



Original Research Article

Incidental Extraspinal Findings in the Thoracic Spine during Magnetic Resonance Imaging of Intervertebral Discs

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ABSTRACT

Objective: The purpose of this research was to determine the frequency of incidental extraspinal findings in the thoracic spine on magnetic resonance imaging (MRI).

Materials and Methods: A total of 120 thoracic 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 120 patients, incidental extraspinal findings were found in 16 patients (13.3%). Various incidental findings (IFs) were seen, including renal cysts, liver mass, thyroid goiter, and pleural effusion. Out of these IFs, 37.5% were considered clinically significant.

Conclusions: Various IFs were identified during a routine thoracic spine MRI, and approximately one-third of them were clinically significant. Therefore, it is essential for the reporting radiologists to pay attention to extraspinal findings while reporting thoracic spine MRI to avoid missing clinically significant findings.

Keywords: Incidental extraspinal findings, Magnetic resonance imaging, Pleural effusion, Thoracic spine, Thyroid goiter

INTRODUCTION

Incidental findings (IFs) are asymptomatic abnormalities other than expected pathologies, found during radiological examinations. In recent years, improves in the digital evaluation of radiological imaging (e.g., high magnification zoom, the ability to focus on individual images, and digital archiving) have improved detection limit of incidental lesions.^[1]

Magnetic resonance imaging (MRI) of the thoracic spine is performed to test patients with back pain. The images for reporting are magnified around the vertebral column, cropping out much of the structure within the thoracic cavity. While this gives an excellent delineation of spinal

pathologies, it results in the exclude of important extraspinal pathologies from the final data set.^[2] Given the simplicity of providing a wide field of view (FOV) reconstructions that encompass these structures; the authors have examined the incidence and type of extraspinal incidental findings reported by a wide FOV review.

This study was designed with an aim to determine the frequencies of incidental extraspinal findings in the thoracic spine on MRI of the intervertebral discs of the thoracic spine. The authors wish to present the prevalence of these IFs and to stress their clinical significance too.

MATERIALS AND METHODS

Study population

After obtaining approval from the Local Ethics Committee of the Faculty of Radiology and Nuclear Medicine Sciences, Diagnostic Radiology Department, The National Ribat University, Khartoum, Sudan, this prospective study was carried out in the period between August 2018 and April 2019, consisting of 120 consecutive patients (64 females and 56 males with a median age of 40.7 ± 19.8 years old), by evaluating 120 MRI examinations of the thoracic spine. The age distributions were 1–20 years, 21–40 years, 41–60 years, and 61–80 years. All the patients complaining of recurrent back pain (thoracic region) with the period of symptoms varying from several months to several years were included in the study. Patients who gave any information about a known pathology (extraspinal masses, cancer, pulmonary diseases, vascular diseases, etc.) or congenital anomalies were omitted.

MRI imaging technique

In the first medical center, the scans were done using a Toshiba Medical Systems 1.5 Tesla. The sequences were sagittal T₂-Weighted (TR 2000/TE 100; slice thickness: 5 mm; size of the matrix 384 × 224; FOV 35 cm), sagittal T₁-Weighted (TR 500/TE 10; slice thickness: 5 mm; size of the matrix 384 × 224; FOV 35), axial T₂-Weighted (TR 3500/TE 120; slice thickness: 5 mm; size of the matrix 256 × 129;FOV 25), and axial T₁-Weighted (TR 800/TE 10; slice thickness: 5 mm; size of the matrix 256 × 129; FOV 25). One sequence could have been included, depending on the radiologist: Sagittal STIR (TR 2300/TE 48; slice thickness: 5 mm; size of the matrix 384 × 224; FOV 35 cm).

The thoracic spine scans in the second medical center were produced on a Toshiba Medical System 1.5 Tesla. The protocol was accomplished according to the following sequence: Sagittal T₂-Weighted (TR 3500/TE 100; slice thickness: 4 mm; size of the matrix 336 × 325; FOV 23 cm), sagittal T₁-Weighted (TR 480/TE 9; slice thickness:

4 mm; size of the matrix 336 × 325; FOV 23 cm), axial T₂-Weighted (TR 3500/TE 100; slice thickness: 4 mm; size of the matrix 116 × 85; FOV 12 cm), and axial T₁-Weighted (TR 450/TE 8; slice thickness: 4 mm; size of the matrix 116 × 85; FOV 12 cm). One sequence could be included depending on the radiologist: Sagittal plane STIR images (TR 3500/TE 80; slice thickness: 4 mm; size of the matrix 336 × 325; FOV 23 cm).

MRI scanning in the third medical center was conducted on a Siemens 0.4Tesla. The scan was done according to the following sequence and parameters: Sagittal T₂-Weighted (TR 4500/TE 144; slice thickness: 4–5 mm; size of the matrix 300x300; FOV 40 cm), sagittal T₁-Weighted (TR 450/TE 25; slice thickness: 4–5 mm; size of the matrix 300x300; FOV 40 cm), axial T₂-Weighted (TR 4500/TE 112; slice thickness: 4–5 mm; size of the matrix 300 × 300; FOV 33 cm), and axial T₁-Weighted (TR 450/TE 25; slice thickness: 4–5 mm; size of the matrix 300 × 300; FOV 33 cm).

