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Original Research Paper

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# COMPARATIVE STUDY OF DIGITAL X-RAY L-S SPINE AND DEXA L-S SPINE IN THE EVALUATION OF OSTEOPOROSIS

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ABSTRACT AIMS & OBJECTIVES- The aim of the study was to compare the sensitivity of Digital X-ray of L.S.Spine in relation to DEXA Scan in the detection of reduced bone mass (osteopenia/ osteoporosis) and evaluate the association of osteoporosis/osteopenia with certain factors like age, height, weight, smoking, alcoholism and awareness.

MATERIALS AND METHOD- This Prospective, this prospective observational study included 100 patients of both sexes between 40 – 80 years age, who presented to in the Department of Radiodiagnosis, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly (Uttar Pradesh) with presenting symptoms of non- inflammatory low back pain and underwent dexa scan of L.S. Spine and X-Ray of L.S.Spine. A detailed history including demographic feature and social factor (history of smoking and alcoholism and education/ knowledge status). The investigation findings were recorded and tabulated and data were analyzed statistically.

**RESULTS-** The DXR L.S.Spine shows the sensitivity 75.29%, specificity 78.95%, and accuracy was 77.01% in compression to dexa scan in patients with osteopenia/ osteoporosis. There was negative correlation between weight and height and knowledge of the patient with osteopenia/ osteoporosis and no significant correlation between history of smoking and alcoholism.

**CONCLUSION-** In conclusion, DXR and DEXA measurements shows fair agreement. Our results suggest DXR to be a promising screening tool for detecting low bone quality or osteoporosis.

KEYWORDS : DXR- Digital X-Ray, DEXA- Dual energy X-Ray absorptiometry, BMD- Bone mineral density.

## INTRODUCTION

Osteoporosis is defined as a decrease in the strength of the bone leading to an enlarged risk of fracture<sup>1</sup>. The term osteoporosis was coined by **Pommer** in 1885 and it means "increased porosity of bone"<sup>2</sup> (in Greek, **osteon** means **bone** and **porus** means **passage**). This is the most commonly encountered metabolic disease of bone. Loss of bone tissue is connected with weakening in skeletal micro architecture with abnormalities of bone metabolism without any disturbance of mineralization. Osteopenia corresponds to low bone density which remains asymptomatic but therapeutic interventions are nevertheless justified. The term osteopenia means "poverty of bone".

The World Health Organization (WHO)<sup>3</sup> operationally defines osteoporosis as a bone density that decreases 2.5 standard deviations (SD) below the mean for young healthy adults of the gender- also mentioned to as a T-score below -2.5. A Tscore between -1 to -2.5 is defined as osteopenia.

Dual-energy X-ray absorptiometry (DEXA) is the golden standard for the bone quality measurement in children as well as adults, because of precision, reproducibility, & availability of normative data<sup>4</sup>. DEXA measurements give information about BMD of the site studied. Different skeletal sites are clear for BMD measurement in children. DEXA of the lumbar spine L1–L4 (DEXALS) is a suggested site & is superior to DEXA of the femur or fore arm.

The purpose of this study is to estimate the use of visual assessment of digital x-rays of the lumbosacral spine to diagnose osteoporosis compared to BMD dignified by DEXA scan. We hypothesize that, despite improvements in image quality, digital X-rays, similar to their analog counterparts, still have inadequate accuracy, reliability & physician agreement to determine BMD

### MATERIAL & METHOD INCLUSION CRITERIA

- 1. Patients (female & male) of 40 80 years age presenting with non-inflammatory low back pain.
- 2. Patient over age of 40 with any of the following :
- a. Previous bone fracture from minor trauma
- b. Rheumatoid arthritis
- c. Patient receiving or planning to receive long term steroid therapy
- d. Patient with primary hyperthyroidism
- 3. X-ray L.S.Spine were evaluated for loss of secondary trabeculae / prominent primary trabeculae and cortical thinning involving L.S.Spine.
- 4. Dexa scan T and Z score were calculated for division of patients in normal and osteopenia / osteoporosis.

## EXCLUSION CRITERIA

- 1. Patient below the age of 40 years
- 2. Who were not willing to participate in study

## RESULT

The present study was conducted in the Department of Radiodiagnosis, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh in 100 patients presenting with symptoms suggestive of a low back pain and osteoporosis.

### Table No. 1: - Age Distribution

Age Group (In Years)	Number (N=100)	Percentage (%)
40-50	23	23%
51-60	42	42%
61-70	23	23%
71-80	12	12%
Mean Age (Min-Max)	) 58.08±9.51 (40-76 Years)	

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Table No. 2: - Personal History

Personal History		Number (N=100)	Percentage (%)
Smoking	YES	10	10%
	NO	90	90%
Alcohol	YES	10	10%
	NO	90	90%

Table No. 3: -Comparison of Age, Weight, Height & BMD in Normal and Osteopenia/ Osteoporosis Result in DEXA Scan Lumbosacral.

