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"INCIDENCE OF ORTHOSTATIC HYPOTENSION DURING PHASE I CARDIAC REHABILITATION AFTER CORONARY ARTERY BYPASS GRAFT SURGERY"

[1]Ankita Yelikar,[2] Manish P Shukla

[1]Ankita Yelikar, BPTh, Intern, MGM Institute of Physiotherapy, N-6, CIDCO, Aurangabad-431003, Maharashtra, India. Miss Ankita Yelikar at: ankitayelikar5@gmail.com
[2]Manish P Shukla, MPT, Associate Professor, MGM Institute of Physiotherapy, N-6, CIDCO, Aurangabad-431003, Maharashtra, India. Dr Manish shukla at: manish.shukla20@gmail.com

Abstract

Background: Orthostatic Hypertension (OH) is common after surgery and is related to an increased risk of postoperative morbidity. Previous studies reported a higher incidence of OH during early mobilization after major cardiac and abdominal surgery. The purpose of the present study was to determine the current prevalence of orthostatic hypotension in cardiac phase I rehabilitation undergoing coronary artery bypass graft patients.

Method: In this prospective observational study, we consecutively analyzed data from 31 patients who underwent CABG surgery. We examined the incidence of OH during phase I cardiac rehabilitation. We observed and documented the patient's blood pressure on POD-1, POD-3, and POD-5.

Result: In this study among 31 patients 22 (71%) patients were experienced orthostatic hypotension during phase I cardiac rehabilitation. In this 7 (32%) are females and 15 (68%) are males. We saw maximum patient's experienced postural hypotension only on POD-1 compared to the POD-3 or POD-5.

Conclusions: Results of this study suggest that approximately 71% of patients experience OH during phase I cardiac rehabilitation.

Keywords: Orthostatic hypotension, cardiac rehabilitation, CABG

INTRODUCTION

Orthostatic hypotension (OH), defined by a drop in blood pressure of at least 20 mmHg for systolic blood pressure and at least 10 mmHg for diastolic blood pressure within 3 minutes of standing up. [1] OH happens once mechanisms for the regulation of upright BP management fails. Such regulation depends on the baroreflexes tradinational blood volume and defenses against excessive blood vessel pooling.[2] Among hospitalized patients, about 60% adults experience OH and in the setting of an acute illness, immobilization and surgical in hospitals are risk factors for OH and its associated complications.[3]

According to the results of a recent population-based study, both diastolic OH and orthostatic hypotension increase the risk of cardiovascular mortality.[4] OH is common after surgery and is related to an increased risk of postoperative morbidity. For preventing complications like orthostatic hypotension during post operative care as the patients are immobilized for long time early mobilization can be very helpful.[5-6] Immobilization as a result of the operative procedure may lead to neuromuscular weakness, insuline resistance, joint contracture and orthostatic hypotension.[7-8] Even though there are advanced surgical techniques of cardiac surgeries remain major problem.[9] Several studies have shown increased sympathetic and decreased parasympathetic tone in patients with acute myocardial infarction at 30 or 60 days after CABG, compared with age-matched healthy subject.[10]

Previous studies have reported that cardiac surgical patients being mobilized 12–18 h postoperatively have a marked reduction in the central venous oxygen saturation (ScvO2), suggesting an imbalance between systemic oxygen delivery and tissue oxygen consumption. Furthermore, drugs used for premedication, anaesthesia, and postoperative analgesia, including opioids may contribute to orthostatic intolerance because of a reduced arterial pressure and an associated reduction in cerebral blood flow and oxygenation.[11,12] Transient inability to ambulate is observed after ambulatory surgery and is a major cause of prolonged hospital stay.[13] The prevalence and duration of orthostatic intolerance in patients after major procedures like coronary artery bypass graft is not known.

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Previous study examined the incidence of OH during early mobilization after major cardiac and abdominal surgery. However, there is limited study that showed the incidence of orthostatic hypotension during phase I cardiac rehabilitation after coronary artery bypass graft surgery.

Method

This observational study was conducted in a tertiary institutional cardiovascular & thoracic surgery ICU from November 2019 to August 2020. The study was approved by the Institutional Research Board and informed consent was obtained from each patient who met the eligibility criteria. The study population included consecutive patients scheduled to undergo elective cardiac surgery and coronary artery bypass grafting (CABG) with or without cardiopulmonary bypass (CPB). Exclusion criteria consisted of age <18 years, the use of thoracic epidural analgesia, and the presence of severely impaired cardiac function as defined by the left ventricular ejection fraction <20% or the need for preoperative inotropic support or intra‐aortic balloon pump. Postoperatively, patients were secondarily excluded if they presented neurological impairment, hemodynamic instability, metabolic acidosis (blood lactate >3 mmol/L), or persisting pain (visual analog scale >4/10) that precluded mobilization. All patients were managed by the same team of cardiac surgeons and anesthetists in the operating theater and in the ICU.

