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The role of angioplasty in patients with acute coronary syndrome and previous coronary artery bypass grafting

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ABSTRACT

Introduction: Angioplasty has changed the management of acute coronary syndrome (ACS). However, in patients with previous coronary artery bypass grafting (CABG), the role of angioplasty in the management of ACS is widely debated. Lack of clear guidelines leads to subjective and often stereotypical assessments based on clinician preferences. We sought to investigate if angioplasty affected all cause mortality in ACS patients with previous CABG.
Methods: Completely anonymous information on patients with ACS with a background of previous CABG, co-morbidities and procedures attending three multi-ethnic general hospitals in the North West of England, United Kingdom in the period 2000–2012 was traced using the ACALM (Algorithm for Comorbidities, Associations, Length of stay and Mortality) study protocol using ICD-10 and OPCS-4 coding systems. Predictors of mortality and survival analyses were performed using SPSS version 20.0.
Results: Out of 12,227 patients with ACS, there were 1172 (19.0%) cases of ACS in patients with previous coronary artery bypass grafting. Of these 83 (7.1%) patients underwent angioplasty. Multi-nominal logistic regression, accounting for differences in age and co-morbidities, revealed that having angioplasty conferred a 7.96 times improvement in mortality (2.36–26.83 95% CI) compared to not having angioplasty in this patient group.
Conclusions: We have shown that angioplasty confers significantly improved all cause mortality in the management of ACS in patients with previous CABG. The findings of this study highlight the need for clinicians to conscientiously think about the individual benefits and risks of angioplasty for every patient rather than confining to age related stereotypes.

1. Introduction/background

The management of acute coronary syndromes (ACSs) has led to vastly improved outcomes in the UK and worldwide because of the introduction of percutaneous coronary intervention [1–4]. The role for percutaneous coronary intervention is well established both in the emergency situation in patients suffering from ST segment elevation myocardial infarctions (STEMIs) by means of primary percutaneous coronary intervention (PPCI) and in patients with non-ST segment elevation myocardial infarctions (NSTEMIs) [5–7]. Therefore, there is substantial evidence that angioplasty is now an extremely important step in the management of ACS.

However, in certain groups of patients with ACS, uncertainty remains regarding the long-term benefits versus hazards of angioplasty and its impact on hard end points [1,8–10]. One such group of patients are those with a background of coronary artery bypass grafting (CABG) and subsequently suffer from acute coronary syndrome. There is a great deal of debate and controversy regarding the management of these patients. In the UK, evidence is clearly lacking and there is no general consensus about whether angioplasty is useful. Therefore, decisions by clinicians based on personal experiences and often stereotypes are rife [11].

The role of angioplasty in patients with ACS and previous CABG is widely debated. There have been considerable improvements in the techniques of percutaneous coronary artery and graft interventions over the last decade [12]. With a few exceptions, the default position in the UK in terms of management of such patients is the medical treatment of ACS.

A recent study from ACS patients in countries in the Middle East has shown that patients with prior CABG have adverse baseline characteristics, and reported higher GRACE risk score, multi-vessel disease, more severe LV dysfunction, cardiogenic shock and in-hospital major bleeding [13]. However, they did not look at the role of angioplasty in the

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management of these patients. Therefore, evidence regarding the role of angioplasty in these patients needs evaluation.

In this study, we specifically looked at the role of angioplasty in ACS patients with previous CABG from a large dataset in the North West of England, UK from 2000 to 2012. Our aim was to evaluate hard outcomes by means of all cause mortality in ACS patients who have a background of previous CABG who are managed with/without angioplasty.

2. Methods

The study was conducted as a case–control study examining the role of angioplasty in patients suffering from ACS with previous CABG. The design was retrospective, observational, and with up to thirteen years of follow-up. The main outcome measures were all cause mortality and survival.

