Emergency Hepato-Renal Artery Bypass Using a PTFE Graft

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Abstract. A 51-year-old patient suffering from Buerger’s disease with bilateral lower limb amputation and Leriche syndrome presented with uncontrollable hypertension and renal failure caused by right renal artery subocclusive stenosis associated with an occluded left renal artery and atrophic kidney. He underwent a right hepato-renal bypass grafting using an externally supported polytetrafluorethylene (PTFE) graft. Renal function improved markedly and hypertension could be controlled by standard antihypertensive treatment. Normal right renal function was maintained at one-year follow-up.

Introduction

Surgical renal artery reconstruction is an effective and durable therapy for patients with poorly controlled hypertension and/or deterioration of renal function secondary to atherosclerotic renal vascular disease. However, the diffuse nature of atherosclerosis often makes the aorta and iliac arteries inadequate as inflow sites for renal artery bypass grafting. The method of hepato-renal and spleno-renal grafting has been used to avoid a diseased or scarred aorta. Favourable results with this approach have been observed so that hepato- or spleno-renal bypass grafting is currently a procedure of choice for elderly patients with atherosclerotic renovascular disease, in order to avoid the haemodynamic effects of aortic crossclamping and the difficulties encountered in originating a graft from a diseased aorta. The first description of hepato-renal arterial anastomosis was by Libertino et al. in 1976 (1). The present report illustrates the application of that surgical concept adapted to an extreme clinical situation.

Case history

A 51-year-old man was admitted in emergency with severe hypertension and progressive respiratory distress which had started two weeks earlier. The patient suffered from Buerger’s disease and maintained his smoking habits (20 cigarettes a day). He had been operated on several times with multiple bypass procedures on both legs, which had ended in a bilateral above-knee amputation eight years earlier. He also presented a thrombosis of the aorto-iliac axis responsible for a Leriche syndrome and had a long history of hypertension. Physical examination revealed a sinus rhythm of 112 beats/minute and blood pressure of 200/130 mmHg. Heart auscultation revealed no abnormalities. Abdominal clinical examination was normal. His temperature was 38.8°C. Relevant blood analysis results were as follows : white blood cell count 10.8/µL, CRP 4.46 mg/dl, urea 91 mg/dl, creatinine 2.2 mg/dl. Blood gas analysis showed a pH at 7.37, PCO2 of 38 mmHg, PO2 at 55 mmHg and an oxygen saturation of 87.2%. A chest x-ray revealed a left-sided posterobasal bronchopneumonia and bilateral basal effusions. Pulmonary embolism was excluded by a negative scintigraphy. A transthoracic cardiac ultrasonographic examination showed an ejection fraction of 40% with a moderately decreased systolic function of the left ventricle and pulmonary hypertension with systolic pulmonary artery pressure reaching 63 mmHg. Diffuse hypokinesia was present. Twenty-four-hour blood pressure monitoring showed a mean systolic arterial pressure of 156 mmHg with a peak at 180 mmHg and a mean diastolic pressure of 98 mmHg with a peak at 130 mmHg.

During his hospitalisation the patient experienced progressive deterioration of his renal function (urea of 154 mg/dl and creatinine of 2.3 mg/dl) with episodes of oligoanuria and hyperkalemia (5.4 mEq/l). He suffered from severe hypertension (stage II) resistance to drug therapy with peaks reaching 240/140 mmHg and he finally developed left heart failure with bilateral pleural effusions. An abdominal ultrasonography showed a left shrunken kidney with an incomplete cortico-sinusual dedifferentiation and a right kidney with incipient dedifferentiation lesions. Magnetic resonance angiography showed a severe stenosis of the right renal artery and an occluded left renal artery. The left kidney was atrophic. The distal abdominal aorta ended blind and the mesenteric arteries were well developed with a large celiac
axis. Since the patient's condition deteriorated despite intravenous nitroprussiate therapy, a percutaneous transluminal renal angioplasty (PTRA) was planned and a surgical standby was organized. The selective catheterisation of the right renal artery confirmed a subocclusive stenosis that could not be relieved by balloon angioplasty (Fig. 1). The endovascular procedure was converted to an open revascularization procedure at the same session.

A median laparotomy was performed. The omentum was separated from the transverse colon and the celiac axis was exposed in the lesser sac, the stomach being lifted upward. The descending duodenum was mobilized by Kocher's manoeuvre, the inferior vena cava and the right renal vein were readily located. The right renal artery was identified as it emerges from behind the vena cava. The inferior vena cava was mobilized and the proximal right renal artery was isolated. The gastroduodenal artery was not used as a source for inflow, since it could serve as an important collateral supply, given the infrarenal aortic occlusion. The infrarenal aorta and common iliac arteries were not available as inflow vessels due to the evolving Buerger’s disease with manifest infrarenal aortic occlusive disease. In addition, no greater saphenous vein was available. Under these exceptional circumstances, we decided to use the common hepatic artery as the source for inflow. A 6 mm externally supported polytetrafluorethylene (PTFE) prosthesis was anastomosed end to side to the common hepatic artery proximal to the origin of the gastroduodenal artery with a 6/0 monofilament running suture (Fig. 2). The prosthesis was placed behind the head of the pancreas to reach the right renal artery. The distal anastomosis was realized end to side in the same way.

Flow in the renal artery distal to the anastomosis was 215 ml/min as measured by dual-beam Doppler. No simultaneous left nephrectomy was performed.