Patients were transferred from cardiac OT to the intensive care unit after CABG and received ventilatory support in addition to treatment for hemodynamic stabilization and electrolyte balance. Cardiac rehabilitation commenced on the first day after CABG depending on their condition. A cardiac physiotherapist examined the incision, pain severity, mobility and assessed vital parameters during an attempt to perform a standing exercise on postoperative day 1 (POD- 1). Systolic blood pressure (mmHg; SBP), diastolic blood pressure (mmHg; DBP), heart rate (beats per minute; HR), oxygen saturation (percentage; SpO2), and respiratory rate (frequency per minutes; RR) were monitored. Their values in a supine position were defined as the baseline levels. We evaluated patients in the supine position, while sitting on the edge of a bed (immediate, 3 and 5 min after), and while standing (immediate and 3 min after).

For blood pressure measurements, a brachial cuff was placed around the left arm kept in a fixed position at heart level. Supine and standing blood pressure measurements were always taken on the same arm as seated measurements (right arm, unless there was a medical contraindication). After 20 min of supine rest, measurements were taken for 2 min. Participants were then instructed to stand. To prevent cuff slippage and to assure a standard, comfortable position, participants were asked to bend their elbows and to support the hand of the cuffed arm with their other hand. When their feet touched the ground, standing measurements were taken for 2 min. Postural blood pressure change was calculated as the average of the supine minus the average of the standing blood pressure measurements.

HR was measured using an electrocardiogram of the same monitor. SpO2 was measured using a probe that attached to the right finger. OH and the cardiovascular response while the patients transitioned from sitting on the edge of the bed to standing were evaluated. Patients were classified using the consensus definition (OH =≥ 20 mm Hg drop in SBP or ≥ 10 mm Hg drop in DBP).

Statistical analysis

Analyses were conducted using SPSS statistics 23. A estimation of population mean based on previous experience (SD-14, precision-5% with 1- α set level of confidence -0.95) indicated that 31 participants were sufficient to show effects. Age-specific and age-adjusted (to mean age) incidence of OH were calculated. All values are expressed as median (1st–3rd quartiles) unless stated otherwise. Risk factor levels and 95% confidence intervals (CI) were calculated by OH status, controlling for age, and gender. Comparisons between supine, sitting and standing blood pressure after surgery were determined by the paired t test and the Mann–Whitney *U* test used for between the POD-1 to POD-5.

Result

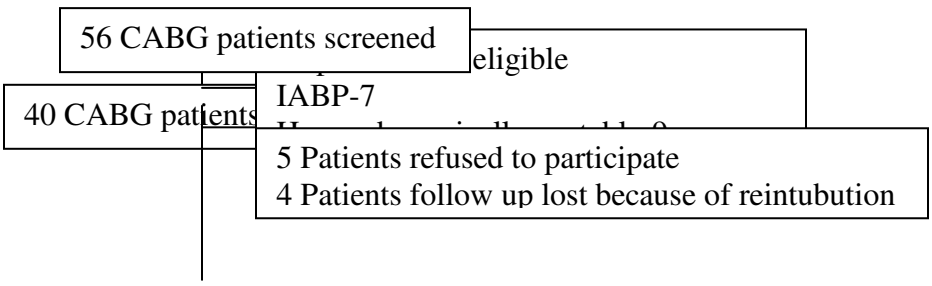

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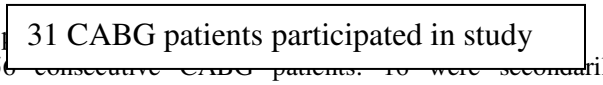
Figure 1:- Flow of p



We considered 50 consecutive CABG patients. 10 were secondarily excluded (IABP-7, Haemodynamically unstable-9, Finally 31 patients were included in the present study [Figure 1]. Baseline characteristics are presented in Table 1.

Table:1: Demographic Characteristics

Characteristics	**n=31**
Age	61.09±9.91
Gender (M/F)	25/6
Orthostatic Hypotension	22 (71%)

The majority of patients were male 25 (81%), female 6(19%) with a mean age of 61.09±9.91 years. The proportion of orthostatic hypotension in the present study was 71% in phase I cardiac rehabilitation undergoing coronary artery bypass graft patients. The general characteristics of the 31 coronary artery bypass grafting surgery patients of whom 25 (80.64%) were men and women 6 (19.35%) are shown in Table 1. OH was present in 22 patients (20 men and 2 women).

Table 2: Comparison of **SBP** on POD-1, POD-3 and POD-5 between supine Vs sitting, supine Vs standing and sitting Vs standing.

