A new anatomic variant of the aorta: A case report

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Anatomic anomalies of the infrarenal aorta and iliac arteries are rare. We report a 39-year-old man who presented with an ileo-cecal fistula secondary to Crohn disease. A computed tomography scan and subsequent arteriography noted his aorta bifurcated immediately inferior to the main renal arteries, at the level of the second lumbar vertebrae. Associated vascular anomalies included a common superior mesenteric artery/celiac axis plus multiple renal arteries. To our knowledge, this is the first report of this aortic anomaly in the literature. (J Vasc Surg 2008;48:213-5.)

Anomalies of the aortoiliac arteries are exceedingly rare, with few case reports in the literature.[1-4] Most vascular variations are asymptomatic and noted incidentally upon imaging for other medical concerns; when detected, however, further arterial imaging may be important for patient care. The current imaging modalities of choice include conventional arteriography and computed tomography angiography (CTA) with three-dimensional reconstruction. We present a congenital vascular anomaly wherein the aortic bifurcation arises just inferior to normally located main renal arteries, with a dominant left common iliac artery giving rise to the inferior mesenteric artery as well as the paired lumbar arteries. To our knowledge, this anomaly has not been previously reported.

CASE REPORT

A 39-year-old man presented with right flank pain, nausea, and emesis for 2 weeks. He had no significant past medical or surgical history, and his family history was unremarkable. A nonpulsatile, tender mass was noted on examination of his right lower quadrant. He had normal upper and lower extremity pulses without evidence of a peripheral aneurysm.

A CT scan revealed an inflammatory mass at the terminal ileum with creeping fat consistent with Crohn disease. Coincidentally, his aortic bifurcation occurred immediately distal to the main renal arteries, at the level of the second lumbar vertebra (Fig 1, *a*). The right common iliac artery traveled in a circuitous route through the right retroperitoneum (Fig 1, *c*) and ultimately bifurcated at the level of the superior acetabular rim (Fig 1, *f*). The left common iliac artery coursed straight into the pelvis, bifurcating high at the fifth lumbar vertebra (Fig 1, *e*). Associated findings on this scan included the inflammatory mass (Fig 1, *d*) and a malrotated left kidney (Fig 1, *b*).

He received outpatient treatment for the Crohn disease; however, the symptoms returned 6 weeks later. A CT scan revealed an abscess with a fistula at the terminal ileum, indicating the need for right hemicolectomy. Because the right common iliac artery coursed within the planned operative field, an arteriogram was performed to characterize further the aberrancy (Fig 2). In addition to the nonbranching right iliac artery (Fig 3, *a*) and high bifurcation of the aorta, additional views noted:

1. a common celiac axis-superior mesenteric artery trunk (Fig 3, *b*);
2. paired lumbar arteries off the dominant left iliac artery (Fig 3, *b*) and a replaced right hepatic artery;
3. four left renal arteries and three right renal arteries;
4. the medial sacral artery branching off the left proximal common iliac 1 cm proximal to the left renal artery; and
5. the low right iliac bifurcation at the acetabular rim and the high left iliac bifurcation at the level of the fifth lumbar vertebra (Fig 3, *c*).

An uncomplicated right hemicolectomy was performed to remove the nonperforated inflammatory mass. The right common iliac artery coursed within the right retroperitoneum but was not involved in the inflammatory process and did not require mobilization. The patient recovered from surgery without vascular complications.

DISCUSSION

The patient described exhibits numerous variants of arterial anatomy. Most unusual is the iliac bifurcation located at the second lumbar vertebrae with a circuitous retroperitoneal course of the right common iliac artery. In conjunction with a common celiac-superior mesenteric arterial trunk, supernumerary renal arteries, and dominance of the left common iliac artery, the patient demonstrates truly unique anatomy.

Understanding of the normal embryologic development of the abdominal aorta lends light in understanding this anomaly. In the embryo, development of the aorta begins in the third gestational week with the dorsal migration of two lines of cells from the endocardial mesenchyme. These cells grow along the neural groove, eventually fusing into a single aorta. Numerous segmental arteries form and regress, with the 10th, 13th, and 22nd persisting to form the celiac, superior mesenteric, and inferior mesenteric arteries, respectively. The common iliac arteries form by way of anastomoses between the allantoic and fifth lumbar dorsal intersegmental arteries. The umbilical artery gives rise to the internal iliac artery, and the external iliac artery forms from a bud from the common iliac artery.[5]

In this patient, we hypothesize that a partial interruption of the normal fusion between the dorsal aorta gave rise

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Competition of interest: none.

