Splenorenal Arterial Bypass: Description of Technique and Case Example in an Instance of Renal Revascularization during Adrenalectomy for Adrenocortical Carcinoma

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Abstract

We present a patient with a 16 cm adrenocortical carcinoma that underwent a left adrenalectomy en bloc with resection of the involved segment of the left renal artery. A splenectomy and splenorenal bypass was performed to revascularize the left kidney. To our knowledge, this is the first instance in the literature of a splenorenal arterial bypass being reported for renal revascularization during an extirpative oncologic procedure. A 64-year-old male patient, with history significant for adrenocortical carcinoma, status post prior right adrenalectomy with partial right nephrectomy, presented for an elective left adrenalectomy. Preoperative work-up revealed an 11.4 × 13.2 × 16 cm left adrenal mass, most consistent with an adrenocortical carcinoma. At the time of surgery, the mass was found to be intimately adherent to the aorta at the takeoff of the left renal artery. Moreover, the left renal artery appeared to be coursing directly through the mass. The involved segment of the left renal artery was resected en bloc with the tumor. Because of concerns for a small and likely poorly functioning right renal remnant, a decision was made to attempt to salvage the left kidney. This was accomplished by performing a splenectomy and constructing a splenorenal bypass. Serial Duplex Doppler renal ultrasound studies were obtained over the first three postoperative days and demonstrated improved arterial waveforms. Serum creatinine reached a peak level of 3.76 mg/dL on postoperative day 3, and then began to slowly trend down to 3.37 mg/dL on the day of discharge (postoperative day 7).

Keywords

- reperfusion
- renal failure
- transplant
- creatinine
- ischemia
- kidney
- hypertension

We present a patient with a 16-cm adrenocortical carcinoma who underwent a left adrenalectomy en bloc with resection of the involved segment of the left renal artery. A splenectomy and splenorenal bypass was performed to revascularize the

left kidney. To our knowledge, this is the first instance in the literature of a splenorenal arterial bypass being reported for renal revascularization during an extirpative oncologic procedure.

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Case Description

A 64-year-old male patient presented for an elective left adrenalectomy in March 2014. He had a history significant for adrenocortical carcinoma and had undergone an open right adrenalectomy and partial right nephrectomy in January 2009. He reported a history of intermittent abdominal pain and anorexia. On physical examination, he had a well-healed right thoracoabdominal scar and a palpable left upper quadrant abdominal mass. Preoperative laboratories revealed normal metanephrines (< 25 pg/mL [reference ≤ 57 pg/mL]), normetanephrines (97 pg/mL [reference ≤ 148 pg/mL]), and serum electrolytes. His baseline serum creatinine was 1.19 mg/dL (reference, 0.5–1.3 mg/dL). Computed tomographic (CT) scan of the abdomen and pelvis revealed an $11.4 \times 13.2 \times 16$ cm heterogeneous left adrenal mass causing compression of the left renal vein and posterior/inferior displacement of the left kidney (►Fig. 1). Whole body PET-CT revealed uptake within the left adrenal mass as well as within the right kidney (►Fig. 2).

The patient was taken to the operating room for resection of the left adrenal mass. The abdomen was entered through a left subcostal incision. Access to the retroperitoneum was accomplished by mobilization of the splenic flexure. The pancreas and spleen were mobilized laterally and reflected medially. It was noted that the mass was adherent to the surface of the left hemidiaphragm, prompting an en bloc partial resection of the diaphragm. The diaphragmatic defect was closed with a number 1 Maxon suture in a figure-of-eight fashion.

On further mobilization, it was evident that the mass was intimately adherent to the aorta at the takeoff of the left renal artery. Moreover, the left renal artery appeared to be coursing directly through the mass. The left renal vein and ureter were

Fig. 1 Preoperative computed tomographic scan of the abdomen revealed an $11.4 \times 13.2 \times 16$ cm heterogeneous left adrenal mass (indicated by arrows) causing compression of the left renal vein and posterior/inferior displacement of the left kidney.

Fig. 2 Whole body PET CT revealed uptake within the left adrenal mass as well as within the right kidney (indicated by arrows).

able to be dissected free and preserved. The involved segment of the left renal artery was resected en bloc with the tumor.

Shortly following ligation of the left renal artery, the patient became anuric. Because of concerns for a small and likely poorly functioning right renal remnant, a decision was made to attempt to salvage the left kidney.

