Laparoscopic Repair of Renal Artery Aneurysm

A Description of the Technique and Results in 2 Cases

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Background and Purpose: Renal artery aneurysm is a rare occurrence. We report our experience in the management of 2 symptomatic renal artery aneurysms with laparoscopic approach.

Material and Methods: Two patients, male and female, mean age 44 years (range: 43 to 45 y), diagnosed with left renal artery aneurysms during routine hypertension work-up, underwent laparoscopic aneurysm reconstruction.

Results: Operative time was 180 and 150 minutes with a warm ischemia time of 46 and 15 minutes and an estimated operative bleeding of 50 and 0 mL, respectively. The patients were discharged home on postoperative day 2 and 5, respectively. A selective left renal arteriography showed normal caliber of the repaired arteries in both patients. A follow-up of 45 and 7 months, respectively, has been uneventful.

Conclusions: In well-selected patients, vascular surgical techniques may offer excellent results. Laparoscopy provides the advantages of the minimally invasive approach while achieving adequate vascular control. However, advance training in laparoscopic reconstructive surgical techniques is required before attempting this procedure.

Key Words: laparoscopy, renal artery, aneurysm

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Renal artery aneurysm is a rare occurrence; its estimated incidence ranges from 0.09% to 0.3% in the general population. These localized dilations, caused by the weakening of the elastic tissue and media of the arterial wall, can be found on the main renal artery and its branches.[1] According to the categorization of Poutasse,[2] renal artery aneurysm can be classified as saccular, fusiform, dissecting, and intrarenal. Most aneurysms are small and asymptomatic, but clinical manifestations may vary between hypertension, subcostal or flank pain, hematuria, abdominal bruit, and more rarely, a palpable pulsating mass. Spontaneous aneurysm rupture is always a potential risk. However, surgical treatment remains controversial in aneurysms < 2 cm. Nevertheless, there is consensus that aneurysms larger than 2 cm with absent or incomplete calcification have formal indication for elective surgical resection.[1,3]

We report our experience in the management of 2 symptomatic renal artery aneurysms by means of laparoscopy.

PATIENTS AND METHODS

Between September 2002 and November 2005, 2 patients with diagnosis of renal artery aneurysm underwent laparoscopic transperitoneal surgical treatment. Their mean age was 44 years (range: 43 to 45 y). The 2 aneurysms were verified at the left renal artery. Patients were referred to our service by the section of hemodynamic of our institution.

Both patients planned for the laparoscopic approach were fully informed of the possible complications of the procedure. Final decision for the surgery was based on a consensus between the patients and the medical team. Informed consent was signed by every patient.

Case 1

A 43-year-old man was evaluated for an acute onset of a severe case of hypertension. The patient required an indication of daily doses of 5-mg amlodipine, 32-mg candesartan, and 75-mg captopril for its management. Abdominal ultrasound and Doppler showed an important decreased flow of the left renal artery. An aortography was indicated, which revealed a 2.5-cm left renal artery aneurysm. The aneurysm lesion was verified on the main arterial branch responsible for the vascularization of upper two-thirds of the kidney (Fig. 1). The patient received medical treatment for 2 months; afterwards, surgical treatment was decided and performed using a laparoscopic approach.

Case 2

A 45-year-old female patient was seen for chronic headaches. On initial work-up, high blood pressure was noticed with diastolic readings up to 120 mm Hg. Treatment was started with daily doses of 10-mg enalapril and 50-mg hydrochlorothiazide. The patient had a history of a direct relative with fibromuscular dysplasia of the renal artery managed with

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FIGURE 1. Preoperative selective renal angiography showing a 2.5-cm saccular aneurysm in main left renal artery.

angioplasty. An aortography revealed a bilateral renal artery stenosis with a 2.5-cm left renal artery aneurysm, compatible with fibromuscular dysplasia (Fig. 2). Bilateral balloon angioplasty was performed with adequate results. The patient was controlled and medicated with a daily oral dose of 50-mg atenolol, 75-mg clopidogrel, and 200-mg aspirin; normal blood pressure was achieved.

