# Management of wide-based renal artery aneurysms using noncovered stent-assisted coil embolization

Xiaolong Wei, MD, Yudong Sun, MD, Yani Wu, MD, Zhenjiang Li, MD, Jiang Zhu, MD, Zhiqing Zhao, MD, Rui Feng, MD, *and* Zaiping Jing, MD, *Shanghai, China*

## ABSTRACT

**Objective:** This study describes the safety and midterm efficacy of a noncovered stent-assisted embolization (SAE) technique in treating patients with wide-base renal artery aneurysms (RAAs).

**Methods:** Between February 2011 and June 2014, 34 RAAs in 28 consecutive patients were treated with noncovered SAE in our center.

**Results:** Technical success was 100%. During an average follow-up of 19 months, the systolic and diastolic blood pressures were significantly decreased. Serum creatinine was significantly decreased, and the glomerular filtration rate was significantly increased at the 6 and 12 month follow-up compared with the baseline. The aneurysm sac thrombosis ratio was obviously increased at 1, 6, and 12 months of follow-up. Complications occurred in four patients, including one major, two minor, and one late complication. Computed tomography angiography or digital subtraction angiography demonstrated that the primary patency at 1, 6, and 12 months was 100%, 96%, and 100%, respectively, and primary assisted and secondary patency was 100%, without endoleaks.

**Conclusions:** SAE can be safely and effectively performed in patients with wide-based RAAs or those with critical anatomy. It showed a midterm reduction of blood pressure and improvement of renal function in RAA patients. (J Vasc Surg 2017;■:1-8.)

Renal artery aneurysm (RAA) is a rare disease, with an estimated incidence of 0.1% in the general population.[1] However, angiographic studies have indicated a higher incidence rate of 2.5% in hypertensive patients.[2] The clinical symptoms include flank pain and tenderness, hypertension, hematuria, and even hypovolemic shock. Most patients with RAA are asymptomatic, and almost all are diagnosed by routine physical examination. The rupture of an RAA can lead to hemorrhage and renal function impairment. The risk factors for rupture of RAAs include large size (diameter >20 mm), expansion, and pregnancy.[3]

An aneurysm of diameter >20 mm is considered suitable for surgical treatment by most surgeons. Surgical managements of RAAs include open surgery and endovascular techniques such as transcatheter embolization and stenting. The elimination of surgical trauma, potential decreased morbidity, and faster recovery make endovascular repair an attractive alternative treatment. Morphology and location of the aneurysm along the renal artery are the main determinants of surgical treatment choice.[4] RAAs with a complex anatomy, including unfavorable base or sac ratio, can be hardly treated by traditional endovascular methods. The classification of RAAs is always according to their shape, location, and wall. Saccular aneurysms may be arbitrarily classified as narrow or wide base according to the diameter of the entry portal from the parent vessel to the aneurysm sac.

Noncovered stent-assisted embolization (SAE) as an endovascular remodeling technique has been used for the treatment of intracranial aneurysms with complex anatomy.[5] Our purpose for this study, after a thorough review of our experience of noncovered stent-assisted coiling embolization for treatment of RAAs, was to gain insight into the advantages and limitations of the application of noncovered stent-assisted coiling embolization and develop a scientific approach for the most optimal treatment choice for RAAs.

## METHODS

This study was approved by the Changhai Hospital Medical Ethics Committee, and written informed consent was obtained from all participants. The endovascular procedure performed in our study was in accordance with the current guidelines on peripheral artery disease.[6]

**Inclusion criteria and patient characteristics.** RAAs were defined as focal, isolated dilatation of all three layers of the arterial wall that measured >1.5 times the diameter of the normal proximal adjacent arterial

From the Department of Vascular Surgery, Changhai Hospital, Second Military Medical University.

This work was partly supported by the National Natural Science Foundation of China (grant no. 81330034) and the Shanghai Science and Technology Projects (grant no. 14411963900).

Author conflict of interest: none.

Correspondence: Rui Feng, MD, Department of Vascular Surgery, Changhai Hospital, 168 Changhai Rd, Shanghai 200433, China (e-mail: fengrui1588@qq.com).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214



http://dx.doi.org/10.1016/j.jvs.2017.04.035

segment. Between February 2011 and June 2014, 114 consecutive patients with RAAs verified by computed tomography angiography (CTA) were treated at our institution, Changhai Hospital, Second Military Medical University, Shanghai, China (Fig 1). The indications for hospital intake usually were low back pain, refractory hypertension, RAAs ≥2 cm, or progressive aneurysmal dilatation of the renal artery. Aneurysms with relevant branches perfusing a significant portion of the kidney and patients with limited economic conditions would be treated by open surgery. Open surgery was performed in 11 patients, and s ix patients required medicine for treatment.

