Coronary artery bypass graft surgery in Newfoundland and Labrador

Evidence

Études

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This article has been peer reviewed.

CMAJ 1998;158:1137-42

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Abstract

Background: Newfoundland and Labrador, like other health care jurisdictions, is faced with widening gaps between the demands for health care and a strained ability to supply the necessary resources. The authors carried out a study to determine the rates of appropriate and inappropriate coronary artery bypass grafting (CABG) in the province and the waiting times for this surgery.

Methods: This retrospective cohort study was performed in the tertiary care hospital that receives all referrals for coronary angiography and coronary artery revascularization for Newfoundland and Labrador. By reviewing the hospital records, the authors identified 2 groups of patients: those in whom critical coronary artery disease was diagnosed on the basis of coronary angiography and who were referred for CABG between Apr. 1, 1994, and Mar. 31, 1995, and those who actually underwent the procedure during that period. By applying specific criteria developed by the RAND Corporation, the authors determined the appropriateness and necessity of CABG in each case. They also compared waiting times for CABG with optimal waiting times, as determined by a consensus-based priority score.

Results: A total of 338 patients underwent CABG during the study period. The cases were characterized by multivessel disease and late-stage angina symptoms. Almost all of the patients had high appropriateness scores (7–9), and nearly 95% had high necessity scores (7–9). However, during the study period, the waiting list increased by about 20%, because a total of 391 patients were referred by the weekly cardiovascular surgery conference; the authors identified these and an additional 31 patients as having necessity scores of 7 or more. Only 7 (23%) of 31 patients for whom CABG was considered very urgent underwent surgery within the recommended 24 hours, and only 30 (24%) of the 122 patients for whom CABG was considered urgent underwent surgery within the recommended 72 hours.

Interpretation: These results provide evidence that the cardiac surgery program in Newfoundland and Labrador is performing CABG in patients for whom surgical revascularization is highly appropriate and necessary. Access to CABG is less than ideal, however, since the waiting list continues to expand, and many patients wait beyond the recommended time for surgery.

Résumé

Contexte : Dans le domaine des soins de santé, Terre-Neuve et le Labrador font face, comme les autres provinces et territoires, à des écarts qui se creusent entre la demande et une capacité grevée de fournir les ressources nécessaires. Les auteurs ont réalisé une étude pour déterminer les taux de pontages aortocoronariens (PAC) appropriés et inutiles dans la province et la durée des périodes d'attente écoulées avant de subir cette intervention chirurgicale.

Méthodes : Cette étude rétrospective de cohorte a été réalisée dans l'hôpital de soins tertiaires qui reçoit tous les patients que l'on envoie subir une coronarographie et une revascularisation de l'artère coronaire à Terre-Neuve et au Labrador. En étudiant les dossiers de l'hôpital, les auteurs ont défini deux

groupes de patients : ceux chez lesquels on a diagnostiqué une coronaropathie critique à la suite d'une angiographie coronarienne et que l'on a envoyé subir un PAC entre le 1er avril 1994 et le 31 mars 1995, et ceux qui ont vraiment subi l'intervention au cours de la même période. En utilisant des critères particuliers mis au point par la RAND Corporation, les auteurs ont déterminé la pertinence et la nécessité du PAC dans chaque cas. Ils ont aussi comparé les périodes d'attente aux périodes d'attente optimales déterminées en fonction de priorités établies par consensus.

Résultats : Au total, 338 patients ont subi un PAC pendant la période d'étude. Les multiples vaisseaux atteints et les symptômes angineux au stade final caractérisaient les cas. Chez presque tous les patients, les résultats de pertinence étaient élevés (7–9) et dans presque 95 % des cas, l'intervention était très nécessaire (7–9). Au cours de la période d'étude, toutefois, la liste d'attente s'est allongée d'environ 20 % parce qu'au total, 391 patients ont été présentés à la suite de la table ronde hebdomadaire sur la chirurgie cardiovasculaire; les auteurs ont déterminé que chez ces patients et chez 31 autres, la cote de nécessité atteignait 7 ou plus. Seulement 7 (23 %) des 31 patients chez lesquels on a jugé qu'un PAC était très urgent ont subi l'intervention chirurgicale dans le délai recommandé de 24 heures et 30 (24 %) seulement des 122 patients chez lesquels on a jugé le PAC urgent ont subi l'intervention chirurgicale dans le délai recommandé de 72 heures.

