

Incidental Diagnosis of Urinary System Diseases on Lumbar Spine MRI Performed for Lower Back Pain

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Abstract

Original Research Article

Objective: purpose of this study was to calculate the frequencies of pathological findings that incidentally detected in urinary system during magnetic resonance imaging (MRI) of lumbar spine scans. **Materials and Methods:** A total of 379 lumbar spine MRI patients were prospectively examined in the period extending from August 2018 to April 2019. Both 1.5 and 0.35 Tesla MRI systems (Toshiba and Siemens Medical system) were applied to investigate patients with suspected intervertebral disc abnormalities at three MRI diagnostic centers in Khartoum, Sudan. **Results:** Out of the 379 patients, urinary system incidental findings were found in 56 patients (14.7%). Various incidental findings (IFs) were seen, including renal cysts, hydronephrosis, atrophic kidney, ectopic kidney, bladder wall thickening and ADPKD. **Conclusions:** Various urinary system incidental findings were identified during a routine lumbar spine MRI and approximately the majority of them were not significant clinically. Therefore, it is essential for the reporting radiologists to pay attention to urinary system abnormalities and other abnormalities while reporting lumbar spine MRI to avoid missing clinically significant findings.

Keywords: Renal Cyst, Incidental Findings, Ectopic Kidney, Urinary System.

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1 INTRODUCTION

Estimates of the global burden of disease indicate that disease of kidney and urinary tract account for approximately 830,000 deaths and 18,467,000 disability adjusted life years annually, ranking them 12th among causes of death (1.4 percent of all deaths) and 17th among causes of disability (1.0 percent of all disability adjacent life years) [1].

To our knowledge, incidental findings (IFs) are the findings that are obtained in an unrelated investigation but are of great clinical importance. These findings could range from normal anatomical variants to life-threatening issues, which may affect the life in patients. These findings may in some cases be of more clinical value compared to the issue that has caused patients to have MRI tests [2-4].

These findings cause clinical and behavioral concerns in patients for seeking treatments on the one hand, and may even be life threatening and impose costs on the individual and their health system on the other hand. Obtaining information on the prevalence of these findings, on how to deal and manage these

findings, their impact on patients' lives, and the impact of these findings on the imaging techniques, notification of patients about the risks and prevalence of normal variants can be of great importance [2-4].

In fact, incidental urinary tract abnormalities are common, for example, being reported in 15% of bone scans [5]. Magnetic resonance imaging (MRI) of the lumbar spine is frequently performed to evaluate patients with lower back pain. The images for reporting are commonly magnified around the lumbar spine cropping out much of the intra-abdominal and retroperitoneal structures. While this provides optimal delineation of spinal abnormalities, it potentially results in the exclusion of important extraspinal abnormalities that located in the structures outside field of view (FOV) from the dataset. Given the simplicity of providing wide FOV that encompass these structures [6].

When performing lumbar spine MRI, a substantial number of incidental findings relate to urinary system given it is close proximity to abdominopelvic organs. These incidental findings can be completely asymptomatic but at times are the

unexpected cause of the patient's symptoms. Recognition of the etiology of these findings is therefore important for appropriate diagnosis and, at times, patients care [7].

This study was designed with the aim of calculating the frequencies of pathological findings that incidentally detected in urinary system during MRI lumbar spine scans for the patients complaining of lower back pain and suspected intervertebral discs abnormalities.

2 MATERIALS AND METHODS

Patients Selection

The study was performed in a three radiology departments within a three private hospital at Al-Zaytouna Specialist Hospital, Dar Al-Elaj Specialized Hospital and El-Nilein Medical Diagnostic Centre, Khartoum, Sudan. The study was conducted during the period from December 2011 to December 2011. A total 379 patients 185 (49%) males and 194 (51%) females were included in this study. The patients who gave any information of known extraspinal diagnosis were excluded. The institutional ethics review board granted approval from the local ethics committee of the Faculty of Radiology and Nuclear Medicine Sciences, National Ribat University, Khartoum, Sudan and A waiver of informed consent was conceded as per institutional rules.

