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CABG-Procedures in Patients with Advanced Age: Early Extubation and Fast Track Management as an Option?

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Abstract: In cardiac surgery shorter hospital stays and decreased costs can be reached by early extubation and fast-track management protocols. The feasibility of such protocols in elderly patients is still discussed controversially. We analyzed 800 consecutive patients undergoing CABG. Total 496 patients (62 %) underwent early extubation, defined as extubation within 6 h postoperatively (group I). In the early extubated group elderly patients of at least 70 years (n = 210, mean age 78.1 years) were compared with younger patients (n = 286, 61.2 years). The mean length of stay (LOS) in hospital for all patients extubated within 6 h was 9.1 days vs. 13.3 days for patients who underwent later extubation. The hospital mortality rate was comparable between the older and the younger group of patients (2.6 vs. 2.3%). We found a shorter LOS in hospital among the younger patients (8.5±1.3 vs. 10.2±1.3 days), although the LOS on ICU was similar (old: 31±5 vs. 26±4 h). The immediate extubation (before ICU) could be correlated to the most uncomplicated postoperative courses among all early extubated patients.

Key words: CABG-procedures, advanced age, early extubation, fast track managment

INTRODUCTION

Cardiac surgical intervention has become a common method of treating advanced coronary artery disease. The increased demand for cardiac surgical procedures coincides with the growing elderly population (Ivanov *et al*., 1998). Coronary revascularization surgery is increasingly performed on patients aged 65 years and older, with extensive coronary artery pathology, impaired left ventricular function, decreased physiologic reserve and multiple comorbid conditions (Christakis *et al*., 1990; Mangano, 1990; Jones *et al*., 1991; Fuchs, 1990). More than 1,300 adult cardiac surgical procedures are performed annually at our institution. To contain these increasing costs, there has been widespread acception of Fast-Track Cardiac Surgery (FTCA) pathways (Cheng *et al*., 2003; Lee *et al*., 1996). Weaning from mechanical ventilation and extubation is usually proceeded straightforwardly. In cardiac surgery shorter hospital stays and decreasing costs can be reached by early extubation and fast-track management protocols. The feasibility of such protocols in elderly patients is still discussed controversially. Thus it was the main focus of this study to compare the outcomes of elderly patients with younger ones undergoing the same protocol of fast track extubation.

PATIENTS AND METHODS

All records of patients undergoing isolated Coronary Artery Bypass Grafting (CABG) at the Heinrich-Heine-University-Hospital Duesseldorf between 2004 and 2005 were analyzed and a retrospective study was performed. Exclusion criterium was additional surgery, such as vlave replacement or aortic reconstruction. The entire cohort consisted of 800 patients and was defined regarding to the postoperative extubation management after CABG. We divided the cohort into four study groups: Group I: early extubation (<6 h) 496 patients, group II: late extubation (> 6 h) 304 patients, group: III: early extubation (>70 years) 210 patients, group IV: early extubation (<70 years) 286 patients (Fig. 1). We defined as early extubation within 6 h postoperatively (group I, III and IV). Including such definition we could differ the patients in group I, in the early extubated group III consisting of elderly patients of at least 70 years (n = 210, mean age 78.1 years) and compared them with younger patients, adressed in group IV (n = 286, 61.2 years).

The postoperative items of these patients were listed and compared between group I and II, as well as between group III and IV. We compared the entire duration of the operation, stay at ICU, blood loss, substitution of colloids

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(RCC and FFP) intraoperatively, need of re-exploration due to bleeding, postoperative neurological complications, myocardial ischemia, atrial fibrillation and sternal wound complications and made a coherence between age, risk assessment and the feasibility of fast track extubation.

Statistical methods: Descriptive measures are given as mean values with the Standard Error of the Mean (SEM). Comparisons between groups were performed with χ^2-tests or with Student's t-test as appropriate. A $p<0.05$ was considered to be statistically significant.

Anesthesia/operative details: Anesthesia was started with 1 mg flunitrazepam and 200 mg phenobarbital in the evening prior to the day of surgery. During induction it was maintained using 100-300 mg thiopental, 0.1-0.3 mg fentanyl and 4-8 mg pancuronium. Sevoflurane was applied as volatile anesthetics, furthermore repetitive doses of fentanyl were given.

All operations were performed using a median sternotomy, with the help of Cardiopulmonary Bypass (CPB) in moderate hypothermia and cardioplegic arrest using Bretschneider's solution or with warm blood cardioplegia (Calafiore). After transfer to the Intensive Unit Care (ICU), patients were weaned from the respirator using a standard regime; when patients were satisfactory vigilant and hemodynamically stable, they were considered for extubation. They underwent extubation if they met the following standard criteria: respiratory rate of 10-28 breaths min^{-1}, tidal volume greater than 5 mL kg^{-1}, vital capacity greater than 10 mL kg^{-1}, negative inspiratory force bigger than -25 cm H_2O and the aibility to maintain adequate oxygenation with supplemental oxygen of below 35% FIO_2.