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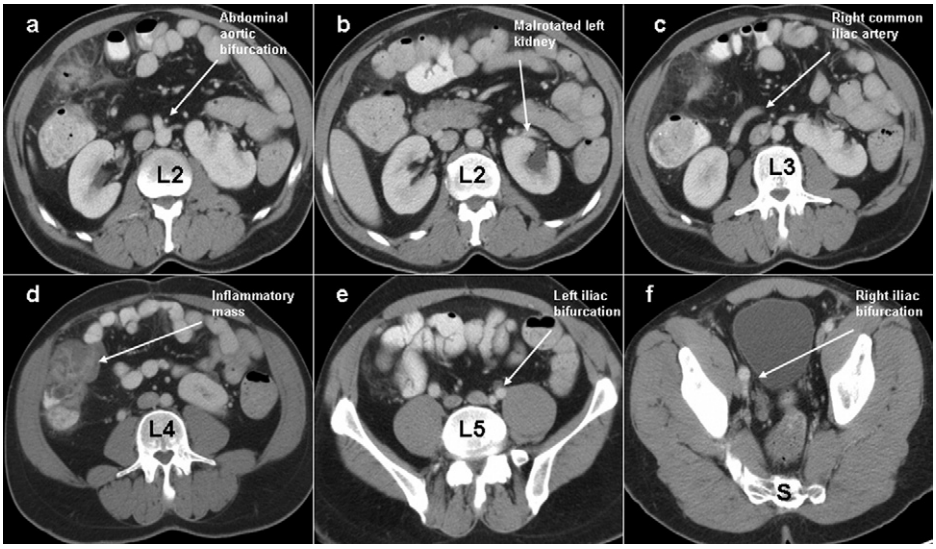

Fig 1. Serial computed tomography scans with intravenous contrast demonstrate various anomalies: **(a)** high bifurcation of the aorta at L2; **(b)** malrotated left kidney; **(c)** right common iliac artery bifurcation at L3; **(d)** inflammatory mass of the right colon; **(e)** left iliac artery bifurcation at L5; **(f)** Right iliac artery bifurcation at the level of the sacrum.

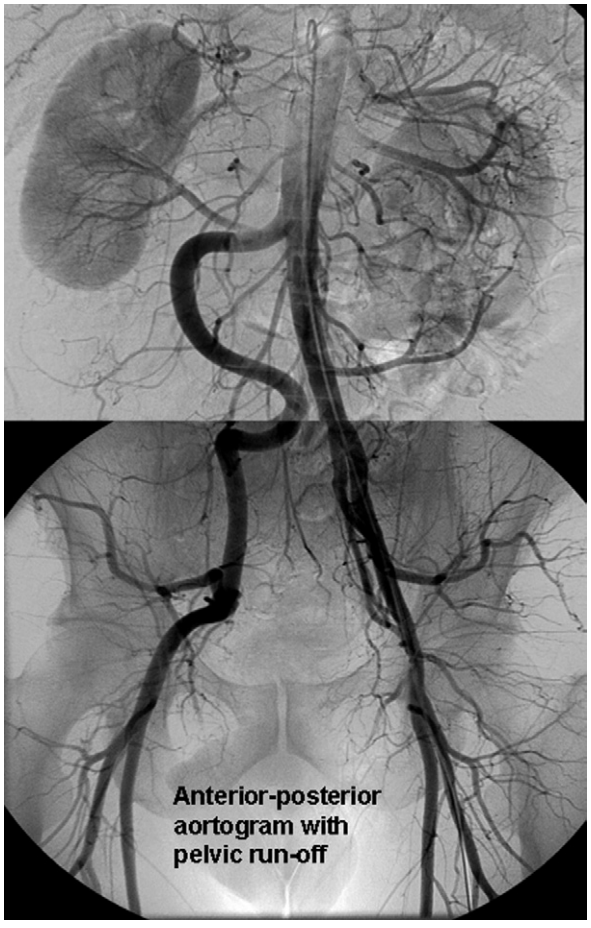

Fig 2. Arteriogram with pelvic runoff demonstrates the high bifurcation of the aorta and sweeping right common iliac artery.

to a dominant left common iliac artery and with it, the origin of the inferior mesenteric and paired lumbar arteries. The natural history of this variation is unknown; however, correlation between this and a replaced right subclavian artery suggests that aneurysm formation might be observed.[6] As such, follow-up imaging may be important for early detection of potential aneurysmal disease.

Although this variant is unique, the literature describes known variations of iliac anatomy, with a reported incidence of 6 in 8000 patients.[3] Tamisier et al[4] classified these variants into three major categories: group 1 are anomalies of origin or course, group 2 are hypoplasia or atresia with a persistent sciatic artery, and group 3 are isolated hypoplasia or atresia. Group 1 variants are usually asymptomatic and coincidentally found. Group 2 have a high incidence of aneurysm formation, typically presenting with acute occlusion or embolism. Most published case reports involve this classification.[7-9] Group 3 often presents with claudication, typically in the second through fifth decades of life, and may necessitate surgical intervention.[4,10]

