

Original Article**Morphometric Study of the Transverse Process of the Dry Fully Ossified Human Fifth Lumbar Vertebrae**K Sultana¹, MO Goni², A Sultana³**Abstract:**

Background: The vertebral column is the central bony pillar of the body. With the development of vertebral surgery and biomechanics as well as the improvement of recognition in vertebral column diseases, the overall anatomic data are needed to be provided. The data can be useful while carrying out surgical procedures with the help of model vertebral column in the operation theatre.

Materials and Methods: This cross-sectional study was carried out with an attempt to construct data on the length of the transverse process of fully ossified dry human fifth lumbar vertebrae in the Department of Anatomy, Sir Salimullah Medical College, Dhaka, from January 2012 to December 2012. In this study, a total of 153 morphologically normal complete bones of unknown sex were included. Sexes of the collected bones were determined.

Results: This study observed that the mean + SD value of transverse process length of 153 fifth lumbar vertebrae were 29.1 + 2.3 mm in male and 27.8 + 2.5 mm in female on left and 27.9 + 2.4 mm in male and 26.0 + 2.3 mm in female on right side. All values were significantly higher in male than that of female.

Conclusion: The results of the present study provide useful information for safe surgery of posterior segmental screw fixation & for the development of new spinal implant system.

Keywords: Fifth lumbar vertebra, Transverse process length.

Introduction:

The vertebral column is the central bony pillar of the body.¹ It has drawn much interest for medical researchers because of the upright posture.² It acts as a firm support to the body, help in the maintenance of the upright posture in standing and walking, transfer the body weight to the legs, enclose and protects the spinal cord.¹

There are five lumbar vertebrae, of which the first four are typical and the fifth is atypical. The largest fifth lumbar vertebra has a ventral body and a dorsal neural arch consisting of a pair of pedicles, laminae, transverse processes, superior and inferior articular processes and an unpaired spinous process, together enclosing the vertebral foramen.

1. Kohinur Sultana, MBBS, M-phil (Anatomy), Associate Professor, Department of Anatomy, Dhaka Community Medical College, Dhaka. Email: dr.kohinuraa@gmail.com.

2. Md. Osman Goni, MBBS, MS (Surgery), Associate Professor, Department of Surgery, Faridpur Medical College, Faridpur. Email: dosmangoni@gmail.com

3. Afroza Sultana, MBBS, M-phil (Anatomy), Associate Professor, Department of Anatomy, Ad-din Sakina Women's Medical College, Jashore. Email: sultanaafroza278@gmail.com

Address of correspondence:

Kohinur Sultana, MBBS, M-phil (Anatomy), Associate Professor, Department of Anatomy, Dhaka Community Medical College, Dhaka. Email: dr.kohinuraa@gmail.com, Phone number: +8801716570216.

Loads lifted and carried by the upper extremities cause significant loading stress to the vertebral column.³ The load in thoracic and lumbar regions is transmitted through two vertical running columns, anterior of which

is formed by vertebral bodies and intervertebral discs, while posterior column is formed by successive articulations of neural arch elements.⁴

Due to present lifestyle and with its speed, the incidence of assaults on the vertebral column is increasing.⁵ The lumbar spine is the site for numerous orthopaedic disorders such as spondylosis, kyphosis, scoliosis and ankylosing spondylitis which contribute for the development of low back pain.⁶ Low back pain is a major public health problem all over the world. An estimated 75% of all the people may experience back pain at some time in their lives out of which most of them recover without surgery while 3-5% of the patients present herniated disc and 1-2% have compression of nerve root.⁷ Intervertebral disc prolapsed is one of the most common neurological emergencies faced by most physicians. It occurs most commonly between the fourth and fifth lumbar vertebra and also in between fifth lumbar and first sacral vertebra. It compresses adjacent nerve roots and cauda equine resulting in pain, numbness and other neurological signs along the area supplied by the affected nerves.⁸

In osteoporosis, vertebral fractures frequently occur in the lumbar region. The axial skeleton is involved in up to 80% in case of Paget's disease.⁹ All of the benign tumours of long bones such as chondroma, osteoma, fibroma, haemangioma can occur in the vertebrae. The commonest malignancies that metastasize to the vertebrae include breast, lung, prostate, renal, gastro-intestinal and thyroid.¹⁰ Lumbarization and sacralization are the congenital anomalies of the lumbosacral region.¹¹

