

The Value of Standing X-ray in Detecting Physiological Spondylolisthesis in Patients with Single Disc Prolapse with Normal Intensity MRI Findings

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ABSTRACT

Background: A common spinal disease is lumbar disc herniation (LDH) accompanied by clinically relevant symptoms and it affects nearly one to 3 percent of general population. It has been inferred from long-term studies that approximately 15 percent of patients with spondylosis will have spondylolisthesis in addition. When adults are taken into consideration, 10% women and 5% of men are going to have lumbar spondylolisthesis that is not accompanied by a defect in the pars. **Aim of the study:** The current study was carried out in order to highlight the association between physiologic spondylolisthesis and disc herniation.

Patients and methods: The current cross-sectional study was carried out at radiology unit, Al-Diwaniyah teaching hospital, Al-Diwaniyah province, Iraq. The work with this study is dated back to March 2019 and lasted till April 2020. The study included 100 patients with single disc prolapsed, who were randomly selected from the pool of patients referred by orthopedic unit to radiology unit. Those patients were investigated by MRI according to the routinely recommended examination done in the radiology unit for patients with single disc prolapse in addition to conventional plane x-ray in supine and standing positions (anteroposterior and lateral).

Results: The following results were found after data evaluation. Regarding the age interval of 20-40, 15 of them have disk prolapse with normal signal intensity, no one of them have spondylolisthesis, and 5 of them have abnormal signal intensity (dehydrated disk), one patient showing spondylolisthesis. Regarding the age interval of 41 to 60, 18 of them have disk prolapse with normal signal intensity, no one of them have spondylolisthesis, and 42 of them have abnormal signal intensity (dehydrated disk), 4 patient showing spondylolisthesis. With respect to the age above 60, one of them are have disk prolapsed with normal signal intensity, no one of them have spondylolisthesis, and 19 of them have abnormal signal intensity (dehydrated disk), one patient showing spondylolisthesis.

Conclusion: standing position lateral X-ray must be performed for every patient with single disk prolapse having normal or abnormal signal intensity MRI to exclude physiological spondylolisthesis.

Keywords: standing x-ray, physiological spondylolisthesis, single disc prolapse

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INTRODUCTION

Although, may be asymptomatic, the slippage of a vertebral body one another adjacent one can cause considerable back pain related to mechanical and or reticular nature. This condition in clinical practice is often called spondylolisthesis. The condition may be acquired or congenital, but idiopathic cases exist. The condition may be related to ischemic, degenerative, dysplastic or traumatic nature and the severity of the condition is related to the degree of vertebral slippage ([Randall et al., 2016](#)). It has been inferred from long-term studies that approximately 15 percent of patients with spondylosis will have spondylolisthesis in addition ([Kalichman et al., 2009](#); [Omidi-Kashani et al., 2014](#)). When adults are taken into consideration, 10% women and 5% of men are going to have lumbar spondylolisthesis that is not accompanied by a defect in the pars ([Bouras et al., 2015](#)). The condition is frequently asymptomatic and it often involves the L4 to L5 levels ([Eismont et al., 2014](#)). The incidence of the acquired degenerative variety increases with age ([Eismont et al., 2014](#)). High grade spondylolisthesis is rarely seen in degenerative variety ([Schulte et al., 2016](#)). Clinical improvement may sponatenously happen because of concomitant stabilization of the vertebral segments due to chronic nature of the pathology ([Schulte et al., 2016](#)).

A common spinal disease is lumbar disc herniation (LDH) accompanied by clinically relevant symptoms and it affects nearly one to 3 percent of general population; however, only one fifth of these cases are in need for surgical intervention. Although, Lumbar discectomy can be viewed as the most straightforward and frequent spinal surgery, it is accompanied by potentially serious drawbacks ([Omidi-Kashani et al., 2016](#)). One of the frequent finding in daily clinical radiology is the finding of degenerative disc disease. Although in the majority of affected individuals a direct relationship with low back pain cannot be guaranteed, the pathology starts from the second decade of life and the prevalence and severity rises with advancing age ([Urban and Roberts, 2003](#)). Lumbar spondylolisthesis and spondylolysis are other frequent paraclinical associations in patients and they may be seen often on lumbosacral radiographs routinely done; however, they are usually free of symptoms or associated with minimal symptoms that respond well to medical intervention ([Kalichman et al., 2009](#)). The rarity of national studies dealing with coincidence of disc herniation and spondylolisthesis in addition to frequent clinical observation of such coincidence permitted the planning and conduction of the current study in order to

highlight the association between physiologic spondylolisthesis and disc herniation.

PATIENTS AND METHODS

The current cross-sectional study was carried out at radiology unit, Al-Diwaniyah teaching hospital, Al-Diwaniyah province, Iraq. The work with this study is dated back to March 2019 and lasted till April 2020. The study included 100 patients with single disc prolapsed, who were randomly selected from the pool of patients referred by orthopedic unit to radiology unit and the selection of those patients was based on random digits generated by a computer software. Those patients were investigated by MRI according to the routinely recommended examination done in the radiology unit for patients with single disc prolapse in addition to conventional plane x-ray in supine and standing positions (anteroposterior and lateral). The main outcome was the presence or absence of accompanying spondylolisthesis in addition to radiological evidence of disc herniation. The study was approved by the institutional approval company and verbal consent was obtained from every participant following thorough explanation of aim and the procedure of the study.

