

RADIOLOGICAL STUDY OF HUMAN LUMBAR VERTEBRAL CANAL IN VIDHARBHA REGION

Shruti Mamidwar¹, Kiran G. Palikundwar²

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ABSTRACT: Increase in number of patients suffering from backache all over world needs changing health polices and cost benefit analysis, it is important to look at diseases causing low back pain and for this study of radiological structure of lumbar vertebral canal is undertaken.

AIMS: To reveal the radiological feature of Human lumbar vertebral canal. **METHOD AND**

MATERIAL: 50-xray of lumbar canal was collected from orthopedic department of government medical college, Nagpur. **STATISTICAL ANALYSIS:** Data is presented in mean±standard deviation and categorical variable are presented in percentage. Comparison with previous study is done.

RESULT: Maximum measurement as greater in male than female of same age group.

CONCLUSION: The present study and previous studies are compared and the non-significant result is found.

KEYWORDS: Radiological Study of Lumbar Canal.

INTRODUCTION: Vidarbha is a big region where race, climate and nutritional status varies. Abnormal movements, jerks cause by speed breakers or uneven surface during driving vehicle results lumbar problems.

Human lumbar canal is located within five lumbar vertebrae. The lumbar region is important due to factors due to many movements, to maintain up right posture and weight transmission.

The spinal canal is wider and contains cauda equina in place of spinal cord and hence, in lumbosacral region the neurological involvement is rare.

Taking into account the limitation of the investigation procedure, plain radiographic examination of vertebral column retains its diagnostic significance more so as economic screening procedure and easy accessibility by the majority. It's importance shall however, increase if standard values of upper and lower limits of canal and body dimensions are available for application to the group of any population under study.

Thus, this work is of great interest and would be helpful to Anthropologist, Anatomy experts, Orthopaedician and Radiologist.

Thus human lumbar vertebral canal requires further more study in this regards.

The vertebral column i.e. backbone, spine or central pillar of the body extends from base of the skull to the tip the coccyx. This vertebral column in human body forms the main part of axial skeleton.

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According to various radiological study following reports are there: Christenson (1977)⁽¹⁾ indicated that the ideal x-ray projection for measuring pedicles and interpedicular distance is the AP view which is important for determining spinal canal for population in adult age group.

According to Einsentein S. (1977)⁽²⁾ radiologically the overall lower limit of normal interpedicular diameter is 20mm in anteroposterior X-ray.

Ammoonoo Kuofi (1982)⁽³⁾ studied 290 plain AP x-rays of lumbar spine of adult Nigerians between 20 to 45 year of age groups. He concluded that width of canal varies according to age and sex. He also established that increase in the size of pedicles would give rise to reduction of canal.

Gorden L. (1982)⁽⁴⁾ radiologically stated that the minimal interpedicular diameter from L-1 to L-4 is 21to 23mm. and the sagittal diameter is 15 mm in adult Americans.

Radiologically Pieria et al (1983)⁽⁵⁾ indicated that 22 mm is the minimum size for transverse diameter in adult Saudis.

According to Chabra S. (1991)⁽⁶⁾ in north Indians the transverse diameter of canal is 26-37mm in males and in females of adult age.

According to Vairagade B.R. (1996)⁽⁷⁾ the transverse diameter of canal on x-ray ranges between 18-34 mm in males and midsagittal diameter ranges between 16-20 mm in 30 x-ray of males for asymptomatic cases. Whereas, anteroposterior diameter of body ranges between 36-38mm in males and transverse diameter of body ranges between 43-55mm in adult age group.

According To Nirwan A. B.(2003)⁽⁸⁾ in Gujarati population the transverse diameter of canal ranges between 24-30mm in males 18-30 mm females of adult age group of radiological study.

According to Mcnab (1971)⁽⁹⁾ in trauma biochemical ageing changes accelerates lumbar disc degeneration.

According to McGregor (1986)⁽¹⁰⁾ distribution of hydrophilic properties of nucleus, stretching of annulus and posterior longitudinal ligament, osteophytes formation, subluxation and bulking of soft tissues results into disc degeneration.

MATERIAL AND METHODS: 50 x-ray of lumbar canal from orthopaedic department of Government medical college, Nagpur are collected.

Radiological Measurement of lumbar canal: 30 x- rays of males and 20 x- rays of females, both Anteroposterior (AP) And lateral (lat) views of lumbar canals are collected.

