



A Comparative morphometric study of sacralised lumbar vertebra with the fifth lumbar and first sacral vertebra

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Abstract

Introduction: *Unilateral or bilateral fusion of fifth lumbar vertebra with the sacrum producing partial or complete sacralisation. due to many changes at this level .person suffers from low back pain with advancing age.*

Method: *The present study was conducted on 30 dry human sacra and 30 dry fifth lumbar vertebrae with the help of digital Varnier Caliper.*

Result: *The transverse diameter of vertebra foramen is maximum in sacralisation as compared to L5 and S1. While, the transverse as well as anteroposterior diameter of vertebral body was maximum in sacralisation.*

Conclusion: *Earlier diagnosis of sacralisation with the measurements of vertebral body and vertebral canal by CT scan in patients suffering from low back pain can be advised with proper exercises and precautions to strengthen the joints ,ligaments and muscles so that the disabilities could be prevented.*

Keywords: *Saralisation, Fifth lumbar vertebra, Sacrum, Low back pain.*

Introduction

Sacralisation means incorporation of fifth lumbar vertebrae to sacrum. It may be unilateral or bilateral producing partial or complete sacralisation. Complete sacralisation consists of complete bony union between the abnormal transverse process and sacrum. Incomplete sacralisation shows a well defined joint line between the process and the sacrum (Moore 1925)⁽¹⁾. Lumbosacral transitional vertebrae (LSTV) occur as a congenital anomaly in the

segmentation of the lumbosacral spine. This anomaly is observed in about 3.6% to 18% of the people and is usually bilateral.

This condition occur due to defect in the segmentation of the lumbosacral spine during development (Eyo et al,2001)⁽²⁾. It may be a cause of disc bulge or herniation nine times more common at the interspace immediately above it than at any other level⁽³⁾. Bertolotti⁽⁴⁾ first observed the L S T V (Lumbosacral transitional vertebrae) and stated that these abnormal

vertebrae may produce low back pain (LBP) due to arthritic changes which occur at the site of false articulation. Low back pain (LBP) is quite a common ailment affecting about 80% of the population in their life time⁽⁵⁾. Both developmental stenosis and degenerative changes may contribute to LBP. So there is a need for morphometric study of vertebral body and vertebral canal in both 5TH lumbar vertebra and sacralised lumbar vertebra. Various publications are available on the morphometric measurements of lumbar vertebrae but few literatures are available on the morphometric measurements of sacralised and sacral vertebra. In this study we try to give comparative data on the anteroposterior and transverse dimensions of these vertebrae.

Material and Methods

The present study was conducted on 30 dry adult human sacra and 30 dry 5th lumbar vertebrae obtained from the department of anatomy, B.R.D Medical College, Gorakhpur and Department of anatomy, I.M.S, B.H.U Varanasi. Sacralization were found in 8 vertebrae. We looked for the complete or incomplete fusion of inferior articular process, body, transverse process and spine of L5 with the sacrum.

The following parameters were measured with the help of digital vernier caliper from the superior aspect of vertebrae.

1-The AP diameter of vertebral foramen was measured as the distance between posterior border of vertebral body and the lamina posteriorly in the midline (fig 1).

2-The transverse diameter of vertebral foramen or inter-pedicular distance was measured at the mid pedicular level as the distance between inner borders of both the pedicles of vertebral body (fig 2).

3-Maximum transverse diameter of body was measured from the site of attachment of transverse process of both side (fig 3).

4-AP diameter was measured in the mid saggital plane from posterior border to anterior border of body on the upper surface (fig 4).

Fig 1 Measurement of antero posterior diameter of vertebral foramen



Fig 2 Measurement of transverse diameter of vertebral foramen



Fig 3 Measurement of transverse diameter of vertebral body



Fig 4 Measurement of AP diameter in the mid saggital plane



Observation & Results**Table-1** Comparison of dimensions of vertebral canal

Dimensions	L5		S1		Sacralised	
	Mean(mm)	S.D	Mean(mm)	S.D	Mean(mm)	S.D
Anteroposterior	17.2	2.9	13.97	1.36	15.14	1.03
Transverse	25.1	2.09	28.92	1.63	31.84	1.12

Table 2 Comparison of dimensions of vertebral body

Dimensions	L5		S1		Sacralised	
	Mean(mm)	S.D	Mean(mm)	S.D	Mean(mm)	S.D
Anteroposterior	30.56	1.82	28.45	1.95	32.45	3.44
Transverse	46.90	1.13	42.42	2.76	51.25	2.54

Sacralisation of L5 were found in eight vertebrae out of 30 sacrum so the prevalence in our study is 26.6% . The greatest mean value (31.84mm) of transverse diameter of vertebral foramen in sacralised vertebrae shows that the interpedicular distance widens at L5 compatible with sacral assimilation of the last lumbar vertebra which behaves as S1.

