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Factors Influencing Timing of Active Mobilization After Coronary Artery Bypass Grafting in Critical Care Unit of Selected Hospital, Kolkata.

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Abstract:
Background*: A coronary artery bypass graft (CABG) is a surgical procedure used to treat coronary heart disease. Mobilizationafter cardiac surgery is a great task for the patients as well as therapist as the patients are with many lines, tubes etc. Early mobilization positively affects the improvement of functional status of the patients after coronary artery bypass grafting. This study was carried out to identify the time taken to start active mobilizationof cardiac surgery patients in the early postoperative period. Recovering from a coronary artery bypass graft procedure takes time and everyone recovers at slightly different speeds. Early mobilization plays an important role in early recovery.*
Materials and Methods*: The investigator conducted a descriptive observational study to identify the timings of active mobilizationand factors influencingmobilization in patient undergoing Coronary Artery Bypass Grafting in a selected private hospital, Kolkata120 patients who underwent postoperative coronary artery bypass grafting, were selected by total enumerative sampling method.Data were collected through record analysis proforma.*
Results*: The study findings revealed that the mean timing of active mobilization from bed to chair is 28.9 hours ±12; from chair to walking with assistance is 23 hours ±11; Bed to walking with assistance (ITU receiving to assisted walking) is 51.9 hours ±14.4 hours. Age, duration of mechanical ventilation, duration of drainage, duration of inotropes used are found to be influencing factors for timing of active mobilization from bed to assisted walking*
Conclusion:*Early mobilization after coronary artery bypass surgery is significantly hampered by the need for long duration of mechanical ventilation, inotrope requirements, postoperative hypoxemia and chest drainage*
Key Word*:Timing of Mobilization; Coronary Artery Bypass Graft, Factors influencing mobilization*

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I. Introduction

Coronary artery disease (CVD) is a pathological condition of the heart which involves the formation ofatherosclerotic plaque in the vessel lumen, leading to impairment of blood flow and oxygen delivery to the myocardium. CVD is a major cause of morbidity and mortality worldwide, thus requiring prompt diagnosis and intervention. Coronary artery bypass grafting (CABG) is a surgical modality of relieving this obstruction, by implanting venous segments or internal mammary artery directly from the aorta to the point beyond the existing obstruction.[1]

Being an invasive intervention, CABG may result into a variety of functional and systemic consequences which is further potentiated by pre-existing risk factors and comorbidities.[1,2,3] In addition to these, the length of hospital stay is also influenced by combination of several other factors such as duration of mechanical ventilation, surgical and anesthesia time, etc.[4]

Enhanced Recovery After Surgery (ERAS) protocol emphasizes the need for early mobilization, even in patients undergoing radical surgery, provided their vitals are stable.[5] ICU mobilization strategies include both passive and active range of motion (ROM) exercises, frequent posture changes, in- bed exercise, sitting by the bed, moving from bed to chair, standing and walking activities.[6,7]

Although various studies complement the positive impact of early mobilization in postoperative period of cardiac surgery, several factors have been identified which directly or indirectly influences the active mobilization, postoperatively.

Thus, considering the association of several such factors, present study aims to identify the impact of those factors which influence the initiation of active mobilization of CABG patients postoperatively, in Critical care unit.

II. Material and Methods

A hospital baseddescriptive observational study was conducted amongpatients who underwent Coronary artery Bypass Grafting (CABG), during the months of August and September 2022 at NH Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata,West Bengal.

Objectives of the study:

1. To identify the timings of active mobilization after CABG operation
2. To find out the influencing factors of active mobilization

Data collection tools: Data were collected through record analysis proforma which has two parts. Part A consisted of demographic information and illness profile and Part B consisted of timing of active mobilization and influencing factors. Timing of active mobilization was assessed in three dimension; Bed to chair, chair to walker/ assisted walking and Bed to assisted walking. Independent walking was not assessed as routinely it was not allowed to all patients in critical care unit. The following influencing factors of active mobilization was assessed; comorbid conditions, techniques of CPB, duration of total surgery time, Cross clamping time, hemodynamic instability, acid base imbalance, inotropic support, duration of sedation, re exploration, reintubation event, weaning failure etc.