Initially, the study population consisted of all adult patients (n = 362,492) who were admitted for hospital treatment or elective day treatment in three general hospitals in the North West of England patient care between 1st January 2000 and 30th June 2012. This method of tracing anonymous patients was performed using the ACALM (Algorithm for Comorbidities, Associations, Length of stay and Mortality) study protocol which has been previously used and described by our group [14–17]. The ACALM protocol uses International Classification of Disease, 10th edition (ICD-10) and Office of Population Censuses and Surveys Classification of Interventions and Procedures (OPCS-4) coding systems to trace patients [14–17]. The beginning of the study period was set from 1 January 2000 because the ICD-10 coding reliably started at this year in these hospitals. For patients with several hospitalisations the first admission to hospital treatment was chosen as index admission. The participating hospitals specialised in physical disease. The target population consisted of all patients with previous CABG and a diagnosis of ACS that were consecutively admitted for hospital treatment during the study period (n = 1172, Table 1).

Anonymous raw information of registered discharge diagnoses and procedures of all patients admitted to hospital treatment in the three general hospitals between 1 January 2000 and 30 June 2012 was received from the local health authority computerised hospital activity analysis register. The ACALM study protocol was subsequently applied to transfer this raw data into a useful research database. The complete data of final diagnoses, co-morbidities and procedural codes at discharge are entered for each patient in the hospital electronic diagnosis database and thus eliminates the possibility of counting patients twice. Furthermore, important clinical information becomes available later on in a patient's hospital stay and therefore, diagnosis at discharge is more likely to be accurate.

The group of patients with ACS that had a hospitalisation within the 12-year observation period with previous CABG were traced and analysed. Patients with ACS were diagnosed according to the ICD-10 by senior clinicians responsible for the formulation of the individual treatment plans. All ICD-10 codes that covered the spectrum of ACS such as myocardial infarction and unstable angina were included. Patients who were identified as having stable angina were not included in this analysis. The determination of the diagnosis of ACS primarily relied on local standardised guidelines. The ICD-10 coding system has been proven free of errors for definitive diagnoses such as ACS, chronic kidney disease and other cardiovascular co-morbidities, although errors are found in the coding of non-specific diagnoses such as 'viral infections' or 'gastroenteritis' [14–24].

A co-morbidity or procedure was defined as any diagnosis of a physical disease or procedure other than ACS registered at discharge during the study period. Co-morbidities in this patient group were determined and traced using ICD-10 and OPCS-4 coding using the ACALM study protocol. These would have been diagnosed according to the evaluation of a patient's previous medical history, previous hospital coding systems and/or clinical evaluation at the time of admission. Procedures such as CABG were traced according the OCPS-4 using the ACALM study protocol. In our analysis we focussed on the most relevant co-morbidities that influence the decision to evaluate if a patient is fit for angioplasty or not. The most common conditions that physicians look at to evaluate a patient's fitness for angioplasty are heart failure, chronic kidney disease, ischaemic stroke, carotid artery disease, peripheral vascular disease and previous myocardial infarction.

Vital status (all cause mortality) on 30 June 2012 was determined by record linkage to the National Health Tracing Services (NHS strategic tracing service) and was received along with the raw data. For each patient, follow-up was commenced at the beginning of the index admission to hospital treatment. Follow-up of patients continued until 30 June 2012. The average length of hospital stay was defined as the number of inpatient days at index hospitalisation. The days of admission and discharge were counted in the length of the hospital stay. Confidentiality of information was maintained in accordance with the UK Data Protection Act. The patient information was anonymous and non-identifiable when received by the authors and conformed to local research ethics policies.

