Editorial Comment

Explosive Growth of Coronary Angioplasty
Success Story of a Less Than Perfect Procedure

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Given the high prevalence of coronary artery disease in Western countries, selection of the optimal therapeutic strategy for individual cardiac patients has become an issue of utmost cost-benefit importance. During the past two decades, large clinical trials have established the respective roles of medical treatment versus coronary artery bypass surgery in the management of patients with coronary disease. In 1978, Grünzig et al’s report of their early experience with coronary angioplasty1 opened the era of interventional cardiology, and since then, angioplasty has emerged as a major tool in the armamentarium for treating coronary artery disease. Initially, the use of angioplasty was restricted to selected patients with angina pectoris refractory to medical treatment. However, as interventionists became more skilled and equipment more sophisticated, indications for angioplasty were rapidly extended to include patients with moderate or mild angina. This led to an exponential growth in the number of angioplasties performed over the past decade, and in 1991, more than 300,000 procedures were performed in the United States alone at an estimated cost of $7.2 billion, representing roughly 1% of the total annual expenditure for health care.

See p 1489

To the outside observer this growth may appear puzzling, given some well-known limitations of this procedure. Although balloon dilatation is successful in up to 90% of cases for immediately improving the coronary artery luminal caliber, and it is associated with acceptably low mortality and morbidity rates,2 several important problems remain. First, the restenosis rate remains at a disappointing 30–50% at 6 months, and pharmacological, dietary, and mechanical interventions have as yet failed to significantly reduce this rate.3-4 Second, the abrupt closure rate remains at 2–5%, although the introduction into clinical practice of new techniques such as stents, directional atherectomy, and laser balloon angioplasty may, in some cases, restore vessel patency.5-7 Third, although highly successful in reducing the percent stenosis of a given coronary lesion, angioplasty has not yet been shown to reduce the subsequent risk of plaque rupture and infarction, events that represent an important cause of morbidity and mortality in patients suffering from coronary artery disease. Fourth, coronary thrombosis and myocardial infarction may occur at sites in the coronary tree at which only minor stenoses are present.8 Yet, angioplasty deals only with high-grade lesions and thus, leaves the distal coronary bed unprotected from abrupt closure at sites of minor stenoses. Finally, results of studies comparing angioplasty with coronary artery bypass surgery are still awaited, only a single randomized trial comparing angioplasty with medical treatment having been published so far.9

Given these limitations, what are the possible explanations for the marked increase in the number of angioplasties performed over the last decade? First, coronary artery disease is highly prevalent and represents the leading cause of mortality in most industrialized countries. Not surprisingly, therefore, an enormous effort is directed at developing new diagnostic and therapeutic tools in an attempt to reduce the morbidity and mortality associated with coronary artery disease. In this context, any promising new technique has the potential for rapid growth. Second, it has been shown that in experienced hands, angioplasty is associated with a low mortality and morbidity, particularly in patients with single-vessel disease and good left ventricular function.2 Third, symptomatic relief with angioplasty may be superior to that with medical treatment in selected subgroups of patients with symptomatic single-vessel coronary artery disease and abnormal treadmill tests.9 Fourth, there is a prevailing mechanistic understanding of coronary artery disease. Psychologically, it is often difficult for patients to live knowing that they have unattended “narrowings” of their coronary vessels. Given the choice, many patients, even the most informed ones (physicians and cardiologists) will choose angioplasty, which gives them the impression that the cause of their symptoms (the coronary stenosis) has been eliminated, rather than symptomatic relief with medical therapy.

Still, the present use of the technique appears disproportionate, given its limitations, and the combined effect of additional factors may have contributed to this exponential growth.10 First, angioplasty is a lucrative procedure, despite recent trends toward reducing fees for procedures, better rewarding primary care, and favoring competition among providers. Second, indications for angioplasty are often decided by the cardiologist who performs the coronary angiography, a pattern of self-referral. In other fields of medicine, evidence has accumulated to indicate that self-referral can be associated with overuse of both diagnostic procedures and
therapeutic interventions.\textsuperscript{11} Finally, angioplasty may be fun to perform. Introducing a wire into a tortuous coronary artery while planning the turns to make on a fluoroscopic screen generates challenge and excitement similar to those of the latest videogame. We have suggested previously that the synergistic effects of the combination of these three factors may have markedly contributed to the unprecedented explosive growth of this new medical procedure despite obvious limitations and unresolved issues.\textsuperscript{10} We speculated that “faced with an accessible coronary lesion, an interventionist’s decision about whether to intervene is most often predictable, and does not rely on a thorough, objective, and independent review of the appropriateness of the procedure in the particular clinical context.”\textsuperscript{10}

In this issue of \textit{Circulation}, Topol et al\textsuperscript{12} now substantiate this prediction by showing that in a large insured patient population, angioplasty was performed without exercise testing to document the presence of ischemia in a large majority of the patients. Indeed, in their population of 2,101 patients, only 29\% had undergone an exercise test before their coronary angioplasty, a practice that stands in contrast with guidelines established by the two major professional organizations that recommend preprocedural demonstration of myocardial ischemia.\textsuperscript{13} Furthermore, in the subgroup of patients having undergone angioplasty after thrombolytic therapy for acute myocardial infarction, only 9\% had an exercise test before angioplasty. This finding is at odds with several recent trials indicating that an angioplasty is not needed if such patients have a negative exercise test. Thus, the study by Topol et al\textsuperscript{12} suggests that angioplasty is performed primarily on the basis of coronary anatomic findings. This interpretation is in accordance with findings in patients after myocardial infarction.\textsuperscript{14} In that study, patients at low risk of cardiac mortality according to clinical criteria often underwent coronary angiography in the absence of prior exercise testing. After angiography, many such patients had revascularization procedures, including angioplasty and coronary bypass surgery, suggesting again that coronary anatomy rather than clinical evaluation and evidence of ischemia guided the therapeutic approach.\textsuperscript{14}

Angioplasty clearly has become a useful and safe procedure for the effective treatment of symptomatic ischemia in subsets of patients with coronary artery disease. Its growth has triggered the development of additional new technology in the field of interventional cardiology that, in the future, may allow treatment of patients with more complex forms of coronary disease with acceptable morbidity and mortality. If the results of ongoing studies show that long-term mortality, particularly in patients with multivessel coronary artery disease, is altered by angioplasty and compares favorably with results of bypass surgery, angioplasty may become a cost-effective treatment for a large number of patients with coronary disease. One might also expect that when the indications for angioplasty are better defined on the basis of multicentric randomized studies, greater procedural uniformity across the country will ensue. In the meantime, cardiologists should consider restricting the use of angioplasty for symptomatic relief of coronary artery disease in accordance with the guidelines established by their professional associations. It should also be remembered that medical treatment is effective in a large number of patients with single-vessel and even multivessel coronary artery disease,\textsuperscript{15} and it may avoid the costs, immediate risks, and morbidity of angioplasty. Finally, research efforts on regression of atherosclerosis and reduction of the risk of plaque rupture and thrombosis should be pursued. Preliminary data, for instance, suggest that cholesterol reduction might be as effective as mechanical interventions in reducing morbidity from coronary artery disease.\textsuperscript{16–18}

Given the budget constraints, incentives may be needed that will enable physicians to use health care resources in the most appropriate and cost-effective way. In the case of angioplasty, which costs the health care system billions of dollars, restricting its current use to accepted medical indications seems imperative to avoid bankruptcy of the system and to allow the development of other aspects of interventional cardiology and of modern technology for the benefit of the overall population.

References


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