

Original article:

Early Versus Late Mobilization Following Cardiac Surgery – A

Prospective Study

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Abstract:

Conventionally patients after cardiac surgery remain confined to bed for prolonged period to prevent the complications and promote rest and wound healing. Rationality behind this practice is most clinicians think that circulatory homeostasis would be impaired as a result of myocardial stunning, fluid shift, and autonomic dysfunction. But in recent times, the clinicians have understood the advantages of early mobility following extubation and the cardiac surgery discipline has also acknowledged the benefits of the practice which include decreased ICU stay and post-operative hospitalization, improved pulmonary toileting, lower risk of pulmonary complications like pneumonia and atelectasis, less nausea and vomiting, better wound healing, lower risk of venous thromboembolic complications, reduced deconditioning and lower need of rehabilitation. Patient mobilization practices include dangling at bedside, transferring from beds to chairs, walking around the bed and ambulation in the room and hallway. Here the term early mobilization is defined as mobilization practices within 3rd post-operative day and late mobilization thereafter.

Keywords: cardiac surgery , mobilization

Introduction:

Cardiac surgery is a well-known effective and safe option for treating cardiac patients. Among the different type of surgeries coronary artery bypass grafting (CABG), valve replacement, atrial septal defect(ASD)/ventricular septal defect(VSD) closure are the popular ones. But these surgeries carry significant morbidity and mortality with them and the complexities of the procedures and the use of cardio-pulmonary bypass (CPB) have increased the complications. As it is well-known that CPB induces a systemic inflammatory response by releasing various inflammatory mediators that impair immune response, increase capillary permeability and its deleterious effects, the major ones being respiratory illnesses like atelectasis, pleural effusion, pneumonia, acute kidney injury, neuromuscular disorders, low cardiac output syndrome, impaired wound healing, wound infections and impaired glycemic control.

Systemic complications in the postoperative period increases the duration of mechanical ventilation and sedation and promotes muscle weakness, leading to a longer period in the intensive care unit (ICU) and a reduction in mobility. The deleterious effects of immobility include decreased protein synthesis, increased proteolysis, and

loss of muscle mass and strength, compromising functional capacity and ability to perform activities of daily living. It is known that the likely consequences generated by immobility can last for months and even years after an ICU length of stay, preventing patients from fully returning to baseline functional ability and increasing the risk of hospital readmission.

The role of physical therapy in the ICU has been recently highlighted, as well as its importance in the practice of early mobilization and exercise protocols for surgical patients. It is feasible and safe to carry out a physical exercise protocol in the short term. Early mobilization is also associated with decreased respiratory complications following cardiac surgery, reduced loss of muscle strength, decreased morbidity and mortality, improved cognitive conditions, and an increase in the number of days free of mechanical ventilation. Despite reports of improvement in physical capacity due to early mobilization in patients after cardiac surgery, there is a lack of standardization regarding the intensity, type, frequency, and duration of the mobilisation. More studies are needed that concentrate on the importance of standardized protocols since the repercussions of these procedures can influence the patients for a long period after hospital discharge. Thus, this study aims first to assess the effectiveness of early mobilization on the functional capacity of patients undergoing cardiac surgery and subsequently evaluate the possible influence on the length of the hospital stay and the development of postoperative pulmonary complications, emphasizing the importance of identifying the need for specific protocols for continued rehabilitation and new physical therapy strategies.

Materials and Methods:

Study design: This is a prospective randomized control study conducted in the post-cardiac surgery patients in the Department of Cardiothoracic and Vascular Surgery, G.B. Pant Institute of Postgraduate Medical Education and Research, New Delhi, India during the period from November 2018 to October 2020, which are: Patients undergoing elective coronary artery bypass grafting, mitral valve replacement, aortic valve replacement, atrial septal defect and ventricular septal defect closure total of 100 patients were taken and divided into two groups- group A and B, each comprising of 50 patients. Group A was subjected for early mobilization both on and off the bed during the 3rd post-operative day and Group B with conventional late mobilization thereafter. Patients were observed in the post-operative ICU and wards and followed up for 1month post-discharge.

Observations were made on the basis of duration of ICU stay and post-operative hospitalization, incidence of pulmonary complications, complaint of nausea and vomiting, return of peristaltic sounds, wound infections, venous thromboembolic complications and subjective deconditioning.

Exclusion criteria consisted of age <18 years, low left ventricular ejection fraction <30% or the need for preoperative inotropic support or perioperative intra-aortic balloon pump, postoperative neurological impairment, hemodynamic instability, metabolic acidosis (blood lactate >3 mmol/L), or persisting pain (visual analog scale [VAS] >4/10) and patients requiring prolonged mechanical ventilation(>2 days) that precluded mobilization.

Criteria for shifting the patients from ICU to ward included: tolerance of mobilization, absence of vasoactive treatment, stable hemodynamic, satisfactory respiratory conditions, unnecessary of invasive monitoring, and no further active interventions planned.

