Renal Transplant Arterial Stenosis Treated With Bare-Metal Versus Drug-Eluting Stents: Comparison of Treatment Outcomes

R.F. Hanna, F. Hao*, C.F. Kraus, G. Mitsopoulos, G.E. Goldstein, J. Weintraub, D. Sperling, J. Susman, P. Schlossberg, and V. Sheynzon

Department of Radiology, Columbia University Medical Center, New York, New York

ABSTRACT

Introduction. This study aims to evaluate outcomes of bare-metal stents (BMS) versus drug-eluting stents (DES) in patients who undergo stenting for transplant renal arterial stenosis.

Materials and Methods. We retrospectively reviewed records of renal transplantation patients who underwent transplant renal arterial stenting from September 2009 to September 2013. All stents greater than 5 mm were excluded to allow for equivalent comparison between the DES and BMS groups. Statistical comparisons were performed using a two-tailed Fischer exact test, and analysis of continuous variables was analyzed using a one-way analysis of variance.

Results. The final study population included a total of 18 patients who received either BMS or DES (11 and 7 patients, respectively) for transplant renal arterial stenosis. The most common indications for stenting were increasing creatinine level and abnormal Doppler velocities. There were more re-interventions with BMS (n = 4/11) than DES (n = 0/7), but the trend was not statistically significant ($P = .12$). Three patients who received BMS had a clinically significant decrease in blood pressure versus 4 in the DES group ($P = .33$). Six patients who received BMS had a clinically significant decrease in creatinine level versus 3 in the DES group ($P = 1.0$).

Conclusion. There is an absolute but not statistically significant difference in the incidence of restenosis requiring repeat intervention between the BMS and DES groups. No difference was detected in clinical success as measured by decreases in blood pressure or creatinine. Future larger studies are needed to corroborate these findings.

A MYRIAD of complications can result from renal transplantation for definitive treatment of end-stage renal disease, such as hemorrhage, rejection, graft-versus-host disease, and transplant renal artery stenosis (TRAS) [1,2]. TRAS has become an increasingly recognized cause of graft dysfunction and transplant recipient morbidity, and is evidenced by increasing creatinine level and refractory hypertension. The estimated incidence of TRAS ranges from 1% to 23%, with a more recent largescale study finding the incidence to be 8.3% [3–7].

Although TRAS has been shown to be amenable to surgical revision, Ghazanfar et al observed better outcomes in patients treated with percutaneous transluminal angioplasty relative to surgery [3,8,9]. The addition of bare-metal stents (BMS) to angioplasty has improved on the relatively high restenosis rates associated with angioplasty alone, ranging from 6.4% to 62% [5,10–12].

The etiologies of TRAS include atherosclerosis, bend-kink, suture and donor procurement techniques, and immune-mediated intimal hyperplasia. Drug-eluting stents (DES) have been shown to decrease intimal hyperplasia and confer increased vessel patency in the treatment of coronary artery disease [13,14], and further studies have explored the application of DES in TRAS to reduce the effects of intimal hyperplasia. However, data comparing angiographic

*Address correspondence to Frank Hao, MD, Department of Radiology, New York Presbyterian Hospital, 630 West 168th Street, New York, New York 10032. E-mail: frankhao1@gmail.com

0041-1345/15
http://dx.doi.org/10.1016/j.transproceed.2015.09.062

outcomes in native renal artery stenosis treated with BMS versus DES stents did not show a significant difference in vessel patency at 6 months [15].

Reports of DES in the treatment of TRAS are limited and have focused on the safety and clinical efficacy of such stents. The purpose of our study was to evaluate the outcomes of BMS versus DES in the treatment of transplant renal artery stenosis.

MATERIALS AND METHODS

Study Design

A retrospective single-center study was conducted of all renal transplantation patients who underwent an IR procedure from September 2009 until September 2013. Institutional review board approval was obtained and informed consent was waived. The PACS database was analyzed for the number and dates of IR examinations from which included the words renal, transplant, and stent. Patients were excluded if they did not have renal transplant arterial stenting or if the stent they received was greater than 5 mm in diameter to allow for better comparison in stent diameters as 6-mm diameter DES were not widely used or available. Parameters recorded within the final study population included clinical indications for stenting, date of transplantation, etiology of renal disease, age, gender, smoking status, the presence of diabetes mellitus, and time to follow-up. Systolic and diastolic blood pressures measurement, creatinine levels, and dialysis status were recorded before stenting as well as after.

