Aortobifemoral bypass for occlusive aortic disease in a patient with a duplicate inferior vena cava

Noah Dargy, MD, Adrian Santini, MD, Landon Reading, BS, and Albeir Mousa, MD, FACS, CWA, RPVI, MPH, MBA, Charleston, WV

ABSTRACT

We present the case of a 66-year-old woman with severe aortoiliac occlusive disease (TASC-D) and an incidental finding of a left sided inferior vena cava, discovered on the preoperative computed tomography scan. This uncommon congenital finding can create intraoperative challenges to the vascular surgeon. In this case report, we have described this anatomic variant and elaborated on our surgical technique to suggest a few tips and tricks for addressing these cases. (J Vasc Surg Cases Innov Tech 2022;8:261-4.)

Keywords: Aortoiliac occlusive disease; Duplicate; Inferior vena cava; Left sided

Congenital venous abnormalities such as a left sided (duplicate) inferior vena cava (D-IVC), a retroaortic left renal vein, and a circumaortic left renal vein pose an interesting challenge to operating surgeons.1 A D-IVC will usually be asymptomatic and detected incidentally on imaging studies. The incidence of D-IVC has been reported to be ~0.3% to 3.0% and was first reported in 1916.2,5 In this report, we have described a case of aortoiliac occlusion in a patient with D-IVC who underwent aortobifemoral bypass.

CASE REPORT

A 66-year-old woman with a history of peripheral arterial disease, coronary artery disease with coronary artery bypass grafting, renal artery stenosis with stenting, type 2 diabetes mellitus, hypertension, hyperlipidemia, and a 5 pack-year smoking history had presented to our department for bilateral lower extremity chronic limb-threatening ischemia with rest pain (left more than right). Noninvasive ankle brachial index and toe brachial index studies showed a right of 0.3 and 0.2 and a left of 0.2 and 0.1, respectively. She was taking aspirin, clopidogrel, and atorvastatin. Preoperative computed tomography angiography showed an occlusive infrarenal aorta not amenable to revascularization with normal saline for the first 48 hours postoperatively, with a transition to maintenance fluids thereafter. She was discharged home on postoperative day 4 without complications. The patient provided written informed consent for the report of her case details and imaging studies. She denied lifestyle limiting claudication or rest pain at her 8-week follow-up and continued to have triphasic Doppler signals.

From the Division of Vascular and Endovascular Surgery, West Virginia University, Charleston Area Medical Center.

Author conflict of interest: none.

Correspondence: Albeir Mousa, MD, FACS, CWA, RPVI, MPH, MBA, Division of Vascular and Endovascular Surgery, West Virginia University, Charleston Area Medical Center, 3200 MacCorkle Ave SE, Charleston, WV 25304 (e-mail: amousa@hsc.wvu.edu).

The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

© 2022 The Authors Published by Elsevier Inc. on behalf of Society for Vascular Surgery. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/). https://doi.org/10.1016/j.jvscit.2022.03.014
DISCUSSION
The overall incidence of D-IVCs ranges from 0.04% to 3.0%. There are three types of D-IVCs. Type I, or a major duplication, has two bilateral, symmetric trunks with a preaortic trunk of the same diameter. Type II, or a minor duplication, has two symmetric trunks, although the duplicate trunk is smaller than the preaortic trunk. Type III, or an asymmetric duplication, occurs when a small left IVC and a larger right IVC are present. D-IVCs typically occur early in gestation and result from failed regression of the left supracardinal vein. In one study, the incidence of combined IVC and iliac vein anomalies occurred in 2% of patients with IVC anomalies. Venous congenital anomalies are important to recognize before any retroperitoneal surgery, especially during aortic clamping.

In patients with a D-IVC, care must be taken during dissection and clamping of the aorta, because anomalous venous branches and irregular tissue planes between the D-IVCs and the aorta are a significant risk of unconventional intraoperative bleeding. Retroperitoneal venous anomalies will typically be thin walled and less tolerant of manipulation without major wall trauma and hemorrhage. As described by Stęfańczyk et al., their aorta bifemoral bypass repair of a symptomatic infrarenal aortic aneurysm with a D-IVC led to 400 mL of intraoperative blood loss from an injury within the proximal segment of the left D-IVC.

Control of the venous branches or caval injuries in these situations is challenging. With diligent dissection and careful tissue manipulation, this risk will be minimized. In the present case, we elected to begin dissection of the aorta from an unconventional distal to proximal approach with the sole intention of controlling any anomalous distal venous branches that could be present within the tunneling plane and to allow for tension-free
retraction of the D-IVC with minimal risk of inadvertent iatrogenic injury. Although manipulation and increased dissection of any vascular field is well known to create a greater margin for vessel injury, the advantages of further control of venous comitantes and visualization of critical structures within the retroperitoneum proved advantageous to this operation. Our experience with this technique demonstrated no differences in intraoperative blood loss compared with more traditional anatomic variants, and no major iatrogenic venous injuries were created.

