Cutting Balloon Angioplasty for Cardiac Transplant Vasculopathy

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We performed Cutting Balloon angioplasty on 20 lesions in 11 heart transplant recipients 7.5 ± 3.8 years after transplantation. The mean percentage of diameter stenosis decreased from 88.3% ± 13.8% to 19.6% ± 13.7% after Cutting Balloon angioplasty without complication. Seven patients underwent follow-up angiography at 4.9 ± 1.7 months in a total of 12 lesions, and all lesions showed restenosis with a mean diameter stenosis of 84.4% ± 19.2%. Cutting Balloon angioplasty can be used to treat obstructions in cardiac transplant coronary arteries; however, it may cause exacerbation and produce a high restenosis rate. J Heart Lung Transplant 2002;21:910–913.

Accelerated allograft vasculopathy significantly limits the survival of patients who undergo orthotopic heart transplantation.1–3 Balloon angioplasty, directional atherectomy, and rotational atherectomy have been used to treat this disease process; however, these techniques have higher procedural morbidity, mortality, and restenosis compared with their use in native coronary artery atherosclerotic disease.1–8 This may be because of the diffuse nature of transplant arteriopathy and its intense proliferative tissue response.

The Cutting Balloon is a relatively new device for treatment of coronary artery disease.9 The Cutting Balloon has been reported to be superior to conventional balloon angioplasty,10 especially in treating in-stent restenosis.11 We hypothesized that there may be advantages to using the Cutting Balloon to treat transplant arteriopathy in which diffuse disease is commonly seen.

METHODS
Study Population

A total of 11 consecutive patients with heart transplant arteriopathy were treated with Cutting Balloon angioplasty between June 2000 and March 2001. The mean age was 56 ± 11 years, and 9 were men. The indications for cardiac transplantation were idiopathic cardiomyopathy in 5 patients, coronary artery disease with ischemic myopathy in 4 patients, valvular heart disease in 5 patients, coronary artery disease with ischemic myopathy in 4 patients, valvular heart disease in 1 patient, and right ventricular dysplasia in 1 patient. The mean time since transplant was 7.5 ± 3.8 years.

Cutting Balloon Angioplasty

We performed coronary angioplasty according to standard clinical practice, through the femoral artery with a 6F or 8F catheter. We treated 20 lesions with Cutting Balloon angioplasty. There were 13 de novo lesions, and 7 were restenotic (6 because of in-stent restenosis and 1 restenosis was secondary to conventional balloon angioplasty). Quantitative coronary angiography measurements were performed with an automated computer-based system (CRS-PC+, General Electric Company; Fairfield, CT). Procedural success was defined as a post-procedural lumen diameter stenosis <50% without creatine kinase elevation, Q-wave myocardial infarction, emergency bypass surgery, or death related to the current Cutting Balloon angioplasty. We defined angiographic restenosis at follow-up as the return of >50% diameter stenosis.
Accelerated graft arteriopathy is a major limitation to the long-term survival of cardiac transplant recipients. The only definite therapy for such diffuse disease is repeat transplantation, but the survival rate of retransplantation is worse than for initial transplantation and is limited by organ availability. Coronary artery bypass surgery also is of limited value in the diffuse, small-vessel disease manifested in these patients. Instead of surgical therapy, percutaneous catheter-based coronary revascularization has been used to attempt to reduce ischemic morbidity and mortality of cardiac transplant recipients.

Cutting Balloon angioplasty is a new treatment for coronary artery stenosis and has unique features. Three or 4 microsurgical blades, 0.010 inches in height, are bonded longitudinally to a traditional angioplasty balloon surface. During inflation of the Cutting Balloon, the atherotomes expand radially and incise the plaque, which facilitates a uniform longitudinal dissection. In this study, we evaluated the Cutting Balloon for its efficacy and safety in treating allograft arteriopathy. Although the number of lesions treated was small, transplant arteriopathy is a relatively rare disorder.

**Cutting Balloon Angioplasty for Allograft Arteriopathy**

In this unusual patient population, 20 allograft lesions in 11 patients were treated with Cutting Balloon angioplasty. Despite treating 9 total or sub-total lesions, immediate angiographic success was obtained in all cases and no complication occurred during Cutting Balloon angioplasty. Two patients underwent repeat orthotopic heart transplantation, 1 patient died of heart failure, and 1 patient died suddenly 3 months after Cutting Balloon angioplasty. These events were not related to the Cutting Balloon angioplasty itself but serve as an indication of the severity of disease associated with transplant arteriopathy. We had some initial concern that the stiff blades of the Cutting Balloon catheter could disrupt the luminal surface of the abnormal tissue seen in transplant arteries. However, the Cutting Balloon was used safely in these arteries despite the delicate tissue and propensity for spasm frequently seen with transplanted coronary arteries. The Cutting Balloon can be used effectively to treat long lesions with stent use reserved for those focal areas that remain underexpanded. In this study, we used this technique of IVUS-guided “spot stenting” to the transplant arteriopathy lesions.

Unfortunately, the angiographic restenosis rate in the small group of patients who were restudied was
100% at a mean of 4.9 months. This restenosis rate is high compared with conventional balloon angioplasty for cardiac allograft arteriopathy.\textsuperscript{4,5,8} We initially suspected the high restenosis rate associated with use of the Cutting Balloon was a manifestation of the aggressive proliferation seen with this patient population rather than a direct effect of Cutting Balloon angioplasty when used in transplanted arteries. However, the Cutting Balloon itself might exacerbate the aggressive tissue proliferation associated with transplant arteriopathy and result in a high restenosis rate. The true incidence of restenosis after Cutting Balloon angioplasty remains unclear because these results are obtained from only 12 lesions in 7 patients.

**CONCLUSION**

The Cutting Balloon can be used safely and effectively for the acute treatment of allograft arteriopathy. The diffuse nature of this disease process requires an efficient dilatation technique that can be used in association with focal application of coro-
nary artery stents to minimize restenosis. However, the current restenosis rate is unacceptably high, which may be caused by stimulation of aggressive tissue proliferation associated with transplant arteriopathy. This implies that adjunctive therapy, such as brachytherapy or anti-metabolite eluting stents, may be necessary to effectively treat transplant arteriopathy.

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