



Anatomical variations of iliolumbar artery and its relation with surgical landmarks

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Objectives: The aim of this study was to reveal the variations of origin of iliolumbar artery, and its relations with the surrounding surgically important anatomical structures.

Methods: The origin, diameter, and tract of iliolumbar artery were determined bilaterally in 21 formalin-fixed adult male cadavers (21 right and 21 left arteries) in the Laboratory of Department of Anatomy.

Results: Iliolumbar artery was originating from common iliac artery in 4.8% (2 arteries), internal iliac artery in 71.4% (30 arteries), posterior trunk of internal iliac artery in 19% (8 arteries), and as two different arteries from internal iliac artery in 4.8% (2 arteries) of the cases. The mean diameter of the iliolumbar artery was 3.7 mm.

Conclusion: The anatomical properties of iliolumbar artery and its relation with anatomical landmarks, which were presented here, would be helpful in decreasing iatrogenic trauma to iliolumbar artery during surgery.

Key words: Anatomy; clinical application, iliolumbar artery; injury; spine surgery.

Iliolumbar artery classically arises from the posterior radix of internal iliac artery and extends in an oblique fashion superiorly and laterally in front of sacroiliac joint and lumbosacral trunk. It crosses obturator nerve and external iliac artery and vein. Subsequently it reaches to medial edge of psoas major, branches off lumbar and iliac arteries behind this muscle, and joins the arterial supply of iliac bone, iliopsoas, quadratus lumborum, and cauda equina.^[1] Iliolumbar arterial injuries can be seen during anterior and anterolateral surgical procedures of lumbar/lumbosacral vertebrae, and major vascular and neural structures.^[2,3]

Beside the deep circumflex iliac artery, iliolumbar artery is used as a convenient and permanent feeding

pedicle in iliac crest flaps.^[1,4] Iliac artery and its branches can be damaged during the anterior and anterolateral spinal approaches, lumbosacral spinal endoscopic procedures, and especially far-lateral disc excision. Additionally, during anterior approaches to sacroiliac joint for arthrodesis or internal fixation, iliolumbar artery and its branches may be injured iatrogenically and intraoperative hemorrhage can be seen.^[5,6] Iliolumbar artery also has an injury risk in posterior pelvic fractures (open book or shearing fractures), because it is very close to sacroiliac joint.^[6,7]

Location and variations of iliolumbar artery are very important for surgeons, since it is used as feeding pedicle in bone flaps and has injury risk after pelvic trauma or regional operations.^[5] On the other

hand, there are only a few studies investigating its anatomical variations and its relations with the important neurovascular structures. In this study, we aimed to determine the variations of iliolumbar artery and its relation with important anatomical structures.

Materials and methods

This study was performed in Dokuz Eylül University Faculty of Medicine, Laboratory of Department of Anatomy. The origin, diameter, and course of iliolumbar artery were evaluated bilaterally in 21 (21 right and 21 left arteries) formalin-fixed adult cadavers. Common iliac artery, external iliac artery, and internal iliac artery were dissected. After iliolumbar artery was defined, origins were determined and dissected. Obturator nerve and lumbosacral trunk, which are closely related with iliolumbar artery, were determined and dissected. The diameter of iliolumbar artery at its origin, its length up to the point it divides into lumbar and iliacus branches, the distance between the iliolumbar artery and L5 inferior margin, and the distance between the iliolumbar artery and bifurcation point of common iliac artery were measured. The relation of the iliolumbar artery to obturator nerve and lumbosacral trunk was determined and recorded. The measurements were performed by using a Vernier caliper sensitive to 0.1 mm. Data were analyzed with descriptive statistics in SPSS 11.0 software.

Results

Iliolumbar artery was exposed in all 21 cadavers (42 arteries) bilaterally. The iliolumbar artery arose from common iliac artery in 4.8% (2 arteries) (Fig. 1), from internal iliac artery in 71.4% (30 arteries) (Fig. 2), from posterior trunk of internal iliac artery in 19% (8 arteries) (Fig. 3), and from two different points from internal iliac artery in 4.8% (2 arteries) of the arteries (Fig. 4). The mean diameter of iliolumbar artery at origin was 3.7 ± 0.7 mm. The mean distance between origin of the iliolumbar artery and bifurcation point to iliacus and lumbar branches was 13.2 ± 5.5 mm. The distance between origin of the iliolumbar artery and lower edge of lumbar fifth vertebra was 43.2 ± 12.6 mm. The distance between origin of the iliolumbar artery and bifurcation point of the common iliac artery was 28.7 ± 12.6 mm.

