



Retroperitoneal anatomy and avascular spaces for pelvic surgery: Cadaveric dissection atlas

Pelvik cerrahi için retroperitoneal anatomi ve avasküler alanlar: Kadavra diseksiyon atlası

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Abstract

This paper presents a comprehensive cadaveric dissection atlas detailing the retroperitoneal anatomy essential to advanced pelvic surgery. Developed by a multidisciplinary team of anatomists, gynecologists, and gynecologic oncologists, the study provides a systematic, layer-by-layer guide for navigating the pelvic avascular spaces. It details five critical surgical corridors: the presacral (retrorectal) space, the pararectal space (divided into the Latzko and Okabayashi compartments), the paravesical space (medial and lateral compartments), the prevesical (retropubic/Retzius) space, and the medial psoas space (laterovascular plane). This atlas emphasizes the use of reliable landmarks, such as the sacral promontory, the obliterated umbilical artery, and the ureter, to define anatomical boundaries and ensure safe surgical practice. The primary objective is to maintain adequate exposure after retroperitoneal entry and to perform layer-by-layer surgical dissection to identify critical anatomical structures. The superior hypogastric plexus; hypogastric nerve; pelvic splanchnic nerves; inferior hypogastric plexus with its vesical and rectal branches; the internal iliac artery with its posterior and anterior trunk branches (including the superior gluteal, iliolumbar, lateral sacral, uterine, inferior gluteal, pudendal, obturator, middle rectal, and inferior and superior vesical arteries, and the obliterated umbilical artery); the external iliac artery; and the corresponding internal and external iliac veins were discussed. Additionally, the somatic nerves, obturator nerve, lumbosacral trunk, sacral nerves, sciatic nerve, genitofemoral nerve, and femoral nerve were reviewed. The parietal fascial planes, pubocervical fascial structure, and visceral compartments were evaluated as part of the whole. Respecting fascial planes—particularly the presacral fascia—is mandatory to avoid catastrophic hemorrhage and autonomic nerve injury. These spaces serve as the “neurovascular roadmap” for complex procedures, including radical hysterectomy, nerve-sparing pelvic surgery, pelvic lymphadenectomy, and hemorrhage control. Mastery of these interconnected retroperitoneal compartments facilitates a transition from organ-based to space-oriented surgery, significantly reducing morbidity while maintaining oncologic radicality.

Keywords: Retroperitoneum, pelvic avascular spaces, ureter, internal iliac artery, nerve-sparing surgery

Öz

Bu makale, ileri düzey pelvik cerrahi için gerekli olan retroperitoneal anatomiye dair ayrıntılı bir kadavra diseksiyon atlası sunmaktadır. Anatolistler, jinekologlar ve jinekolojik onkologlardan oluşan multidisipliner bir ekip tarafından geliştirilen çalışma, pelvik avasküler boşlukların cerrahide kullanılmasına yönelik sistematik, katman katman bir kılavuz sağlamaktadır. Beş kritik pelvik cerrahi alanı ayrıntılı olarak ele almaktadır: presakral (retrorektal) boşluk, pararektal boşluk (Latzko ve Okabayashi bölmelerine ayrılmıştır), paravezikal boşluk (medial ve lateral olarak değerlendirilir), prevezikal (retropubik/Retzius) boşluk ve medial psoas boşluğu (laterovasküler düzlem). Bu atlas, anatomik sınırları tanımlamak ve güvenli cerrahi uygulamaları sağlamak için sakral promontorium, oblitere umbilikal arter ve ureter gibi sabit referans noktalarının kullanımını vurgulamaktadır. Asıl önemli nokta, retroperitoneal girişten sonra yeterli cerrahi görünümün sağlanması ve kritik anatomik yapıları belirlemek için katman katman cerrahi diseksiyon yapılmasıdır. Superior hipogastrik pleksus, hipogastrik sinir, pelvik splanchnik sinirler, enferior hipogastrik pleksus, mesane ve rektal dalları, ayrıca superior gluteal arter, iliolumbar arter ve lateral sakral arter, uterin arter, inferior gluteal arter, pudendal arter, obturator arter, middle rektal arter, enferior ve superior vesical arter ve oblitere umbilikal arter gibi posterior ve anterior kök dalları olan internal iliak arter ile external iliak arter ve bunlara karşılık gelen internal iliak ve eksternal iliak ven ele alındı. Ayrıca, somatik sinirler, obturator sinir, lumbosakral trunk, sakral sinirler, siyatik sinir, genitofemoral ve femoral sinir incelendi. Parietal fasya düzlemleri, puboservikal fasyayı oluşturan kompartmanlar ve visseral bölmeler,

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Received/Geliş Tarihi: 23.02.2026 Accepted/Kabul Tarihi: 11.05.2026 Epub: 22.05.2026 Publication Date/Yayınlanma Tarihi: 04.06.2026

Cite this article as: Selçuk İ, Özdemir Ö, Kocabıyık N, Güner MA, Doğanay M. Retroperitoneal anatomy and avascular spaces for pelvic surgery: cadaveric dissection atlas. Turk J Obstet Gynecol.



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bir bütütün parçası olarak değerlendirildi. Cerrahi kanama ve otonom sinir hasarını önlemek için fasyal düzlemlere, özellikle de presakral fasyaya ve devamına özen göstermek gerekir. Bu alanlar, radikal histerektomi, sinir koruyucu pelvik cerrahi, pelvik lenfadenektomi ve kanama kontrolü de dahil olmak üzere kompleks cerrahi prosedürler için “nörovasküler yol haritası” görevi görür. Bu birbirine bağlı retroperitoneal alanların uygun kullanımı, organ odaklı cerrahiden alan odaklı cerrahiye geçişi sağlayarak, onkolojik radikalliği korurken morbiditeyi önemli ölçüde azaltır.

Anahtar Kelimeler: Retroperiton, pelvik avasküler alanlar, ureter, internal iliac arter, sinir koruyucu cerrahi

Introduction

The pelvic bones (sacrum posteriorly, pubic bone anteriorly, ilium posterolaterally on the superior side, ischium anterolaterally on the inferior side) encircle the pelvic structures. The inner layer of the pelvic bones is formed by the muscles (obturator internus laterally and levator ani at the base) and ligaments, all of which are covered by the parietal fascia. The loose, connective, and supportive fatty tissue surrounds the midline pelvic organs (the rectum posteriorly, the bladder anteriorly, and the uterus between them), and this compartment is covered by the parietal peritoneum⁽¹⁾. This review focuses on the detailed surgical anatomy of the pelvic retroperitoneum as encountered during incision of the pelvic parietal peritoneum and layer-by-layer dissection from superficial to deep structures. The pelvic avascular spaces—presacral, pararectal, paravesical, and prevesical—and the laterovascular plane (medial psoas space) are well described in the literature.

Methods

This educational cadaveric dissection was performed at the Anatomy Department Laboratory of the University of Health Sciences Türkiye, Gülhane Faculty of Medicine, Ankara, Türkiye. The multidisciplinary team, consisting of anatomists, gynecologists, and gynecologic oncologists, worked collaboratively. An educational video lecture of this video can be found on the YouTube platform (https://www.youtube.com/watch?v=x_VmYaQxclM&t=1402s).

Presacral Space (Retrorectal Space) Definition and Surgical Concept

The presacral space is a midline, retroperitoneal, avascular pelvic space located anterior to the sacrum and posterior to the rectum, extending from the pelvic brim (sacral promontory) to the pelvic floor. It represents the central posterior pelvic dissection plane and serves as a critical corridor for posterior pelvic surgery, nerve identification, and en bloc resections in gynecologic oncology. The presacral space is particularly important for the orientation of the superior hypogastric plexus, hypogastric nerves, and major pelvic vessels, and it acts as the anatomical bridge between the paraaortic region and the posterior pelvic compartments.

Anatomical Boundaries (Figures 1 and 2)

The presacral space is defined by constant and easily identifiable landmarks:

- Anterior boundary:
Rectum,
Mesorectal fascia (mesorectum).
- Posterior boundary:
Sacrum,
Presacral fascia (Waldeyer's fascia).
- Lateral boundaries:
Ureters,
Common iliac artery, internal iliac artery (proximal portions).
- Superior boundary:
Pelvic brim (sacral promontory),
Inferior border of the sigmoid mesocolon.
- Inferior boundary:
Levator ani muscle,
Anococcygeal ligament.

These boundaries position the presacral space as the deepest posterior pelvic avascular plane, in close proximity to major vascular and autonomic neural structures.

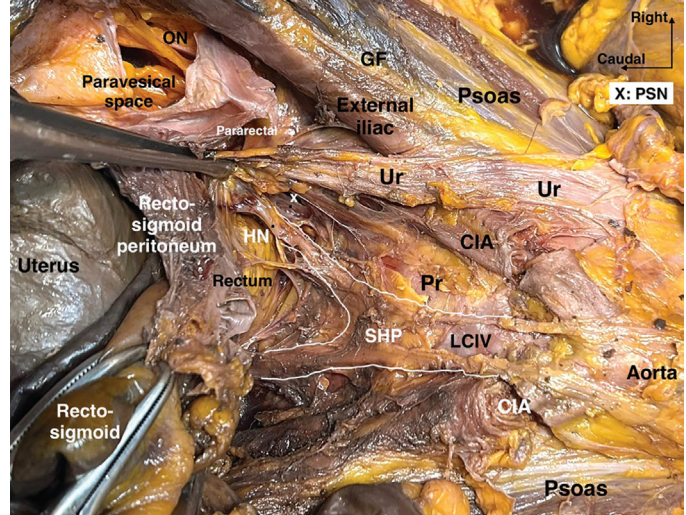


Figure 1. The presacral space, anterior to the sacrum and posterior to the rectum. Laterally, the common iliac artery and the ureter are visible. The left common iliac vein and the superior hypogastric plexus are important anatomical landmarks for the presacral space (All cadaveric dissections were performed by the author, MD-PhD İlker Selçuk, and his team)

CIA: Common iliac artery, Ur: Ureter, LCIV: Left common iliac vein, Pr: Promontorium, SHP: Superior hypogastric plexus, HN: Hypogastric nerve, ON: Obturator nerve, PSN: Pelvic splanchnic nerves, GF: Genitofemoral nerve

