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Does fast-track recovery improve outcomes in adult cardiac surgery?

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Abstract

Complications following cardiac surgery can be associated with severe morbidity and mortality. The interdisciplinary approach according to a structured protocol aims to optimise outcomes post cardiac surgery. We aimed to evaluate the evidence of fast track recovery programmes in adult cardiac surgery.

Altogether 164 papers were found using the reported search, of which seven represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers were analysed to get consensus recommendations.

In-hospital mortality was lower in one retrospective cohort study ($p<0.01$, 0.5% vs. 3.3%). The total length of stay was lower in two studies ($p<0.01$, 10 days (8–12) vs. 11 days (9-4), $p=0.02$). One study showed lower pain scores on day 1-3 ($p<0.01$, $p<0.05$, $p<0.01$). Morphine was given for a shorter period of time (3 days (2-3) *vs*. 0 days, $p<0.01$). Fast-track recovery had lower mean ±SD costs (£4182±£2284 ($6683±$3650) vs. £4553±£1355 ($7277 ± $2165), $p<0.001$).

Three studies analysed success rates of fast-track recovery, describing it as 97%, 89% and 84% retrospectively. In one study the readmission rate following failure of fast track recovery was associated with a prolonged ICU stay (105±180.0 vs. 19.2±2.4 hours of initial ICU stay) and worse outcomes. Independent risk factors for failure were described to be age, female sex, prolonged surgery, and prolonged cross-clamp time and left ventricular dysfunction.

Small retrospective and prospective studies demonstrate fast track recovery after cardiac surgery as an important management strategy in carefully pre-selected patient groups decreasing the total and intensive care length of stay, total duration of intubation and is a cost-effective strategy compared to conventional recovery. There is a lack of randomised trial data assessing which components of the fast-tracking system contribute most to the outcomes.

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Introduction

Enhanced recovery and fast track recovery programmes, also known as Enhanced Recovery after Surgery (ERAS), are defined as multimodal evidence-based and procedure specific pathways to optimize the perioperative care, recovery and discharge of surgical patients [1].

Over the past two decades enhanced recovery principles have been implemented across various surgical specialties and there is compelling evidence from the meta analyses of multiple randomized controlled trials that there is a benefit of fast track recovery post major general abdominal and urological surgery [2-5]. However, it is unclear how these relate to the post cardiac surgery population [6].

The factors driving this change are pressures on surgeons to decrease resource consumption while increasing operation numbers on an increasingly co-morbid aging population, without compromising safety and quality of care. There are additional financial pressures on all health care systems to deliver optimal high-quality care with increasing efficiency savings.

The principles of fast track recovery programmes focus on pre-, intra- and postoperative components and rely on interdisciplinary communication and support (Figure 1). The implementation of these programmes is protocol based. Fast track recovery protocols include numerous components [7].

These include pre-operative optimisation of patient's haematinics, lung function, exercise capacity, smoking cessation, weight loss where possible and low-risk patient selection.

Patients undergo intense counselling on the postoperative rehabilitation processes and discharge plans. Patients receive preoperative carbohydrate loading whilst prolonged preoperative fasting and pre-medications are avoided.

The core intraoperative components include minimally invasive surgery and minimally invasive surgery using mini-cardiopulmonary bypass circuits, a goal-directed fluid and normothermic management and short-acting anaesthetics.

The post-operative care aims to deliver protocoled early extubating, judicious fluid management, multimodal pain management, prophylaxis for nausea and vomiting, early removal of lines, drains and catheters; early mobilisation and feeding and dietary supplementation with high protein drinks.

The outcome measures that are analysed are length of intubation, duration of ITU and hospital stay, any complications and mortality.

The necessity of the implementation of fast track recovery programmes in adult cardiac surgery have widely been discussed. However, these strategies are not adopted in many cardiac surgery programmes and there remain numerous individual and institutional barriers to their uptake. We aimed to analyse the outcomes for adult cardiac surgical programmes to assess how they impact on patient care.

