Predictors and outcomes of early coronary angiography in patients with prior coronary artery bypass surgery presenting with non-ST elevation myocardial infarction

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ABSTRACT

Introduction: The best strategy in patients with prior coronary artery bypass graft surgery (CABG) who present with non-ST elevation myocardial infarction (NSTEMI) remains less well defined. We compare the characteristics, therapeutic interventions and outcomes of patients with prior CABG presenting with NSTEMI.

Methods: All patients who presented to our hospital during 2007–2012 with available electronic records were analysed retrospectively. Outcomes were compared between patients who underwent coronary angiography or percutaneous coronary intervention (PCI) versus those who were treated medically.

Results: A total of 117 patients were analysed. Of that, 79 patients were managed medically while 38 underwent early angiography, of which only 11 (9.5%) received PCI. Patients treated medically (did not undergo angiography) were older (74±10 vs 70±8; p=0.05). ECG changes were the only independent predictor for early angiography (OR 0.4, 95% CI 0.15 to 0.99; p=0.05) while recurrent chest pain (OR 0.2, 95% CI 0.05 to 0.97; p=0.05) predicted PCI on multivariate analysis. The PCI group had higher Global Registry of Acute Cardiac Events (GRACE) score (176±29 vs 150±31; p=0.01). No significant difference was found in readmission rates, morbidity (unstable angina pectoris, NSTEMI, ST elevation myocardial infarction (STEMI), or combination) or mortality at 12 months between the groups who underwent angiography, PCI, or treated medically on univariate and multivariate analysis.

Conclusions: The opportunity to intervene in prior CABG patients presenting with NSTEMI is often low. Initial medical management may be a reasonable option in carefully selected patients particularly in the absence of ongoing symptoms, ECG changes, or very high GRACE scores.

INTRODUCTION

Coronary artery disease (CAD) is a major healthcare challenge worldwide. Despite the advances in coronary artery bypass graft surgery (CABG) and percutaneous coronary intervention (PCI) techniques and equipment, risk of adverse cardiac outcomes remain high as compared with normal population.1,2 Current guidelines support an early invasive strategy for CAD including high-risk unstable angina pectoris (UAP), non-ST elevation myocardial infarction (NSTEMI) and ST-elevation myocardial infarction (STEMI). The best strategy in the subgroup of patients with prior CABG who present with NSTEMI however remains less well defined. This population, despite a growing number, has been either under-represented or excluded in major trials3–6; and stronger evidence-based management strategies are required to improve their clinical outcomes. This retrospective observational study compares the characteristics, therapeutic interventions and outcomes of patients with prior CABG presenting with NSTEMI.
Available electronic records of patients who presented to Northern Health (Melbourne, Australia) during 2007–2012 were screened. All patients who had a history of CABG and a discharge diagnosis of NSTEMI were analysed. Standard definition of NSTEMI was used. The patients were divided into a coronary angiography group and a medically managed group if they did not undergo angiography during the index admission or within 2 weeks of discharge. The coronary angiography group was further categorised on the basis of requiring percutaneous intervention. Characteristics and outcomes were compared between patients who underwent coronary angiography, PCI, and who were treated medically. Global Registry of Acute Cardiac Events (GRACE) risk score, which is a validated predictor of inhospital mortality, was calculated based on age, heart rate, systolic blood pressure, Killip class, cardiac arrest, ECG changes, serum creatinine level and cardiac biomarker status of each patient on presentation. ECG changes were defined as new ST segment depression or transient elevation ≥1 mm.

Two-sample t tests were used to compare continuous data and equal variances were assumed. And Fisher’s exact tests were performed for categorical data. A two-tailed p value of <0.05 was considered statistically significant. Factors found significant on univariate analysis were adjusted on multivariate analysis to look for independent associations.

### Table 1 Clinical characteristics

|                        | Coronary angiogram not performed (n=79) | Coronary angiogram performed (n=38) | p Value |
|------------------------|----------------------------------------|-------------------------------------|---------|
| Age                    | 74±10                                  | 70±8                                | 0.05    |
| Males                  | 62%                                    | 74%                                 | 0.2     |
| Length of stay         | 5.6±4.2                                | 8.1±6.4                             | 0.01    |
| Troponin I levels      | 2.0±4.6                                | 4.7±10.6                            | 0.06    |
| New ECG changes        | 30%                                    | 57%                                 | 0.01    |
| Recurrent chest pain   | 27%                                    | 49%                                 | 0.02    |
| Diabetes               | 53%                                    | 45%                                 | 0.4     |
| Hypertension           | 75%                                    | 87%                                 | 0.1     |
| Months since CABG      | 140±103                                | 148±84                              | 0.7     |
| Number of grafts       | 3.1±1                                  | 2.8±0.9                             | 0.1     |
| Ejection fraction      | 52±16                                  | 49±13                               | 0.4     |
| Creatinine             | 114±56                                 | 111±49                              | 0.8     |
| Haemoglobin            | 123±22                                 | 131±16                              | 0.05    |
| Albumin                | 35±4                                   | 37±4                                | 0.02    |
| GRACE score            | 150±29                                 | 158±36                              | 0.2     |

CABG, coronary artery bypass graft surgery; GRACE, Global Registry of Acute Cardiac Events.
DISCUSSION
This study represents the real-world data on a growing population of people with prior CABG who present with NSTEMI. We found that most of these patients did not undergo an early coronary angiogram, and a very small percentage was treated with percutaneous intervention. These were the patients with recurrent symptoms of chest pain or new ST changes on ECG, and had very high GRACE scores (176±29). This group represents a very high-risk patient population regardless of any opportunity to intervene as evident by our mortality data. The GRACE registry used a cut-off score of 140 to denote high-risk patients; however, it is noted that only 14% patients of the NSTEMI arm had a history of CABG in the registry. The under-representation of this specific population with high mortality makes the interpretation and application of GRACE score to guide an early coronary angiography difficult. Furthermore, a history of CABG was the third biggest independent predictor of ‘no reperfusion’ (OR 2.28; CI 1.35 to 3.87) after heart failure and age, in patients presenting with acute coronary syndrome (ACS). A lower rate of angiography was also seen compared with ‘no prior CABG group’, adjusted for age, gender and diagnosis at presentation (OR 0.64; CI 0.54 to 0.75).

