

A Morphometric Study to Measure the Height and Width of Pedicles of Second Cervical Vertebrae in Different Sex

Masuma Akhtar Banu¹, Shamim Ara², Rehena Yusuf³

Abstract

Context: Identification provides a biological profile of an individual, including estimation of ancestry, age and particularly sex by the morphology of bones. Examination of bone is important for identification and estimation of sex of an individual. The present study was planned to collect data regarding morphometric measurements of pedicle of human dry ossified second cervical vertebrae and to find out possible variations in different sex.

Materials and Methods: A cross-sectional analytical study was performed in the Department of Anatomy, Dhaka Medical College, Dhaka from January 2012 to December 2012. The study materials consists of 156 (one hundred & fifty six) human dry ossified second cervical vertebral of unknown sex. The study samples were distributed in male & female sex groups by discriminant function analysis technique. With the help of digital slide calipers different measurements were recorded in millimeters.

Result: Among 156 vertebrae 87 was male and 69 was female. The mean (\pm SD) The mean (\pm SD) height and width of pedicle was greater in male than that of female ($P < 0.05$).

Conclusion: There was no significant difference in height and width of pedicle, between right and left side in both sexes.

Key words: height, width, pedicle.

Introduction:

Pedicle is the thick part between body and transverse process of second cervical vertebrae. Antero- lateral surface is deeply grooved by the vertebral artery. The inferior surface of each pedicle bears a deep, smooth inferior intervertebral notch, in which the large root sheath of third cervical nerve lies¹. The aim of this study is to evaluate the value of some morphometric parameters measured from pedicle of second cervical vertebrae. Transpedicular screw fixation is done at pedicle. The screw entry point is the location of the projection point of the pedicle axis line allowing instrumentation on the cervical second and third

facet joint. Transpedicular screw fixation may be dangerous. Atrogenic deviation of the screw along the pedicle may cause damage to the structures related to the pedicle².

Fractures of the vertebral arch of axis are one of the most common injuries of the cervical vertebrae (up to 40%). Usually the fracture occurs in the bony column formed by the superior, inferior articular processes of axis and pars interarticularies. A fracture in this location, called a traumatic spondylolysis which is important to the radiologist for diagnosis of the fracture³.

By reviewing existing literature it is observed that many works have been done on second cervical vertebra in other countries. So far it is known, there is no published work on second cervical vertebra collected from Bangladesh. So this study provides us much information which will be helpful to us.

The study will be helpful for the forensic experts and anthropologists for determination of sex. It will

1. Assistant Professor, Department of Anatomy, Uttara Adhunik Medical College, Uttara, Dhaka
2. Professor and Head, Department of Anatomy, Dhaka Medical College, Dhaka
3. Associate Professor, Department of Forensic Medicine, Uttara Adhunik Medical College, Uttara, Dhaka

Correspondence: Dr. Masuma Akhtar Banu

be helpful for spine surgeons and radiologists for diagnosis of traumatic, congenital disorder and treatment of cervical instability, dens axis fractures, spinal trauma and extensive laminectomies.

Materials and methods:

The study was performed on 156 (one hundred and fifty six) human dry ossified second cervical vertebrae of unknown sex. Sampling technique is purposive sampling. The second cervical vertebrae were collected from Department of Anatomy of Dhaka Medical College and other government and non-government Medical Colleges in Dhaka city. Then the sex of collected vertebrae was determined by a multivariate linear discriminant function analysis technique^{4,5,6}.

By discriminant analysis technique the sex was determined and the grouping was done. Afterwards for the measurement of parameters of pedicle of second cervical vertebrae the following procedure was done.

For measurement of the height of the pedicles, two points were determined, one point on the superior surface and another point on the inferior surface of the pedicle close to vertebral foramen at the level of foramina transversarium. Two dots were given at the determined points. Then the height of the pedicle of second cervical vertebra was measured as the distance between the superior surface and inferior surface of the pedicle with the help of digital slide calipers. The reading was recorded both on right and sides².

Again for the measurement of the width of the pedicles two points were determined one point on the internal surface close to vertebral foramen and another point on the external surface of the pedicle near the foramina transversarium. Two dots were given on the determined points. Then the width of the pedicle of second cervical vertebra was measured as the distance between the internal surface and external surface of the pedicle with the help of digital slide calipers. The reading was recorded both on right and left sides².



Fig-3.2.22: Photograph showing the measurement of height of pedicle by using digital slide calipers. Red dot and blue dot indicates superior and inferior surface of pedicle respectively.



Fig 3.2.23: Photograph showing the measurement of width of pedicle by using digital slide calipers. Red and blue dots indicate internal and external surface of pedicle respectively.

After collection of data, the findings of this study was analyzed by SPSS version 17 and revealed important information regarding morphometric variation. Comparison of the values of different variables between male and female was done by unpaired Student's 't' test.

Ethical Clearance:

This study was approved by Ethical Review Committee of Dhaka Medical College, Dhaka

Results:

The present study was carried out on 156 human dry ossified second cervical vertebrae and was grouped into male and female by discriminant function analysis technique (Table-1).

