

# Preaortic iliac confluence: A rare anomaly of the inferior vena cava

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Open aortoiliac surgery for aneurysms of the infrarenal aorta accounts for a major part of the vascular surgeon's work. One of the most important complications of this type of surgery is massive venous hemorrhage. Intraoperative injury to the inferior vena cava (IVC), iliac veins, or the left renal vein is more likely to occur if the venous anatomy is abnormal. Anomalies of the IVC or its tributaries occur in approximately 2% to 3% of patients; the most important form is duplication of the IVC or a left-sided IVC.<sup>1-5</sup> Although reports indicate that the preoperative diagnosis can be made accurately and reliably by computed tomography (CT),<sup>6</sup> the examiner may not always be aware of these rare anomalies.

Preaortic iliac confluence is a rare anomaly, but it carries a risk for intraoperative injury. We describe two patients with abdominal aortic aneurysms in whom preaortic iliac confluence was detected intraoperatively.

## CASE REPORTS

### Case 1

A 70-year-old man was admitted to our clinic for resection of an asymptomatic, 6.5 cm, infrarenal abdominal aortic aneurysm. The aneurysm had been detected in the course of abdominal ultrasound performed for symptomatic cholecystolithiasis. Preoperative CT and arteriography indicated that the aneurysm, which had a diameter of approximately 2 cm, was not confined to the infrarenal aorta but extended to both common iliac arteries.

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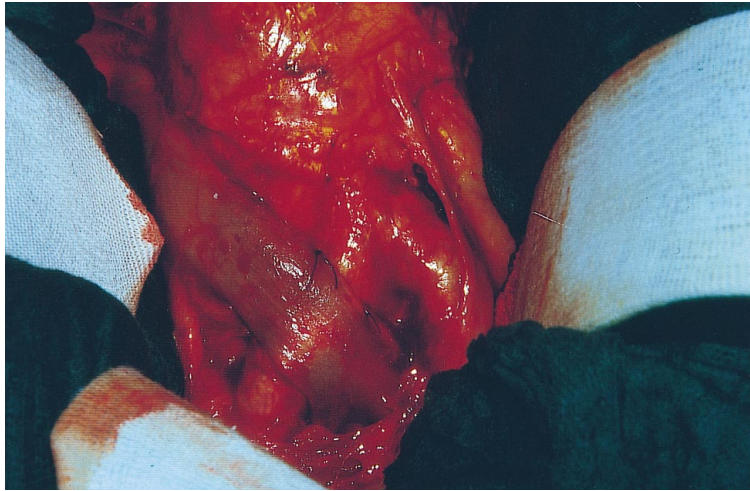
On CT, no venous anomaly was detected. The patient had no history of deep vein thrombosis of the legs. On surgical dissection, the left common iliac vein was found to pass anteriorly, covering the distal 4 cm of the aortic aneurysm and the aortic bifurcation (Figs. 1 and 2). It was flattened to a diameter of less than 0.5 cm and regained its regular circular shape only after surgical mobilization (Fig. 1). The iliac confluence was to the right of and 2 cm superior to the aortic bifurcation. No left-sided IVC was discovered, and the anatomy of the left renal vein was normal.

After careful dissection of the IVC from the aortic wall, the infrarenal aortic aneurysm was resected, and a 16-mm Dacron tube graft (Sorin-Carbo graft, Baxter, USA) was placed (Fig. 2) without major difficulty. No venous hemorrhage occurred. Cholecystectomy was then performed. The postoperative course was uneventful, and the patient was discharged on the ninth postoperative day. He is doing well 1 year after the operation. Neither clinical nor duplex ultrasound findings revealed deep vein thrombosis of the legs.

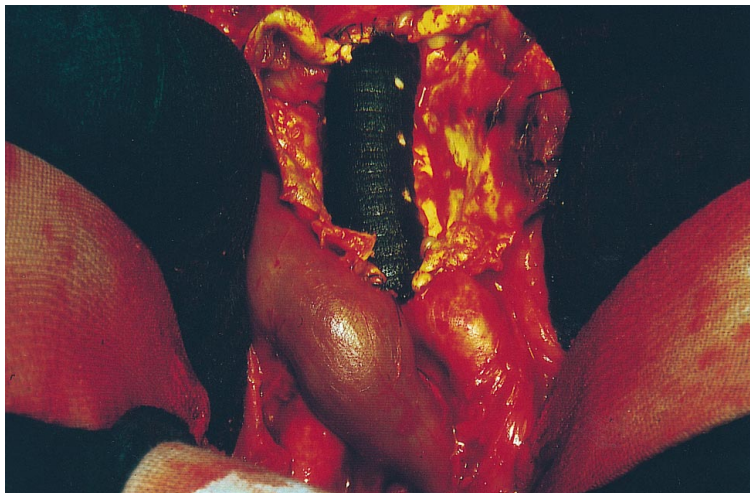
### Case 2

A 76-year-old man presented with an asymptomatic abdominal aortic aneurysm. Angiography and CT showed that it extended from the superior mesenteric artery to the aortic bifurcation. Its maximal diameter was 7.2 cm in the infrarenal portion. Both renal arteries had subtotal stenoses proximally. There was no history of deep vein thrombosis of the legs or pelvis.