MR Imaging Protocol

MRI lumbar scans were acquired by using a 1.5 Tesla MRI machine with a posterior spinal coil

(Toshiba Medical Systems, Tokyo, Japan) at the Al-Zaytouna Specialist Hospital, and Dar Al-Elaj Specialized Hospital and a 0.35 Tesla MRI machine with a posterior spinal coil (Siemens Medical Systems, Munich, Germany) at the El-Nilein Medical Diagnostic Centre. The MR imaging protocol included sagittal T1 and T2 weighted images, an axial T2-weighted images. The slice thickness was 4 mm with 10% interslice gap for the sagittal T1, T2-weighted and axial T2-weighted images.

Image Interpretation

The obtained MRI images from the areas of study were interpreted by the radiologist with at least 5 years' experience. The following abnormalities were detected: i) renal cysts; ii) hydronephrosis; iii) atrophic kidney; iv) ectopic kidney; v) bladder wall thickening; vi) autosomal dominant polycystic kidney disease (ADPKD).

Renal cysts (Fig 1 and 2), were diagnosed when the signal intensity was decreased on T1-weighted image and increased on T2-weighted image. ADPKD was diagnosed when the kidneys Loss of normal architecture an enlarged in size with multiple cysts those cysts appear hyperintense in T2, and hypointense T1 (Fig 3).

Hydronephrosis was diagnosed based on finding a dilatation of the pelvicalyceal system (renal pelvis and calyces), as shown in (Fig 4).

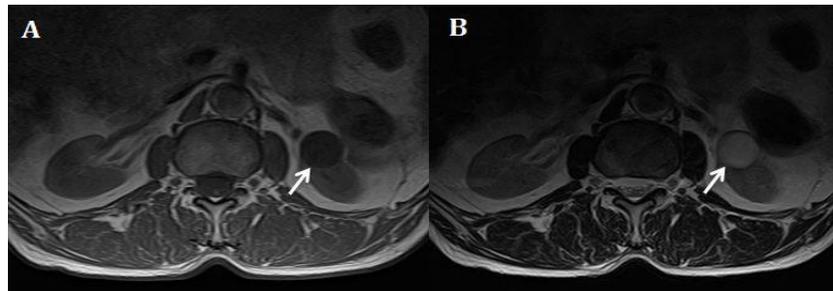


Fig-1: Lumbar MRI shows left kidney simple renal cyst (arrows) on axial T1-weighted (A) and T2-weighted (B) images.

In addition, an ectopic kidney was diagnosed as normal-shaped kidney located within the bony pelvis.

Furthermore, atrophic kidney was diagnosed when the kidney shrunk to smaller than its normal size.

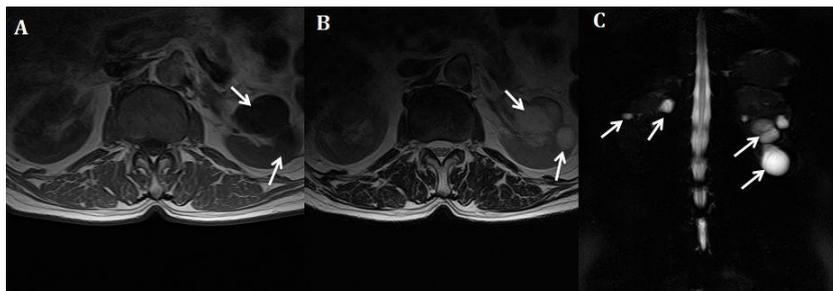


Fig-2: Lumbar MRI demonstrates bilateral multiple renal cyst (arrows) on axial T1-weighted (A), T2-weighted (B) images and Myelogram (C).

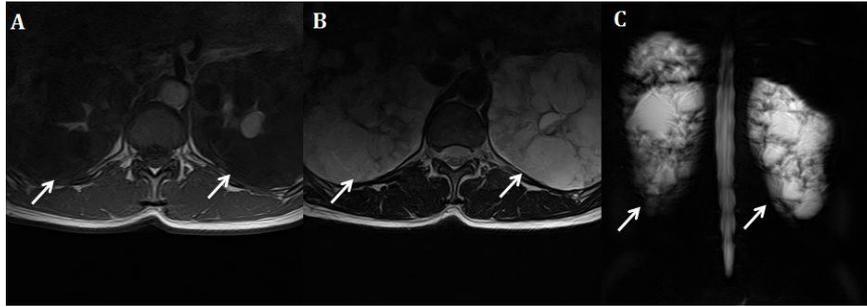


Fig-3: Lumber MRI demonstrates bilateral ADPKD (arrows) on axial T1-weighted (A), T2-weighted (B) images, and Myelogram (C).

