A STUDY OF LUMBAR ARTERIES IN A SOUTH INDIAN POPULATION AT A TERTIARY CARE CENTRE

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INTRODUCTION

There are usually four lumbar arteries on each side, right and left, arising from the posterolateral aspect of the abdominal aorta[1]. Occasionally, a fifth lumbar artery may be seen arising from the median sacral artery. Above the bifurcation of the aorta, it gives rise to the median sacral artery from its posterior aspect, and the common iliac artery gives origin to the iliolumbar artery. [1] The four lumbar arteries run posterolaterally on the bodies of the first four lumbar vertebrae, pass posterior to the sympathetic trunk between the lumbar transverse processes, and then continue into the muscles of the anterior abdominal wall. [1,2] The first and second lumbar arteries on the right side, and the first lumbar artery on the left side, pass posterior to the right and left crura of the diaphragm respectively. [6] These vessels anastomose with each other and with the subcostal, iliolumbar, lower posterior intercostal, deep circumflex iliac and inferior epigastric arteries, ultimately supplying the muscles, ligaments, fasciae, joints, vertebrae and intervertebral discs of the lumbar region. [1]

A sound understanding of lumbar artery anatomy underpins several areas of clinical practice. During adult life, the median sacral and lumbar arteries are frequently obliterated by atheromatous change; this reduction in segmental blood supply has been linked to chronic low back pain and to accelerated intervertebral disc degeneration. [3,4] During endovascular repair of abdominal aortic aneurysms, patent lumbar arteries are not ligated within the excluded aneurysm sac and can continue to transmit retrograde pressure into the sac, predisposing to type II endoleak and, rarely, sac rupture. [5]

MATERIALS AND METHODS

This study was conducted on 69 formalin-fixed cadaveric specimens in the Department of Anatomy, Sree Mookambika Institute of Medical Sciences, between 2012 and 2021. Pelvic dissection was performed according to the technique described in Cunningham's Manual of Practical Anatomy, Volume 2. The pelvic viscera were reflected away from the pelvic side walls to expose the abdominal aorta and its branches; accompanying veins were removed to permit clear identification of the arteries.

RESULTS

In the 69 dissected specimens, the first four pairs of lumbar arteries showed a normal origin and course in every case. A fifth lumbar artery was identified in two specimens (Table 1).

In one specimen, right and left fifth lumbar arteries arose from a common trunk originating from the posterior aspect of the abdominal aorta at the level of the aortic bifurcation, anterior to the upper border of the fifth lumbar vertebra. The left fifth lumbar artery (Figure 1a) arose from this common trunk at the level of termination of the abdominal aorta, ran along the left side of the L5 vertebral body anterior to the sympathetic trunk, and passed deep to the tendinous arch giving origin to psoas major. Deep to psoas major it divided into two branches: one coursed along the upper border of the iliac crest, anterior to the iliolumbar ligament, passing between transversus abdominis and internal oblique to supply them; the other passed downward, giving a spinal branch and supplying the connective tissue of the presacral region. The right fifth lumbar artery (Figure 1b) ran behind the inferior vena cava, deep to the tendinous arch of psoas major, and likewise divided into two branches deep to the muscle — one running laterally, anterior to the iliolumbar ligament, to supply transversus abdominis and internal oblique, and the other passing downward to supply iliacus.

The other specimen presented with a fifth lumbar artery only on the left side (Figure 2), arising from the left common iliac artery.

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Table 1. Origin of the fifth lumbar artery among the study specimens

Origin of right and left fifth lumbar artery	Specimens (n)	Percentage
Left 5th lumbar artery from abdominal aorta	1	0.69%
Left 5th lumbar artery from left common iliac artery	1	0.69%
Right 5th lumbar artery from abdominal aorta	1	0.69%
Total specimens with a 5th lumbar artery	2	2.89%

DISCUSSION

Variation in the branching pattern of the lumbar arteries, and the occasional presence of a fifth lumbar artery, carries clinical and surgical significance. In a cadaveric study of 109 specimens, Karunanayake and Pathmeswaran found that lumbar arteries arose from a common stem in 12% of cases, with the third and fourth pairs sharing a common stem in 3% and 11% of specimens respectively, and the first and second right-sided lumbar arteries passing anterior to the right crus of the diaphragm in 7% and 8% of cases[6]. In a more recent combined cadaveric and CT study of 210 lumbar artery sets in a Kenyan population, Amuti et al reported three to five pairs of lumbar arteries, with the first three pairs typically arising as single ostia and the fourth pair more often sharing a common stem; the first three arteries chiefly originated at the upper third of their respective vertebral bodies, while the fourth artery predominantly arose at the lower third[2]. In an earlier historical account, Young similarly observed that, owing to fusion of their origins, the lumbar arteries may arise bilaterally from a common single stem or separately from the aorta at the same level[7]. Beveridge et al, quantifying the variable positioning of the lumbar vessels for application to retroperitoneal surgery, likewise emphasised that the number of lumbar artery pairs, their pattern of origin, and their distance from the aortic bifurcation vary between individuals and should be anticipated during posterior abdominal wall dissection[10]. This variability appears to have an embryological basis: the paired dorsal intersegmental arteries that give rise to the lumbar arteries may fuse partially during formation of the dorsal aortae between the third and seventh weeks of gestation, producing common-stem origins; Şeker et al documented comparable variation in the number and origin of the lumbar arteries, including the fifth pair, in a morphometric study of human fetuses[12].