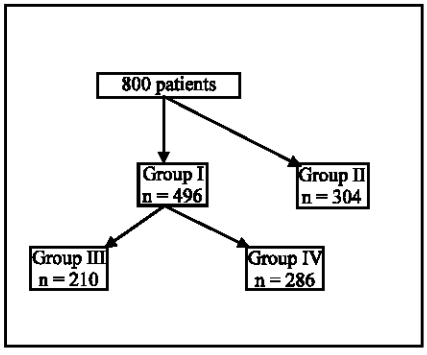

Fig. 1: Eight hundred consecutive patients undergoing CABG, Group I: Early extubation (<6 h), Group II: Late extubation (>6 h), Group III: Early extubation (>70 years), Group IV: Early extubation (<70 years)

RESULTS

The groups did not differ significantly concerning their preoperative data, such as body-mass-index, left ventricular function or comorbidity, such as chronic pulmonary disease or renal insufficiency.

The intraoperative data did either not differ significantly throughout all four groups (time of the entire operation: 224±33 min in group I vs. 210±40 min in group II and 217±23 min in group IV vs. 228±31 min in group IV; ECC-time: 92±23 min in group I vs. 87±31 min in group II and 88±19 min in group III vs. 94±25 min in group IV; cross-clamp-time: 60+8 min in group I vs. 62±14 min in group II and 57±7 min in group III vs. 62+9 min in group IV).

The duration of ITN was significantly longer in group II compared with group I. Another significant difference regarding the duration of ITN can be seen between group III to group IV what is however, not at pronounced as the difference between group I and III (Fig. 2).

The mean length of stay (LOS) in hospital for all patients extubated within 6 h was 9.1 days vs. 13.3 days for patients who underwent later extubation. The hospital mortality rate was comparable between the older and the younger group of patients (2.6 vs. 2.3%). In cases of LOS on ICU between group I to group II and group III to group IV could be found no significant differences. We found a shorter LOS in hospital among the younger patients (8.5±1.3 vs. 10.2±1.3 days), although the stay at ICU was similar (31±5 vs. 26±4 h). The immediate extubation (before ICU) could be correlated to the most uncomplicated postoperative courses among all early extubated patients (Fig. 3-5).

No significant differences could be found concerning the re- intubation, neurological complication, blood loss with substitution of colloids (RCC and FFP) intraoperatively, myocardial ischemia, sternal wound complications and rhythm disturblances, such as group I and group II (Table 1).

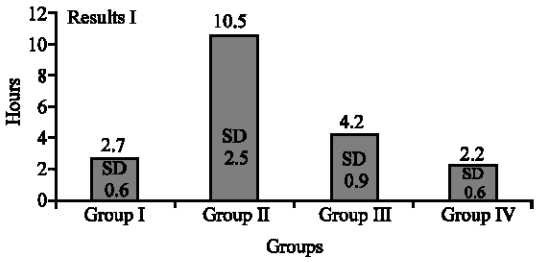

Fig. 2: Duration of ITN; (group I vs. group II, $p<0.05$; group III vs. group IV, $p<0.05$)

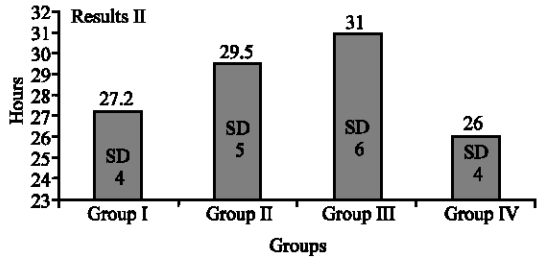

Fig. 3: Stay on ICU (no significance between the groups)

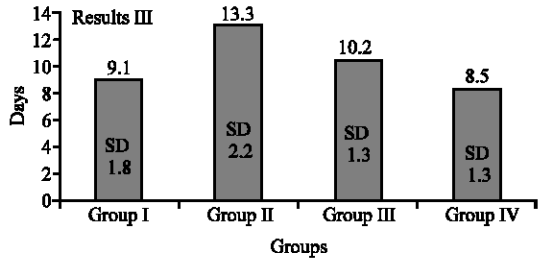

Fig. 4: Stay in hospital; (group I vs. group II, p<0.01; group III vs. group IV, p<0.05)

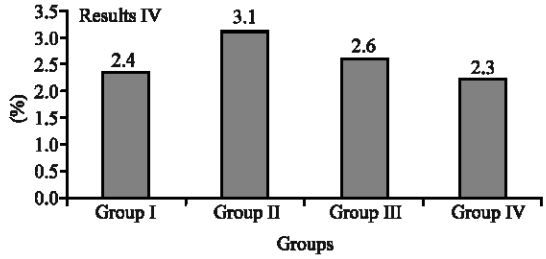

Fig. 5: Mortality; (group I vs. group II, p<0.05; group III vs. group IV, ns)