Search strategy and outcomes

OVID MEDLINE® and Pubmed Index from 1999 to May 2018 were searched using the following terms: [fast-track recovery programme] OR [fast-track recovery programme] OR [fast-track surgery] AND [cardiac surgery] OR [cardiac procedures] AND [outcome] OR [stay].

164 papers were found using the reported search. From these seven papers were identified that provided the best evidence to answer the question. Four compared fast-track recovery with conventional recovery (Table 1), three looked at complications and reasons for failure in fast-track recovery groups (Table 2).

The terms enhanced recovery, fast track recovery programmes and Early Recovery after Surgery (ERAS) have been used interchangeably for similar programmes in the literature. In this paper we will refer to all these terms as fast track recovery programmes.

Results

The feasibility of fast-track recovery after cardiac surgery was studied in prospective [8,9] and retrospective studies [10]. These report that the total number of patients with one or more postoperative complications (including hospital-acquired infections, acute kidney injury, atrial fibrillation, respiratory failure, cardiac tamponade and myocardial infarction) were significantly reduced in the fast-track recovery group (50,3% vs. 19.2%, p<0.01).8 The fast-track recovery pathway led to a reduced length of stay in an intensive care facility (p<0.001) [9,10]. However, the median total hospital Length Of Stay (LOS), incidence of complications, re-intubation and readmission were similar [8,9]. A retrospective study showed a significantly shorter intermediate care unit (21 hours (17–39) vs. 26 hours (19-49), p<0.01) and hospital stay (10 days (8-12) vs. 11 days (9-14), p<0.01) [10].

Postoperative pain scores on the first three postoperative days were significantly lower in the fast-track recovery group ($p < 0.01$, $p < 0.05$, $p < 0.01$) whilst morphine was given for a significantly shorter period postoperatively (3 days (2-3) vs. 0 days (0-0), $p < 0.01$) [8]. The duration of intubation was reduced from 1 to 14 hours (p <0.001) [8,10].

The mean cost of the perioperative care for fast-track recovery was £4182±2284 compared to £4553±1355 for the conventional group with a mean difference of £371 per patient (£166-£1324, p<0.001) [9].

One prospective randomised trial evaluated Minimal Extracorporeal Circulation Circuits (MECC) compared with conventional CPB in facilitating fast-track recovery after elective coronary bypass grafting [11]. Fast-track recovery was significantly higher in patients undergoing MECC (25% vs. 6,7%, p=0.006). MECC was identified as an independent predicting factor for fast-track recovery (OR 3.8, p=0.011). The duration of ventilation (p<0.001), hospital stay (p=0.02), intraoperative (p<0.001) and postoperative (p=0.009) blood transfusions, inotropic support (p<0.001), intra-aortic balloon pump (p=0.03), postoperative atrial fibrillation (p=0.03) and renal failure (p=0.02) was significantly lower in the MECC group.

Readmission rates of 3.29% were described in a fast-track recovery group in a prospective observational study [12]. Patients who required readmission had a significantly prolonged ICU stay compared with the initial ICU stay (105.6+/-180.0 versus 19.2+/-2.4 hours, p<0.001) [12].

Two retrospective cohort studies analysed the reasons for fast-track recovery failure [13,14]. Failure was defined as any transfer of the patient back to the ICU (primary 11.6%, secondary 5.6%). Risk factors were assessed in a multivariate regression analysis. Age over 70 years (p<0.01, OR 2.2), [13,14] female gender (p<0.01, OR 1.5), [13] prolonged operation times

(p<0.01), [13] prolonged cross-clamp times (p<0.01) [13] and left ventricular dysfunction could be defined as independent risk factors for fast-track recovery failure [14].

Discussion

Over the past two decades minimally invasive surgical techniques and enhanced recovery programmes have become the primary methods of improving recovery after surgery, thus providing better short-term outcomes. They focus on pre-, intra- and postoperative components, seeking to provide a holistic approach of interdisciplinary care and are optimizing the use of resources for perioperative care.

