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Incidental findings detected on magnetic resonance imaging scans of the cervical, thoracic and lumbar spine of patients prediagnosed with discopathy

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ABSTRACT

Objective: To determine the frequency and types of incidental findings on magnetic resonance imaging (MRI) scans of the cervical, thoracic, and lumbar spine in patients with intervertebral discopathy.

Patients and Methods: This retrospective study included 1000 patients (513 females and 487 males, with a mean age of 50.5 years) with clinically suspected intervertebral discopathy who underwent MRI. Any abnormal findings and congenital anomalies/anatomical variations unrelated to the primary complaint were referred to as incidental findings. Frequency distributions of the assessed imaging characteristics were calculated.

Results: Of the 1000 patients, 192 (19.2%) patients were presented with incidental findings. The positive findings in the thoracic spine (26%) were higher than those in the lumbar (19.8%) and cervical spine (13.7%). The study found vertebral haemangioma to be the most common finding, followed by Schmorl's nodes in the thoracic and lumbar spine. Thyroid nodules constituted the most common finding in the cervical spine, followed by vertebral haemangioma. Renal cysts in the thoracic and lumbar spine and thyroid nodules in the cervical spine were the most frequent extraspinal findings.

Conclusion: Incidental findings are commonly detected during MRI examination of intervertebral discs, and most are benign findings. However, incidental findings including clinically essential findings can alter the patient's treatment or affect the patient's life. Therefore, it is crucial to systematically evaluate MRIs without focusing solely on the spine and report incidental findings detected on MRI.

Keywords: Incidental findings, Magnetic resonance imaging, Discopathy

1. INTRODUCTION

The term "incidental findings" (IF) refers to lesions detected incidentally during radiological assessments that are unrelated to the patient's primary complaint [1]. To detect spinal disorders, magnetic resonance imaging (MRI) is usually used. This instrument may reveal a clinically insignificant incidental abnormality or a significant non-spinal lesion explaining the patient's symptoms. The images for reporting purposes are commonly magnified around the vertebral column cropping out much of the structures within, the neck, back, and waist. While this procedure increases the probability of detecting spinal pathologies, it ignores possible extraspinal pathologies. Given how straightforward it is to create reconstructions with a wide field of view that includes these structures, the authors looked at the frequency and kind of extraspinal incidental findings (ESIF) that have been recorded [2].

An increased number of findings have been observed in spinal MRIs after the image archiving and communication system established for image evaluation in most hospitals became operational [3, 4]. In the daily practice of radiologists, it is reported that lesions detected incidentally in spinal MRI examinations are very high [1, 5]. Although, there are studies related to IFs in lumbar spinal MRIs in the literature, very few

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studies are associated with IFs detected in cervical and thoracic spinal MRIs [4, 6, 7].

In this study, we sought to emphasize the type, prevalence, and clinical importance of incidental findings in the lumbar, cervical, and thoracic MRI scans for intervertebral disc disease.

2. PATIENTS and METHODS

In our study we evaluated radiological images of 1000 patients with clinically suspected intervertebral discopathy who underwent MRI between 01/10/2020 and 01/10/2021 (cervical, thoracic and lumbar). A radiologist re-evaluated the spinal MRIs (cervical, thoracic, and lumbar spinal). Patients under the age of 18, those with recent acute trauma, known malignancies, a prior history of spinal surgery, and those with incomplete or subpar MR images were not included in the study. The local Institutional Review Board approved this retrospective study protocol. The study had no requirement for informed patient consent.