Table 1: Preoperative data in groups I-IV

Item	Group I	Group II	p-value
Age	66.9±12.4	67.2±12.2	ns
BMI	25.8±3.6	25.3±3.1	ns
EF (%)	63.0±9.1	63.0±8.6	ns
COPD (%)	29.0	27.0	ns
Diabetes (%)	29.0	31.0	ns
Renal insufficiency (%)	14.0	13.0	ns
Emergency (%)	6.0	5.0	ns
Gender male (%)	73.1	70.1	ns
Item	**Group III**	**Group IV**	**p-value**
Age	75.1±14.8	61.4±11.1	<0.05
BMI	25.0±3.8	26.4±4	ns
EF (%)	62.0±8.8	64.0±6.1	ns
COPD (%)	27.0	30.0	ns
Diabetes (%)	29.0	32.0	ns
Renal insufficiency (%)	12.0	15.0	ns
Emergency (%)	4.0	7.0	ns
Gender male (%)	76.0	71.2	ns

Table 2: Perioperative results in groups I-IV

Item	Group I	Group II	p-vaue
Re-ITN (%)	9	8	ns
Re Op (bleeding) (%)	3.4	4	ns
RCC peri Op (mL)	340.0±105.2	365.0±98.7	ns
FFP peri Op (mL)	200.0±99.5	200.0±56.4	ns
Neurol. compl. (%)	3.5	3.7	ns
Myocardial. Isch. (%)	4.0	4.2	ns
Blood loss (mL)	450.0	400.0	ns
Stern. compl. (%)	4.2	3.7	ns
Atr. fibril (%)	24.2	27.0	ns
Item	**Group III**	**Group IV**	**p-value**
Re-ITN (%)	9.4	8.7	ns
Re Op (bleeding) (%)	4.8	2.3	<0.05
RCC peri Op (mL)	360.0±77.9	330.0±71.6	ns
FFP peri Op (mL)	240.0±44.3	170.0±49.6	<0.05
Neurol. compl. (%)	4.0	3.2	ns
Myocardial. Isch. (%)	5.2	3.0	<0.05
Blood loss (mL)	480.0	430.0	ns
Stern. compl. (%)	4.2	3.9	ns
Atr. fibril. (%)	28.0	21.5	<0.05

A further significant difference could be seen in the group with advanced age (group III) versus the younger patients (group IV) regarding the need of re-exploration (4.8 vs. 2.3, p<0.05) due to bleeding and the substitution of colloids (significant more FFP (240 vs. 170 mL, p<0.05) without RCC) intraoperatively.

Significant differences could be found concerning the perioperative maximum of CK: Including ECG-criteria the portion of myocardial infarction was significantly higher comparing group III and IV (5.2 vs. 3.0%, p<0.05). Besides that, the incidence of atrial fibrillation was more pronounced in group III in comparison to group IV (28 vs. 21.5%, p<0.05) (Table 2).

DISCUSSION

The patient population in cardiac surgery has significantly changed during the last two decades: Since interventional cardiology especially in coronary artery disease has tremendously improved, both cardiac pathology and concomitant clinical status of patients which are scheduled for CABG have impressively impaired. Too long mechanical ventilation after routine CABG is a persistent problem in cardiac surgery, especially in the background to the rising age and co-morbidity in the average patient population. Thus, the individual concept for each patient has the main goal to avoid adverse events in order to optimize the immediate postoperative outcome. Early extubation is a tool that enables to shorten stays at ICU with all corresponding economic advantages and may prevent from pneumonia, however, should not be burdened with a higher rate of respiratory failure afterwards.

In former times prolonged controlled ventilation has been a standard concept, mainly because of high-dose narcotic anesthesia and fear of myocardial ischemia (Cheng *et al*., 1996) in the early postoperative period. The incidence of myocardial ischemia in the present

population was just slightly pronounced in the early extubation group. However, in agreement with other authors fast track protocols are increasingly popular (Reis *et al*., 2002; Kurki and Kataja, 1996; Wong *et al*., 1999; Tuman and McCarthy, 1992) mainly due to a greater rationalization of utilization of resources (Tu *et al*., 1995; Westably *et al*., 1993).

Recently published data show that extubation within eight h is well documented in cardiac surgery and besides may be cost effective (Cheng, 1998). Congruent to the findings of the current investigation shorter stays on ICU respectively in hospital could be observed (Higgins *et al*., 1992).

Controverse debate, however, is matter of subject concerning the underlying protocol and the chance on immediate extubation on the desk. One more aspect can be seen in the risk factor obesity with an increased incidence of sternal wound complications what certainly did not play a role in our study.

Additionally, the aim of the current study was to compare early vs. late extubation in different age of patients population (>70 years in group III vs. <70 years in group IV following coronary surgery):

Our analysis shows that early extubation is safe with regard to patients' outcome; this means the immediate extubation could be correlated to the most uncomplicated courses among all early extubated patients. Although elderly patients may have more comorbid conditions, an early extubation results in a shortened LOS in hospital. The re-intubation rate among the elderly patients is not increased with regard to the other groups. Comparable results have already been found by the group around Dowd (2000), who investigated 83 patients undergoing elective cardiac surgery.

In order to sum up all our findings we can state that early extubation even in elderly patients is a safe protocol and thus a feasible concept in every-day coronary surgery.

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