SBP	**POD-1**			**POD-3**			**POD-5**		
	Supine Vs Sitting	**Supine Vs Standing**	**Sitting Vs Standing**	**Supine Vs Sitting**	**Supine Vs Standing**	**Sitting Vs Standing**	**Supine Vs Sitting**	**Supine Vs Standing**	**Sitting Vs Standing**
Mean diff	14.96	16.35	1.38	10.83	12.16	1.32	9.09	10.61	1.51
t-value	3.209	3.55	0.285	2.911	3.237	0.337	2.56	2.933	0.397
p value	0.002*	0.001**	0.777	0.005*	0.337	0.737	0.013*	0.005*	0.693

The table 2 represents that comparison between mean differences of SBP of POD-1, POD-2 & POD-5 shows statistically significant correlation between supine Vs sitting & supine Vs standing. However, SBP from the supine to the standing position, there was mean difference of 16.35 ($p<0.001$) on POD-1 showed highest difference compared with other post-operative days. Whereas SBP from sitting to standing was not showed any significant mean difference on POD-1 (1.38, $p>0.77$) and POD-5 (1.51, $p>0.69$).

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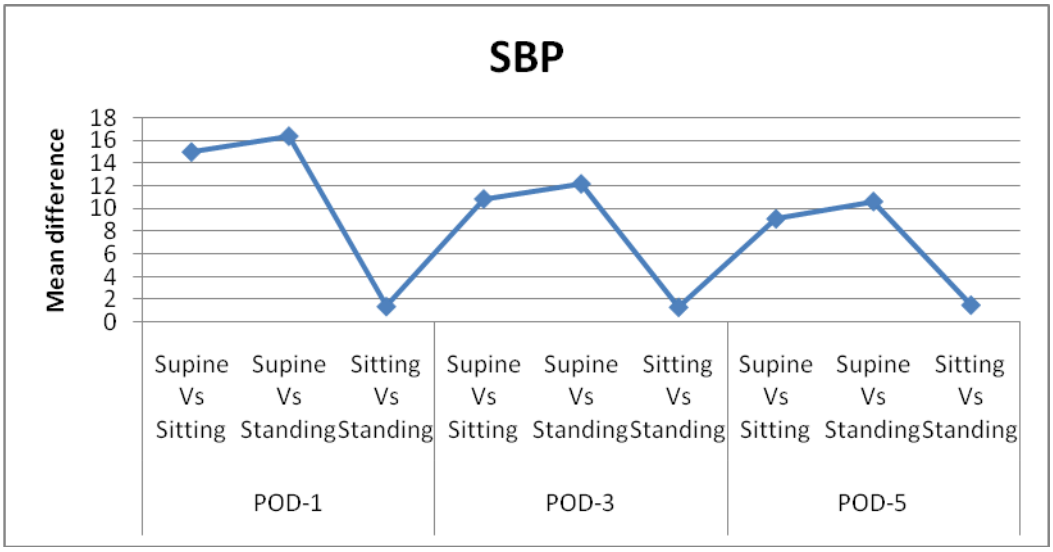

Fig:2 Comparision of SBP responses on POD-1, POD-3 and POD-5 in supine to sitting, supine to standing and sitting to standing

Table 3: Comparison of **DBP** on POD-1, POD-3 and POD-5 between supine Vs sitting, supine Vs standing and sitting Vs standing.

DBP	**POD-1**			**POD-3**			**POD-5**		
	Supine Vs Sitting	**Supine Vs Standing**	**Sitting Vs Standing**	**Supine Vs Sitting**	**Supine Vs Standing**	**Sitting Vs Standing**	**Supine Vs Sitting**	**Supine Vs Standing**	**Sitting Vs Standing**
Mean diff	8.09	9.06	0.96	6.90	7.64	0.741	5.12	6.12	1.0
t-value	3.480	3.986	0.407	3.582	3.997	0.402	2.095	2.583	0.424
p value	0.001*	0.000*	0.685	0.001*	0.000*	0.689	0.040	0.012	0.673

The table 3 represents that comparison between mean differences of DBP of POD-1, POD-2 & POD-5 shows statistically significant correlation between supine Vs sitting & supine Vs standing. However, DBP from the supine to the standing position, there was mean difference of 9.06 (p=0.000) on POD-1 showed highest difference compared with other post-operative days. Whereas SBP from sitting to standing was not showed any significant mean difference on POD-1 (0.96, p>0.68) and POD-5 (1.0, p>0.67).

