Retroaortic Left Renal Vein and Its Implications in Abdominal Aortic Surgery

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The embryological development of the retroperitoneal venous system is a complex process. As a result, the anatomy of the inferior vena cava (IVC) and renal veins shows extensive variability. Improper completion of this process may lead to six anatomical variants: retroaortic left renal vein (LRV) types I and II, circumaortic venous collar, duplication of the IVC, transposition or left-sided IVC, and preaortic iliac confluence. All six are infrequent, but may be encountered during abdominal aortic reconstruction and pose challenging problems to the operating surgeon. Failure to appreciate these anomalies can lead to inadvertent injury and major venous bleeding. Preoperative diagnosis can be made on a CT scan, but this is not always performed prior to aortic surgery. In this report, we analyze two cases of retroaortic LRV complicating abdominal aortic aneurysmectomy, describe the most common infrarenal venous anomalies encountered during aortic surgery, and briefly review the literature.

In the 48 years since Charles Dubost reported the first successful abdominal aortic aneurysm (AAA) repair in 1952, major advances in preoperative cardiac assessment, anesthesia, surgical technique, and postoperative management have rendered abdominal aortic reconstruction a safe and effective procedure. Occasionally, massive intraoperative bleeding may complicate aortic dissection, the most troublesome being venous rather than arterial hemorrhage. Significant venous bleeding, in particular, can occur if major retroperitoneal venous anomalies are present. Inadvertent injury may then transform a simple AAA repair into a difficult and life-threatening procedure. In this article, we present the cases of two patients with a retroaortic left renal vein (LRV) complicating AAA repair and describe the most frequent infrarenal venous anomalies encountered during abdominal aortic reconstruction. Focusing mainly on the retroaortic LRV, we discuss their important surgical implications and review the literature.

CASE REPORTS

Case 1

A 75-year-old man was referred by his general practitioner to the vascular clinic for elective repair of a large infrarenal AAA. This was found incidentally during ultrasonography for vague abdominal pain. A contrast-enhanced computed tomography (CT) scan confirmed the presence of an infrarenal AAA, which was 7.0 cm in its maximum diameter and involved the bifurcation and both the proximal common iliac arteries. It was also noted that the LRV ran through the retroaortic space (Fig. 1). At operation, the presence of a retroaortic LRV was confirmed, while a normal ventral (preaortic) limb of the LRV was not identified. Proximal control of the aorta was obtained using a straight aortic cross-clamp applied from the front and below the anomalous LRV, making a conscious attempt to minimize retroaortic dissection. Venous injury was avoided by confining our dissection strictly to...
the immediate area for repair. An 18 × 9 mm Dacron bifurcated graft was implanted using the “in-lay technique.” The two limbs of the graft were anastomosed in an end-to-end fashion to the common iliac arteries restoring the continuity of the aorta. The patient had an uneventful postoperative recovery.

Case 2

A 71-year-old man presented to the urologist with macroscopic hematuria. On examination there was a large palpable mass at the left side of the abdomen and flank. A contrast-enhanced CT scan showed a large tumor of the left kidney, but also revealed an infrarenal AAA, 6.0 cm in its maximum diameter, and a retroaortic LRV (Fig. 2). At operation, the juxtarenal abdominal aorta was dissected first and the left renal artery was ligated and divided. Proximal aortic control was obtained by cross-clamping the aorta above the retroaortic LRV. The aorta was then transected, so that the retroaortic LRV could be ligated behind it. This anomalous vein was found lower than the position one would expect to find the orthotopic preaortic LRV. After both renal artery and vein had been divided, left nephrectomy was performed, but with great difficulty, in view of the size of the tumor. As the right common iliac artery was aneurysmal, the external iliac was ligated proximally and then transected. The left common iliac artery was similarly ligated and divided. An 18 × 9 mm Dacron bifurcated graft was implanted and joined end-to-end to the aorta proximally, and end-to-end to the external iliac artery on the right and the common iliac on the left. At completion, although vascular anastomoses were dry, severe and diffuse bleeding was encountered from the small veins of the left retroperitoneal space, which was impossible to control. The patient received massive blood transfusion. The abdominal cavity was packed with large abdominal swabs to slow down the hemorrhage. However, the patient continued to bleed, developed disseminated intravascular coagulation and hypovolaemic shock, and suffered cardiac arrest refractory to any resuscitative attempts. Histological examination of the tumor confirmed the diagnosis of adenocarcinoma of the left kidney.

DISCUSSION

Knowledge of the normal evolution of the retroperitoneal venous system from the embryonic period to term is required if the most common anatomical variants are to be understood. The caval system is derived from the modification of three parallel sets of veins that appear during different periods of gestation: the postcardinal, subcardinal, and supracardinal veins. The postcardinal veins appear first, but soon disappear, with their most proximal and distal portions forming the azygos systems and the iliac bifurcation. The subcardinal veins, anterior...