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# A COMPARATIVE ANALYSIS OF MEASURES IN PLAIN RADIOGRAPHS AND DRY BONES FOR THE SIZE OF THE LUMBAR SPINAL CANAL AND BODY

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ABSTRACT

**Background:** The spinal column holds up the upper limbs and the trunk, and it also takes a lot of the force that is put on these parts of the body. The study's goal is to see how the normal sizes of the lumbar spinal canal and lumbar vertebral body compare to the measurements taken from x-rays of dry lumbar vertebrae.

**Materials and Methods:** This analysis utilized normal plain anteroposterior and lateral radiographs of the lumbar spine from 50 adult male and female patients. This study was conducted at the Department of Anatomy, Dr. VRK Women's Medical College and Research Centre, Aziznagar, Telangana, India. Study was conducted between October 2023 to September 2024. The demographic information regarding age and sex of these radiographs was established. Radiographs of both sexes were obtained in a supine position, centered on L3, with an anode-film distance of one meter.

**Results:** The study's goal is to see how the lumbar spinal canal and lumbar vertebral body measurements from people who don't have any symptoms relate to standard measurements taken from dry lumbar vertebrae. For this study, 50 regular plain x-rays and 64 sets of normal lumbar vertebrae were looked at. From L1 to L5, the anteroposterior diameter of the spinal canal got smaller, but the transverse diameter of the spinal canal, the vertebral body, and the anteroposterior diameter of the vertebral body got bigger. In any case, the canal body ratio didn't change. The measures from the radiological group were better than those from the osteological group.

**Conclusion:** It will be beneficial to monitor any evolving patterns in metric measurements if such studies are performed over time in a certain geographic region and subjected to meta-analysis. The baseline criteria's validity must be periodically evaluated.

**Keywords:** Spinal index of jones, radiographic, and osteological.

## INTRODUCTION

The condition known as lumbar spinal stenosis, in which the lumbar vertebral canal narrows, is becoming more common as people age and has been identified more often in the last 20 years. Most of the time, irreversible changes are thought to cause this disease.[1-3] The lumbar spinal canal's transverse width is a good way to figure out how big it is. Finding out the space between the discs may help doctors figure out if someone has lumbar canal stenosis syndrome. The human spinal column holds the weight of the upper limbs and trunk, as well as a large portion of the forces that are put on these body parts.[2-4]

The lumbar spine is strong and flexible, but it also has to deal with a lot of pressure and stress, which can lead to a number of painful conditions. In the lower back part of the spinal canal, the conus medullaris and cauda equina are located in a dural sac. If there is an abnormal spinal canal narrowing at this level, the stiff bone wall of the canal may press on the nerve roots.[3-5] This causes a number of symptoms, including back pain and other nerve signs. Spinal canal narrowing can be either learned or born with.

Portal was the first to report that the abnormal curve of the spine causes the vertebral canal to narrow. Intraspinal tumors can make the spinal cord swell. Vertebral body expansion can happen naturally or because of diseases that don't let you bear weight, like paralysis and fibrous dysplasia. Because of this, it is important to find out how big the lumbar vertebrae are.[4-6]

To diagnose and treat spinal canal stenosis, it is important to know the different structural changes that happen and how they relate to a wide range of symptoms. For people with lumbar spine stenosis, there is a weak link between the size of the central canal and their symptoms. A small, triangular opening in the spine at L5 that is "pinched" at the sides.[5-7] Researchers have found that while most cases of spinal canal stenosis are acquired, some people may have had it from birth. The lumbar spine canal in humans has more than one level and isn't always shaped like a triangle.[6-8] The goal of this study is to find out what the lumbar spinal canal looks like in a group of Egyptian adults of both sexes and to measure and examine the canal's mean transverse and anteroposterior diameters.

## MATERIALS AND METHODS

This analysis utilized normal plain anteroposterior and lateral radiographs of the lumbar spine from 50 adult male and female patients. This study was conducted at the Department of Anatomy, Dr. VRK Women's Medical College and Research Centre, Aziznagar, Telangana, India. Study was conducted between October 2023 to September 2024. The demographic information regarding age and sex of these radiographs was established. Radiographs of both sexes were obtained in a supine position, centered on L3, with an anode-film distance of one meter.

## RESULTS

50 sets of normal lumbar vertebrae and fifty plain x-rays were looked at. The data are shown in Table 1 for the spinal canal's front-to-back and side-to-side dimensions and its transverse dimensions. [Table 1]

The results of the canal body ratio and the Jones spinal index, which were calculated based on the measures described above, are displayed in tables 2. [Table 2]

The mean transverse spinal canal diameters of the whole imaging group were compared to those from earlier studies. Similarly, the mean anteroposterior spinal canal diameters of the whole osteological group sample were compared to those from earlier studies.