Subjects

From January 2009 to August 2013, our institution performed transplant renal arterial stenting in 18 patients for clinical care (Fig 1). The patient population included 15 men and 3 women whose mean age was 63 years (range, 42 to 76 years) who received either a cadaveric or living donor renal allograft. The arterial anastomoses were sutured in an end-to-side fashion to the external iliac artery. No patients were younger than 18 years. Of 18 patients, 4 were diabetic, 2 were current smokers, and 1 was both a smoker and a diabetic. Smokers composed a small contingent of the study population due to a policy of smoking cessation before transplantation. Twelve patients (67%) required intervention due to elevated creatinine, 4 (22%) due to elevated velocities/resistive indices on Doppler ultrasound, 1 (5%) due to hypertension, and 1 (5%) patient required intervention with hypertension and an elevated creatinine level. The mean interval between transplantation and intervention was 146 days (range, 49 to 247 days). The etiologies of renal disease included 6 patients with hypertension, 4 with diabetes, 2 with polycystic kidney disease, 3 with glomerulonephritis, 2 with lithium toxicity, and 1 patient with two or more. Eleven of 18 (61%) patients received BMS and 7 of 18 (39%) patients had DES placed (Table 1).

Differences in the time interval between transplantation and stenting, pre-procedure creatinine level, pre-procedure systolic blood pressure, time to creatinine follow-up, and time to blood pressure follow-up were found not to be statistically significant in the BMS versus the DES groups (Table 2).

Treatment Method

For each intervention, selective angiography of the transplant renal artery was performed. The ipsilateral iliac artery was visualized to exclude proximate transplant renal artery stenosis (non-renal artery stenosis which occurs in the aortoiliac segment proximal to the transplant artery), an entity that has been described to present similarly to TRAS [5]. In light of concerns for further compromise of the renal graft, CO_2 angiography or 50% diluted iodinated contrast was used throughout the interventional procedure. Stenosis was considered significant if there was luminal diameter narrowing of greater than 50% or if pressure measurements across the stenosis were greater than 20% peak systolic pressure.

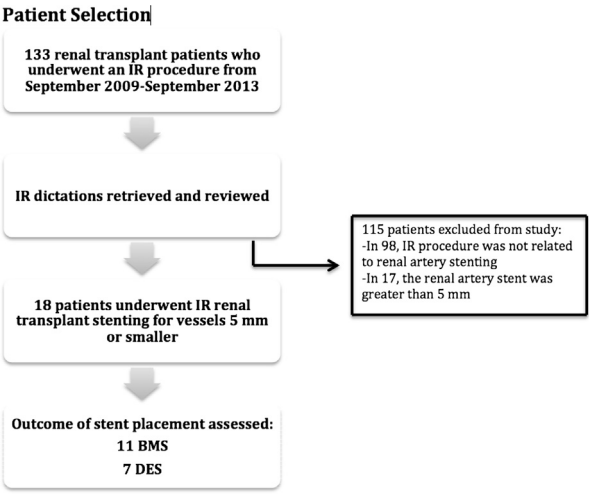

Fig 1. Flow chart of patient selection. *Solid lines* specify patients who were included in the study and *dotted line* specifies patients who were excluded. Abbreviations: BMS, bare-metal stent; DES, drug-eluting stent.

In all cases, the stenosis was traversed with a guidewire, and a 5 Fr angled catheter was introduced to obtain pressure measurements. After appropriate image calibration, the diameter of the stent was chosen by comparing to the adjacent normal segment of the renal artery [16]. Stents lengths were chosen so as to completely traverse the entire stenosis. After administration of intravenous heparin, the stenosis was then treated by DES or BMS. BMS included Liberte (also called VeriFLEX, Boston Scientific, Natick, Massachusetts, United States), Palmaz Genesis (Cordis, Miami Lakes, Florida, United States), and Herculink (Abbott Vascular, Santa Clara, California, United States), with diameters ranging from 3.5 to 5 mm. DES included Xience V everolimus eluting stents (Abbott Vascular) and Resolute Zotarolimus-eluting (Medtronic, Minneapolis, Minnesota, United States) also with diameters ranging from 3 to 5 mm. Usage of a particular stent type was dictated by preference of the attending physician and patients were

Table 1. Demographics and Stent Sizes

	BMS (n = 11)	DES (n = 7)
Diabetes mellitus, n (%)	2/11 (18)	2/7 (14)
Smoker (within past 10 y), n (%)	1/11 (9.0)	1/7 (14)
Stent size, mm		
3.0	0	2
3.5	1	3
4.0	2	1
4.5	2	1
5.0	6	0

Abbreviations: BMS, bare-metal stent; DES, drug-eluting stent.