Data analysis was performed using SPSS version 20.0 (SPSS Inc., Chicago, IL). The Student's *t* test and chi-square analysis were applied for group comparisons of patient and clinical course characteristics. Multivariate logistic regression analysis accounting for variations in age, gender and ethnicity was used to determine differences in the co-morbidities between the angioplasty and no-angioplasty groups. Logistic regression analysis accounting for variations in age, gender and ethnicity with hospital death as a dependent variable was used to identify those co-morbidities/procedures that were independent risk factors of all cause mortality. Relative risks with respect to the significant co-morbidity and 95% confidence intervals (CIs) were calculated. The time of follow-up duration varies according to the date of index admission and therefore different time periods existed within the study period from the beginning (1 January 2000) up to more than 12 years (30 June 2012). Time zero was defined as the date a patient was admitted to hospital treatment for the first time within the study period. Endpoints were the outcomes in all cause death; censoring date was the end of the study period, i.e. 30 June 2012. Kaplan–Meier curves were used to determine survival in patients. All p-values were calculated as two-tailed analyses; $p < 0.05$ was taken as significant.

Table 1
Characteristics of patients with previous coronary artery bypass grafting presenting with acute coronary syndrome.

	Angioplasty	No Angioplasty
(%)		
n	83 (7.1)	1089 (92.9)
Mean age (years)	60.4	64.9*
Male	69 (83.1)	873 (80.2)
Female	14 (16.9)	216 (19.8)
Caucasian	76 (91.6)	884 (81.2)*
South Asian	7 (8.4)	47 (4.3)
Afro-Caribbean	0 (0.0)	2 (0.2)
Other	0 (0.0)	156 (14.3)*
Heart failure	6 (7.2)	94 (8.6)
Chronic kidney disease	0 (0.0)	42 (3.9)
Ischaemic stroke	0 (0.0)	7 (0.6)
Previous ACS	45 (54.2)	836 (76.8)*
Peripheral vascular disease	7 (8.4)	93 (8.5)
Carotid artery disease	0 (0.0)	8 (0.7)
Alive	79 (95.2)	929 (85.3)*
Deceased	4 (4.8)	160 (14.7)
Mean survival (days)	2551	2819*

* Denotes statistical significance, $p < 0.05$.

3. Results

Out of the 12,227 patients with ACS during the study period, there were 1172 (19.0%) patients who had previous CABG. Of these 83 (7.1%) patients underwent angioplasty. Although patients who did not undergo angioplasty had a higher prevalence of chronic kidney disease (3.9% vs. 0%), ischaemic stroke (0.6% vs. 0%), heart failure (8.6% vs. 7.2%), carotid artery disease (0.6% vs. 0%) and peripheral vascular disease (8.5% vs. 8.4%) compared to patients who underwent angioplasty, none of these differences were statistically significant. Patients who underwent angioplasty had a significantly lower history of previous acute coronary syndrome (54.2% vs. 76.8%; $p < 0.05$). Full basic demographics of ACS patients with previous history of CABG are shown in Table 1.

Multi-nominal logistic regression, accounting for differences in age, gender, ethnic group and co-morbidities showed that heart failure (RR 2.18; 95% CI 1.27–3.75) and chronic kidney disease (RR 2.79; 95% CI 1.37–5.67) were the two significant predictors of worse mortality in these patients. Angioplasty conferred an improved mortality of 3.40 (95% CI 1.23–9.43) times compared to not having angioplasty in this patient group.

Fig. 1 shows the 5-year survival with and without angioplasty in these ACS patients with a previous history of CABG. As it is clear, the 5 year survival of the group that has been treated with angioplasty seems to be significantly better than the group without angioplasty. As Table 1 shows, 95.2% of the patients who were treated with angioplasty were still alive by the end of the study period compared to 85.3% of patients who were not treated with angioplasty in this group. The mean survival in the patients with angioplasty was lower than those without angioplasty (2551 days vs. 2819 days). The length of stay for patients who underwent angioplasty was significantly lower compared to patients who did not have angioplasty (4.80 days vs. 6.21 days; Table 1).

4. Discussion

The results of our study show that angioplasty confers significantly improved mortality in the management of patients with ACS and previous CABG. More specifically in ACS patients with previous CABG,