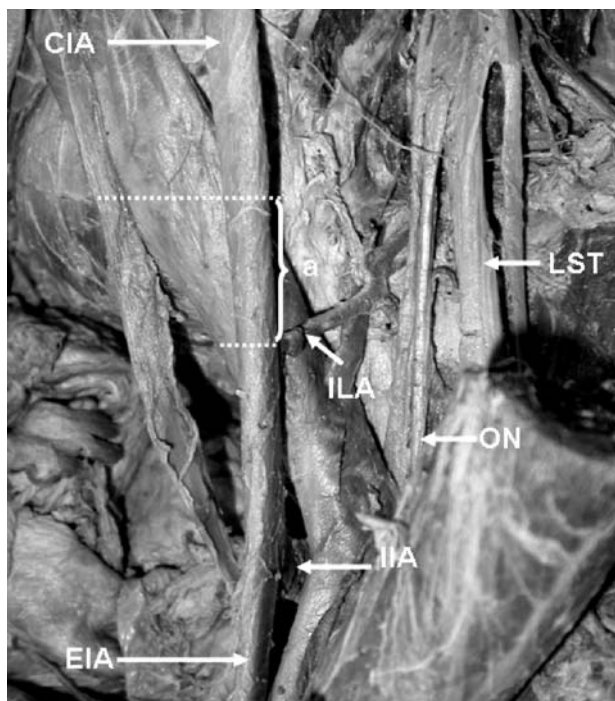


Fig. 1. Iliolumbar artery arising from common iliac artery. CIA: Common iliac artery, ILA: Iliolumbar artery, IIA: Internal iliac artery, EIA: External iliac artery, LST: Lumbosacral trunk, ON: Obturator nerve, a: Distance between origin of the iliolumbar artery and L5 inferior margin (left side).

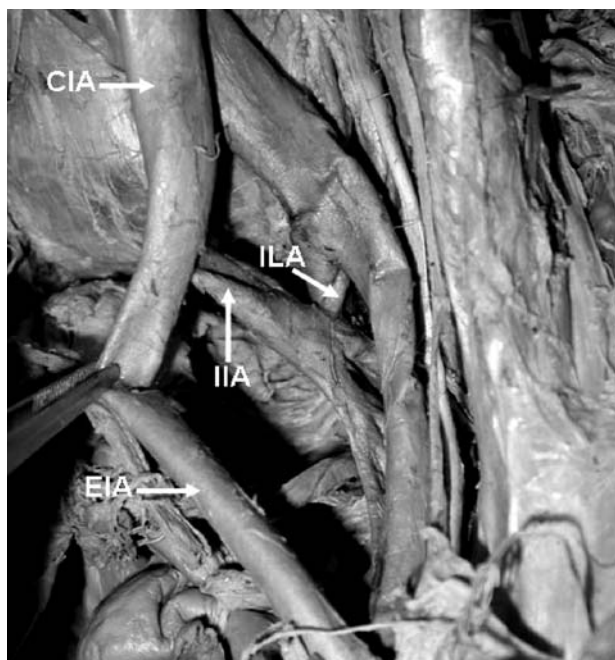


Fig. 2. The iliolumbar artery arising from internal iliac artery. CIA: Common iliac artery, ILA: Iliolumbar artery, IIA: Internal iliac artery, EIA: External iliac artery (left side).