Interprétation : Ces résultats démontrent que dans le cadre du programme de chirurgie cardiaque à Terre-Neuve et au Labrador, on pratique des PAC chez des patients pour lesquels la revascularisation chirurgicale est très pertinente et nécessaire. L'accès au PAC n'est toutefois pas idéal, car les listes d'attente continuent de s'allonger et beaucoup de patients attendent plus longtemps que le délai recommandé pour subir une intervention chirurgicale.

Despite the evidence supporting coronary revascularization, controversy exists regarding the appropriate use of coronary artery bypass grafting (CABG) in clinical practice. This debate relates to overuse in some regions and underuse in others and is the result of inconsistent descriptions of patient outcomes,[1] observed variations in practice,[2,3] different ratings of appropriateness,[4] escalating costs,[5] rationing of health care services[6,7] and recent media attention.[8]

The province of Newfoundland and Labrador, like other health care jurisdictions, is faced with widening gaps between the demands for health care and a strained ability to supply the necessary resources. Effective delivery of CABG to the community implies that the surgery be performed in appropriate patients, that waiting periods be reasonable and that the patients who need the procedure actually receive it. We carried out a study to determine the rates of appropriate and inappropriate CABG and the waiting times for this surgery in Newfoundland and Labrador over a 12-month period.

Methods

The study protocol was approved by the Human Investigation Committee at Memorial University of Newfoundland, St. John's.

Patient selection

We reviewed the records of the tertiary care hospital that receives all referrals for coronary angiography and coronary artery revascularization for Newfoundland and Labrador. We identified 2 groups of patients: those with a diagnosis of critical coronary artery disease established by coronary angiography[9] who were referred for CABG between Apr. 1, 1994, and Mar. 31, 1995, and those who actually underwent the procedure during that period (many of whom were already on the waiting list for CABG at the beginning of the study period). We obtained the patients' medical records, including pertinent documents from referring hospitals, from the Health Care Corporation of St. John's. We used a modified medical record abstraction form[9] to capture the data required to determine the appropriateness, necessity and priority of CABG. The data were collected by experienced research nurses and data abstractors trained to use the form. The information collected included demographic characteristics such as age, sex and date of coronary angiography. Additional data included angina symptoms, cardiovascular history, cardiac medications and coronary artery anatomy. We also collected data on noninvasive testing, such as exercise stress testing and assessments of left ventricular function.

We classified angina symptoms, coronary artery anatomy and indications for CABG on the basis of the data collected and subsequently reviewed these classifications for accuracy. All abstracted records were reviewed by 2 of us (G.A.F. and P.S.P.) for completeness and consistency. In addition, these 2 authors independently scored each record for the appropriateness and necessity of CABG according to the RAND Corporation criteria.[9] The appropriateness and necessity scores were subsequently compared, and discrepancies were settled by consensus.

Whenever possible, for each case we obtained photocopies of notes from the cardiac catheterization procedure, the cardiovascular surgery conference and the surgery itself and attached these documents to the data record form. In addition, discharge summaries and letters of consultation as well as results of investigations such as stress tests and echocardiography were attached to the form.

Definitions

The definitions for unstable angina, angina class, asymptomatic coronary artery disease, significant coronary artery disease, maximum medical therapy, results of noninvasive tests, levels of operative risk and contraindications to CABG were those approved by the Canadian panel that developed the scoring instrument.[9,10]

Scoring of appropriateness and necessity

After collecting the data, we assessed each case for the appropriateness and necessity of CABG using a predetermined criterion-based, validated scoring system developed by the RAND Corporation and adapted for the Canadian population.[9]

A procedure was deemed appropriate if the expected health benefits exceeded the expected negative consequences by a margin that would lead the physician to regard the procedure as worth doing, exclusive of monetary costs.[9] A procedure was deemed necessary if the physician would feel obligated to recommend this procedure as the best clinical option available, given the high probability of a clinically important benefit in patients with that presentation.[9] Thus, the necessity ratings include a more stringent risk–benefit assessment than do the appropriateness ratings, and, by definition, if a procedure is considered necessary it must first be considered appropriate.

Appropriateness was scored on an ordinal scale from 1 (extremely inappropriate) to 9 (extremely appropriate). In general terms, a score of 1 to 3 indicates inappropriate, 4 to 6 intermediate and 7 to 9 appropriate. The same ratings were used for the necessity scores.

Priority scoring

Using a priority score developed by consensus,[11,12] we ranked patients waiting for CABG according to need. The priority ranking was determined by the pattern or severity of angina symptoms, the coronary artery anatomy and the results of noninvasive tests of ischemic risk.[12] The cases were categorized as follows: very urgent (patient should undergo surgery within 24 hours), urgent (should undergo surgery within 72 hours), semi-urgent (should undergo surgery within 14 days during the same hospital stay), short elective list (should undergo surgery within 6 weeks) and delayed elective list (should undergo surgery within 6 months).

