Original Article

A comparative study of immediate and late extubation after open heart surgery

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Background: Cardiovascular surgery provides especial challenges, and specific conditions, for optimizing the weaning process. Earlier extubation after heart operations was shown to be both safe and cost-effective. Early extubation is performed 1 and 6 hours after arrival in the Intensive Care Unit (ICU) and associated with shorter ICU stays, and accordingly lower costs. The present retrospective study was conducted to assess immediate and early extubations in regard to postoperative complications, and cost-effectiveness in patients undergoing open cardiac surgeries.

Patients and Methods: The medical records of 2126 patients who had undergone cardiac operation between March 2003 and February 2005 were reviewed in relation to two distinctive extubation protocols. Group A consisted of 1833 patients undergoing either immediate or early extubation. Group B comprised 293 patients who underwent late extubation. Four major types of surgeries were performed in patients.

Results: Among 2126 patients, 71.8% were male and 28.2% were female. There were no significant differences in risk factors between the two groups. The mean age of patients in group A was 56±13, and in group B 50±17 years. Extubation time in group A was 2.06 hours compared with 13.22 hours in group B ($P<0.05$). The mean of post-op bleeding in the first 12 hours between the two groups did not differ significantly, and were 482.4 and 426.4 ml respectively ($P>0.05$). Reintubation had been performed in 2.6% of group A and 1.6% of group B, a difference that was not significant ($P>0.0$ 5). The mean ICU stay in group A and B were 2.79 and 3.42 days, respectively ($P<0.05$). The respective mortality in groups A and B were 2 % and 4.7% ($P<0.05$).

Conclusion: Immediate extubation after open heart surgery can be performed safely for most of the patients. This would probably lead to a decrease in costs and prevent artificial ventilation problems without increasing post-op complications. It also reduces the duration of ICU and Hospital stay. We therefore recommend that early and immediate extubation be used more frequently in cardiac surgeries.

Keywords: Immediate extubation; Cardiac surgeries; Reintubation; CABG; Weaning

Introduction

Cardiovascular surgery poses especial challenges, and create specific conditions for optimizing the weaning process. Much of cardiovascular surgery in each hospital is elective, with a relatively small team of participants including surgeons, anesthesiologists, and intensivists, which standardize a number of aspects of care[1]. Furthermore, strategies for minimizing the duration of intubation can include anesthetic and sedation regimens.[1] Investigators have taken advantage of these unique features to test a number of interventions designed to facilitate the early extubation of patients after cardiovascular surgery[1]. As in all situations in which clinicians try to hasten weaning,

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the risk is that they will precipitate complications resulting from the premature termination of mechanical ventilation. The concern is greater in patients who have just undergone cardiac surgery, in which physiologic stress may induce cardiac ischemia and heart failure.[1] were collected and stored at -20°C until used.

In cardiac surgery, prolonged controlled ventilation has been a standard practice, mainly because of high-dose narcotic anesthesia and fear of myocardial ischemia in the early postoperative period. However, fast track extubation (FTE) protocols are becoming increasingly popular mainly due to a greater rationalization of resource utilization. Lower costs in the postoperative period, mainly due to a reduction in intensive care (ICU) and the length of hospital stay, are other achievable targets.[2]

Cost containment and the use of efficient resource have forced anesthesiologists to rethink their management strategies for cardiac surgery. In the late 1970s, when anesthetic practice predominantly involved inhalational anesthesia, it was possible to extubate cardiac surgical patients within a few hours after surgery. However, there was no economic pressure or incentive to practice cost-effective medicine at the time.[3]

Length of stay in the ICU following coronary artery bypass graft (CABG) surgery has been substantially shortened during the past decade, thus reflecting the current trend for what is called fast-track cardiac anesthesia (FTCA). The efforts of physicians to ensure early extubation of patients are supporting this policy in most ICUs, and a vast majority of patients are successfully extubated within 6 to 8 hours after their surgery. However, in spite of this, a large number of patients requiring mechanical ventilation still remain in the ICU for > 24 or 48 h. The appropriate identification of these patients could be of interest for planning ICU resources when the patient enters the unit.[4]

Newer guidelines for myocardial revascularization have generated greater demand for scarce resources. This is combined with higher risk patients presenting for cardiac surgery, demanding a closer evaluation of bed use in cardiac intensive care unit [CICU]. Current CICU practice is under challenge. In many adult cardiac centers in the UK, high-risk procedures in sicker patients reduce resource availability for routine coronary artery bypass graft (CABG) and valve replacement patients.[5]

In this study, we tried to show that immediate and early extubation did not increase postoperative complications and could be used safely and cost-effectively in patients undergoing open cardiac surgeries.

Patients and Methods

Retrospectively, we reviewed complete charts of 2126 patients operated between March 2003 and February 2005 by a single surgeon with two distinctive extubation protocols. Patients were divided into two groups. Group A consisted of 1833 patients who underwent either immediate (within the first hour of arrival in ICU) or early extubation (within less than 6 hours). Group B which was considered as control consisted of 293 patients who underwent late extubation (more than 6 hours). In all instances, the data corresponding to group A (study group) are followed by those of group B (control group), for the sake of brevity and to avoid redundancy. The mean age of adults in group A was 56 years and in group B 50 years.

