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# Venous Resection in Urological Surgery

Brian Duty and Siamak Daneshmand\*

From the Section of Urologic Oncology, Division of Urology and Renal Transplantation, Oregon Health & Science University, Portland, Oregon

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**Purpose:** Complete removal of retroperitoneal and pelvic tumors may require resection or ligation of major retroperitoneal, pelvic and mesenteric venous structures. We provide an overview of venous anatomy and collateral drainage, and review the veins that can be safely resected.

**Materials and Methods:** We reviewed major anatomical texts, and performed a directed MEDLINE® literature search of retroperitoneal, pelvic and mesenteric venous anatomy. Resection and reconstruction of these vessels were also reviewed with an emphasis on collateral blood flow and post-resection sequelae.

**Results:** The infrarenal inferior vena cava, iliac veins, left renal vein, lumbar veins, inferior mesenteric vein and splenic vein may be resected or ligated without reconstruction. Resection of the right renal vein results in renal demise in the majority of instances. The portal vein may not be resected without reconstruction. Venous reconstruction may be performed with autologous or synthetic graft material.

**Conclusions:** Most major veins in the body can be safely resected or ligated with minimal sequelae. However, it is imperative to understand venous anatomy and collateral blood flow to minimize intraoperative and postoperative complications.

*Key Words:* vena cava, inferior; iliac vein; retroperitoneal space; reconstructive surgical procedures

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Urologists are confronted by a variety of malignancies within the pelvis and retroperitoneum. Complete surgical excision of these tumors affords patients the best chance at long-term disease-free survival. However, aggressive excision may require resection or ligation of major retroperitoneal and pelvic venous structures. An understanding of venous anatomy and collateral drainage is of paramount importance to safe venous resection, and it minimizes postoperative sequelae. There are only a few reports in the literature pertaining to resection of major pelvic or retroperitoneal veins and there is no consensus on when to use synthetic grafts. Therefore, decisions are largely based on experience and anecdotal reports. We provide an overview of retroperitoneal and pelvic venous anatomy with an emphasis on collateral blood flow. We consulted anatomy textbooks and reviewed the literature highlighting the clinical consequence of ligation or resection of the principal veins within the retroperitoneum and pelvis.

## RETROPERITONEAL AND ABDOMINAL VENOUS ANATOMY

The IVC arises from the confluence of the common iliac veins at the level of the 5th lumbar vertebrae. Tributaries of the IVC are the inferior phrenic veins, major and minor hepatic veins, right adrenal vein, renal veins, right gonadal vein and lumbar veins. The right renal vein usually lacks tributaries. Left renal vein collaterals include the inferior phrenic and

adrenal tributaries, gonadal veins, capsular veins and, if present, lumbar vein. A lumbar vein is associated with the left renal vein in approximately 40% of patients.<sup>1</sup> Entering posteriorly along the entire length of the IVC are lumbar veins which travel anterior to the spinal transverse processes. The lumbar veins connect to the azygous and hemiazygous venous systems, ultimately draining into the superior vena cava (fig. 1).<sup>2</sup>

Blood from the abdominal viscera reaches the liver via the portal vein which arises from the SMV and splenic veins. The SMV drains the small intestines, cecum, ascending and transverse colon, stomach and pancreas. The splenic vein receives tributaries from the short gastric veins and IMV, which drain the greater curvature of the stomach and large intestines, respectively (fig. 1, inset).<sup>2</sup>

## PELVIC VENOUS ANATOMY

The pelvis is primarily drained by the internal iliac veins. However, some drainage occurs via the median sacral, superior rectal and ovarian veins. A small amount of blood from the pelvis also communicates with the internal vertebral venous plexuses. The internal iliac vein receives blood from outside the pelvis, the sacrum and the pelvic viscera. The superior and inferior gluteal veins drain the upper thigh and buttocks, the internal pudendal vein drains the perineum, and the obturator vein drains the adductor portion of the upper thigh. The anterolateral portion of the sacrum

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\* Correspondence: Division of Urology & Renal Transplantation, 3303 SW Bond Ave., CH10U, Portland, Oregon 97239 (telephone: 503-494-1342; e-mail: siadaneshmand@yahoo.com).

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**Editor's Note:** This article is the second of 5 published in this issue for which category 1 CME credits can be earned. Instructions for obtaining credits are given with the questions on pages 2724 and 2725.