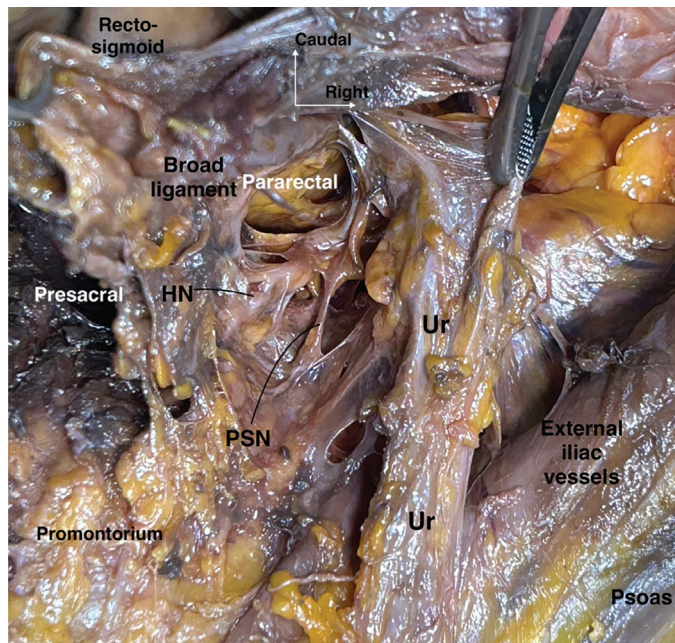


Figure 2. The anterolateral part of the presacral space with the hypogastric nerve and the pelvic splanchnic nerves. The presacral space is continuous with the pararectal space

Ur: Ureter, HN: Hypogastric nerve, PSN: Pelvic splanchnic nerves

Surgical Development (Step-by-Step)

1. Identification of the Sacral Promontory (Promontorium)

The sacral promontory is the key landmark for safe entry. It marks the transition between the paraaortic and pelvic retroperitoneum.

2. Peritoneal Incision

The parietal peritoneum is incised:

- On the right, inferior to the radix mesenterii of the small bowel,
- On the left, along the Toldt's line after mobilization of the sigmoid colon.

3. Recognition of Critical Structures

Ureters are identified laterally.

The left common iliac vein is visualized anterior to the lumbar 5th vertebra, superior to the sacral promontory.

Superior hypogastric plexus is identified anterior to the left common iliac vein or lumbar 5th vertebra, attached to the retrorectal adipose tissue (posterior mesorectal plane).

4. Blunt Dissection

Dissection proceeds anterior to the presacral fascia.

Sharp dissection posterior to the presacral fascia must be avoided to prevent massive venous bleeding.

5. Caudal Extension

The space is deepened toward the pelvic floor.

The superior hypogastric plexus is divided into right and left hypogastric nerves.

Hypogastric nerves are followed caudally and caudolaterally at the anterior (anterolateral) part of the sacrum towards the pararectal spaces.

Proper development results in a bloodless midline surgical corridor that allows safe posterior pelvic mobilization.

Contents and Key Structures

Although the presacral space is considered avascular, its walls are closely associated with critical elements:

• Neural

Superior hypogastric plexus at the superior part, mixed nerve with dominantly sympathetic and also partially parasympathetic activity.

Bilateral hypogastric nerve lies caudolaterally at the anterolateral part of the sacrum and the posterolateral part of the rectum.

• Vascular

Median sacral artery and vein, posterior to presacral fascia.

Left common iliac vein, superiorly.

Common iliac artery, laterally.

• Fascial

Presacral (Waldeyer's) fascia, the posterior boundary, covering the sacrum.

• Lymphatic

Presacral lymphatic tissue (limited but clinically relevant).

Understanding these contents is essential to avoid catastrophic hemorrhage and autonomic nerve injury.

Surgical Applications

The presacral space has multiple critical applications in pelvic surgery:

• Radical hysterectomy

Provides a posterior access and dissection plane.

Enables safe identification and preservation of the superior hypogastric plexus and hypogastric nerve.

• Nerve-sparing surgery

Serves as the primary orientation plane for autonomic nerve preservation, the superior hypogastric plexus.

• Posterior pelvic resections

Essential for rectosigmoid mobilization.

Facilitates posterior or total pelvic exenteration.

• Ovarian cancer cytoreduction

Enables en bloc resection of the uterus, rectum, and sigmoid colon in cases of obliterated Douglas pouch.

• Hemorrhage control

Provides access to proximal vascular control when pelvic bleeding is encountered.

These applications emphasize the presacral space as a strategic posterior pelvic corridor rather than a simple anatomical cavity.

Key Surgical Insight

The presacral space is the anatomical gateway to the pelvic autonomic nervous system and to the identification of the ureter at the pelvic brim level. Respecting the presacral fascia is the single most important rule to prevent uncontrollable bleeding and nerve injury.

Pararectal Space

Definition and Surgical Concept

The pararectal space is a paired, retroperitoneal, avascular pelvic space located lateral to the rectum and medial to the internal iliac vascular system. It represents a critical surgical corridor within the posterior pelvic compartment, providing access to the uterosacral ligament, pelvic autonomic nerves, internal iliac vessels, and posterior (dorsal) parametrium. In gynecologic oncology, the pararectal space is essential for radical hysterectomy, nerve-sparing procedures, and posterior pelvic resections, serving as a key orientation space for differentiating vascular from neural planes.

Anatomical Boundaries (Figures 3 and 4)

The pararectal space is anatomically defined by the relationship between the rectum, ureter, and internal iliac system:

- Medial boundary:

Rectum,

Uterosacral ligament (posterior parametrium, rectouterine ligament/ligamentum rectouterinum),

Ureter, which divides the pararectal space into medial and lateral compartments.

- Lateral boundary:

Internal iliac artery and its branches (internal iliac vein is noticed inferior to the internal iliac artery).

- Anterior boundary:

Cardinal ligament (lateral parametrium, parauterine and paracervix tissue),

Uterine artery-vein complex with the pelvic autonomic nerves.

- Posterior boundary:

Sacrum,

Presacral fascia.

- Superior boundary:

Pelvic parietal peritoneum.

- Inferior boundary:

Levator ani muscle (iliococcygeus component).

These boundaries position the pararectal space at the crossroads of the vascular, neural, and visceral components of pelvic anatomy, making it one of the most critical pelvic spaces when approaching the frozen pelvis.

Subdivision of the Pararectal Space (Figure 5)

If the ureter is dissected and lateralized from the posterior leaf of the broad ligament, it is the key landmark dividing the pararectal space into two surgically distinct compartments:

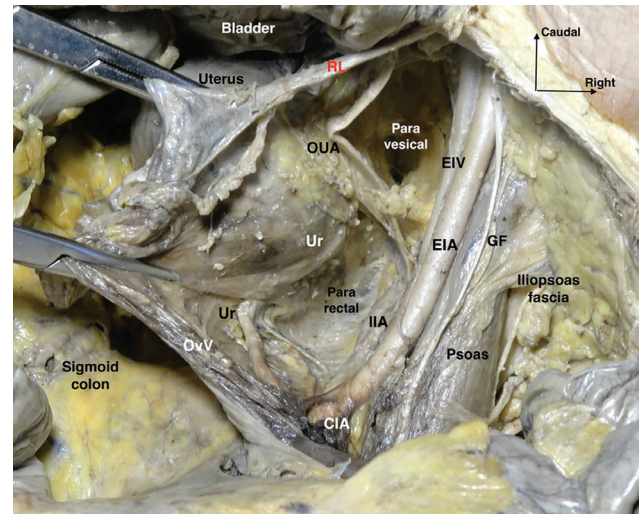


Figure 3. The anatomical boundaries of the pararectal and paravesical spaces after cutting the pelvic lateral parietal peritoneum and broad ligament

CIA: Common iliac artery, EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, GF: Genitofemoral nerve, RL: Round ligament, OvV: Ovarian vessels, OUA: Obliterated umbilical artery, Ur: Ureter

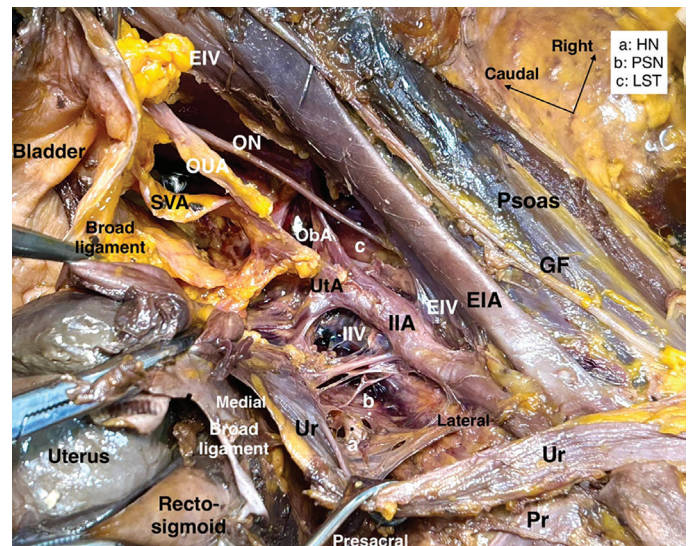


Figure 4. The pararectal and paravesical space with the obturator fossa and main anatomical components

EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, GF: Genitofemoral nerve, HN: Hypogastric nerve, LST: Lumbosacral trunk, ObA: Obturator artery, ON: Obturator nerve, OUA: Obliterated umbilical artery, Pr: Promontory, PSN: Pelvic splanchnic nerves, SVA: Superior vesical artery, Ur: Ureter, UTA: Uterine artery

1. Lateral pararectal space (Latzko space)

Located between the ureter (medially) and the internal iliac artery (laterally),

Primarily vascular in orientation, following the internal iliac artery will lead to the uterine artery, which is the first

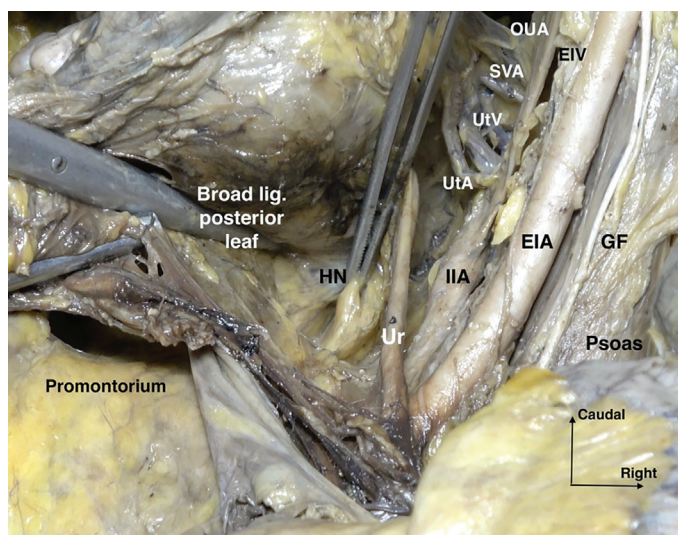


Figure 5. The medial pararectal space and the hypogastric nerve after dissection and lateralization of the ureter from the broad ligament posterior leaf

GF: Genitofemoral nerve, EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, Ur: Ureter, HN: Hypogastric nerve, UtA: Uterine artery, UtV: Uterine vein, SVA: Superior vesical artery, OUA: Obliterated umbilical artery, lig: Ligament

anteromedial branch arising from the internal iliac artery, Contains the origin and proximal parts of the pelvic splanchnic nerves.

