

# Magnetic resonance imaging of the lumbar spine in adult: Evaluation of spinal incidental findings in patients with low back pain

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## Abstract

**Aim:** We aimed to incidental findings discovered in patients with suspected low back pain disease undergoing MRI of the lumbar spine and the clinical importance of those findings.

**Material and Methods:** One thousand seven hundred fourteen patients included who were admitted to our hospital with a preliminary diagnosis of low back pain were examined. The duration of low back pain complaints of the patients was ranging from 1 week to 4 years. MRI examinations were interpreted by academic neuroradiologists who had 7 years of experience, at the time of the study.

**Results:** Overall, 358 patients (20.9%) had incidental findings. Transitional vertebrae was the most common (134 cases, 7.8%) incidental finding, followed by vertebral hemangioma (65 cases, 3.8%) and Tarlov cyst (54 cases, 3.2%). The incidence of fatty filum terminale, compact bone island, spina bifida, synovial cyst and sacral meningocele was 2.1%, 1.5%, 1%, 0.8% and 0.7% respectively. Of these 1714 patients, 329 patients (92.06%) had one finding, 22 patients (5.95%) had two findings, and 7 patient (1.98%) had three findings.

The conus medullaris was terminated in 1710 (99.7%) of the patients (L1-2). This level were considered normal. In four cases, the spinal cord was determined to be below the required level. The prevalence of transitional vertebra was 7.8%. The prevalence of sacralization and lumbalization was 5.1% and 2.7%, respectively.

**Conclusion:** In this study we showed that incidental findings are mostly benign but interestingly there were no malignant or potentially malignant incidental lesions.

**Keywords:** Magnetic Resonance Imaging; Incidental Findings; Low Back Pain.

## INTRODUCTION

Incidental findings are usually asymptomatic lesions that are encountered during radiological examinations, independent of the pathologies examined. Recently, the incidence of these lesions has increased in tandem with the increasing frequency of radiological imaging in daily routine and the developments in technology (1). Low back pain is an important cause of morbidity in the world and 80-85% of people have experienced this pain in at least one period of their lives. Magnetic Resonance Imaging (MRI) is frequently used in the diagnosis of low back pain (2).

Various incidental findings can be seen on MRI of the lumbar spine during an evaluation for suspected low back pain. We focused on spinal abnormalities and excluded incidental findings associated with other organs. The

incidental findings are transitional vertebrae, vertebral hemangioma, Tarlov cyst, lipoma of filum terminale, compact bone island, spina bifida, synovial cyst and sacral meningocele.

In the literature, although the prevalence of extraspinal lesions are considered in patients with lumbar spinal MRI, publications related to intraspinal lesions are limited (3).

In this study, we assessed incidental findings discovered in patients with suspected low back pain disease undergoing MRI of the lumbar spine and the clinical importance of those findings.

## MATERIAL and METHODS

### Case Selection

In our study; lumbar MRI of 994 (58%) females, 720 (42%) males, total 1714 patients who were admitted to

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our hospital between January 2018 and December 2018 presenting with a preliminary diagnosis of low back pain were examined. The mean patient age was 56 (age range, 18-104 years), 86 (5%) patients were aged 29 and below, 445 (26%) were aged 30-49 years, 806 (47%) were aged 50-69 years and 377 (22%) were aged 70 and over. The duration of low back pain complaints of the patients was ranging from 1 week to 4 years.

Patients with history of malignancy, acute trauma, infection were excluded from the study. This retrospective study was approved by the institutional ethics review board. There was no requirement for informed patient consent.

Written informed consent was received from all patients, and the study protocol was approved by the hospital's local ethics committee (-2018P/70) in accordance with the Helsinki Declaration and Good Clinical Practice Guidelines.

### Image Analysis

MRI examinations were interpreted by an academic neuroradiologists and neurosurgery who had 7 years of experience, at the time of the study. The radiologist evaluated the MRI examinations for the presence of variable incidental findings in the spine. The incidental findings that we have identified were not about the main complaint. In our study; transitional vertebrae, vertebral hemangioma, Tarlov cyst, lipoma of filum terminale (Fatty filum terminale), compact bone island, spina bifida, synovial cyst and sacral meningocele were reported as incidental findings.