By comparing this categorization with the length of time the patients actually waited for CABG, we were able to make an indirect assessment of the efficiency with which the cardiac surgery program delivers CABG in the province.

Results

Study population

Coronary angiography was performed in 1604 patients during the study period. Of these, 1082 had critical coronary artery disease involving at least one artery. Percutaneous transluminal coronary angioplasty (PTCA) was performed in 266 of these patients. Of the 816 patients with critical coronary artery disease who did not undergo PTCA, 58 had a contraindication to surgery, and 9 had incomplete medical records. Of the remaining 749 patients, 391 (279 men and 112 women with a mean age of 61.9 [SD 10.2] years) were referred for CABG, and 358 (252 men and 106 women with a mean age of 57.6 [SD 11.2] years) were treated medically. The clinical characteristics of the 2 groups are shown in Table 1.

The average waiting time for CABG among the 391 patients referred for this procedure during the study period was 33 (SD 63.5) days (range less than 1 hour to 397 days). The last CABG procedure for this group was performed on Oct. 14, 1995. Of the 391 patients, 301 (77.0%) had symptoms compatible with class IV angina, and 71 (18.2%) had class III angina symptoms. A total of 328 patients (83.9%) were receiving maximum medical therapy at the time of coronary angiography. Over half (222 [56.8%]) had triple-vessel disease, and 61 (15.6%) had disease of the left main coronary artery.

During the 12-month study period only 338 patients (242 men and 96 women with a mean age of 61.0 [SD 10.6] years) actually underwent CABG (Table 2). Of these, 208 had been on the waiting list before Apr. 1, 1994. Most presented with unstable angina (252 [74.6%])

or had persistent ischemia following myocardial infarction (33 [9.8%]). A total of 252 (74.6%) had left main artery or triple-vessel disease, and 289 (85.5%) were receiving maximal medical therapy.

Appropriateness of CABG

The appropriateness and necessity scores were high. Of the 338 procedures, 334 (98.8%) were considered appropriate and 317 (93.8%) were considered necessary. There were no cases in which CABG was considered inappropriate (Table 2).

Table 1: Clinical characteristics[9,10] of patients in Newfoundland and Labrador in whom critical coronary artery disease was diagnosed by angiography over a 1-year period and who did not undergo percutaneous transluminal coronary angioplasty

Characteristic	Group; no. (and %) of patients: Referred for CABG surgery *n = 391*	Medical treatment *n = 358*
Angina		
None	9 (2.3)	54 (15.1)
Class I	2 (0.5)	54 (15.1)
Class II	8 (2.0)	35 (9.8)
Class III	71 (18.2)	42 (11.7)
Class IVA	77 (19.7)	136 (38.0)
Class IVB	81 (20.7)	26 (7.3)
Class IVC	143 (36.6)	11 (3.1)
Indication for CABG		
Stable angina	49 (12.5)	80 (22.3)
Unstable angina	275 (70.3)	153 (42.7)
Acute MI	4 (1.0)	2 (0.6)
Post MI	43 (11.0)	91 (25.4)
Asymptomatic	3 (0.8)	28 (7.8)
Near sudden death	1 (0.2)	3 (0.8)
Complications of PTCA or CA	5 (1.3)	0 (0.0)
Valve surgery	11 (2.8)	1 (0.3)
Coronary anatomy		
Protected left main artery	1 (0.2)	2 (0.6)
Unprotected left main artery	60 (15.3)	1 (0.3)
3-vessel disease	222 (56.8)	48 (13.4)
2-vessel disease + PLAD	52 (13.3)	46 (12.8)
2-vessel disease	35 (9.0)	67 (18.7)
1-vessel disease + PLAD	15 (3.8)	46 (12.8)
1-vessel disease	6 (1.5)	148 (41.3)
Ejection fraction, %		
> 35	287 (73.4)	285 (79.6)
15–35	80 (20.5)	63 (17.6)
< 15	20 (5.1)	8 (2.2)
No data	4 (1.0)	2 (0.6)
Operative risk		
Normal or low	250 (63.9)	268 (74.9)
Moderate or high	101 (25.8)	81 (22.6)
Very high	40 (10.2)	9 (2.5)

Note: CABG = coronary artery bypass grafting, MI = myocardial infarction, PTCA = percutaneous transluminal coronary angioplasty, CA = coronary angiography, PLAD = proximal left anterior descending artery.

Waiting period

Although 391 patients were referred for CABG during the study period, only 338 underwent surgery; thus, the waiting list increased by 53 patients.