Small retrospective and prospective studies demonstrate fast track recovery after cardiac surgery as an important management strategy in carefully pre-selected patient groups with beneficial effects with respect to potentially decreased duration of intubation, total length of ITU/hospital stay, less postoperative complications und cost effectiveness compared to conventional recovery.

Different independent risk factors have been shown to predict failure in a fast track process post-surgery. Among all the pre-operative variables, emergency operation, increasingly complex operations, age, renal function, pre-procedure stroke, redo surgery, impaired left ventricular function and female gender were identified as the most important variables to prolonged ITU stay and complications. In a systematic review 20 models for risk prediction of ITU stay post adult cardiac surgery were assessed. The Parsonnet and Euro SCORE were identified as superior models to allow prognostication [15]. It is imperative that they form the basis of patient selection for the success of the fast track recovery programmes.

Limitations of this review should be considered as most studies focused on different elements of fast track recovery and included different patient groups. There is a lack of randomised trial and prospective data assessing which components of the fast-tracking system contribute most to the outcomes. Further large-scale pooled studies would be useful to assess how these results can be applied to those patients in the intermediate and high-risk groups as they would benefit the most from the adoption of these strategies.

We conclude that fast track recovery programmes after cardiac surgery are safe, and feasible to conduct. An interdisciplinary agreement on the management of patients and the most important fast-track elements and rigid and strict discharge criteria are important factors that contribute to the success of these programmes.

The support and awareness of operative care practitioners, nursing staff, physiotherapist, pharmacists, nutritionists and social workers are of up most importance for the implementation of fast track recovery programmes.