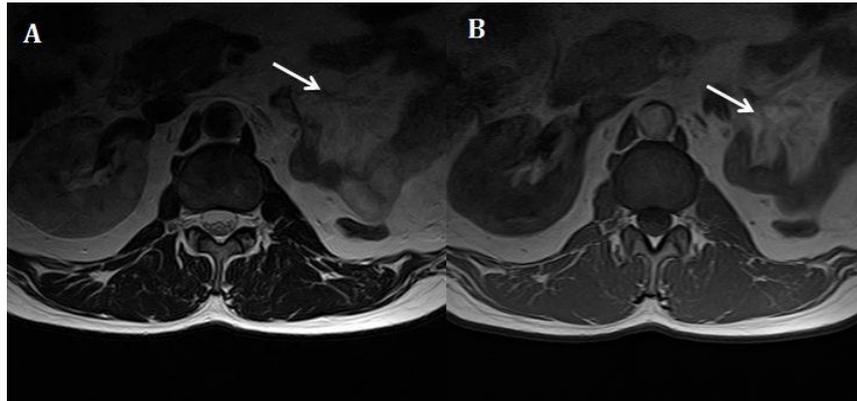


Fig-4: Lumber MRI shows right kidney hydronephrosis (arrows) on axial T1-weighted (A) and T2-weighted (B) images

Finally, in bladder wall thickening, the wall of the urinary bladder does not appear to be distended on MRI, but the wall thickness appears to be more than 6 mm (Fig. 5)

3 RESULTS

In 379 MRI lumbar spine examinations, 194 (51%) were females and 185 (49%) were males, with a mean age of 46.8 years (range, 10–85 years). The percentage of urinary system incidental findings was 14.7% and 85.3% of patients had normal findings on the MRI scan (Table 1).

Table-1: Demonstrate the percentage of incidental findings from all data

	Frequency (n)	Percentage (%)
Normal Findings	323	85.3%
Incidental Finding	56	14.7%
Total	379	100%

Table-2: Prevalence of incidental findings (IFs) among the study sample (n=379).

Incidental Findings	Frequency (n)	Percentage (%)
Renal cyst	40	71.4%
Hydronephrosis	11	19.6%
Atrophic Kidney	2	3.6%
Ectopic Kidney	1	1.8%
Bladder wall thickening	1	1.8%
ADPKD	1	1.8%
Total	56	100%

The incidence percentage of incidental findings based on age groups were 4% , 7% , 38%,40% and 11% for age ranges ≥ 20 years, 21-40 years , 41-60

years, 61-80 years and $81 \leq$ years , respectively (Table 3).

Table-3: Prevalence of incidental findings (IFs) corresponding to the age group

Incidental Findings	≥20 (n; %)	21-40 (n; %)	41-60 (n; %)	61-80 (n; %)	81≤ (n; %)
Renal cyst	0	4	12	18	6
Hydronephrosis	0	0	7	4	0
Atrophic Kidney	2	0	0	0	0
Ectopic Kidney	0	0	1	0	0
Bladder wall thickening	0	1	0	0	0
ADPKD	0	0	1	0	0
Total	2 (4%)	5 (7%)	21 (38%)	22 (40%)	6 (11%)

In addition, the urinary system incidental findings were most likely related to the kidneys (54; 98%) (Table .2) and were more likely to affect males (41; 75%) and females' (14; 25%) (Table 4). Renal cysts (40; 71.4%) were the most common urinary system incidental findings across MRI scans of the lumbar spine (Table 2 and Fig 1-2).

Table-4: Prevalence of incidental findings (IFs) corresponding to patient gender

Incidental Findings	Gender	
	Male	Female
Renal cyst	28	12
Hydronephrosis	9	2
Atrophic Kidney	2	0
Ectopic Kidney	1	0
Bladder wall thickening	1	0
ADPKD	1	0
Total	42 (75%)	14 (25%)

4 DISCUSSION

In the current study, of the 379 patients examined, 56 (14.7%) were found to have urinary system incidental findings on lumbar spine MRI scans, as shown in Table 1. The majority of these findings were not clinically significant because they were not related to the illness or causes that prompted the diagnostic imaging test in the first place.

