Low-profile Stent System for Treatment of Atherosclerotic Renal Artery Stenosis: The GREAT Trial

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PURPOSE: The Palmaz Genesis Peripheral Stainless Steel Balloon Expandable Stent in Renal Artery Treatment (GREAT) Trial was designed to assess the safety and performance of a low-profile stent for the treatment of obstructive renal artery disease by looking at 6-month renal artery patency uniformly analyzed by a Core Lab.

MATERIALS AND METHODS: Fifty-two consecutive patients (mean age, 63.7 years) were successfully treated with the Palmaz Genesis Peripheral Stent (Cordis, Miami, FL) on the Slalom 0.018-inch Delivery System (Cordis Europe N.V., Oosteinde 8, NLO-9301 LJ Roden, The Netherlands) at 11 investigational centers. Patients with severe renal failure and > 8-mm renal artery were excluded. Primary endpoint was angiographic determination of in-stent percent diameter stenosis at 6 months. Fifty-one patients were treated with one stent, one patient was treated with two stents to cover the complete lesion.

RESULTS: Mean percentage diameter stenosis before renal angioplasty was 68.2% ± 12.0%. No stent implantation failure, displacement, need for additional stent implantation, or procedural complication was observed. Six-month angiography was performed in 41 of 52 patients (79%) resulting in a mean in-stent percent diameter stenosis or Quantitative Vessel analysis (QVA) at 6 months of 23.9%. The in-stent binary (percent diameter stenosis > 50%) restenosis rate at 6 months was 14.3%. No fatal events occurred up to 6 months after implantation. Major adverse events occurred in five patients: four patients (7.7%) required a revascularization and one patient (1.9%) experienced a cerebrovascular event, which regressed spontaneously.

CONCLUSIONS: The Palmaz Genesis stent (Cordis) provides good results for renal artery stent placement, with an in-stent binary restenosis rate (percent diameter stenosis > 50%) at 6 months of 14.3% as determined with angiography.

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Abbreviations: GREAT = Palmaz Genesis Peripheral Stainless Steel Balloon Expandable Stent in Renal Artery Treatment, PTRA = percutaneous transluminal renal angioplasty, RAS = renal artery stenosis

THE various modalities used in the treatment of renal artery stenosis (RAS) have evolved over the years. In the late 1970s, percutaneous transluminal renal angioplasty (PTRA) was introduced as an alternative to surgical revascularization; however, intimal hyperplasia causing restenosis after PTRA still remained a problem. The location of the lesion in the renal artery significantly impacts the success of PTRA. Canzanello (1) reported complete or partial technical success rates for PTRA of 72% in non-ostial lesions and 62% in ostial lesions.

The introduction of stent placement in renal artery treatment did improve the results (ie, less immediate restenosis), especially for renal ostial lesions. A meta-analysis of the literature done by Leertouwer (2) showed a 6-month restenosis rate close to 17% when 0.035-inch compatible stents are used. This also showed a lack of well-vali-

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Table 1
Inclusion and Exclusion Criteria

Inclusion Criteria
Age over 30 years;
If female patient with child bearing potential, must have a documented negative pregnancy test within 3 days prior to inclusion;
Clinical indication for renal artery revascularization of atherosclerotic renal artery stenosis ≥ 50% as measured by operator or estimated original vessel diameter, based on healthy vessel segment and contralateral side;
The reference vessel renal artery must be ≥ 4mm and ≤ 8 mm by visual estimate;
The patient must have a baseline serum creatinine of ≤ 5.0 mg/dL;
Patient is willing and able to comply with the specified follow-up evaluation;
The patient or legally authorized representative must provide written informed consent prior to the procedure.
Exclusion Criteria
More than one index lesion in a renal artery, including tandem lesions; however, bilateral artery stenosis are allowed (If the patient requires treatment of the contralateral renal artery, this is allowed during the same procedure, as long as this is done prior to the index procedure, and with a successful outcome.);
Total occlusion of the renal artery;
Lesions that would require more than two stents;
Any known complication (eg, guide wire perforation) following balloon angioplasty;
Lesions which are in arteries to transplanted or bypassed kidneys;
Any patient allergic or intolerant to aspirin and/or sirolimus (Rapamycin);
Any patient with a co-existing condition with a life expectancy of less than 2 years;
Patients with a known bleeding or hypercoagulation disorder;
Absolute contraindication to administration of intravenous contrast material, heparin, or known allergy to 316 L stainless steel or any of its components;
Abdominal aortic aneurysm > 4 cm in diameter;
Major surgical or interventional procedures within 30 days prior to this study or planned surgical or interventional procedures within 30 days of entry into this study;
Patients with ASA classification ≥ 4;
Life expectancy of less than 2 years or factors making clinical follow-up difficult;
Imprisoned persons;
Patients enrolled in this or other clinical trial or anticipated to be included into a trial which may interfere with this study, or patients already enrolled in this trial before.