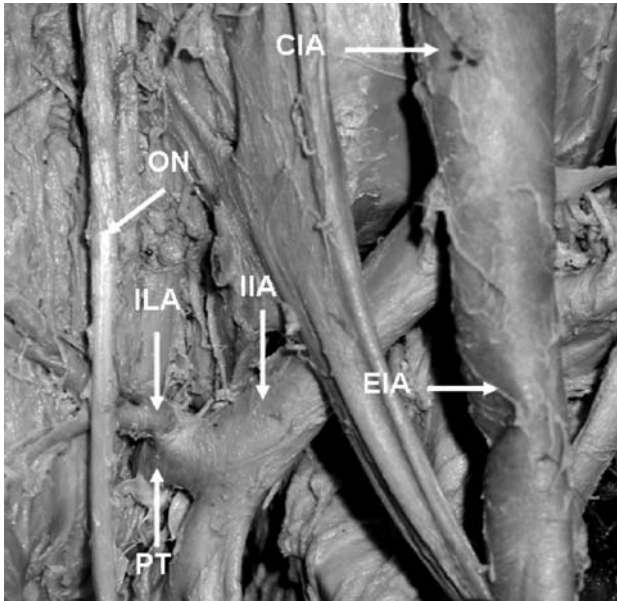


Fig. 3. The iliolumbar artery arising from posterior trunk of internal iliac artery. CIA: Common iliac artery, ILA: Iliolumbar artery, IIA: Internal iliac artery, EIA: External iliac artery, PT: Posterior trunk, ON: Obturator nerve (right side).

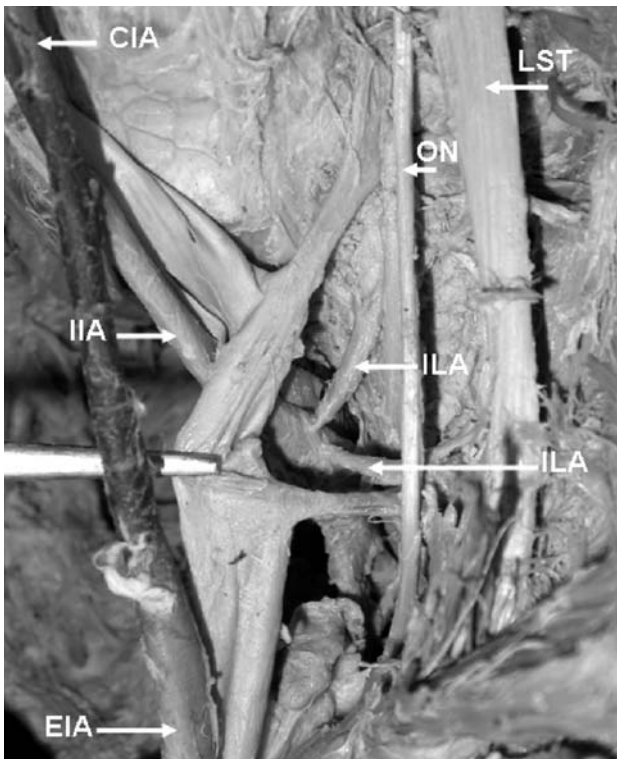


Fig. 4. The iliolumbar artery arising from two different points from internal iliac artery. CIA: Common iliac artery, ILA: Iliolumbar artery, IIA: Internal iliac artery, EIA: External iliac artery, LST: Lumbosacral trunk, ON: Obturator nerve (left side).

Obturator nerve is one of the important neural structures closely related with iliolumbar artery before dividing to lumbar and iliacus branches. In two cadavres iliolumbar arteries passed from and in 40 from posterior of obturator nerve. Two iliolumbar arteries passed from anterior and 40 from posterior of obturator nerve. Lumbosacral trunk was the other neural structure closely related with the artery. According to lumbosacral trunk, iliolumbar artery passed anteriorly in 22 (52.4%) and cleaved in 15 (35.7%), and posteriorly in 5 cases (11.9%).

Discussion

In reconstructive bone surgery, vascularized bone grafts have some advantages such as rapid bone healing and decreased morbidity. In these surgical approaches; fibula, iliac crest and ribs are used frequently as donor sites.^[1,4,8] Although fibula has a strong cortical formation, complication risk is increased due to elongated revascularization when it is used as bone flap. Costal and iliac crest flaps can be used as pedicle flap without microsurgical vascular anastomosis. The disadvantages of vascular costal flaps are their inclined shape and their relatively weak cortical structure. Pedicle length of vascular costal flaps is also not enough for large bony spinal defects. Iliac crest is supplied by different vessels and it can be used in reconstructive bone surgery in different ways.^[1] Deep circumflex iliac artery, superior gluteal artery, fourth lumbar artery, and iliolumbar artery are used as vascular pedicle in iliac crest flaps. Iliolumbar artery and its branches are used in bone reconstructions and particularly in lumbar spinal surgery as supplying pedicle, because it is easily defined, lies in loose connective tissue, and has appropriate length and diameter.