In different study implemented to detect of urinary tract abnormalities with skeleton Scintigraphy, the rates of incidental findings were described to be 15 % [5]. In the present study, this rate was 14.7%, which is lower than the percentage reported in this previous study.

In the current study, we noticed that patients aged 61-80 years presented with higher incidence rates of urinary system incidental findings (40%) when compared with the other age groups. This age-specific effect for renal incidental findings is consistent with the results of Zidan *et al.* [8].

To our knowledge, renal cysts are benign clinical conditions may occur well within the kidney or on its surface. Simple renal cysts usually occur in normal kidneys and become more prevalent as people age.

Our study shows that renal cysts are the most frequent reported urinary system findings (71.4%), as presented in Table 2. The majority these cysts in the patients over 61 years; the increasing incidence of renal cysts in older people may be due to the manifestation of progressive nephrons loss that occurs with age. This age-specific effect for renal cysts is consistent with the results of Zidan *et al.* [8].

In addition, the incidence of renal cyst was more prevalent in males group. Further, Carrimand Murchison [9] and Chang *et al.* [10] reported on the incidence rates for renal cysts during Lumbar spine MRI and found that these cysts were more prevalent in men than women.

Hydronephrosis is a condition that typically occurs when a kidney swells due to urine failing to properly drain from the kidney to the bladder. The incidence rate of hydronephrosis in our results was (19.6%) (Table 2), which is higher to the rates reported by Dilli *et al.* [11] and Tuncel *et al.* [12] 0.7% and 0.2%, respectively. This difference because of Dilli *et al.* [11] and Tuncel *et al.* [12] Calculate the percent of hydronephrosis incidence rate out of all findings related to internal male and female genitalia.

A pelvic kidney, with incidence of 1:900, [13] occurs when the metanephros fails to migrate into abdomen and instead stays at its origin in the pelvis [14].

Only one case (1.8%) of ectopic kidney was registered as a urinary system anatomical variation. In addition, an ectopic kidney may be asymptomatic and may function normally even though it is not in its usual position.

In such cases, ectopic kidneys are often found incidentally during investigations for other reasons. However, an ectopic kidney, though benign from a clinical point of view, may have future consequences.

Only one case (1.8%) of atrophic kidney in the current study was detected (Table 2). To our knowledge, the normal bladder wall thickness changes with the degree of bladder filling. Normal bladder wall thickness in female is thought to be less than 5 mm when measured in a bladder containing less than 50 mL

of urine [15]. In our results, the bladder wall thickening incidence rate was 1.8% (Table 2).

It is important to evaluate whether the thickening is symmetric of asymmetric infection usually causes symmetric bladder wall thickening, whereas asymmetric bladder wall thickening should raise concern for malignancy [7].

When further exploring Autosomal dominant polycystic kidney disease (ADPKD) is one of the most common, life-threatening genetic diseases, in the study conducted by Cynthia *et al*. [16], the incidence of ADPKD was 3.96%, while the incidence of ADPKD in our study was 1.8% (Table 2). The difference in incidence rates could be due to smaller sample size when compared to the Cynthia *et al* study.

A limitation of our study is that we are unable to determine which incidental findings were preexisting and known versus those that are a new diagnosis. From a diagnostic point of view, this is only a small limitation as the referring doctor should be able to differentiate these.

Other limitations of this study heterogeneity of the population because of the randomized selection process, which may influence the exactness of our outcomes and lessen the intensity of our conclusions, since it makes other age groups have a lower factual validity if applied in future investigations. Our study identified increasing age and male gender as risk factors for incidental findings.

5 CONCLUSION

In conclusion, during MRI examination of the lumbar spine, paying attention to incidentally detected urinary system findings is very important because they can alter the treatment of the patient or affect the patient's life. In addition, urinary system incidental findings are common in routine lumbar MRI examinations, although their clinical significance is uncommon. Clinically significant urinary system incidental findings are occasionally omitted from formal clinical reports.

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