JACC: CARDIOVASCULAR INTERVENTIONS VOL. 4, NO. 3, 2011

ISSN 1936-8798/$36.00
PUBLISHED BY ELSEVIER INC. DOI: 10.1016/j.jcin.2010.11.013

5-Year Follow-Up of Polytetrafluoroethylene-Covered Stents Compared With Bare-Metal Stents in Aortocoronary Saphenous Vein Grafts

The Randomized BARRICADE (Barrier Approach to Restenosis: Restrict Intima to Curtail Adverse Events) Trial

Gregg W. Stone, MD,* Sheldon Goldberg, MD,† Charles O'Shaughnessy, MD,‡ Mark Midei, MD,§ Robert M. Siegel, MD,‖ Ecaterina Cristea, MD,* George Dangas, MD,* Alexandra J. Lansky, MD,* Roxana Mehran, MD*

New York, New York; Philadelphia, Pennsylvania; Elyria, Ohio; Towson, Maryland; and Phoenix, Arizona

Objectives We sought to evaluate the utility of the JOSTENT polytetrafluoroethylene (PTFE) stent-graft (Jomed GmbH, Rangendingen, Germany) in patients with diseased saphenous vein grafts (SVGs)
undergoing percutaneous coronary intervention (PCI).

Background Prior trials of the JOSTENT stent-graft did not mandate high-pressure implantation or prolonged dual antiplatelet therapy, and were limited by short-term follow-up.

Methods A total of 243 patients at 47 centers with 1 to 2 discrete lesions in SVGs were prospectively randomized to JOSTENT implantation (≥18 atm.) versus bare-metal stents (BMS). The JOSTENT patients were treated with aspirin indefinitely and clopidogrel for ≥8 months. Routine angiographic follow-up was performed at 8 months, and all patients were followed for 5 years.

Results The primary end point of in-lesion binary restenosis occurred in 31.8% of lesions treated with the JOSTENT versus 28.4% of lesions treated with BMS (relative risk: 1.12, 95% confidence interval [CI]: 0.72 to 1.75, p = 0.63). At 9 months, the major secondary end point of target vessel failure (death, myocardial infarction, or clinically driven target vessel revascularization) occurred in 32.2% of patients treated with the JOSTENT versus 22.1% of patients treated with BMS (hazard ratio: 1.54, 95% CI: 0.94 to 2.53, p = 0.08). During long-term follow-up, significantly more events accrued in the JOSTENT arm such that by 5 years target vessel failure had occurred in 68.3% of JOSTENT patients versus 51.8% of BMS patients (hazard ratio: 1.59, 95% CI: 1.13 to 2.23, p = 0.007).

Conclusions The long-term prognosis for diseased SVGs requiring PCI is dismal. The JOSTENT PTFE stent-graft results in inferior outcomes compared with BMS, despite high-pressure implantation and prolonged dual antiplatelet therapy, a finding that becomes more evident with longer-term follow-up. (J Am Coll Cardiol Intv 2011;4:300–9) © 2011 by the American College of Cardiology Foundation

From the *Department of Medicine, Division of Cardiology, Columbia University, Medical Center/New York-Presbyterian Hospital and the Cardiovascular Research Foundation, New York, New York; †Hahnemann University Hospital, Philadelphia, Pennsylvania; ‡EMH Regional Medical Center, Elyria, Ohio; §St. Joseph's Medical Center, Towson, Maryland; and the ‖Phoenix Memorial Hospital, Phoenix, Arizona. Dr. Stone reports receiving research grants from Jomed, and serving on the scientific advisory board for and receiving honoraria from Abbott Vascular and Boston Scientific. Dr. Goldberg reports receiving research grants from Jomed. Dr. O'Shaughnessy reports receiving research support from Abbott Vascular and serving on their advisory board. Dr. Dangas reports that his spouse has received speaker honoraria from Abbott Vascular. Dr. Mehran reports serving as a consultant/advisory board member for Abbott Vascular, AstraZeneca, Cardiva, Cordis, The Medicines Company, and she received research grants from Bristol-Myers Squibb/Sanofi-Aventis. Drs. Midei, Siegel, Cristea, and Lansky report that they have no relationships to disclose.

Manuscript received October 28, 2010, accepted November 16, 2010.

As many as 25% to 30% of saphenous vein grafts (SVGs) fail within 12 to 18 months after coronary artery bypass graft surgery (CABG) (1), a proportion that increases to >50% beyond 10 years (2,3). Compared with treatment of native coronary arteries, percutaneous coronary intervention (PCI) of diseased SVGs is associated with higher rates of periprocedural complications and an increased incidence of clinical and angiographic restenosis (4,5). Distal protection devices improve the procedural safety of PCI in SVGs (6,7), whereas bare-metal stents (BMS) improve event-free survival compared with balloon angioplasty (8). Recently, 2 small randomized trials have provided conflicting results as to whether drug-eluting stents (DES) further improve outcomes after PCI of SVGs (9,10). Novel approaches are needed to further improve the prognosis of diseased SVGs.