In this study, we defined any abnormal finding not related to the primary complaint as IF. IFs were defined separately according to the cervical, thoracic and lumbar regions: cervical (pituitary mass, perineural cyst, cerebellar hernia, schmorl's nodule, lymphadenopathy, syringomyelia, thyroid nodule and vertebral haemangioma), thoracic (lung mass, renal mass, hepatic haemangioma, stomach tumour, gallbladder stone, oesophageal disorder, nodule, syringomyelia, vertebral haemangioma and Tarlov cyst), lumbal (abdominal artery aneurysm, horseshoe kidney, renal stone, bladder stone, gallbladder stone, cysts and masses in the urogenital organs, retroperitoneal mass, schmorl nodule, syringomyelia, vertebral haemangioma and Tarlov cyst). Clinically significant findings (E3 and E4 according to a modified CT Colonography Reporting and Data System (C-RADS) classification), anatomic variations (C-RADS E1) and benign conditions (C-RADS E2) were noted during the review of the reports [8].

Statistical Analysis

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

3. RESULTS

Magnetic resonance images of a total of 1094 patients with clinically suspected intervertebral discopathy, were retrospectively evaluated. Nine of these images were excluded from the analysis because the patients were under the age of 18. 13 were excluded due to low-quality or incomplete imaging; while another 13 were excluded due to acute trauma. Additionally, 59 patients were excluded because they had either previously undergone spine surgery or had a known malignancy.

Out of a total number of 1000 patients, 487 were men (48.7%), and 513 were women (51.3%). The mean age of patients in our study was 50.5 years, ranging between 18 and 88 years. Overall, 192 patients (19.2%) had incidental findings. The mean age of the patients with IFs was 48.4 ± 14.7 years. The percentages of IFs on the cervical, thoracic, and lumbar spinal MRI were 13.7%, 26% and 19.8%, respectively. The study found high positive findings in the thoracic spine than those in the lumbar and cervical spine. Vertebral haemangioma and Schmorl's nodes in the thoracic and lumbar spines were the two most frequent findings. Thyroid nodules were the most typical discovery in the cervical spine, followed by vertebral haemangiomas (Table I, Table II, Table III). The most common extraspinal finding was renal cysts in the thoracic and lumbar spine and thyroid nodules in the cervical spine (Table I, Table II, Table III). The percentages of clinically significant findings on cervical, thoracic, and lumbar spinal MRI were 2%, 1.5% and 1%, respectively. In 77 cases, discopathy was not detected by MRI. 74 of these 77 patients had no findings, while 3 showed IF.

Concerning the lesions C RADS E4, only two aortic aneurysms, one adnexal mass, one endometrial thickening and 1 bladder wall thickening were found.

Table I. *Incidental Findings of the Lumbar Spine on MRI scans*

	Incidental Findings	Frequency (n)	Percentage (%)
Spinal Findings	Vertebral Hemangioma	40	8
	Schmorl's Nodule	15	3
	Perineural Cyst	4	0.8
	Syringomyelia	1	0.2
Urinary System Findings	Horseshoe Kidney	4	0.8
	RenaL Cyst	11	2.2
	Renal Stone	2	0.4
	Bladder Calculus	1	0.2
	Bladder Diverticulum	1	0.2
	Bladder Wall Hypertrophy	1	0.2
	Chronic Cystitis	1	0.2
Genital Organ Findings	Adnexal Mass	1	0.2
	Adnexal Cyst	2	0.4
	Uterine Myoma	7	1.4
	Ovarian Cyst	1	0.2
	Nabothi Cyst	2	0.4
	Endometrial Hyperplasia	1	0.2
Other	Retroperitoneal Mass	1	0.2
	Abdominal Aortic Aneurysm	2	0.4
	Cholelithiasis	1	0.2
	No Lesion Detected	401	80.2

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Table II. *Incidental Findings of the Cervical Spine on MRI scans*

Incidental Findings	Frequency (n)	Percentage (%)
Vertebral Hemangioma	9	3
Schmorl's Nodule	3	1
Perineural Cyst	2	0.6
Syringomyelia	6	2
Thyroid Nodule	14	4.6
Cervical Lymphadenopathy	1	0.3
Cerebellar Hernia	4	1.3
Pituitary Mass	2	0.6
No Lesion Detected	259	86.3