Sample selection: Considering the SD of timing of initiation of active mobilization as 8 from the mini field study conducted earlier; 95% desired level of confidence and 5% the acceptable margin of error, the calculated sample size was 114. Ultimately 120 patients underwent coronary artery bypass grafting were selected as sample through total enumeration technique. The patients undergone emergency cardiac surgery and CABG with other surgery e.g.Mitral Valve Replacement were excluded.

Procedure methodology

After obtaining clearance from institutional ethics committee, a preoperative written informed consent was obtainedfrom all patients who were posted for elective coronary artery bypass graft (CABG) surgery, expressing their willingness to participate in the study. After completion of CABG the patients were shifted to Cardio-thoracic critical care unit.

One hundred twenty willing patients who underwent elective CABG were enrolled for the study.

Statistical analysis. Mean, median, range and SD were calculated in the area of timing of active mobilization and in the other areas where time duration was calculated. Frequency percentage distribution were calculated in the few areas of influencing factors.*Pearson r* and *chi square* were calculated to identify the relationship between time of active mobilization and factors associated it.

III. Results

Data presented in Table no 1 & Figure 1 showed that 90% were male patients and maximum patients belonged to age group of 55-59 years. Most of the patients had hypertension and most of the patents BMI was within normal range.

Table no 1: Distribution of demographic characteristics of CABG patients

N=120

Sl No.	Variables	Frequency	Percentage
1.	Age		
	• 35 – 44	6	5
	• 45 – 54	24	20
	• 55 – 64	50	42
	• 65 – 74	34	28
	• > 75	6	5

2.	Gender		
	• Male	108	90
	• Female	12	10
3.	Presence of comorbidities *		
	• Hypertension	90	75
	• DM	64	53
	• Hypothyroidism	6	5

* Data are neither mutually exclusive nor exhaustive

N= 120

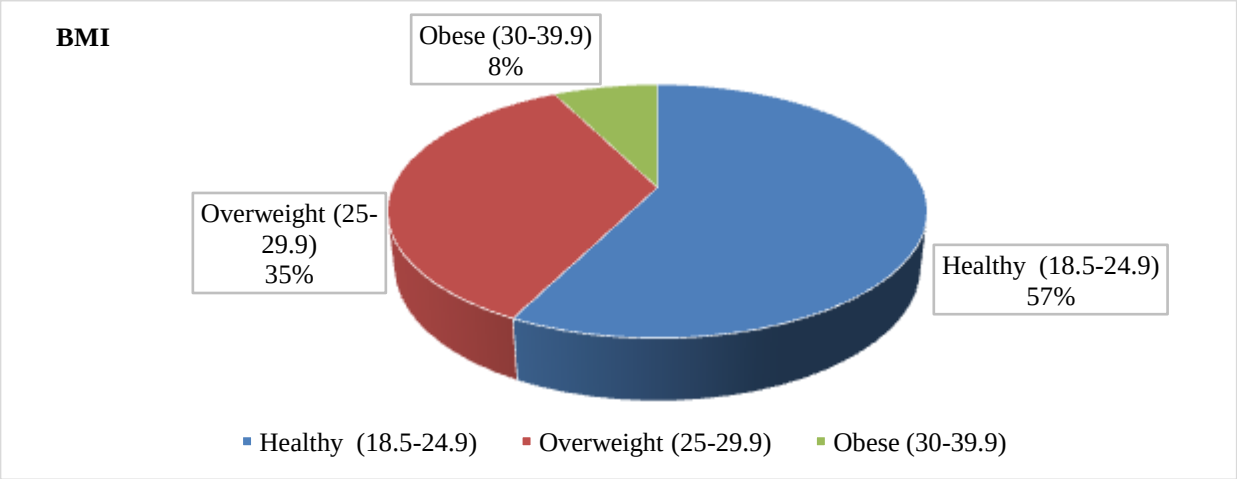


Fig 1. BMI status of the patients

The data presented in Table no 2 and Figure no 2 shows that only 3 % patients underwent on pump machine; rest of the patients' surgery performed in off pump method. 90 % patients had three and more grafts. Only 2 % patients required IABP assistance. All the patients had three drains. No patients underwent re-exploration, weaning failure, reintubation and no patients had respiratory complication during the study period. Only 12 % patients had twice or more times event of hypotension; only 33 % patients experienced hypoxemia; almost all the patients i.e. 97 % patients had episodes of electrolytes abnormalities.

