Coronary artery bypass grafting in elderly patients: the price of success

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Because of its frequency and its relatively high cost, coronary artery bypass grafting (CABG) consumes a significant share of health care resources. In this issue (page 805) Dr. Gary Naglie and colleagues add to the already extensive literature on costs of CABG with a comparison of costs for older versus younger patients and the factors responsible for any differences.[1]

There are probably several reasons for the marked growth in bypass surgery rates among elderly patients.[2] First, the procedure is undeniably effective in relieving angina in all age groups.[3] The beneficial effect on mortality in older patients with three-vessel or left main coronary artery disease (the group studied by Naglie and colleagues) is not seriously questioned, even though the randomized trials that established this benefit excluded elderly patients.[4] Second, refinements in surgical and anesthetic techniques have led to improved outcomes in most patient subgroups, but particularly in those at highest risk for perioperative complications, such as older patients. Third, elderly patients more frequently have diffuse coronary artery disease, which, despite developments in angioplasty such as stents, is still a particularly vexing problem for catheter-based therapy. Finally, there are changing expectations regarding the maintenance of an active lifestyle despite advancing age, and there is perhaps less willingness among older people to accept the limitations imposed by persistent angina.

Improved perioperative outcomes have probably had 2 distinct influences on the pattern of surgical practice among older patients. Those who are otherwise well now face a low enough perioperative risk that bypass surgery is more readily considered in the overall therapeutic plan. Likewise, those with significant concurrent disease, who might at one time have been turned down as operative candidates, are now more likely to undergo surgery, with an improved chance of survival[5] but a still formidable risk of perioperative complications.[6] In daily practice it is this latter group that often raises difficult questions concerning allocation of limited resources.

Naglie and colleagues determined costs in a relatively small sample of patients from a single centre. However, the cost figures were based on a detailed patient-level determination of resource consumption derived from chart review. This "bottom-up" method is labour intensive but more accurate than a "top-down" analysis, which begins with aggregate costs and then attempts to determine the factors contributing to the aggregate.[7] Although differing methods, jurisdictions and health care systems lead to differences in actual cost estimates, the finding that bypass surgery costs more in older patients is a consistent one.[8–10]

The study also demonstrates a cost gradient associated not only with age but also with the presence or absence of postoperative complications. This, of course, is not surprising: complications result in a longer hospital stay and the need for additional diagnostic and therapeutic interventions. The authors also stratified costs according to whether the operation was elective or nonelective, and they show (again, not surprisingly) that the difference arises in large part from the preoperative care received by patients undergoing nonelective surgery on medical or cardiology wards. Thus the difference in costs actually attributable to the surgery between elective and nonelective cases is less than that presented in the article, and the significance of the timing of surgery as an independent predictor in their adjusted cost model is uncertain. Nonetheless, a recent study that counted costs beginning on the day of operation still found nonelective status to be an independent predictor of total cost.[8]

Atrial fibrillation, which occurs in about one-third of all patients following bypass surgery, is significantly more common among older patients than among younger patients and has been consistently shown to prolong hospital stay and add to the cost.[11,12] Despite this fact, Naglie and colleagues did not include atrial fibrillation in their definition of complications. Had they done so, they might have accounted for an additional portion of the age-related increase in costs that they observed within each subgroup of patients, thereby further clarifying the relation between costs and complications.

The existence of such a relation suggests a conceptual

model in which the total direct cost of bypass surgery has 2 components, loosely analogous to the economic concept of fixed and variable costs. The "fixed" component can be thought of as representing the total cost for the lowest-risk, most routine case in which the patient experiences no perioperative complications, whereas the "variable" component can be thought of as representing the additional costs incurred in caring for sicker patients, including (but not limited to) the costs of treating complications. This construct is helpful because it highlights the distinct strategies required to address each component within an overall cost-containment effort. Since 1991/92 (the period studied by Naglie and colleagues), significant changes have occurred in many routine processes of care, such as same-day admission, "fast-track" intensive care unit stay with early extubation and early discharge from hospital. These developments have almost certainly reduced the cost of bypass surgery in the routine case (the fixed component). Addressing the variable component is more difficult, in part because many of the known determinants of increased cost (or its surrogate, increased length of stay) are nonmodifiable characteristics. Both recent[8] and earlier[9,10] cost analyses have shown that the independent preoperative predictors of higher cost are similar to the predictors of perioperative complications and death: increasing age, poor ventricular function, renal failure, timing of surgery, reoperation and prior stroke. Although not the primary intent of their paper, Naglie and colleagues show essentially the same thing in their adjusted cost model: along with increased age, they demonstrate that renal failure, low ejection fraction and, possibly, timing of surgery were independent predictors of higher cost. (Because they also included the cost of complications in their model, they in fact demonstrate that these characteristics increase the cost even in the absence of a postoperative complication.) Some factors, such as timing of surgery, may be partially modifiable, for example by attempting to stabilize the ischemic syndrome medically and eventually performing surgery on an elective or semi-elective basis. The clinical and economic implications of such strategies are not well defined, but studies such as the one by Naglie and colleagues do highlight potential avenues for future research. One factor not considered by the authors was the effect of the particular surgeon; in one study the attending surgeon was found to be the most important determinant of cost, independent of patient characteristics.[9]