After 3 years, the patient was diagnosed with high blood pressure refractory to medical treatment. A magnetic resonance imaging revealed a left renal artery aneurysm and a right renal artery stenosis. Laparoscopic management for the aneurysm was decided.

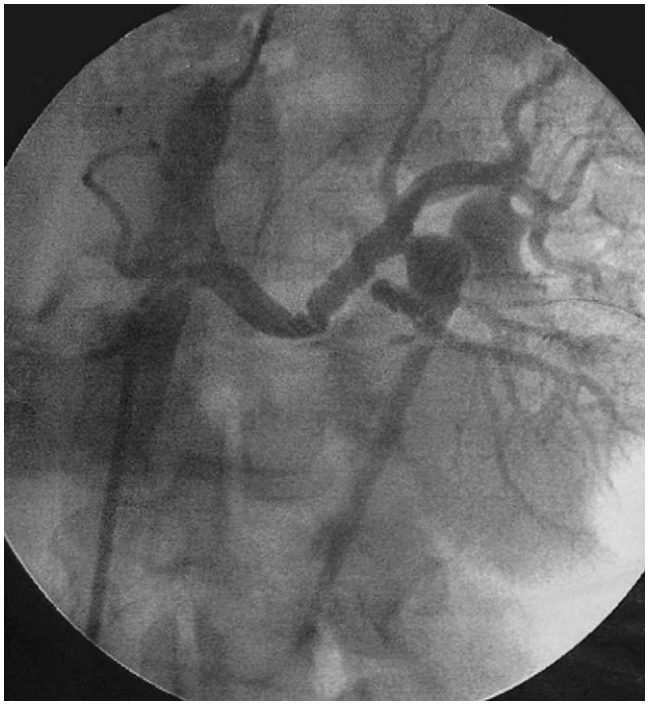

FIGURE 2. Aortography showing bilateral renal artery stenosis with a 2.5-cm left renal artery aneurysm.

Surgical technique

Under general anesthesia, the patient is placed on a right lateral decubitus (Fig. 3A). Nasogastric tube and a Foley catheter are inserted. An intermittent pneumatic compression device is installed in the lower extremities. Pneumoperitoneum is created using a Veress technique. A 4-port technique was performed. The first port was a paraumbilical trocar placed for the 30-degree laparoscope. The rest of the ports were placed as follows:

A 10-mm trocar was placed on the left lower quadrant; and two 5-mm trocars were placed, 1 on subcostal and 1 on the left flank (Fig. 3B). Using the harmonic scalpel (Ethicon, Endosurgery), the left colon was totally reflected medially. The splenocolic ligament is divided to mobilize the spleen to expose the upper pole of the left kidney. The left gonadal vein was identified and dissected up to the renal hilum; at this point, it was clipped and divided along with the left adrenal and lumbar veins. This allows for adequate exposure of the renal artery.

In the first patient, the aneurysm was found on the upper pole artery, right over the renal vein. In the second

