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ORIGINAL ARTICLE

Single-Centre Experience with Perioperative Use of Intraaortic Balloon Pump in Cardiac Surgery☆

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Background Intraaortic balloon pump (IABP) is frequently used in cardiac surgery in order to prevent or treat low cardiac output syndrome. Although being widely used and forming the first line therapy in these haemodynamically unstable patients despite maximal medication, optimal timing for IABP insertion is still discussed. This retrospective study evaluates hospital outcomes of patients receiving IABP at preoperative, intraoperative and postoperative periods during cardiac surgery.

Materials and methods Between 2006 and 2012, 2196 patients underwent open cardiac surgery in our centre. IABP was used in 121 (5.4%) patients. Nine patients had preoperative IABP insertion, 76 patients (62.8%) had intraoperative insertion to ease weaning from cardiopulmonary bypass, and 36 patients (29.8%) had postoperative insertion in the intensive care unit mainly due to refractory haemodynamic instability. Hospital outcomes of these 121 patients were analysed retrospectively.

Results The majority of the patients were male (men 89, 73.6% and women 32, 26.4%; mean age was 65.9 ± 11.5 years). Among the cohort 87 (71.9%) underwent isolated coronary artery bypass surgery (CABG) and the rest (34 patients, 28.1%) were operated for valve disease with/without CABG or for CABG with carotid endarterectomy, left ventricular aneurysm repair, post myocardial infarction ventricular septal defect or pathologies involving ascending aorta. The overall hospital mortality of the whole cohort was 27.3%. Mortality rates according to IABP timing were 33.3%, 19.7% and 41.7% for pre, intra and postoperative insertion, respectively. Logistic regression analysis identified female gender, low ejection fraction (<30%), complex surgery and postoperative insertion as risk factors for mortality.

Conclusion IABP insertion timing in cardiac surgery is crucial and many reports advocate early insertion since patient outcomes are poor for late insertions. This single centre study also confirms that the least favourable results are among patients with postoperative IABP insertion.

Keywords Intraaortic balloon pump • Low cardiac output syndrome • Cardiac surgery • Circulatory support • Extrocorporeal balloon counterpulsation

Introduction

Providing assistance for failing heart is one of the most challenging issues in cardiac surgery. Intra-aortic balloon pump was introduced in 1968 by Kantrowitz [1]. Counterpulsation with IABP is an established adjunctive therapy to pharmacological inotropic medication in patients with low cardiac output syndrome during perioperative period for

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cardiac operations. IABP increases myocardial oxygen supply by increasing diastolic coronary blood flow while decreasing afterload and hence work load of left ventricle [2]. Patients having haemodynamic instability due to myocardial ischaemia benefit the most from IABP in critical clinical states [3,4]. However, the overall hospital mortality is high in patients who receive an IABP because of the cardiac problems that led to the need for the device, ranging between 26% and 50% [5]. This high mortality should be judged with the underlying cardiac problems leading to haemodynamic compromise requiring mechanical support. In other words, the need for IABP use, itself, is considered as a poor prognostic factor for cardiac surgery.

Timing of IABP insertion seems to be critical for receiving optimal effect. Preoperative insertion is associated with 18.8–19.6% mortality [6]. Mortalities for intraoperative and postoperative insertions are 27.6–32.3% and 39–40.5%, respectively [6]. Given results led to the suggestion of preoperative prophylactic IABP insertion in high risk patients [7]. However, others find this strategy unnecessary with meticulous myocardial protection and use of inotropes such as epinephrine and milrinone.

We do not use prophylactic IABP strategy in our clinic. Therefore the present study evaluates retrospectively our experience with IABP use during the perioperative period, among cardiac surgical patients, all who needed IABP insertion for their exact clinical situation. Single centre experience reports are useful for determining the benefit of not prophylactic but clinically driven IABP use for patients undergoing cardiac surgery.

Materials and Methods

Between January 2006 and March 2012, 2196 patients underwent open cardiac surgery in our department. Among these patients, 121 (5.5%) required IABP support perioperatively. Data were obtained by reviewing the operative and intensive care unit records retrospectively. The patients included were all who underwent isolated or combined CABG or valve procedures or thoracic aortic or grown-up congenital disease surgery. All on-pump surgical procedures were performed using moderate hypothermia. Myocardial protection was achieved by initial cold crystalloid, followed by cold blood cardioplegia every 20 min along with topical cooling, terminated with final warm blood cardioplegia.

Patients were classified into three groups according to the timing of the IABP insertion as preoperative, intraoperative and postoperative. All patients who received IABP before entering the operating room were classified as preoperative group. The intraoperative group included patients receiving IABP at the operating room during any phase of the operation. Patients requiring IABP in the intensive care unit constituted the postoperative group. All IABP insertions were made percutaneously via the femoral artery. The indications for IABP insertion were cardiogenic shock, acute pulmonary oedema or intractable angina/arrhythmia for the preoperative group. The common indication for intraoperative group was difficulty of weaning from cardiopulmonary bypass (CPB) despite moderate doses (10 µg/kg/min dobutamine and/or 10 µg/kg/min dopamine) of positive inotropic medications. Postoperative IABP use in the intensive care unit was mainly due to haemodynamic instability (along with other signs of low cardiac output syndrome) that is refractory to moderate doses of inotropic agents.

The perioperative clinical variables along with patients' demographical data were then analysed. The operations were classified as isolated CABG; isolated non-CABG (single valve or ascending aorta procedures like supracoronary grafting); combination of two procedures (CABG combined with valve procedures or carotid endarterectomy, double valve surgery, Bentall procedure, CABG with post-MI VSD or left ventricular restoration procedures); and complex surgery combining any kind of three procedures (Bentall with CABG or CABG with double valve surgery or triple valve surgery). Descriptive statistical analysis was made to assess if there were significant differences related to the timing of the IABP. Clinical outcomes were compared between the three groups. The study was approved by our local ethical committee.

Statistical Analysis

Continuous variables were given as median and standard deviation whereas categorical variables were given as number and frequency distribution. *T*-test was used for continuous variables and chi-square test was used for categorical variables. p value less than 0.05 was considered as significant. Stepwise forward logistic regression was used to identify risk factors influencing hospital mortality. The statistical analysis was done with SPSS 17.0 program.

Results

Out of 2196 open cardiac surgery patients analysed, 121 (5.5%) received an IABP perioperatively. The majority were male, 89 men (73.6%) and 32 women (26.4%). Mean age was 65.9 ± 11.5 years (range, 46–88). The ratio of patients with diabetes mellitus, hypertension and chronic obstructive lung disease was high among the cohort, 78.5% (n = 95), 80.2% (n = 97), and 72.7% (n = 88), respectively. Demographic data of these 121 patients are summarised in Table 1. Nine patients (7.4%) received IABP preoperatively, 76 patients (62.8%) intraoperatively and 36 patients (29.8%) postoperatively.

Among 1552 isolated CABG patients, 87 (5.6%) required an IABP which constitutes the majority of 121 IABP requiring patients (71.9%). Of these 87 patients, nine were off-pump CABG cases (7.4%). The other 34 patients (28.1%) were operated for single or multiple valve disease with or without CABG, or for other cardiovascular pathologies. Distributions for the type of surgery of IABP inserted patients are shown in Fig. 1.

The overall hospital mortality for the whole IABP cohort was 27.3% (n: 33 out of 121). Mortality rates according to