Despite the advances in the treatment of CAD, patients with prior CABG and ACS have a poor prognosis as compared with patients without prior CABG. Our study demonstrates no significant difference in clinical outcomes at 1 year between the initial medical management and early intervention groups. This includes all-cause death, ACS and stable symptoms. Length of stay was longer in the patients who had an early coronary angiography performed which may be due to angiography-associated delays or may represent a more unstable group of patients requiring invasive management strategy. Somewhat similar results have been reported by the Acute Catheterization and Urgent Intervention Triage Strategy (ACUITY) trial, in which adjusted 30-day and 1-year rates of major adverse cardiac events were increased in patients treated with revascularisation rather than medically. This cohort included patients with prior CABG presenting with ACS including UAP. All patients underwent diagnostic coronary angiography and in the medically treated patients, revascularisation was declined due to either the physician’s or patient’s preference, lesion anatomy, absence of significant lesion or due to comorbidities. Similarly, 6-month mortality of patients with ACS with prior CABG in the GRACE was lower in patients revascularised versus those treated medically on univariate but not on multivariable analysis. Data indicated that an invasive approach within 48 h did not improve inhospital or 6-month death, rehospitalisation for heart disease or non-fatal

| Table 2 Angiographic characteristics |
|--------------------------------------|
| **No revascularisation** | **Percutaneous coronary intervention** | **p Value** |
| (n=27) | (n=11) | |
| Culprit lesion | | |
| Not identified | 17 (63%) | 0 | <0.0001 |
| Ungrafted native vessel | 4 (15%) | 7 (64%) | 0.005 |
| Grafted native vessel | 4 (15%) | 3 (27%) | 0.4 |
| Vein graft | 2 (7%) | 1 (9%) | 1.0 |
| Arterial graft | 0 | 0 | Not applicable |
| Occluded grafts/severe disease (>70% angiographic stenosis) | | |
| Total | 0.41±0.7 | 0.18±0.4 | 0.3 |
| Arterial | 0.22±0.5 | 0 | 0.1 |
| Venous | 0.19±0.4 | 0.18±0.4 | 0.9 |

| Table 3 Medication at discharge after the index admission |
|---------------------------------------------|
| **No revascularisation** | **Percutaneous coronary intervention** | **p Value** |
| (n=106) | (n=11) | |
| Aspirin | 106 (100%) | 11 (100%) | 1 |
| Clopidogrel/ticagrelor/prasugrel | 100 (94%) | 11 (100%) | 0.4 |
| ACE inhibitors/angiotensin receptor blockers | 55 (52%) | 11 (100%) | 0.002 |
| β-Blockers | 97 (91.5%) | 9 (82%) | 0.3 |
| Calcium channel blockers | 80 (75%) | 8 (73%) | 0.8 |
| Nitrates | 63 (59%) | 7 (64%) | 0.8 |
| Nicorandil | 39 (37%) | 1 (9%) | 0.06 |
| Statins | 102 (96%) | 11 (100%) | 0.5 |

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reinfarction. Conversely, it was associated with increased risk of major bleeding, including haemorrhagic stroke. A large Swedish registry on the other hand, involving 10 469 patients with previous CABG, showed 1-year adjusted mortality was 50% lower with revascularisation compared with medical management. The study included NSTEMI and UAP, and excluded patients >80 years. In all, 33% of NSTEMI while 50% of the UAP included NSTEMI and UAP, and excluded patients specifically.

Table 4 Outcomes at 12 months on multivariate analysis using logistic regression

|                | No revascularisation | Percutaneous coronary intervention | p Value |
|----------------|----------------------|------------------------------------|---------|
| Readmissions   | 1.56±2.5             | 1.55±2.5                           | 0.96    |
| Deaths         | 12%                  | 18%                                | 0.63    |
| STEMI          | 1%                   | 0%                                 | 1.0     |
| NSTEMI         | 22%                  | 18%                                | 0.81    |
| Stable angina  | 16%                  | 18%                                | 0.98    |
| Asymptomatic   | 49%                  | 45.5%                              | 0.84    |

STEMI, ST elevation myocardial infarction; NSTEMI, non-ST elevation myocardial infarction.

Overall, there is conflicting data and no concrete evidence exists for any single strategy over the other in this specific population. The risk–benefit ratio may differ in this subset and perhaps an improved selection of patients who would benefit the most from invasive management using initial non-invasive means may prove useful. Our study is limited by its small number and a retrospective observational design and a significant selection bias cannot be removed. It does not have the power to draw any definitive conclusions; however, it does raise questions about the best management strategy in this particular cohort, and highlights the vacuum in evidence. A randomised trial may be able to answer this question in future.

CONCLUSION

The opportunity to intervene in patients with prior CABG presenting with NSTEMI is often low. Initial medical management may be a reasonable option in carefully selected patients particularly in the absence of ongoing symptoms, ECG changes or very high GRACE scores. Further studies are required to evaluate the safety of initial non-invasive strategies in managing this population.

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