Statistical analysis was carried out using statistical package for social sciences (SPSS) (IBM, Chicago, USA, version 23) and Microsoft Office Excel 2010. Quantitative data were expressed as mean, range and standard deviation while qualitative data were expressed as number and percentage. Fischer exact test was used to

study association between qualitative variables and the level of significance was set at $P \leq 0.05$.

RESULTS

The characteristics of patients with disc prolapse enrolled in the present study are shown in table 1. The study included 100 patients with an age range of 20 to 65 years and a mean age of 49.08 ± 10.84 years. The frequency distribution of patients according to age has shown that the majority of cases were between 40 to 60 years accounting for 60 %. The study included 58 males and 42 females.

The following results were found after data evaluation. Regarding the age interval of 20-40, 15 of them have disk prolapse with normal signal intensity, no one of them have spondylolisthesis, and 5 of them have abnormal signal intensity (dehydrated disk), one patient showing spondylolisthesis. Regarding the age interval of 41 to 60, 18 of them have disk prolapse with normal signal intensity, no one of them have spondylolisthesis, and 42 of them have abnormal signal intensity (dehydrated disk), 4 patient showing spondylolisthesis. With respect to the age above 60, one of them are have disk prolapsed with normal signal intensity, no one of them have spondylolisthesis, and 19 of them have abnormal signal intensity (dehydrated disk), one patient showing spondylolisthesis. Positive finding of spondylolisthesis has been found to be limited to patients with abnormal signal; however, the association was not significant ($P = 0.093$), as shown in table 2.

Table 1: Characteristics of patients with disc prolapse enrolled in the present study

Characteristic	Results
Number of cases	100
Age (years)	
Mean \pm SD	49.08 ± 10.84
Range	20-65
20-40, <i>n</i> (%)	20 (20 %)
41- 60, <i>n</i> (%)	60 (60 %)
61 and over, <i>n</i> (%)	20 (20 %)
Gender	
Male, <i>n</i> (%)	58 (58.0 %)
Female, <i>n</i> (%)	42 (42.0 %)

SD: standard deviation; *n*: number of cases

Table 2: Frequency of spondylolisthesis detected by standing x-ray in association with disc prolapse in relation to disc signal on MRI examination

Spondylolisthesis	Prolapse with abnormal signal disc (<i>n</i> = 66)		Prolapse with normal signal disc (<i>n</i> = 34)		<i>P</i>
	<i>n</i>	%	<i>N</i>	%	
Positive	6	9.1	0	0.0	0.093 F NS
Negative	60	90.9	34	100.0	

F: Fischer exact test; NS: not significant at $P > 0.05$

DISCUSSION

Based on our clinical observation in Al-Diwaniyah teaching hospital, mid-Euphrates region of Iraq, it has been found that some patients with single disc prolapse have in addition spondylolisthesis when examine by standing x-ray; therefore, the current study was investigated to highlight the association between disc herniation and spondylolisthesis in a sample of Iraqi patients. At the end of the study, we were able to include 100 patients, 6 % of whom were diagnosed to have spondylolisthesis. Indeed, previous reports have raised the issue of such an association, and it has been estimated that a significant proportion of patients with disc herniation may have spondylolisthesis in addition (Bouras *et al.*, 2015; Kalichman *et al.*, 2009). One of the striking features of the current study is the occurrence of disc herniation in the age above 40 very more frequent than younger age group and this is in line with previous observation that degenerative disc herniation incidence becomes higher with advancing age (Urban and Roberts, 2003). In addition, it was found that men are more frequently affected which can be explained by more physical activity and more laborious nature of men occupations in comparison with women. Routine axial scanning with MRI with cursors directed through the intervertebral spaces results in significant intervening gaps. Migrated sequestrated disc, pars interarticularis defect (spondylolysis), facets, conjoined

nerve roots, neuroforamen, intraspinal synovial cysts, and lateral recesses may be frequently undetected on routine axial MRI. "The correct method for axial image cutting should be contiguous from the midbody of L3 to the midbody of S1, and it is not necessary to be exactly parallel to the intervertebral discs" (Singh *et al.*, 2007).

One of the important events during standing and lying positions is the change in vertebral alignment or slippage. It is well accepted that spinal radiography during standing is more appropriate for detection of deformity or instability or (such as kyphosis and scoliosis), whereas anatomical details are best visualized during supine spinal radiography. When a patient reclines from the upright position, vertebral slippage may be reduced by up to 26 percent (Warner *et al.*, 2013). For that reason, during routine supine MRI, lumbar spondylolisthesis may be missed. Plain standing lateral and anteroposterior lumbosacral radiographs must be performed when surgical intervention is planned for patients with lumbar disc herniation. Although bone scan or computed tomography can be necessary to diagnose a pars lesion in suspicious cases, oblique views of the lumbosacral spine can help sometimes (Leone *et al.*, 2011).

In conclusion standing position lateral X-ray must be performed for every patient with single disk prolapse having normal signal intensity MRI to exclude physiological spondylolisthesis.



Fig 1. sagittal view MRI T2 weighted image: loss of normal signal intensity of normal disks (dehydrated disk), with post. Disk prolapsed of L4/L5.



Fig 2. lateral view X-ray LSS, showing grad 1 spondylolisthesis.

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