The greatest AP as well as transverse dimension of body of sacralised L5 may be associated with the narrowing or stenosis of corresponding intervertebral foramen which lead to nerve root compression and one of the important cause of low backache.

Mostly the weight transmission occurs through body of the vertebrae .In case of sacralisation where the intervertebral disc is absent and the body of L5 is fused with the body of sacrum, the body weight from L5 body passes directly to sacrum that's why the shape and size of sacralised L5 body corresponds more to that of the first sacral vertebra.

Discussion

Incidence of sacralisation was found 11.1% by Kubawat et al ⁽⁶⁾ in Gujarat population and 38% by Chakravarti et al ⁽⁷⁾ in 2013. The incidence in present study conducted on the specimen obtained from the eastern UP was 26.6%.

Comparison Table –L5 Verebral canal

S.N.	Authors	Interpedicular Distance in mm	Mid sagittal diameter in mm
1	Mohammad El-Rakhawy et al ⁽⁸⁾ (2009) done by computed tomography.	25.1	15.6
2	Tarek Aly et al ⁽⁹⁾ (2013) done by CT scan.	43.41	26.07
3	Kapur Yael et al ⁽¹⁰⁾ (2014) dry bone study.	21.5	14.75
4	Sethi R et al ⁽¹¹⁾ (2015) X ray study	29.25	-----
5	Present study .	25.1	17.2

Interpedicular distance and mid sagittal diameters of L5 was measured by many researchers through various methods , the results are tabulated.

The greater interpedicular distance in sacralisation as compared to normal L5 in the present study was similar to the observation of Bron et al in 2007⁽¹²⁾. Varol et al⁽¹³⁾ in the Osteometric study in Dry Bones and Computed Tomography Images of Patients With and Without Low

Back Pain concluded that the sagittal diameter of vertebral canal less than 11 mm is a more realistic definition of stenosis. Generally, whether disc pathology is developmental or acquired, there is a correlation between the diameters of the canal and the occurrence of the symptoms of this pathology. Bertolotti first observed the LSTV and stated that these abnormal vertebrae may produce low back pain due to arthritic changes which occur at the site of false articulation⁽⁴⁾.

In our study we found bilateral fusion of various parts of the vertebra similar to the observation of the Kanchan et al⁽¹⁴⁾ which is useful for medicolegal purpose in identification of individual. Williams et al⁽⁹⁾ stated that the person is usually asymptomatic or may present with symptoms which include spinal or radicular pain, disc degeneration, L4/L5 disc prolapse, lumbar scoliosis and lumbar extradural defects. According to Castellvi et al. the transitional vertebrae cause abnormal torque movements above these anomalous vertebrae that could result in disc degeneration⁽¹⁵⁾.

Clinical significance

- Due to sacralisation of fifth lumbar vertebrae, the fusion of lumbosacral joint may cause greater difficulty during labour because of less mobile pelvis. It may be the reason of low back pain problem. Because of actual pressure on nerves or nerve trunk, ligamentous strain around the sacralisation, compression of soft tissues between bony joint, by an actual arthritis if a joint is present, by a bursitis if a bursa is present. In addition this anomaly has known implications in the field of disc surgery.
- Although many cases with LSTV remains asymptomatic for many years but if it can be diagnosed earlier and the patient is advised to take precautions in doing daily activities and proper exercise, complications and disabilities which could occur with advancing age can be prevented. The size of vertebral canal and body can be measured radiologically and more accurately by CT scan in patients suffering from low back pain and can put forth a data regarding the dimensions of vertebral body and vertebral canal which could be helpful in diagnosing cases of vertebral stenosis and the adverse effects of sacralisation.

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