

Research Article

The Impact of the Postoperative Fast-Track Protocol on Cardiac Patients' Management and Outcome

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Abstract

Objectives: We aim to determine whether nurse-led fast track protocol in low-risk cardiac patients is safe and effective in improving extubating time, length of hospital stay, mortality and morbidity.

Method: A retrospective study on low risk and isolated AVR and CABG patients between 2018 and 2019 in South Yorkshire Cardiothoracic centre. Ethical approval was obtained from the local regulation team. The study compares the outcome of nurse-led fast track protocol in a Progressive Care Unit (PCU) with standard care in a Cardiac Intensive Care Unit (CICU) in extubating time, length of hospital stay, mortality and complications.

The study's inclusive criteria included: Patients aged 75 years or less, moderate to good LV function (ejection fraction >35%), creatinine <125 µmol/L, well-controlled diabetes, uneventful operation, and adequate haemostasis intraoperatively.

Postoperatively the low-risk patients either went to PCU and followed a nurse-led fast track protocol or admitted to CICU where standard protocol followed in a random selection process based on bed and staff availability in PCU and CICU.

Data were analyzed using SPSS software version 26, where independent t-test was performed in data analysis.

Results: 162 patients (37 female and 125 males) were analyzed. 87 patients went to CICU and followed a standard care, and 75 patients went to PCU and followed fast track protocol.

The average age of PCU patients was 64.5 years (Standard Deviation (SD) ± 8.3 years), while those went to CICU 63.7 years (SD ± 9.9). Both PCU and CICU patients had no statistical difference in their Logistic Euro score with mean 3.14 and 4.08, respectively.

PCU patients extubated faster than CICU patients with an average time of 2.3 hours for PCU patients and 5.03 hours for CICU patients. Length of hospital stay was less in fast-track PCU patients, and they had fewer complications and no mortality although that was statistically insignificant.

Conclusion: From our experience, we can conclude that low-risk cardiac patients can be managed safely in progressive care units with nurse-led fast track protocol when carefully selected. That can in turn free more cardiac ITU beds for complex cases.

Keywords: Cardiac fast track; Cardiac ERAS; Early extubation; Cardiac surgery

Introduction

Cardiac surgeries are invasive and complex procedures which require postoperative critical care to the patients. Mechanical ventilation and extubating of patients vary according to the surgery's complexity, and protocols followed in units. The cost of cardiac surgery postoperative care is more expensive than other specialties. Many studies were conducted to assess the possibility of reducing cardiac surgery cost by maintaining good patients' standard of care. Early extubating of cardiac patients and early mobilization are proven effective strategies to reduce cost [1,2].

Citation: Sherif MA, EL-Gheryani M, Guha S, Haqzad Y, Chetty G. The Impact of the Postoperative Fast-Track Protocol on Cardiac Patients' Management and Outcome. *Cardiovasc Surg Int.* 2021;2(1):1012.

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Publisher Name: Medtext Publications LLC

Manuscript compiled: Apr 28th, 2021

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Enhanced Recovery after Surgery (ERAS) is a well-established surgical care protocol and well documented. The effect of ERAS in cardiothoracic surgery has been studied with many protocols followed by units [3,4]. Overall, there is a move towards 'fast-tracking' patients to facilitate earlier extubating, patient mobility and early discharge. Studies have shown that fast-tracking cardiac surgery patients improve recovery, shorten the length of stays in hospital and safer in terms of mortality and morbidity. That, in turn, would reflect on improving cost of cardiac surgery [5,6].

There are many protocols for fast-track cardiac patients based on patients' earlier extubating postoperatively [7]. Our study's objective is to evaluate the efficiency and safety of our nurse-led fast track protocol on low-risk cardiac patients. We compared those patients to low-risk cardiac patients who follow a standard care.

Our study's primary endpoint was to determine any survival disadvantage of our nurse-led fast track protocol in PCU compared with standard treatment in CICU. The secondary endpoints were to determine any advantaged of our fast track protocol in terms of early extubating, length of hospital stay, drain and lines removal and complications.

Our Nurse-led fast track protocol

The inclusion criteria for patients to be fast-tracked by nurses in PCU are as following:

The patient either had isolated CABG or isolated AVR. Patient aged 75 years or less. Their echo shows moderate to good LV function (Ejection fraction >35), their creatinine <125 µmol/L. Patients either non-diabetics or have well-controlled diabetes. No pre-operative history of CVA and Uneventful operation with adequate haemostasis intraoperatively.

Nurses follow the following criteria to extubated patients independently. Patients mandatory ventilation mode have to be SIMV (PRVC)+PS. A patient has to be stable from the anaesthetic and cardiovascular point of view. A chest drain is less than 100 mls per hour. The patient is warm and well perfused. Pupils equal and reactive. Ventilator setting is on FiO₂ ≤ 0.6, PEEP ≤ 7. Patient parameters are stable with ABG of PH ≥ 7.3, PaO₂ ≥ 11 KPa, PaCO₂ ≤ 7. Once patients reach these criteria, our well-trained nurses will stop sedation and start the extubating process without waiting doctors' input. Nurses then will start early physiotherapy and mobilization as a core of our nurse-led fast track protocol. Drains and lines are removed early once patient meet criteria. In cases of failed extubation, anaesthetic senior doctor will be contacted for re-intubation and patient will be excluded from the fast track protocol.

