

# Stents had similar clinical outcomes but more repeated revascularization than did bypass surgery in multivessel disease

Serruys PW, Unger F, Sousa JE, et al., for the Arterial Revascularization Therapies Study Group. Comparison of coronary-artery bypass surgery and stenting for the treatment of multivessel disease. *N Engl J Med*. 2001 Apr 12;344:1117-24.

## QUESTION

In patients with multivessel coronary artery disease, how effective and cost-effective is coronary stenting compared with bypass surgery for reducing clinical outcomes at 1 year?

## DESIGN

Randomized (allocation concealed\*), unblinded,\* controlled trial with 12-month follow-up (Arterial Revascularization Therapies Study [ARTS]).

## SETTING

67 centers in 19 countries.

## PATIENTS

1205 patients (mean age 61 y, 77% men) with angina pectoris or silent ischemia plus  $\geq 2$  lesions in different vessels or territories that were amenable to stenting. Exclusion criteria included previous bypass surgery, ejection fraction  $\leq 30\%$ , congestive heart failure, history of stroke, and recent transmural myocardial infarction (MI). 99% of patients in the stent group and 96% in the bypass-surgery group received their allocated treatment.

## INTERVENTION

600 patients were allocated to stenting and 605 to bypass surgery. Details of procedures were decided by the operator.

## MAIN OUTCOME MEASURES

Combined cardiac or cerebrovascular events (death, transient ischemic attacks, stroke, reversible ischemic neurologic deficits, MI, and repeat revascularization) and costs for direct medical care.

## MAIN RESULTS

Patients in the stent group had higher rates of adverse events, repeated revascularization (Table), angina (21% vs 10%), and combined events ( $P < 0.001$  for each) than did patients in the bypass group, although medical costs per patient were lower (US \$6441 vs \$10 653 for procedure-related costs and \$10 665 vs \$13 638 for direct medical costs at 1 y,  $P < 0.001$  for both). The groups did

not differ for mortality, stroke, MI (Table), or quality of life.

## CONCLUSIONS

In patients with multivessel coronary artery disease, coronary stents and bypass surgery had similar rates of mortality, myocardial infarction, and stroke, although stenting had more adverse events and a need for repeated revascularization. Stenting was less expensive than bypass surgery at 1 year.

Source of funding: Cordis.

For correspondence: Dr. P.W. Serruys, Department of Interventional Cardiology Heart Center, Erasmus University Rotterdam, Dr. Molewaterplein 40, 3015 GD Rotterdam, The Netherlands. FAX 31-10-4369154. ■

\*See Glossary.

## Stents vs coronary bypass surgery for multivessel coronary artery disease†

Outcomes at 1 y	Stents	Bypass	RRI (95% CI)	NNH (CI)
Any event‡	26%	12%	114% (66 to 175)	7 (5 to 10)
Revascularization	21%	3.8%	452% (259 to 749)	6 (5 to 7)
Myocardial infarction	6.2%	4.8%	29% (-20 to 106)	Not significant
			RRR (CI)	NNT
Mortality	2.5%	2.8%	11% (-55 to 77)	Not significant
Stroke	1.7%	2.1%	22% (-66 to 76)	Not significant

†Abbreviations defined in Glossary; NNH and its CI calculated from data in article.

‡Any event = death, transient ischemic attack, stroke, reversible ischemic neurologic deficit, or myocardial infarction.

## COMMENTARY

For most patients who need coronary revascularization, the best procedure is clear-cut: bypass surgery for left-main or extensive 3-vessel disease and angioplasty for single-vessel disease. In the "gray zone" between these 2 extremes (about 15% of patients), either procedure is an option. In the early 1990s, several randomized controlled trials in such patients found equal rates of mortality and MI but better angina relief with surgery (1). After enrollment in these trials was complete, however, coronary stents became available. Although stents reduce restenosis, they are more expensive than balloon angioplasty, and it was unclear whether their development made previous trials obsolete. ARTS is the first trial to compare stenting with bypass surgery, and its results are similar to those of previous trials: no difference in death, MI, or stroke but more repeated procedures and angina in patients who received stents. Thus, the principles derived from earlier clinical trials are still applicable in the stent era.

The major concern about stents is their high cost. In previous trials of balloon angioplasty and bypass surgery, the 30% initial cost advantage

of angioplasty was trimmed to  $< 5\%$  over several years. In ARTS, the 40% initial cost advantage of stents was cut to 22% over 1 year, but the difference was still statistically significant. Costs in Europe are quite different from those in the United States, however, and the follow-up in ARTS was too short to capture all the late costs. Thus, the cost-effectiveness of stenting compared with that of bypass surgery remains uncertain, especially in the United States. Nevertheless, stents are a safe alternative for patients with multivessel coronary disease who wish to avoid bypass surgery.

Mark A. Hlatky, MD  
Stanford University School of Medicine  
Stanford, California, USA

## Reference

1. Sim I, Gupta M, McDonald K, Bourassa MG, Hlatky MA. A meta-analysis of randomized trials comparing coronary artery bypass grafting with percutaneous transluminal coronary angioplasty in multivessel coronary artery disease. *Am J Cardiol*. 1995;76:1025-9.