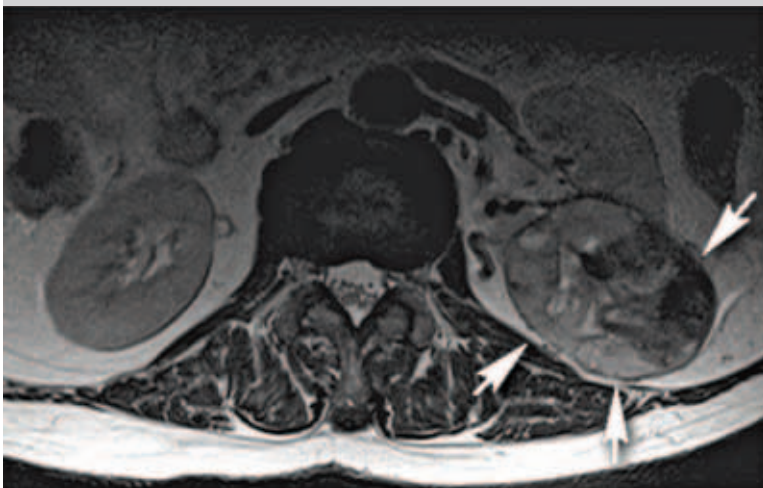


Figure 2. A 66-year-old female presented with low back pain. MRI of lumbar spine demonstrated degenerative disc disease in lumbar spine without metastatic bone lesion. However, detailed assessment of T2-weighted axial images demonstrated a mass lesion at posterior portion of left kidney with left kidney displaced anteriorly. The tumor was proven to be a renal cell carcinoma.

The following MR sequences were performed: T1-weighted spin-echo (TR range/ TE range, 400-550/11-12), T2-weighted spin-echo (TR range/TE range, 4000-4300/95-120), and STIR (TR range/ TE range, 4000-4500/60-90). The slice thickness in all images was 4 mm, and the field of view was 22 cm in the axial plane and 26 cm in the sagittal and coronal planes.

RESULTS

During the study period, we screened 5104 patients who experienced low back pain or sciatica and underwent routine non-enhanced MRI examinations, and 215 of them also received CT scans within one year. A total of 26 patients were enrolled (17 male and 9 female, age range:

33-84 years old, mean age: 55.7 years old). The prevalence was approximately 0.5%. The extraspinal malignancies were only mentioned on initial reports of L-spine MRI in 13 patients and neglected in another 13 patients of total 26 patients with extraspinal malignancies. As compared with the CT findings, the L-spine MRI provided sensitivity 50%, specificity 100% and accuracy 94%.

In our study group, a total of 28 extraspinal malignancies were included in this study (Table 1), 24 patients with one finding and two patients with two abnormalities. One patient had iliac bony metastasis with lymphadenopathy and another one patient had renal cell carcinoma with lymphadenopathy. The incidental extraspinal malignancies included 9 paraaortic lymphadenopathies (Fig. 1), 7 renal tumors (Fig. 2), 5 iliac bony lesions (Fig. 3), 4 adrenal tumors (Fig. 4), 2 liver tumors (Fig.5), and 1 colon tumor

