

Open supraceliac aortic repair of an iatrogenic aortic partial ligation during laparoscopic nephrectomy

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ABSTRACT

Iatrogenic aortic injury is a rare complication of laparoscopic nephrectomy with potentially catastrophic complications. Delays in recognition and treatment contribute significantly to patient morbidity and mortality. We present the case of a patient with acute limb ischemia and mesenteric ischemia secondary to partial transection of the supraceliac aorta during laparoscopic nephrectomy with a staple ligature. The injury was successfully treated with resection of the stapled aorta and reconstruction of a thoracoabdominal aortic bypass with a jump graft to the celiac artery. (*J Vasc Surg Cases Innov Tech* 2024;10:101415.)

Keywords: Aortic occlusion; Iatrogenic injury; Thoracoabdominal aortic repair

Iatrogenic vascular injury is a rare complication during nephrectomy associated with distorted anatomy from bulky tumors, perihilar adenopathy, or the presence of significant adhesions.¹ Most reported cases refer to inadvertent injury to, or ligation of, the superior mesenteric artery (SMA) due to difficulty distinguishing it from the left renal artery or mistaking the SMA for a duplicated left renal artery.¹ Simultaneous injuries to the celiac artery and SMA have also been reported; however, to the best of our knowledge, no cases have been reported of aortic injury during nephrectomy. We present a rare case of acute lower extremity and mesenteric ischemia from severe supraceliac aortic stenosis secondary to partial ligation during laparoscopic nephrectomy. The patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

A 52-year-old man was transferred from outside hospital with >12 hours of bilateral lower extremity and mesenteric ischemia secondary to stapler ligation of the supraceliac aorta. No significant complications were noted during the patient's laparoscopic left nephrectomy for a renal mass concerning for malignancy. However, several hours into postoperative recovery, the patient began complaining of severe lower extremity pain

and was noted to have absent femoral and distal pulses bilaterally with worsening lactic acidosis. Computed tomography angiography (*Fig 1*) demonstrated a significant supraceliac aortic stenosis with partial occlusion through the visceral aortic segment and associated short segment occlusion of the celiac artery origin. The patient was transferred to our institution for further management.

On arrival, the patient's mental activity was normal, and he was normotensive without significant tachycardia. He endorsed mild abdominal pain and complained of lower extremity pain and paresthesia without motor deficits. The bedside examination confirmed the absence of femoral pulses and absent Doppler signals in the bilateral lower extremities. In addition, the patient was incontinent, with diarrhea that began during transport. Based on the clinical examination and imaging findings, the patient was taken to the operating room for immediate exploration and revascularization.

A thoraco-retroperitoneal approach through the ninth intercostal space was used for descending thoracic aortic exposure. The peritoneum was sharply entered to assess the abdominal contents, and the small bowel was found to be pale with limited peristalsis, although without frank infarction. The colon had a similar ischemic appearance. A clamp and sew revascularization technique was planned, because coordinating cardiothoracic surgery presence and establishing a partial left ventricular bypass were deemed to be disproportionately time-consuming with limited benefit. The initial dissection was carried down to the visceral aorta. The origins of the celiac artery and supraceliac aorta were encased in inflamed tissue with incorporation of a significant portion of retroperitoneal tissue and left crus of the diaphragm into two poorly visualized staple lines. Given the difficulty of dissection and the friability of the tissue, the thorax was entered, and proximal control of the descending thoracic aorta was obtained.

After adequate proximal control, the crus of the diaphragm was dissected off the aorta, and two staple lines were identified—one transverse staple essentially ligating the supraceliac aorta and occluding the origin of the celiac artery and a

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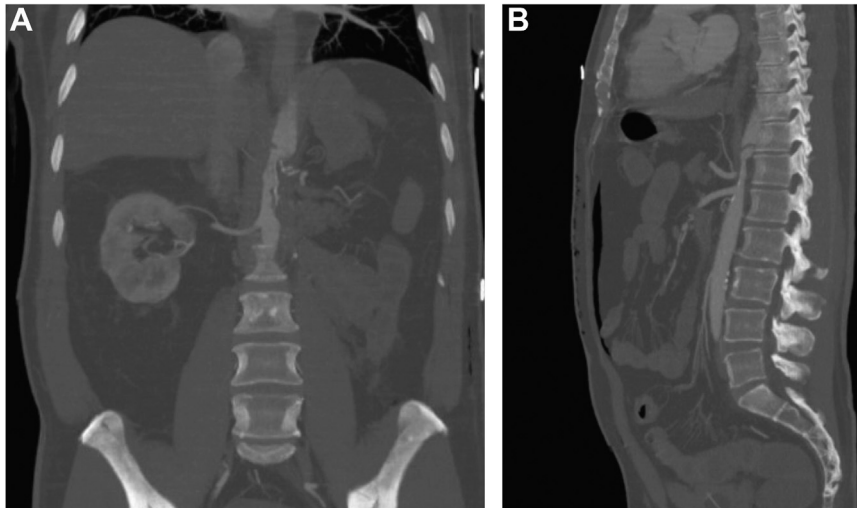


