Perioperative Predictors and Clinical Outcome in Early and Late ICU Discharge after Off-Pump Coronary Artery Bypass Surgery

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Received: 23 Sep. 2010; Received in revised form: 15 Oct. 2010; Accepted: 23 Oct. 2010

Abstract- The duration of ICU (intensive care unit) stay in cardiac surgery patients has an important role in the rate of complications and costs. The aim of this study was to determine the role of perioperative risk factors in clinical outcome based on the time of ICU discharge. In this descriptive study, 219 patients undergoing off-pump coronary artery bypass (OPCAB) surgery in Afshar Hospital in Yazd, an Iranian city, were divided into early (≤24 hrs) and late (>24 hrs) ICU discharge groups according to the duration of ICU stay. The preoperative, intraoperative and postoperative risk factors, the complications and the outcome were evaluated. Age, sex, hyperlipidemia, diabetes mellitus, previous myocardial infarction, renal failure, cerebrovascular accident, and level of hematocrit and creatinine were not significantly different between the two groups. Patients with hemodynamic instability, respiratory dysfunction, ejection fraction <35%, hypertension, inotrope administration, left main coronary artery involvement, use of intraaortic balloon pump (IABP) and arrhythmia had significantly higher mortality and longer ICU stay (>24 hrs) compared to others (P<0.05). The duration of intubation was significantly lower in the early discharge group (7.8 ± 3.8 hrs compared to 17 ± 9.9 hrs) than in the late discharge group. Time of ICU discharge depends on perioperative risk factors, and risk factor modification may improve clinical outcome.

Acta Medica Iranica 2011; 49(5): 307-309.

Keywords: Coronary artery bypass, off-pump; Intensive care unit

Introduction

Coronary artery bypass graft (CABG) surgery is one of the most expensive and major surgical procedures.

Therefore predictive models of morbidity, mortality and length of ICU (intensive care unit) stay have been developed, which allow patient risk assessment and comparison of outcome between institutions (1-5). The length of ICU stay is one of the most important limiting factors (6). Causes of a prolonged ICU stay are unclear and it has been often-with conflict–related to independent risk factors such as re-exploration, advanced age, low ejection fraction, lung disease, organ failure and the surgeon (7-11).

During the last decade, cardiac surgery has faced growing interest in early discharge from ICU (6). It's important to identify patients that are high risk for or prone to long ICU stays. The aim of this study was to determine preoperative, intraoperative and postoperative factors influencing on early discharge from the ICU. We compared clinical outcomes in patients with early and late ICU discharge and assessed the relation between perioperative factors and complications with prolonged ICU stay after off pump coronary artery bypass (OPCAB) surgery.

Material and Methods

This study was designed as a descriptive, case series research on 219 patients undergoing OPCAB between March 2007 and December 2008. The study was approved by the ethics committee at the Heart Research Center of Yazd University of Medical Sciences, and informed consent was obtained from all patients. Patients' clinical and demographic data including age, sex, body surface area (BSA), history of recent MI (myocardial infarction) within the previous 30 days, diabetes mellitus, hypertension, CVA (cerebrovascular accident), hyperlipidemia, smoking, addiction, renal failure, COPD (chronic obstructive pulmonary disease),

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New York Heart Association (NYHA) class, Left ventricular ejection fraction less than 35%, number of grafts, need for of inotrope during ICU stay (at least 6 hours with maximum doses of adrenaline, dopamine or dobutamine), left main coronary artery involvement, arrhythmia (if treated with drugs or shock), use of intraaortic balloon pump, type of operation (urgent or elective) and the duration of surgery were obtained.

The extubation criteria were: at least an hour from ICU admission, stable hemodynamics, chest tube drainage of less than 100 ml/h, urine output exceeding 0.5 ml/kg/h checked each hour, response to command, $PaCO_2$<50 mm Hg, oxygen saturation>95% (with pulse oxymetry) at a FIO_2 of less than 50%, *p*H>7.3 and normal cardiac rhythm. The criteria for ICU discharge were: no confusion, saturation of oxygen exceeding 90% at a FIO_2 of less than 50%, no uncontrolled arrhythmia, no active chest tube drainage, urine output exceeding 0.5 ml/kg/h and stable hemodynamic without vasopressor administration. After the ICU discharge the respiratory and renal function and the hemodynamic and mental status of the patients were carefully observed and registered.

According to duration of ICU stay patients divided into early (≤24 hrs) and late (>24 hrs) ICU Discharge groups. Two groups compared based on preoperative, intraoperative, and post operative risk factors and clinical outcome. Variables were analyzed by the t-test, Chi square test, and Fischer exact test using SPSS software (version 13). Variables are expressed as mean ± standard deviation or as count and percentage.

Results

One hundred thirty nine patients (63.5%) were discharged early, and 80 patients (36.5%) had a late discharge from the ICU. About 71.2% of the patients were male and 28.8% were female, with an average age of 60.4±10.2 yrs. Three patients (1.4%) had re-do operation. The mean duration of ICU stay was 37.7±33.5 hour.