Intraoperatively, the distal IVC was found ventral to the aorta, and the left common iliac vein passed ventral to the aortic bifurcation. The right common iliac vein was anterior to the right common iliac artery. No other venous malformations were detected. After careful dissection of the IVC from the aortic wall, the aortic aneurysm was resected, and a 16 mm Dacron tube prosthesis was placed. The subtotal stenosis of the left renal artery was eliminated by transaortic thromboendarterectomy, and that of the right renal artery was eliminated by eversion thromboendarterectomy and end-to-side anastomosis to the Dacron tube. The postoperative course was complicated by cardiac and pulmonary complications, and the patient died on the 65th postoperative day of cardiorespiratory failure.



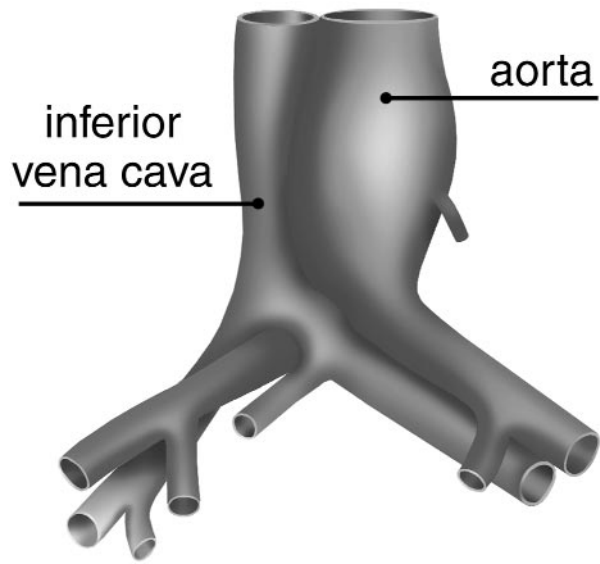
**Fig. 1.** Preaortic iliac confluence with an anterior left common iliac vein in a 70-year-old patient (case 1) is seen during an operation for an infrarenal abdominal aortic aneurysm after dissection of the left anterior common iliac vein from the anterior circumference of the aortic aneurysm and the aortic bifurcation.



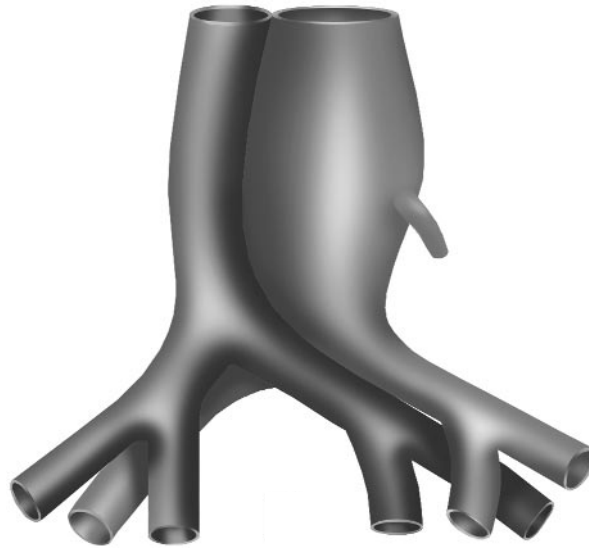
**Fig. 2.** Intraoperative situation after exclusion of the infrarenal aortic aneurysm and placement of a 16-mm Dacron tube graft (case 1).

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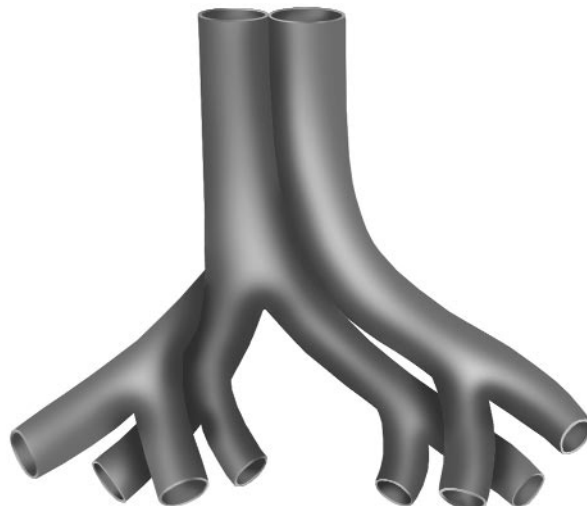
**Fig. 3.** (*see p. 769*) Variations of preaortic iliac confluence. **A**, In case 1, the left common iliac vein passed anterior to the aortic bifurcation, and the right common iliac vein followed a posterior course along the right common iliac artery. **B**, In case 2, the left common iliac vein passed anterior to the aortic bifurcation, and the right common iliac vein followed an anterior course along the right common iliac artery. **C**, The inferior vena cava is anterior to the aortic bifurcation, and the common iliac veins are behind the respective common iliac arteries. (**C** from Gladstone RJ. Development of the inferior vena cava in the light of recent research, with especial reference to certain abnormalities, and current descriptions of the ascending lumbar and azygos veins. *J Anat* 1929;64:70-93.)