A common surgical technique for improving exposure to the perirenal aorta for dissection and proximal clamping is to divide the left renal vein if it is not possible to obtain adequate retraction on the vessel. The anatomy of the D-IVC does not allow for that surgical freedom, because flow from the left D-IVC is often dependent on this branch. It is our recommendation that all attempts to preserve the left renal vein should be taken to prevent any substantial lower extremity swelling or pelvic congestion postoperatively. In our case, the additional time dedicated to dividing the venous branches allowed for enough mobilization to successfully expose the aorta.

Although intraoperative bleeding is a major concern during open aortic surgery with a D-IVC, a documented association exists between D-IVC thrombosis and surgical manipulation. No pathophysiology behind the phenomenon has been clearly documented; however, this should be considered, especially within the perioperative period. Our patient did not demonstrate any venous thrombosis, and our patient was treated routinely with pharmacologic medication, intermittent compression, and early ambulation for deep vein thrombosis prophylaxis.

Given the rarity of this anatomic variant, we have listed some considerations when planning for or performing open repair for occlusive aortic disease with a D-IVC in this patient population:

1. One should consider beginning dissection of the aorta from distally to proximally along the anterior aortic surface, moving laterally on either side with diligent identification of the tissue planes to fully visualize anomalous relationships between the D-IVC and other major retroperitoneal veins.
2. Mobilization of the D-IVC should be minimized before dissection of the branches, because the vessel is less resilient to manipulation without breakdown of the vascular wall, which would lead to rapid intraoperative blood loss.
3. Diligent review of the preoperative computed tomography scans is required, not only for venous anomalies, but also for anomalies of common structures found within the typical operative field.

CONCLUSIONS
Although venous anomalies can complicate exposure and clamping of the aorta, procedures that require these maneuvers in patients with a D-IVC can still be performed. Extra attention is required by the surgeon when performing retroperitoneal surgery to prevent potential catastrophic bleeding and ipsilateral lower extremity swelling. Appropriate preoperative planning, with computed tomography is recommended, because anatomic variants of the arterial and venous systems can be assessed and included in the operative plan. Special care should be taken intraoperatively; however, the presence of a D-IVC should not preclude patients from undergoing open surgical revascularization.

REFERENCES
1. Giordano JM, Trout HH III. Anomalies of the inferior vena cava. J Vasc Surg 1986;3:924-8.
2. Trigaux JP, Vandroovenbroek S, De Wispelaere JF, Lacrosse M, Jamart J. Congenital anomalies of the inferior vena cava and left renal vein: evaluation with spiral CT. J Vasc Interv Radiol 1998;9:339-45.
3. Brochet A, Reynolds T. Unusual duplication anomaly of the inferior vena cava with normal drainage of the right IVC and hemiazygous continuation of the left IVC. J Vasc Interv Radiol 2001;12:483-5.
4. Kennealey PT, Saidi RF, Markmann JF, Ko DS, Kawai T, Yeh H. Duplicated inferior vena cava—something to consider in the evaluation of a living-donor renal transplant. Dial Transplant 2009;38:420-2.
5. Lucas MF. A case of double inferior vena cava. J Anat 1916;51(Pt. 1):69-70.
6. Rajabnejad Y, Aliakbarian M, Rajabnejad A, Motie MR. Left-sided inferior vena cava encountered during organ retrieval surgery: report of two cases. Int J Organ Transpl Med 2016;7:229-32.
7. Starly B. A rare vascular anomaly—type III asymmetric duplicated inferior vena cava. Eur Soc Radiol 2014. Case 12098.
8. Shaha P, Garg A, Sahoo K, Kothari N, Garg P. Duplication of inferior vena cava with associated anomalies: a rare case report. J Clin Diagn Res 2016;10:T01-4.
9. Shaaban M. Congenital anomalies of the inferior vena cava and iliac veins: a cross-sectional study by multi-detector computed tomography. Egypt J Radiol Nucl Med 2016;47:883-90.
10. Downey RS, Sicard GA, Anderson CB. Major retroperitoneal venous anomalies: surgical considerations. Surgery 1990;107:359-65.
11. Stefańczyk L, Majos M, Majos A, Polguj M. Duplication of the inferior vena cava and retroaortic left renal vein in a patient with large abdominal aortic aneurysm. Vasc Med 2014;19:144-5.
12. Chung BH, Kang JH, Heo SH, Park YJ, Kim YW, Woo SY, et al. The effect of left renal vein division on renal function following open abdominal aortic surgery using propensity score matching analysis. Ann Vasc Surg 2020;62:232-7.
13. Anne N, Pallapothu R, Holmes R, Johnson MD. Inferior vena cava duplication and deep venous thrombosis: case report and review of literature. Ann Vasc Surg 2005;19:740-3.

Submitted Jan 24, 2022; accepted Mar 31, 2022.