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Original Article

Plain Radiographic Evaluation of Degenerative Changes of Lumbosacral Spine-Correlation with Magnetic Resonance Imaging Findings

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Abstract:

Back pain resulting from degenerative disease of the spine is one of the most common causes of disability in adults of working age. The structures which may be responsible for the origin of the degenerative spine are bone (spondylolisthesis, spondylolysis), ligaments (hypertrophy of the spinal ligaments, particularly the ligamentum flavum), facet joints (facet hypertrophy, synovial cyst) and intervertebral disc (bulging and herniation)[1]. This was a cross sectional study of 105 patients with low back pain. All Plain X-ray and MRI findings were collected for each patient in a pre-designed structured data collection sheet. In plain X-ray 74 subjects had posterior disc height < 6mm; out of them nerve root compression found in 56, spinal stenosis found in 54. Those who had posterior osteophytes, (86.8%) found to have disc herniation. Among facetal hyperthrophy (72 subjects), 62 (86.1%) had disc herniation. In this study significant correlation found between plain radiographic findings of degenerative changes of lumbosacral spine with MRI.

Key words: Plain radiograph, Degenerative changes of lumbosacral spine, Magnetic resonance imaging.

Introduction:

The characteristic findings of discogenic degenerative change on conventional radiographs include loss of disc height, irregularity and sclerosis of the endplates, and herniation of nuclear disc material into the margins of the endplates (Schmorl's node) & intranuclear gas due to vacuum phenomena[2]. Osteoarthritis of the facet joints is another component of spinal degenerative disease that may be responsible for the patient's symptoms while contributing to spinal canal stenosis or neural foraminal narrowing. On conventional radiography, degenerative change of the facet joints can present as increased scleroris and oblique projections, joint spaces narrowing can often be defined[3,4]. Plain x-ray is the most commonly ordered spinal imaging test because of ready availability and low cost and can be very helpful in its ability to demonstrate bony abnormalities. Most often, an x-ray of the spine will be the first diagnostic tool used in evaluating back pain, and it is usually done before consideration of an MRI or a CT scan. Good quality X-rays will permit not only an analysis of the individual bones of the spine but also the overall contour of the spinal column[5]. Now a days, MRI of lumbosacral spine is considered as gold standard imaging modality for evaluation of nerve root compression & spinal stenosis, but it has some drawbacks i.e. 1) it is a costly procedure, 2) contraindicated-in patients having pacemaker, metallic, stents/prosthesis and claustrophobia[6]. In a study carried out in abroad & found that posterior disc height of less than 6 mm in plain x-ray correlated significantly with root compression and spinal stenosis in MRI. Significant correlation was observed between posterior osteophytes, end plate sclerosis and irregularity, facet arthropathy, spondylolysis and spondylolisthesis with disc herniation, spinal nerve root compression, and spinal stenosis. The study showed that sensitivity of plain radiograph was 92.7% and the positive predictive value was 96.2%[7]. In another study, the three radiographic parameters height-loss, osteophytes and intra-discal calcifications correlate significantly with the morphological degree of degeneration[8]. Thus the purpose of this study is to investigate the correlation between plain radiographic findings and the MRI features in patients with degenerative spine disease.

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Materials and Methods:

This cross sectional study was carried out in the department of Radiology and imaging of Bangladesh Institute of Research & Rehabilitation in Diabetes, Endocrine &Metabolic Disorders (BIRDEM) from 1st January 2010 to 31st December 2011. A total of 128 subjects attending department of Radiology and imaging, BIRDEM for MRI of lumbosacral spine were enrolled first for the study. Out of these 128 cases 105 subjects fulfilled the inclusion criteria thus taken as cases. Their age ranges from 28 years to 72 years. Remaining 23 patients were excluded. Out of which 05 subjects had history of previous trauma, 04 subjects had lumbosacral spine surgery, 04 subjects had spondylolisthesis, 02 had congenital lumbosacral spinal anomaly and remaining 8 with spinal lesions other than degenerative change. After reviewing the clinical history demographic data, age of all subjects were collected. Plain X-ray of lumbosacral spine followed by MRI were performed for each patient. At first, plain radiographs were evaluated by researcher and then followed by consultant radiologist. All Plain X-ray and MRI findings were collected in a pre-designed structured data collection sheet. Data were analyzed & presented accordingly.