The JOSTENT stent-graft (Jomed GmbH, Rangendingen, Germany) consists of a distensible polytetrafluoroethylene (PTFE) membrane sandwiched between 2 316L stainless steel slotted tube, balloon-expandable stents (Fig. 1) (11). This device is currently available in the U.S. as the GraftMaster (Abbott Vascular, Santa Clara, California) under a Humanitarian Device Exemption for treatment of life-threatening coronary perforations (12). Hypothetical benefits of elective use of the JOSTENT PTFE stent-graft in SVGs include reduced periprocedural myocardial infarction (MI) (by trapping potentially embolic degenerated atherosclerotic debris behind the PTFE membrane) and decreased restenosis (by serving as a barrier isolating the lumen from smooth muscle cell proliferation, migration, and extracellular matrix production arising from the media) (13). After favorable results from a multicenter registry (14), 2 trials were performed in which the JOSTENT was randomized to BMS in diseased SVGs, demonstrating comparable or increased rates of MI, restenosis, and late occlusion with the stent-graft (15,16). However, neither of these trials mandated high-pressure balloon inflation or prolonged dual antiplatelet therapy, measures that might be necessary to mechanically optimize the implant and facilitate endothelialization without thrombosis. Moreover, follow-up was limited to only 6 and 12 months in these studies, precluding the opportunity to determine whether there are late benefits (or harm) from this device—a salient issue, because the time course of both target lesion revascularization (TLR) and target vessel revascularization (TVR) might be protracted in SVGs compared with native coronary arteries (17).

Therefore, we performed a prospective, multicenter, randomized, controlled trial termed BARRICADE (Barrier Approach to Restenosis: Restrict Intima to Curtail Adverse Events) to evaluate the utility of the JOSTENT PTFE stent-graft for the treatment of discrete atherosclerotic lesions in diseased SVGs. JOSTENT post-dilation to ≥18 atm was mandated to overcome limitations of prior studies, as was use of dual antiplatelet therapy for ≥8 months, and all patients were followed for a total duration of 5 years. The present report represents the principal and final analysis from the BARRICADE trial.

Methods

Enrollment criteria. To be eligible for the BARRICADE trial, patients ≥18 years of age with clinical evidence of ischemia or a positive functional study had to have 1 or 2 SVG lesions eligible for PCI with either both lesions in 1 SVG or 1 lesion in each of 2 SVGs. Lesion eligibility required all the following to be present: visually estimated diameter stenosis of ≥50% and <100%; target vessel diameter ≥3.0 mm and ≤5.0 mm; lesion length ≤25 mm; and Thrombolysis In Myocardial Infarction flow grade ≥1 after successful wire passage. All patients had to agree to all follow-up procedures and provide informed, written consent. Patients were excluded from randomization if any of the following were present: contraindication to aspirin, heparin, clopidogrel, stainless steel, PTFE, or contrast media that could not be adequately pre-medicated; MI within 24 h before the procedure or any creatine phosphokinase (CPK)-myocardial band (MB) greater than normal; left ventricular ejection fraction <25%; PCI in a nonstudy vessel required ≤24 h before or during the index procedure or after (if staged procedure earlier, all other entry criteria must be met, including normal baseline creatine kinase-MB); unprotected left main disease; target lesion involving the distal anastomosis; presence of a ≥50% untreated stenosis proximal or distal to the target lesion; stent(s) located within 5 mm of the target lesion borders; excessive proximal tortuosity or lesion angulation; current participation in another investigational drug or device trial that had not completed the entire follow-up period; comorbidity with anticipated life expectancy to ≤12 months; liver function tests >3× normal; serum creatinine ≥2.0 mg/dl; platelet count <100,000 cells/mm^3; hemoglobin <10.0 g/dl; history of stroke or transient ischemic attack within 6 months; gastrointestinal bleeding within 6 months; history of bleeding diathesis or coagulopathy or will refuse blood transfusions; and active pregnancy or lactation.

Abbreviations and Acronyms

BMS = bare-metal stent(s)
CABG = coronary artery bypass graft surgery
CPK = creatine phosphokinase
DES = drug-eluting stent(s)
IVUS = intravascular ultrasound
PCI = percutaneous coronary intervention
PTFE = polytetrafluoroethylene
MB = myocardial band
MI = myocardial infarction
QCA = quantitative coronary angiography
SVG = saphenous vein graft
TLR = target lesion revascularization
TVF = target vessel failure
TVR = target vessel revascularization