dated angiographic follow-up data because angiographic follow-up was not done routinely nor was duplex ultrasonography (US) used. New generation premounted stents with lower profiles (0.018-inch) might improve the deliverability and reduce procedural complications, such as punctured balloons, but little is known about the restenosis rate with these new devices. Prospective data on renal artery patency, especially data obtained through a uniform analysis by a Core Lab, are lacking.

Cordis Corporation designed the bare Palmaz Genesis stent, available on the Slalom Balloon Delivery System over an 0.018-inch guide wire with a crossing profile of 0.064-inch for the 5-mm stent and 0.066-inch for the 6-mm stent, to achieve a possible reduction in restenosis. Larger stent delivery systems like the 0.035-inch compatible stents report crossing profiles up to 0.080 inch. It was expected that the lower platform of the stent would allow a better technical success rate, but the restenosis rate with this device had to be investigated (3). The Palmaz Genesis Peripheral Stainless Steel Balloon Expandable Stent in Renal Artery Treatment (GREAT) Trial was designed to assess the safety, technical efficacy, and 6-month binary restenosis rate of this stent for the treatment of obstructive renal artery disease by looking at the 6-month renal artery patency uniformly analyzed by a Core Lab.

MATERIALS AND METHODS

Study Design and Patient Group

The GREAT trial is a multicenter, prospective, controlled, feasibility study evaluating the primary patency of the low-profile balloon expandable stent.

Competent authorities and ethics committees gave their approval prior to patient inclusion. All patients gave written consent and agreed to undergo stent placement and to come to the hospital for the protocol required follow-up visits, including a 6-month angiographic control.

From November 2001 to October 2002, 52 patients were enrolled at 11 sites (Appendix 1) across Europe. Patients with a clinical indication for renal artery revascularization of the atherosclerotic RAS were included. Clinical indication for renal artery revascularization was arterial hypertension of renal origin and/or impaired renal function.

Inclusion and Exclusion Criteria

Inclusion criteria included a visual assessment of the stenosis which had to be ≥ 50% stenosis in a reference vessel between 4 and 8 mm in diameter. Visual assessment (estimation of the degree of RAS) was measured by the operator or based on estimated original vessel diameter, healthy vessel segment, and contralateral side. Further main inclusion criteria were: age more than 30 years and/or baseline serum creatinine ≤ 5.0 mg/dL. The main exclusion criteria stated that the patient could have more than one lesion, but only one target lesion fulfilling the angiographic criteria as described above would be considered. Totally occluded renal arteries were excluded as well as lesions requiring more then two stents or located in arteries to transplanted or bypassed kidneys. An overview of all inclusion and exclusion criteria is listed in **Table 1**.

Procedure

Standard available introducers with hemostasis valve, guiding catheters, and guide wires were used during the index procedure. Pre- and post-dilatation of the lesion and balloon sizing were left to the investigators discretion. The use of pressure gradient measurements and method of stent deployment were left to the discretion of the center. All patients were treated with the bare Palmaz Genesis stent (Cordis) compatible with a 0.018-inch guide wire. This stent is a balloon-expandable, laser-cut stent made from 316 L stainless steel tubing