In each lateral radiograph the distance between the upper parts of the posterior surface of vertebral body is recorded as AP or midsagittal diameter at that vertebral level.

Transverse diameter of the canal i.e. interpedicular distance or the transverse diameter between the bases of pedicles.

Total length of lumbar canal is measurement from upper border of L1 to upper border of s1in lateral view of x-rays.

Radiological Measurement of Diameter of body.

Anteroposterior diameter of body (AP distance) is measured in the middle of vertebral body in radiography.

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Transverse diameter of body, the greater midwaist distance, is recorded in an Anteroposterior radiograph.

Other dimension of body included 4 reference points which are marked on the defined vertebra according to the following definition,

- Most superoanterior point on body.
- Most superoposterior point on body.
- Most inferoanterior point on body.
- Most inferoposterior point on body.

Thus for each vertebral body the dimension are described as: Anterior height of vertebral body and posterior height of vertebral body. All the above radiological dimension are recorded tube 110cm from the plate, by universal convention.

To mark the posterior limit of the spinal canal, radio opaque metal markers is placed within spinal canals of the vertebrae and the mid sagittal posterior limit marks the posterior limit of the spinal canal Jones et al (1968).⁽¹¹⁾ This method being complex is not selected and the simpler method of measuring the midsagittal diameter of the canal as suggested by S. Eisenstein (1977)⁽¹²⁾ is adopted.

STATISTICAL FORMULAE FOR CALCULATIONS

Mean $\rightarrow \bar{x} = \frac{\sum x}{n}$

Where \bar{x} = Mean
 x = Individual value
 n = Number of observations
 $\sum x$ = The sum of all measurements

Standard deviation $\rightarrow S.D. = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$

Coefficient of Variation $\rightarrow \frac{S.D.}{\bar{x}} \times 100$

Standard error $\rightarrow \frac{S.D.}{\sqrt{n}}$

OBSERVATIONS:

Table number 1 Shows interpedicular diameter is steadily increased from L 1 to L5 in both series.

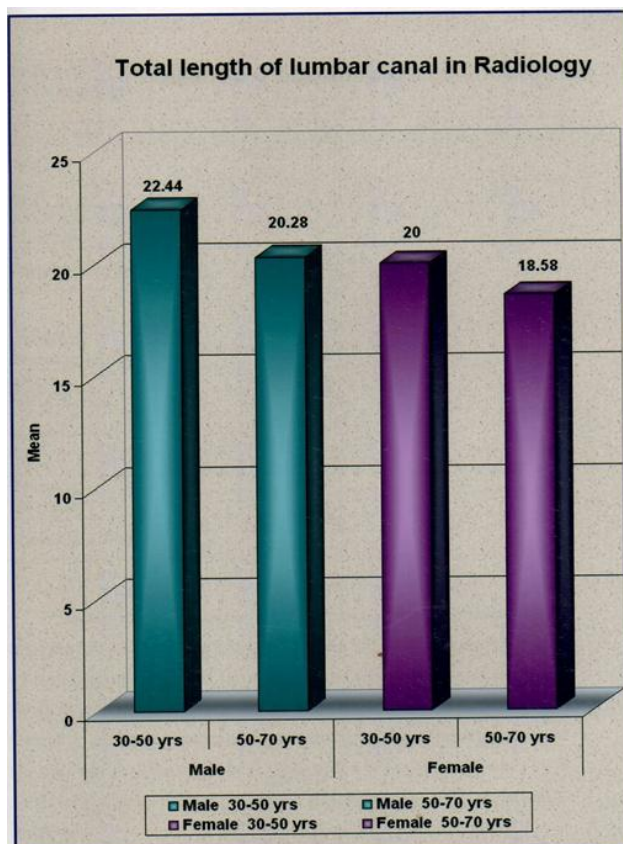
Table number 2 Shows anteroposterior diameter is steadily narrowing from level L1 to L 5.

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Table number 3 shows gradual increase of diameter of lumbar vertebral body from L 1 to L 5 in both series.

Table number 4 shows gradual increase in anteroposterior diameters of a body from L1 to L 3. There is decrease in diameter at L 4 level and then at L 5 level.

Table number 5 and 6 shows the mean values and standard deviation of anterior & posterior heights of each vertebral level are calculated.



DISCUSSION: The Present study results were compared with work done by various authors.