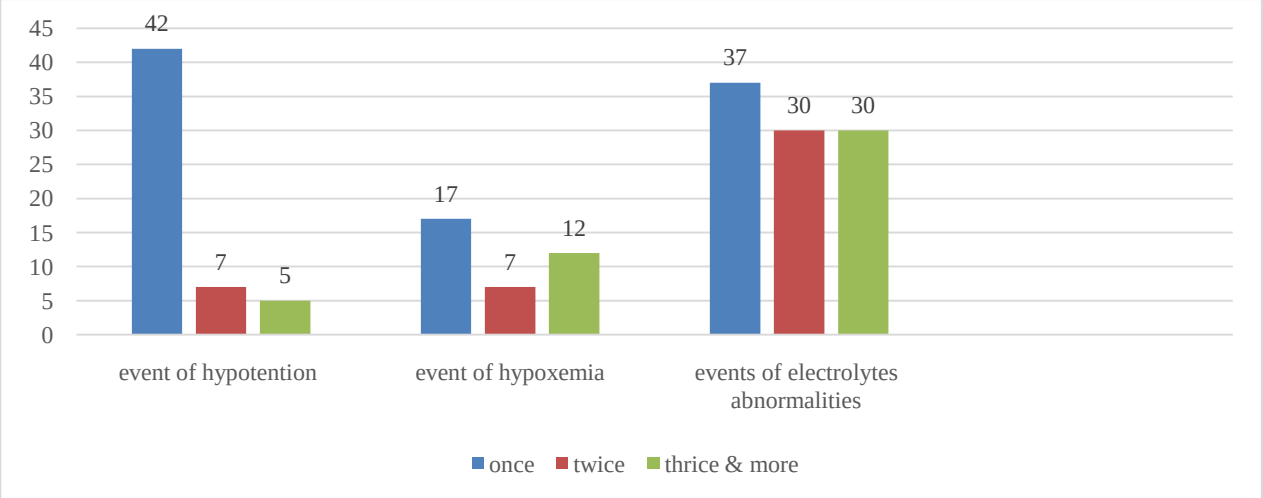
Table no 2: Distribution CABG patients in terms selected surgical profiles.

N = 120

Sl No.	Surgical profiles	Frequency	percentages
1.	Techniques of CPB		
	• On pump	2	2
	• Off pump	118	98
2	No of bypass graft		
	• Two	12	10
	• Three	58	48
	• Four	50	42
3	IABP used	2	1.6
4	Presence of No of drains		
	• One to two	Nil	-
	• Three	120	100
5	Event of re-exploration, reintubation, weaning failure	Nil	-
8	No of inotropic drugs used		
	• One	44	37
	• Two	70	58
	• Three	6	5

9	Events of hypotension	64	53
10	Events of hypoxemia	40	33
12	Events of electrolytes abnormalities	116	97
13	Respiratory complication	Nil	-

N=120



***** Data areneither mutually exclusive nor exhaustive

***Fig 2.** Distribution of events of hypotension, hypoxemia, electrolytes abnormalities in terms of no. of times.

Data presented in Table no 3 reflects that duration of sedation used and inotropic used are widely varied as shown by high SD

Table no 3: Mean, Median, SD of duration of MV, surgery time, drainage, sedation & inotropes.

