Surveillance of critical findings of MRI in cases of low back pain without any neurological deficit

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Abstract
Objective: *There are many injuries, mostly to tendons or muscles, which can lead to lower back pain. This study aims to see the critical findings in magnetic resonance imaging in patients with low back pain without radiculopathy, no history of trauma, who did not respond to conservative treatment.*
Methods: *Between April 2018 and November 2019, 443 patients with LBP who did not respond to conservative treatment were examined using MRI with sagittal T1- and T2-weighted imaging.*
Results: *Vertebral fractures, infections, pars defects, malignancies, and spinal cord tumors were found in 19.4%. Of thirty-one vertebral fractures identified, twenty-one (67.7%) were new while ten were old. Twenty-seven Pars defects were identified, twelve (44.4%) had spondylolisthesis, seven (25.9%) had undislocated, and eight (29.6%) had only Pars edema. The neoplastic disorder was seen in ten (11.6%), none of whom were suspected before imaging. Benign neoplastic diseases such as hemangiomas / vertebral arteriovenous malformations (AVM) were excluded. Eighteen subjects had a variety of conditions, including six ankylosing spondylitis, two discitis, two large vascular aneurysms, two ovarian cysts, two herniated discs, a sacral regurgitation fracture, a previously unsuspected horseshoe kidney, a ruptured fracture, or a retroperitoneal hematoma.*
Conclusion: *The majority of patients with LBP are clinically best judged and imaging is usually not required. An MRI scan will detect a large number of abnormalities in patients with symptoms of concern. It is important to identify and separate these smaller patient groups to allow early detection and better management of the underlying disease.*
Keywords: *Thoracolumbar spine, low back pain, pars interarticularis, vertebral fracture, MRI.*

Introduction

Low back pain (LBP) with or without radiculopathy is one of the most common complaints in orthopedics OPD, not only in older age groups but also in younger age groups. The majority of patients who have mechanical back pain due to muscle spasms, facet disorders, or degenerative disc disease that respond well to conservative treatment do not require imaging, resume normal activities after about 30 days, although a small proportion of these experience more persistent pain that justify the use of further

imaging to rule out an ominous disease[1,2]. The challenge, therefore, is to distinguish those small segments within this large patient population that should be further investigated because of the suspicion of a more serious problem. The main causes of LBP to be excluded are vertebral collapse, infections, malignancies, spondylitis, or pars defects (especially in younger people). Simple X-rays are the imaging technique of choice but have decreased sensitivity, mainly in the early stages of the disease, and while the abnormalities are localized, simple X-rays may not fully define them, e.g. X-rays, but chronic collapse cannot be of one acute condition can be distinguished and benign conditions are difficult to distinguish from malignant ones[3-6]. These differences are better recognized in MRI because it has excellent spatial resolution and high soft-tissue contrast, allowing for detailed observation of the anatomy of the lumbar spine and detection of biochemical and morphological anomalies that could not previously be observed[7]. This increased sensitivity in detection has provided us with invaluable data for diagnosing infectious, degenerative, metabolic, inflammatory, and neoplastic diseases of the lumbar spine, making MRI the diagnostic imaging of choice for most painful lumbar spine disorders[8,9].

Methods and Materials

The study was carried out following the principles of the Helsinki Declaration. Ethical approval was not considered necessary as it was not a study comparing simple X-rays and MRIs. A written declaration of consent was obtained.

In this retrospective study, which includes data from April 2018 to November 2019, we examined 443 patients in the age group between 20 and 65 years with at least 6 weeks of LBP duration without radiculopathy. They were treated conservatively with nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, and calcium tablets. Patients who failed to respond to conservative treatment continued to have an MRI scan. In patients with claustrophobia, MRI was performed under sedation with the help of the anesthesia department.

Study participants were supine for at least 45 minutes immediately before the MRI. T1 and T2 images of the lumbar spine of the study participants were recorded with a 1.5 Tesla (1.5 T) scanner (Siemens GE, USA) with a surface coil. The field of view was 300 mm, while the distance between the slices and the slice thickness was 1 mm and 0.4 mm for the sagittal images and 0.5 mm / 1 mm and 0.4 mm for the axial slices, respectively.

Results

In the study 443 patients are included, where 273 women and 160 men. Anomalies in addition to degenerative disc disease were noted in eighty-six patients (19.4%), the most common findings being abnormal pars interarticularis and vertebral hernia fractures [Table 1]. Vertebral fractures [Fig. 1] were detected in thirty-one patients, of whom twenty-one (67.7%) had a recent injury (indicated by signal characteristics) while ten had normal bone marrow signals, suggesting that these fractures were older [Table 2]. Of the twenty-seven identified cases of pars defect [Fig. 2], twelve (44.4%) patients had spondylolisthesis, seven (25.9%) had a non-displaced and eight (29.6%) had only Pars edema (a state before the fracture) [Table 3]. Malignant and neural tumors were the only neoplastic diseases included in the study and were found in ten (11.6%) patients, none of whom were suspected before MRI. Benign diseases such as spinal arteriovenous malformation (AVM) or hemangioma were not included in the study. Some other critical findings were ankylosing spondylitis in six, discitis in two, aneurysm in large vessels in two, cyst in the ovaries in two, disc sequestration in two, sacral regurgitation fracture in one, previously suspected horseshoe kidney in one, fracture in one, or retroperitoneal hematoma in a patient.