The fixation of lumbar spine is needed for various spinal problems like fracture in lumbar spine, resection of tumours in vertebral bodies, gross spondylolisthesis and lumbar instabilities.⁴ With the help of screw, various devices (rods, plates, wires) can be applied to spine for immobilization or fixation. Morphometric study are useful to determine the exact location of the entry point and orientation of the tool, in particular when a computerized guidance system is used.¹² The massive transverse process projects laterally from the pediculo-laminar junction. During postero-lateral spinal fusion, the transverse process is usually exposed and a bone graft is placed over them.¹³

With the development of vertebral surgery and biomechanics as well as the improvement of recognition in vertebral column diseases, the overall anatomic data are needed to be provided. The data can be useful while

carrying out surgical procedures with the help of model vertebral column in the operation theatre.⁵

Materials and Methods:

This cross sectional, analytic type of study was carried out on 153 dry fifth lumbar vertebrae which are fully ossified, complete & morphologically normal bones. This study was performed in the Department of Anatomy, Sir Salimullah Medical College, Dhaka from January 2018 to December 2018 & the bones were collected from the students of Sir Salimullah Medical College, Dhaka and Medical College for women & Hospital, Uttara, Dhaka. Transverse process length was the distance between the tip of transverse process and lateral border of vertebral foramen. The fixed jaw of the digital slide caliper was placed on the most lateral point of transverse process and the sliding jaw was placed on the most lateral point of lateral border of vertebral foramen of the fifth lumbar vertebra on its superior aspect. Distance between these two points was taken with the digital slide caliper in mm.¹³ Measured length were compared within same sex by paired Student's 't' test & between sex by unpaired Student's 't' test. Results were presented in tables.



Figure 1: Measurement of transverse process length

Results:

Sex of the collected bones were determined by using discriminant function analysis 10 formula¹⁴ & other sex differentiating features of the fifth lumbar vertebra. Then grouping was done into male & female (Table 1).

Table 1: Distribution of samples according to age (N=153)

Sex	Number (%)
Male	74 (48.37)
Female	79 (51.63)

Measured length of right & left transverse process was compared within same sex; it was found that length of left transverse process is significantly larger than the right (p value <0.001). Length was also compared between sexes & length of male vertebra were significantly larger than that of female ((p value <0.001) (Table 2)

Table-2: Distribution of sample according to transverse process length at left & right side of fifth lumbar vertebrae in male & female in mm. (N=153)

Sex	Transverse process length; Range (Mean±SD)		p value
	Left	Right	
Male (n=74)	22.93-34.58 (29.1± 2.3)	21.65 - 33.82 (27.9± 2.4)	<0.001*
Female (n=79)	19.96-33.6 (27.8± 2.5)	18.96 - 32.29 (26.0± 2.3)	<0.001*
p value	<0.001**	<0.001**	

NB: Comparison within same sex was done by paired Student's 't' test* & comparison between sex was done by unpaired Student's 't' test**

Discussion:

The skeletal characteristics of different bones vary among populations and each population has specific standards to optimize the accuracy of identification. There are three major biologic divisions of human race which include Caucasoid (White), Negroid (Black) and Mongoloid (yellow). Turkish, Italian, Egyptian and Saudis are Caucasian. Negroid race people are found in Africa. Korean, Thai and Japanese are Mongoloid by race.¹¹

The study population belong to the people who are the mixture of Austrics, Indo-Aryans, Mongolians and Dravidians group.¹¹ Observed results of morphological parameters of the present study showed some similarities as well as dissimilarities with the available data present on different publications.

There was significant difference between male and female bones in transverse process length on left (p<0.001) and right side (p<0.001) as shown in Table 2. The mean difference in transverse process length between left and right side found statistically significant in male (p<0.001) and in female (p<0.001) as shown in Table 2. This study showed that the length of the transverse process was higher in males than in females & this can be explained in terms of the greater upper body weight of males. The observed values in the present study does not significantly coincide (p<0.001) with the similar study conducted by Masharawi and Salame on the skeleton of the Haman-Todd Osteological Collection.¹² This may be due to ethnic related morphologic differences as Bangladeshi have noticeably smaller body build than their western counterparts. The authors would like to express their deepest gratitude to the Department of Anatomy, Sir Salimullah Medical College, Dhaka, for providing the necessary support and facilities to conduct the study.

Conclusion:

The results of the present study provide useful information for safe surgery of posterior segmental screw fixation & for the development of new spinal implant system. A comparison of the present study with the published data supports the view that there is ethnic as well as racial variations in the size of transverse process of fifth lumbar vertebrae. So, it is necessary to compile tables that are applicable to every population. To get normative data on Bangladeshi population, study with larger sample size of known age, sex, stature and ethnicity is needed. Comparative study between dry bones and living bones by radiological methods are recommended.

Conflict of interest:

There is no conflict of interest.

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