N=120

Sl No.	Factors	Lowest duration (hrs.)	Highest duration (hrs.)	Mean (hrs.)	Median (hrs.)	SD
1	Duration of mechanical ventilation (MV)	8.8	42.5	18.5	17.4	06.9
2	Total surgery time	3.4	6.6	4.6	4.5	0.81
3	Duration of Drainage	26.5	60.7	35.5	34.4	07.8
4	Duration of sedation used	11.5	63.2	39.4	42.2	12.3
5	Duration of inotropic used	12.6	78.3	34.9	30.5	15.6

Data presented in table no 4 highlights that mean timing of active mobilization from bed to chair is 28.9 hours ±12; from chair to walking with assistance is 23 hours ±11; Bed to walking with assistance (ITU receiving to assisted walking) is 51.9 hours ±14.4 hours.

Table no 4: Mean, Median, SD of timings of active mobilization

N=120

Sl No.	Phases of active mobilization	Time duration (Hours)				
		Highest	Lowest	Mean	Median	SD
1	*Bed to chair (ITU receiving to bed to chair)*	68	12.8	28.9	22.7	12
2	Chair to walker (chair mobilization to walking with assistance)	51	2	23	23.9	11
3	Bed to walking with assistance (ITU receiving to walking)	92.3	28.5	51.9	45	14.4

Data presented in table 5, 6 reflects that BMI is significantly associated with timings of bed to chair active mobilization$(\chi^2=20,\ p \leq 0.05)$

Table no 5: calculation of*chi square*to determine the association between timings of active mobilization from bed to chair and co-morbidity, BMI&no of inotropes.

N=120

Bed to chair mobilization							
Sl No.	Factors		Above Median	Below Median	Chi-Square	df	P value
1	Co-morbidity	Hypertension	48	42	0.013	1	0.9
		DM & Other	33	30			
2	BMI	18.5-24.9	30	36	1.21	1	0.27
		>24.9	30	24			
3	No. of Inotropes	One	15	27	5.27	1	0.02
		Two - Three	45	33			

Table no 6:calculation of *chi square*to determine the association between timings of active mobilization from bed to assisted walking and co-morbidity, BMI&no of inotropes.

N=120

Bed to assisted walking							
Sl No.	Factors		Above Median	Below Median	Chi-Square	df	P value
1	Co-morbidity	Hypertension	51	39	2.82	1	0.09
		DM & Other	27	36			
2	BMI	18.5-24.9	24	48	20	1	<0.0001
		>24.9	36	12			
3	No. of Inotropes	One	27	24	0.31	1	0.57
		Two - Three	33	36			

Data presented in Table 7 shows that age *(r=0.27; p<0.05)*, duration of MV *(r=0.39; p<0.05)*, sedation used *(r=0.21; p<0.05)*, duration of inotropes *(r=0.50; p<0.05)* and events of hypoxemias *(r=0.45; p<0.05)* positively correlates with timings of active mobilization from bed to chair. Timings of active mobilization from bed to assistive walking, age *(r=0.26; p<0.05)*, duration of MV *(r=0.29; p<0.05)*, duration of drainage *(r=0.43; p<0.05)* and duration of inotropes *(r=0.38; p<0.05)* are also positively correlated.

Table no 7: calculation of *Pearson r* between timings of active mobilization and influencing factors**.**

N=120

Sl No.	Influencing Factors	Bed to chair	Chair to assisted walking	Bed to Assisted walking
1	Age	0.27*	0.04	0.26*
2	Duration of mechanical ventilation	0.39*	0.04	0.29*
3	Total surgery time	0.04	0.24	0.15
4	Duration of Drainage	0.09	0.46	0.43*
5	Duration of sedation used	0.21*	0.04	0.12
6	Duration of inotropes used.	0.50*	0.04	0.38*
7	No of events of hypoxemia	0.45*	0.24	0.18
8	No of events of arrythmia	0.12	0.08	0.14

IV. Discussion

Bed rest after surgery contributes to dysfunction of multiple organ systems. Immobility impairs oxygen transport including lung and tissue oxygenation; increases risk of deep vein thrombosis and pulmonary thromboembolism; and contributes to loss of muscle mass and strength.[8]Hence, the timing of mobilization initiation plays a key role in patients' recovery.