Table-II
Distribution of study subjects into different sex according to discriminant function analysis technique

Sex	Number of second cervical vertebra (n)
Male	87
Female	69

In male the mean (\pm SD) height of pedicles of the second cervical vertebrae was 7.69 ± 1.03 mm and 7.70 ± 1.24 mm on right side and on left side respectively. There was no significant difference in mean height between right side and left side ($P = 0.887$). In female the mean (\pm SD) height of pedicles of the second cervical vertebrae was 7.24 ± 1.12 mm and 7.39 ± 1.21 mm on right side and on left side respectively. There was no significant

difference in mean height between right side and left side ($P = 0.385$). On right side the mean length was greater in male than that of female ($P < 0.05$). On left side there was no significant difference in mean height between male and female ($P = 0.113$).

In male the mean (\pm SD) width of pedicles of the second cervical vertebrae was 10.91 ± 1.62 mm and 11.07 ± 1.79 mm on right and on left side respectively. There was no significant difference in mean width between right side and left side ($P = 0.262$). In female the mean (\pm SD) width of pedicles of the second cervical vertebrae was 10.35 ± 1.74 mm and 10.41 ± 1.83 mm on right and left side respectively. There was no significant difference in mean width between right and left side ($P = 0.810$). The mean width was greater in male than that of female both on right side ($P < 0.05$) and on left side ($P < 0.05$) (Table 2, Fig 2).

Table-II
Height and width of pedicles of second cervical vertebrae of male (n=87) and female (n=69)

Sex	Height (mm)			Width (mm)		
	Right Mean \pm SD (5.15 10.30)	Left Mean \pm SD (4.84 12.32)	<i>P</i> value	Right Mean \pm SD (6.30 14.74)	Left Mean \pm SD (6.58 15.55)	<i>P</i> value
Male	7.69 ± 1.03	7.70 ± 1.24	0.887 ^{ns}	10.91 ± 1.62	11.07 ± 1.79	0.262 ^{ns}
Female	7.24 ± 1.12 (5.57 11.99)	7.39 ± 1.21 (5.10 12.56)	0.385 ^{ns}	10.35 ± 1.74 (6.54 14.48)	10.41 ± 1.83 (6.48 15.32)	0.810 ^{ns}
<i>P</i> value	0.010*	0.113 ^{ns}		0.042*	0.025*	

Figures in parentheses indicate range. Comparison between right and left side done by paired Student's 't' test and comparison between sex done by unpaired Student's 't' test, ns = not significant, * = significant at $P < 0.05$

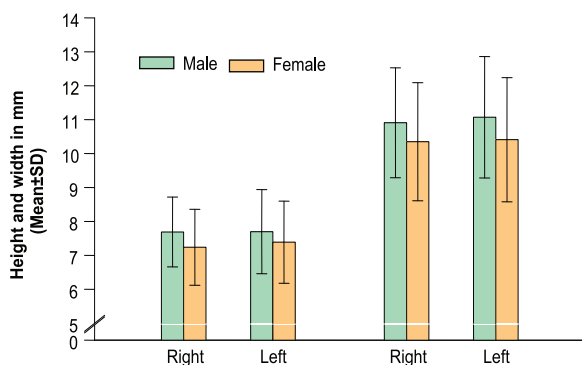


Fig. 2 Height and width of pedicles of second cervical vertebrae of male (n=87) and female (n=69)

Discussion:

Kazan, Yildirim, Sindel and Tuncer² studied on 40 dry axis vertebrae to determine the suitability of groove for the vertebral artery for atlanto-axial transarticular screw fixation technique. They reported 8.82 ± 1.25 mm and 8.60 ± 1.03 mm mean height of pedicle on right and left side respectively. They also reported 10.72 ± 1.53 mm and 10.71 ± 1.44 mm mean width of pedicle on right and left side respectively. In the study of Sengul and Kadioglu⁷, they showed 9.6 ± 2.4 mm and 9.5 ± 2.2 mm mean width of pedicle on right and left side respectively.

In the present study the mean (\pm SD) height and width of pedicle was greater in male than that of female there was no significant difference of mean height and width of pedicle between right and left side in both male and female. There was significant difference of those values between male and female except the height of pedicle on left side ($P < 0.05$).

The present study was carried out in second cervical vertebrae collected from Bangladesh. Skeletons that are available in Bangladesh also come from neighboring countries. Bangladeshis are mixed race of Negroid, Caucasoid and Mongoloid⁸. In the present study the mean value of the height of pedicle in both sexes was lower than that of Kazan, Yildirim, Sindel and Tuncer². But the height in present study was nearly similar to the mean values of Sengul and Kadioglu⁷. Both researchers did not mention the sexes. So the variation may be geographical or for without mentioned sex differentiation.

However the present study is similar to the study reported by Kazan, Yildirim, Sindel and Tuncer². In the present study the width of the pedicle of second cervical vertebrae was greater than the height which was similar to the findings of the above mentioned researchers.

Conclusion:

Measurement directly taken from autopsy cases is more accurate and reliable than that of dried ossified samples. We cannot claim that these second cervical vertebrae belong to Bangladeshi people. So in further studies along with larger sample size we require second cervical vertebrae from Bangladeshi cadaver to get more precise picture of Bangladeshi people which will help to establish a baseline data from which we can compare different morphometric parameters of second cervical vertebrae with the findings of other

researches. Radiographic study and measurement of different parameters of living second cervical vertebrae and compare the radiographic findings with the morphometric study of human dry ossified second cervical vertebrae are recommended.

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