MRI image analysis

MR scans were interpreted in consensus by two radiologists who had 5–2 years of experience. They assessed the thoracic spine scans for the presence of extraspinal incidental findings. The authors defined IFs as any unusual finding not referred to as the main complaint. The following pathologic conditions were noted: Renal cysts, thyroid goiter, thyroid nodules, pleural effusion, splenic cyst, splenomegaly, liver mass, hydronephrosis, and cervical cyst.

Thyroid nodule was determined when signal intensity was decreased on T₁-Weighted images; signal intensity was increased on the T₂-Weighted images. Thyroid goiter was diagnosed when the size of the thyroid increased. Renal cysts, splenic cysts, and cervical cysts were diagnosed when signal intensity was decreased on T₁-Weighted images; signal intensity was markedly increased on the T₂-Weighted images. Hepatic lesion was recognized as increased signal intensity on non-fat-suppressed T₁-Weighted MR images and diminished signal intensity on fat-suppressed T₁-Weighted images, with no enhancement after gadolinium (hepatic lipoma). Splenomegaly is a term that indicates an enlargement of the spleen. The normal adult splenic length upper limit is around 12–15 cm. In our research, the spleen was appeared enlarge in size after measuring the spleen the size around 17–18 cm. Hydronephrosis was determined as dilatation of the urinary collecting system of the kidney (calyces and pelvis). Pleural effusion produces a low signal on T₁-Weighted and high signal on T₂-Weighted images.^[3] On MR imaging, stones present as non-specific signal voids, overlooked, or confused with other structures or artifacts. Because of this limitation, guidelines have excluded MRI as a kidney stone imaging modality.^[4-6]

Statistical analysis

All measurable data were summed up in a comparison tables and graph. Descriptive analysis using the Statistical Package for the Social Sciences version 20 for Windows (IBM Corporation, Armonk, NY, USA) was applied.

RESULTS

In this study, the mean age of the patients with IFs was 40.69 ± 19.8 years old, ranged between 3 and 80 years. IFs were found in 13.3% of 120 patients with prevalence among women of 37.5% and 62.5% for men. Table 1 shows the prevalence of IFs according to patient gender.

The percentage of significance IFs was 37.5%, including 2 (12.5%) patients with thyroid goiter, 1 (6.25%) patient presented with a liver mass, and 3 (18.75%) conditions of hydronephrosis.

Figure 1 presents the incidence of IFs according to age group, where IFs were frequently presented in the age group of 21–40 years rather than other age groups. The prevalence of IFs, according to the organs, is cited in Table 2. It should be noted that renal cyst (3.3%) was the commonly detected

pathology during an MRI of the intervertebral discs of the thoracic spine.

DISCUSSION

To the best of our knowledge, in most institutes, the patients were rarely referred for thoracic spinal MRI examinations for the imaging of intervertebral discs, which is also correct for our institute. According to our results, 16 (13.3%) out of 120 patients were found to have IFs on MRI scans of the thoracic spine [Table 1].

In two different researches conducted to demonstrate pathological extraspinal findings and congenital anomalies/ anatomical abnormalities that were incidentally found on MRI scans of the intervertebral discs (cervical, thoracic and lumbar spine), the rates of thoracic IFs were specified to be 10.5% and 4.7%, respectively.^[7,8] The rates of thoracic spine IFs were smaller than Ramadorai *et al.*^[8] This might be because our study concentrated on all age groups, but Ramadorai *et al.*^[8] focused on pediatrics groups. Furthermore, our findings were slightly higher than the rate of 10.5% mentioned by Dilli *et al.*^[7]

In addition, we recognized that the frequency of IFs increases in older patients. The rate of thoracic spine IFs was more popular in age groups between 21 and 40 years (37.5%), when compared with the other age groups [Figure 1]. Our results show that renal cysts were the most common IFs in thoracic spine scans (3.3%). Furthermore, our findings indicate that the incidence of renal cysts was more dominant in males rather than females with a ratio of 3:1 [Table 1]. In the present study, the data concerning the prevalence of renal cysts were in agreement with the findings of Dilli *et al.*^[7], Joori *et al.*^[9], and Sobhan *et al.*^[10], where they found incidence rates of renal cysts of 2.9%, 7.2%, and 6.2%, respectively. Carrim and Murchison^[11] and Chang *et al.*^[12] published on the prevalence rates for renal cysts. They identified that these cysts were more dominant in males than females, with a prevalence rate of 4:1 and 8:2 for each.

Table 1: Prevalence of incidental findings (IFs) corresponding to patient gender.