2. Medial pararectal space (Okabayashi space)

Located between the ureter (laterally) and the rectum/ uterosacral ligament (medially),

Contains critical pelvic autonomic nerve structures, the hypogastric nerve, caudal (medial distal) parts of the pelvic splanchnic nerves, and the inferior hypogastric plexus,

This subdivision is fundamental to nerve-sparing surgical procedures (radical hysterectomy, endometriosis surgery, mesorectal resection) because neural elements are concentrated in the medial compartment.

Surgical Development (Step-by-Step)

1. Retroperitoneal entry

Achieved by incising the lateral parietal peritoneum:

- Cut the pelvic lateral parietal peritoneum, along and lateral to the infundibulopelvic ligament (ovarian vessels),
- Or medial approach, medial to the infundibulopelvic ligament, cut the posterior leaf of the broad ligament, and notice that the ureter is attached to the posterior leaf of the broad ligament inferior to the ovarian vessels.

2. Identification of the ureter

The ureter is identified at the pelvic brim, crossing over the common iliac vessels,

It is followed caudally along the posterior leaf of the broad ligament, inferior to the ovarian vessels.

3. Creation of the lateral pararectal space (Latzko)

Blunt dissection between the ureter and the internal iliac artery,

Develops a relatively avascular plane anterior to the sacrum.

4. Development of the medial pararectal space (Okabayashi)

After mobilization or lateralization of the ureter from the broad ligament posterior leaf,

Dissection proceeds between the ureter and rectum/ uterosacral ligament.

5. Caudal maturation

The space deepens toward the pelvic floor and the levator ani. Notice the internal iliac vein inferior (inferior in surgical supine position, posterior in anatomical position) to the internal iliac artery.

The hypogastric nerve, at the medial pararectal space, inferior to the ureter and attached to the perirectal visceral fascia, becomes identifiable (sympathetic activity). The ureter and the hypogastric nerve lie within the same fascial sheet, the ureterohypogastric fascia.

The pelvic splanchnic nerves, located in the lateral pararectal space at the inferomedial aspect of the internal iliac vein, arise from the sacral 2-4 foramina (parasympathetic activity).

They lie obliquely medial to the paracervix and are attached to the paracervix inferior to the deep uterine or vaginal vein.

The hypogastric nerve and the pelvic splanchnic nerves merge to form the inferior hypogastric plexus at the medial part of the paracervix, inferior to the level of the (deep) uterine vein, which is a mixed ganglion with parasympathetic and sympathetic innervation.

Correct development creates a bloodless, anatomically stratified space, permitting precise oncologic and nerve-preserving dissection.

Contents and Key Structures

Although avascular, the pararectal space is closely related to critical structures:

• Neural

Hypogastric nerve, medially,

Pelvic splanchnic nerves, laterally,

Inferior hypogastric plexus, at the medial caudal compartment, closely related to the medial paracervix, lateral to the rectum and posterolateral to the upper vagina.

• Vascular

Internal iliac artery branches, in the lateral compartment,

Uterine artery, at the anterior part, superior to the ureter,

Deep uterine vein, at the anterior part, inferior to the ureter.

• Fascial

Uterosacral ligament, medially,

Presacral fascia, posteriorly.

- Visceral

Rectum, medially,

Ureter, central landmark.

- Beyond the pelvic brim, the ureter lies caudomedially within the medial aspect of the pararectal space, is situated inferior to the ovarian vessels, and is attached to the posterior leaf of the broad ligament. Between the pararectal and paravesical spaces, the ureter lies medially, interposed between the parauterine tissue—comprising the uterine artery and associated lymphatic structures (parauterine lymphatic tissue, PULT) located superior to the ureter—and the paracervix, which contains the (deep) uterine vein and related lymphatic tissue, along with the distal segments of the pelvic splanchnic nerves. Following this junction, the ureter traverses the ureteric tunnel in the lateral aspect of the upper vagina, lying between the vesicouterine ligament superiorly and the vesicovaginal ligament inferiorly. Subsequently, the ureter enters the bladder at the trigone. The vesicouterine ligament contains cervicovesical vessels, whereas the vesicovaginal ligament lies adjacent to the vesicovaginal venous plexus and bladder nerve branches. Moreover, the vesicovaginal ligament is continuous with the lateral paracervix.

Recognition of these structures is mandatory to avoid injury to the autonomic nerves and to prevent pelvic organ dysfunction.

Surgical Applications

The pararectal space is indispensable in advanced pelvic surgery.

- Radical hysterectomy

Enables posterior and lateral parametrial resection, Essential for Querleu-Morrow type B and C procedures.

- Nerve-sparing surgery and ureteric dissection

Allows identification and preservation of the hypogastric nerve and inferior hypogastric plexus with the ureteric dissection and mobilization,

The pelvic splanchnic nerves can be identified and dissected from the paracervix.

- Pelvic lymphadenectomy

Provides orientation for obturator and internal iliac nodal dissection.

- Posterior pelvic resections

Facilitates rectosigmoid mobilization, Essential in posterior or total pelvic exenteration.

- Complex pelvic and oncologic surgery

Crucial when the rectouterine (Douglas) pouch is obliterated by tumor or fibrosis.

- Hemorrhage control

Provides access to proximal vascular control (internal iliac and uterine artery) when pelvic bleeding is encountered,

These applications underline the role of the pararectal space as a surgical neurovascular roadmap.

Paravesical Space

Definition and Surgical Concept

The paravesical spaces are bilateral, avascular, retroperitoneal spaces situated lateral to the urinary bladder within the pelvis. It constitutes an essential surgical corridor in the anterior pelvic compartment, facilitating secure access to the lateral pelvic wall, bladder, and parametrial structures. In gynecologic oncology surgery, the paravesical space serves as a key landmark for pelvic lymphadenectomy, radical hysterectomy, nerve-sparing procedures, and hemorrhage management.

Anatomical Boundaries (Figures 3 and 4)

The paravesical space is best understood in relation to the bladder medially and the pelvic sidewall laterally.

- Medial boundary:

Urinary bladder,

Pubocervical ligament,

Obliterated umbilical artery (OUA), which divides the paravesical space into medial and lateral compartments.

- Lateral boundary:

The external iliac vessels are observed along the medial aspect of the psoas major muscle. The external iliac artery lies medial to the psoas major muscle, and the external iliac vein lies inferomedial to the artery. The caudal (distal) ends of these vessels constitute the lateral boundary of the paravesical space.

Obturator internus muscle and fascia.

- Anterior boundary:

Superior pubic ramus, pubic bone,

Retropubic (prevesical) space lateral continuity.

- Posterior boundary:

Cardinal ligament [lateral parametrium, parauterine tissue (uterine artery) and paracervix tissue (uterine vein and pelvic autonomic nerves)],

Proximal internal iliac artery branches.

- Inferior boundary:

Pelvic floor (levator ani muscle, pubococcygeus and iliococcygeus).

- Superior boundary:

Pelvic parietal peritoneum, broad ligament anterior leaf,

These boundaries place the paravesical space at the intersection of vascular, neural, and lymphatic surgical planes, emphasizing its importance in oncologic dissection.

Subdivision of the Paravesical Space (Figure 6)

If the OUA is dissected and lateralized from the perivesical visceral fascia and fatty tissue (the umbilicovesical fascia), it is the key landmark dividing the paravesical space into two distinct compartments:

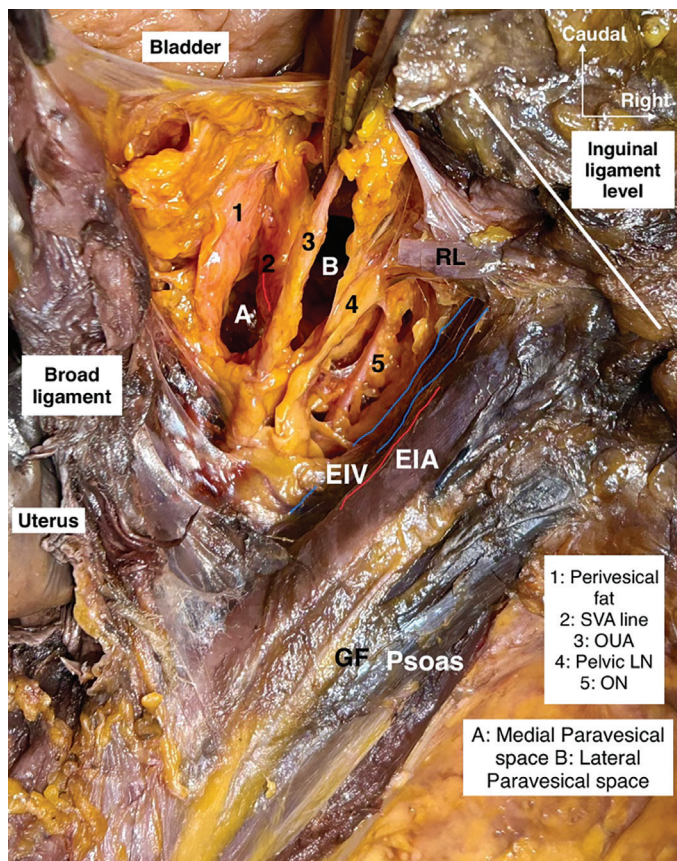


Figure 6. The medial and lateral paravesical space after dissection and lateralization of the OUA from the perivesical fatty tissue

GF: Genitofemoral nerve, EIA: External iliac artery, EIV: External iliac vein, RL: Round ligament, ON: Obturator nerve, LN: Lymph node, OUA: Obliterated umbilical artery, SVA: Superior vesical artery

1. Medial paravesical space

Located between the bladder and the OUA, Closely related to the anterior (ventral) parametrium and bladder vascular supply.