A standard care in CICU

Patients who are fit to the fast-track criteria, but randomly selected to CICU will follow a standard care. Reasons for selecting those patients to CICU are a lack of bed or staff in PCU. In CICU, patient's extubation is led by anaesthetics team review in postoperative ward rounds and not led by nurses. The decision of extubating is led by the anaesthetic consultant on call that reviews CICU patients and decide the extubating process. Standard care in CICU dose not involves early mobilization and physiotherapy and there is no emphasis on early extubating.

Methods

A retrospective study on isolated, low-risk AVR and CABG patients who had surgery in South Yorkshire Cardiothoracic Centre, UK, between 2018 and 2019. These patients either went to PCU and followed fast track protocol or were admitted to CICU where the fast-track protocol was not followed, and they received a standard CICU care.

In our study the outcome measures included peri-operative and post-operative outcomes. These data include demographics, Euroscore, cross-clamp time, cardiopulmonary bypass time, blood transfusion, time to extubation, PCU length of stay, CICU length of stay, drain removal time, lines removal time, post-operative complications and in hospital mortality.

The statistical analysis was done using the SPSS version 26 software where an independent t-test analysis, univariant analysis preformed. A probability of P <0.05 was considered as statistically significant.

Results

Our study included 162 patients who were low risk cases that had isolated CABG or AVR and met the inclusion criteria. 75 (46%) patients went to PCU and followed a nurse-led fast track protocol, and 87 (54%) patients went to CICU and followed a standard care in a random selection process based on staff and bed availability. There

were 126 (78%) male patients and 36 (22%) female patients involved in the study.

The demographic data and baseline characteristics are summarised in Table 1. Overall, our perioperative data shows that there are statistically insignificant differences between both groups in terms of gender, age, logistic Euroscore and Euroscore 2. Average age of patients went to PCU is 64.5 years compared to 63.7 years in CICU patients (p=0.79). The mean logistic Euroscore was (PCU=3.14, CICU=4.08; p=0.35) and Euroscore II was (PCU=3.7, CICU=4.3; p=0.38).

Intraoperatively the mean cross clamp time for PCU patients was higher than CICU patients with means 67.1 minutes and 54 minutes respectively and p value of <0.05 (statistically significant). The same trend was observed in the mean cardiopulmonary bypass time where the mean time for PCU patients was 84.10 minutes and CICU patients was 54.2 minutes (p<0.05) (Table 1).

Patients extubated faster in PCU comparing to CICU patients with a statistically significant differences (PCU= 2.28 hours, CICU=5.03 hours, P<0.05). Regarding PCU vs. CICU patients length of hospital stay PCU patients were discharged earlier than CICU patients with average days of 4.2 and 6.35 days respectively (p=0.001).

There was no statical difference in time of removal of central venous line and catheter, Table 2. The rate of post-operative complications was similar in both PCU and CICU patients. There were no postoperative stroke, myocardial infarction, renal failure or in hospital mortality in both groups. The 2 years follow-up of the patients showed no mortality in the groups. Only one patient from CICU group had to be re-intubate and explored for post-operative bleed and that was statistically insignificant (p=0.93). The rate of sternal wound infection was the same for CICU and PCU groups (0.6%) (Table 3).

Discussion

CICU beds availability for cardiac patients are challenging and costly, especially during COVID-19 pandemic. There is a movement towards minimally invasive surgery and fast track patients' recovery in the era of modern cardiac surgery. This evolution has its challenges in terms of patients' safety and the effectiveness of the interventions. Fast track protocols post-cardiac surgery have become well-known intervention, and widely accepted practice among cardiac and anaesthetic teams [8,9]. In our South Yorkshire cardiothoracic unit, PCU nurses are trained on fast-track protocol, patients extubation, de-

Table 1: The patient demographics and operation-related data are summarized.

Parameter	PCU patients	CICU patients	P-value
Number of patients	75	87	0.87
	Male=62 (83%)	Male=64(74 %)	
	Female=13(17%)	Female=23(26 %)	
Mean age in years	64.5 (SD ± 8.3)	63.7 (SD ± 9.9)	0.79
CABG cases	23 (14%)	28 (17%)	0.42
AVR cases	64 (39.5%)	47 (29%)	<0.05
Logistics Euroscore (mean)	3.14 (SD ± 2.3)	4.08 (SD ± 3.1)	0.35
Euroscore II (mean)	3.7 (SD ± 1.9)	4.3 (SD ± 2.4)	0.38

Table 2: Univariate analysis summary for intra-operative outcomes.

