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Anatomy

SACRALISATION IN ADULT DRY SACRUM OF BURDWAN DISTRICT IN WEST BENGAL- A MORPHOMETRIC STUDY

Sumi Ghorai*

Assistant Professor, Department of Anatomy, Burdwan Medical College, Burdwan, West Bengal, India. *Corresponding Author

ABSTRACT **Background:** Degenerative spondylolisthesis, lumbar disc degeneration ultimately leading to low back pain navigates our interest towards lumbosacral region. Sacralisation is one the causes of low back pain. Low back pain is quite a common complaint affecting about 80% of the population in their life time. This abnormality can be detected by plain radiography. **Aim:** a. To determine whether 5th lumbar vertebra has joined with 1st sacral vertebra, b. to determine the fusion is unilateral or bilateral and complete, c. to determine if there is any gender preponderance. **Methods:** In the present study 81 adult human sacra were examined in the department of Anatomy, Burdwan Medical College, Burdwan, West Bengal. **Results:** In our study, out of 81 sacra (57 male, 24 female) ,14 showed sacralisation. In these sacralised bones 8 (6 male sacra) bones showed bilateral sacralisation of 5th lumbar vertebra and 6 (5 male sacra) showed unilateral sacralisation. **Conclusion:** Knowledge of lumbosacral transitional vertebra is of utmost importance for radiologists, orthopedicians, neurologists, clinical anatomists and physiotherapists for diagnosis, medical management and surgical treatment of cases with low back pain and nerve compression symptoms.

KEYWORDS : 5th lumber vertebra; Sacralisation; Low back pain.

INTRODUCTION

The human sacrum is a triangular bone with its base above between two iliac bones at sacroiliac joints, forming posterior wall of pelvis. Its base articulates with fifth lumbar vertebra and its blunt apex articulates with coccyx. Normally there are five sacral vertebrae between fifth lumbar vertebra cranially, and first coccygeal vertebra caudally, forming four pair of sacral foramina (The sacrum may contain six vertebrae, by development of an additional sacral element or by incorporation of the fifth lumbar or first coccygeal vertebrae. Inclusion of the fifth lumbar vertebra (sacralization) is usually incomplete and limited to one side. In the most minor degree of the abnormality a fifth lumbar transverse process is large and articulates, sometimes by a synovial joint, with the sacrum at the posterolateral angle of its base. Reduction of sacral constituents is less common but lumbarization of the first sacral vertebra does occur: it remains partially or completely separate[1]. Lumbosacral transitional vertebrae (LSTV) are congenital anomalies of the lumbosacral region, which includes sacralization of fifth lumbar vertebra and lumbarisation of first sacral vertebra observed for the first time by Bertolottin in 1917. This condition occurs due to defect in the segmentation of the lumbosacral spine during development[2]. Lumbosacral spine is a very important segment of vertebral column. It not only protects the spinal cord and spinal nerves but also supports and transmits body weight to the lower limbs and therefore plays a significant role in posture and locomotion. Stability of spine and its biomechanics will be exaggerated in any kind of pathology either congenital or acquired, when compromise the skeletal features[3]. In the year 1917, Bertolottin first reported that Lumbo-sacral vertebrae (LSTV) are one of the common congenital anomalies of the Lumbosacral region. Sacralisation of 5th lumbar vertebrae and lumbarisation of first sacral vertebrae were included in this anomaly[4]. This developmental defect occurs due to segmentation of the lumbosacral spine[5]. There were many formations in the transitional vertebra the commonest feature being an atypical lumbosacral articulation between the transverse process of L5 and the sacrum [3]. Prevalence of LSTV was reported 1-20% [6]. When sacralization occurs, there are only four lumbar vertebrae, whereas in lumbarisation there are six lumbar vertebrae and many others intermediate variations are also reported. Complete sacralisation consists of a complete bony union between abnormal transverse process and the sacrum. Incomplete sacralisation shows a well-defined joint line between the process and the sacrum. Both forms may be either unilateral or bilateral[7]. Sacralisation is usually bilateral and observed in about 3.6% to 18% in general population. There is a strong association between low back pain (LBP) and the LSTV. Most likely low back pain occurs due to chronic defective biomechanics. It is possible that sacralisation of L5 contributes to the developments of degenerative spondylo-listhesis, lumbar disc degeneration and disc herniation[8]. Investigations to diagnose such condition in clinical practice are plain x-rays, CT scan & MRI[9]. The aim of this present study was carried out to know the incidence of sacralization of L5 vertebrae in adult male and female in semi urban West Bengal and to find out the morphological changes associated with it which in turn help management of illness around Lumbosacral region.