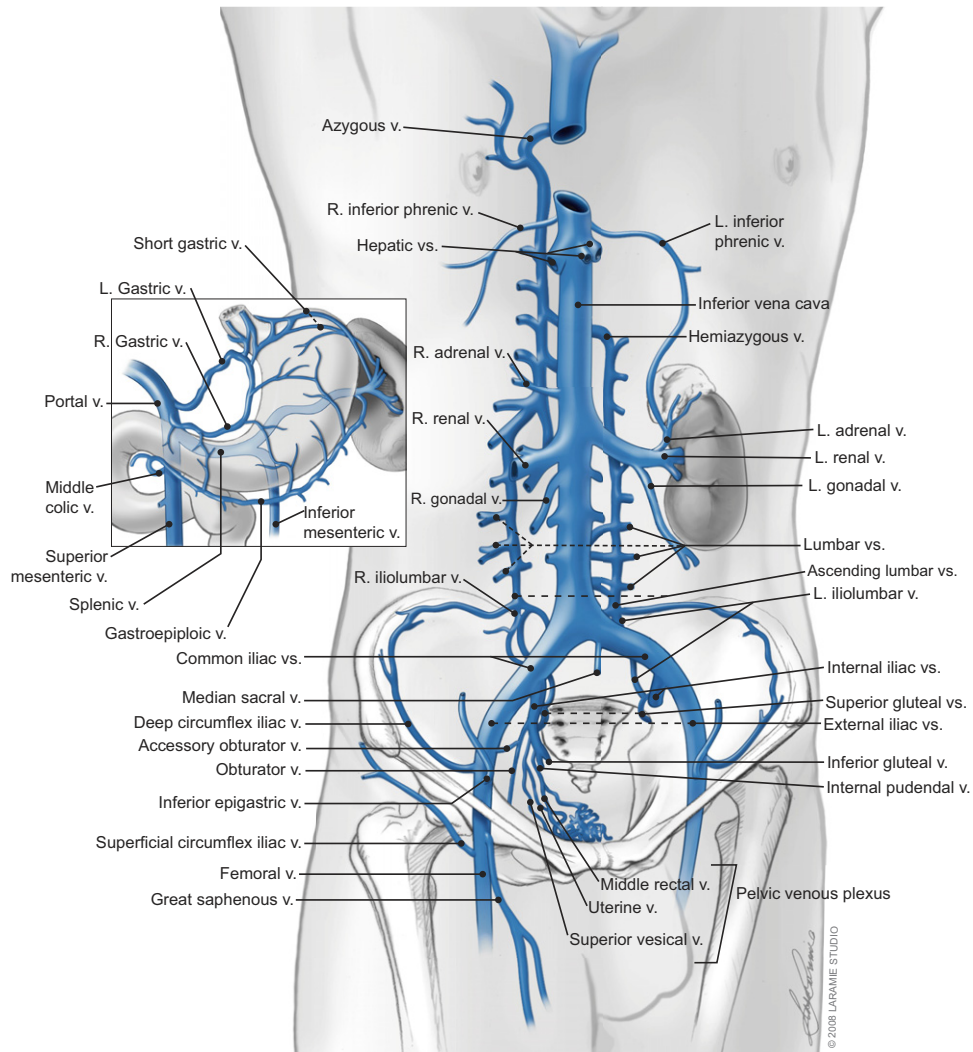


FIG. 1. Veins of retroperitoneum, pelvis and portal system

drains into the proximal internal iliac vein via the lateral sacral vein (fig. 1).<sup>2</sup>

The viscera of the pelvis drain into the internal iliac vein via an intercommunicating network of venous plexuses which include the rectal, prostatic, vesical and uterovaginal veins. The rectal plexus is drained by the superior, middle and inferior rectal veins which empty into the IMV, internal iliac and internal pudendal veins, respectively. The dorsal vein of the penis gives rise to the dorsal venous complex of the prostate which is composed of a superficial and 2 lateral plexuses which communicate with the vesical plexus. The vesical plexus drains the bladder by way of 3 to 5 inferior vesical veins and the superior vesical vein which each empty into the internal iliac vein. The vagina and uterus empty into the uterovaginal plexus, which in turn drains into the internal iliac vein via the uterine vein (fig. 1).<sup>2</sup>

**RESECTION OF THE ILIAC VEINS**

The internal iliac vein has an extensive network of collaterals including the contralateral pelvic venous plexus, gonadal vein, median sacral vein, inferior mesenteric vein by way of the superior rectal vein, accessory obturator vein, if present, and the iliolumbar and lateral sacral veins depending on the

resection location. The external iliac vein has fewer collaterals. They include the deep and circumflex iliac veins, inferior epigastric vein and accessory obturator vein, if present. Collaterals of the internal and external iliac veins may bypass the common iliac vein.

Internal iliac vein resection is commonly performed in renal transplantation and other urological procedures without consequence. However, there are case reports but no urological series to our knowledge regarding resection of the common and external iliac veins for malignancy. Mullins et al reported the Detroit General Hospital experience with traumatic injury and resultant operative ligation to the external iliac vein in 5 patients and common iliac vein in 3.<sup>3</sup> None of the patients had lower extremity edema at discharge home, but of those who had outpatient followup moderate edema requiring support hose developed in half.

Surgical reconstruction of the iliac veins is rarely performed. Data regarding long-term patency rates and clinical outcomes are scant. The risk of long-term graft failure is higher than for IVC reconstruction because of the smaller vessel diameter. Caldarelli et al reported their experience with iliofemoral vein bypass with reinforced PTFE grafts for urologically related malignancies in 5 patients.<sup>4</sup> Two pa-

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