Table 2: Clinical characteristics of the 338 patients who underwent CABG during the 1-year study period*

Characteristic	No. (and %) of patients
Angina	
None	6 (1.8)
Class I	1 (0.3)
Class II	5 (1.5)
Class III	50 (14.8)
Class IVA	66 (19.5)
Class IVB	67 (19.8)
Class IVC	143 (42.3)
Indication for CABG	
Stable angina	34 (10.1)
Unstable angina	252 (74.6)
Acute MI	3 (0.9)
Post MI	33 (9.8)
Asymptomatic	2 (0.6)
Near sudden death	1 (0.3)
Complications of PTCA or CA	5 (1.5)
Valve surgery	8 (2.4)
Coronary anatomy	
Protected left main artery	1 (0.3)
Unprotected left main artery	62 (18.3)
3-vessel disease	189 (55.9)
2-vessel disease +PLAD	49 (14.5)
2-vessel disease	24 (7.1)
1-vessel disease +PLAD	11 (3.2)
1-vessel disease	2 (0.6)
Ejection fraction, %	
> 35	250 (74.0)
15–35	63 (18.6)
< 15	21 (6.2)
No data	4 (1.2)
Stress test result	
Very positive	161 (47.6)
Not very positive	28 (8.3)
No data	149 (44.1)
Operative risk	
Normal or low	217 (64.2)
Moderate or high	85 (25.1)
Very high	36 (10.6)
Appropriateness score for CABG†	
1–3	0 (0.0)
4–6	4 (1.2)
7–9	334 (98.8)
Necessity score for CABG†	
1–3	4 (1.2)
4–6	17 (5.0)
7–9	317 (93.8)

*Of these patients, 289 (85.5%) were receiving maximum medical therapy at the time of CABG.
†1 = extremely inappropriate or unnecessary, 9 = extremely appropriate or necessary.[9] See Methods.

In addition, using the RAND Corporation criterion of a necessity score of 7 or higher as an indication for surgery,[9] we identified another 31 patients (i.e., 422 in all) for whom CABG was considered necessary.

The length of time spent on the waiting list for each category of patient is shown in Fig. 1 (for patients referred for CABG during the study period). On the basis of the priority scores, CABG was considered very urgent for 31 patients, of whom 7 (23%) underwent the surgery within the recommended time. The proportions of patients in the other groups who underwent CABG within the recommended time were as follows: 30/122 (24%) in the urgent group, 56/87 (64%) in the semi-urgent group, 49/98 (50%) in the short wait group and 40/53 (75%) in the delayed wait group.

To our knowledge, 4 patients died while awaiting CABG during the study period.

Interpretation

We found that, for the period under review, the cardiac surgery program in Newfoundland and Labrador performed CABG predominantly in patients with late-stage angina symptoms and multivessel coronary artery disease. In addition, bypass surgery was performed in patients for whom the surgery was considered highly appropriate and necessary. However, we did observe substantial delays relative to suggested waiting periods.

Most of the patients in this study presented with advanced disease, 587 (78.4%) of the 749 with class III or IV angina symptoms. Unfortunately, the inconsistent reporting of angina symptoms in the literature[13–16] precludes valid comparisons of angina classification between studies. A total of 493 (65.8%) of the 749 patients in the study cohort had angiographic evidence of multivessel coronary artery disease involving the left main coronary artery or the proximal left anterior descending artery. This finding is similar to the proportion of patients with multivessel disease with or without left main or left anterior descending artery involvement reported in other studies (54% to 62%).[13–15]

Among the 338 patients who underwent CABG, we did not observe any cases in which the surgery was considered inappropriate. In comparison, the reported rate of inappropriate procedures at other centres varies from 2% to 16%.[9] Furthermore, 94% of the CABG procedures in our study were considered necessary according to RAND Corporation criteria.[9] This rate exceeds other Canadian and US reports of 70% to 83%.[15,17]

Despite the delivery of highly appropriate and necessary surgery there were still delays for some patients awaiting CABG. We observed considerable discrepancies between recommended and actual waiting times for surgery. Although some patients underwent surgery within the optimal period, an average of about 50% of patients in each category were still waiting for surgery at the end of their recommended waiting period. There was evidence, however, that cases were given priority on the basis of urgency, since patients with class IV angina symptoms underwent the procedure sooner than patients with less severe angina.