There were no morbid events in the postoperative period. Signs of left heart failure disappeared and urine output improved. Diastolic blood pressure decreased from 98 to 90 mmHg and creatinine value fell to 1.4 mg/dl. The patient presented at the outpatient clinic 3 weeks after the intervention. He was asymptomatic and had no dyspnea. Blood pressure was 150/90 mmHg. Creatinine level was 1.3 mg/dl and urea was 30 mg/dl. The antihypertensive treatment was as follows: Moxonidine 0.2 mg once daily, Amlodipine 5 mg once daily, Cilazapril 2.5 mg twice daily. A renal perfusion scintigraphy (Mag 3) completed by a Captopril test showed a normally functioning right kidney. One year later, blood analysis showed a creatinine of 1.4 mg/dl and a urea of 47 mg/dl. Nevertheless, 24-hour blood pressure monitoring showed a persistent hypertensive status with systolic blood pressure superior to normal values during 71.7% of the time and diastolic blood pressures superior to normal during 83% of the time. Renal scintigraphy showed a well functioning right kidney (99% of captation).

The patient had to be readmitted 21 months later for the recurrence of a symptomatic hypertensive crisis reaching 220/110 mmHg. An intra-arterial angiography was performed by a right humeral approach. It demonstrated an occlusion of the coeliac trunk and an 80% stenosis of the superior mesenteric artery. The flow in the pancreatico-duodenal arcade was inverted and the hepato-renal bypass graft was patent (Fig. 3). The patient presented suddenly severe and diffuse abdominal
pain. Mesenteric ischemia was suspected. A percutaneous angioplasty of the superior mesenteric artery associated with stent insertion was successfully performed. The abdominal symptoms resolved and the hypertension was controlled by custom medication.

Discussion

Aorto-renal bypass grafting has been the preferred method of revascularization (high inflow, simplicity, durability) with or without transaortic thrombendarterectomy. Other alternatives are renal artery reimplantation (with replacement of a diseased distal aorta by a Dacron graft) and hepato- or spleno-renal bypass grafting. The durability of celiac axis branch vessels as sources of inflow vessels for renal bypass grafts is excellent, provided these arteries are not affected by flow-limiting lesions. One should be aware of the fact that hemodynamically significant celiac artery stenoses are prevalent in patients with advanced (> 75% diameter loss) renal artery stenoses (2). In the present case, renal artery revascularization was mandatory and the surgical possibilities were limited by the difficult clinical situation: the proximal anastomosis had to be completed without using partial aortic occlusion, there was no saphenous graft available, splanchnic collateral circulation had to be preserved given the Leriche syndrome. For these reasons, percutaneous angioplasty was attempted first. Given the risk of dissection and loss of the kidney, the procedure was performed carefully and briefly with a surgical team on standby.

Wong et al. reported on 51 consecutive patients undergoing surgical repair after failed percutaneous angioplasty: emergency operation was required in two patients for renal artery thrombosis (3). In comparison with patients treated by operation alone, they observed that the blood pressure benefit was significantly decreased among patients with atherosclerosis.

According to Moncure et al. (4) the peri-operative mortality rate is 6% for hepato-renal and spleno-renal reconstructions for atherosclerotic renal artery disease. Cure or improvement in hypertension is achieved in 83% of the patients. Renal function was preserved or improved in 87% of the patients. Postoperative hepatic dysfunction was never observed. In a large series including 323 renal artery reconstructions, Cambria et al. demonstrated that performance of aorto-renal and extra-anatomic bypass grafting was equivalent (5).

Renal artery reconstruction with prosthetic conduit has an acceptable result whether used for primary renal artery reconstruction or concomitant reconstruction with aortic procedures: secondary patency at 1 and 5 years was 98 and 96%, respectively (6). In the latter series, inflow was aorta or aortic graft in 95% of patients with the remainder taken from iliac or visceral vessels. Conversely, the use of a venous graft in a situation of renovascular hypertension carries the risk of aneurysmal degeneration and late rupture (7). PTFE grafts were used with satisfactory clinical results in aorto-renal bypass (8-10). However, hepato-renal bypass using a PTFE graft has rarely been performed since Pay et al. (6) reported only four hepato-renal bypass grafts with PTFE among 489 prosthetic renal artery reconstructions. The unusual positioning behind the head of the pancreas represents a possible risk of pancreatic complications. Nevertheless, our patient did not disclose any clinical or biological sign of pancreatitis or biliary tract compression. The late occlusion of the celiac trunk and stenosis of the superior mesenteric artery corroborates our avoidance of using the gastro-duodenal artery as an inflow for graft renal revascularization in the present case. Indeed, the pancreatico-duodenal arcade played a major role in the splanchnic blood supply by allowing reverse flow toward the celiac territory, the hepato-renal bypass graft and the right renal artery. Actually, it saved the patient, at least temporarily, from mesenteric ischemia.

Refractory hypertension in association with renal insufficiency shows significant improvement in response to revascularization although the individual outcomes are heterogeneous (11-13). The immediate renal function response to revascularization is often limited by the almost universally present renal parenchymal disease. In the present case, despite a dramatic improvement in renal function, the patient showed persistent moderate hypertension. This can be explained by his long history of hypertension since it was demonstrated that the
response rate is generally better for recent onset hypertension, compared to long-standing hypertension (14).

In addition, patients with a patent renal artery on angiogram but without normalization of blood pressure show an improvement of functional parameters evidenced by radionuclide techniques such as effective renal plasma flow, glomerular filtration and tubular transport time. In cases of re-stenosis or re-occlusion, all parameters deteriorate after surgery (15).

Because of progressive extrarenal artery disease and an aorto-iliac occlusive disease, one can be faced with inadequate inflow sources, thus increasing the complexity of surgical repair. The use of the hepatic circulation for inflow for renal revascularization may be an alternative to conventional renal artery reconstructive techniques in selected circumstances in patients requiring renal artery reconstruction for renovascular hypertension or preservation/retrieval of renal function.

References