A vertebral hemangioma was diagnosed when signal intensity was increased on T1-and on T2-weighted images. Tarlov cyst was defined as cerebrospinal fluid filled sacs that cover nerve roots exiting from the sacral area of the spine ( 4). Lipoma of the filum terminale (fatty filum terminale) was diagnosed when linear fat signals were seen within the filum terminale on T1- and T2-weighted images without severe thickening or a tethered cord. Synovial cyst was diagnosed when a cystic lesion showed low-to-intermediate signal intensity on T1-weighted images and high signal intensity on T2- weighted images with hypointense cystic capsule. Sacral meningocele was defined as sacral bone defect and abnormal dilatation of the meninges lying within the borders of the sacral spinal canal ( 5).

### MRI Parameters

MRI scans were obtained using a 1.5-T unit (GE MR360 Optima, General Electric Medical Systems, Wisconsin, USA). MRI sequences included: T2 (TR:2570, TE: 90, Flip Angle:90, Matrix, 320x224, FOV:28 cm) images in the axial and sagittal planes, T1(TR:580, TE: 16, Flip Angle:90 Matrix, 288x224, FOV: 28 cm) images in the axial and sagittal planes, T2-weighted images with fat saturation in the sagittal plane. The sequences were obtained in 4 mm thick sections. The MRIs and the official reports were reviewed using the SARUS program (Hacettepe, Ankara, Turkey), which is available at our institution.

### Statistical Analysis

Frequency distributions of the assessed imaging characteristics were calculated. For analysis of the relationship of the incidental findings, with patient characteristics, the chi-square test was used. The association of the incidence of each incidental finding was evaluated with regard to patient. A p value < 0.05 was considered to indicate statistical significance.

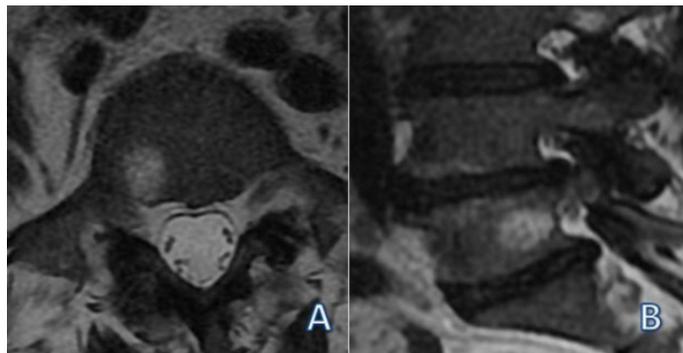
## RESULTS

Lumbar spinal MRI images of 1714 patients who applied to our outpatient clinic with low back pain and had no pathological findings in neurological examination were evaluated retrospectively.

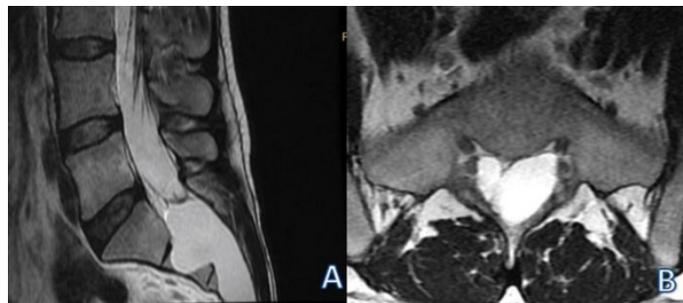
Overall, 358 patients (20.9%) had incidental findings in which there was no malignant or potentially malignant lesions. All of them were benign. Transitional vertebrae was the most common (134 cases, 7.8%) incidental finding, followed by vertebral hemangioma (65 cases, 3.8%) (Figure 1) and Tarlov cyst (54 cases, 3.2%) (Figure 2). The incidence of fatty filum terminale, compact bone island, spina bifida (Figure 3), synovial cyst (Figure 4) and sacral meningocele was 2.1%, 1.5%, 1%, 0.8% and 0.7% respectively. Of these 1714 patients, 329 patients (92.06%) had one finding, 22 patients (5.95%) had two findings, and 7 patient (1.98%) had three findings. (Table 1).

The conus medullaris was terminating at the normal level (L1-2) in 1710 ( 99.7) patients. In 4 cases, the spinal cord was determined inferior to the level where it should be.

The prevalence of transitional vertebrae was 7.8%. The sacralization and lumbalization prevalence was 5.1% and 2.7%, respectively.