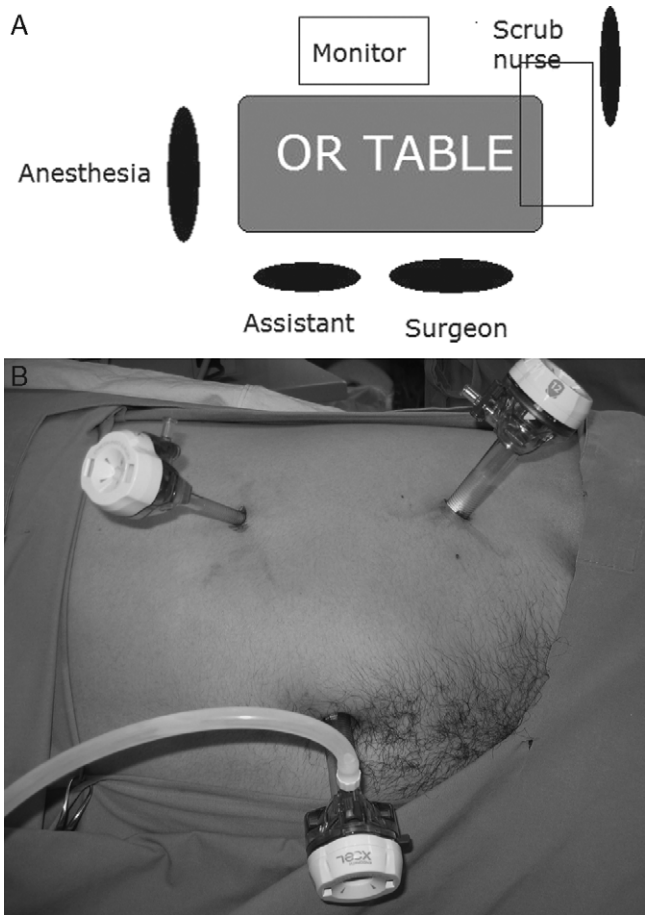

FIGURE 3. Patient (A) and trocar (B) positioning.

case, despite an extended hilar dissection, the kidney had to be completely freed and medially mobilized to identify the aneurysm lesion located posteriorly.

The aneurysm was circumferentially dissected, and systemic heparin was administered; renal artery was clamped both proximally and distally to the aneurysm. A Rummel-type tourniquet[4] was used in the proximal area, and 2 vascular clamps (Vascu-Statt II Midi Straight disposable clamps) were placed distally to the aneurysm at the artery bifurcation. These clamps are easily introduced through the 10 to 12-mm trocar. Using laparoscopic minishears, the aneurysm is bivalved and its walls are excised. The lumen of the aneurysm was carefully inspected and irrigated with heparin solution. The renal artery was then repaired using a 5-0 polypropylene nonabsorbable suture with an RB-1 needle on a running fashion. The distal clamps were removed, followed by the proximal Rummel clamp. The integrity of the suture line was verified watertight (Figs. 4A, B). Systemic heparinization was reversed using protamine. A window was created in Gerota's fascia and the perirenal fat to visualize adequate renal revascularization. The entire procedure was performed laparoscopically in the 2 cases.

RESULTS

Case 1

Operative time was 180 minutes with a warm ischemia time of 46 minutes and an estimated blood loss of 50 mL. There was no bleeding when clamps were removed. Postoperative analgesia was managed with parenteral ketorolac for 24 hours without the need of opiaceos medication. On postoperative day 1, an ecodoppler ultrasound showed adequate perfusion for the left kidney. Patient was discharged home on postoperative day 2. A selective left renal arteriography was performed 1 month after surgery showing normal caliber of the repaired artery. Histologic examination showed an arterial aneurysm with moderate atheromatosis and focal thrombosis. A 48-month follow-up has been uneventful with no hypertension. AngioTAC work-up performed at this time has showed adequate renal artery patency (Fig. 5).

Case 2

Operative time was 150 minutes with a warm ischemia time of 15 minutes and an estimated blood loss of 0 mL. It is worth mentioning that we determine surgical bleeding by measuring the quantity of blood collected by the suction device. In this surgery, there was not enough liquid to be measured. A postoperative magnetic resonance imaging showed excellent left renal perfusion and the presence of narrowing of the right renal artery. An aortography showed normal caliber of the reconstructed artery, whereas a second balloon angioplasty of the right renal artery was performed without incidents (Fig. 6).