Reduced segmental vascular supply to the paravertebral muscles and vertebral column has been proposed as a contributor to low back pain. Kauppila and Tallroth found that 88% of patients with low back pain had one or more absent lumbar artery pairs on postmortem angiography, supporting a vascular contribution to symptoms[3]. Beckworth et al subsequently demonstrated, using CT angiography, that atherosclerotic occlusive disease of the lumbar arteries correlates with degenerative disc disease, facet arthropathy and spinal stenosis[8]. Ratcliffe, in an arteriographic study of one hundred live subjects, found the fourth lumbar artery absent in 37 of 100 cases and visualised in the remaining 63; a fifth lumbar artery was partially or completely opacified bilaterally in 38 cases and unilaterally in 14[9]. Low back pain remains a substantial global health burden: a systematic review and meta-analysis by Morris et al reported a lifetime prevalence of low back pain of 47% and a point prevalence of 39% among African populations, both exceeding global estimates, underscoring the potential relevance of vascular insufficiency as a contributing mechanism[11].

Atheromatous obstruction of the lumbar arteries has also been linked to disc degeneration; Kauppila's systematic review concluded that atherosclerosis of the lumbar segmental vessels is associated with disc degeneration and low back pain, plausibly through impaired nutrient diffusion to the avascular disc[4].

Retroperitoneally, the vasculature of the lumbar arteries follows a broadly consistent pattern, though individual variation is common, particularly in the number of vessels arising from the abdominal aorta (typically two to five pairs) and their relationship to the aortic bifurcation[10].

Iatrogenic injury to the lumbar arteries is a recognised complication of several percutaneous and endovascular procedures. Liu et al, analysing 78 abdominal CT angiograms, characterised the course of the lumbar arteries in relation to the extrapedicular approach used in percutaneous vertebroplasty and kyphoplasty, and concluded that this approach carries a high risk of lumbar artery injury at L4 and L5, particularly in female patients, and is therefore not recommended at these levels[13].

Case reports continue to illustrate this risk: Krejčí et al described a delayed rupture of a lumbar artery as an unusual complication of percutaneous renal biopsy[14], and Devi et al similarly reported significant lumbar arterial haemorrhage following renal biopsy that required selective embolisation[15].

Chahrour et al documented pseudoaneurysm formation after percutaneous renal biopsy in a patient with systemic lupus erythematosus, highlighting the additional bleeding risk conferred by underlying connective tissue and renal disease[16].

More recently, Xie et al reported haemorrhagic shock from lumbar artery rupture after percutaneous vertebroplasty in a 90-year-old patient, emphasising the vulnerability of elderly, osteoporotic patients to this complication[17], while Giordano et al described successful endovascular management of a ruptured lumbar artery pseudoaneurysm following combined

cryoablation and vertebroplasty of a lumbar metastasis[18]. Ngo et al proposed a structured workflow for the recognition and management of massive lumbar arterial bleeding after percutaneous renal biopsy, reflecting growing recognition of this complication across nephrology and interventional radiology practice[19].
The major complication of endovascular abdominal aortic aneurysm repair remains endoleak, most commonly arising from retrograde flow through patent lumbar arteries or the inferior mesenteric artery into the excluded aneurysm sac. Giagtzidis et al, reviewing their experience with transarterial coil embolisation for type II endoleak after endovascular aneurysm repair, achieved primary technical success in 84.6% of patients, underscoring both the clinical importance of lumbar arterial anatomy in aneurysm sac exclusion and the feasibility of endovascular management once endoleak occurs[5].

CONCLUSION

Lumbar arteries are of considerable importance in diagnostic, analytical and therapeutic practice. Variation in their origin and course can complicate the interpretation of angiographic and cross-sectional imaging. The present study shows that, in most specimens, the origin and course of the first four lumbar arteries are normal, with a fifth lumbar artery present in 2.89% of cases. While earlier literature describes the fifth lumbar artery as typically arising from the median sacral artery, the present study instead found it arising from the abdominal aorta (Figure 1a, b) and from the common iliac artery (Figure 2). As the lumbar arteries are prone to haemorrhage during investigative and surgical procedures — particularly renal biopsy, as reported by multiple authors — detailed anatomical knowledge of the first four, and occasional fifth, lumbar arteries is essential for vascular surgeons, nephrologists performing percutaneous renal biopsy and nephrostomy, radiologists interpreting abdominal CT angiography, and spine surgeons performing extrapedicular percutaneous vertebroplasty.

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