Source	Group	Level	L	L2	L3	L4	L5
		M/F					
1. Amonoo Kuofi(1990)	Adult Saudies 160 Sample (M/F)	M	21-28 Mean	22-28	22-30	22-31	25-36
2. B.R. Vairagade (1996)	PUNE 30 Sample (M)	F	20-26	20-27	21.28	23-30	24.3
		M	43.9	46.7	48.9	51.7	55.5
3. Present Study (2005)	Vidarbha	M	43.72	45.24	47.78	51.4	55.5
	Region 50 sample (M/F)	F	41.51	43.12	46.09	50.42	54.29

Table 1: Showing various racial measurement of transversed diameter of bodies in radiologically

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In present study (2005) the mean of transverse diameter of body are calculated for 50 samples of both sexes.

In Pune Population (1996) means of transverse diameter of study only in males was calculated.

Both values are nearly similar or within range.

Source	Group	No. of Samples	Male	Female
1) Verbiest (1950)	Americans	50	18-15 mm	17-15 mm
2) Eisenstein S. (1977)	All races	–	15 mm	15mm
3) Gorden (1982)	Americans	50	15mm	15mm
4) B.R. Vairagade (1996)	Pune population	30(M)	16-20 mm	–
5) Present Study (2005)	Vidharbha Region	50	15-18 mm	15-19 mm

Table 2: Showing variouse racial midsagittal diameters of lumbar canal in radiology

In present study (2005), midsagittal diameter of 50 samples are measured out of 50, samples 30 belongs to male and 20 belongs to females values are calculated.

In Pune Population (1996) Only males samples were measured and their values were within normal range i.e. below 15mm was taken as steno tic, however according to Eisenstein 15mm is lower limit of normal for all races.

Source	Group	No. of Sample	Level (Mean)	
			M	F
1. B.R. Vairagade (1996)	Pune Population	30 (M)	L1-36.3	...
			L2-37.5	...
			L3-37.1	...
			L4-38.1	...
			L5-37.6	...
2. Present Study (2005)	Vidharbha Region	50 (M/F)	L1-36.75	35.07
			L2-37.30	36.23
			L3-37.31	36.45
			L4-38.30	37.86
			L5-37.83	36.49

Table 3: Showing anteroposterior diameters of lumbar vertibral body in radiology

In present study (2005) anteroposterior diameter of lumbar vertebral bodies in 50 specimens are measured and out of which 30 samples belongs to male and 20 sample belongs to females.

In Pune population (1996) only male sample were measured.

The values of both groups are nearly equal in males. But values of females in AP diameter of lumbar vertebral bodies cannot be compared due to absence of measurement of female in Pune population.

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TABLE SHOWING VARIOUS RACIAL TRANSVERSE DIAMETERS OF LUMBAR CANAL IN RADIOLOGY.

Source	Group	No. of Samples		Male	Female
		M	F		
1. Hinck et al (1966)	Americans	59	59	25 - 30 mm	24 - 29 mm
2. Eisenstein S. (1977)	Caucasoids Zulus	78	78	23 - 26 mm	35 - 25 mm
		108	108	21 - 26 mm	20 - 24 mm
3. Amonoo Kuofi (1982)	Nigerians	150	140	22 - 28 mm	21 - 28 mm
4. Piera et al (1988)	Spanish	110	105	27 - 34 mm	25 -33 mm
5. Amonoo Kuofi (1990)	Saudis	160	180	25 - 30 mm	23 - 29 mm
6. S. Chabra (1991)	North Indians	124	91	26 - 37 mm	24 - 34 mm
7. B.R.Vairagade (1996)	Pune (indians) population	30	--	18 - 34 mm	--
8. A.B. Nirwan (2003)	Gujarathi	101	101	24 - 30 mm	18.9 - 30 mm
7. Present Study (2005)	Vidharbha (indians)	30	20	19 - 26 mm	18 - 27 mm

The transverse diameter in the table no. 4 shows different values because of regional and racial variations. However the transverse diameter in North Indian, Gujaratis, Pune and Vidarbha region shows little difference that may be regional variation however the values in Pune and Vidarbha region approximately similar for lower limits but variation in the higher limits in males and this difference may be because of dietary, genetic and different profession variations.

CONCLUSION: Radiological Study: Thirty asymptomatic males of different profession of age group 30 to 70 yrs are radio graphed for lumbosacral region in anteroposterior and lateral views. The twenty asymptomatic females of different profession of age group 30 to 70 years were radio graphed for lumbosacral region in body are recorded. The interpedicular diameter of canal in male ranges between 19 to 26mm (L1 TO L5) and in female it ranges between 18 to 26mm.

