

THE IMPORTANCE OF VERTEBRAL MORPHOLOGY

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ABSTRACT :

In this study, the morphological parameters which were seen as important for the proper spinal instrumentation on the 225 lumbar vertebrae were examined. The data was evaluated so as to have maximum and minimum values, arithmetic means and standart deviation.

Key Words: *Vertebral morphology, Pedicle screws, Pedicle size.*

INTRODUCTION :

In the last years, the spinal instrumentations which are used in the stabilization of fractures of the spine, in the correction of spinal deformities and to obtain rigid immobilization in spine has got complex (3). In the contemporary life, transpedicular screw fixation, sublaminar wiring and the usage of multiple hooks have entered to routine application area. However during these applications are being carried out, there is the necessity of using the appropriate implants. As a result of this, it has been thought that for the designing of appropriate implants and a safe practice, vertebral columns need a detailed morphometric examination (1).

For the purpose of forming proper implants within the "İbni Sina Spinal Instrumentation Project" that has been developed due to this purpose, a co-study has been programmed between the Departments of Anatomy and Orthopaedics at Faculty of Medicine in the University of Ankara and morphometric evaluations belonging to the lumbar spines of Anatolian people have been done.

MATERIALS AND METHODS :

In this study, under the light of parameters which are detected on the 225 undamaged lumbar vertebrae at University of Ankara, Faculty of Medicine, Department of Anatomy, morphometric measurements have been carried out.

As the age, sex and certain vertebral levels of the lumbar vertebrae under consideration could not be detected, this information has been out of evaluation.

The parameters which are important in the design of proper implants for lumbar spine and its practice have been taken to examination.

These parameters are:

- 1) pedicle width.
- 2) pedicle height.
- 3) Interpedicular distance.
- 4) the angle between pedicle axis and the transverse axis of vertebral body in the frontal plane.
- 5) the width of arcus vertebrae.
- 6) the height of arcus vertebrae.
- 7) the angle between the transverse axis of vertebral body in the frontal plane and one side arcus vertebrae axis.
- 8) the angle between the horizontal axis of vertebral body in the sagittal plane (which crosses the highest point of pedicle) and the axis crossing the spinal process and the pedicle.

During the evaluations, linear measurements were made with calliper and angular measurements were taken with a goniometer. The maximum and minimum values, arithmetic mean and the standart deviation of the data have been statistically evaluated.

RESULTS :

The average pedicle width (between 10.6 mm and 5.5 mm) and the average pedicle height (between 20.4 mm and 14.5 mm) have been found as 8.2 mm and 17.6 mm. The average interpedicular distance (between 31.6 mm and 26.0 mm), the average width of arcus vertebrae (between 8.4 mm and 5.9 mm) and its average height (between 24.6 mm and 17.5 mm) have been found as 27.6 mm, 6.7 mm and 20.4 mm. For the average angular values, the angle between pedicle axis and the transverse axis of vertebral body in the frontal

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plane is 138° (between 145° and 136°), the angle between the transverse axis of vertebral body in the frontal plane and one side arcus vertebrae axis is 46.7° (between 58° and 40°), the angle between the horizontal axis of vertebral body in the sagittal plane and the axis crossing the spinal process and the pedicle is found out to be 66.2° (between 79° and 50°). The maximums and minimums, arithmetic means and standart deviations of these values are presented cumulatively in **Table 1**.

Table 1.

Parameter	Maximum	Minimum	Mean	Sd
1	10.6 mm	5.5 mm	8.2 mm	1.14
2	20.4 mm	14.5 mm	17.6 mm	1.43
3	31.6 mm	26.0 mm	27.6 mm	1.21
4	145°	130°	138°	0.42
5	8.4 mm	5.9 mm	6.7 mm	0.04
6	24.6 mm	17.5 mm	20.4 mm	1.43
7	58°	40°	46.7°	4.5
8	79°	50°	66.2°	4.7

DISCUSSION :

A wide variation is a matter in question between the milimetric and angular measurements obtained during the detailed morphometric evaluation of pedicle (2, 4). In the studies that have been executed, the presence of this variation has been being pointed out Similar to our evaluation results, in the study accomplished by Scoles et al. some results have been obtained by taking T/1-3-6-9-12 and L/1-3-5. vertebral levels into evaluation (3). When this study is compared with our results, the pedicle width and height and the results of interpedicular distance measurements show a similarity between the results of measurements done on the L/1 level. However, it has been impossible to make a comparison with the evaluations of L/1-3-5 level.

In a study on the lumbar vertebrae executed by computerised axial tomography which is carried out by Zindrick et al., the average pedicle width has been found out as 11.76 mm (between 29 mm and 4 mm) (4). In another study by Marchesi, it has been declared as 11.36 mm (between 24.9 mm and 4.8 mm) (2). According to our measurements, concerning the Turkish people, the lumbar pedicle width is 8.2 mm (between 10.6 mm and 5.5 mm) on the average.

The average pedicle height is proclaimed as 14.82 mm (between 21 mm and 6.3 mm) by Zindrick et al.

(4), and as 14.94 mm (between 19 mm and 11.4 mm) by Marchesi (2). As for our results, it is 17.6 mm (between 20.4 mm and 14.5 mm).

With the comparison of pedicle size it has been seen that the results differ from each other as far as the race is concerned. Especially, this research in which the morphometric examinations of the lumbar spines of Turks have been done, gives a lower pedicle width than that of the other races. It has been concluded that, for a safe instrumentation application, the dimensions of pedicle screws should be changing between 5 and 6 mm.

We are in the belief that the evaluations on the eight parameters that are done for having appropriate implant within the project will be a guideline in the planning of implants like screws, hooks and transverse linkers in designing the instruments in proper sizes.

CONCLUSIONS :

We think that a positive and a safe application will be provided in spinal surgery by using the results of morphometric evaluations of Anatolian people's lumbar spines in the designing of the components of the Ibni Sina Spinal Instrumentation that will be developed.

In the end of this study, as a result of the morphometric examination of lumbar vertebrae, we believe that it will be possible for our country's people to be provided a safer practice and Ibni Sina Spinal Instrumentation will be planned in safe dimensions. The malresults which may arise due to spinal morphometric size differentials in the application of universal systems to our country's people will come to end by the planning of Ibni Sina Spinal Instrumentation according to morphometric measurements of Anatolian people.

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