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ORIGINAL ARTICLE

Age as a Prognostic Factor in Patients with Acute Coronary Syndrome undergoing Urgent/Emergency Cardiac Surgery

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Background Patients presenting with acute coronary syndrome (ACS) who require urgent/emergency coronary artery bypass grafting (CABG) are increasing, as is the complexity of their clinical characteristics, one of which is advanced age. We evaluated the prognostic role of age in patients undergoing urgent/emergency cardiac surgery for ACS.

Methods From January to December 2013, 452 consecutive patients underwent CABG at our institution. Among these, 213 presented with ACS, were enrolled in the study and divided into tertiles of age: First: 40-65 years old (n=73), Second: 66-74 (n=70), Third: 75-89 (n=70). Patients were followed post-operatively for 30 days.

Results No differences between tertiles were found for baseline clinical and angiographic characteristics. Off-pump interventions were 67.6%. Older patients more frequently required an associate intervention to CABG for a mechanical complication of ACS. Overall 30-day all-cause mortality was 4.7% (*n*=10); 0.6% (n=1) in patients undergoing isolated CABG (n=168, 78.9%). The STEMI diagnosis was an independent risk factor for 30-day mortality, and age was not.

Conclusions The 30-day mortality rate of older ACS patients who undergo urgent/emergency CABG is comparable to that of younger ones. Pre-operative risk assessment should rely on evaluation of the clinical complexity of each patient independent of their chronological age, to customise the therapeutic strategy.

Keywords Acute coronary syndrome • Urgent coronary artery bypass grafting • Emergency revascularisation • Age • Prognostic factor • Elderly patient

Introduction

Revascularisation strategies for acute coronary syndromes (ACS) have increased in recent years, leading to a decline in mortality for this condition in North America and Western Europe [1,2]. However, some categories of patients such as women and the elderly are still undertreated. Although optimal treatment for ACS should be based on risk assessment and should be aggressive in patients at higher risk of events, therapeutic decisions are often influenced more by patient age and geographic location than by the patient's individual risk profile [3,4]. Following the implementation of fibrinolysis and percutaneous coronary interventions (PCI), CABG is nowadays a secondary choice for treatment of acute

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coronary syndromes, though it remains crucial in treating patients with severe coronary artery disease, left main involvement, and those with mechanical complications [5].

The surgical approach to ACS has never been tested in randomised trials and there are many open questions, concerning optimal timing, the best surgical techniques, and mechanical and pharmacological perioperative therapies, as well as prognostic variables. The subgroup of patients with ACS requiring urgent or emergency CABG is growing and includes more complex and older subjects. However, surgical revascularisation is frequently not performed in older ACS patients due to a perception of higher risk and limited life expectancy. Nevertheless the frequency of CABG is increasing in the elderly [6,7].

The objective of the present investigation was to evaluate the prognostic role of age in hospital outcome and 30-day all-cause mortality in 213 consecutive patients undergoing urgent/emergency cardiac surgery for ACS in our tertiary centre.

Materials and Methods

Patients and Study Design

From January to December 2013, 452 consecutive patients underwent CABG surgery at our institution, either isolated or combined with other surgical procedures. From these, 213 consecutive patients were selected to constitute our study population. All patients gave their informed consent. The ethical principles outlined in the Declaration of Helsinki have been followed. Patients were included if they met each of the following criteria: presented with ACS (unstable angina, UA, ST-elevation myocardial infarction, STEMI, non ST-elevation myocardial infarction, NSTEMI), and underwent CABG during the index hospitalisation. Exclusion criteria were: concomitant significant aortic valve stenosis, or any concomitant operation in addition to heart surgery.

ACS was defined as follows: STEMI: presence of: 1) new ST elevation at the J point in at least two contiguous leads of $\geq$2 mm in men or $\geq$1.5 mm in women in leads V2–V3 and/or of $\geq$1 mm in other contiguous chest leads or the limb leads, and 2) positive markers for cardiac necrosis (Troponin I, TnI, at least twice the upper limit of normal). NSTEMI: 1) absence of ST-segment elevation as defined previously and 2) positive markers for cardiac necrosis. UA: 1) absence of ST-segment elevation as defined previously, 2) negative markers for cardiac necrosis, and 3) angina pectoris (or an equivalent type of ischaemic discomfort) with any one of the following three features: *a.* angina occurring at rest or for a prolonged period (usually>20 min), *b.* new-onset (< 2 months in duration) angina that is severe (at least class-III severity according the Canadian Cardiovascular Society (CCS) severity scale) or frequent ($\geq$ 3 episodes/day), *c.* recent (within the preceding two months) acceleration of angina: increase in severity of at least one CCS class to at least CCS class III [8–10].

Cardiogenic shock was assumed to be present in cases with a systolic blood pressure of <90 mmHg persisting for > 1 hour despite a fluid challenge and with signs of hypoperfusion (cool extremities or a urine output of <30 ml per hour, and a heart rate of $\geq$60 beats per minute), or a cardiac index of <2.2 L/ (min·m^2), or the need for supportive measures to maintain a systolic blood pressure of > 90 mmHg.

Data Collection

A dedicated database was designed to prospectively collect the data of the 213 consecutive patients who underwent surgical intervention for ACS. This database included preoperative risk factors, demographics, clinical data, laboratory and imaging testing results, angiographic and intraoperative variables, postoperative outcomes and complications. Data were collected prospectively and analysed retrospectively.

End Points/Outcome Measures

All study end points used in this analysis were pre-specified. The primary study end point was 30-day all-cause mortality, which was defined as death within 30 days following heart surgery, taking into consideration which variables were related to it. Moreover we analysed the population characteristics in relation to age. With this purpose our series was divided into age tertiles: the first tertile included patients from 40 - 65 years of age (n=73), the second, ages 66 - 74 (n=70), and the third, ages 75 - 89 (n=70).

Preoperative Management

Patients came from the Emergency Department of our institution or were transferred from other hospitals. Based on their clinical condition, they were either transferred directly to the operating room or admitted to the Critical Care Unit, Step-Down Unit or ward.

All patients underwent coronary angiography, the timing of which was optimised in accordance with their risk stratification. In case of STEMI with indication for surgical revascularisation, the decision to percutaneously treat the occluded culprit vessel was made by the heart team after having evaluated the clinical presentation, angiographic images, and comorbidities. Following diagnosis, patients were managed preoperatively with haemodynamic monitoring and adjunctive pharmacologic therapy, which included beta-blockers, morphine, nitrates, inotropic drugs (where necessary), low-molecular-weight or intravenous heparin, aspirin, and adenosine diphosphate-receptor antagonists.

Preoperative prophylactic use of intra-aortic balloon pump (IABP) was considered in selected cases, namely high risk patients with any or all of: severely impaired left ventricular function; preoperative haemodynamic instability requiring inotropic support; UA despite intravenous nitroglycerin and heparin, severe left main or three-vessel disease. An extra-corporeal membrane oxygenation (ECMO) system was applied for patients who were refractory to inotropic drugs and IABP due to severely impaired myocardial function [11,12].

Surgical Management

In our Center the surgical strategy is customised to the patient [13,14]. The optimal timing for surgery depends on