Original Research Article

A morphometric study of dry human typical thoracic vertebral body in Marathwada region

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Abstract

Background: In recent years, there have been considerable developments in instrumentation designed to stabilize and correct the thoracic spine. At present, artificial vertebral implants have proven to be effective in the treatment of spinal tumors, infections, fractures and other diseases. Studies show that the movable artificial vertebral implants needs further improvement and hence the present study has given importance to the morphometry of vertebral body in typical thoracic vertebrae. **Objective:** To measure various parameters of the vertebral body in typical thoracic vertebrae by digital vernier calliper. **Materials and methods**: Seventy five typical thoracic vertebrae of undetermined age and gender were selected for the study. Various measurements were taken with the help of digital vernier calliper. **Results:** The superior anteroposterior distance of the vertebral body in typical thoracic vertebrae ranged from 14.61-31.85mm with a mean of 22.37+3.80mm. The inferior anteroposterior distance ranged from 12.60-32.79mm with a mean of 23.21+ 3.79mm. The anterior height ranged from 11.92-27.23mm with a mean of 20.15+2.81mm. The posterior height ranged from 12.31-27.28mm with a mean of 21.12+2.78mm. The right lateral height ranged from 10.83-25.61mm with a mean of 20.60+2.84mm. The left lateral height ranged from 11.31-26.76mm with a mean of 20.37+2.89mm. The superior transverse diameter ranged from 18.70-34.87mm with a mean of 28.25+ 3.56mm.The inferior transverse diameter ranged from 19.75-35.58mm with a mean of 29.65+ 3.82mm. **Conclusion:** The data provided will be a useful reference for more accurate optimization of design and modelling of artificial vertebral body implants and instrumentation in Indian population.

Key Word: Typical thoracic vertebra, anterior height, superior anteroposterior distance.

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INTRODUCTION

The adultvertebral column consists of 33 vertebral segments (7 cervical, 12 thoracic, 5 lumbar, 5 scaral, 5 coccygeal) and is one of the most complex structures of the human body. The vertebrae may be involved in various conditions like fractures, malignancies, inflammatory disorders, infections, abnormal curvatures such as kyphosis and scoliosis. In recent years there have been considerable developments in instrumentation designed to stabilize and correct the thoracic and lumbar spine. Majority of the previous studies have mainly focused on the pedicle diameters and their angulations and very little importance has been given to the vertebral body. In the thoracic curvature[1], the compressive force tends to centre on the vertebral bodies. Similarly, a change in the structure and shape of the vertebral column in the thoracic region with respect to its two components, body and arch, might be due to change in the magnitude of compressive force distributed between the two components because of the change in curvature. Taking into account the complex nature of the thoracic spine, the present study has given importance to the vertebral body.

MATERIALS AND METHODS

The study was conducted on 75 typical thoracic vertebrae obtained from department of Anatomy of various colleges

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in Marathwada region. The vertebrae were undamaged and of undetermined age and sex. Each vertebra was assigned a serial number. Anatomical measurements were taken on these specimens using a digital Vernier calliper. The following parameters were recorded in a proforma:

1. Superior Anteroposterior distance: It is the distance between anterior border and posterior border of the superior surface of the vertebral body in midline.
2. Inferior Anteroposterior distance: It is the distance between anterior border and posterior border of the inferior surface of the vertebral body in midline.
3. Anterior height of the body: It is the vertical distance between the superior and inferior surface in the midline anteriorly.
4. Posterior height of the body: It is the vertical distance between the superior and inferior surface in the midline posteriorly.
5. Right lateral height: It is the vertical distance between the superior and inferior surface of the body in the lateral side of the vertebra.
6. Left lateral height: It is the vertical distance between the superior and inferior surface of the body in the lateral side of the vertebra.
7. Superior transverse diameterof the vertebral body: It is the maximum transverse diameter of the vertebral body at the superior surface
8. Inferior transverse diameter of the vertebral body: It is the maximum transverse diameter of the vertebral body at the inferior surface.

RESULTS

1. The superior anteroposterior distance of the vertebral body in typical thoracic vertebrae ranged from 14.61-31.85mm with a mean of 22.37± 3.80mm
2. The inferior anteroposterior distance of the vertebral body in typical thoracic vertebrae ranged from 12.60-32.79mm with a mean of 23.21± 3.79mm.
3. The anterior height of the vertebral body in typical thoracic vertebrae ranged from 11.92-27.23mm with a mean of 20.15±2.81mm.
4. The posterior height of the vertebral body in typical thoracic vertebrae ranged from 12.31-27.28mm with a mean of 21.12±2.78mm.
5. The right lateral height of the vertebral body in typical thoracic vertebrae ranged from 10.83-25.61mm with a mean of 20.60±2.84mm.
6. The left lateral height of the vertebral body in typical thoracic vertebrae ranged from 11.31-26.76mm with a mean of 20.37±2.89mm.
7. The superior transverse diameter of the vertebral body in typical thoracic vertebrae ranged from 18.70-34.87mm with a mean of 28.25± 3.56mm
8. The inferior transverse diameter of the vertebral body in typical thoracic vertebrae ranged from 19.75-35.58mm with a mean of 29.65± 3.82mm.

