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# An interesting variation in the fifth lumbar vertebra

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## Introduction

Variations in the lumbosacral region of the vertebral column are frequent and well documented [HIBBS, SWIFT 1929; HORWITZ, SMITH 1940; NATHAN, ARENSBURGH 1972]. Ten percent of patients presenting with symptoms of low back-pain are found to have some segmental anomaly of the lumbosacral spine [MCCULLOCH, WADDELL 1980].

In the present report, an interesting variation of the fifth lumbar vertebra (L5) is described and appraised with respect to its embryology and its possible functional significance.

## Material and description

The variant vertebra was found in the skeleton of a 60 year old black South African male. The skeletal material is housed in the Raymond A. Dart collection of the Department of Anatomy and Human Biology at the University of the Witwatersrand, Johannesburg. No abnormalities, other than the variations presently described, were found in the skeleton. The most striking variant feature is a round foramen of approx. 3 mm diameter in the left transverse process (fig. 1). The orientation of the superior articular facets is asymmetrical, in that the left facet is orientated in the usual coronal plane, while the right facet is sagittally orientated (fig. 1). In addition, the left superior articular facet is larger than its fellow. The above arrangement mirrors that of the inferior articular facets of the fourth lumbar vertebra with which the variant vertebra articulates. The height of the right side of the body of L5 is markedly greater than that of the left side resulting in the shape of the

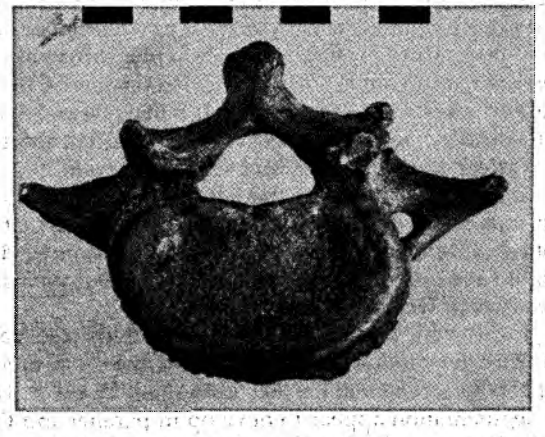

**Fig. 1.** Fifth lumbar vertebra (superior aspect) showing a foramen in left transverse process and asymmetrical orientation of the superior articular facets

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right intervertebral notch being correspondingly more rounded than that of the left, which is flatter supero-inferiorly. The spine of the variant vertebra is unusually bifid and inclines toward the right and the right prominence of the bifid spine is longer and more massive than the left. The above-mentioned features of the spine of the variant vertebra are common to all of the preceding lumbar vertebrae of the skeleton presently being discussed. There is no evidence of sacralisation of the variant vertebra.

## Discussion

The unusual foramen in the left transverse process of L5 may be considered as the sequel of either of two possible developmental pathways. We propose that both pathways involve the interposition of an artery in the sclerotome of the developing vertebra.

In the lumbar region, the dorsal aorta gives off an intersegmental branch at each vertebral level. However, at the 5th lumbar vertebral level, there is no such intersegmental artery. The supply at this level is usually from the lumbar branch of the iliolumbar artery which arises from the internal iliac artery in the pelvis [BECK, MOFFAT, DAVIES 1985, p. 197]. In the present case, it is possible that this lumbar branch became interposed, during development, between the two chondrification centres of the developing left transverse process of L5. This is a likely possibility since the dorsal arteries arise from the developing dorsal aorta at about the same time as the mesenchyme of the sclerotome is migrating medially to form the L5 vertebra [BECK, MOFFAT, DAVIES 1985, pp. 120-2; WILLIAMS, WARWICK 1980, pp. 138-40]. After migration has occurred, the mesenchyme of the sclerotome is converted to cartilage from three primary chondrification centres, a dorsal centre for the neural arch, a lateral for the transverse process and a ventral for the costal element [WILLIAMS, WARWICK 1980, p. 282; BECK, MOFFAT, DAVIES 1985, pp. 120-2]. In the lumbar region, the costal element fuses with the transverse process element, such that no visible distinction can usually be made between the two in the adult [BECK, MOFFAT, DAVIES 1985, p. 124]. In the present case, however, the lumbar branch of the left iliolumbar artery could have interrupted the above-mentioned fusion in the L5 vertebra, resulting in the foramen in the left transverse process.

The second possible cause of the variant foramen concerns the umbilical arteries. These develop as the most caudal pair of arteries from the descending aorta. At around six weeks of embryonic life, both the left and right umbilical arteries anastomose with the common iliac artery of the same side whilst losing their connection with the descending aorta. At birth, the proximal end of each umbilical artery persists as a terminal branch of the internal iliac artery [AREY 1965]. In respect of the present L5 vertebra, the proximal end of the left umbilical artery might have persisted at its connection with the left common iliac artery, thereby being positioned within the mesenchyme of the developing left transverse process. Chondrification of the transverse process and costal element would then have proceeded around the proximal end of the persistent umbilical artery, giving rise to the observed foramen.

Could the foramen in the left transverse process of L5 be developmentally associated with the asymmetry of the superior articular facets of that vertebra? We suggest that the above-mentioned interposing artery, in upsetting the normal development of the left transverse process, might have caused a lesser amount of mesenchymal material to be available for the formation of the articular facets.

Insufficient evidence is available from the skeletal material and patient record to determine whether the variations described have given rise to mechanical instability of the zygapophyseal joints between L4 and L5. According to MCCULLOCH and WADDELL [1980], neurological and bony segmentation appear to develop in parallel and the myotomes tend to match the bony anomaly. It is possible, therefore, that the greater bulkiness of the right side of the spinous processes of L2 to L5 resulted from increased muscle activity in those regions, serving to compensate for functional consequences of the asymmetries as observed in the L5 vertebra.

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