Variables	Normal	Osteopenia/	t-	P-
		Osteoporosis	value	Value
	$Mean \pm SD$	Mean ± SD		
Age(in years)	$55.87 \pm 9.53$	$58.47 \pm 9.51$	0.976	0.332
Weight(in Kg)	$71.27 \pm 11.55$	$58.62 \pm 12.54$	3.642	0.004*
Height(in cm)	$156.67 \pm 8.52$	$152.34 \pm 7.33$	2.058	0.042*

\*statistically significant

Table No. 4: Comparison of X-Ray Examination and DEXA Scan at Lumbosacral Spine.

	X-Ray L.S. Spine	DEXA
Normal	36	15
Osteopenia/Osteoporosis	64	85

Table No. 5: Sensitivity, Specificity & Accuracy of X-Ray Examination at Lumbosacral Spine

Sensitivity	75.29%
Specificity	78.95%
Positive Predictive Value	80.13%
Negative Predictive Value	73.92%
Accuracy	77.01%

#### Case No.-1



Lumbosacral Spine-Normal Case No.-2



Lumbosacral spine-Osteopenia Case No.-3



#### DISCUSSION

In our study the mean age of normal patients was  $55.87 \pm 9.53$ years and in Osteopenia/ Osteoporosis was 58.47 ± 9.51 years, mean age was little bit more in Osteopenia/ Osteoporosis patients as compare to normal we see that as age increases, the chance of developing osteoporosis also increases but the difference was statistically not significant. Mean weight of normal patients was  $71.27 \pm 11.55$  kg and in Osteopenia/Osteoporosis was  $58.62 \pm 12.54$  kg, mean weight was more in normal patients as compare to Osteopenia/ Osteoporosis patients we see that patients with a lower body weight are more prone to develop osteoporosis and the difference was statistically significant. Mean height of normal patients was 156.67 ± 8.52 cm and in Osteopenia/ Osteoporosis was  $152.34 \pm 7.33$  cm, mean height was little bit more in normal patients as compare to Osteopenia/ Osteoporosis patients and the difference was statistically significant. Mean BMD of normal patients was  $1.04 \pm 0.01.02$  $\pm$  0.05 and in Osteopenia/ Osteoporosis was 0.75  $\pm$  0.13, mean BMD was more in normal patients as compare to Osteopenia/ Osteoporosis patients and the difference was statistically significant. LiminTian et al<sup>5</sup> reported the mean age in osteopenia/ osteoporosis was 69.07±6.81 years while in normal patients were 60.34±8.01 years and association was significant (<0.001). An Indian population study Ahuja K et al<sup>6</sup> reported the mean age in cases was 62.04±12.15 years and in normal patients were 59.01±13.18 years and association was insignificant (>0.05). While mean height of normal patients was 162.1  $\pm$  0.68 cm and in cases was 160.0  $\pm$ 0.92 cm, and mean weight of normal patients was  $61.42 \pm 7.41$ kg and in cases was  $56.09 \pm 8.35$  kg, and association was significant (<0.001). So our study demographic profile similar to the other similar studies. Similarity PallagattiS et al<sup>7</sup> also reported the mean age in cases was  $61.05\pm6.26$  years and in normal patients were 56.71 ±9.43 years. While mean height of normal patients was 154.29  $\pm$  5.29 cm and in cases was 154.05  $\pm$  5.59 cm, and mean weight of normal patients was 65.52  $\pm 14.51$  kg and in cases was  $54.71 \pm 11.85$  kg. So our study demographic profile similar to the other similar studies. Andrew J. Miller et al<sup>8</sup> (2017) did a prospective study of the qualitative evaluation of digital hand x-rays is not a reliable method to evaluate bone mineral density & observed that the mean weighted kappa coefficient of agreement between viewers was 0.29 (range 0.02-0.41) reflecting a reasonable agreement. Grouping osteoporosis & osteopenia together associated to normal, the correctness, inter-observer & intraobserver rates enlarged to 63%, 0.42 and 0.54 respectively. There is poor correctnesscomparative to DEXA scan & only reasonable agreement in diagnosing osteoporosis by visual assessments of digital x-rays.

Adiotomre E et al<sup>9</sup> (2017) did a prospective study of the diagnostic accuracy of DEXA compared to conventional spine radiographs for the recognition of the vertebral fractures in children and observed that the average sensitivity and specificity in diagnosing one or more vertebral fractures requiring treatment was 70 % and 97 % respectively for DEXA &74 % and 96 % for radiographs. Lateral spine DEXA should substitute conventional radiographs for the calculation of vertebral fractures in the children.

#### CONCLUSION-

In conclusion, DXR and DEXA measurements shows fair agreement. Our results suggest DXR to be a promising screening tool for detecting low bone quality or Osteopenia/ osteoporosis.

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