The anteroposterior diameter of canal in male ranges between 13 to 20mm (L1 to L5) and in females it ranges between 14 to 19mm. There are marked differences between the mean value of anteroposterior and transverse diameters of the canal for different geographical areas, because of racial variation, number of sample variation, dietary and genetic variation.

The transverse diameter of body ranges between 40 to 59mm in males and 34 to 58 mm.in females. The anteroposterior diameter of body ranges between 33 to 41(mm) in males and 32 to 40(mm) in females.

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The anterior height of lumbar vertebral body in male ranges between 25-35 mm, and ranges between 25 to 33mm in females whereas, the posterior height of lumbar vertebral body ranges between 28 to 34 mm in males and 27to34mm.in females.

Radiologically, the height of lumbar canal in male varies between 19 to 24cm for 30-50 age groups and 18 to 22cm for 50-70yrs age group while in female 18 to 21cm for 30-50 age group and 18 to 19 cm for 50-70yrs age groups. As the age increases the height of canal decreases. Degenerative changes in bone and soft tissues bordering the spinal stenosis of the canal in vertebra is considered to be stenotic where the anteroposterior diameter of the canal is significantly reduced.¹²

BIBLIOGRAPHY:

1. Christenson P.C. The Radiological study of normal spine Radiological clinical North Am. J. (1977); 15: 145-154.
2. Einsentein S. Morphometry and pathological anatomy at the lumbar spine in South African, Negros and caucasoids with specific reference to spinalstenosis. J. of bone and joint Surgery (1977); 59 B: 173-180.
3. Ammoonoo Kuofi H.S. Maximum and Minimum lumbar interpedicular distance in normal adult Nigerians J. Anat (1982) 135; 225-233.
4. Gorden L. S. symposium on idiopathic low back pain, Miami Florida, American academy of ortho, surgens (1982); 118-149.
5. Pieria et al morphology of lumbar canal Acta. Anatomica (1988); vol. 131, Jan. 35-40.
6. Chabra S. Gopinathan K. and Chhibber, S. R. Transverse diameter of the lumbar vertebral canal in north Indian J. Anat. Soc. India.(1991); vol. 41(1), 25-32.
7. Vairagade B.R. cadaveric lumbar vertebrae its Geometric Evaluation and Co-relation with Cases of Backache, thesis (1996) 33-40.
8. Nirwan A. B. Pensi C.A. Patel J. P. Shah G.V. and Dave R.V. a study of inter-pedicular distance of the lumbar vertebral measured in plain ateroposterior radiography in Gujratis J. Anat. Asso. of India Vol. (2003); 54, no-2, 58-61.
9. Mcnab Negative Disc Exploration J.Bone and Jt.Surgery (1971); 53 A: 891 903.
10. McGregor the Synopsis of Surgical Anatomy 12th Edition (1981); 712.
11. Jones et al As quoted by Author no (28), (1968).
12. Eisenstein S. The trefoil configuration of the lumbar vertebral canal. A study of south African Skeletal Material. J. Bone and Joint Surgery (1980); 62B: 73-77.

OBSERVATIONS TABALES:

Table 1: Radiological interpedicular or transverse diameter of lumbar canal (mm).

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L 3	L 4	L 5
Levels					
No. of X-rays	30	30	30	30	30
Range	19.7	19.2	19	19.5	21.5
	-23.6	-23.4	-24	-24	-26

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Mean	21.55	21.48	21.79	21.71	23.17
Standard deviation	1.05	1.02	1.14	1.20	1.20
Calculated	19.45	19.45	19.31	21.3	25.6
Range	-23.65	-23.52	-24.11	-26.1	-31.9

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	20	20	20	20	20
Range	18.9	19.2	19.6	20.2	22.3
	-23.6	-23.6	-23.9	-24.7	-26.9
Mean	21.22	21.42	22.73	22.84	24.61
Standard deviation	1.61	1.42	1.10	1.38	1.52
Calculated	17.98	18.58	20.53	20.08	21.57
Range	-24.42	-24.26	-24.93	-25.6	-27.65

Table 1

Table no 1 show the mean IP diameter is steadily increased from L1 to L 5 in both the sexes. Upper and lower limits of the normal values for use in clinical practices have been worked out for each lumbar vertebral level by calculating 95% confidence limit separately at each level. In males it ranges from 19.7-26 and in females it ranges from 18.9-26.9. These ranges which are the high and low limits and most of the values lies between 95% confidence interval but some values from vertebrae to vertebrae.

