Review

Step by step ligation of internal iliac artery

Selçuk et al. Ligation of internal iliac artery

İlker Selçuk¹, Bora Uzuner², Erengül Boduç², Yakup Baykuş³, Bertan Akar⁴, Tayfun Güngör¹

1Department of Gynecologic Oncology, Health Sciences University, Zekai Tahir Burak Woman's Health Training and Research Hospital, Ankara, Turkey

2Department of Anatomy, Kafkas University Faculty of Medicine, Kars, Turkey

3Department of Obstetrics and Gynecology, Kafkas University Faculty of Medicine, Kars, Turkey

4Clinic of Obstetrics and Gynecology, VM Medical Park Kocaeli Hospital, Kocaeli, Turkey

Address for Correspondence: İlker Selçuk

Phone: +90 312 306 50 00 e.mail: ilkerselcukmd@hotmail.com

ORCID ID: orcid.org/0000-0003-0499-5722

DOI: 10.4274/jtgga.2018.0124

Received: 8 October, 2018

Accepted: 28 November, 2018

Abstract

Internal iliac artery is the main vascular supply of pelvic visceral structures. All the pelvic surgeons must know the anatomic landmarks and basic steps of internal iliac artery ligation to stop a massive pelvic hemorrhage. This cadaveric demonstration and clinical review of internal iliac artery shows the anatomic landmarks and basic steps of internal iliac artery ligation.

Keywords: internal iliac artery, hypogastric, bleeding, postpartum, pelvic

Introduction

The anatomy of the internal iliac artery (IIA) has been well documented previously and it is the major blood supply of pelvic structures. It arises from the common iliac artery and runs infero-medially in the pelvis. An enormous number of small vessels, collateral circulation and variations exist in pelvic vasculature(1, 2) The role of internal iliac artery ligation to control intractable pelvic hemorrhage had been described by Howard Kelly for the first time in 1893 for a cervical carcinoma case(3). Actually, ligation of internal iliac artery could also be a life-saving procedure during peripartum bleeding(4, 5). Since IIA is the main blood supply of pelvic viscera, in selected cases ligation of internal iliac artery is also an option during intraperitoneal bleeding where the exact location can not be identified(6). During a massive pelvic hemorrhage or peripartum bleeding, bilateral ligation of internal iliac artery reduce the pelvic arterial blood flow by 49% and pulse pressure by 85%(7). After bilateral ligation of internal iliac artery collateral circulation will maintain the re-functioning of internal iliac artery. Deep femoral artery is the principal vascular supply to provide a re-vasculature to the internal iliac artery. Anastomosis between medial femoral circumflex and obturator artery, and lateral femoral circumflex and superior gluteal artery are the main connection areas(8). Additionally, ovarian artery also provides a blood flow to the uterus. Despite bilateral ligation of internal iliac artery, future reproductive potential is not affected totally and term pregnancies has also been reported previously(9, 10).

Despite some technical difficulties with regard to anatomical relationships, and potential complications due to an injury during ligation of IIA; it provides a rapid way to decrease the pelvic arterial blood flow. Since all the pelvic surgeons need to know how to ligate the internal iliac artery, this clinical and photographic review will state the surgical technique used in ligation of internal iliac artery step by step.

Materials and methods

The figures of this study were obtained during the cadaveric dissections at Consultants in Obstetrics and Gynecology-Management of Peripartum Bleeding and Morbidity Cadaveric Course, Bahcesehir University Faculty of Medicine, Istanbul, 2017 and Management of Peripartum Hemorrhage Cadaveric Course, Kafkas University Faculty of Medicine, Kars, 2018.

Probable indications of internal iliac artery ligation

Ligation of internal iliac artery has a proven success rate to control a massive pelvic hemorrhage, varying between 40% and 100% and obstetric pathologies occupies the first place as the leading factor(11, 12). Table 1 shows the obstetric and gynecologic indications of internal iliac artery ligation.

Probable complications during ligation of internal iliac artery

The risk of operative injury beyond success is the major gap beneath the feasibility of the procedure (Table 2). A detailed knowledge of anatomy requires a good exposure to achieve the procedure with the maneuver of traction and counter-traction. Bilateral ligation of IIA is better to control the total blood flow in the pelvis and the surgeon would prefer to change the operative side for a comfortable surgical practice.

Basic anatomy of internal iliac artery

The aorta is divided into left and right common iliac arteries at the level of lumbar fifth (L5) vertebra and after a pathway of 3-4cm common iliac artery gives the branches of external iliac artery and internal iliac artery. The internal iliac artery runs infero-medially after the pelvic brim (Figure 1) and has two divisions, posterior and anterior (Table 3). Anterior division starts after 2.5-3.5cm from the origin of IIA and branches of posterior division diverges before that part. Anterior division is the main blood supply of pelvic viscera.

Accurate identification of adjacent anatomic structures (Table 4) will make the procedure easier and decrease the risk of complications during the surgical approach (13).

Clinical tips

Monopolar or bipolar electrocoagulation could also be used during dissection of the surgical field, bleeding from small veins will stop spontaneously, nevertheless care must be taken. Before ligation of internal iliac artery, dissection of ureter is extremely important and better than just palpation of ureter in the context of preventing any probable injury. Although ligation of internal iliac artery could be performed at any side of the patient either right or left, the surgeon must be careful during dissection and traction of the internal iliac artery because the movement of right angle clamp from medial to lateral will cause a laceration on the external iliac vein.

Conflict of interest

Nothing to declare as a conflict of interest.