**Table 1: Both study groups had transverse spinal canal and vertebral body diameters**

| | Spinal canal transverse diameter | | | | Vertebral body transverse diameter | | | |
|---|---|---|---|---|---|---|---|---|
| | Radiological | | Osteological | | Radiological | | Osteological | |
| | Mean | | Mean | | Mean | | Mean | |
| | M | F | M | F | M | F | M | F |
| L1 | 25.22 | 22.14 | 21.78 | 20.63 | 44.51 | 38.36 | 35.23 | 34.28 |
| L2 | 24.33 | 22.76 | 21.45 | 21.38 | 46.64 | 40.78 | 39.12 | 36.75 |
| L3 | 28.12 | 22.77 | 22.14 | 22.14 | 49.23 | 40.92 | 41.33 | 34.23 |
| L4 | 29.13 | 26.55 | 23.61 | 24.13 | 50.50 | 45.55 | 41.52 | 38.74 |
| L5 | 31.63 | 29.39 | 26.14 | 26.46 | 59.62 | 48.34 | 44.36 | 40.23 |

**Table 2: Spinal Index of Jones in radiological and osteological groups of this study**

| | Jones spinal index | | | |
|---|---|---|---|---|
| | Radiological | | Osteological | |
| | M | F | M | F |
| L1 | 01:02.2 | 01:02.1 | 01:02.1 | 01:03.6 |
| L2 | 01:02.6 | 01:02.4 | 01:02.3 | 01:02.2 |
| L3 | 01:02.8 | 01:02.8 | 01:02.3 | 01:02.2 |
| L4 | 01:05.9 | 01:05.2 | 01:02.3 | 01:02.4 |
| L5 | 01:05.9 | 01:03.4 | 01:02.8 | 01:02.5 |

## DISCUSSION

From the first to the fifth level of the spinal canal, the average transverse width of the spinal canal increased in both groups. The male and female populations are significantly different from one another, according to the statistics. There is a possibility that the variation in overall somatic size can be attributed to the lower dimensions of females.[8-10] The weight-bearing capabilities of the vertebral body increased from L1 to L5, resulting in an increase in the mean transverse dimension of the vertebral body. This progression occurred ascending from superior to inferior. The values of males and females were found to be significantly different from one another, according to statistical analysis. The development of the vertebral body in a transverse direction is influenced to some degree by masculinity.[11-13]

The canal-body ratio is a proportion that measures the transverse diameter of the spinal canal in comparison to the diameter of the vertebral body. This ratio is used as a physique indicator. The canal's diameter remained constant in relation to the size of the

vertebral body at all levels, despite the fact that the width of the vertebral body increased from L1 to L5, as demonstrated by the ratio of the canal to the body.[14-16] This information is obviously significant if it is found that there are identifiable differences in physical characteristics between particular groups of people, such as males and girls. Therefore, it demonstrates that the dimensions of the vertebral body at each segmental level coincide with the transverse diameter of the spinal canal. This is the case because of the subsequent illustration. At 0.6, the canal body ratio is nearly the same in both groups across all spinal levels. This is the case without exception.[17-19]

As one moves from level 1 to level 5, the spinal canal's mean anteroposterior diameter progressively decreases. The average values of females are substantially lower when compared to those of males. The osteological group displays a statistically significant difference between males and girls at L1, L4, and L5, whereas the radiological group demonstrates a statistically extremely significant difference between the two groups.[18-20]

The first lumbar vertebra is located at the functional transition between the more stable thoracic spine and the movable lumbar spine. It also serves the purpose of accommodating the contents at this level, which is the reason why the spinal canal at the L1 level is larger than it is at the other levels. The transition from lumbar to sacral morphology is responsible for the gradual narrowing of the spinal canal, which can be ascribed to the progression of the condition. As the vertebral body moves from L1 to L5, the average diameter of the anteroposterior region of the vertebral body gradually rises.[19-21] When moving from L1 to L5, the Jones spinal index rises across the board for both males and females. Given that only the transverse diameters are taken into consideration, the canal body ratio provides an indication of the percentage of the body to the spinal canal that corresponds to it. On the other hand, the spinal index is a measurement that provides information on the proportion of the body's anteroposterior and transverse diameters while also taking into account the spinal canal.[20-22]

There is a continuous increase in the mean values of the spinal index of Jones, the transverse diameter of the spinal canal, the transverse diameter of the vertebral body, and the anteroposterior diameter of the vertebral body from the first level to the fifth level. As the investigation progresses from L1 to L5, the anteroposterior spinal diameter decreases in both of the study cohorts.[23-25] As a consequence of this, it is clear from the tables that were presented earlier that the anatomical values of the radiological group are lower than those of the cadaveric lumbar vertebrae when direct measurements are compared. It is quite likely that this is due to the magnifying factor of the radiological group. When compared to the findings of prior research, the findings of the current study suggested that there was greater geographical variation. This variation was mostly attributed to the interaction between environmental and ethnic characteristics.[24-27]

## CONCLUSION

A set of normative values was established for the radiological and osteological groups as a result of the study being conducted. According to the findings of the radiography and osteological exams, there were statistically significant variations in mean values between boys and girls in the anteroposterior and transverse dimensions of the spinal canal and vertebral bodies. These discrepancies indicated that there was sexual dimorphism. Further evidence of sexual dimorphism can be found in Jones' spinal index. After contrasting the findings of the radiological and osteological studies, it was concluded that the radiological findings were more favorable than the osteological information. Nevertheless, the canal-body ratios in these two investigations did not change at any point for any reason.

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