Table 2: Radiological measurement of anteroposterior or midsagittal diameter of canal (mm).

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	30	30	30	30	30
Range	14.5	15.1	15.4	14.6	13.8
	-20.3	-19.2	-18.7	-17.9	-17.9
Mean	17.27	16.98	16.69	16.08	15.78
Standard deviation	1.19	0.95	0.83	0.8	0.99
Calculated	14.89	15.08	15.03	14.48	13.8
Range	-19.65	-18.88	-18.35	-17.68	-17.76

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	20	20	20	20	20

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Range	14.4	14.1	14.5	14.8	14.8
	-18	-17.8	-19.5	-19.7	-19.7
Mean	16.23	16.17	16.17	16.04	15.98
Standard deviation	1.09	1.08	1.05	1.27	1.25
Calculated	14.05	14.01	14.07	13.5	13.48
Range	-18.41	-18.33	-18.27	-18.58	-18.48
Table 2					

Normally, the anteroposterior diameter shows a steady narrowing from the level of L 1 to L 5. In table No. (2), the midsagittal diameter shows a narrowing from the level L 1 to L 5 in both sexes. The midsagittal profile of the vertebral canal was wider at cephalic end than at the caudal end and narrowing started at mid lumbar level proportionate to the build, variations of height of pedicals and width of lamina and these are the factors which determine the anteroposterior diameter of canal. In males it ranges from 14.5 to 17.9mm. And in females it ranges from 14.4 to 19.7 mm. Present study shows variation in diameter 1-2 mm, beyond normal range.

Table 3: Radiological transverse diameter of lumbarvertebral body (mm).

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	30	30	30	30	30
Range	40.5	41.5	43.2	40.2	50.9
	-47.6	-49.2	-53.2	-54.8	-59
Mean	43.72	45.24	47.78	51.40	55.50
Standard deviation	1.99	2.09	2.83	3.08	2.20
Calculated	39.74	41.06	42.12	45.24	50.9
Range	-47.7	-49.42	-53.44	-57.56	-60.1

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	20	20	20	20	20
Range	34.2	40.5	42.6	47	52.3
	-44.6	-48.2	-50.6	-54.2	-58
Mean	41.51	43.12	46.09	50.42	54.29
Standard deviation	2.45	1.96	2.01	2.06	1.57
Calculated	36.61	39.2	42.07	46.3	51.51
Range	-46.41	-47.04	-50.11	-54.54	-57.43
TABLE 3					

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In table no. 3 showing gradual increase of diameter from L₁ to L₅ in both sexes. There is greater and marked increase of diameter at L₄ and L₅ level. In male it ranges from 40.5 to 59 mm. and in female it ranges from 34.2 to 58 mm. Carefully measured dimensions fall outside the limits given, and there is a difference of 1-2mm, they are non-significant.

Table 4: Radiological transverse diameter of anteroposterior diameter of body (mm).

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	30	30	30	30	30
Range	33.6	34.2	33.2	34.5	34.6
	-40.5	-40.6	-40.6	-40.2	-41.5
Mean	36.45	37.3	37.31	38.3	37.83
Standard deviation	1.95	1.98	1.69	1.98	1.89
Calculated	32.35	33.66	33.95	34.4	33.87
Range	-41.45	-40.94	-41.07	-42.2	-41.79

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	20	20	20	20	20
Range	32.6	33.5	34.8	34.6	33.6
	-39.4	-40.6	-39.4	-41.5	-40.6
Mean	35.07	36.23	36.45	37.86	36.49
Standard deviation	1.85	1.94	1.26	1.84	1.99
Calculated	31.37	32.35	33.93	34.18	32.51
Range	-38.77	-40.11	-38.97	-41.54	-40.47

Table 4

Table No. 4 Showing gradual increase of anteroposterior diameters of body from L₁ to L₃. There is a decrease in diameter at L₄ level then L₅ level. In male it ranges from 33.6-41.5mm. In female it ranges from 32.6-40.6 mm. Some diameters are beyond 35% of normal limit but there is a difference 1-2 mm. Therefore they are non-significant.

Table 5: Radiological measurement of anterior height of vertebral body (mm).

