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Original article

Clinical outcomes of the intra-aortic balloon pump for resuscitated patients with acute myocardial infarction complicated by cardiac arrest

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ABSTRACT

Background: The aim of this study was to investigate the clinical effects of intra-aortic balloon pump (IABP) in patients who received cardiopulmonary resuscitation (CPR) before procedure.
Methods and results: Between November 2005 and April 2014, 49,542 patients were enrolled in a prospective cohort study for acute myocardial infarction (AMI) in Korea (KAMIR). CPR was performed in 1700 patients with cardiac arrest. Patients were excluded from the study if they had not undergone a coronary angiogram, if extracorporeal membrane oxygenation or thrombolysis was performed, and if mechanical complications presented. The primary end point was 1-month all-cause mortality. A total of 883 patients in the IABP group and 476 in the control group were included. During the 1-month follow-up, all-cause death occurred in 749 patients (55.1%). The IABP group was predominantly male and had a higher prevalence of ST-segment elevation MI and a higher risk of coronary lesions including left main disease and three-vessel disease. Glycoprotein IIb/IIIa inhibitor was administered less in the non-IABP group. In the total population, the IABP group had worse outcomes in terms of mortality rates after multivariate analysis [hazard ratio (HR) 1.22, 95% confidence interval (CI) 1.02–1.47, $p = 0.034$] without increasing the incidence of recurrent MI, stroke, and major bleeding. After propensity matching with a

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pair of 452 patients, no significant differences were observed in baseline characteristics or clinical outcomes (HR 1.21, 95% CI 0.93–1.57, $p = 0.158$).
Conclusion: The use of IABP did not show clinical benefits in patients with AMI complicated by severe cardiogenic shock after propensity matching analysis.

Introduction

The adjunctive use of intra-aortic balloon pump (IABP) has little evidence of benefit in cardiogenic shock combined with acute myocardial infarction (AMI). The most convincing evidence against the routine use of IABP for treating cardiogenic shock in patients with AMI is the Intra-aortic Balloon Pump in Cardiogenic Shock (IABP-SHOCK) II randomized trial [1,2]. In this study, the use of an IABP did not reduce either 1-month or 1-year mortality without increasing hemorrhagic complications in patients for whom an early revascularization strategy was planned. In addition, no significant difference was observed in treated patients with regard to length of stay in the intensive care unit, renal function during hospitalization, and general quality of life of survivors during the 1-year follow-up period.

However, a weak point of this study – other than the development of mechanical complications (26 of 30 patients) – was the high rate of crossover from the control group to the IABP group. It is possible that patients with severe shock and an acute deterioration status were not enrolled and if enrolled, crossed over. In the present study, we investigated whether IABP insertion could be beneficial in patients with AMI complicated severe cardiogenic shock and planned early revascularization.

Methods

The Korea Acute Myocardial Infarction Registry (KAMIR), launched in November 2005, is a prospective multi-center data collection registry reflecting real-world treatment practices and outcomes in Asian patients diagnosed with AMI. The registry consists of 50 community and teaching hospitals with facilities for primary percutaneous coronary intervention (PCI) and on-site cardiac surgery. Eligible patients were at least 18 years of age at the time of hospital admission. Patients had a symptomatic history with or without ST-segment elevation above 2 mm in 2 or more precordial leads or above 1 mm in 2 or more limb leads, or new onset of left bundle branch block on the 12-lead electrocardiogram (ECG) with a concomitant rise of at least one cardiac biomarker of necrosis. From November 2005 to April 2014, 49,542 patients were enrolled in the KAMIR. Data were collected by a trained study coordinator using a standardized case report form and protocol. The study protocol was approved by the ethics committee at each participating institution.

Patient characteristics

In the present study, 1700 cardiogenic shock patients underwent cardiopulmonary resuscitation (CPR) as a result of cardiac arrest before procedure. Patients were considered to be in cardiogenic shock if they had a systolic blood pressure of less than 90 mmHg with supportive measures or needed infusion of vasopressors to maintain a systolic pressure above 90 mmHg, and had clinical signs of end-organ hypoperfusion such as cold extremities, oligouria, and mental change. Vasopressors were used in all patients in this study. Mechanical ventilation was applied in about 80% of the patients. Patients were excluded from the study based on the following criteria: if patients did not receive early revascularization strategy by undergoing a coronary angiogram, if alternate mechanical circulatory support such as extracorporeal membrane oxygenation was utilized, if thrombolysis was performed, or if there were mechanical complications such as ventricular septal defect or acute severe mitral regurgitation. A total of 1359 patients comprised the final study population. They were divided into two groups according to the insertion of IABP (IABP group $n = 476$, no IABP group $n = 883$) (Fig. 1). The decision of the IABP insertion was all left to the discretion of the operator. The entire study population completed the 1-month follow-up period with data collection.

Study definitions

The primary end point of this study was 1-month all-cause mortality. Safety end points included recurrent MI, stroke, and major bleeding. Recurrent MI was defined as fulfillment of at least two of the following conditions: recurrent symptoms, new

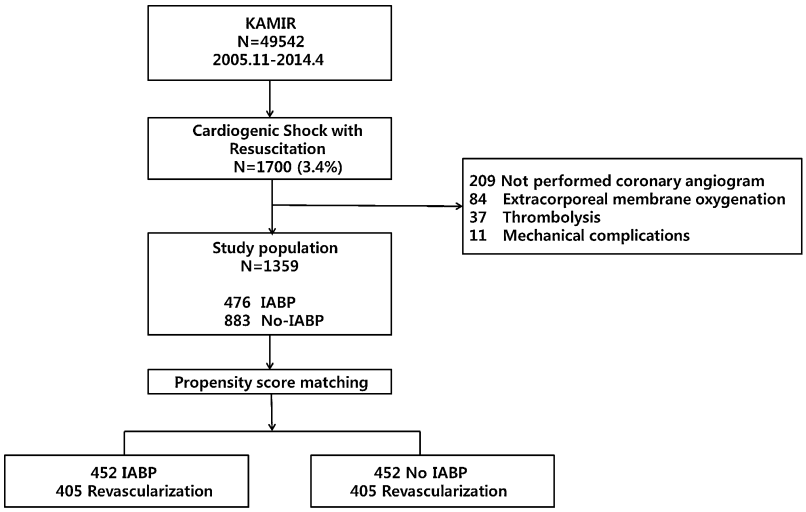

Fig. 1. Study population diagram. KAMIR, Korea Acute Myocardial Infarction Registry; IABP, intra-aortic balloon pump.