2. Lateral paravesical space

Located between the OUA and the external iliac vessels,

Continuous laterally with the obturator fossa,

This subdivision is surgically critical because pelvic lymph node dissection is performed through the lateral paravesical compartment, whereas nerve-sparing parametrial dissection of the anterior parametrium is performed through the medial paravesical compartment.

Obturator Fossa

The obturator fossa represents the lateral extension, at the inferior aspect of the external iliac vein, of the lateral paravesical space. Its lateral boundary is delineated by the obturator internus muscle, with the obturator nerve positioned medially relative to the obturator lymph nodes. The obturator nerve exits the pelvis via the obturator canal, located at the

superolateral portion of the obturator foramen. The superior margin of the obturator foramen corresponds to the superior pubic ramus. The pelvic anastomotic branches between the obturator vessels and either the inferior epigastric or external iliac vessels are called Corona Mortis vessels (pubic vessels) and are situated over the lateral aspect of the superior pubic ramus. These vessels are predominantly venous anastomoses, with their branches extending from the medial side of the obturator nerve towards the obturator canal. The obturator vessels are generally located inferior to the obturator nerve. In the cranial part of the obturator fossa, the internal iliac vein is located medial to the obturator nerve.

Surgical Development (Step-by-Step)

1. Retroperitoneal entry

Achieved by incising the pelvic lateral parietal peritoneum:

- Either by transecting the round ligament, or,
- Between the round ligament and the infundibulopelvic ligament,
- Or directly anterior to the round ligament (broad ligament anterior leaf).

2. Identification of landmarks

External iliac artery and vein laterally,

OUA medially,

Pubic bone anteriorly.

3. Blunt dissection

Gentle blunt dissection between the bladder medially and the pelvic sidewall laterally opens the paravesical space, The loose areolar tissue allows atraumatic development.

4. Space maturation

The space is deepened caudally toward the pelvic floor (levator ani, pubococcygeus, iliococcygeus),

Posteriorly, it connects with the pararectal space at the level of the cardinal ligament (lateral parametrium),

Proper development creates a bloodless, anatomically oriented working field, essential for safe pelvic surgery.

Contents and Key Structures

The paravesical space itself is avascular, but its walls are closely related to critical structures:

- Vascular

Superior vesical artery at the posteromedial part,

Proximal branches of the internal iliac artery at the posterior part.

- Neural

Obturator nerve, laterally, in continuity with the obturator fossa.

- Lymphatic

External iliac lymph nodes,

Obturator lymph nodes, accessed via lateral paravesical extension,

PULT along the uterine artery at the posterior part, the supraureteric lymphatic pathway crossing over the OUA.

- Fascial

Pelvic parietal fascia, levator fascia inferiorly and obturator fascia laterally,

Tendinous arch of levator ani between the levator ani and obturator internus muscle fascia,

Paracervical connective tissue,

Understanding these relationships permits safe dissection and helps avoid vascular or nerve injury.

Surgical Applications

The paravesical space is indispensable in modern gynecologic oncology surgery:

- Pelvic lymphadenectomy

Provides direct access to the external iliac and obturator nodes.

- Radical hysterectomy

Facilitates identification and dissection of the paracervix and anterior parametrium,

Enables separation of the bladder from the cervix and upper vagina.

- Nerve-sparing surgery

Serves as an orientation space for preserving bladder branches of the inferior hypogastric plexus

After the vesicouterine ligament has been dissected from the superior portion of the distal ureter, the paravaginal space (Yabuki's space) can be developed between the vagina and the ureter. Inferiorly, the vesicovaginal ligament can be identified, and the bladder nerve branches of the inferior hypogastric plexus (vesical branches, parasympathetic activity) can be dissected between the ligament and the lateral paracervical tissue. At this location, the vesicovaginal venous plexus lies close to the bladder nerve branches.

- Hemorrhage control

Allows safe exposure of the internal iliac artery branches, the uterine artery,

Essential for stepwise internal iliac artery ligation.

- Pelvic exenteration and complex resections

Acts as an anterior access corridor when posterior planes are distorted, important for bladder resections,

These applications highlight the paravesical space as a foundational anatomic unit rather than a dissection cavity.

Key Surgical Insights for the Pararectal and Paravesical Spaces (Figures 7-12)

The pararectal space serves as the gateway to preservation of pelvic autonomic nerves; correct development of this space distinguishes modern nerve-sparing oncologic surgery from purely radical resection. Mastery of the paravesical space transforms pelvic surgery from an organ-based dissection to a space-oriented surgery, reducing morbidity while maintaining radicality.

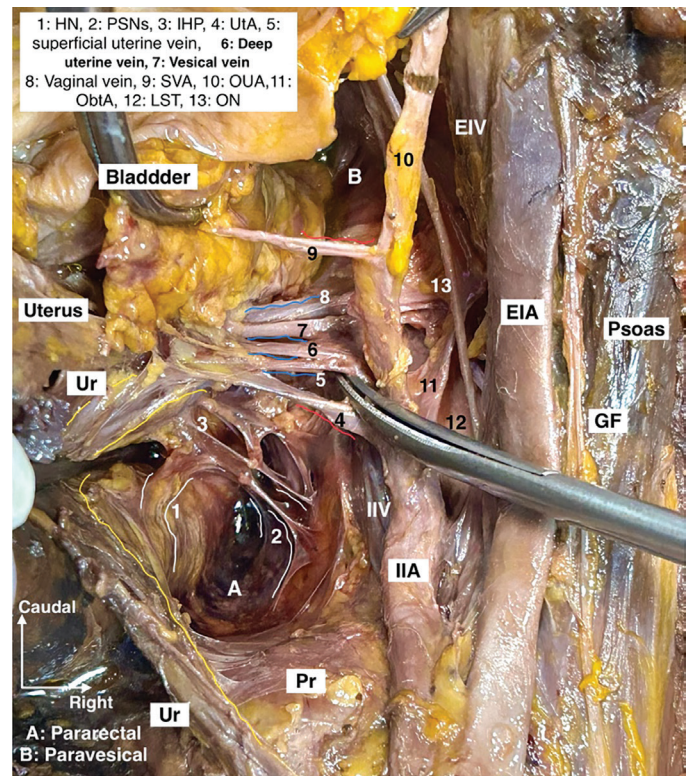


Figure 7. The lateral parametrium situated between the pararectal and paravesical spaces, along with the corresponding anatomical components. The lateral parametrium, which has historically been referred to as the cardinal ligament, is not a suspensory ligament; rather, it predominantly consists of cellulolympathic tissue that contains the uterine artery, the uterine vein, the vesical veins, and the distal portions of the pelvic splanchnic nerves, arranged from superior to inferior. The ureter lies between the uterine artery (superior) and the uterine vein (inferior). “4-5” constitutes the paraarterial tissue, and “6-8” constitutes the paracervix tissue

EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, GF: Genitofemoral nerve, HN: Hypogastric nerve, IHP: Inferior hypogastric plexus, LST: Lumbosacral trunk, ObtA: Obturator artery, ON: Obturator nerve, OUA: Obliterated umbilical artery, Pr: Promontory, PSNs: Pelvic splanchnic nerves, SVA: Superior vesical artery, Ur: Ureter, UTA: Uterine artery

Prevesical Space (Retropubic Space of Retzius) Definition and Surgical Concept

The prevesical space, also known as the retropubic space of Retzius, is a midline, anterior, extraperitoneal, avascular compartment located between the posterior surface of the pubic bone and the anterior wall of the urinary bladder. It represents the most anterior avascular space of the pelvis and constitutes the primary surgical corridor of the anterior pelvic compartment. In pelvic surgery, the prevesical space is essential for anterior pelvic orientation, bladder mobilization, and access to the paravesical spaces.

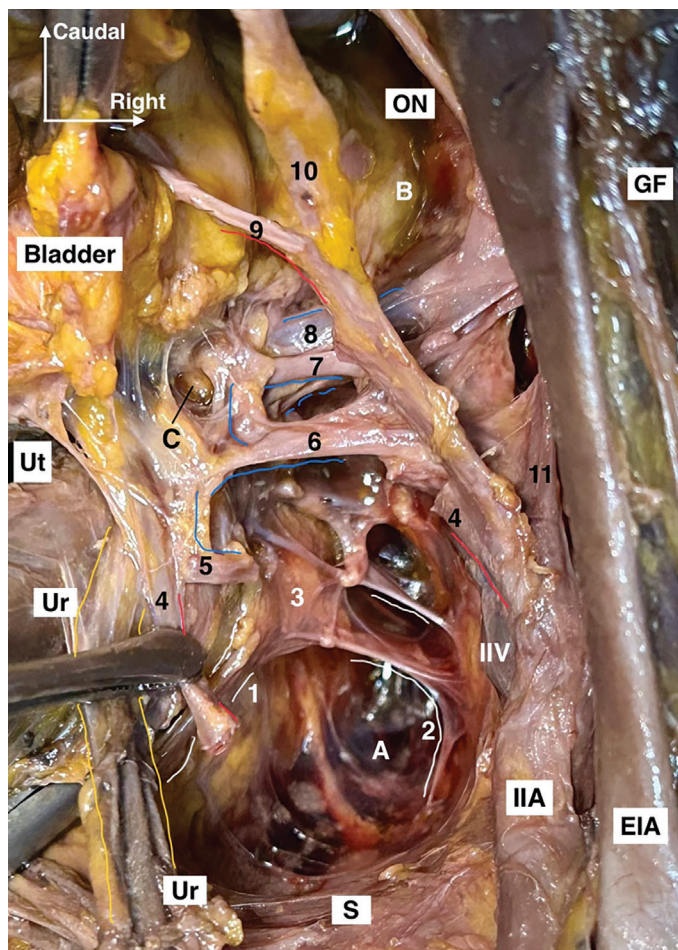


Figure 8. The lateral parametrium and pelvic autonomic nerves within the pararectal and paravesical spaces. The paraarterial tissue, uterine artery, and accompanying superficial uterine vein are dissected from the superior part of the ureter. “4-5” constitutes the paraarterial tissue and “6-8” constitutes the paracervix tissue

