Are waiting times for coronary artery bypass graft surgery longer than they should be? Implications of the NICE guidelines for coronary artery stents

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Abstract

The objective of this study was to test the hypothesis that some patients on the routine waiting list for coronary artery bypass (CABG) surgery are suitable for percutaneous coronary intervention (PCI), as suggested in the NICE appraisal of coronary artery stents. A retrospective analysis was performed of 100 consecutive patients who had recently undergone CABG surgery from the routine waiting list in a tertiary cardiothoracic centre. The coronary angiograms of these patients were reviewed by an interventional cardiologist and a cardiac surgeon to assess patients' potential suitability for PCI.

The mean total waiting time from being listed for angiography to having CABG surgery was 18.7 months. The mean delay from angiography to CABG surgery was 13.5 months. Of the 100-patient cohort, 70 were referred by a non-interventional cardiologist and 30 by an interventionalist (ratio 2.3:1). Fifteen patients were deemed potentially suitable for PCI after angiographic review. Of these, 13 (87%) were referred by a non-interventional cardiologist without angiographic review by an interventional specialist. The majority (86%) of the 15 patients deemed potentially suitable for PCI had single or double vessel coronary artery disease, in contrast to the population as a whole (38%).

These data suggest (a) that current CABG waiting lists could be reduced by up to 15% if coronary angiograms were reviewed by an interventional cardiologist in addition to a consultant cardiothoracic surgeon and (b) that referral arrangements should be adopted to facilitate such a review. The clinical implications of these data could be fully assessed by rolling out prospectively to other groups in the Coronary Heart Disease Collaborative.

Key words: angiography, CABG, PCI, waiting lists.

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Introduction

Percutaneous coronary intervention (PCI) is now a well-established therapeutic option for symptomatic coronary artery disease. The short- and medium-term outcomes have been transformed by the introduction of coronary artery stents; the stent rate in PCI procedures in many centres is now over 90%. Furthermore, evidence is available to demonstrate equivalent one-year outcome between multivessel PCI and coronary artery bypass graft surgery (CABG) in terms of death and myocardial infarction (MI), though there is a significantly higher rate of revascularisation in the PCI group related to restenosis.[1,2] Recognition of PCI as a successful and attractive revascularisation option has now been provided by both the National Service Framework (NSF) for Coronary Heart Disease[3] and the fourth appraisal from the National Institute of Clinical Excellence (NICE) *Guidance on coronary artery stents in the treatment of ischaemic heart disease*.[4]

The three most important guidelines from the NICE document are:

(a) 'For patients with either stable or unstable angina, or acute MI and where PCI is the clinically appropriate procedure, stents should be used routinely.'
(b) 'Where it is considered clinically appropriate to undertake either PCI or coronary artery bypass grafting (CABG), the availability of stents should push the balance of decision-making towards PCI.'
(c) 'NHS trusts managing cardiothoracic services should review their current clinical practice against this guidance. This should take account of the guidance in paragraph 1.2 ([b] above) on the balance between PCI and CABG for patients on CABG waiting lists.'

This study was designed to assess the hypothesis that some patients on the CABG waiting list at a busy regional cardiotho-

racic centre might have been suitable for PCI instead. As part of this assessment we analysed in detail the length of the patient's journey from his being placed on the list for a coronary angiogram to his CABG operation in order to identify areas of avoidable delay. This analysis is of considerable relevance in the context of recent controversy about presentation of waiting-list data. Routine PCI waiting lists are very substantially shorter than CABG lists. Proof of the study's hypothesis would have important implications for service improvement, both directly for the patients diverted to more rapid PCI revascularisation and indirectly for the patients left on the (now smaller) CABG list. This would be beneficial in the pursuit of National Service Framework standards.

Methods

Patient selection

We performed a retrospective analysis of 100 consecutive patients who underwent CABG surgery at the regional cardiothoracic centre. Patients were included only if they were for elective surgery and had been waiting on a routine list. They were excluded from the study if they were due to undergo valve surgery or if they had presented on an urgent or emergency basis. The patients were a consecutive cohort from the total of 787 patients undergoing non-urgent CABG-only surgery at the centre for the financial year 2000–2001. Patients were identified by the Cardiac Surgery Activity Coordinator from computer-based records.

