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Comparing Surgical With Percutaneous Revascularization in Three-vessel Disease: Current Status

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ABSTRACT

Percutaneous coronary intervention (PCI) is an alternative therapeutic modality to coronary artery bypass surgery (CABG) for the revascularization of patients with multivessel coronary artery disease (CAD). Its effectiveness has been questioned because of higher rates of repeat revascularization and anginal attacks compared to CABG. Over the recent years drug eluting stents (DES) have been used for the management of patients with multivessel CAD as a major breakthrough technology in terms of a remarkable reduction of restenosis and repeat revascularization. Results from the Artery Revascularization Therapies (ARTS II) study indicate that DES and CABG have comparative effectiveness in major adverse cardiac events (MACE) in patients with multivessel CAD. Whether DES will replace CABG in the revascularization of patients with multivessel disease remains to be seen by the impending results of ongoing multicenter comparative trials.

KEY WORDS: *percutaneous coronary intervention; coronary artery bypass grafting; coronary artery disease; coronary stenting; coronary angioplasty*

Abbreviations and Acronyms
ARTS= Arterial Revascularization Therapy Study
CABG= coronary artery bypass grafting
CI= confidence interval
DES= drug-eluting stents
HR= hazard ratio
LAD= left anterior descending coronary artery
LIMA= left internal mammary artery
MIDCABG= Minimally invasive direct coronary artery bypass graft surgery
PES= paclitaxel-eluting stents
PCI= percutaneous coronary intervention
SES= sirolimus-eluting stents

BACKGROUND

Percutaneous coronary intervention (PCI) with or without coronary stents is an alternative to surgery therapeutic modality for mechanical coronary revascularization. Procedures involving PCI outnumber surgical procedures involving CABG as the most frequent revascularization modality for obstructive coronary artery disease (CAD), although the role of PCI has been limited by restenosis rates up to 20% with bare metal stents (BMS) [1].

As a consequence, CABG was demonstrated to have better long-term outcomes than PCI with BMS and/or balloon angioplasty in two and three vessel CAD. Since the introduction of drug eluting stents (DES) which constitute a major breakthrough in restenosis reduction, target lesion and vessel revascularization are no longer a drawback when treating patients with obstructive CAD.

Indeed, a recently published study (ARTS II) demonstrated that the sirolimus eluting stents have comparable rates of major cardiac adverse events (MACE) for the treatment of patients with multivessel CAD at three years when compared to CABG [2].

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PCI VS CABG IN THE PAST

A meta-analysis including nine trials of multivessel CAD treated by percutaneous balloon angioplasty alone or CABG showed a statistically significant benefit in terms of survival in favor of surgery at five and eight years [3]. However, these survival data were from early studies that did not use stents in the initial revascularization procedure. Nevertheless, the Stent or Surgery Trials (SOS), which involved the use of stents, reported similar findings after a median follow-up of 2 years [4].

However, the Angentine Randomized Trial Coronary Angioplasty with stenting versus Coronary Bypass Surgery With Multivessel Disease (ERACI-II) suggested that the trend in favor of CABG for survival at 5 years was no longer present in the stent era [5] (Fig. 1). The final analysis of the arterial revascularization therapies study (ARTS I) involved the use of bare metal stents in patients with multivessel disease versus CABG [6]. At five years there was no difference in mortality between stenting and surgery for multivessel disease. Furthermore, the incidence of stroke or myocardial infarction was not significantly different between the two groups. However, overall MACE rate was higher in the stent group, driven by the increased need for repeat revascularization (Fig. 2).

PCI VS CABG: PRESENT AND FUTURE

Are DES equivalent in terms of effectiveness to CABG in treating patients with multivessel CAD? For PCI to replace CABG as preferred therapy in multivessel CAD, clinical trials must demonstrate that long-term outcomes are comparative.

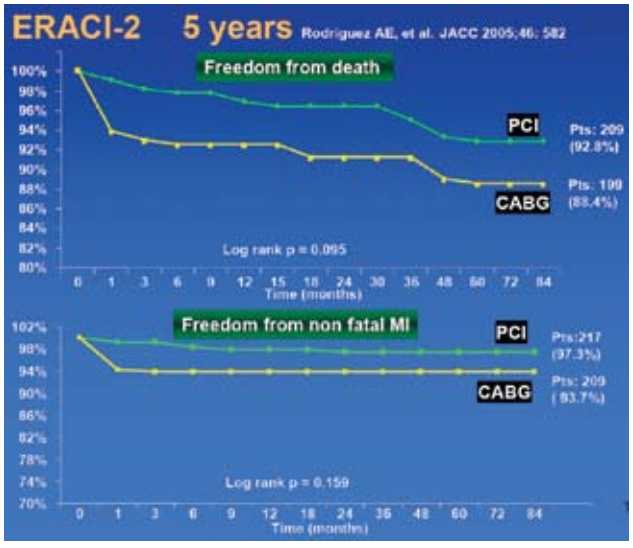

FIGURE 1. ERACI II 5-year survival curves.