Humans may exhibit other abdominal aortic branch anomalies, with most aberrancy involving the celiac axis and mesenteric arteries. A study by Koops et al[11] examined 604 patients who underwent celiac and superior mesenteric angiography and found aberrancy in 21% of patients. The most common variant cited was a replaced right hepatic artery arising from the superior mesenteric artery in 12% rather than the celiac axis, followed by a replaced left hepatic artery emanating from the left gastric artery in 3%. Celiac axis anatomy variants existed in 4% of patients, along with a combination of these variants in 2%. These anomalies, however, are exceedingly rare in conjunction with iliac anatomic variation and were not noted in any of the 604

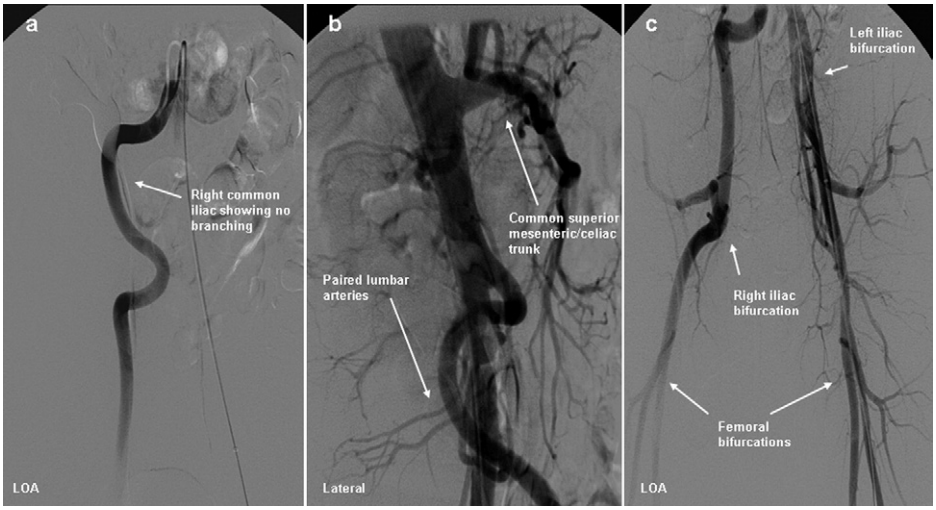

Fig 3. Selective arteriograms show **(a)** circuitous route of the right common iliac artery with no branches, **(b)** common superior mesenteric/celiac trunk and paired lumbar arteries, and **(c)** bifurcation points of the left and right iliac arteries as well as the femoral bifurcations.

patients.[11] This case demonstrates a common origin of these arteries.

Herein we have described a unique variant of aortic anatomy, one that has not been described to our knowledge in the literature. Associated vascular findings included multiple bilateral renal arteries and a common celiac-mesenteric trunk. Although it was discovered upon investigation of right retroperitoneal pathology, we do not believe the inflammatory process had any bearing on the patient's noted vascular anatomy. Long-term follow-up is suggested given the possibility of aneurysmal degeneration.

REFERENCES

1. Oduro GD, Cope LH, Rogers IM. Case report: lower limb arterial blood supply arising from the renal artery with congenital absence of the ipsilateral iliac arteries. Clin Radiol 1992;45:215-7.
2. Koyama T, Kawada T, Kitanaka Y, Katagiri K, Ohno M, Ikeshita M, et al. Congenital anomaly of the external iliac artery: a case report. J Vasc Surg 2003;37:683-5.
3. Greeb J. Congenital anomalies of the iliofemoral artery. J Cardiovasc Surg 1977;18:317-23.
4. Tamisier D, Melki JP, Cormier JM. Congenital anomalies of the external iliac artery: case report and review of the literature. Ann Vasc Surg 1990;4:510-4.
5. Lin P, Chaikof E. Embryology, anatomy and surgical exposure of the great abdominal vessels. Surg Clin North Am 2000;80:417-33, xiv.
6. Austin EH, Wolfe WG. Aneurysm of aberrant subclavian artery with a review of the literature [review]. J Vasc Surg 1985;2:571-7.
7. Williams LR, Flanigan DP, O'Connor RJ, Schuler JJ. Persistent sciatic artery: clinical aspects and operative management. Am J Surg 1983;145: 687-93.
8. Martin KW, Hyde GL, McCready RA, Hull DA. Sciatic artery aneurysms: report of three cases and review of literature. J Vasc Surg 1986;4:365-71.
9. McLellan GL, Morettin LB. Persistent sciatic artery: clinical, surgical and angiographic aspects. Arch Surg 1982;117:812-22.
10. Howard JM, Goudelock WJ, Couves CM. Congenital atresia of the external iliac artery. Arch Surg 1957;75:296-9.
11. Koops A, Wojciechowski B, Broering D, Adams G, Krupski-Berdein G. Anatomic variations of the Hepatic Arteries in 604 selective celiac and superior mesenteric Angiographies. Surg and Radiol Anat 2004;26: 239-44.

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