Table III. *Incidental Findings of the Thoracic Spine on MRI scans*

Incidental Findings	Frequency (n)	Percentage (%)
Vertebral Hemangioma	24	12
Schmorl's Nodule	8	4
Perineural Cyst	2	1
Syringomyelia	6	3
Lung Mass	2	1
Esophageal Dilatation	1	0.5
Gastric Cancer	1	0.5
Liver Hemangioma	3	1.5
Cholelithiasis	1	0.5
Renal Cyst	4	2
No Lesion Detected	148	74

4. DISCUSSION

MRI is frequently used to evaluate patients with neck, back and low back pain. Benign lesions are the IFs commonly seen on MRI scans [4]. However, it is unclear how these IFs affect human health [1, 3, 4]. Sometimes these IFs may be a more serious disease finding than the preliminary diagnoses that lead to an MRI request, and further investigations may be required [3, 9].

There are several studies in the literature about the IFs detected in lumbar MRI examinations. For instance, Park et al., detected 107 (8.4%) IFs in 1268 patients who were thought to have lumbar disc herniation [4]. Eroglu et al., found IFs in 82 (13.3%) of 613 patients who underwent lumbar MRI, considering that they had lumbar discopathy [10]. Ibrahim et al., reported 90 (22.5%) cases had incidental non-spinal findings in 400 patients [11]. In our study, IFs were detected in 19.8 % of cases submitted to lumbar MRI for low back pain (12 % spinal, 7.8% extraspinal). The rates of IFs differ for a variety of reasons. In the study of Park et al., only spinal IFs were investigated. Eroglu et al., investigated spinal and extraspinal lesions, while only extraspinal lesions were evaluated in the other two studies. In addition, while some findings such as hip lesions, prostatic enlargement, fluid in the Douglas cavity were included as IFs in some studies, they were not included as IFs in other studies referans .

In our study, the most common IFs in the lumbar region were spinal IFs. This is inconsistent with the findings of Park et al., who found fibrolipoma as the most common lumbar IF [4]. We did not find any fibrolipoma in the lumbar region in our study. Consistent with the study of Eroğlu et al., and Sobhan et al., the most common IF in the lumbar region was vertebral haemangioma [10, 12]. The frequency of vertebral haemangiomas was determined in the study of Barzin and Maleki to be 9.5% in autopsy reports, which is compatible with our findings (8%) [13]. Since, vertebral haemangiomas are age-related, the difference in the mean age of patients in the studies may explain these inconsistent rates. Tarlov cysts detected in our study were not associated with the patients' symptoms. Tarlov cysts predominated in the younger group, and the incidence of the lesion in our study was found to be 0.8%. In previous studies, researchers reported a 1–3.5% incidence [10, 14]. In our study, we found Schmorl's nodule in 3% of the patients and asymptomatic syringomyelia in only one.

Several studies have reviewed the frequency of incidental extra spinal findings on lumbar spine MRI scans. Variable prevalence of ESIF in the range of 8.1-68.8% has also been reported among different age groups [1, 3, 8, 15, 16]. In our study, this rate was 7.8%, which was lower than the percentages noted in previous studies. This is because some findings such as pelvic fluid, uterine septation defects, uterine cavity dilation, lymphadenopathies less than 1 cm and fibrinoids are not included. The majority of our ESIFs were renal in origin followed by genital organ pathologies. This is consistent with the studies of Tuncel et al., and Zidan et al. [6, 11]. Contrary to our study, Ibrahim et al., reported that most of the ESIFs were of the uterus and ovarian origin [15]. Simple renal cysts are the most common lesions in the kidney, which usually do not show clinical findings. They are seen incidentally because of radiological examinations. However, they rarely require treatment. According to Erolu et al., and Sobhan et al., incidence rates of renal cysts were 2.2% and 2.9%, respectively [5, 10, 12]. Our findings on the prevalence of renal cysts (2.2%) are in line with their findings. In contrast to a study conducted by Ciezanowski et al., the prevalence of renal cysts was found to be 25.1% [5]. Our study found uterine myoma (1.4 %) as the second most common ESIF. Most uterine myomas are benign and do not cause any problems. In different studies, the prevalence of uterine fibroids ranging from 2.6 to 4.5% has been reported [6, 11, 15, 17]. The difference in prevalence rates could be due to different sample sizes and female/male ratios in these studies. Four cases (0.8%) of horseshoe kidneys were registered as an incidental extraspinal congenital anomaly. Although, it is usually asymptomatic, it may be associated with some syndromes such as Turner syndrome [18].