Figures

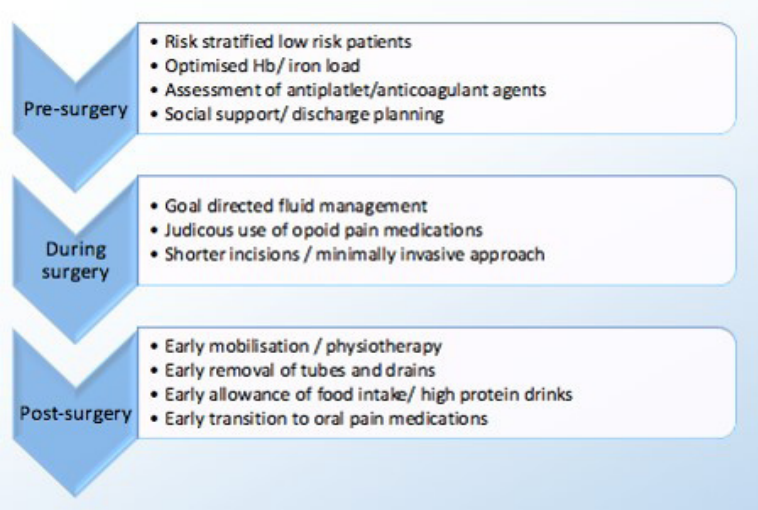

Figure 1: Principles of fast track recovery programmes

Table 1: Fast track recovery in adult cardiac surgery

Author, date and country, Study type (level of Evidence)	Patient group	Outcomes	Key results	Comments
Fleming et al, 2016 Journal of Cardiothoracic and Vascular Anaesthesia UK [8] Prospective observational study (level 1c)	n=105 (52 fast track, 53 conventional)	Mortality	2 (3.8%) vs. 1(1.9%) p = 0.57	Fast-track recovery has the potential for decreased post-operative morbidity after cardiac surgery.
		Complications	19.2% vs. 50.3% p < 0.01 significantly less one or more postoperative complications in the fast track group	
		Length of stay (days)	6(5-9) vs. 6(4-7) p = 0.31	
		Postoperative pain	Day 1-3, significantly lower in the fast-track recovery group (p < 0.01, p < 0.05, p < 0.01) Morphine given for significantly shorter period (3 days (2-3) vs. 0 days (0-0), p < 0.01)	
Salhiyyah et al, 2011 The Heart Surgery Forum, UK [9] Prospective observational study (level 1c)	n= 146 (84 fast track, 52 conventional)	Mortality	1 (1.1%) vs. 0(0%), p = 0.430	Fast-track recovery after cardiac surgery decreases the intensive care LOS and the total duration of intubation. It is a cost-effective strategy compared with conventional recovery protocols; however, it does not reduce the total hospital LOS or the incidence of complications.
		Complications		
		Length of stay (days)	Mean±SD 8.47±4.69 vs. 8.22±2.55 p=0.645	
		ICU length of stay (days)	Mean±SD 14.38±31.23 vs. 26.78±11.58 p < 0.001	
		Duration of intubation (days)	Mean±SD 3.36±2.54 vs. 5.11±2.87 p < 0.001	
		Reintubation rate	Mean±SD 4 (4.77%) vs. 3 (5.77%)	
		Costs	£4182±£2284 ($6683± $3650) vs. £4553±£1355 ($7277 ± $2165)	
		Reexploration for bleeding	1 (1.12%) vs. 1(1.92) p = 0.730	
		Renal failure	2 (2.4%) vs. 1(1.92%) p = 0.860	
		Chest infection	11 (13.1%) vs. 5(9.62%) p = 0.540	
		Sternal wound infection	3 (3.6%) vs. 1(1.92%) p = 0.435	
		Leg wound infection	1 (1.12%) vs. 2(3.85) p = 0.306	
		Other infections	8 (9.52%) vs. 3(5.77%) p = 0.435	
		Atrial fibrillation	23 (27.38%) vs. 12(23.08%) p = 0.577	
		Pneumothorax	2 (2.40%) vs. 0(0%) p = 0.262	
		Pericardial effusion	1 (1.12%) vs. 0(0%) p = 0.430	
		Gastrointestinal complications	5 (5.95%) vs. 3(5.77%) p = 0.430	

Anastasiadis et al, 2013 Journal of Cardiothoracic and Vascular Anaesthesia [11] Prospective randomised study (level 1c)	120 patients (60 fast track, 60 conventional) MECC vs. CPB in CABG-patients	Duration of ventilation (hours)	11.8±5.5 vs. 16.6±5.1 p < 0.001	MECC vs. CRB in CABG patients leads to a reduced duration of ventilation, reduced cardiac unit stay and less intra- / postoperative complications Fast-track recovery was significantly higher in patients undergoing MECC (25% vs. 6,7%, p = 0.006) MECC was identified as an independent risk factor for fast-track recovery (OR 3.8, p = 0.011)
		Length of stay (days)	10.8±2.6 vs. 11.5±2.8 p = 0.31	
		Cardiac recovery unit stay (days)	2±0.6 vs. 2.3±0.7 p = 0.02	
		Intra-operative blood transfusion Post-operative blood transfusion (units)	0.5±0.7 vs. 1.5±1.1 p < 0.001 2±1.7 vs. 3±2.4 p = 0.009	
		Inotropic support (hours)	20.4±5.4 vs. 35.2±6.3 p < 0.001	
		Intra-aortic balloon pump	2 (3.3%) vs. 5(8.3%) p = 0.03	
		Postoperative atrial fibrillation	20 (33.3%) vs. 32(53.3%) p = 0.03	
		Renal failure	1 (1.7%) vs. 5(8.3%) p = 0.02	
Ender et al, 2008 Anaesthesiology, Germany [10] Retrospective cohort study (level 2b)	842 patients (421 fast track, 421 historic conventional group) Leipzig fast-track concept	Mortality	2 (0.5%) vs. 14(3.3%) P < 0.01	The Leipzig fast-track recovery protocol is a safe and effective method to manage cardiac surgery patients after a variety of cardiac operations.
		Complications (times in median and IQR)		
		PACU/ICU (hours)	4 (3–5) vs. 20 (16–25) p < 0.01	
		Intermediate care (hours)	21 (17–39) vs. 26 (19–49) p < 0.01	
		Hospital stay (days)	10 (8–12) vs. 11 (9–14) p < 0.01	
		Intermediate care readmission	61 (14.5%) vs. 42 (9.7%) p = 0.6	
		LOS for intermediate care readmission (hours)	18 (7–33) vs. 14 (5–25) p = 0.23	
		ICU readmission	24(5.7%) vs. 32(7.6%) p = 0.33	
		LOS for ICU readmission (hours)	25(13–53) vs. 19(10–120) p = 0.75	
		Myocardial infarction	1(0.2%) vs. 4(1.0%) p = 0.37	
		Low cardiac output	2(0.5%) vs. 12(2.9%) p < 0.05	
		Renal failure	4(1.0%) vs. 9(2.1%) p = 0.25	
		Stroke	5(1.2%) vs. 10(2.4%) p = 0.30	
		Mediastinitis	1(0.2%) vs. 2(0.5%) p = 0.88	
		Time to extubation (minutes)	75 (45–110) vs. 900 (600–1,140) p < 0.01	
		Length of stay (days)	10 (8 –12) vs. 11 (9 –14) p < 0.01	
		ICU length of stay (hours)	4 (3.0 –5) vs. 20 (16 –25) p < 0.01	
		Time to extubation (minutes)	75 min (45–110) vs. 900 min (600–1140) p < 0.01	
		Postoperative low cardiac output syndrome	2 (0.5%) vs. 12 (2.9%) p < 0.05	