Table 1. Demographics of the study population

Number of patients	**100**
Mean age (years)	61.45
Smokers (past or present)	84%
Hypertension	58%
Diabetes	24%
Past MI	59%
Hypercholesterolaemia	90%
Past PCI	3%
Single vessel disease	9%
Double vessel disease	29%
Triple vessel disease	62%
Left main stem disease	9%
LV good	72/99 (72.7%)
LV moderate	23/99 (23.2%)
LV poor	4/99 (4%)
TC occlusion	23%
Referred by interventionalist	30%
Referred by non-interventionalist	70%
District hospital	60%
MRI	40%

Key: PCI = percutaneous intervention; MI = myocardial infarction; LV = left ventricle; MRI = Manchester Royal Infirmary; TC = total chronic

Data collection

Each patient's medical notes were retrieved and a dataset was completed on each in a spreadsheet constructed using SPSS software version 9.0, which thereby served as a data collection tool. Particular interest was taken in the times from one part of the patient's journey to another and in whether the patient's angiogram had been discussed with an interventional colleague. Basic demographic data were also collected for the rest of the 787 routine CABG-only patients for that financial year so that we could ensure that our study group was a representative sample.

Angiogram review

The angiogram for each patient was reviewed by a consultant in interventional cardiology (NC) and by a consultant cardiothoracic surgeon (BP). The films were reviewed together but the reviewers were blinded both to the patient's details and to the identity of the referring cardiologist. Each reviewer was required to give an opinion on whether, based purely on the angiographic findings, the patient was potentially suitable for PCI. For the purposes of the analysis, only those cases in which both the interventionalist and the surgeon agreed that the anatomy was favourable for PCI were included.

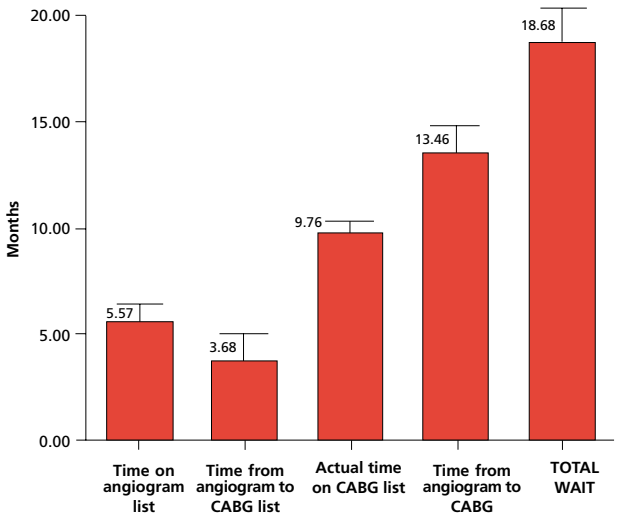
Statistical analysis

Data analysis was performed using SPSS 9.0 for Windows software. Graphical presentation of data was produced employing either SPSS or Excel. The mean and either standard error of the mean (SEM) or confidence interval (CI) were derived where appropriate. Statistical analyses that were used included: Pearson's chi-squared test to compare appropriate variables between the study group and the total population; Student's t-test to test for association between patient age and suitability for PCI; and logistic regression analysis to determine whether the number of diseased vessels or the presence of an occluded vessel were associated with suitability for PCI. Statistical methods are stated in the appropriate position in the results section and were undertaken following statistical advice.

Results

After initial identification of 100 consecutive patients, as described above, it was necessary to exclude seven patients and recruit seven more. These seven patients were excluded for the following reasons: two sets of notes could not be found; two angiograms could not be found; and three had undergone PCI procedures that had either been angiographically unsuccessful (one patient) or had been angiographically successful at the target site but had failed to achieve resolution of the symptoms (one patient) or had had a successful stent to one coronary as part of a staged procedure with subsequent MIDCAB to the left anterior descending coronary artery (one patient). These three patients were excluded because they could not be considered potential candidates for PCI in the study. By contrast, three other

Figure 1. Breakdown of waiting times from listing for angiography to CABG surgery



patients with a history of PCI were included in the study group. These patients had undergone symptomatically successful PCI previously and had then re-presented with angina. In these patients there was no reason to exclude PCI as a therapeutic option.

Overall demographic and clinical data for the study population are shown in table 1. The mean age of the study group was 61.5 years. Two-sided Pearson's chi-squared tests were used to compare a variety of clinical and demographic variables between the remainder of the patients and the study population. No difference was found between the groups in terms of sex, age, length of time waiting, or history of hypertension or diabetes. In the study population the prevalence of current smoking (76% *vs.* 84%), hypercholesterolaemia (79% *vs.* 90%) and a past history of myocardial infarction (44% *vs.* 59%) were all significantly higher (all p values < 0.05) than in the total population.

A breakdown of the points of delay along the patient's journey from being listed for a coronary angiogram to actually having CABG surgery is shown in figure 1. The mean total waiting time was 18.7 months. The average wait for an angiogram was 5.6 months, with a subsequent delay to CABG of 13.5 months which was made up of the time on the list plus an average of 3.7 months after the angiogram before the patient was entered on to a surgery waiting list.