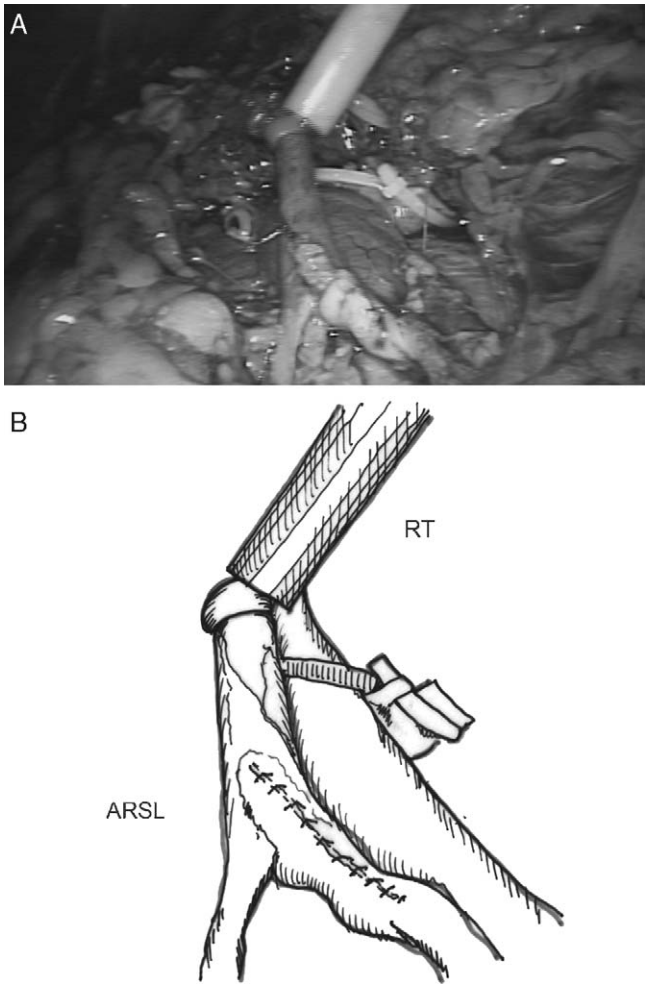

FIGURE 4. A and B, The integrity of the suture line was verified watertight. ARSL indicates arterial suture line, RT, Rummel tourniquet.

The patient was discharged on postoperative day 5. A 10-month follow-up has been uneventful without the need for antihypertensive medication.

DISCUSSION

Renal artery aneurysms are infrequent. These lesions are generally diagnosed during routine hypertension work-up. Nevertheless, some aneurysms are diagnosed in the context of flank pain, hematuria, or abdominal tremor.[1] In some cases, these lesions may be incidentally found with unrelated abdominal imaging. Complications of renal artery aneurysms include renovascular hypertension, thrombosis with renal infarction, arteriovenous fistulas, decreased renal function, and spontaneous rupture.[1,2] Spontaneous rupture is more frequent in aneurysms larger than 2 cm with absent or incomplete calcification and in hypertensive or pregnant patients. Indications for surgery are in relation with factors that may induce or increase the risk for

FIGURE 5. AngioTAC showing adequate renal artery patency.

spontaneous rupture.[3] Options for aneurysm repair vary for each specific case. Segmental artery aneurysm with concomitant parenchyma atrophy may warrant percutaneous steel coil embolization to diminish the risk of spontaneous rupture. However, complex, intrarenal, or multiple aneurysms may require one or more bypass or even extracorporeal bench aneurysmectomy with reconstruction and autotransplantation. For cases of saccular aneurysms, a viable option is to bivalve the aneurysm, excise the aneurysm sac, and perform reconstruction of the vessel. By restoring normal caliber to the vessel, this procedure eliminates the risk of spontaneous rupture and reestablishes adequate kidney perfusion.[5–7] Surgical treatment is a safe and feasible option, as showed by Seki et al[8] who reported 12 renal artery aneurysms successfully repaired by different surgical techniques, demonstrating the feasibility of vascular repair with excellent results. Herein, we present our experience in artery reconstruction in 2 cases with renal artery aneurysms. We must agree in considering this procedure a very difficult task, even with the aid of endoscopic view, which is optimum for it; intracorporeal suturing must be mastered before any attempt is undertaken. Gill et al[9] presented in the year 2001 the first report on repair of a renal artery aneurysm through laparoscopic approach.[10] They reported a 57-year-old woman with a 3-cm aneurysm of left main renal artery. The lesion was verified at the artery bifurcation, just like in the 2 cases we are presenting. They employed the laparoscopic 4-port transperitoneal technique to mobilize and repair the aneurysm. Vascular control was achieved with the use of bulldog clamps. For vascular control, we found the use of the Rummel tourniquet extremely helpful in controlling the distal segment of the aneurysmatic artery. This easily reproducible tourniquet has the advantages of being atraumatic, flexible, inexpensive, and can be rapidly assembled with materials commonly found in any operating room, as reported by Rosales et al.[4] Different than the common bulldog clamps, Rummel tourniquet can be placed through a 10-mm access port. We used this tourniquet in both the cases reported. It is noteworthy to mention our preference for the minivascular clamp; these clamps have excellent grip with the advantage of being smaller than common laparoscopic bulldog clamps. We used these clamps for distal vascular control.