Parameter	PCU patients	CICU patients	P value
Mean cross clamp time in minutes	67.1 (SD ± 23)	50 (SD ± 19.4)	<0.05
Mean bypass time in minutes	84.10 (SD ± 30)	64.2 (SD ± 19.1)	<0.05

Table 3: Summaries postoperative data.

Parameter	PCU patients	CICU patients	P-Value
Mean extubation time in hours	2.28 (SD ± 1.5)	5.03 (SD ± 3.7)	<0.05
Volume of fluid given in 1 st twelve hours in litres	1.42 (SD ± 0.7)	1.81 (SD ± 1.1)	0.01
Removal of CVC in days	1.9 (SD ± 0.8)	2.4 (SD ± 0.8)	0.79
Drain removal in days	1.5 (SD ± 0.52)	1.6 (SD ± 0.67)	0.01
Catheter removal in days	1.85 (SD ± 0.6)	2.08 (SD ± 0.55)	0.32
Length of hospital stay in days	4.2 (SD ± 2.3)	6.35 (SD ± 2.7)	0.001
Reopen for bleed (n%)	0	1 (1.33%)	0.93
Stroke (n%)	0	0	1
Renal failure (n%)	0	0	1
MI (n%)	0	0	1
Sternal wound infection	1 (0.6%)	1(0.6%)	1
In hospital and 2 years mortality	0	0	1

SD: Standard Deviation

line and mobilizing patients early and independently from anaesthetic team. Our study wanted to evaluate the efficiency and safety of the nurse-led fast track of cardiac patients in PCU beds comparing with patients receiving a standard care by intensivists in CICU. Low risks cardiac patients who had isolated CABG or AVR and met inclusion criteria either went to PCU or CICU bed in a random selection based in bed and staff availability decided by cardiac bed manager. We compared the outcome of these similar groups of patients in terms of extubating time, length of hospital stays, morbidity and mortality. With the fast-track protocol, patients extubated significantly early, went home earlier, had similar complication rates as those who managed by intensivists in CICU. Many studies in the literature have supported our finding of the fast-track protocol's efficiency and safety. That supports the argument that low risks cardiac patients can be managed safely by nurses with fast track protocols in high dependency units [10].

We believe that our early extubating time is the critical factor for the low post operative fluid infusion, earlier de-line of the patients and early discharge with few complication and no mortality. Studies have supported the view of the importance of early extubation on cardiac patients. Majority of our fast-track patients were extubated in the recovery room even before reaching PCU bed. Once patients meet our extubating criteria, nurses will extubated their patients and not delay the process for anastatic team reviews. All fast-track patients receive Continuous Positive Airway Pressure (CPAP) for a short time until their blood gas is satisfactory. This practice is supported by previously published studies [11]. In an emergency situation where patients need to be re-intubated an on-call anaesthetic consultant and senior registrar are available for support and reintubation.

Most fast-track cardiac studies have focused on coronary artery bypass surgeries and fast-tracking those patients in CICU. Our study had a mix of coronary artery bypass and aortic valve replacement cases. In addition, we utilized our PCU beds and trained our nurses on fast-tracking patients to offload pressure on CICU beds. After our study has proven that our nurse-led fact track protocol is safe and efficient, other cardiac cases such as low-risk mitral valve repairs, AF surgery and aortic surgery cases can be admitted to PCU and fast-tracked home.

One of the limitations of our study is the fact that it was a retrospective study. However, we compared two similar low-risk cardiac patients who had two different postoperative management protocols. Our patients had similar age rang, logistic Euro score and sample size. Interestingly our fast-track patients had a significantly

longer bypass and cross-clamp time, which is usually a risk factor for higher morbidity and mortality [10]. Despite that, the longer bypass time and cross-clamp time did not affect the fast-track protocol outcome. A possible reason for that was that surgeons at the start of fast tracking patients to be managed by nurses in PCU they spend more time on ensuring hemostasis to avoid emergency re-exploration and reintubation in PCU and as learning curve effect.

Another limitation of our study was the small size of our study sample. The power of the study is low. Hence justifying the lack of statistical difference between the study groups might be challenging. That raises the importance of performing a multicentre prospective study to further analyse the safety and efficiency of nurse-led fast-track protocols in PCU. In which a logistic regression analysis can be used to weigh all the potential cofounders. Despite that, our study result was pilot studies that support the safety and efficacy of nurse led fast track protocols in low risk cardiac patients.

Conclusion

From our experience in this study, we can conclude that fast track of low-risk cardiac patients can be achieved in high dependency units with nurse-led protocol when carefully selected. That can increase cardiac units' capacity, especially with the limited ITU beds.

More extensive multicentre studies are needed to evaluate further the cost benefits and safety of nurse-led fast track protocols in managing higher risk cardiac patients.

Disclosures

Nothing to be disclosed from all authors, all authors included in the paper have contributed to the research, analysis and writing up the manuscript as per the journal guideline.

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