Method

This is an observational study, conducted in the Department of Anatomy Burdwan Medical College Burdwan, West Bengal, India. 81 adult human sacra of known sex (57 male and 24 female) were included in this study. The sacra merge with the 5th lumbar vertebra were selected for the study. We subdivided the sacralisation as complete or bilateral sacralisation which consists of union between the transverse process and body of the sacrum on both sides and incomplete or unilateral sacralisation shows a bony union between the transverse process and body of the sacrum either side right or left.

RESULTS

Total 81 adult dry human sacra were included in this observational study, 57(70.37%) were male sacra and 24(29.63%) were female sacra. Sacrum consisting with five segments, typical sacrum was observed in 67(82.7%) specimens whereas sacralisation of vertebrae was observed in 14(17.3%) sacra. Out of 14 sacra 11(19.3%) were male and 3(12.5%) were female sacra showed sacralization of 5th lumbar vertebra. It is also observed that bilateral sacralisation is more common than unilateral sacralization of 5th lumbar vertebra.

Table 1: Shows The Distributions And Classification Of Sacralisation.

Sacrum studied (n=81)	Sex	Sacralisation	Distributions of sacralization Of 5th lumbar vertebra			
			Unilateral			Bilateral
			Rt	Lt	Total	
	M=57 (70.37%)	11 (19.3%)	3	2	5 (45.5%)	6 (54.5%)
	F=24 (29.63%)	3 (12.5%)	1	0	1 (33.3%)	2 (66.6%)
Total	81 (100%)	14 (17.3%)	4	2	6 (42.8%)	8 (57.2%)

DISCUSSION

Complete sacralization consists of a complete body union between the transverse process and the sacrum. Incomplete sacralisation shows a well-defined joint line between the process and the sacrum. They may be unilateral or bilateral. The complete bilateral sacralization varies into a sixth sacral vertebra and cannot be distinguished except by the number of other vertebrae present. In this present study the incidence of sacralisation of 5th lumber vertebra is 17.5% and slightly male predominance, on the other hand, evidence of sacralisation of coccygeal vertebra seen in 4 (4.94%) male sacra. Based on the previous literature these findings are comparable to the findings reported 11.5% by Zaveri et al.[9], 11.1% by Dharati et al.[10] and 10% by Swargam et al.[11] but differ with the findings reported 14.1% by Vandana et al.[12], 15% by Singh et al.[13], 6.6% by Khairnar et al.[14] and 9.2% by Hughes et al[15].

By approximately 17th day of intra-uterine life cells of mesodermal germ layer close to midline proliferate and form a thickened plate of tissue known as paraxial mesoderm. By the beginning of the third week

paraxial mesoderm is organized into segments, known as somitomeres, first appear in the cephalic region of the embryo, and their formation proceeds cephalocaudally. Each somitomere consists of mesodermal cells arranged in concentric whorls around the center of the unit. From the occipital region caudally, somitomeres further organize into somites. By the beginning of the 4th week, cells forming the ventral and medial walls of the somite lose their compact organization, become polymorphous and shift their position to surround the notochord and spinal cord. These cells collectively known as sclerotome. During the fourth week of development, cells of the sclerotomes shift their position to surround both the spinal cord and the notochord. This mesenchymal column retains traces of its segmental origin, as the sclerotomic blocks are separated by less dense areas containing inter segmental arteries. During further development the caudal portion of each sclerotomic segment proliferate extensively and condenses. This proliferation is so extensive that it proceeds into the subjacent intersegmental tissue and binds the caudal half of one sclerotome to the cephalic half of the subjacent sclerotome. Thus, the body of the vertebra is formed which is intersegmental in origin. Mesenchymal cells between the cephalic and caudal parts of the original sclerotome segment do not proliferate but fill the space between the pre-cartilaginous vertebral bodies. In this way they contribute to the formation of intervertebral disc.[16]

Improper formation, migration, differentiation and union of somites results into segmental vertebral abnormalities. The cranial shift often occurs at only one or two transitional border areas but caudal shifts involve three or four borders and the shifts are often in the same direction. The cranial shifts are more common than caudal shifts, so the sacralization is more common than lumbarization[12,17]. Patterning of the shapes of the different vertebrae is regulated by HOX genes. The normal patterning of lumbar and sacral vertebrae as well as the changes in the axial pattern, such as lumbosacral transitional vertebra, results from mutations in the HOX- 10 and HOX -11 paralogous genes[18].

CONCLUSION

The association of LSTV and low back pain is known as Bertollott's syndrome. In chronic cases LSTV leads to Pain due to nerve trunk compression which is perhaps due to intervertebral disc degeneration and or herniation. The proper knowledge of LSTV is important to the surgeons and anesthetists during operation. Though this study does not show prevalence of sacralization, specifically in found in Burdwan district but still will play a vital role in different diagnostic and therapeutic procedures. The information about sacra with five pairs of sacral foramina stresses upon accurate radiological evaluation before any interventional measures.

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