**Figure 1.** Axial (B) and Sagittal (A) T2-weighted MRI images showing vertebral hemangioma at lumbar vertebral body



**Figure 2.** Sagittal (A) and axial (B) T2-weighted MRI images showing sacral tarlov cyst localised between S1 and S3 vertebra body



Figure 3. Axial (B) T2-weighted images show spina bifida in lumbar vertebra

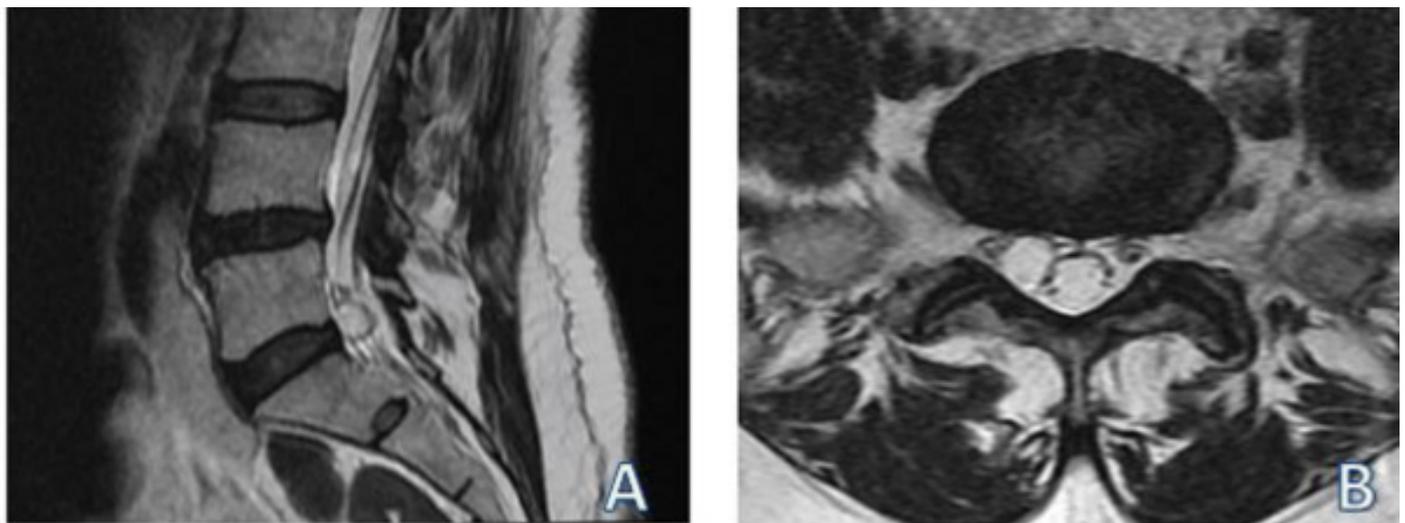


Figure 4. Sagittal (A) and axial (B) T2-weighted images show synovial cyst at the right foraminal recess

Table 1. Incidental Findings of the Lumbar Spinal MRI Categorized by Gender									
Sex-No. (%) of patients	Transitional Vertebrae	Vertebral Hemangioma	Tarlov Cyst,	Lipoma of filum terminale	Bone Island	Spina Bifida	Synovial Cyst	Sacral-Meningocele	Total
Women	83	41	34	17	10	9	10	2	994
Men	51	24	20	19	16	8	4	10	720
P	0.923	0.716	0.565	0.186	0.420	0.671	0.306	0.003	-
Total, No. (% of Patients)	134 (7.8)	65 (3.8)	54 (3.2)	36 (2.1)	26 (1.5)	17 (1)	14 (0.8)	12 (0.7)	1714

## DISCUSSION

The incidental findings are mostly benign and treatment-free lesions. However, a few numbers of malignant or potentially malignant incidental lesions can be seen (5). Nowadays, in parallel with the technological advances in radiological imaging and the excessed number of radiological examinations in daily routine, detection of incidental lesions has increased. Although studies on this subject have been started recently, the information obtained is not sufficient. Incidental findings that can be seen in the lumbar spine are transitional vertebrae, vertebral hemangioma, Tarlov cyst, fatty filum terminale, bone islet, spina bifida, synovial cyst, and sacral meningocele.

In accordance with the literature, incidental findings at lumbar MRI of patients with low back pain was 20.9% in our study. Incidental lesions may cause back pain. By the way, all of the detected incidental findings were symptom free benign lesions as expected.

Lumbosacral Transitional vertebra (TV) is a congenital spinal anomaly described as lumbarization of the 1st sacral vertebra (S1) or sacralization of the 5th lumbar vertebra (L5). Sacralization of L5 vertebrae (~17%) is more common than lumbarization of S1 vertebrae (~2%) (6).