Fig 1. Coronal (A) and sagittal (B) computed tomography angiographic views demonstrating aortic injury with two separate staple lines across the aorta, leading to near occlusion of the supraceliac aorta and significant stenosis throughout the visceral segment. The injury was caused by two separate staple lines: a transverse ligation of the supraceliac aorta and a second vertical staple line longitudinally down the length of the aorta.

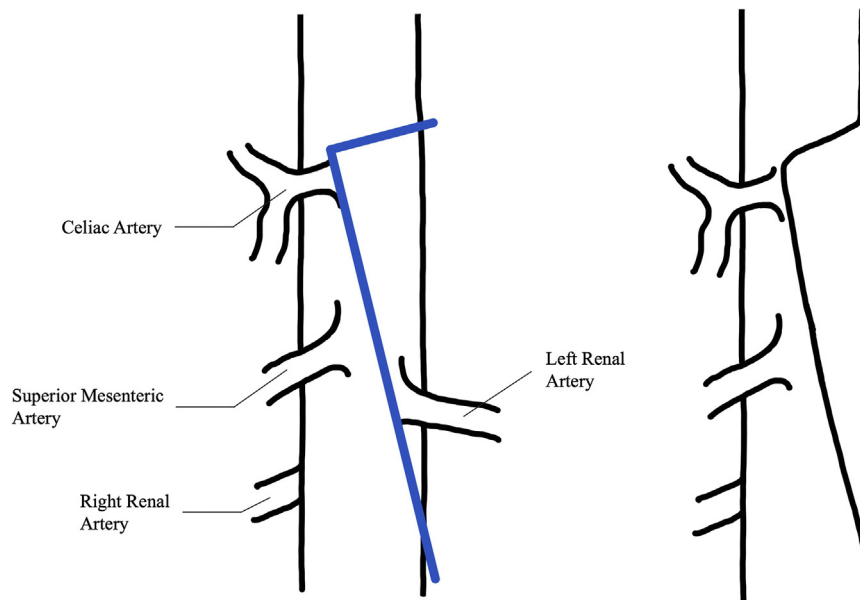


Fig 2. Diagram depicting the two staple lines across the supraceliac and visceral aortas, leading to significant aortic stenosis and distal ischemia.

second longitudinal staple line along the visceral segment (Fig 2). Following a systemic dose of mannitol for renal preservation and heparin, control of the celiac artery and SMA was obtained with silastic loops, and the descending thoracic and infrarenal aorta were clamped. The distal thoracic aorta was divided, and a 20-mm Dacron graft was sewn in the standard

fashion (Fig 3). Distally, the aorta was beveled to include both the SMA and right renal artery, and the graft was sewn into place (Fig 3).

Perfusion was confirmed in the SMA and lower extremities by palpation and insonation with a hand-held Doppler probe. The total clamp time was 38 minutes, and attention was turned to

