Reconstruction for renal artery aneurysms using the tailoring technique

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ABSTRACT

Objective: Renal artery (RA) aneurysm (RAA) is a rare and complex disease. Treatment options for a RAA include endovascular surgery and open surgery with ex vivo repair or in situ reconstruction. This study evaluated the long-term outcome after vascular reconstruction of RAAs using the tailoring technique. Tailoring or aneurysmorrhaphy means a partial resection of the aneurysm with direct suture of the remaining arterial wall.

Methods: A single-center retrospective study was conducted between January 1990 and December 2015. The tailoring technique was used to surgically repair 88 RAAs in 80 patients (52 women) with a mean age of 52.9 years. Patients' demographic data, vascular therapy, and renal function during follow-up were retrospectively evaluated.

Results: The localization of the RAA was at the right kidney in 58 patients. The mean size of the aneurysm was 21.4 ± 9.7 mm (range, 8-67 mm). Hypertension was diagnosed in 56 patients, and 23 were asymptomatic. One RAA was ruptured. The overall morbidity rate was 16.3%, including bleeding (n = 4), RA stenosis (n = 3), RA occlusion (n = 4), RA dissection (n = 1), and myocardial infarction (n = 1). One patient died of myocardial infarction for a 30-day mortality rate of 1.3%. The 30-day primary patency rate was 90.0%. The 30-day secondary patency rate was 95.0%. Follow-up data were obtained from 71 patients who underwent tailoring in 78 RAAs. The mean follow-up period was 60.7 months (range 2-229 months). In 76.4% of patients with RAA and hypertension, RAA reconstruction contributed to the cure or improvement of hypertension. The long-term patency after RAA reconstruction was demonstrated in a Kaplan-Meier curve, with cumulative patency rates of 98.7%, 97.4%, 94.8%, and 92.3% after 18, 24, 36, and 48 months, respectively. Estimated survival rates were 98.8%, 97.5%, and 96.3% after 12, 48, and 60 months, with an estimated mean time of 216.5 ± 7.2 months.

Conclusions: The tailoring technique is a safe and effective procedure with good long-term outcomes. RAA reconstruction contributed to the cure or improvement of renovascular hypertension. (J Vasc Surg 2016;■:1-6.)

Visceral artery aneurysms are rare vascular pathologies with an incidence of 0.1% to 2%.[1] Of these visceral artery aneurysms, 22%[2] are renal artery (RA) aneurysms (RAAs), with an estimated incidence of 0.1%.[3] The frequency of incidentally discovered RAAs has increased because of the widespread use of modern abdominal imaging such as computed tomography and magnetic resonance imaging.[4] Atherosclerosis, fibromuscular dysplasia (FMD), and arteritis are causes for RAA. Current indications for repair are an aneurysm size >3 cm, symptomatic aneurysms (hypertension, hematuria, and flank or abdominal pain), and aneurysms of any size in women of childbearing age.

Disagreement and controversy about the treatment criteria for RAAs >2 cm is present in the literature.[4] The risk of rupture is not well-known because of the rarity of the disease, which is thought to be <3% of diagnosed RAA.[4] Many authors dispute a direct correlation between aneurysm size and rupture, however.[5]

Among the treatment options are observation for asymptomatic RAA, endovascular therapy, and open surgery, which includes ex vivo and in situ repair such as interposition of a venous graft or excision with end-to-end anastomosis. Most RAAs have a morphology with an undilatated part of the RA and sufficient artery wall (saccular aneurysm) and are suitable for a reconstruction with the tailoring technique. Tailoring means resection of the aneurysm and direct suture of the remaining sufficient wall of the artery. Aneurysmorrhaphy is a simple common technique for aneurysm treatment.

Tailoring has been performed for RAA in our department since 1985. The objective of our study was to evaluate the long-term outcome after vascular reconstruction of RAA using the tailoring technique.

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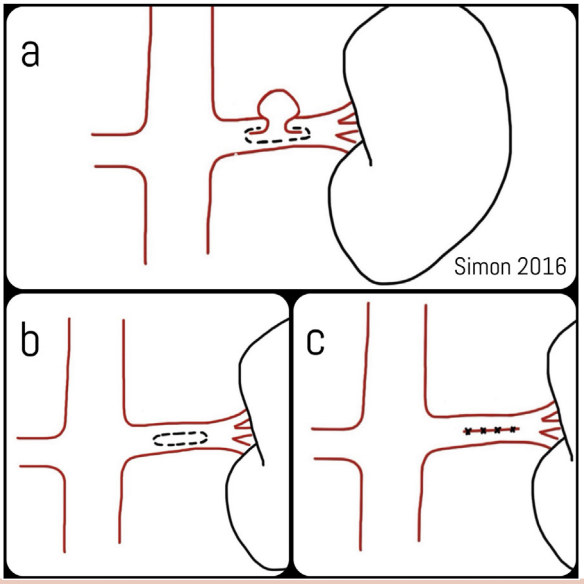

Fig 1. Drawing of the tailoring technique. **a,** Renal artery aneurysm (RAA); **b,** Resection of RAA; **c,** Direct suture of the remaining arterial wall.