Incidental findings (IFs)	Gender	
	Male	Female
Renal cyst	3	1
Thyroid goiter	2	0
Thyroid nodule	0	1
Pleural effusion	2	0
Splenic cyst	1	0
Splenomegaly	0	1
Liver mass	0	1
Hydronephrosis	2	1
Cervical cyst	0	1
Total	10 (62.5%)	6 (37.5%)

Table 2: Prevalence of incidental findings (IFs) according to the organs among the study sample (n=120).

Organs	Incidental findings (IFs)	Frequency (n)	Percentage (%)
Kidneys	Renal cyst	4	3.3%
	Hydronephrosis	3	2.5%
Thyroid gland	Thyroid goiter	2	1.7%
	Thyroid nodule	1	0.8%
	Cervical cyst	1	0.8%
Lungs	Pleural effusion	2	1.7%
Spleen	Splenic cyst	1	0.8%
	Splenomegaly	1	0.8%
Liver	Liver mass	1	0.8%

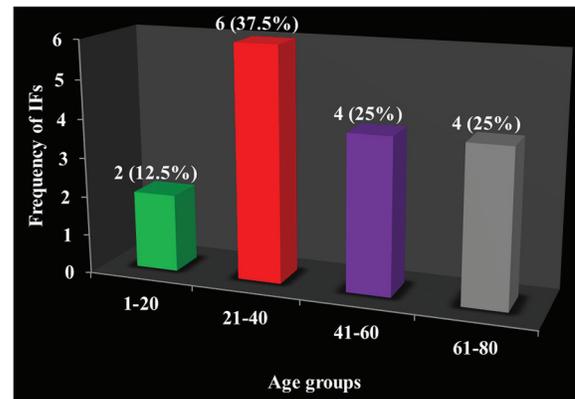


Figure 1: Prevalence of incidental findings (IFs) corresponding to the age groups.

Furthermore, the incidence rate of a thyroid goiter in thoracic spine MRI scans was 1.7% [Table 2], which is lower than the rate 4.6% described by Zidan *et al.*^[13] This might be due to the fact that our research focused on the thoracic spine but that is of Zidan *et al.*^[13] focused on the cervical spine. In the studies conducted by Dilli *et al.*^[7] and Zidan *et al.*^[13], the IFs in the thyroid gland were 17.4% and 6.3%, respectively, while IFs in the thyroid gland in the present research were 3.3% in the form of thyroid goiter (1.7%), thyroid nodule (0.8%), and cervical cyst (0.8%) [Table 2]. This inequality in the incidence rates could be validated based on their enormous population study related to our research.

A pleural effusion is an excess fluid that accumulates in the pleural cavity, the fluid-filled space that surrounds the lungs. This excess fluid can impair breathing by reducing the extension of the lungs.^[14] The incidence of pleural effusion in our research was 1.7% [Table 2].

Splenomegaly is explained as an enlargement of the spleen, measured by size or weight.^[15] In the past, splenomegaly was a clinical finding, but in later years, imaging studies have also encouraged to evaluate or confirm mild splenomegaly. Regarding our findings, splenomegaly was encountered in 1 (0.8%) case [Table 2]. Such findings could be matched to a retrospective study of 355 patients that assessed the conclusions obtained during a CT scan of the lumbar spine on a wide FOV reconstruction, their incidence of splenomegaly was also 1 (0.3%) case.^[2] Further, cysts of the spleen are rare and are usually discovered fortuitously. Splenic cysts are most often asymptomatic but may present with abdominal pain in the left upper quadrant. The incidence of splenic cysts in our study was 0.8% [Table 2], which could be correlated to the findings of Sutherland *et al.*^[2] where the incidence of splenic cysts was noticed to be 0.3%.

The prevalence of hydronephrosis in our research group was 2.5% [Table 2], which is higher than the rate of 0.7% and 0.2% mentioned by Dilli *et al.*^[7] and Tuncel *et al.*^[16], respectively. This variety in incidence rates could be for the smaller sample size we studied ($n = 120$) when correlated to other studies. Furthermore, the incidence rate of a liver mass in the present study was 0.8% [Table 2], which is lower than the rate of 0.6% mentioned by Dilli *et al.*^[7]

Limitations of this study were: (i) There was a limited cohort sample size; (ii) the selection criterion may have omitted patients with known congenital anomalies, pathologies, or normal variants; (iii) the authors could not follow-up examinations to further verify the clinical importance of most of the IFs that were recognized during the thoracic spine MRI scans; (iv) and the heterogeneity of the population due to the randomized selection process, which may affect the exactness of our outcomes and impair the strength of our conclusions, since it causes other age groups have a less factual validity if committed in future investigations. However, to

the best of our knowledge, this is the first large cohort study that evaluates the prevalence and clinical importance of IFs during thoracic spine MRI scans in Sudanese patients, which therefore represents the importance of this study.

CONCLUSIONS

The authors determined that the IFs were frequently observed during a routine thoracic spine MRI, and many of these findings were clinically significant. However, IFs including clinically relevant findings were occasionally omitted from formal radiological reports.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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