Table 1: Demographic data

Parameters	Group A (Case)	Group B(Control)	P-Values
Population	1833	293	.00
Male	71.8%	62%	.08
Female	28.2%	38%	.06
Mean age	51 y/o	44 y/o	.055
Mean age for adults	56 y/o	50 y/o	.06

Males were predominant in both groups (73 vs 62%). In pediatrics the mean age of males was 9.6 and of females 9.4 years (Table 1). Four major types of surgeries were performed in groups A and B including coronary artery bypass grafting (CABG), valvular, congenital, and aneurysmal. The significant differences found between the four different types of operations considered in this study limited our comparison, which was inevitable due to significant diversities between these types of surgeries in our region. Data extracted from charts mainly included preoperative, intraoperative, and postoperative parameters. The aspects reviewed comprised demographic data, risk factors, total pump and aortic cross-clamp time, duration of intubation, reintubation, if applied, post-op bleeding, inotrope and analgesic use in ICU, length of ICU stay, and mortality. Data analysis was performed by SPSS version 11 and independent student's t-test and Pearson chi-square were used to compare the results of the data between groups A and B. P values less than 0.05 were considered significant.

Exclusion criteria for early and immediate extubation in our study included complex congenital heart disease, cardiogenic shock, heart failure, emergent operations, recent myocardial infarction (<7days), and pulmonary edema.

Results

The incidence of diabetes in groups A and B were 26% and 25%. Hypertension was detected in 35%(group A) and 41% (group B). Smoking rates in groups A and B were 22% and 12%. There was no significant difference in urgent operations between the two groups (Table 2).

Coronary artery bypass grafting (CABG) accounted for 83.3% and 64.3% of groups A and B. The average number of grafts in each CABG was 2.81 grafts. (CLARIFY IF THIS IS PERCENT OR NOT!). Valvular, aneurysmal, and congenital surgeries accounted for 4.4 % vs 20%, 1.5% vs 0%, and 10.3% vs 15.7% (Table 3). The total pump time in groups A and B were 58.4 and 67.9 minutes (P<0.05).
The aortic cross-clamp time for groups A and B were 38.3 and 44.5 minutes (P<0.05).

Table 2: Risk factors in cardiovascular surgery

Risk factor	Group A	Group B	P-Values
Diabetes	26%	25%	.78
Hypertension	35%	41%	.26
Smoking	22%	12%	.07
Urgent operations	8.3%	7.1%	.69

Table 3: Types of cardiovascular surgeries

Type	Group A	Group B	P-Values
CABG	83.3%	64.3%	.00
Valvular	4.4%	20%	.00
Congenital	10.3%	15.7%	.00
Aneurysmal	1.5%	0%	.00

Extubation time in groups A and B were 2.06 and 13.22 hours (P<0.05). Mean post-op bleeding in the first 12 hours were 482.4 and 426.4 cc in groups A and B (P>0.05). Reintubation corresponding to groups A and B were 2.6% and 1.6% (P>0.05). Analgesics administered after surgery were 55.1% and 82.8% in groups A and B (P<0.05). In order to control bleeding, 0.7% and 2.1% were referred to the operating room (P>0.05). Inotropic dopamine and epinephrine were used for 15.1 vs 9.7 and 8.5 vs 3.3 hours (P<0.05). The mean ICU stay was 2.79 and 3.42 days (P=0.006). Mortality rates were 2 % and4.7% in groups A and B (P<0.05) (Table 4).

Discussion

While many have proposed the use of early extubation to reduce costs of cardiosurgeries, some have worried about its safety, particularly among high risk populations[5]. In this study, we found that early extubation was associated with significantly shorter post operative ICU stay and that it can be performed safely, without increasing the mortality or reintubation rates.

The question whether early extubation leads to shorter post operative length of ICU stay has rapidly gained importance over the past decade, considering the correlation between length of hospital stay and costs[6,7]. Although some investigations did not find a difference between in post operative length of stay in early and late extubated patients[8,9]. Most observational studies and small randomized clinical trials showed significant benefits for early extubation[6,7,10-15].

A recent meta-analysis combining the results of 10 randomized controlled trials provided evidence that post operative length of stay is shorter in cardiac surgery patients who underwent early extubation[16]. Previous studies have shown that prolonged intubation after bypass is associated with increased mortality,

Table 4: Comparison of groups A and B by different variables

Variable	Group A	Group B	P-Values
Extubation time	2.06 hrs	13.22 hrs	.000
Total pump time	58.4 min	67.9 min	.002
Aortic cross-clamp time	38.3 min	44.5 min	.005
Mean post-op bleeding in 1st 12 hrs	482.4 cc	426.4 cc	.26
Analgesic use	55.1%	82.8%	.000
Inotropic dopamine use	15.1 hrs	9.7 hrs	.016
Inotropic epinephrine use	8.5 hrs	3.3 hrs	.001

the development of multi organ failure, and sepsis[17]. Another study showed that reintubation is a predictor of midterm mortality[18].

The authors of the meta-analysis stated cautiously that no definitive conclusion could be drawn regarding the potential benefit or harm of early extubation. Moreover, many previous studies included a selection of younger low risk patients and were performed at highly specialized university centers, clearly limiting the generalization of their findings[16].

Multiple factors can influence post-operative intubation time. In a study conducted in Portugal, patients were extubated immediately after resumption of conscious, normothermic, non-bleeding, hemodynamic stable, and with acceptable respiratory function. Post-operative monitoring, control of weaning from mechanical ventilation, and critical extubation were also crucial for fast-track success[19].

In our study, risk factors such as diabetes, hypertension, smoking, and urgent operations were not significantly different between groups A and B. CABG was the most frequent operation conducted in both groups. Administration of analgesics in regard to the length of ICU stay was significant which was much higher in group B. This showed that immediate extubation lessens the need for analgesia. The use of inotropic dopamine and epinephrine during ICU stay were higher in group A. This could be due to inaccurate completion of charts in ICU. Reintubation was not critical which showed that immediate extubation was safe and did not increase the risk of reintubation. In conclusion, the early and immediate extubation protocol could be both effective and safe as it reduced intubation and ventilation times without increasing postoperative complications. Therefore, we recommend that early and immediate extubation be used more frequently in cardiac surgeries.

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