A: Pararectal space, B: Paravesical space, C: Paravaginal space, EIA: External iliac artery, IIA: Internal iliac artery, IIV: Internal iliac vein, GF: Genitofemoral nerve, ON: Obturator nerve, S: Sacrum, Ur: Ureter, Ut: Uterus, 1: Hypogastric nerve, 2: Pelvic splanchnic nerves, 3: Inferior hypogastric plexus, 4: Uterine artery, 5: Superficial uterine vein, 6: Deep uterine vein, 7: Vesical vein, 8: Vaginal vein, 9: Superior vesical artery, 10: Obliterated umbilical artery, 11: Obturator artery

Anatomical Boundaries (Figure 13)

- Anterior boundary: Posterior surface of the pubic symphysis and pubic bone.
- Posterior boundary: Anterior wall of the urinary bladder.
- Lateral boundaries: Pubocervical ligaments, OUA, Transition to the bilateral paravesical spaces.
- Superior boundary:

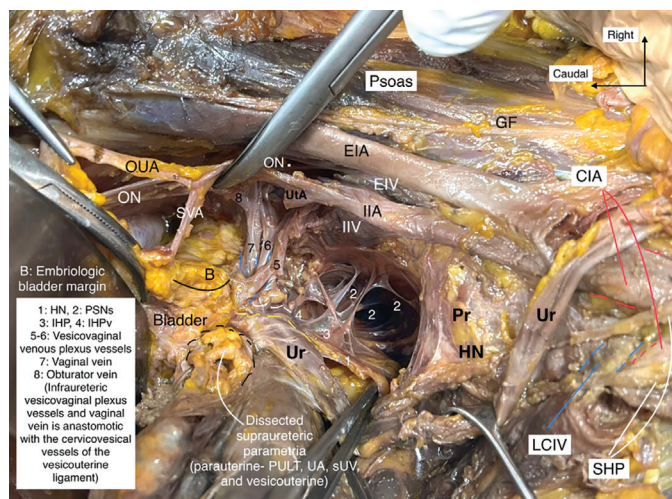


Figure 9. Deep caudal dissection of the pararectal and paravesical spaces, exposing the paracervix, vesicovaginal venous plexus, and pelvic autonomic nerves. All the supraarterial parametria are dissected and mobilized craniomedially. The “5-7” region, defined as the lateral continuity of vesicovaginal venous plexus vessels and the vaginal vein, constitutes the lateral paracervix

CIA: Common iliac artery, EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, GF: Genitofemoral nerve, HN: Hypogastric nerve, LCIV: Left common iliac vein, ON: Obturator nerve, OUA: Obliterated umbilical artery, Pr: Promontory, PULT: Paraarterial lymphatic tissue, SHP: Superior hypogastric plexus, SUV: Superficial uterine vein, SVA: Superior vesical artery, UA: Uterine artery, Ur: Ureter, 1-HN: Hypogastric nerve, 2-PSNs: Pelvic splanchnic nerves, 3-IHP: Inferior hypogastric plexus, 4-IHP-v: Inferior hypogastric plexus vesical branches (bladder branches)

Anterior parietal peritoneum, reflection over the bladder dome.

- Inferior boundary:

Pelvic floor, Endopelvic fascia (corresponds to the en bloc structure of the visceral fascia of the bladder and pelvic parietal fascia over the levator ani, pubocervical fascia), The inferolateral border is the tendinous arch of pelvic fascia, These boundaries position the prevesical space as a central, anterior, avascular plane that is continuous laterally with the paravesical spaces.

Surgical Development (Step-by-Step)

1. Anterior peritoneal mobilization

The bladder peritoneum is gently mobilized caudally from the anterior abdominal wall at the posterior aspect of the rectus abdominis muscle. The urachus is visible, extending from the bladder apex to the umbilicus. This exposes the extraperitoneal plane above the bladder dome.

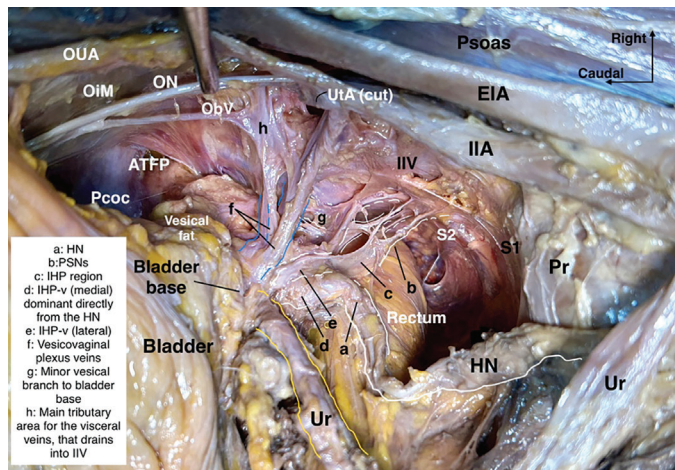


Figure 10. After total dissection of the supraureteric parametria with the medial paracervix, the anatomic exposure reveals the lateral paracervix with the vesicovaginal venous plexus and vaginal vein/deep uterine vein. The hypogastric nerve is exposed medially, inferior to the ureter, and the pelvic splanchnic nerves are dissected from the medial part of the internal iliac vein and selectively separated from the paracervix. The inferior hypogastric plexus is identified in the paracervical area; its vesical branches lie paravaginally between the vesicovaginal ligament and the lateral paracervix. “f” region, the lateral continuity of vesicovaginal plexus veins, constitutes the lateral paracervix

ATFP: Arcus tendineus fascia pelvis, EIA: External iliac artery, IIA: Internal iliac artery, IIV: Internal iliac vein, ObV: Obturator vein, OiM: Obturator internus muscle, ON: Obturator nerve, OUA: Obliterated umbilical artery, Pcoc: Pubococcygeus, Pr: Promontory, S: Sacrum, Ur: Ureter, UtA: Uterine artery, HN: Hypogastric nerve, a-HN: Hypogastric nerve, b-PSNs: Pelvic splanchnic nerves, c-IHP: Inferior hypogastric plexus, d-IHP-v: Inferior hypogastric plexus vesical branches (bladder branches)

2. Midline entry

Blunt dissection is initiated in the midline between the bladder and pubic symphysis, Loose areolar tissue allows atraumatic entry, slightly lateral to the bladder neck, bilaterally.

3. Space expansion

Dissection proceeds caudally, along the lateral aspect of the urethra,

The bladder is gently displaced posteriorly.

4. Lateral extension

The space is widened bilaterally, Continuity with the paravesical spaces is established, Correct development creates a bloodless retropubic working space, enabling safe anterior pelvic surgery.

Contents and Key Structures

The prevesical space itself is avascular but contains and is closely related to critical structures:

- Vascular

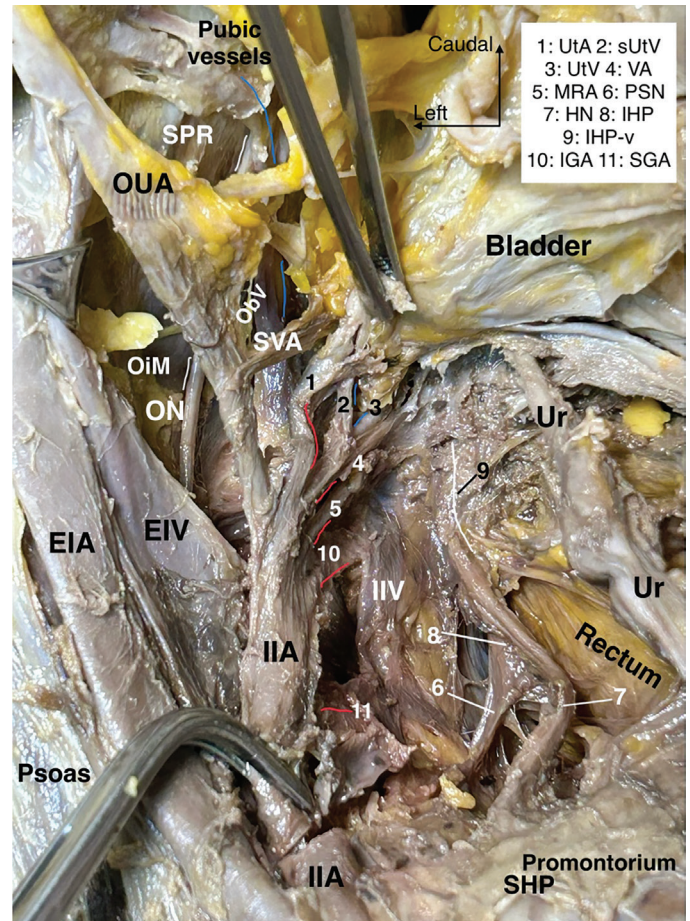


Figure 11. The pararectal and paravesical spaces, along with their anatomical components, as well as the branches of the internal iliac artery situated along the lateral parametrium (“1-4” in the figure)

EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, ON: Obturator nerve, OiM: Obturator internus muscle, ObV: Obturator vein, SPR: Superior pubic ramus, OUA: Obliterated umbilical artery, SVA: Superior vesical artery, SHP: Superior hypogastric plexus, Ur: Ureter, 1/UtA: Uterine artery, 2/sUtV: Superficial uterine vein, 3/UtV: Uterine vein, 4/VA: Vaginal artery, 5/MRA: Middle rectal artery, 6/PSN: Pelvic splanchnic nerves, 7/HN: Hypogastric nerve, 8/IHP: Inferior hypogastric plexus, v: Vesical branches, 10/IGA: Inferior gluteal artery, 11/SGA: Superior gluteal artery

Retropubic venous plexus (Santorini plexus), lateral to the urethra at the deep paravaginal compartment, Small pubic veins.

- Fascial
Endopelvic fascia, pubocervical fascia,
Pubovesical ligaments.

- Visceral

Urinary bladder, posteriorly,

Because of the proximity of the retropubic venous plexus, meticulous blunt dissection is essential to avoid significant bleeding.