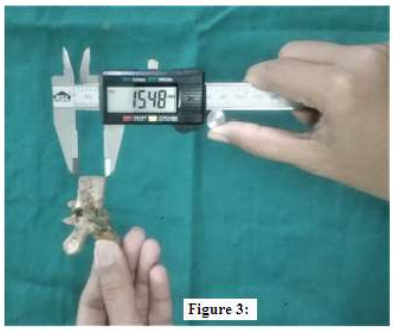

Figure 1: Illustration showing measurement of the superior transverse diameter in typical thoracic vertebra; **Figure 2:** Illustration showing measurement of the superior anteroposterior distance in typical thoracic vertebra; **Figure 3:** Illustration showing measurement of the anterior height in typical thoracic vertebra.

DISCUSSION

Thoracic vertebrae have been studied by various authors by using different methods such as plain radiographs, quantitative 3 dimensional anatomic techniques and direct measurements. These include Panjabi MM *et al*, Tan *et al*, Patil Dhaval *et al*, M. Vasantha *et al*, Singh R *et al*, Kunkel *et al*. However, Berry JL *et al* studied only the 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 superior anteroposterior distance of the vertebral body in typical thoracic vertebrae with other studies

Study	Year	Country	Material for study	Mean (in mm)
Panjabi MM[2] *et al*	1991	USA	Dry bones	24.26
Tan[3] *et al*	2004	Singapore	Dry bones	20.21
Patil Dhaval K[6] *et al*	2014	India	Dry bones	20.78
M.Vasantha[7]*et al*	2017	Telangana-India	Dry bones	21.96
Present study	2019	Marathwada- India	Dry bones	22.37

When compared, the mean superior anteroposterior distance of the vertebral body in the present study is lesser than the value found by Panjabi MM[2]*et al* but is greater than the findings of Tan[3] *et al*, Patil Dhaval[6] *et al* and M.Vasantha[7] *et al*.

Table 2: Comparison of mean superior transverse diameter of the vertebral body in typical thoracic vertebrae

Study	Year	Country	Material for study	Mean (in mm)
Panjabi MM[2] *et al*	1991	USA	Dry bones	26.06
Tan[3]*et al*	2004	Singapore	Dry bones	23.84
Singh R[5] *et al*	2011	India	Dry bones	25.9
Patil Dhaval K[6] *et al*	2014	India	Dry bones	27.02
M.Vasantha[7] *et al*	2017	Telangana-India	Dry bones	27.9
Present study	2019	Marathwada- India	Dry bones	28.25

The mean superior transverse diameter of the vertebral body in the present study is greater than that of the other studies.

Table 3: Comparison of mean anterior height of the vertebral body in typical thoracic vertebrae

Study	Year	Country	Material for study	Mean (in mm)
Tan[3] *et al*	2004	Singapore	Dry bones	15.04
Kunkel[4] ME *et al*	2011	Germany	Cadaveric,Radiographic	15.84
Singh R[5]*et al*	2011	India	Dry bones	17.39
Patil Dhaval K[6]*et al*	2014	India	Dry bones	17.17
M.Vasantha[7] *et al*	2017	Telangana-India	Dry bones	17.71
Present study	2019	Marathwada- India	Dry bones	20.15

The mean anterior height of the vertebral body in the present study is greater than that of the other studies.

Table 4: Comparison of mean posterior height of the vertebral body in typical thoracic vertebrae

Study	Year	Country	Material for study	Mean (in mm)
Berry JL[8] *et al*	1987	USA	Dry bones	17.8
Panjabi MM[2] *et al*	1991	USA	Dry bones	16.86
Tan[3] *et al*	2004	Singapore	Dry bones	16.41
Kunkel ME[4] *et al*	2011	Germany	Cadaveric, Radiographic	17.99
Singh R[5]*et al*	2011	India	Dry bones	18.19
Patil Dhaval K[6]*et al*	2014	India	Dry bones	18.27
Present study	2019	Marathwada- India	Dry bones	21.12

The mean posterior height of the vertebral body in the present study is greater than that of the other studies. Singh R[2] *et al* found that the anterior height of the vertebral body was less as compared with the posterior height of the body at all levels of the thoracic spine. They noted this as an explanation for the normal physiological kyphosis present in the thoracic region. The present study found a similar observation.

CONCLUSION

The current increased interest in vertebral body implants and spinal implants call for a detailed knowledge of its anatomy. Direct measurements on specimens is the best method for extracting morphometric data from anatomical structures. The present study has focused on a comprehensive data set which provides quantitative anatomy of vertebral body of typical thoracic vertebrae. The differences in the result 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 as well as methods used for the studies. The quantitative findings from the present study can hopefully provide more accurate information in the design of vertebral implants for the population studied.

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