Some ESIFs have significant clinical importance and require further examination and treatment. 5 (1%) ESIFs (C RADS E4), which are clinically significant were found in the current study, including 2 aortic aneurysms, 1 adnexal mass, 1 thickening of the endometrial, and 1 thickening of the bladder wall. An abdominal aortic aneurysm can cause life-threatening complications. Adnexal mass, endometrial thickening, and bladder wall thickening can signify cancer.

While many studies on the lumbar region are related to IFs detected on MRI, incidental findings in the cervical and thoracic spine have not been as extensively studied in the literature. Since, the liver, ovaries, uterus, kidneys, and vascular structures are

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located in the lumbar region, incidental extraspinal pathologies are more common in MRI of the lumbar region [19]. In our study, we detected IFs (spinal and extraspinal) most frequently in the thoracic spine, while we detected ESIFs more frequently in the lumbar spine. In the current study, 41 (13.6%) out of 300 patients were found to have IFs on MRI scans of the cervical spine (20 spinal, 21 extraspinal). The most common incidental pathologies in cervical spinal MRI are thyroid nodules [20]. In this study, the prevalence of thyroid nodules was recorded as 4.6% (n=14). We also noticed 6 (2%) clinically significant ESIFs: four cerebellar hernias and two pituitary masses. In addition, we saw clinically significant ESIFs more frequently in the cervical region than the thoracic or lumbar, at 2%, 1.5%, and 1%, respectively. These abnormalities may result in persistent head and neck pain, even though the patients' spine MRIs may be perfectly normal. Chronic neck pain commonly requires the use of an MRI for diagnosis. To prevent missing uncommon causes of persistent head and neck pain, cervical MRIs should be thoroughly evaluated.

According to our results, 52 (26%) out of 200 patients were found to have IFs on MRI scans of the thoracic spine. In three studies, thoracic IF rates were reported as 13.3%, 10.5% and 4.7%, respectively [7, 17, 21]. The rates of thoracic spine IFs were higher in our study as compared to findings in the existing literature. This might be because our study focused on all age groups. Nevertheless, considering Ramadorai et al., who focused on paediatrics groups, and the number of cases examined by Zidan et al., were still relatively low compared to our study [7, 21]. In addition, spinal findings such as vertebral haemangioma, Tarlov cysts and syringomyelia were not included in the study by Zidan et al., and Dilli et al., [7, 17]. This rate also was higher than IFs detected in the cervical and lumbar regions. However, only 12 of these findings were extraspinal, and three of them (one stomach cancer, two lung masses) were of clinical significance.

The major limitation of this study is its retrospective nature. Another limitation is the small number of cases in the thoracic region compared to the lumbar and cervical regions. Nevertheless, despite these limitations, the study's strengths are its relatively large patient population and comprehensive investigation of the cervical, thoracic, and lumbar regions.

In conclusion, reporting IFs detected in MRI may enable early diagnosis and treatment of a serious disease of the patient and prevent unnecessary further investigations. It is essential to systematically evaluate MRIs without focusing solely on the spine and report incidental findings detected in MRI, whether they are associated with the patient's pre-diagnosis for MRI. Also, it is necessary to learn about the frequency of incidental lesions, manage them, and determine their impact on patients' lives.

Compliance with Ethical Standards

Ethical Approval: The study was approved by the Clinical Research Ethics Committee of Kocaeli Derince Training and Research Hospital, University of Health Sciences (date: 25.11.2021, number: 2021-122).

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