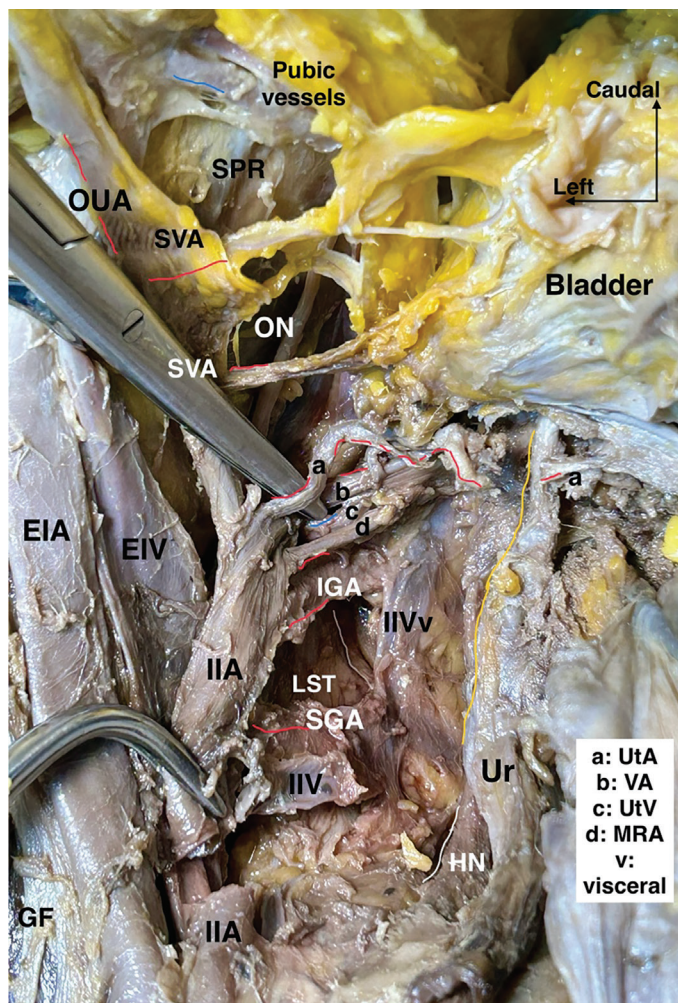


Figure 12. The pararectal and paravesical spaces, emphasizing the neurovascular anatomy associated with the lateral parametrium (“a-c” in the figure)

GF: Genitofemoral nerve, EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, ON: Obturator nerve, SPR: Superior pubic ramus, OUA: Obliterated umbilical artery, SVA: Superior vesical artery, a/UtA: Uterine artery, b/VA: Vaginal artery, c/UtV: Uterine vein, d/MRA: Middle rectal artery, IGA: Inferior gluteal artery, SGA: Superior gluteal artery, LST: Lumbosacral trunk, HN: Hypogastric nerve, Ur: Ureter

Surgical Applications (Figure 14)

The prevesical space has multiple important surgical applications:

- Radical hysterectomy
- Enables anterior bladder mobilization, Facilitates the separation of the bladder from the cervix and upper vagina in complex cases.
- Pelvic lymphadenectomy
- Provides orientation for anterior pelvic anatomy before entering paravesical spaces in frozen pelvis cases.
- Hemorrhage control

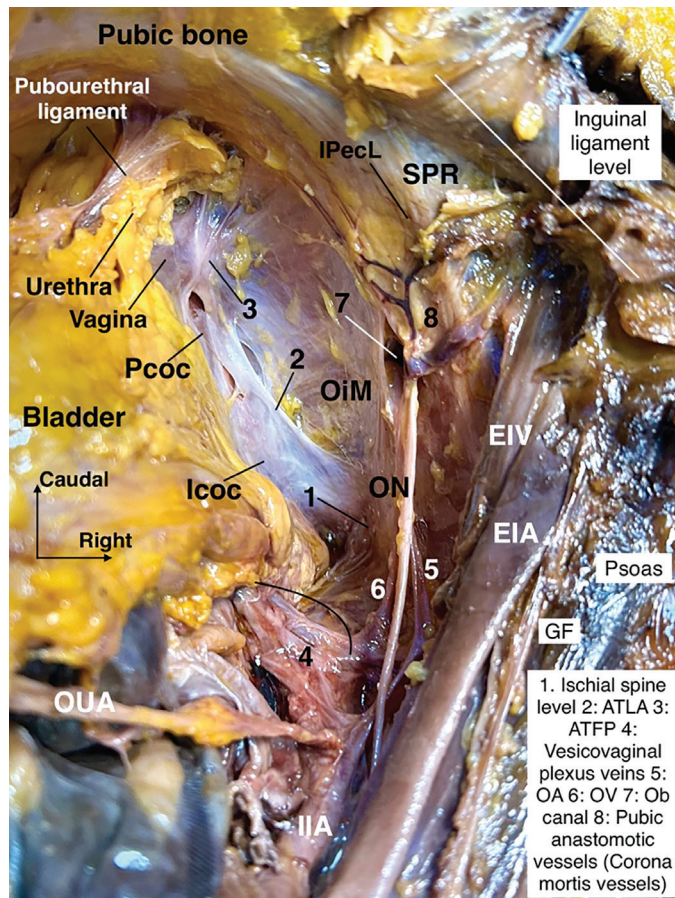


Figure 13. The prevesical space in continuation with the paravesical space. The pelvic support fascia, tendinous arch of pelvic fascia, as a condense parietal fascia between the lavator ani and obturator internus muscle. Corona Mortis, anastomotic pubic vessels, lying over the superior pubic ramus

EIA: External iliac artery, EIV: External iliac vein, Icoc: Iliococcygeus, IIA: Internal iliac artery, IPecl: Pectineal ligament, GF: Genitofemoral nerve, OiM: Obturator internus muscle, ON: Obturator nerve, OUA: Obliterated umbilical artery, Pcoc: Pubococcygeus, SPR: Superior pubic ramus, ATLA: Arcus tendineus levator ani, ATFP: Arcus tendineus fascia pelvis, OA: Obturator artery, OV: Obturator vein, Ob: Obturator

Allows exposure and compression of the retropubic venous structures.

- Pelvic exenteration
- Serves as the anterior dissection plane in anterior or total pelvic exenteration.
- Reconstructive and urogynecologic procedures
- Provides access for retropubic sling placement (conceptually relevant for anatomical orientation), transvaginal tape procedure,
- Pectineal ligament suspension (Cooper’s ligament, Burch procedure),
- These applications highlight the prevesical space as a foundational anterior pelvic corridor rather than a simple anatomical cavity.

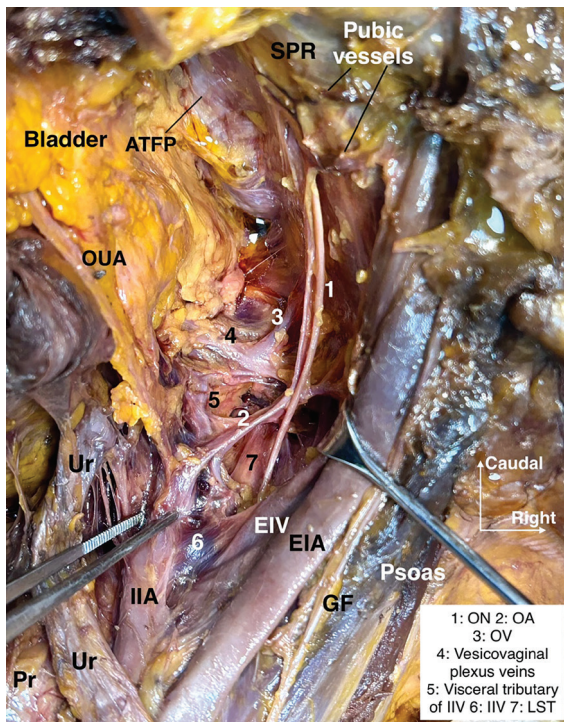


Figure 14. Lateral pelvic wall, the corridor along the prevesical and paravesical spaces, the interiliac region, and the medial psoas space

GF: Genitofemoral nerve, EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, Ur: Ureter, Pr: Promontory, OUA: Obliterated umbilical artery, ATFP: Arcus tendineus fascia pelvis, SPR: Superior pubic ramus, ON: Obturator nerve, OA: Obturator artery, OV: Obturator vein, LST: Lumbosacral trunk

Key Surgical Insight

The prevesical space is the anatomical starting point of anterior pelvic surgery; gentle midline blunt dissection and respect for the retropubic venous plexus are essential to maintain a bloodless field.

Medial Psoas Space (Laterovascular Plane) Definition and Surgical Concept

The medial psoas space, also referred to as the laterovascular plane, is a retroperitoneal anatomical plane located medial to the psoas major muscle and lateral to the iliac vessels. It is not a classical “avascular space,” such as the paravesical or pararectal spaces, but rather a longitudinal dissection plane that serves as the lateral boundary for pelvic vascular and lymphatic dissection. This plane is fundamental for pelvic and paracervical lymphadenectomy, for safe exposure of the iliac vessels, the obturator region (including the obturator nerve) and the lumbosacral trunk, and for providing a stable anatomical reference along the pelvic sidewall.

Anatomical Boundaries (Figure 15)

The medial psoas space is defined by consistent muscular, vascular, and fascial landmarks:

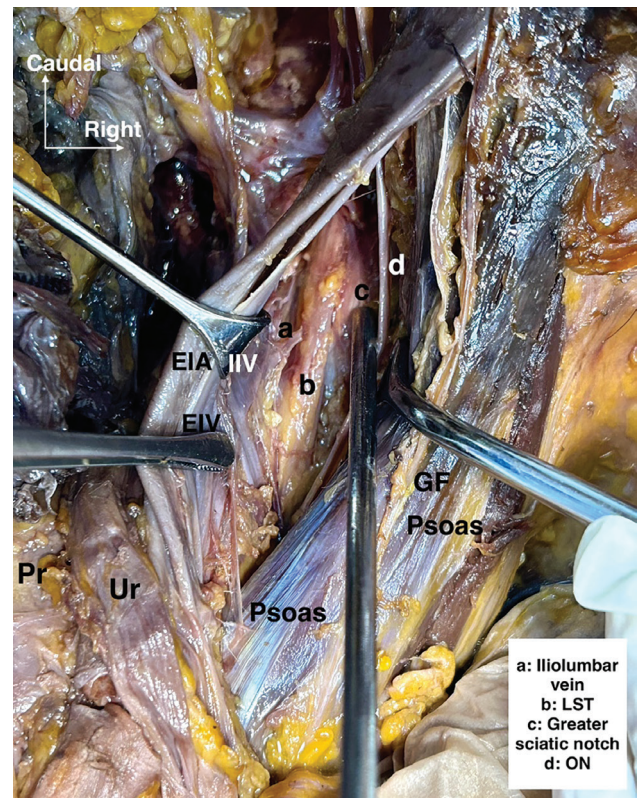


Figure 15. The laterovascular plane, medial psoas space, revealing the obturator nerve and lumbosacral trunk with the obturator and paracervical lymph nodes

EIA: External iliac artery, EIV: External iliac vein, IIV: Internal iliac vein, GF: Genitofemoral nerve, Pr: Promontory, Ur: Ureter, LST: Lumbosacral trunk, ON: Obturator nerve

- Lateral boundary: Psoas major muscle, Psoas fascia.
 - Medial boundary: External iliac artery and vein, Internal iliac vein, Common iliac vessels (cranially).
 - Anterior boundary: Retroperitoneal fatty-lymphatic tissue.
 - Posterior boundary: Psoas major muscle body.
 - Superior boundary: Pelvic brim, linea terminalis, Overlying parietal peritoneum.
 - Inferior boundary: Obturator fossa region,
- These boundaries position the medial psoas space as the lateral limit of pelvic oncologic dissection and the entry plane into the obturator and sacral compartments.