Besides serving as a vascular pedicle of bone grafts, the trajectory of iliolumbar artery is important because it is vulnerable to injury during lumbosacral spinal surgery, anterior approaches to sacroiliac joint, and posterior pelvis fractures. Harrington^[5] reported that iliolumbar artery can be injured during L5-S1 far-lateral disc excision and emphasized the importance of its variations at this level. Ebraheim et al.^[6] reported that iliolumbar artery and branch supplying ilium that arises from iliolumbar artery have injury risk during anterior approaches to sacroiliac joint for arthrodesis and internal fixation. Thus, the

anatomic location of the artery must be well known. In addition, Yiming et al.^[7] suggested that iliolumbar artery can be injured during open-book or shearing fractures because it has very close relation with sacroiliac joint. So if a patient has pelvic posterior arcus fracture and bleeding symptoms, injury risk of iliolumbar artery should be considered.

The vascular anatomy of pelvis and sacrum is also very important in orthopedic surgery and in some spinal fixations. The relationship of the iliolumbar artery with sacroiliac joint and L5 increases the injury risk of artery during posterior pelvic fixations or lumbosacral implantations. Anterior exposure of the lumbosacral junction and the L4/L5 disc space is widely used in the surgical treatment of tumors, infections, and degenerative disorders. Posterior surgery is advocated for open-book type pelvic fractures, and it can be used by percutaneous way.^[9] It is also indicated for spinopelvic fixations in neuropathic scoliosis. For these approaches, determination of variations of the iliolumbar artery and topographical patterns are crucial. Harrington^[5] emphasized that iliolumbar artery variants may be at the margins of extraforaminal intervertebral disc exposures, and thus, preoperative magnetic resonance imaging scans should be evaluated for this vasculature structure. It was biomechanically shown that the bicortical screw purchase to the sacrum increases the pull-out strength.^[10] This theory may be adapted to other cancellous bones such as pelvis and sacroiliac joint. The tip of the screws or pins may penetrate the inner cortex of pelvic bones and may damage the vascular structures.^[11] Therefore, iliolumbar artery variations and related neurovascular structures are important.

Chen et al.^[4] reported that iliolumbar artery arises 96.3% from internal iliac artery and 3.7% from common iliac artery. Yiming et al.^[7] studied 10 cadavers and found that iliolumbar artery arises from internal iliac artery in all. In our study, the iliolumbar artery arose mostly from internal iliac artery (71.4%) and from common iliac artery in 4.8%, from posterior trunk of internal iliac artery in 19%, and from two different points of internal iliac artery in 4.8% of cases.

Chen et al.^[4] evaluated the diameter and length of iliolumbar artery at medial of psoas major and found

that its mean diameter is 2.7 ± 0.6 mm and length is 2.2 ± 0.7 cm. Harrington^[5] reported that its diameter is 3–4 mm. In our study the average diameter of iliolumbar artery at origin was 3.7 ± 0.7 mm and the distance between the origin and the bifurcation point was 13.2 ± 5.5 mm. The distance between origin of the iliolumbar artery and bifurcation point of the common iliac artery was 28.7 ± 12.6 mm. Harrington^[5] reported this distance as 2 cm. This shows that the numeric measurements are similar between studies and there is no remarkable difference between people from different ethnic origins in terms of measurements.

In addition, we found that the mean distance between origin of iliolumbar artery and lower edge of L5 vertebra was 43.2 ± 12.6 mm. We also evaluated its relation with obturator nerve, one of the important neural structures closely related with iliolumbar artery, before it is divided to lumbar and iliac branches and found that iliolumbar artery passed from anterior of obturator nerve in 2 cases (4.8%) and from posterior of obturator nerve in 40 cases (95.2%). The other important neural structure, which is closely related with artery, is lumbosacral trunk. With respect to lumbosacral trunk, iliolumbar artery passed anterior in 22 cases (52.4%), posterior in 5 cases (11.9%), and cleaved in 15 cases (35.7%).

This study showed that iliolumbar artery has many different variations. Injury of iliolumbar artery during surgery may lead to acute hemorrhage or postoperative hematoma. Anatomical variations of iliolumbar artery can also be important for harvesting the vascular iliac bone graft. The surgeon should consider that the anatomical variations of iliolumbar artery may complicate both anterior exposure of lumbosacral junction and posterior sacroiliac fixations.

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