Table 1. Demographic profile of the patients(n=100)

	Group A(n=50)	Group B(n=50)
Age(years)	39.1.1±19.4	40.4±17.4
Male	38 (76.0%)	42 (84.0%)
Female	12 (24.0%)	8 (16.0%)
Weight (Kg)	65.9±16.7	67.9±13.2
Median BSA(m2)	1.8±0.4	1.9±0.5
BMI(kg/m2)	28.6±4.2	26.0±4.7
Co-morbidities		
Diabetes mellitus	13 (26.0%)	9 (18.0%)
Hypertension	8 (16.0%)	11 (22.0%)
Hypothyroidism	3 (6.0%)	5 (10.0%)
Previous PCI	4 (8.0%)	3 (6.0%)
Renal insufficiency	2 (4.0%)	1 (2.0%)
LVFE(0.30- 0.50)	6 (12.0%)	5 (10.0%)
Pulmonary hypertension	2 (4.0%)	3 (6.0%)
NYHA -III	38 (76.0%)	36 (72.0%)
NYHA -IV	10 (20.0%)	13 (26.0%)

LVEF- Left Ventricular Ejection Fraction, PCI- Percutaneous Intervention, NYHA-New York Heart Association.

In this study, a total of 100 patients were taken and divided into two groups- group A and group B, each consisting of 50 patients. In group- A and B majority were male patients, 76.0% and 84.0% respectively. 13 (26.0%) patients in group A and 9(18.0%) patients in group B had diabetes mellitus with good glycemic control on oral hypoglycemic agents. 8 (16.0%) and 11 (22.0%) patients in group A and B respectively had hypertension 3 (6.0%) and 5 (10.0%) patients in group A and B respectively were known case of hypothyroidism and were in euthyroid state on thyroxin supplementation therapy. 2 (4.0%) and 1 (2.0%) of patients were having renal insufficiency with serum creatinine ranging from 1.2-1.5 mg/dl. 4 (8.0%) in group A and 3 (6.0%) in group B were having prior percutaneous interventions for single and double vessel coronary artery disease. Group-A patients were subjected to a standardized early mobilization protocol within 3rd post-operative days, comprising of moving the limbs in awake mechanically ventilated patients, post-extubation dangling at bedside, transferring to chair, walking around the bed and ambulation in the room and hallway. Hemodynamic parameters of the patients were monitored immediately before and after mobilization. Group B patients were confined to beds for prolonged period (>3 days).

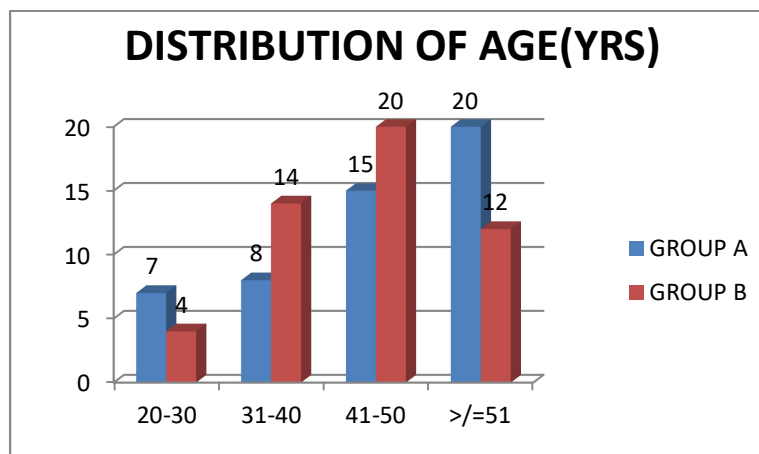


Table 2: Different types of surgical procedures done in the patients

Surgical Procedures (%)	Group A (n=50)	Group B (n=50)
ASD Closure	6 (12.0)	7 (14.0)
ICR for TOF	2 (4.0)	1 (2.0)
MVR	15 (30)	19 (38.0)
AVR	10 (20.0)	7 (14.0)
MVR+AVR	6 (12.0)	6 (12.0)
CABG	11 (22.0)	10 (20.0)

ASD-Atrial septal defect, ICR- Intra-cardiac repair, MVR – Mitral valve replacement, AVR- Aortic valve replacement, CABG – Coronary artery bypass grafting. TOF- Tetralogy of Fallot

