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Long-Term Outcome following Stent Reconstruction of the Aortic Bifurcation and the Role of Geometric Determinants

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We assessed the long-term patency of kissing stent reconstruction of the aortoiliac bifurcation and identified variables that may influence it. We retrospectively reviewed our experience with stent-reconstruction procedures of the aortoiliac bifurcation from January 1998 through June 2005. The impact of demographic variables, vascular risk factors, disease location and characteristics, stent material and design, and stenting configuration on stent patency was assessed using univariate and multivariate analysis. In particular, we evaluated the effect of geometric mismatch between the protruding segment of the stents and the distal aortic lumen. Sixty-six patients underwent aortobi-iliac stent reconstruction. Indications were bifurcation or bilateral proximal iliac disease in 52 patients and unilateral ostial disease requiring contralateral protection in 14 patients. Limited disease (TASC A and B) was present in 40 limbs in 19 patients; extensive/diffuse disease (TASC C and D) was present in 78 limbs in 47 patients. Complete occlusions were present in 37 limbs in 28 patients (bilateral in nine patients). Self-expanding stents were used in 56 procedures and balloon-expandable stents in 10. Crossing configuration was used in 43 procedures, while abutting configuration was used in 23 procedures. Technical success was achieved in 62 patients (94%), with all four failures due to inability to cross a chronically occluded limb. Three of these patients underwent aortomono-iliac stenting with a crossover femoral–femoral bypass graft, with the remaining one opting for no further interventions. Median combined follow-up was 37 ± 27 months (range 0-102). Hemodynamically significant restenosis developed in nine patients (14%). The management of restenosis was endovascular in eight patients and was successful in all (balloon dilation in four, restenting in three, thrombolysis and stenting in one) and operative in one patient who developed aortic occlusion and underwent aortobifemoral grafting. Survival table analysis showed primary and assisted patency rates at 4 years of 81% and 94%, respectively. The mortality rate during follow-up was 19 (cardiac cause in eight, pulmonary cause in three, and malignancy in five). Univariate analysis showed radial mismatch (aortic lumen dead space around the protruding segment of the stents), female gender, prior occlusion, and residual stenosis to be significant predictors of restenosis. Multivariate logistic regression analysis showed radial mismatch to be the only significant determinant of restenosis, although the statistical power of the model was limited by the small number of restenoses. Stent reconstruction of the aortoiliac bifurcation for occlusive disease is effective and durable, even with complex aortoiliac

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disease and long segment occlusions. Most restenoses are amenable to endovascular treatment, with excellent long-term assisted patency. Geometric variables related to individual aortic anatomy and disease pattern (patient-dependent) and stenting configuration (operator-dependent) may have an impact on long-term patency.

INTRODUCTION

Although percutaneous transcatheter revascularization has become the mainstay modality in the management of focal aortoiliac occlusive disease, the role of these techniques in the management of extensive and complex aortoiliac disease has not been well established.[1-3] One particularly challenging pattern of involvement in aortoiliac occlusive disease is aortic bifurcation disease or disease involving the ostia of the common iliac arteries. Historically, the technique of bilateral-simultaneous balloon angioplasty, also referred to as ''kissing'' balloon angioplasty, was first described by Tegtmeyer et al.[4] as a viable option for the endovascular treatment of focal aortic bifurcation or bilateral proximal common iliac artery stenoses. However, dissections and suboptimal angiographic and/or hemodynamic results were frequent complications.[5] Later, the use of simultaneously deployed bilateral stents, or kissing stents, for the reconstruction of the aortic bifurcation was described,[6,7] thus rendering a majority of aortoiliac atherosclerotic lesions amenable to percutaneous therapy. Several series describing the use of kissing stenting in patients with aortoiliac disease were subsequently reported, using a variety of stent designs and stenting configurations.[8-15]

A number of subsequent reports cautioned of early failure and distal embolic complications with aortobi-iliac stenting, especially when used in a crossing configuration where the cephalic ends of the stents cross each other and protrude into the distal aorta.[16-18] So far, no demographic, clinical, technical, or stent-related factors have been shown to consistently influence patency rates of kissing stents. In specific, the impacts of geometric variables related to individual aortic anatomy and stenting configuration on long-term patency have, to our knowledge, not been previously assessed. We therefore retrospectively reviewed our experience with long-term outcome following stent reconstruction of the aortoiliac bifurcation and to evaluate the impact of a number of demographic variables, vascular risk factors, disease patterns, and characteristics on stent patency. In addition, we examined the effect of stent type and material as well as aortic anatomy and stenting configuration.

MATERIALS AND METHODS

The records of 66 consecutive patients who underwent stent reconstruction of the aortoiliac bifurcation at our departments from January 1998 through June 2005 were retrospectively reviewed. The demographics, characteristics, and indications for intervention in these patients are listed in Table I.

All stenting procedures were performed via bilateral retrograde transfemoral access. Following heparinization, lesion traversal was accomplished using an appropriate directional catheter and guidewire combination. Choice of stenting pattern and type of stent were dictated by operator preference, which varied based on lesion location and complexity and the presence of distal aortic disease. In general, longer lesions were treated with self-expanding stents, whereas balloon-expanded stents were more often used for short or focal ostial lesions where an ''abutting'' stents configuration was contemplated. Longer lesions extending into the distal aorta were often treated with a ''crossing'' stents configuration (Fig. 1). Postdilation to an appropriate diameter was routinely performed using high-pressure inflation. Following removal of the hardware, hemostasis was achieved by manual compression in 41 procedures or by the use of a vascular closure device in the remaining procedures. All patients received appropriate preoperative antibiotics prophylaxis. Heparin was administered during the procedure in all patients (3,000-5,000 IU initial bolus with subsequent 1,000 boluses every 1 hr). Eighteen patients were preloaded with clopidogrel before or immediately following the procedure (300 mg orally). In four patients who underwent technically difficult procedures and/or had underlying thrombosis and/extensive disease, therapeutic heparin was maintained in the form of an intravenous drip for 24-48 hr following the procedure. All patients received at least one form of antiplatelet therapy. Twelve were maintained on aspirin alone (81 or 325 mg daily lifelong), 44 received clopidogrel combined with aspirin (75 mg daily for at least 4 weeks and 81 or 325 mg daily lifelong), four received clopidogrel alone (75 mg daily for at least 4 weeks), and six with prior indication for chronic

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