Endovascular repair was offered to 97 patients. Aneurysms presenting with a wide base or involving bifurcations, with possible subsequent exclusion of more than one branch, were included for this type of treatment. Exclusion criteria for this type of endovascular treatment were the presence of aneurysms without an adequate neck for catheterization or without optimal proximal and distal landing zones when stent placement was planned, the presence of significant tortuosity of the target vessel, all of the contraindications to the use of iodinated contrast medium, and fusiform aneurysms.

The three main endovascular operation methods to treat RAA are covered stent exclusion, coil embolization, and noncovered-stent assist coil embolization. Twenty-eight eligible patients were acceptable candidates for treatment with noncovered stent-assisted coil embolization following the technique described in this report. No limitations were placed on the number of aneurysms and vessels to be treated.

**Baseline measurements.** The symptomatic RAA is defined as difficult-to-control hypertension, flank pain, hematuria, abdominal pain, and other pain (back pain, etc). CTA was used to evaluate the renal arteries, and three-dimensional reconstruction was obtained with Aquarius software (TeraRecon, Foster City, Calif). Status of patency or thrombosis of the aneurysms was assessed using delayed-phase imaging.

Blood pressure was obtained from patients seated in a chair after at ≥5 minutes of rest. Blood pressure was measured twice, and the average of the two values was recorded. Hypertension was defined as systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg, or both. Patients with hypertension who took oral antihypertensive medications before being hospitalized stopped the antihypertension therapy after they were hospitalized and did not take any medicine to control blood pressure during follow-up. The serum creatinine concentration and glomerular filtration rate (GFR) were obtained from all patients before and after the operation. GFR was used as an index of kidney function and was calculated using the isotope dilution mass spectrometry-traceable Modification of Diet in Renal Disease Study equation ($GFR = 186.3 \times [\text{creatinine}^{-1.154}] \times [\text{age}^{-0.203}] \times [0.742^{\text{if female gender}}]$). GFR was assessed preoperatively and postoperatively at 1, 6, and 12 months and at the last follow-up.

## ARTICLE HIGHLIGHTS

- **Type of Research:** Single center retrospective cohort study
- **Take Home Message:** Stent-assisted embolization was used to treat 34 renal artery aneurysms in 28 patients with 100% technical success, and 100% secondary patency at 1 year. Blood pressure and renal function improved. Four patients had complications.
- **Recommendation:** Early results suggest that stent–embolization is effective treatment of wide-based renal artery aneurysms.

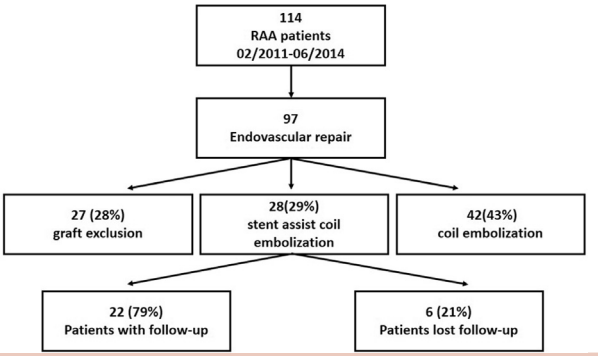


**Fig 1.** Flowchart shows treatment follow-up. *RAA,* Renal artery aneurysm.

**Selection of endovascular prosthesis.** The diameter and length of the stent was determined by information derived from the CTA and intraoperative aortography with calibrated catheters. All of the stents used in our study were self-expanding stents: Solitaire FR (eV3 Endovascular, Inc, Plymouth, Minn), Express2 (Boston Scientific, Natick, Mass), and PALMAZ BLUE (Cordis, Miami Lakes, Fla) were used. According to the diameter of the RAA, the 0.018-inch or 0.035-inch Interlock Fibered IDC Occlusion System (Boston Scientific) was chosen for filling the RAA.

**Endovascular procedure.** After the patient provided informed consent, the embolization was performed with local anesthesia via transaxillary access or transfemoral approach. A dose of clopidogrel (75 mg daily) and aspirin (100 mg daily) was administered orally immediately after a decision was made to perform noncovered stent-assist coil embolization for the treatment of RAAs.

Systemic heparinization was given at the beginning of the procedure, aiming for an increase of the activated