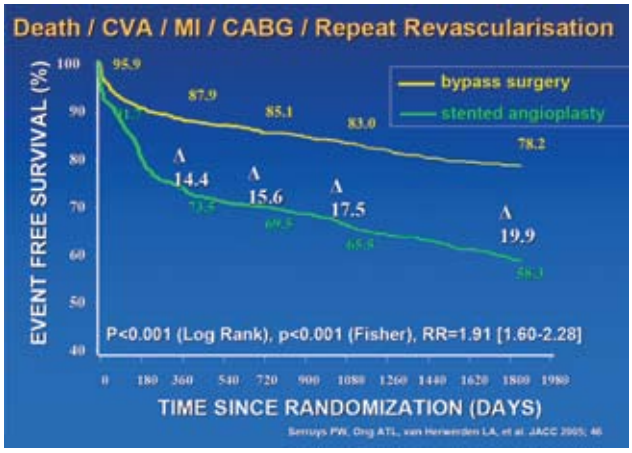

FIGURE 2. ARTS I, MACE curves over 5 years.

The problems that must be overcome include restenosis, diffuse disease and diabetes. DES reduce restenosis rates to less than double digits in non-complex cases raising the possibility that perhaps they would also be useful in complex cases [7,8].

The Arterial Revascularization Therapies Study II trial (ARTS II) is a 45 center, 607 patient single-arm study. Three-year outcomes were compared to the outcome of the historical cohorts of ARTS I using the same inclusion and exclusion criteria and MACE definitions. Patients were stratified by clinical site to ensure that at least 1/3 had 3 vessel disease to achieve a number of treated lesions per patient comparable to ARTS I. An angiographic coronary score to characterize lesion complexity was applied to allow the identification of patients who might benefit the most from multivessel stenting. This non-randomized study showed that despite the higher clinical angiographic risk profile, the overall MACE rate at three years was lower in ARTS II than in the ARTS-I PCI was comparable to ARTS-I CABG. However, the re-intervention rate in ARTS-I CABG remained significantly lower that in ARTS-II [2] (Fig. 3).

WHAT IS NEXT?

Coronary revascularization methods continue to be refined, so that evaluation of the outcomes of PCI and CABG remains a moving target. Randomized trials are underway to evaluate whether DES provide outcomes similar to CABG in multivessel CAD when technically feasible. FREEDOM and CARDIA studies are randomized trials that included diabetic patients with three vessel disease examining the long-term effectiveness of DES in terms of MACE compared to CABG. Syntax is a randomized trial that included patients with three vessel and or left main disease aiming to determine which is

the most appropriate therapy between DES and CABG.

Awaiting the results of these important studies and in the absence of a definitive clinical trial to support the superiority of DES over CABG, the prudent cardiologist should rely on the facts presented in a recent systematic review study comparing the effectiveness of PCI and CABG [9]. The authors of this review concluded that compared with PCI, CABG was more effective in relieving angina and led to fewer repeated revascularizations but had a higher risk for procedural stroke. Survival to 10 years was similar for both procedures.

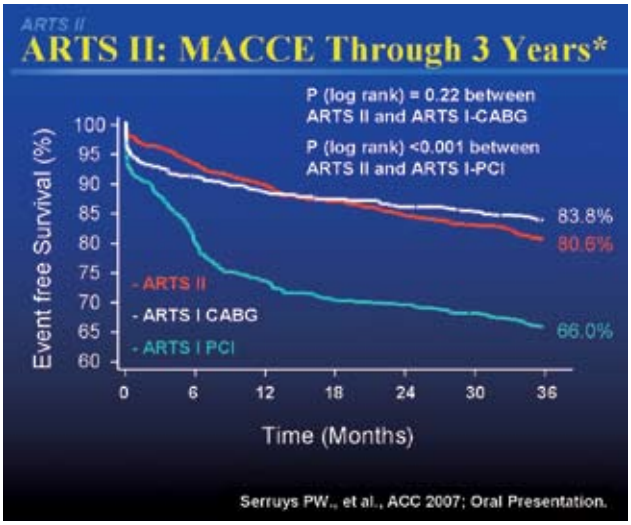

FIGURE 3. ARTS II MACE curves over 3 years.

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