The failure to achieve optimal waiting times resulted, at least in part, from the constant addition of urgent cases to the top of the waiting list, thus consuming a limited resource. In addition, the total number of CABG procedures performed annually was far less than the number of

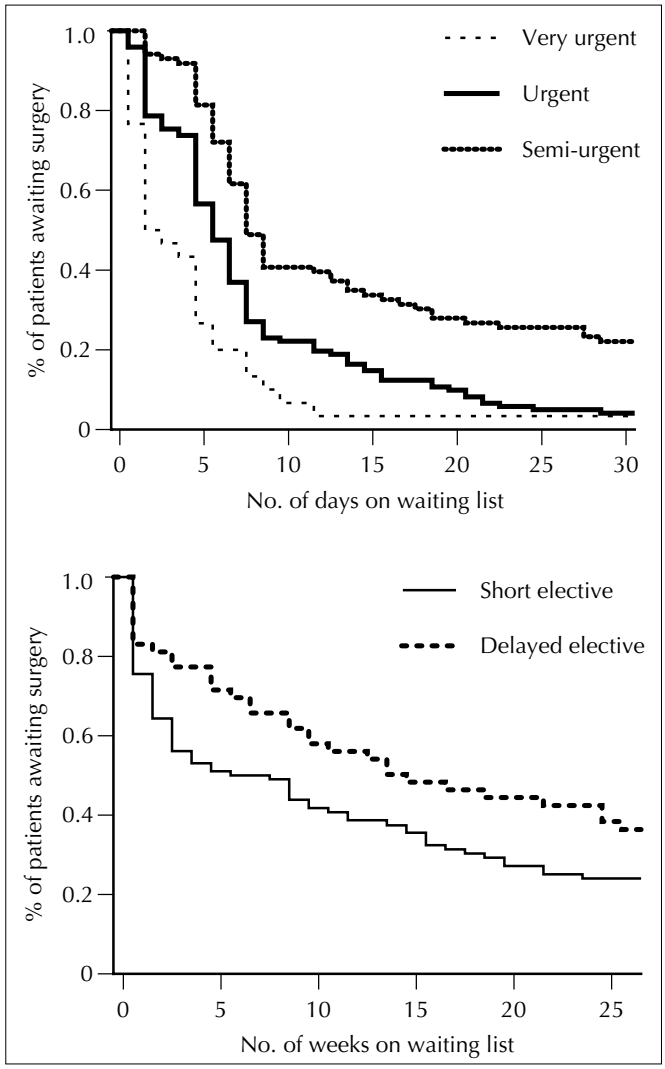

Fig. 1: Length of time on waiting list for coronary artery bypass graft surgery for patients referred between Apr. 1, 1994, and Mar. 31, 1995, in Newfoundland and Labrador. The categories refer to the recommended priority of the cases: very urgent, surgery should be performed within 24 hours; urgent, within 72 hours; semi-urgent, within 14 days during the same hospital stay; short elective, within 6 weeks; delayed elective, within 6 months.

patients who required surgery, as determined by either the cardiovascular surgery conference (391) or the RAND Corporation criteria (422). These factors select for patients with more advanced coronary artery disease and may delay access to CABG for others. Additional reasons for delays include economic restraint, lack of access to critical care beds, lack of surgical assistants and a limited number of cardiac surgeons.

Limitations

The predominant limitation of our study arises from the use of a retrospective chart audit for data collection. The abstraction of data was therefore dependent on the accuracy of the information recorded at the time of the original consultation, coronary angiography, surgical procedure and follow-up visits. To minimize these problems, we used properly trained data abstractors and a standardized, validated data abstraction record adapted for the Canadian population.

Conclusions

The patient profile and indications for CABG in our study show that in 1994 and 1995, the cardiac surgery program in Newfoundland and Labrador was providing revascularization to patients with late-stage angina symptoms and advanced coronary artery disease. However, despite the performance of appropriate and necessary surgery in patients with advanced disease, the waiting list for bypass surgery continued to expand, and optimal waiting times for individual patients were often exceeded. This discrepancy has prompted the provincial government to use specific criteria (i.e., RAND Corporation necessity score of 7 or higher) to estimate the annual needs for CABG. This policy warrants investigation to determine its effect on the delivery of CABG.

Failure to perform CABG quickly in urgent cases may contribute to excess illness, unnecessary hospital costs and patient dissatisfaction. Furthermore, there is likely a larger group of symptomatic patients with less advanced disease whose condition is stable for whom CABG may be delayed. The long-term effects on this subgroup in terms of death, illness and lost productivity are unknown.

We thank Dr. C. David Naylor, of the Institute for Clinical Evaluative Sciences in Ontario, for providing the evaluation tools necessary to carry out this study.

This work was funded by the Health Care Corporation of St. John's.

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