Even without an increase in the CABG rate, the demographic trends in our population make it virtually certain that there will be a substantial increase in the number of older people undergoing this procedure in the foreseeable future. This is a sobering thought when we are faced with constrained health care resources on the one hand and a study such as Naglie and colleagues' on the other. No doubt the clarion call of appropriateness will be heard. Although it is difficult to determine just what the rate of bypass surgery should be,[13] one approach that would not be appropriate would be to limit elderly people's access to bypass surgery because of the higher cost. Just as an astute clinician weighs the likely outcomes associated with alternative treatments such as angioplasty and medical therapy, health care planners and administrators must consider the costs of such alternative therapies. An elderly patient with concurrent conditions who undergoes bypass surgery for severe angina may well experience a lengthy, and expensive, postoperative course. However, if not operated on, that same patient does not cease to consume health care resources (unless death ensues quickly). To the extent that it can be quantitated, the trade-off between resource expenditure and health outcome among these treatment options can be evaluated by cost-effectiveness analysis, and Naglie and colleagues' study is useful as an input to such an analysis. Ultimately, however, decision-making for an individual patient must be guided by the best interests of the patient rather than by economic imperatives.

There are recent developments that may favourably affect the clinical and economic outcome of elderly patients needing revascularization. The advent of a variety of minimally invasive surgical approaches may not only facilitate earlier ambulation and discharge but may also lessen the risk of stroke, a complication strongly associated with increased age. New trials comparing "stent-era" angioplasty and bypass surgery are under way and may show angioplasty to be the preferred alternative in certain older patients. Despite these developments, however, the strain on health care resources imposed by bypass surgery will continue and will almost certainly intensify, a consequence of its enduring clinical success. Bypass surgery is not unique among medical interventions in posing this dilemma; it is, however, almost certainly unique in terms of the extent and quality of data available to fuel the debate.

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Research letters in *CMAJ*

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The volume of manuscripts received at *CMAJ* has been increasing steadily. In 1997 the number of original research articles and related submissions was about 50% higher than in the previous year (Table 1), and a further increase occurred in 1998. The greater flow of manuscripts has intensified demands on our peer reviewers, exacerbated an already acute shortage of space in the journal and made particularly challenging our objective of reducing the interval between manuscript acceptance and publication.

Attempts to offset the increased pressure on our reviewers have included an expansion of our reviewer database, carried out last summer. Space contraints are being addressed in various ways. One of these is the creation of a Research Letters section to enhance our ability to accommodate Evidence articles. In this issue we launch this new section with reports on 3 very diverse topics: obstetrics in primary care (page 815), the inclusion of complementary medicine in undergraduate medical education (page 816) and the allocation of dialysis modalities (page 818; see accompanying editorial, page 828).

Table 1: Number of manuscripts received at *CMAJ*, 1994–1998

	Year; no. of manuscripts				
Category	1994	1995	1996	1997	1998
Original research and related manuscripts	422	418	432	600	724
Features, news articles, letters, other	1001	1153	1175	1133	986
Total	1423	1571	1607	1733	1710

The Research Letters format is intended for articles that focus on singular themes and do not require extensive elaboration with respect to methods and results. Submissions should be limited to 500 words of text with an accompanying table or figure and 6 to 8 references. All Research Letters undergo peer review and are processed in a manner similar to that for full-length Evidence articles.

Although the increased volume of submissions is one reason for introducing a Research Letters section, this succinct format also has the advantage of making interesting and pertinent information available to our readers in a highly accessible form and of adding to the publishing options available to researchers. Research Letters are used effectively by other medical journals and in fact are not entirely new to *CMAJ*. Brief reports of research findings appeared in the 1950s, for example, under headings such as Clinical and Laboratory Notes and Short Communications. Indeed, expeditious communication is the goal. Given the time constraints faced by all practising physicians, brevity in the presentation of new findings should not be undervalued. We hope that Research Letters will find favour among authors and readers alike.

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