Results:

The mean (±SD) age of the subject was 50.0±13.0 years with range from 28 to 72 years. Male (66) female (39) ratio was 1.7:1. (Figure-I)

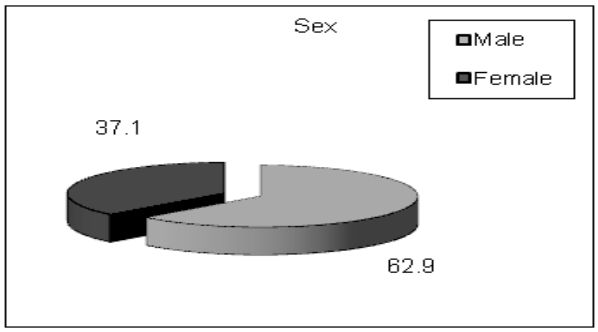

Figure-I: Sex distrbution.

Out of the 105 cases < 6mm posterior disc height found in 74 (X-ray), among them 56 (75.7%) were confirmed MRI diagnosis for nerve root compression (Table I)

Table I: Correlation between plain X-ray and MRI for prediction of nerve root compression from posterior disc height (n=105).

Plain X-ray	MRI diagnosis for nerve root compression		
Posterior disc height	Present	Absent	
	n	n	%
<6mm (n=74)	56(TP)	18(FP)	24.3
>6mm (n=31)	3(FN)	28(TN)	90.3

TP-True positive, TN-True negative, FP-False positive, FN-False negative

Among the above 74 cases of <6mm (on X-ray) posterior disc height, MRI diagnosis of spinal stenosis was found in 54 (73%) (Table II)

Table II: Correlation between plain X-ray and MRI for prediction of spinal stenosisfrom posterior disc height (n=105).

Plain X-ray	MRI diagnosis for spinal stenosis			
Posterior disc height	Present		Absent	
	n	%	n	%
<6mm (n=74)	54(TP)	73.0	20(FP)	27.0
>6mm (n=31)	2(FN)	6.5	29(TN)	93.5

In plain X-ray evaluation out of the 105 cases posterior osteophytes found in 38. Among them 33 (86.8%) showed disc herniation on MRI (Table III).

Table III: Correlation between plain X-ray and MRI for prediction of disc herniation from posterior osteophytes (n=105).

Plain X-ray	MRI diagnosis for disc herniation			
Posterior osteophytes	Present		Absent	
	n	%	n	%
Present (n=38)	33(TP)	86.8	5(FP)	13.2
Absent (n=67)	37(FN)	55.2	30(TN)	44.8

In plain X-ray facetal hypertrophy was found in 72 out of the 105 cases. Among these 72 cases 62 (86.1%) confirmed disc herniation on MRI (Table IV).

Table IV: Correlation between plain X-ray and MRI for prediction of disc herniation from facetalhy pertrophy (n=105).

Plain X-ray	MRI diagnosis for disc herniation			
Facetal hypertrophy	PrPresent		Absent	
	n	%	n	%
Present (n=72)	62(TP)	86.1	10(FP)	13.9
Absent (n=33)	10(FN)	30.3	23(TN)	69.7

The validity of plain X-ray for prediction of degenerative changes with MRI findings measured in the following table (Table V).

Table V: Sensitivity, specificity, accuracy, positive and negative predictive values of the plain X-ray and MRI evaluation for prediction ofdisc herniation by posterior osteophytes & facetalhyperthrophy, prediction of spinal stenosis and nerve root compression by posterior disc height.

Validity test	Posterior osteophyte	Facetal hypertrophy	Posterior disc height	
	Disc herniation		Spinal stenosis	Nerveroot compression
Sensitivity	47.1	86.3	96.4	94.9
Specificity	85.7	65.6	59.2	60.9
Accuracy	60.0	80.0	79.0	80.0
PPV	86.8	85.1	73.0	75.7
NPV	44.8	67.7	93.5	90.3

PPV=Positive predictive value
NPV= Negative predictive value

Discussion:

In this current study it was observed that the mean (±SD) age of the subjects was 50.0±13.0 years with range from 28 to 72 years and more than one fourth (25.7%) of the patients were in the 5th decade and 21.9% were in the 6th decade. Similarly, Bennekeret et al[7] showed mean age was 54 years with range from 19 to 86 years. Almost similar age range obtained by Dunlop et al[8] and Yong et al[9]. Here plain X-ray and MRI findings were compared for identification of posterior disc height (PDH) and nerve root compression respectively[7-9]. In plain X-ray evaluation for posterior disc height, out of 74 (PDH <6mm) subjects 56 presented with nerve root compression. Among 31 subjects (PDH ≥ 6mm) only 3 cases found to have nerve root compression. Here the measure of agreement, Kappa=0.910 (p=0.001), which was almost perfect agreement for identification of posterior disc height. Similarly, Yong et al. showed good agreement (k=0.701) in both the imaging modalities[9]. In this current study it was found that post disc height less than 6 mm was observed 70.47% and more than 6 mm in 29.52% of the subjects having low back pain evaluated by plain X-ray. For plain radiograph findings reduction of posterior intervertebral disc height (<6 mm) was the most frequent finding seen in 82.5% of patients reported by Yong et al[9]. In plain X-ray facetal hypertrophy found in 72 subjects, among them 62 have disc herniation and 10 have no disc herniation. On the other hand 33 subjects who have no facetal hypertrophy, only 10 have disc herniation. Signs of degenerative disc disease (DDD) were recorded by Jaovisidha et al. from both plain radiographs and MR imaging and found that anterior disc height (ADH) <11.3 mm or posterior disc height (PDH) < 5.5 mm indicate DDD at LS junction with 95% confidence interval[10]. Cohn et al. study results indicates that PDH is the most reliable and easily used criterion for detection of DDD at the Lumbosacral junction (LSJ). PDH < or =5.4 mm on plain lateral film indicates DDD; PDH > or =7.7 mm indicates the absence of DDD on plain film[11]. For prediction of nerve root compression by posterior disc height sensitivity 94.9%, specificity 60.9%, accuracy 80.0%, positive predictive values 75.7% and negative predictive values 90.3% of plain X-ray. In a study, Fujiwara et al showed the accuracy of MRI in assessing facet joint osteoarthritis against CT was 94.0%[12]. Yong et al. have shown the sensitivity of plain radiograph was 92.7% and the positive predictive value was 96.2%[9]. Cohn et al. retorted that there was no statistically significant difference regarding ADH or Lumbosacral arthritis (LSA)[11]. Diagnostic accuracy by visual inspection was not significantly altered using the quantitative data for interpretation of DDD (68.0% correct before 69.5% correct after).

Conclusion:

In evaluation of disc herniation and nerve root compression by facetal hypertrophy and posterior disc height respectively evaluated by plain X-ray were found almost perfect agreement. On the other hand, substantial agreement was observed in identification of spinal stenosis by posterior disc height evaluated by plain X-ray. Whereas a fair agreement observed for prediction of disc herniation by posterior osteophytes evaluated by plain X-ray. Plain lumbosacral radiograph was sensitive though not specific for the investigation of low back pain.

References :

1. Jacobs DS. Degenerative diseases of spine. In:J Haaga editor. CT & MR Imaging of the whole Body. 4th Edn. Mosby: Philadelphia; 2001.p. 724-64.
2. Murphy WA, Preston BJ. Degenerative diseases of the spine, In: Adam A, editor. Grainger & Allison's Diagnostic Radiology: A Text Book of Medical Imaging.4thedn. Churchill Livingstone:London; 2001.p. 2020.
3. Frymoyer JW, Pope MH, Clements JH, Wilder DG, Macpherson B. Risk factors in low-back pain: An epidemiological survey. Journal of Bone& Joint Surgery. 1983; 65: 213-18.
4. Gaskill MF, Lukin R,Wiot JG. Lumbar disc disease and stenosis. Clinical Radiology. 1991; 29:735-64.
5. Lateef H, Patel D. What is the role of imaging in acute low back pain. Current Review of Musculoskeletal Medicine. 2009;2(2):69-73.
6. Craig H, Jason C. Clinical Evaluation and Treatment Options for Herniated Lumbar Disc. American family Physician. 1999; 59(3):575-82.
7. Benneker LM, Heini PF, Anderson SE, Alini M, Ito K. Correlation of radiographicand MRI parameters to morphologicaland biochemical assessmentof intervertebral disc degeneration. European Spine Journal.2005; 14(1):27-35.
8. Dunlop RB, AdamsMA, Hutton WC. Disc Space narrowing and Facet Joints. Journal of Bone &Joint Surgery. 1984; 66(5):706-10.
9. Yong PY, Alias NA, Shuaib IL. Correlation of Clinical Presentation, Radiography, and Magnetic Resonance Imaging for Low Back Pain - a Preliminary Survey. JHK Coll Radiol. 2003; 6:144-51.
10. Jaovisidha S, Techatipakorn S, Apiyasawat P, Laohacharoensombat W, Poramathikul M, Siriwongpairat P. Degenerative disc disease at lumbosacral junction: Plain film findings & related MRI abnormalities.Journal of the Medical Association of Thailand. 2000; 83(8):865-71.
11. Cohn EL, Maurer EJ, Keats TE, Dussault RG, Kaplan PA. Plain film evaluation of degenerative disk disease at the lumbosacral junction. Skeletal Radiology. 1997; 26:161-66.
12. Fujiwara A, Tamai K, Yamato M, Yoshida H, Saotome K, Kurihashi A. Relationship between facet joint osteoarthritis and disc degeneration of the lumbar spine. European Spine Journal. 1999; 8:396-401.