Figure 1, D12 vertebral fracture

Sagittal MRI Image showing fracture of D 12 vertebra in a 40 years old male suffering from low back pain

Figure 2, Pars interarticularis defect

Sagittal MRI image showing Pars Interarticularis defect in a 37 years old female suffering from low back pain

Table 1 - Amount of cases for each non-degenerative disease

	MALE	FEMALE	TOTAL
NEOPLASMS	4	6	10
PARS DEFECTS	13	14	27
VERTEBRAL FRACTURES	10	21	31
OTHERS	8	10	18
ABNORMAL	35	51	86

Table 2 – Proportion of active versus inactive fractures due to osteoporosis

	MALE	FEMALE	TOTAL
ACTIVE	7	14	21
INACTIVE	3	7	10
TOTAL	10	21	31

Table 3 – Amount and type of Pars-interarticularis lesions determined

	MALE	FEMALE	TOTAL
SLIP	5	7	12
NO SLIP	4	3	7
EDEMA	4	4	8
PARS DEFECTS	13	14	27

Discussion

Disc herniation and degeneration are well known in the symptomless population and are common in people with LBP and may reflect age-related changes or asymptomatic disease, although focal herniation of the nucleus pulposus can be observed in a few patients without radiculopathy and whether this is discussed by radiologists should be reported or not. Hemangioma, a common lesion, is easy to spot and often does not need further investigation. The primary indications for an MRI are people with LBP who do not respond to conservative treatment. The main aim of this study is to report critical findings from MRI in patients with LBP without radiculopathy and a history of trauma.

Among the various failure fractures due to osteoporosis, vertebral fractures are the most common and earliest observed fractures. It is estimated that around 20-25% of Caucasian men and women over the age of 50 have a pre-existing vertebral fracture and that the incidence of vertebral fractures increases with age[10-12]. A

vertebral fracture results in a 5 to 12.6 fold risk of subsequent vertebral body fractures and a 2.3 to 3.4 fold risk of hip fractures[13,14]. The observation shows that about 20% of women with a vertebral fracture eventually develop another vertebral fracture within a year; the risk is 4-fold increased in women with fractures due to severe osteoporosis and 3-fold increased in women with multiple fractured vertebrae[15]. Reports show a similar prevalence of 17% for fractured vertebrae in Indian women from population study data[16]. In the study, women had three times as many vertebral fractures as men, with twice as many active fractures and 2.3 times as many old fractures as compared to men. MRI provides a more specific diagnosis for the cause of the vertebral collapse and can also differentiate between chronic and acute lesions, with the former being 10 and the latter being 21 (2.1 times) in the study[7].

Defects in the pars interarticularis begin with a stress reaction (pre-paralytic stage), which develops into acute fractures, the so-called spondylolysis, and finally, leads to chronic fractures[17]. A full pars fracture can result in an antero-listhesis of the vertebrae in question concerning the vertebrae below, known as a spondylolisthesis[18]. Patients with lumbar spondylolysis usually complain of pain that is naturally progressive, in the lumbar region, made worse by twisting or stretching the spine[19]. 93% of spondylolysis patients have had or have had sports activities in the past[20]. A study by Roche & Lowes with 4,200 bodies shows an overall incidence of 4.2% in the study; this was 6.2% when the total number of cases is taken into account[21]. Fredrickson et al. showed that men were 2 to 3 times more likely to be affected than women, in contrast to the study in which the defect was almost the same in men (13 cases) and women (14 cases), suggesting a tertiary referral to the Institute[22].

The most common location for skeletal metastases is the spine with up to 70% of patients with cancer-causing secondary spinal lesions, whereby spinal disease is the first manifestation of carcinoma in almost 95% of metastases, extradural lesions, and intradural-extramedullary lesions are the majority of the remaining lesions. 0.5% of spinal metastases consist of intramedullary lesions[23]. Spinal metastasis is one of the most common forms of secondary osseous involvement in various cancers, most of which clinically present as LBP[24]. This secondary metastasis is 20 times more common than the primary neoplastic lesions of the spine[25]. We had a 2: 3 ratio of men to women in the patients who presented with features that indicated neoplasia on MRI. The results of the study were consistent with some of the previous studies in which herniated discs and bulging were not associated with lower back pain[26-28]. Twenty patients with a history of fractures who were treated with open or closed reduction and fixed with a stainless steel implant could not be eligible for an MRI and were therefore not included in the study.

The study suggests that in patients with LBP without radiculopathy, in addition to degenerative disc disease, there are several critical findings on MRI, most of which are vertebral fractures and Pars defects. This small group of patients needs to be carefully identified and separated from the huge pool of LBP cases to allow for early diagnosis and better management of the underlying pathology. Limitations of the study are the number of subjects included in the study, which was not as high due to the regional differences in the cases.

Conflict of interest

The authors have no conflicts of interest associated with the material presented in this paper.

Author contributions

Conceptualization: AD. Data curation: CG, GKA, SP. Formal analysis: GKA. Methodology: AD, CG, GKA. Project administration: AD. Visualization: CG, GKA, SP. Writing - original draft: CG, GKA, SP. Writing - review & editing: AD, GKA

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