A



B



C

## DISCUSSION

Preaortic iliac confluence<sup>7</sup> occurs when the IVC or the left common iliac vein is located anterior to the right common iliac artery or the aortic bifurcation. It is a rare anomaly of the IVC in humans, but it has been reported to be normal in many marsupial animals.<sup>8</sup> Only 10 human cases (with minor anatomic differences), including our own, have been reported.

Embryologically, the anomaly probably represents the persistent ventral limb of the circumaortic venous ring with disappearance of the normal dorsal limb of the ring.<sup>7</sup> This conformation is similar to the normal formation of the left renal vein but occurs in a more caudal location, at the level of the aortoiliac bifurcation. The first two cases were reported by McClure and Huntington<sup>9</sup> in 1929, and a third case was reported by Gladstone<sup>10</sup> in the same year. The fourth patient, reported by Brener et al.<sup>1</sup> in 1974, presented with occlusive disease and a small infrarenal aortic aneurysm, and the left common iliac vein crossed the right common iliac artery anteriorly. The malformation was tentatively interpreted as a double IVC crossing the aorta caudally and anteriorly.<sup>1</sup> The fifth patient, who had a ruptured infrarenal aortic aneurysm, was reported by Baldrige et al.<sup>5</sup> The abnormal IVC was recognized intraoperatively, and placement of a tube graft was uneventful. The sixth case was described by Vohra and Leiberman.<sup>11</sup> In a 33-year-old woman who presented with severe right leg claudication, an anatomic anomaly comprising a preaortic IVC and a right-sided retrospaoas iliac artery was found during surgical exploration. The right iliac artery arose at an acute angle from the abdominal aorta, passed posterior to the IVC, and disappeared into the depths between the psoas major muscle and the vertebral body. The patient was successfully treated by implantation of an aortofemoral graft. Two cases of preaortic iliac confluence were unexpectedly detected by abdominal CT.<sup>12,13</sup>

In the two cases described here, the preaortic left common iliac vein remained unrecognized on preoperative CT because of flattening and distention of the anterior left common iliac vein by the aortic aneurysm. However, careful postoperative reevaluation of the CT scans did demonstrate the anomaly to those who had had the benefit of seeing the intraoperative conformation. Although the preoperative diagnosis of periaortic venous abnormalities may be made accurately and reliably with routine CT scans,<sup>6</sup> the malformations may be overlooked because of their rareness or a lack of awareness of such anomalies by the examiner.

Three types of preaortic iliac confluence have been described (Fig. 3). In the classic description,<sup>9</sup> the IVC was anterior to the aortic bifurcation, and the common iliac veins were behind the respective common iliac arteries (Fig. 3C). In the cases we describe, the left common iliac vein passed anterior to the aortic bifurcation, while the right common iliac vein followed an anterior (case 2; Fig. 3B) or a posterior course along the right common iliac artery (case 1; Fig. 3A).

In all the described cases,<sup>1,5,9-13</sup> the preaortic IVC had been completely asymptomatic, indicating that the anomaly is not clinically relevant in terms of venous drainage from the legs and pelvis. Unlike other IVC anomalies, no complications need be expected during or after insertion of intraluminal caval filters or extraluminal clips to prevent recurrent pulmonary embolism in patients with preaortic iliac confluence, because there is only one caval lumen. With anomalies such as duplication of the IVC or persistent azygos veins, placement of such devices may not prevent recurrent pulmonary embolism, because open pathways remain through which thromboemboli from the pelvic or leg veins may pass.

A preaortic iliac confluence may predispose the patient to major complications from aortoiliac surgery. Massive injury to the IVC or the left anterior common iliac vein may occur in the course of an emergency operation for a ruptured infrarenal aortic aneurysm, greatly impairing the patient's chances of survival. We believe that every vascular surgeon performing aortoiliac surgery should be aware of the possibility of anomalies of the IVC to avoid fatal intraoperative venous hemorrhage. These venous structures should be searched for during all periaortic dissections. Surgical dissection of the retroperitoneal tissue covering the infrarenal aortic aneurysm and the aortic bifurcation should be performed with caution and in a stepwise manner.

In case 1, we placed a tube graft rather than a bifurcation prosthesis, despite the fact that the iliac arteries were dilated to a diameter of approximately 2 cm, to prevent compromise of the abnormal venous anatomy, especially because it had not caused preoperative symptoms. A bifurcation graft may be placed anteriorly or posteriorly to the veins. In the report by Brener et al.,<sup>1</sup> the first option was used, and major postoperative complications did not occur. However, reports on the anomaly and its surgical management are too few to permit definitive surgical rules to be established.

Implantation of endoluminal stent grafts for abdominal aortic aneurysm may diminish the need

for open aortoiliac surgery in the near future. A major advantage of this approach is avoidance of injury to abnormal retroperitoneal periaortic veins.

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