Surgical Development (Step-by-Step)

1. Retroperitoneal entry

Achieved by incising the pelvic lateral parietal peritoneum:

- After transection of the round ligament, or,
- Between the round ligament and the infundibulopelvic ligament.

2. Identification of the psoas major

The psoas major muscle is visualized as the first constant structure,

Its medial border defines the lateral limit of safe pelvic dissection.

3. Exposure of the vascular structures

The external iliac artery and vein are identified medial to the psoas major muscle,

Retroperitoneal lymphatic tissue and external iliac vessels are gently mobilized medially (during this step, a psoas vessel branch can be noticed).

4. Development of the laterovascular plane

Blunt dissection proceeds along the medial surface of the psoas major muscle,

This creates a longitudinal plane separating the iliac vessels from the muscle.

5. Caudal extension

The plane is followed inferiorly toward the obturator fossa,

The obturator nerve becomes visible at the superficial caudal extent, where it emerges from the posteromedial part of the psoas muscle,

Medially, the internal iliac vein can be noticed,

Inferior to the obturator nerve, the lumbosacral trunk can be dissected, at the inferomedial part cranially, and at the inferolateral part caudally,

Between the obturator nerve and the lumbosacral trunk, the iliolumbar vessels may lie. they drain into the internal iliac vein, Correct development produces a clean, tension-free lateral boundary, enabling safe nodal dissection without vascular or neural injury. Furthermore, the laterovascular plane and the caudal region of the lumbosacral trunk are accessible through the medial approach (Figure 14). During the surgical procedure, the internal iliac artery and vein, along with their associated vessels, may be sacrificed entirely or partially. Additionally, the inter-iliac region, situated between the external and internal iliac vessels, may be utilized.

Contents and Related Key Structures (Figure 16)

The medial psoas space contains or exposes several critical structures:

- Neural

Genitofemoral nerve, running on the anterior surface of the psoas muscle, lateral to the external iliac artery,
Obturator nerve, caudally, at the obturator fossa,

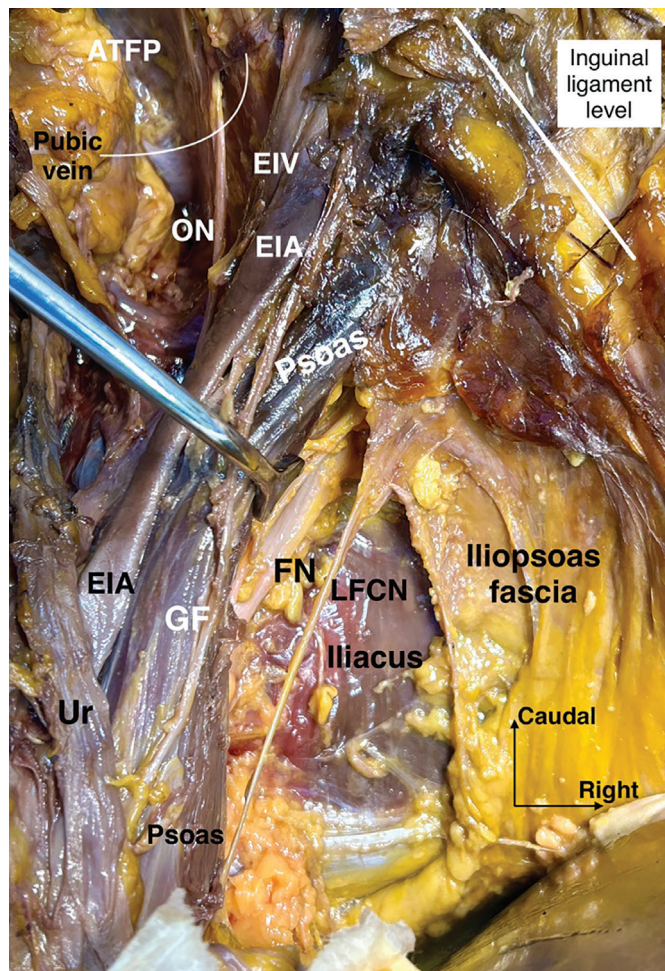


Figure 16. The iliopsoas plane revealing the femoral nerve between the psoas major and iliacus muscles

ATFP: Arcus tendineus fascia pelvis, EIA: External iliac artery, EIV: External iliac vein, FN: Femoral nerve, GF: Genitofemoral nerve, LFCN: Lateral femoral cutaneous nerve, ON: Obturator nerve, Ur: Ureter

Lumbosacral trunk, caudally, inferior to the obturator nerve, merges with the sacral 1-3 nerves to form the sciatic nerve at the infrapiriform part of the greater sciatic foramen.

- Vascular

External iliac artery and vein, medially,

Internal iliac vein, medially, inferior to the external iliac vein,
Femoral nerve is a relevant anatomical structure noticed after dissection of the iliopsoas fascia, between the psoas and iliacus muscles, located at the posterolateral aspect of the psoas major muscle.

- Urologic

Ureter, medial to the iliac vessels, crossing the pelvic brim, is a related adjacent visceral tissue.

- Lymphatic

External iliac lymph nodes,

Obturator lymphatic tissue, distally and caudally,

Paracervical lymph nodes between the obturator nerve and the lumbosacral trunk,
 Deep common iliac lymph nodes,
 Recognition of these structures is essential to maintain oncologic radicality while preserving nerve integrity.

Surgical Applications

The medial psoas space (laterovascular plane) has multiple key surgical roles:

- Pelvic lymphadenectomy

Defines the lateral limit of the external iliac and cranial obturator nodal dissection,
 Guides entry into the obturator fossa, from the lateral perspective.

- Radical hysterectomy

Provides orientation for safe parametrial dissection,
 Protects the genitofemoral and obturator nerves,

Provides paracervical lymphadenectomy,

Provides type D resection, laterally extended parametrectomy, and endopelvic resection.

- Ureteral identification

Facilitates a reliable localization of the ureter at the pelvic brim in complex cases.

- Hemorrhage control

Maintains a clear boundary between the lymphatic tissue and major vessels.

- Advanced pelvic surgery

Serves as the lateral reference plane when extending the dissection cranially.

- Neuropelviology

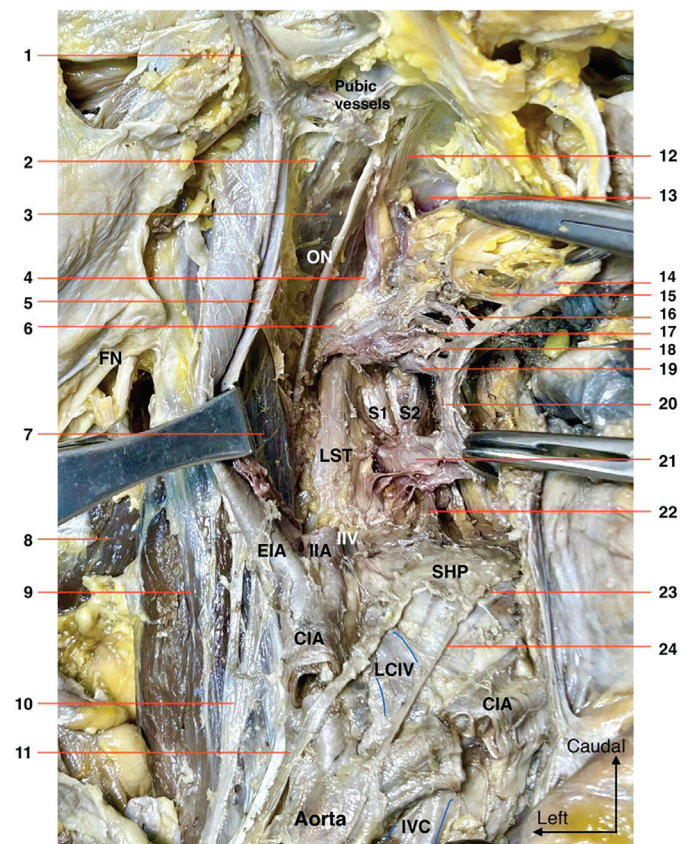
Important for sciatica-related nodules and masses.

Key Surgical Insight (Figures 17-20)

The medial psoas space is the lateral guide for pelvic oncologic surgery; respecting this plane ensures vascular safety, nerve preservation, and oncologic precision.

What does This Study Add to the Literature, and Limitations

The pelvic anatomy is a complex, three-dimensional structure, which complicates its understanding. This complexity may lead to complications during pelvic surgeries. Although numerous anatomical reports have been published, this study aims to enhance understanding of surgical anatomy through a systematic, layer-by-layer dissection progressing from superficial to deep structures. It includes a comprehensive evaluation of pelvic avascular spaces, namely the presacral, pararectal, paravesical, and prevesical. In reviewing surgical anatomy, this study emphasizes the critical anatomical structures and associated surgical maneuvers, employing cadaveric dissection to detail anatomical landmarks. The primary limitation of this study is that it assesses surgical practice solely through photographs of cadaveric dissection. Nevertheless, this represents the primary strength of the study, which was originally designed to delineate the anatomical



1: Inferior epigastric vessels, 2: Superior pubic ramus, 3: Obturator internus muscle, 4: Obturator vessels, 5: External iliac vein, 6: Obturator fascia (ischial spine level), 7: Psoas major muscle, 8: Iliacus muscle, 9: Psoas major muscle, 10: Genitofemoral nerve, 11: Thoracolumbar splanchnics, 12: Arcus tendineus fascia pelvis, 13: Pubococcygeus, 14: Obliterated umbilical artery, 15: Superior vesical artery, 16: Uterine artery, 17: Vaginal artery, 18: Middle rectal artery, 19: Inferior gluteal artery, 20: Internal iliac artery, 21: Superior gluteal artery, 22: Hypogastric nerve, 23: Promontorium, 24: Thoracolumbar splanchnics IIV: Internal iliac vein

Figure 17. The left pelvic sidewall anatomy. Dissection and mobilization of the internal iliac vessel system with the obturator parietal fascia

IVC: Inferior vena cava, CIA: Common iliac artery, LCIV: Left common iliac vein, SHP: Superior hypogastric plexus, EIA: External iliac artery, IIA: Internal iliac artery, IIV: Internal iliac vein, LST: Lumbosacral trunk, S: Sacral, ON: Obturator nerve, FN: Femoral nerve

points using to observe details not identifiable during live surgery.