METHODS

Between January 1990 and December 2015, 108 patients with 122 RAAs underwent a vascular reconstruction for the aneurysm. Of these patients included in the analysis, 80 patients with 88 RAAs were reconstructed using the tailoring technique. Excluded were other vascular reconstructions, such as interposition of a venous graft or excision with end-to-end anastomosis of the RA. Data were prospectively collected and retrospectively analyzed. Institutional Review Board approval was waived because of the retrospective characteristics of the study. All patients gave their written and informed consent before surgery.

The current diagnosis was provided by duplex ultrasound imaging combined with computed tomography angiography or magnetic resonance imaging. In the past, conventional angiography was the standard imaging.

The morphology of the aneurysm was an important factor for the choice of technique used for open repair. Saccular aneurysms were suitable for the tailoring technique. Tailoring or aneurysmorrhaphy means a partial resection of the aneurysm and building a normal diameter of the vessel with direct suture of the remaining arterial wall[6] (Fig 1). This technique depends on undilated parts of the RA. The remaining arterial wall has to be sufficient for a direct suture. In our department, tailoring became the treatment option of choice for RAA at the main artery/hilum and branches with a saccular morphology in the last decade. Surgical access was gained via a retroperitoneal approach in all cases.

SPSS 22.0 software (IBM Corp, Armonk, NY) was used for the statistical analyses. Continuous variables are reported as the means ± standard deviation. The level of significance was defined at $P < .05$ using the *t*-test, Mann-Whitney *U* test, and Wilcoxon test for blood pressure, creatinine level, and resistant index before and after surgery. Blood pressure was measured before surgery and after hospital discharge and was analyzed using Mann-Whitney *U* test. The group whose hypertension was cured were patients who no longer needed antihypertensive medications. The group with improvement of hypertension were patients with a decrease in the number of antihypertensive medications. The Mann-Whitney *U* test was used to compare the group with FMD with the remaining group for change in the number of antihypertensive medications before and after surgery. Survival and patency rates were calculated with the Kaplan-Meier method.

RESULTS

RAAs were identified in 108 patients in a 26-year period, of whom 80 patients (52 women and 28 men) with 88 RAAs in 84 kidneys were treated using the tailoring technique (Fig 2, *a* and *b*). The mean age was 52.9 ± 13.6 years (range, 13-83 years). In situ reconstruction was performed in all cases. Fifty-six patients were hypertensive, 23 were asymptomatic, and the RAA in one patient was ruptured.

The RAAs were unilateral in 95.5% (right in 58 and left in 30) and bilateral in 4.5% (n = 4). RAAs were located at the hilum in 77.3% (n = 68), at the segmental RA in 21.6% (n = 19), and at the polar RA in 1.1% (n = 1). Patients' demographic information is summarized in Table I.

The mean size of the aneurysm was 21.4 ± 9.7 mm (range, 8-67 mm). Our indication for repair in patients with RAA <2 cm were women in childbearing age, symptomatic aneurysm, and ruptured aneurysm. The RAA size of the ruptured aneurysm was 15 mm in a 25-year-old man. Open repair of the 8-mm small RAAs was performed with other vascular repairs, simultaneously in three cases for visceral artery aneurysms and in one case for aortic coarctation. RA stenosis (RAS) was observed as ipsilateral in 9 patients (11.3%), contralateral in 3 (3.8%), and bilateral in 1 (1.3%). The creatinine level was 0.85 ± 0.21 mg/dL preoperatively and 0.90 ± 0.30 mg/dL postoperatively (n = 78), with no significance ($P = .164$ by Wilcoxon test). The resistance index, obtained and measured by duplex ultrasound imaging, was 0.61 ± 0.07 (n = 38) preoperatively and 0.63 ± 0.07 (n = 57) postoperatively, with no significance ($P = .513$ by *t*-test).

Early results. The overall morbidity rate was 16.3%, including bleeding in 4 patients, RAS in 3, RA occlusion in 4, RA dissection 1, and myocardial infarction in 1 (Table II). One patient died of myocardial infarction for a 30-day mortality rate of 1.3%. The 30-day primary patency rate was 90.0%. The 30-day secondary patency rate was 95.0% in 80 patients.