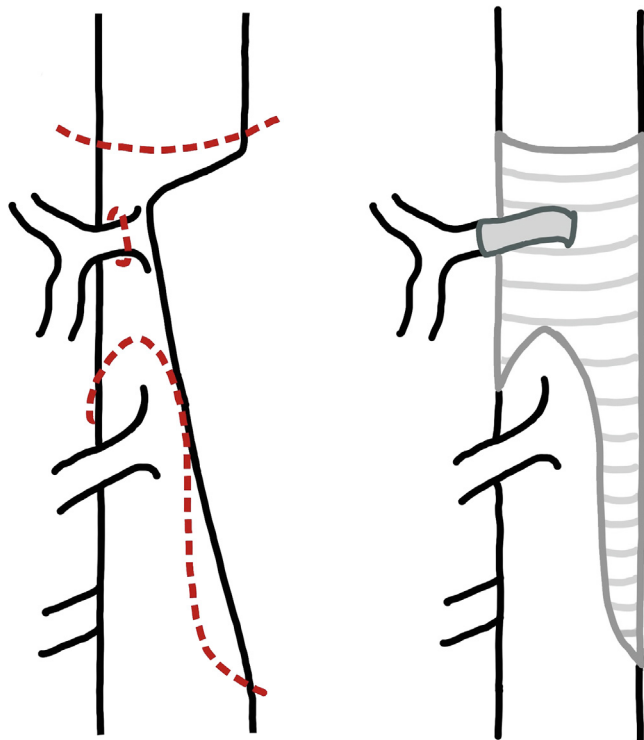


Fig 3. The descending thoracic aorta was transected and a 20-mm Dacron graft was sewn end-to-end in the standard fashion. Distally, the aorta was beveled such that the native superior mesenteric artery (SMA) was included in the distal anastomosis. Following aortic repair, the celiac artery was dissected until healthy celiac artery tissue was identified and a 7-mm Dacron graft was used to bypass from the aortic repair to the celiac artery.

the celiac artery, which had been stapled shut at the origin. This was resected back to normal artery tissue, and a 7-mm Dacron graft was used for an aorto-celiac bypass (Fig 3). A side-biting clamp was placed on the aortic graft, and inflow anastomosis was performed end-to-side, followed by the distal end-to-end anastomosis. Following the repair, on-table duplex ultrasound was performed, with a 15-Hz hockey-stick probe showing a normal appearance of the celiac bypass, right renal artery, SMA, and the aortic anastomoses.

The bowel was reassessed, and the appearance was significantly improved. Due to concerns for reperfusion injury and the potential for abdominal compartment syndrome, the retroperitoneal portion of the incision was left open, and a temporary negative pressure dressing was placed. Bilateral fasciotomies were then performed, because the patient had presented with >6 hours of ischemic time. At the conclusion of the case, the patient had palpable femoral pulses and Doppler signals present in both feet. He was then taken to the intensive care unit for ongoing resuscitation.

On postoperative day (POD) 0, his lactic acidosis resolved and liver enzymes normalized. He remained afebrile and normotensive and maintained renal function despite the recent

nephrectomy. He returned to the operating room on POD 1 for abdominal closure. Pulses in the celiac artery and SMA were palpated, with viable appearance of his bowel and end organs. Omentum was harvested through the peritoneal opening, and the graft was wrapped in an omentum flap. The senior author routinely places an omentum flap in all acute mesenteric ischemia cases in the case of any bowel compromise or surgical infection, given the nearly fatal outcome of graft infection in this location. The retroperitoneal incision was then closed in the standard fashion. The remainder of his hospitalization was uneventful, and he was discharged home on POD 14.

DISCUSSION

Vascular injury is a known complication of radical nephrectomy, especially when the normal anatomy is distorted.^{1,2} Most case reports in the literature site injury to the visceral arteries, and, to the best of our knowledge, no cases of aortic injury during radical nephrectomy have been reported to date. Although bleeding can be easily identified intraoperatively, arterial occlusion might not be diagnosed until clinical signs develop postoperatively. A delayed diagnosis of mesenteric ischemia and lower extremity ischemia are associated with significant morbidity and mortality. Thus, the use of postoperative Doppler or duplex ultrasound can be useful to rule out occlusion and prevent delayed recognition.³

In our patient, the poor prognostic factors included severe aortic injury, a delayed diagnosis, and a delay in revascularization due to interhospital transfer. Minimizing the intraoperative time and ischemic time were priorities. Beveling of the distal anastomosis to include both the SMA and the right renal artery reduced the number of anastomoses, which lowered the risk of anastomotic complications and contributed to the reduced ischemic and operative times.

Given the severity of his aortic injury, it is interesting to note that no irreversible ischemic damage to his mesenteric organs or his lower extremities occurred. It is likely that some residual flow to the SMA, right renal artery, and lower extremities was sufficient to prevent frank necrosis of his mesenteric organs and irreversible lower extremity ischemia. The tangential nature of the aortic occlusion might have allowed for perfusion in systole that was not recognized on nongated computed tomography angiography.

CONCLUSIONS

Iatrogenic arterial injuries during nephrectomies have rarely been reported. We present a case of iatrogenic supraceliac aortic stenosis and celiac artery occlusion resulting in mesenteric ischemia and acute limb ischemia. Because prolonged mesenteric ischemia and lower extremity ischemia are associated with significant morbidity, a concerted effort was made to reduce the ischemic time by gaining proximal control in an uninvolved field and limiting the number of visceral vessels

bypassed by meticulously beveling the distal anastomosis.

DISCLOSURES

None.

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