Table 2: Outcomes after fast track recovery programme failure

Author, date and country, Study type (level of Evidence) Patient group Outcomes Key results Comments	Patient group	Outcomes	Key results	Comments
Kogan et al, 2003 Ann Thorac Surg, Israel [12] Prospective observational study (level 1c) Zahary et al, 2015 Journal of Cardiothoracic and Vascular Anaesthesia, Germany [13] Retrospective cohort study (level 2b)	1,613 patients on a fast track programme	Readmission rate	53 (3.29%) 43% within 24 hours of discharge usually because of pulmonary problems (43%) or arrhythmias (13%)	Among a homogeneous group of patients targeted for fast-track management after cardiac surgery, readmission although uncommon is associated with a longer second ICU stay and significantly higher mortality. The recognition of specific risk factors that lead to readmission may allow for appropriate modification of the postoperative course.
		Duration of initial ICU stay (hours)	Fast-track recovery vs. Re-admitted 16.8±4.8 vs. 19.2±2.4 p = ns	
		Duration of initial ventilation (hours)	6.1±1.7 vs. 6.6±2.4 p = ns	
		Duration of re-admission to ITU for fast-track recovery patients (hours)	105.6±180	
		In-hospital mortality	0 (0) vs. 6/53 (11.3%)	
		Bernstein-Parsonnet risk	On multivariate analysis, a Bernstein-Parsonnet risk estimate more than 20 strongly predicted readmission (odds ratio, 3.08; 95% confidence interval, 1.43 to 6.69	
		Identified risk factors for readmission	• female gender • aged over 70 years • high cardiac risk score • poor ventricular function • prolonged operative time • prolonged-cross clamp time • primary fast track failure: 11.6 • secondary fast track failure 5.6%	
Haanschoten et al, 2012 Interactive CardioVascular and Thoracic Surgery, Netherlands [14] Retrospective cohort study (level 2b)	11895 patients (5367 fast track programme)	Fast- track success rate	84%	Fast-track management is efficient and safe for the postoperative management of selected patients undergoing cardiac surgery. Age and left ventricular dysfunction are significant preoperative predictors of failure of this protocol.
		Independent risk factors for failure: Older age	OR 0.98/year (0.97–0.98)	
		Left ventricular dysfunction	OR 0.31 (0.14–0.70)	