Of the 100 study patients, 70 were referred by a non-interventionalist and 30 by an interventionalist. This gives an overall referral ratio for CABG of 2.3:1 for non-interventionalist to interventionalist. In 15 patients (15%) both the reviewing interventionalist and the reviewing surgeon agreed that the angiographic appearances suggested that the patient was suitable for PCI. The interventionalist felt that four other patients would also have been suitable for PCI. In six of the 15 cases (40%) there was a chronic total occlusion, although in such cases it was felt that the angiographic appearances made them technically suitable for PCI. Table 2 shows clinical variables of the 15 patients deemed potentially suitable for PCI. Of this subgroup of 15 patients, 13 (87%) were referred by a non-interventionalist. This gives an observed ratio in the group found to be potentially suitable for PCI of 6.5:1 in favour of the non-interventional cardiologist. This is greater than expected given that the ratio for the total group was 2.3:1.

Table 2. Characteristics of the 15 patients considered suitable for PCI after angiographic review

Number of patients	**15**
Mean age (years)	56.67
Smokers (past or present)	11/15 (73.3%)
Hypertension	8/15 (53.3%)
Diabetes	4/15 (26.6%)
Past MI	9/15 (60%)
Hypercholesterolaemia	11/15 (73.3%)
Past PCI	0
Single vessel disease	5/15 (33.3%)
Double vessel disease	8/15 (53.3%)
Triple vessel disease	2/15 (13.3%)
Left main stem disease	0
LV good	13/15 (86.7%)
LV moderate	2/15 (13.3%)
LV poor	0
TC occlusion	6/15 (40%)
Referred by intervent	2/15 (13.3%)
Referred by non-intervent	13/15 (86.7%)
District hospital	9/15 (60%)
MRI	6/15 (40%)
Reviewed by intervent	0/13 (0%)

Key: PCI = percutaneous intervention; MI = myocardial infarction; LV = left ventricle; MRI = Manchester Royal Infirmary; TC = total chronic; intervent = interventional cardiologist

None of the cases referred by a non-interventional cardiologist had had angiographic review by an interventionalist as far as was documented in the notes. In the total study population of 100 patients, nine (9%) had single vessel disease, of whom eight (89%) were referred by a non-interventional cardiologist; 29 (29%) had double vessel disease, of whom 19 (66%) were referred by a non-interventional cardiologist; and 62 (62%) had triple vessel disease, of whom 43 (69%) were referred by a non-interventional cardiologist (figure 2). In contrast, of the 15 patients in this study whose angiograms rendered them potentially suitable for PCI, five (33.3%) had single vessel disease, of whom all five (100%) were referred by a non-interventional cardiologist; eight (53.3%) had double vessel disease, of whom six (75%) were referred by a non-interventional cardiologist; and two (13.3%) had triple vessel disease, both (100%) referred by a non-interventional cardiologist. Logistic regression analysis

shows that the patients in the study group were significantly more likely to be found to be angiographically suitable for PCI if they had single (odds ratio = 37.5, p<0.001) or double (odds ratio = 11.4, p<0.01) vessel coronary artery disease.

Discussion

The aim of this study was to test the hypothesis, stimulated by the NICE guidelines for coronary stents,[4] that in our (typical) cardiothoracic centre there is a significant number of patients on the routine waiting list for CABG who could have had PCI instead. This hypothesis has been proven. In a representative subgroup of 100 patients on the CABG waiting list 15 patients were deemed potentially suitable for PCI after review of angiographic data by a cardiac surgeon and an interventional cardiologist. Furthermore, 87% of the patients who were felt to be suitable for PCI were referred for CABG by non-interventional cardiologists and in no case was it documented that the angiographic data had been reviewed with a specialist in interventional cardiology.

These findings have several important clinical implications. First, the analysis of waiting times reveals an average wait from listing for coronary angiography to CABG surgery of 18.7 months. We have no data regarding the total wait from GP referral to listing for angiography, but on the basis of previous data the routine wait from GP referral to CABG surgery is unlikely to be less than two years. This is clearly unacceptable according to the standards set out in the NSF.[3] The nature of the delays on the patient journey is the focus of considerable scrutiny and manipulation by groups working for the Coronary Heart Disease Collaborative.