In accordance with the literature the sacralization and lumbarization prevalence was %5,1 and % 2.7, respectively in our study. Lumbosacral transitional vertebra was the most common incidental finding in our study with the rate of 7.8% and in the literature it has been determined in the range of 4-35% (7). This anatomic anomaly causes the error in plane determination during lumbar surgery. For this reason, it is critical to determine before surgery and to specify it in radiology report (8).

Vertebral hemangioma is a hamartomatous proliferation of vascular tissue of endothelial origin and it is one of the commonest benign tumors of the vertebral column. Its prevalence was reported as 11% at the lumbar vertebrae in autopsy series. In our study vertebral hemangioma was the second most common incidental finding at the lumbar vertebrae with the rate of 3.8%. According to the literature, it is seen two times more common in women, however in our study there was no statistically significant difference in gender. Although it is usually benign lesions without clinical presentation, it has been reported that it causes pathological fracture in 1% that accompany with spinal cord compression and motor deficits secondary to fracture (10). In our cases; pathologic situations related with vertebral hemangioma (compression fracture, neurological deficits etc.) was not detected.

Tarlov cysts, also known as perineural cysts, are Cerebrospinal fluid (CSF)-filled sacs at the dorsal nerve root sheath usually located in the spinal canal of S1–S4 region of vertebrae. Most Tarlov cysts remain asymptomatic and do not cause pain or any neurological sequelae (11). In rare cases, enlargement of the cyst may cause pain by compressing the nerve root or by causing erosion of the sacral bone. Although there are many case

reports or case series, the diagnosis and treatment of these cysts are still controversial (12). In our study Tarlov cyst was the third most common incidental finding (3.2%) and there were no related neurological deficits in patients with Tarlov's cyst. Also there was no significant difference in gender.

Lipoma of the filum terminale is also called fatty filum terminale, partially a common incidental finding of lumbar spinal MRI. In general, fatty filum terminale is not combined with the tethered cord or low-lying conus and it has no clinical significance. Postmortem studies have reported a 4–6% incidence of occult lipomas of the filum terminale (13). In our study, incidence of fatty filum terminale was 3.2% and no statistically significant difference was found between age, gender and body mass index.

Compact bone islet also known as enostosis was determined as a small focus of hamartomatous cortical bone within the cancellous medullary cavity. They are usually asymptomatic. They are often observed in long bones, pelvis, and rarely in the spine. In our study, compact bone island was found in 1.5% of lumbar vertebrae corpus. No pathological findings and complaints were found related with compact bone islet (14).

Synovial cysts appear as lesions with low to intermediate signal intensity on T1-weighted MRI. They are usually asymptomatic incidentally found lesions which are rarely ruptured or infected and may cause complaints. By the way, slight in ratio synovial cysts requiring surgical treatment have been reported (15).

Sacral meningoceles are usually a type of dysraphism and are thought to take place during embryologic development. These lesions are frequently identified in the posterior location over the thoracic and sacral areas at birth and constitute about 10% of all patients with spina bifida (16).

In our study, sacral meningocele (0.7%) was the least common incidental finding and no additional neurological deficits were found other than the complaint of lumbar pain. When we categorized meningocele cases as anterior, posterior and lateral; posterior sacral meningocele was observed in all 12 cases, anterior and lateral meningocele was not seen. In our cases, there were no complaints of gastrointestinal and urogenital system which are usually associated with posterior sacral meningocele. Neurological examinations were normal. In our study male predominance was determined in sacral meningocele and a significant difference was found in gender. There was no significant difference between gender in all other incidental lesions.

We did not detect any malign lesion in our study despite that, with a small percentage potentially malignant (Although histopathologically benign, it may have poor behavior (eg, pathological fracture due to vertebral hemangioma) (10) or malignant lesions can be detected incidentally. It should be noted that incidental lesions detected in such cases may be more important than the disease being investigated (17,18).

Limitations of our study: The clinical follow-up of patients and the change of incidental findings over time could not be evaluated due to the retrospective evaluation of MRI and examination findings at the time of presentation. And also we could not evaluate the patients' knowledge about the incidental findings and the anxiety that could be caused by inappropriate or insufficient information. In addition, patients could not reach long-term follow-up and outcome.

The improper identification or not mentioning these findings in the radiology reports may cause pathologies to be overlooked. Similarly, improper information of patients about these mostly benign incidental lesions that are specified in the radiology report causes fear and anxiety. This situation causes an increase in health expenses due to the repeated examination of incidental findings.

## CONCLUSION

In conclusion, there should be a standardization about reporting incidental lesions and patients should be informed correctly by clinicians about the incidental finding without causing anxiety.

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