Out of all patients studied, 6 (12.0%) and 7 (14.0%) patients in group A and B respectively undergone pericardial patch closure of ASD with size of ASD ranging from 35.2 mm - 38.6mm in group A and 36.1mm- 39.7 mm in group B. Intra-cardiac repair for tetralogy of Fallot was done in 2 (4.0%) patient in group A and 1 (2.0%) patients in group B. Here in all cases, ICR comprised of Dacron patch closure of sub-aortic VSD, right ventricular outflow tract muscle bundle resection, nontrans-annular pericardial patch augmentation of right ventricular outflow tract In group A, 15 (30.0%) and in group B, 19 (38.0%) patients undergone mitral valve replacement with St Jude Medical mechanical mitral valve prosthesis with total posterior mitral leaflet (PML) preservation and partial posterior mitral leaflet (PML) in 8 patients and 7 patients in group A and 11 and 8 patients in group B respectively. The patients were having symptomatic (NYHA-III/IV) severe mitral stenosis/ severe mitral regurgitation. The mitral valve prosthesis was secured to the annulus and edge of the PML with ethibond 2-0 suture 26 mm double arm (DA) in interrupted fashion. Aortic valve replacement (AVR) was done in symptomatic (NYHA- III/IV) aortic stenosis/aortic regurgitation patients, 10 (20.0%) and 7(14.0%) patient in group A and B respectively. St Jude Medical mechanical aortic valve prosthesis was used in all cases. The prostheses were secured to the aortic annulus with ethibond 2-0 suture 17 mm double arm (DA) in interrupted fashion. 6 (12.0%) patients in both group A and B

had undergone double valve replacement (MVR+AVR). 11 (22.0%) and 10 (20.0%) of patients in group A and B respectively undergone coronary artery bypass grafting (CABG) for triple vessel coronary artery disease using left internal mammary artery and reversed great saphenous vein as grafts.

Results and Analysis:

These patients were followed in post-operative period for mean ICU stay, mean duration of hospital stay, mean duration of inotropic support, post-operative nausea and vomiting, post-mobilization dizziness and lethargy, surgical site infection, post-operative pulmonary complications and any post-discharge subjective deconditioning.

Table 3: Outcomes of the study

Parameters	Group A	Group B	P value
Median ICU stay(hours)	48.7 (43.3-56.3)	84.2 (73.4-94.7)	<0.05
Median duration of hospital stay (days)	9 (8-11)	14 (10-17)	<0.05
Median duration of inotropes(hours)	39.2 (36.7-46.3)	44.9 (40.7-49.7)	>0.05
Nausea and vomiting (%)	15 (30.0)	23 (46.0)	>0.05
Dizziness and lethargy (%)	13 (26.0)	30 (60.0)	<0.05
Surgical site infection (%)	4 (8.0)	5 (10.0)	>0.05
Pulmonary complications (%)	5 (10.0)	7 (14.0)	<0.05
Post-discharge deconditioning(%)	15 (30.0)	26 (52.0)	<0.05

The median ICU stay and duration of hospital stay were longer in group B as compared to group A and these were statistically significant. There is statistically significant difference in the incidence of dizziness and lethargy and is higher in group B than group A, but these were self-limiting in all patients. Out of 50 patients of group A, 15 patients (30.0%) developed post-operative nausea and vomiting and in group B, 23 patients (46.0%) developed post-operative nausea and vomiting. In group A, 4 patients (8.0%) developed surgical site infection, whereas in group B, 5 patients (10.0%) developed surgical site infections. Out of 4 wound infection of group A, 1 patient suffered from major wound infection and other 3 suffered from minor wound infection. In group B, 3 patients suffered from major wound infection and other 2 suffered from minor wound infection. Major wound infection requires repeated wound debridement at operating room with proper antibiotic therapy and regular dressing at wards with proper antibiotic therapy. 52.0% of patients in group B complained of subjective deconditioning as compared to 15.0% in group A. none of the patients required hospitalization. 5 patients in group A and 7 patients in group B developed pneumonia. None of the patients required mechanical ventilation and all improved with conservative therapy after sputum culture and sensitive antibiotic therapy.

Discussion:

Traditionally after cardiac surgery, it is customary to keep the patients confined to beds for prolonged because of fear of impairment of hemodynamic homeostasis. But on the contrary, recent studies show that allowing earlier stepwise mobilization in these patients. It is also being increasingly recognized now that prolonged immobilization has several deleterious effects which include decreased protein synthesis, increased proteolysis and loss of muscle mass and strength, compromising functional capacity and ability to perform activities of daily living. It is also well-known that the likely consequences generated by immobility can last for months and even years after an ICU length of stay, preventing patients from fully returning to baseline functional ability and increasing the risk of hospital readmission. Summary & Conclusion

Summary & Conclusion:

This study shows that length of ICU stay, duration of hospitalization,, dizziness and lethargy, incidence of pulmonary complications and post-discharge deconditioning are significantly lower in early mobilization group than the delayed mobilization group. But, there is no significant difference in duration of inotropic support, incidence of nausea and vomiting and surgical site infection between the two groups.

From our study it can be concluded that the conventional wisdom of withholding mobilization for prolonged periods post-operatively might not stand the test of time .The practice of early mobilization is a safe and effective modality in post-operative recovery period.

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