Conclusion

The pelvic anatomy exhibits consistency. All the retroperitoneal compartments—including the presacral, pararectal, paravesical, and prevesical spaces—are interconnected. The laterovascular plane, also known as the medial psoas space, is part of the lateral pelvic spaces (pararectal and paravesical). Key anatomical landmarks for identifying retroperitoneal structures are the sacral promontory posteriorly (representing the anterior edge of the first sacral vertebra at the level of the pelvic brim), the pubic symphysis or the posterior surface of the body of the pubis anteriorly (serving as the superior midline component of the pubic bone), and the psoas major

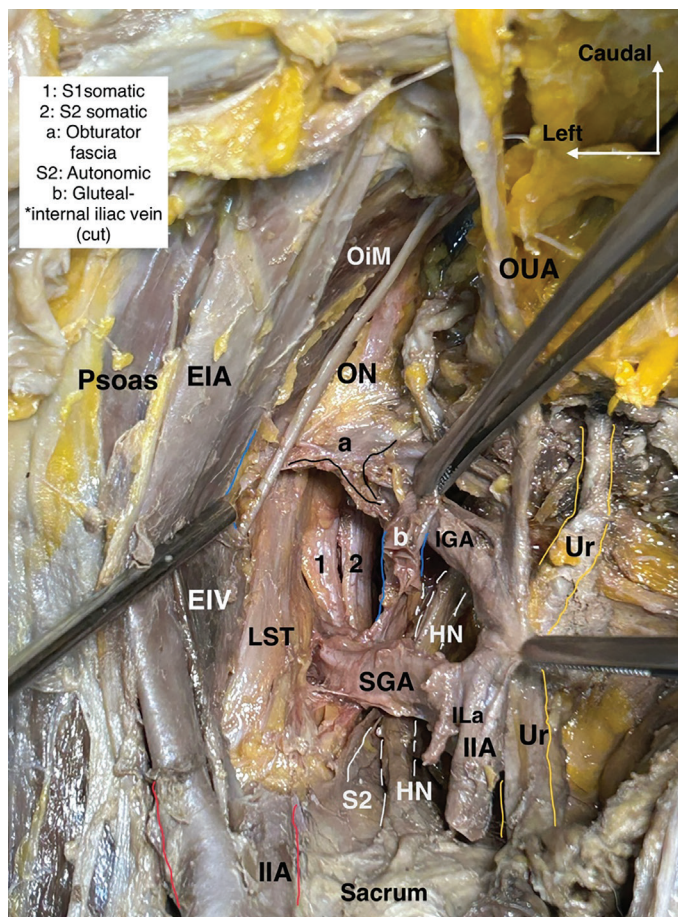


Figure 18. Lumbar and sacral plexus nerves at the left pelvic sidewall. Resection of the internal iliac vessel system will reveal the components of the sciatic nerve

EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, OiM: Obturator internus muscle, ON: Obturator nerve, OUA: Obliterated umbilical artery, Ur: Ureter, S: Sacral, HN: Hypogastric nerve, ILA: Iliolumbar artery, SGA: Superior gluteal artery, IGA: Inferior gluteal artery, LST: Lumbosacral trunk

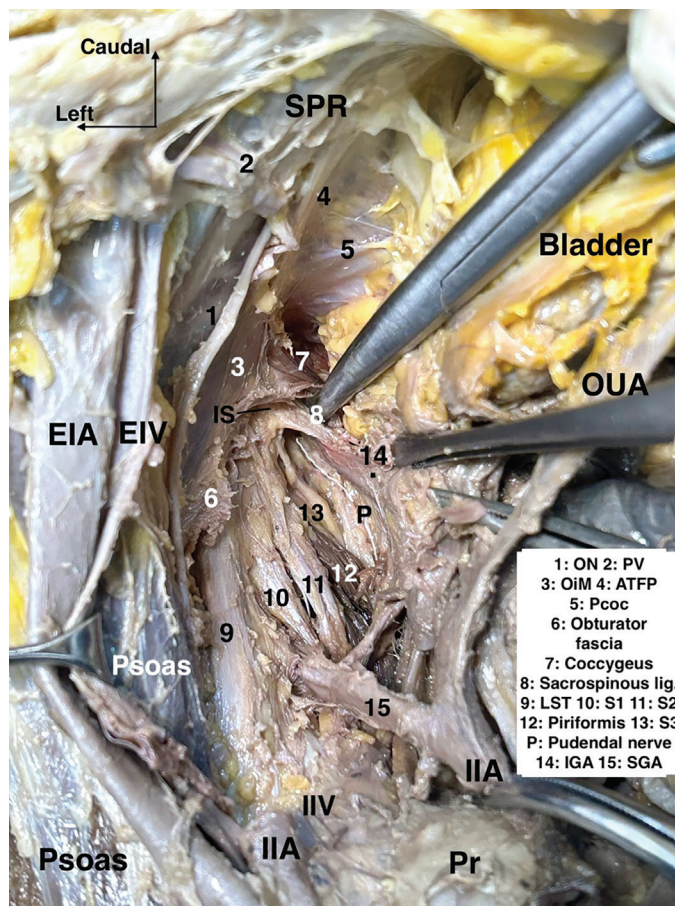


Figure 19. Somatic nerves of the left pelvic sidewall, emphasis on the sciatic and pudendal nerve with the corresponding anatomy

EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, IS: Ischial spine, OUA: Obliterated umbilical artery, P: Pudendal, Pr: Promontory, SPR: Superior pubic ramus, 1-ON: Obturator nerve, 2-PV: Pubic vessels, 3-OiM: Obturator internus muscle, 4-ATFP: Arcus tendineus fascia pelvis, 5-Pcoc: Pubococcygeus, 6: Obturator fascia, 7: Coccygeus, 8: Sacrospinous ligament, 9-LST: Lumbosacral trunk, 10-S1: Sacral 1, 11-S2: Sacral 2, 12: Piriformis, 13-S3: Sacral 3, 14-IGA: Inferior gluteal artery, 15-SGA: Superior gluteal artery, lig: Ligament

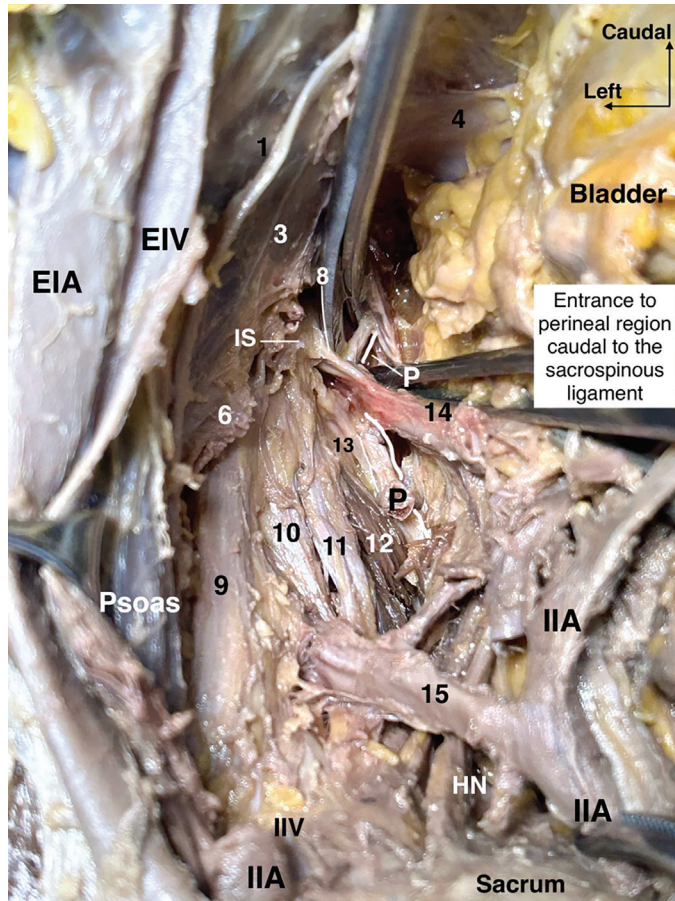


Figure 20. Entrance to the perineal region from the pelvic cavity, caudal to the sacrospinous ligament. The sciatic nerve and pudendal nerve

EIA: External iliac artery, EIV: External iliac vein, IIA: Internal iliac artery, IIV: Internal iliac vein, HN: Hypogastric nerve, IS: Ischial spine, P: Pudendal, 1-ON: Obturator nerve, 3-OiM: Obturator internus muscle, 4-ATFP: Arcus tendineus fascia pelvis, 6: Obturator fascia, 8: Sacrospinous ligament, 9-LST: Lumbosacral trunk, 10: Sacral 1, 11: Sacral 2, 12: Piriformis, 13: Sacral 3, 14-IGA: Inferior gluteal artery, 15-SGA: Superior gluteal artery

muscle laterally. Improved knowledge of retroperitoneal surgical anatomy plays a crucial role in safe pelvic surgery.

Footnotes

Authorship Contributions

Surgical and Medical Practices: İ.S., Ö.Ö., N.K., M.A.G., M.D., Concept: İ.S., Ö.Ö., N.K., M.A.G., M.D., Design: İ.S., Ö.Ö., N.K., M.A.G., M.D., Data Collection or Processing: İ.S., Ö.Ö., N.K., M.A.G., M.D., Analysis or Interpretation: İ.S., Ö.Ö., N.K., M.A.G., M.D., Literature Search: İ.S., Ö.Ö., N.K., Writing: İ.S.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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