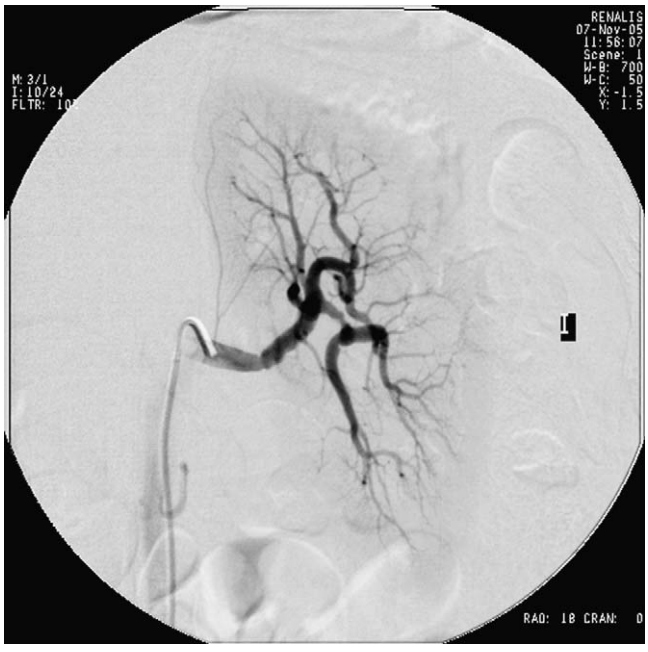

FIGURE 6. Aortography showing normal caliber of the reconstructed artery.

Gill et al[9] did bivalve the renal aneurysm and carefully trimmed it to adjust with the diameter of the renal artery. Their vascular reconstruction was completed with running laparoscopic suturing and intracorporeal knot tying. We have used the same approach in the treatment and repair of our cases.

We are reporting a mean warm ischemia time of 26 minutes (range: 15 to 46 min), which seems comparable with Gill et al's[9] report; however, our mean operative time of 165 minutes (range: 150 to 180 min) is significantly lower than the one published in their report. The lessons learned after years of laparoscopic renal surgery and the advances in laparoscopic reconstructive techniques have prompted the laparoscopist to attempt even more demanding procedures.[10,11] The mastering of advanced laparoscopic techniques has allowed for an expedite management of the renal pedicle with complete mobilization and control of the renal vein and selective clamping

of arterial branches. We have previously reported our experience in laparoscopic aneurysms treatment.[12,13]

We believe that this technique could only be applied in selected cases. Patients must be fully informed of potential risks and complications, as the laparoscopic repair cannot replace complex vascular reconstruction. Endovascular treatment remains the gold standard because it remains a less invasive treatment. Multilevel occlusive disease is also being treated by recanalization and percutaneous transluminal angioplasty/stenting. However, early results show that patency rates of these procedures are inferior to those of surgical bypass and reintervention is frequently necessary.[14] The laparoscopic approach still has limited application, nevertheless, it may be considered before open surgery in the cases in which endovascular treatment has failed. In either case, postoperative verification of improved renal perfusion and adequate repair of the aneurysm are always mandatory.

CONCLUSIONS

Renal artery aneurysms, though rare, can have catastrophic consequences. In well-selected patients, vascular surgical techniques may offer excellent results. Laparoscopy provides the advantages of the minimally invasive approach while achieving adequate vascular control. Advance training in laparoscopic reconstructive surgical techniques is required before attempting this procedure.

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