Preoperative risk factors associated with late discharge were ejection fraction (EF)<35%, hypertension, inotrope administration, left main coronary artery involvement and arrhythmia (P<0.05). Other factors including age, sex, hyperlipidemia, diabetes mellitus, previous MI, renal failure, CVA and the level of hematocrit and creatinine had no significant difference between the two groups (Table 1).

The range of intubation period in early and late ICU discharge groups were 3 to 22 hrs and 3.7 to 72 hrs respectively, with the mean of 7.8 ± 3.8 hrs and 17 ± 9.9 hrs which was significantly lower in the early discharge group. Risk factors of prolonged intubation were significantly higher in the late discharge group. Causes of late extubation were unstable hemodynamics (40%), respiratory dysfunction (35%), neurologic abnormalities (20%), bleeding and cardiac arrhythmia (17%). The rate of reintubation in the early and late ICU discharge groups were 0 and 12.7% respectively, which displayed significant difference (P<0.05).

Intraoperative risk factors of prolonged ICU stay (>24 hrs) according to the ICU discharge criteria were hemodynamic instability (55%), cardiac arrhythmia (27%), neurologic dysfunction (24%), excessive bleeding (20%), respiratory dysfunction (41%) and renal dysfunction (17%). The rate of reexploration (P=0.048), need for intraoperative balloon pump (P=0.017), high serum creatinine (P=0.025), and mortality (P=0.001) were significantly higher in the late ICU discharge group.

In this study we defined post operation mortality as death within 30 days following the OPCAB surgery. We had 7 deaths (8.8%) in the late discharge group compared to no deaths in the early ICU discharge group, that was statistically significant (P = 0.001). Risk factors for mortality were female gender (71.4%), recurrent surgery, reintubation, inotrope administration (100%), prolonged ICU stay, the use of intra-aortic balloon pump (IABP) (42.9%), hemodynamic instability (100% of cases), cardiac arrhythmia (71%), neurologic dysfunction (43%) and renal failure (43%). In most cases the cause of death was multi-organ failure.

The mean duration of hospital stay in the early and late ICU discharge group were 6 and 7.7 days respectively. The factors resulting in prolonged hospital stay were hemodynamic instability, renal, cardiac, respiratory and neurologic dysfunction. For all complications were significantly higher in the late ICU discharge group except respiratory dysfunction.

Discussion

Patients with EF<35%, hypertension, inotrope administration, left main coronary artery involvement, respiratory dysfunction use of IABP and arrhythmia had significantly higher mortality and longer ICU stay (>24 hrs).

Wang *et al*. showed risk factor for prolonged ICU stay were mentioned as age, female gender, MI, use of IABP, inotrope administration, excessive bleeding, renal failure and atrial arrhythmia. In that study risk factors of morbidity included age, female gender, emergent surgery and low ejection fraction. Mortality risk factors

were female gender, recurrent surgery, reintubation, inotrope administration, long ICU stay and use of IABP (1). Bucerius *et al.* showed late ICU discharge (>3 days) was related to perioperative risk factors such as age, IABP, catecholamine administration, acute renal failure, respiratory failure and re-exploration (12). Rayan *et al.* mentioned acute renal failure as a risk factor for prolonged ICU stay (>4 days). In that study respiratory failure (44%) and acute renal failure (32%) were significantly higher in patients with late ICU discharge, and pneumonia was the main cause of respiratory failure. Re-exploration, use of IABP, heart failure, inotrope administration and age were other risk factors for prolonged ICU stay. Re-exploration, age and ventilation were related to high mortality (13). In another study in 2007 by Ranucci *et al*. risk factors associated with late ICU discharge were mentioned as unstable angina, preoperative high serum creatinine, congestive heart failure (CHF), age, combined operation, recurrent surgery and the duration of cardiopulmonary bypass. In that study there was a peak of early discharge in patients with extubation time of 4 hrs from the ICU admission, but an early discharge from ICU did not associate with very early extubation (6). In a study in USA in 1995 by Tu *et al*. the risk factors of prolonged ICU stay (>7 days) were determined. The preoperative risk factors were CHF, renal failure, recurrent CABG, preoperative CCU (coronary care unit) stay, combination of CABG with valve surgery and insulin- dependent diabetes. Post operative factors were arrhythmia, pneumonia, wound infection and respiratory insufficiency (14).

In our study patients with prolonged ICU stay had a longer period of intubation. The mortality rate was 3.2% (7 patients), all of which were from the late ICU discharge group (8.8%). Risk factors for mortality were female gender, recurrent surgery, reintubation, inotrope administration, prolonged ICU stay and application of IABP. We found that early discharge from ICU depends on pre- and intraoperative factors. Hemodynamic instability and respiratory, cardiac, renal and neurologic dysfunction were higher in the late ICU discharge group (>24 hrs).

In conclusion time of ICU discharged and clinical outcome depends on perioperative risk factors, and risk factors modification and management may decrease ICU and hospital stay and improve clinical outcome.

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