Author contribution

I. Selcuk: Hypothesis, dissection, manuscript writing
B. Uzuner: Data collection, dissection
E. Boduc: Data collection, dissection
Y. Baykus: Dissection
B. Akar: Dissection
T. Gungor: Manuscript mentorship

Acknowledgement

These cadavers were imported from science-care organization, U.S.A. for educational purposes.

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Table 1: Indications of internal iliac artery ligation

A. Obstetric factors
Uterine atony
Uterine laceration or rupture
Abruptio placenta
Placental adhesion disorders
Placenta accreta, increta, percreta
Cervical pregnancy
B. Gynecologic factors
Gynecological oncologic procedures
Mass/tumor at the deeper part of pelvis
Exenteration surgery
Radical hysterectomy
Extended radical operations
Postoperative unknown site for pelvic hemorrhage

Table 2: Operative complications during ligation of internal iliac artery

Injury of external iliac vein
Injury of internal iliac vein
Ligation or laceration of external iliac artery
Injury of internal iliac artery
Ligation or laceration of ureter

Table 3: Branches of internal iliac artery with regard to divisions

Posterior division
Iliolumbar artery
Lateral sacral artery
Superior gluteal artery
Anterior division
Internal pudendal artery
Inferior gluteal artery
Obturator artery
Uterine artery
Middle rectal artery
Vaginal artery
Superior vesical artery
Inferior vesical artery

Table 4: Anatomical relations of internal iliac artery

Anterior	Peritoneum
Medial	Ureter
Infero(medial)	Internal iliac vein
Lateral	Psoas major muscle, internal obturator muscle
Inferolateral	External iliac vein and obturator nerve

STEP BY STEP LIGATION OF INTERNAL ILIAC ARTERY

Cadaveric dissection by

Dr. Ilker SELCUK

Health Sciences University, Zekai Tahir Burak
Woman's Health Health Practise and Research
Center, Department of Gynecologic Oncology

Hacettepe University, Faculty of Medicine,
Department of Anatomy

Anatomy of internal iliac artery (Figure 1)

Figure 1: Basic anatomic structures and branches of internal iliac artery; Right pelvic side wall, superior view (1. Common iliac artery, 2. External iliac artery, 3. Internal iliac artery (IIA), 4. Superior gluteal artery, 5. Iliolumbar artery, 6. Lateral sacral artery, 7. Uterine artery (red line), 8. Ureter (white line), 9. Umbilical artery (obliterated), 10. Inferior gluteal artery, 11. Internal pudendal artery, 12. Obturator artery, 13. Obturator nerve (yellow line), 14. Lumbosacral trunk (yellow line), 15. S1 Nerve (yellow line), 16. Middle rectal artery, X. Ligation point of IIA)

Entering the retroperitoneum (Figure 2A, 2B, 2C, 2D)

a

Figure 2A: The lateral parietal peritoneum over the pelvic side wall (over the psoas major muscle and external iliac artery) between the Round ligament (ligamentum teres uteri) (blue line) and infundibulopelvic ligament (ligamentum suspensorium ovarii) (red line) is cutted (X). During this step the uterus is pulled towards the counter side (caudally) of the pelvic wall where we plan to enter the retroperitoneum.
(A: Uterus, B: Right fallopian tube, C: Right ovary, D: Rectum, E: Bladder)

b

Figure 2B: The incision is extended cranially to the level of pelvic brim (green line) parallel to the infundibulopelvic ligament.

c

d

Figure 2(C: superior view, D: lateral view): Posterior (medial) leaf of the Broad ligament (ligamentum latum uteri), (the peritoneum with the ovarian vessels), is tracted medially so the retroperitoneal area (red circle) is visualized.

Identification of ureter and internal iliac artery (3A, 3B, 3C, 3D, 3E)

Figure 3A: The ureter runs on the posterior leaf of Broad ligament under the ovarian vessels, medial to the anterior branch of internal iliac artery, so holding the medial leaf and making a blunt dissection towards the pelvic side wall cranio-laterally (white arrow) targeting the deeper part of medial peritoneal leaf will guide to identify the ureter.

b

c

Figure 3B/C: The ureter (F, white line) is identified on the base of Broad ligament, medial to the internal iliac artery (G, red line).

d

e

Figure 3D/E: The adipose and lymphatic tissue over the internal iliac artery is dissected with a caudal movement (white arrow) (3D). By the way; the ureter (F, white line), the internal iliac artery (G, red line), the external iliac artery (H) and the common iliac artery (I) will be noticed just over the pelvic brim at the upper part of pararectal space (3E) (borders of pararectal space: posteriorly promontorium, medially ureter and rectum, laterally internal iliac artery and anteriorly uterine artery and cardinal ligament (ligamentum transversum cervicis)).

Ligation of internal iliac artery (Figure 4A, 4B, 4C, 4D, 4E)

Figure 4A: A right angle clamp is put under the anterior division of internal iliac artery (white arrow) after main trunk gives the branches of posterior division.

Figure 4B: Care should be taken not to harm the underlying external iliac vein, located on the infero-lateral part of internal iliac artery. So that, the right angle clamp should be moved from lateral to medial under the internal iliac artery (white arrow) while holding the end point of clamp upperly.

Figure 4C: After getting on the other side beneath the internal iliac artery, the suture material is grasped (red circle) and pulled within the same direction to the backward.

Figure 4D: The ureter, external iliac artery and other important anatomic landmarks are re-checked and finally the suture is tied carefully (red rectangle).

Figure 4E: Superior view of right pelvic side wall, how to ligate the internal iliac artery, with close anatomic structures.