Figure 3

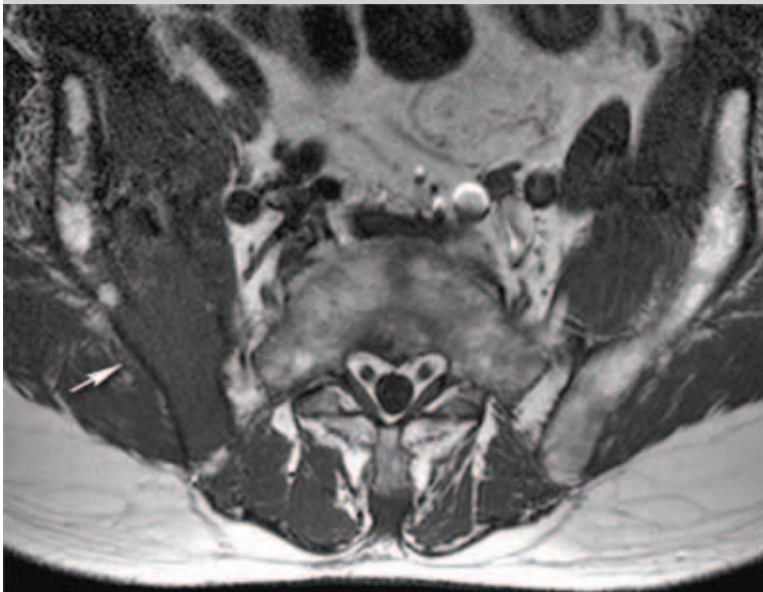


Figure 3. A 54-year-old male presented with right sciatica. MRI of lumbar spine demonstrated degenerative disc disease in lumbar spine without metastatic bone lesion. Axial T1-weighted images demonstrated a protrusion mass lesion at right iliac bone. The patient was proven to have hepatocellular carcinoma with right iliac bony metastasis.

Table 1. The Location, Percentage, Pathology, and the Detected Plane of Extraspinal Malignancies on Lumbar Spine MRI (n=28)

Location	Lesion Number (%)	Pathology (lesion number)	Detected Plane
Lymph Node	9 (32.1%)	Metastasis(6) Lymphoma (3)	Axial/ Sagittal
Kidney	7(25%)	Renal cell carcinoma (6) Lymphoma(1)	Coronal/Axial
Ilium	5 (17.8%)	Metastasis (5)	Coronal/ Axial
Adrenal Gland	4 (14.3%)	Metastasis (4)	Coronal/Axial
Liver	2 (7.1%)	Hepatocellular carcinoma (1), Metastasis (1)	Coronal
Colon	1 (3.6%)	Colon Cancer (1)	Axial

(Fig.6). The paraaortic lymphadenopathies were related to lymphoma (n=3) and metastases (n=6, the primary tumors included prostate cancer, cervical cancer, gastric cancer, and hepatocellular carcinoma). Most of the extraspinal malignancies could be observed in the axial and coronal views; paraaortic lymph nodes could be detected in sagittal and axial views; but hepatic lesion was only detected on coronal view (Table 1).

In 26 patients had malignant extraspinal findings; 14 (53.8%) also presented spinal metastases, and the other 12 (46.2%) did not have spinal metastases (Table 2). The

Figure 4

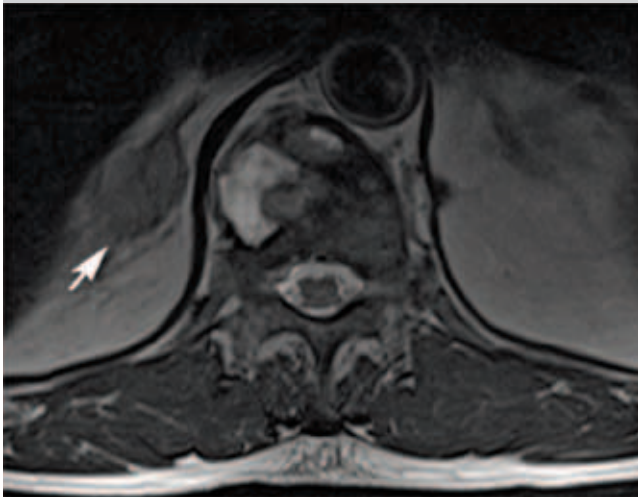


Figure 4. A 76-year-old male presented with low back pain. MRI of lumbar spine demonstrated osteolytic lesion at T12 vertebra. A mass lesion at right adrenal gland was also noted on axial T2-weighted image. The patient was proven to have lung cancer with right adrenal gland and bony metastasis.

Figure 5



Figure 5. A 73-year-old male presented with right sciatica. MRI of lumbar spine demonstrated degenerative disc disease in lumbar spine without metastatic bone lesion. A huge mass lesion was noted at right suprarenal region on coronal STIR image. Histology proved the lesion was hepatocellular carcinoma.

