

A Morphometric Study of Dry Human Typical Thoracic Vertebral Body in Telangana Region.

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Abstract:

Background: Previous studies in the past about morphometry of thoracic vertebrae mainly focused on pedicle diameters and their angulations. The vertebral body were not studied particularly in Telangana Region that is the reason the present study has given importance to the morphometry of vertebral body.

Objective: To measure the various parameters of vertebral body in typical thoracic vertebrae by using vernier caliper.

Material and methods: Hundred dry human typical thoracic vertebrae of undetermined gender and age were selected for the study. The various parameters of vertebral body were measured.

Results: The anteroposterior distance of the vertebral body in typical thoracic vertebrae ranged from 15 - 29 mm with a mean of 21.96mm. The vertebral body superior width (superior tranverse diameter) ranged from 23-32 mm with a mean of 24.4mm. The vertebral body inferior width (inferior trasverse diameter) ranged from 25 - 38 mm with a mean of 31.4 mm. The anterior height (mid sagital) of the body ranged from 14 - 20mm with a mean of 17.71 mm. The Rt & Lt. lateral height of the body ranged from 14 - 21 mm with a mean of 18.01 mm.

Conclusion: The results provide information for more accurate modelling and design of vertebral body implants and instrumentations for Indian population.

Keywords: Anterior height, Posterior height, Vertebral body width, Typical thoracic vertebra

I. Introduction

The adult vertebral column (also called the spine or spinal column) usually consists of 33 vertebral segments- 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4 coccygeal. The functions of the column are to support the trunk, to protect the spinal cord and nerves, and to provide attachments for muscles. It is also an important site of haematopoiesis throughout life⁽¹⁾. The vertebrae can be involved in various conditions. These include fractures, infections, malignancies and inflammatory disorders. Abnormal curvatures of the vertebral column in the thoracic region such as kyphosis and scoliosis may result from developmental anomalies or pathological processes involving vertebrae⁽²⁾. The vertebral bodies and the intervertebral discs form an important column in transmission of weight of the body. In the upper thoracic region, due to the anterior curvature, the main part of the compressive force is transmitted through the anterior column formed vertebral body and intervertebral disc, with resulting increased stress⁽³⁾. The compressive force in the lower thoracic region is transmitted through two parallel columns, one anterior and one posterior formed by successive articulations of laminae with each other⁽⁴⁾. In recent years, there have been considerable developments in instrumentation designed to stabilize and correct the thoracic spine⁽⁵⁾. Anterior inter body fusion, in association with a variety of methods to stabilize both the implant and motion segment, has increased in popularity. Hence, the present study measured the various dimensions of vertebral body.

II. Material And Methods

The study was conducted on dry human typical thoracic vertebrae. The vertebrae were obtained from the bone collection of the Department of Anatomy of Osmania and Kakathiya Medical College in Telangana Region. 100 undamaged typical thoracic vertebrae were selected for the study. The vertebrae were of undetermined gender and age. Each vertebra was assigned a serial number. Anatomical measurements were taken on these specimens using a vernier caliper.

The following parameters were recorded in a proforma:

1. Anteroposterior distance of the vertebral body- It is the distance between anterior border and posterior border of the superior surface of vertebral body in midline.

2. Superior transverse diameter of the vertebral body- It is the maximum transverse diameter of the vertebral body at the superior surface.
3. Inferior transverse diameter of the vertebral body- It is the maximum transverse diameter of the vertebral body at the inferior surface.
4. Anterior height (mid sagittal) of the body- It is the vertical distance between superior and inferior surface of body in the midline anteriorly.
5. Rt and Lt lateral height of the body- It is the vertical distance between superior and inferior surface of body in the lateral side of vertebra.