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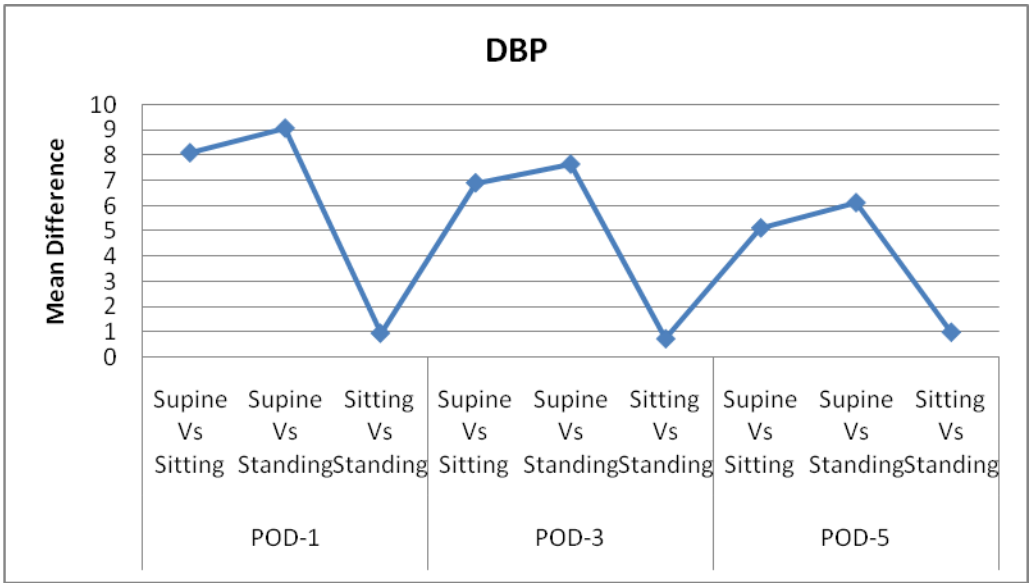

Fig:3 Comparision of DBP responses on POD-1, POD-3 and POD-5 in supine to sitting, supine to standing and sitting to standing

Discussion

The main findings of the present study in patients who had undergone coronary artery bypass grafting surgery; we found that 71% experienced OH during phase I cardiac rehabilitation after surgery. The results suggest that the range of variation in systolic & diastolic blood pressure responses during POD - 1 to POD-5 phase I cardiac rehabilitation and we did not recognize an association between the cardiovascular response and symptoms. In general, postoperative patients are particularly vulnerable upon mobilization aggravate the postural reduction in central blood volume in the upright position.[10] However; a previous study also indicated that there was no relationship between postoperative symptoms and cardiovascular response during early mobilization.[11]

In this study among 31 patients 22(71%) patients were experienced orthostatic hypotension in this 7(32%) are females and 15(68%) are males. In 7 females most of the females were already suffered from hypertension. It revealed that anesthesia effect on POD-1 and hypertension was experience to orthostatic hypotension during early mobilization in phase I. We observed patient's blood pressure on POD-1, POD-3 and POD-5 so in this we saw maximum patient's experienced postural hypotension only on POD-1 compared to the POD-3 or POD-5. We also observed that patient has their anesthesia effect on post operative POD-1 and also patient was on vassopressor it might not be having influenced with orthostatic hypotension but we cannot neglect this. Very high postural hypotension was experienced in patient when they changed their positions from supine to sitting (on edge of the bed) on POD-1.

In this study 14 patients were diagnosed type 2 diabetes with orthostatic hypotension. Due to which no effect occurred on mean blood glucose after grouping. Diabetes is also well known cause of orthostatic hypotension in coronary artery bypass graft. Females are at an increased risk for orthostatic hypotension as a result of common variables related to body size and hormones[14]. However, this study did not show similar results. Among this patient showed presence of orthostatic hypotension with mean difference of systolic blood pressure between supine, sitting and standing and mean difference of diastolic blood pressure between supine, sitting and standing also the symptoms which were experienced by patients such as weakness, dizziness and nausea[15]

The results obtained from our study can say that the incidence of orthostatic hypotension after coronary artery bypass graft surgery is high (71%) therefore it is not possible to mobilized this patients as it is likely they may develop dizziness, drowsiness which may can increase risk of fall further. Moreover, long term immobilization of post surgical patients may cause consequences such as alteration of activity of daily living, loss of muscle strength and endurance, altering metabolism, decreased cardiac reserve, venous thromboembolism.

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Conclusion

The present study found that 71% patient experience orthostatic hypotension during phase I cardiac rehabilitation undergoing coronary artery bypass graft surgery.

Ethical Clearance: The study was approved by the local ethics committee of the MGM Institute of Physiotherapy, Aurangabad- MGM IOP/IEC/UG/2020/06 dated 24/03/2020

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Source of Funding: Self

Conflict of Interest Statement: None

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