Figure 6

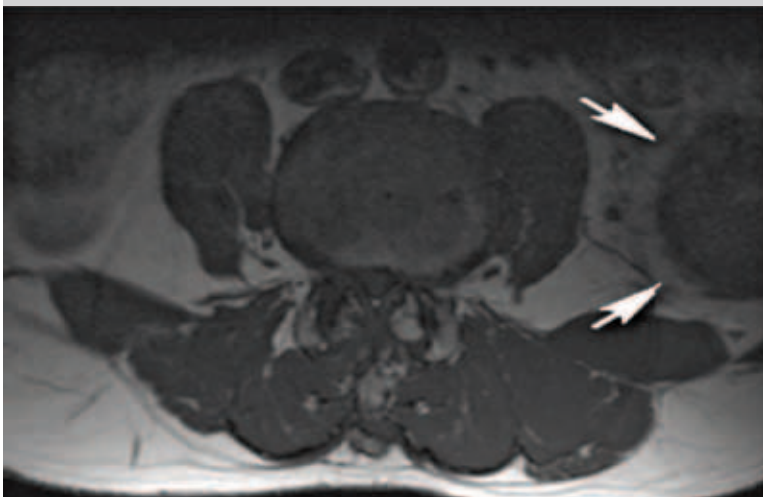


Figure 6. A 62-year-old male presented with right sciatica. MRI of lumbar spine demonstrated degenerative disc disease in lumbar spine without metastatic bone lesion. However, detailed assessment of axial T1-weighted image demonstrated a soft tissue lesion at left lower abdomen with regional fat stranding and small lymph nodes. Further histology proved the lesion was intussusception over ascending colon due to adenocarcinoma.

Table 2. MRI Detectable Extraspinal Malignancies without Spinal Metastasis (n=12)

Malignant Lesions	Lesion Number	Percentage (%)
Renal Cell Carcinoma	4	33.3%
Iliac Bony Metastasis	3	25%
Lymphadenopathy	2	16.7%
Adrenal Metastasis	1	8.3%
Colon Cancer	1	8.3%
Hepatocellular carcinoma	1	8.3%

most common extraspinal malignancies without coexisting spinal metastasis were renal tumors and iliac bony lesions. The possible hypothesis of this result might be due to these extraspinal malignancies demonstrated similar symptoms of low back pain or sciatica.

DISCUSSION

After PACS was widely implemented for image interpretation, more incidental findings had been obtained during daily practice [1, 2]. In pre-PACS hard-copy studies, only limited images of the region of interest were available for reporting purposes. However, PACS offered additional information, including the region out of interest and localizer series. Radiologists must review all information on PACS and interpret the significant incidental findings, because some incidental findings may be more significant than the suspected disease of the prompted imaging. Incidental findings were effectively documented in various image techniques for various body parts [9-15].

Incidental findings during spine MRI examinations were effectively documented [3-6]. A retrospective review of 2500 MRI reports of the lumbar spine reported 202 incidental findings among 183 patients [2], and another review reported 25 incidental findings from 300 MRI reports using PACS [1]. Another study that focused on the lumbar spine reported 107 incidental findings (8.4%) among 1268 patients with clinically suspected herniated intervertebral disc disease [4]. Most of these incidental findings were benign.

A number of studies indicated that the incidentally found tumors resulted in superior prognoses and survival rates [17, 18]. Therefore, it is crucial to pay more attention to the incidental findings with clinical significance, especially malignant neoplasms. A recent study based on lumbar spine CT examinations in 400 patients showed that the prevalence of clinically important incidental findings was 4.3% during full-FOV images, including the whole abdomen [19].

However, to our knowledge, no prior study had addressed the extraspinal malignancies incidentally found on lumbar spine MRI.

In our study, the prevalence of newly diagnosed extraspinal malignancies was approximately 0.5%, which is lower than that in the study based on CT scans of the lumbar spine [19]. This may be attributed to the differing FOV in these studies. In our study, which was based on MRI of the lumbar spine, limited extraspinal structures were included in the FOV. In the study by Lee et al., the incidental findings were best visualized extraspinal abnormalities up to 79.4% patients using full-FOV images, including the whole abdomen [19]. However, under the limited examination time, the MR FOV increasing led to significant resolution decreasing and SNR decreasing rapidly at the part far away from the MR coils. The whole body MR may be applied on these routine spine MR exams for the better detection of extraspinal lesion if the capability of the hardware facilities such as 3T MR machine, whole body coils and rapid scan technique like parallel imaging technique allow.