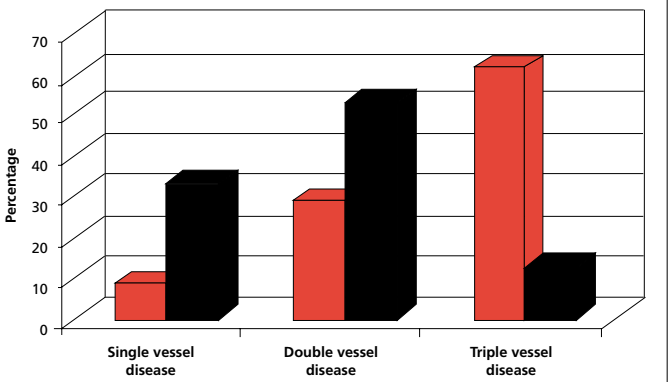
The second important clinical implication from this study is that 15% of the patients on the CABG routine list may be suitable for PCI, which in our centre currently has a waiting list of three months. The obvious benefit of these patients achieving revascularisation more quickly and in a less invasive manner is compounded by the potential benefit to the patients who remain on the CABG list, who might be expected to have their operation 15% more rapidly. It is important to note, however, that some of the patients within this group who had total chronic occlusions might not have been successfully treated by PCI and would probably have been referred subsequently for CABG.

The advantages of coronary stenting compared to plain old balloon angioplasty (POBA) are now well established.[5-7] The comparison between multivessel stenting and CABG in the ARTS study[1] demonstrated equivalent outcome in terms of survival or MI at one year. There was, however, a 14% higher rate of revascularisation in the PCI group at one year. This reflects the restenosis phenomenon associated with coronary stents, that has progressively fallen to single figures at six months in some studies.[8] The prospects for reducing restenosis rates still further, with newer technologies such as coated stents, are promising. It is also important to note that, despite the higher revascularisation rate in ARTS, cost analyses still demonstrated benefit in the PCI group.

The third important clinical implication of this study is that candidates for PCI may be missed and may be referred unnecessarily for surgery if their angiograms are not reviewed by an interventional specialist. In this study 87% of the patients identified as having been potentially suitable for PCI were referred by a non-interventionalist. It is interesting that there is no record of these patients having had angiographic review by an interventionalist. When this group is compared with the total population studied, the ratio of patients referred by a non-interventional cardiologist is higher than expected. Furthermore, there is a statistically significant difference in the distribution of coronary artery disease in the group deemed potentially suitable for PCI: the percentages of these patients with single, double and triple vessel disease were 33.3%, 53.5% and 13.3% compared to 9%, 29% and 62% respectively in the 100 CABG patient population (figure 2). A logical recommendation arising from these data is that more angiograms taken by a non-interventional cardiologist should be reviewed with an interventional specialist in order to maximise the takeup for PCI, and this is particularly important in those with single or double vessel coronary disease. It is, after all, possible that up to 19% of our sample population would have been accepted for PCI given the sole opinion of the interventionalist.

This study has several limitations. First, it is retrospective. Second, although it utilised a carefully collected patient dataset, no account could be taken of decision-making in individual circumstances that might have influenced choice of revascularisation. Such factors may include co-morbidity and patient preference. Third, it is a relatively small study group, although at least we have good evidence that it is a representative sample. Finally, the recently presented SOS study,[9] which like ARTS compared multivessel stenting with CABG, showed very similar outcome data at one year between the groups in terms of MI and revascularisation and it also showed a higher mortality in the PCI arm. This has proved a contentious result, especially because post-hoc analysis suggests that the higher death rate may largely be due to cancer, which might therefore make it a chance finding.

Figure 2. Percentage of patients with single, double or triple vessel coronary artery disease in the total study population of 100 CABG patients (red bars) and in the 15 patients deemed potentially suitable for PCI (black bars)



Key messages

- A significant number of patients on the CABG waiting list could have PCI instead
- Waiting times from listing for coronary angiography to CABG surgery are unacceptably long
- More angiograms taken by non-interventional cardiologists should be reviewed with an interventional specialist in order to maximise the takeup of PCI

In conclusion, this study has proved its hypothesis in that 15% of patients waiting for routine CABG were thought suitable for PCI when their angiograms were reviewed by a cardiac surgeon and an interventionalist. Of these patients, 87% were referred by a non-interventional cardiologist and in no case was there any documentation in the notes to suggest that the films were reviewed by an interventionalist. Given the excessive average wait from listing for angiography to CABG surgery (18.7 months) this result, if clinically applied, could lead to an easing of such waiting for both the PCI-treated group and those left on the CABG waiting list. These data, together with the recommendations in the NICE appraisal, also lead us to recommend that more angiograms taken by non-interventional cardiologists be reviewed by interventional specialists. Further larger scale, prospective studies are now urgently required to investigate the clinical applicability of these data. This could be achieved by rolling out prospectively to other groups in the Coronary Heart Disease Collaborative.

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- A commentary on this article appears on page AIC 19.