References

1. Paton F, Chambers D, Wilson P, Eastwood A, Craig D, et al. Effectiveness and implementation of enhanced recovery after surgery programmes: a rapid evidence synthesis. BMJ Open. 2014; 4: e005015.
2. Zhao JH, Sun JX, Gao P, Chen XQ, Song YX, et al. Fast-track surgery versus traditional perioperative care in laparoscopic colorectal cancer surgery: a meta-analysis. BMC Cancer. 2014; 14: 607.
3. Tyson MD, Chang SS. Enhanced Recovery Pathways Versus Standard Care after Cystectomy: A Meta-analysis of the Effect on Perioperative Outcomes. Eur Urol. 2016; 70: 995-1003.
4. Wang LH, Zhu RF, Gao C, Wang SL, Shen LZ. Application of enhanced recovery after gastric cancer surgery: An updated meta-analysis. World J Gastroenterol. 2018; 24: 1562-1578.
5. Ji HB, Zhu WT, Wei Q, Wang XX, Wang HB, et al. Impact of enhanced recovery after surgery programs on pancreatic surgery: A meta-analysis. World J Gastroenterol. 2018; 24: 1666-1678.
6. Yusuf S, Zucker D, Peduzzi P, Fisher LD, Takaro T, et al. Effect of coronary artery bypass graft surgery on survival: overview of 10-year results from randomised trials by the Coronary Artery Bypass Graft Surgery Trial Lists Collaboration. Lancet. 1994; 344: 563-570.
7. Patel HR, Cerantola Y, Valerio M, Persson B, Jichlinski O, et al. Enhanced recovery after surgery: are we ready, and can we afford not to implement these pathways for patients undergoing radical cystectomy?. Eur Urol. 2014; 65: 263-236.
8. Fleming I, Garrat C, Guha R, Desai J, Chaubey S, et al. Aggregation of Marginal Gains in Cardiac Surgery: Feasibility of a Perioperative Care Bundle for Fast-track Recovery in Cardiac Surgical Patients. J Cardiothorac Vasc Anesth. 2016; 30: 665-670.
9. Salhiyyah K, Elsobky S, Raja S, Attia R, Brazier J, et al. A Clinical and Economic Evaluation of Fast-Track Recovery after Cardiac Surgery. Heart Surg Forum. 2011; 14: 1029.
10. Ender J, Borger MA, Scholz M, Funkat A-K, Anwar N, et al. Cardiac Surgery Fast-track Treatment in a Postanesthetic Care Unit - Six-month Results of the Leipzig Fast-track Concept. Anaesthesiology. 2008; 109: 61-66.
11. Anastasiadis K, Asteriou C, Antonitsis P, Argiriadou H, Grosomanidis V, et al. Fast-track Recovery After Elective Coronary Revascularization Surgery With Minimal Versus Conventional Extracorporeal Circulation: A Prospective Randomized Study. J Cardiothorac Vasc Anesth. 2013; 27; 859-864.
12. Kogan A, Cohen J, Raanani E, Sahar G, Orlov B, et al. Readmission to the Intensive Care Unit After "Fast-Track" Cardiac Surgery: Risk Factors and Outcomes. Ann Thorac Surg. 2003; 76: 503-507.
13. Zahary W, Lindner J, Sgouropoulou S, Eibel S, Probst S, et al. Independent Risk Factors for Fast-Track Failure Using a Predefined Fast-Track Protocol in Preselected Cardiac Surgery Patients. J Cardiothorac Vasc Anesth. 2015; 29: 1461-1465.
14. Haanschoten MC, Van Straten AHM, Ter Woorst JF, Stepaniak PS, Van Der Meer AD, et al. Fast-track practice in cardiac surgery: results and predictors of outcome. Interactive Cardio Vascular and Thoracic Surgery. 2012; 15: 989-994.
15. Ettema RG, Peelen LM, Schuurmans MJ, Nierich AP, Kalkman CJ, et al. Prediction models for prolonged intensive care unit stay after cardiac surgery: systematic review and validation study. Circulation. 2010; 122: 682-689.