A number of lesions were overlooked in initial reports of MRI interpretation. The images on PACS were “zoomed in” to focus on the spinal lesion during interpretation, and a number of extraspinal lesions were ignored. Other possible reasons might due to some MRI artifact of spine could cause poor imaging qualities for detecting extraspinal lesions such as motion artifact, flow artifact and magnetic susceptibility artifact.

The newly diagnosed extraspinal malignancies in our study were found at the kidney (25%), paraaortic lymph node (32.1%), ilium (17.8%), adrenal gland (14.3%), liver (7.1%) and colon (3.6%). The kidney, paraaortic lymph node, ilium and adrenal gland were usually partially included on the routine FOV of lumbar spine MRI, so the prevalence of the extraspinal malignancies at these areas was higher. The hepatic tumor and colon tumor were only noted if the tumor was sufficiently large and extended to the adjacent lumbar spine region. A careful survey of extraspinal pathology must be performed, especially when the MRI of the lumbar spine failed to explain the symptoms of the patients.

A noteworthy finding in this study was that 14 patients (53.8%) had coexisting spinal metastases among 26 patients who had malignant extraspinal findings. Another 12 patients (46.2%) had only extraspinal malignancy without evidence of spinal metastases, and the most common lesions were renal cell carcinomas (33.3%) and iliac bony metastases (25%). These lesions may cause symptoms that are similar to those of degenerative spinal disease. If these crucial findings are overlooked, the medical treatment timing would be delayed.

A systemic approach must be used during a lumbar spine MRI study to avoid overlooking the important extraspinal lesions. After evaluating the spinal lesion, the images must be “zoomed out” to assess the following areas to ensure that the entire field of view is reviewed (Table 3).

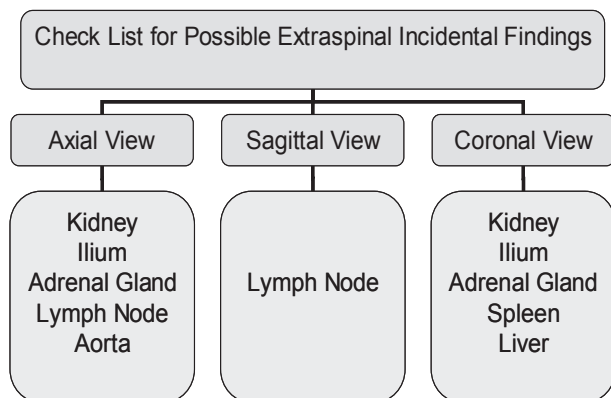
The renal lesions and iliac bone lesions were more easily identified in the coronal view [3, 20], because the whole outline of the kidney and iliac bone could be observed in the coronal view, whereas only small portions could be observed in the axial view. The renal and iliac bone tumors accounted for 58.3% of all extraspinal malignancies without spinal metastasis in our study. The pathologies of the liver were only found in the coronal view in our study group. Therefore, the coronal view can provide most of the information for evaluating extraspinal malignancies.

The main limitation of this study is that it was a retrospective study and the patient selection was based on CT findings within one year. Some patients may not be followed-up if we did not identify the extraspinal malignancies initially. Therefore, the prevalence of the extraspinal malignancies incidentally found in lumbar spine MRI may be underestimated. To avoid overlooking these extraspinal malignancies, we summarized the crucial structures that must be assessed using various views on the MRI of the lumbar spine (Table 3).

CONCLUSION

Extraspinal malignancies sometimes could be initially diagnosed in the lumbar spine MRI during the survey of low back pain and sciatica. The most common extraspinal malignancies found in MRI without coexisting spinal metastases were renal cell carcinoma and iliac bony metastases. Knowledge and familiarity with these possible extraspinal findings were crucial for the timely treatment and outcome of patients. A systemic review of the whole FOV of all images on PACS must be performed during lumbar spine MRI interpretation, especially if the spinal findings cannot explain the symptoms of the patients.

Table 3. Crucial extraspinal structures on various views of Lumbar Spine MRI



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