III. Results

1. The anteroposterior distance of the vertebral body in typical thoracic vertebrae ranged from 15-29 mm with a mean of 21.96mm.
2. Superior transverse diameter of the vertebral body- It is the maximum transverse diameter of the vertebral body at the superior surface ranged from 23-32mm with a mean of 24.4mm.
3. Inferior transverse diameter of the vertebral body- It is the maximum transverse diameter of the vertebral body at the inferior surface ranged from 25-38mm with a mean of 31.4mm.
4. Anterior height of the body- It is the vertical distance between superior and inferior surface of body in the midline anteriorly ranged from 14-20 mm with a mean of 31.4mm.
5. Rt and Lt lateral height of the body- It is the vertical distance between superior and inferior surface of body in the lateral side of vertebra ranged from 14-21mm with a mean of 18.01mm.

IV. Discussion

Several quantitative anatomical studies have been carried out for thoracic vertebrae in different countries. Many authors have studied the vertebrae using different methods such as plain radiographs, direct specimen measurements and quantitative 3dimensional anatomic techniques. These include Panjabi MM et al⁽⁶⁾, Tan et al⁽⁷⁾, Roop Singh et al⁽⁸⁾, Gupta R et al⁽⁹⁾, Kunkel ME et al⁽¹⁰⁾ and Patil Dhaval K. et al⁽¹²⁾. However, Berry JL et al⁽¹¹⁾ studied only second and seventh thoracic vertebrae. The following tables present the comparison of means of the various parameters obtained from previous studies with that of the present study.

Table 1: Comparison of mean anteroposterior distance of the vertebral body in typical thoracic vertebrae with other studies.

Study	Year	Country	Material for study	Mean (in mm)
Panjabi MM et al ⁽⁶⁾	1991	USA	Dry bones	24.26
Tan et al ⁽⁷⁾ 2004	2004	Singapore	Dry bones	20.21
Patil Dhaval K. et al ⁽¹²⁾	2014	India	Dry bones	20.78
Present study	2017	Telangana-India	Dry bones	21-96

When compared, the mean anteroposterior distance of the vertebral body in the present study is lesser than the value found by Panjabi MM et al⁽⁶⁾ but is in greater than with the finding of Tan et al⁽⁷⁾.

Table 2: Comparison of mean transverse diameter of the vertebral body in typical thoracic vertebrae with other studies.

Study	Year	Country	Material for study	Mean (in mm)
Panjabi MM et al ⁽⁶⁾	1991	USA	Dry bones	26.06
Tan et al ⁽⁷⁾	2004	India	Dry bones	23.84
Singh R et al ⁽⁸⁾	2011	India	Dry bones	25.9
Patil Dhaval K. et al ⁽¹²⁾	2014	India	Dry bones	27.02
Present study	2016	India	Dry bones	27.9

The mean transverse diameter of the vertebral body in the present study is slightly greater that of the earlier studies.

Table 3: Comparison of mean anterior height of the body in typical thoracic vertebrae with other studies.

Study	Year	Country	Material for study	Mean (in mm)
Tan et al ⁽⁷⁾	2004	Singapore	Dry bones	15.04
Kunkel ME et al ⁽¹⁰⁾	2011	Germany	Cadaveric, Radiographic	15.84
Singh R et al ⁽⁸⁾	2011	India	Dry bones	17.39
Patil Dhaval K. et al ⁽¹²⁾	2014	India	Dry bones	17.17
Present study	2016	India	Dry bones	17.71

The mean anterior height of the body in the present study is in agreement with the results of study by Singh R et al & Patil Dhaval K. et al⁽¹²⁾ and is greater than the values reported by Tan et al and Kunkel ME et al. Thus, a comprehensive data set has been presented which provides quantitative anatomy of vertebral body of typical thoracic vertebrae. The differences in the results of the present study and those of the previous studies with respect to some of the parameters may be due to differences in race, ethnicity, environmental factors as well as methods used for the studies. These findings strengthen the recommendations by Roop Singh et al⁽⁸⁾ for modification in spinal surgery instrumentations in accordance with the morphometric data obtained from Indian population.

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Fig.1- Illustration showing measurement of the anteroposterior distance and transverse diameter (superior surface) in typical thoracic vertebra.



Fig.2- Illustration showing measurement of anterior and Rt & Lt lateral height of the body in typical thoracic vertebra.