Rapid and improved recovery following surgery is dependent on early mobilization. Early mobilization following cardiac surgery should be performed as soon as patients' presents clinical conditions suitable for such intervention.

Recent studies have emphasized the importance of early mobilization for enhancing oxygen transport and functional return, and reducing postoperative complications and length of hospital stay.[9,10,11] Early mobilization following surgery thus has multiple benefits including improved ventilation, ventilation/perfusion matching, muscle strength and functional capacity.[11]

Data analysis of this study (N=120), reveals that hypertension is the most important risk factor for Coronary Artery Bypass Grafting.The prevalence of chronic disease was 89.4%, as reported by Ibrahimoglu O et al[12].

Intraoperative and postoperative data analysis reveals that majority of CABG are conducted off pump (98%), with patients requiring 3 bypass grafts being numerically more prevalent (48%).Thereare no events of re-exploration,re-intubation or weaning failure while the events of hypotension, hypoxemia and dyselectrolytaemia being 64,40 and 116 respectively.

The timing of initiation of mobilization may vary upon individual's tolerance and clinical factors.[12]According to some study passive mobilization was started in the intubation period as soon as patient become conscious.[13]In this study the median time of active mobilization from bed to chair (From ITU receiving to bed to chair mobilization) and for bed to walking with assistance (ITU receiving to assisted walking) is 22.7 hours and 45 hours respectively (Table 4).Ibrahimoglu O et al[12] conducted a study which reported similar median timing of 22.75 hours and 38.75 hours for sitting over edge of bed and for walking with assistance, respectively.

According to the ERAS (enhanced recovery after surgery), it is recommended that the patient spends 2h out of bed in the first 24 h after surgery and 6h a day until discharge in the following days. Timing of the initiation of mobilization after cardiac surgery varied between studies.[12]In this study number of inotrope requirement has an influencing factoron bed to chair mobilization (Table 5) while BMI is found to have significant consequence on timing of bed to assisted walking (Table 6). Also, the age *(r=0.27; p<0.05)*, duration of MV *(r=0.39; p<0.05)*, duration of sedation used *(r=0.21; p<0.05)*, duration of inotropes *(r=0.50; p<0.05)* and events of hypoxemia*(r=0.45; p<0.05)* positively correlates with timings of active mobilization from bed to chair. In case of timing of active mobilization from bed to assistive walking, age *(r=0.26; p<0.05)*, duration of MV *(r=0.29; p<0.05)*, duration of drainage *(r=0.43; p<0.05)* and duration of inotropes *(r=0.38; p<0.05)* are positively correlated (Table 7). So, these factors (both intraoperative and postoperative),which are positively correlating with the timings of mobilization, may create barrier in early active mobilization.

Despite the severity of patents during cardiac rehabilitation, the well-known benefits of early mobilization are accepted in diverse literatures, but some factors,as analyzed in our study, delay the concept of early hastening, circumvention of which should be comprehended subsequently.

V. Conclusion

Though early mobilization has beneficial effect on postoperative outcomes, several factors like age, duration of mechanical ventilation, duration of sedation and chest drainage, duration and number of inotropes used and hypoxemic events delay the initiation of the same. Hence it is the perioperative responsibility to identify the suitable clinical conditions at the earliest for instituting rapid and early mobilization.

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Authors Contribution:

- Study concept and design, Analysis and data interpretation&Critical revision of manuscript:**Prof. (Dr.) Kasturi Mandal**
- Proposal writing and obtaining ethical permission, Tool development and methodology, Study supervision&Analysis and data interpretation:**Ms. IpsitaBagchi**
- Tool development and methodologyAdministrative and technical support, Study supervision: **Prof. KathikaPattanayak**
- Study supervision, Tool development and methodology&Drafting of manuscript:**Prof. Madhusri Manna**
- Data collection, Contribution in data organization:**Ms. Ditipriya Das** and **Ms. Poulami Das**

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