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	30	30	30	30	30

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Range	25.3	26.9	27	27.2	27.6
	-31.2	-34.6	-34.6	-34.2	-35.2
Mean	28	30.19	30.51	30.65	37.83
Standard deviation	1.69	1.98	1.89	1.97	2
Calculated	24.62	26.23	26.73	26.66	25.85
Range	-31.34	-34.15	-39.06	-38.62	-33.73

Detail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	20	20	20	20	20
Range	25.3	25.8	26.4	25.4	24
	-37.5	-33.2	-32.3	-33.4	-33.6
Mean	28	28.94	29.41	28.35	29.93
Standard deviation	2.61	2.16	1.61	2.37	1.39
Calculated	22.78	24.62	26.19	23.61	27.15
Range	-33.22	-33.26	-32.63	-33.09	-32.71

Table 5

Table 6: Radiological measurement of posterior height diameter of vertebral body (mm).

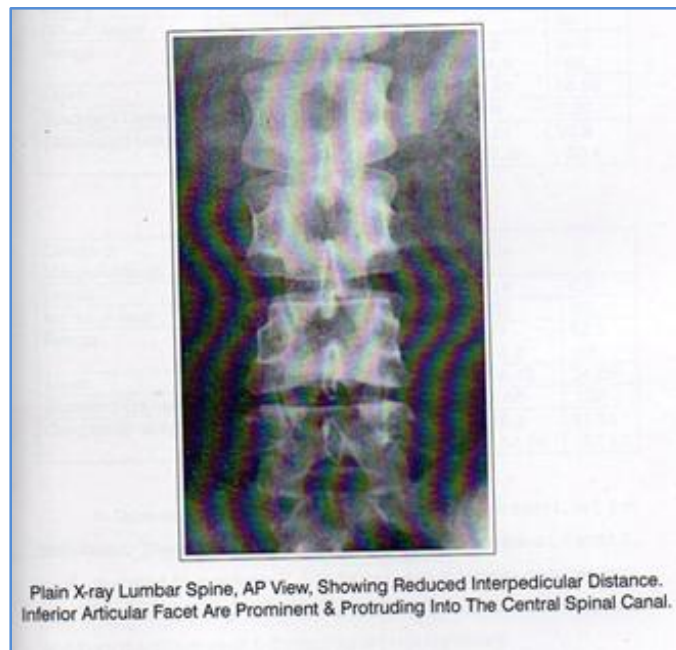
Deatail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	30	30	30	30	30
Range	28.8	29.4	29	28.4	26.3
	-41	-38.6	-38.6	-38.6	-34.2
Mean	35.75	33.42	32.94	32.64	29.79
Standard deviation	4.32	3.10	3.06	2.99	1.97
Calculated	26.11	27.22	26.66	2666	25.85
Range	-43.39	-39.62	-39.06	-38.62	-33.73

Deatail of Measurements	Males 30-70 Years Age groups				
	L 1	L 2	L3	L 4	L 5
Levels	L 1	L 2	L3	L 4	L 5
No. of X-rays	20	20	20	20	20
Range	27.09	27.2	26.4	26.8	25.8
	-39.5	-38.2	-35.2	-36.8	-34.5
Mean	32.48	30.65	30.65	30.54	28.63
Standard deviation	3.23	2.95	2.48	25.69	2.00
Calculated	26.02	24.75	25.69	24.96	24.63
Range	-38.94	-36.55	-35.61	-36.12	-32.63

Table 6

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Table No. 5 & 6 showing the mean values and standard deviation of the anterior and posterior heights of each vertebral level were calculated. In both sexes, the anterior height showed a gradual increase from L 1 to L5 and resulting in lumbar lordosis. The upper and lower limits of normal within were calculated. Measured values falling outside the above range are likely to have some pathology or anomaly, but there is only 2 -3 mm, difference in values, so they are correlated.



ORIGINAL ARTICLE



Plain X-ray Lumbar Spine Lat. View Showing Reduced Ap Diameter Of Canal With Posterior Somatic Osteophytes.



Plain X-ray Lumbar Spine AP View Showing Marked Reduction Of Interpedicular Distance. Inferior Articular Facets Are Prominent And Are Protruding In The Canal.

AUTHORS:

1. Shruti Mamidwar
2. Kiran G. Palikundwar

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anatomy, Indira Gandhi Government Medical College, Nagpur.
2. Ex-Professor & HOD, Department of Anatomy, Government Medical College, Nagpur.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Shruti Mamidwar,
Plot No. 63, Pioneer Residency Park,
Somalvada, Near Narayana Vidyalaya,
Nagpur-440025.
E-mail: shrutikishor@gmail.com

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