The hilum of the left kidney was dissected, exposing the bifurcation of the left renal artery into a smaller superior and a larger inferior branch. Having fully mobilized the spleen, it was decided to perform a splenectomy and revascularize the left kidney by means of the splenic artery. The inferior renal branch was anastomosed to the distal end of the splenic artery in an end-to-end fashion. An end-to-side anastomosis was then performed between the superior renal branch and the splenic artery (►Fig. 3). Both anastomoses were constructed with running 6-0 Prolene sutures.

Once reperfusion was established, the patient was administered lasix 100 mg and mannitol 25 g, intravenously. A progressive return of urine output was exhibited. A Doppler ultrasound probe, used to confirm patency of the anastomosis, showed very high diastolic resistance. Fluorescein dye was administered intravenously at the completion of the splenic to the inferior renal artery anastomosis. This demonstrated that there was perfusion to the inferior aspect of the kidney. A repeat injection of fluorescein after revascularization of the superior renal artery showed homogeneous renal perfusion (►Fig. 4).

Postoperative creatinine was 2.04 mg/dL, an increase from the baseline measurement of 1.19 mg/dL. Urine output was maintained at approximately 100 mL/h. Serial Duplex Doppler renal ultrasound studies, obtained over the first three postoperative days, demonstrated improved arterial waveforms. Over the remainder of the patient's hospital course, he remained stable, tolerated a regular diet, and had good urine output. Creatinine reached a peak level of 3.76 mg/dL on

Fig. 3 The inferior renal branch was anastomosed to the distal end of the splenic artery in an end-to-end fashion. An end-to-side anastomosis was performed between the superior renal branch and the splenic artery.

postoperative day 3, and then began to slowly trend down to 3.37 mg/dL on the day of discharge (postoperative day 7). Hydrocortisone and fludrocortisone therapy was initiated as the patient was now status post-bilateral adrenalectomy. The patient was administered postsplenectomy vaccinations just before discharge.

Pathology evaluation revealed a 1,254 g mass, 20 cm in greatest dimension. Histology was consistent with adrenocortical carcinoma. There was no lymphovascular invasion. Resection margins were negative. The distal segments of the renal artery, as well as the spleen, were negative for malignancy.

Discussion

The splenorenal arterial bypass has been described in the literature as a safe method of revascularization of the left kidney.¹ This traditionally and most often was employed to treat renovascular hypertension secondary to renal artery stenosis.¹⁻³

It also was employed, after both blunt and penetrating trauma to the abdomen, as a salvage procedure to preserve renal function. Other reported applications included treatment of bilateral renal artery injury if only one kidney was present, repair of a solitary arterial injury by simple lateral arteriorrhaphy,⁴ and correction of a renal artery rupture during percutaneous transluminal angioplasty.⁵

Splenorenal arterial bypass may be an advantageous alternative for renal revascularization, particularly, in patients with an aorta that precludes an aortorenal bypass.² Such patients include those whose cardiac dysfunction might be exacerbated by aortic clamping, those who have undergone previous aortic graft placement,³ and those with severely atherosclerotic aortic walls.

In most circumstances, a splenorenal arterial bypass can be performed without performing a splenectomy because of the

Fig. 4 Injection of fluorescein after revascularization of the superior renal artery showed homogeneous renal perfusion.

spleen's extensive collateral circulation. An end-to-side type anastomosis could be constructed allowing for diversion of blood flow to the revascularized kidney without sacrificing flow to the spleen. Valentine et al, however, reported several instances of splenic infarction after splenic to renal artery bypass. They suggested that the existing collateral circulation may not always sustain splenic viability.⁶ The possibility of a steal phenomenon, resulting in either splenic or renal infarction, was of particular concern in our patient given that the spleen already was fully mobilized from its collateral circulation. To maximize the success of our revascularization, we elected to perform a splenectomy in this patient before constructing the anastomosis.

To our knowledge, this is the first instance in the literature of a splenorenal arterial bypass being reported for renal revascularization during an extirpative oncologic procedure. Current guidelines recommend that patients with adrenocortical carcinoma undergo an en bloc resection of the involved adrenal gland and surrounding tissues, including the kidney, liver, and inferior vena cava.⁷ In this patient, given the presence of recurrent contralateral disease, our primary goal was to achieve palliation of his symptoms while preserving renal function.

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