



Effect of Early Physical Therapy Rehabilitation on Patients Following CABG

Dev K.¹, Sambharwal A.³

1.Assistant Professor, Department of Physiotherapy, GJUS&T, Hisar
2.MPT, Guru Jambheshwar University of Science & Technology, Hisar

Abstract

The goal of this study was to determine whether there is significant change in oxygen saturation Post one single cardiac rehabilitation session post CABG. This study will help us in determining the effectiveness of cardiac rehabilitation along in improving oxygen saturation, and determine rate of change in heart rate and rate of perceive exertion in patients with coronary artery bypass grafting (CABG) surgery. The participants in the study were first examined using a predetermined methodology. All of the previously specified inclusion and exclusion criteria were applied to the study participants. If the study participant met all of the criteria, they were informed about the ongoing research as well as all aspects of the study, including the process and dangers. The study participants were then taken for the trial after signing an informed consent form. The study had a total of twenty individuals who were assigned at random. Before and after the treatment method, the participants were assessed and reassessed, and data was obtained using an assessment instrument. it was found that physical therapy plays an important role in recovery from post surgery. It incorporates fast recovery and speedy healing of the patients. Physiotherapy intervention was used for chest physiotherapy, upper limb exercises and lower limb exercises. Chest physiotherapy includes the Active Cycle of Breathing Technique. 4 exercises for the lower limb and 3 exercises for the upper limb were used to improve the mobility of the patients. It was also found during the study that male patients were better as compared to the female patients who underwent the CABG surgical procedure. The sample size was small to check the effectiveness of physical therapy in heart rate, oxygen saturation , temperature and blood pressure. Future research with large size can be done.

Keywords: CABG, Heart rate, oxygen saturation, blood pressure

Introduction

CABG surgery is a type of cardiac surgery that involves rerouting blood around obstructed arteries to improve blood flow and oxygen to the heart. ⁽¹⁾

A segment of a healthy vessel (either an artery or a vein) from the leg, chest, or arm is used to build a bypass around the obstructed artery during CABG surgery. Depending on how many coronary arteries (and their main branches) are blocked, patients commonly have 1 to 5 bypasses every operation. ⁽²⁾

In the United States, around 3.50,000 individuals have coronary artery bypass graft (CABG) surgery each year. Death, myocardial infarction, severe ventricular dysfunction, and stroke are the most common cardiovascular consequences. We estimate that the overall cardiovascular complication rate is 10% or higher based on existing data. ⁽³⁾

Cardiac surgery is a well-established method with great efficacy and safety results in the treatment of heart patients all around the world. Among the several treatments available, coronary artery bypass grafting (CABG) is regarded as a viable option for the treatment of ischemic heart disease. ⁽⁴⁾

Coronary artery bypass grafting (CABG) is a well-established procedure for lowering the symptoms and mortality of coronary artery disease (CAD). ⁽⁵⁾

Clinical trials conducted in the 1970s and 1980s identified several major coronary artery disease (CAD) subgroups for whom coronary artery bypass grafting (CABG) provided incremental survival, angina relief, or both when compared to medical therapy, laying the groundwork for current practise patterns and CABG guideline recommendations. ⁽⁶⁾

In the 1950s, cardiac rehabilitation was first created. After a myocardial infarction in the 1970s, programmes primarily comprised of organised exercise (MI). The United States Department of Health and Human Services produced a clinical practise guideline on cardiac rehabilitation in 1995, which caused a shift from an exercise programme to a holistic approach that included exercise, lifestyle changes, and behavioural treatment. ⁽⁷⁾

Cardiac rehabilitation is a multidisciplinary approach to therapy that is implemented methodically and customised to the needs of individuals with cardiovascular disease (CVD). Cardiac rehabilitation, according to the American Association of Cardiovascular and Pulmonary Rehabilitation and the American Heart Association (AHA), is intended to improve physical, psychological, vocational, and social functioning while reducing or reversing the progression of CVD. ⁽⁸⁾

A medical director and an on-site emergency response team are required as part of the standard of care for cardiac rehabilitation programmes. ⁽⁹⁾

Cardiac rehabilitation usually begins in an inpatient environment and continues after discharge with outpatient treatments. Exercise, dietary counselling, behavioural counselling, vaccines, and smoking cessation programmes are all common components, as are medical services focused at regulating blood pressure, cholesterol levels, and diabetes mellitus. In this essay, we'll go through a few of these elements. Adherence to proper drug regimes is also emphasised in the programmes.⁽¹⁰⁾

In a study of more than 600,000 Medicare beneficiaries hospitalised for acute coronary syndromes, stable ischemic heart disease, or revascularization procedures, individuals who attended cardiac rehabilitation programmes had lower mortality rates than those who did not.⁽¹¹⁾

Over the last three decades, the benefits of cardiac rehabilitation have been frequently established, including a reduction in cardiovascular risk, improved emotional well-being, and improvements in a variety of other outcomes.⁽¹²⁾

Patients who have undergone open heart surgery are frequently treated with chest physiotherapy in the intensive care unit (ICU) during the first few days after surgery. The goals of physiotherapy are to reduce pain, enhance respiratory and peripheral muscle strength, reduce postoperative complications, shorten the duration of hospitalisation, and, as a result, reduce the length of stay. For open heart surgery patients, various types of chest physiotherapy and breathing training with or without mechanical devices are frequently suggested to prevent or reduce the incidence of compromised lung function. Early mobilisation, positioning, incentive spirometry (IS), expiratory positive airway pressure (EPAP), deep breathing exercises, respiratory muscle training, coughing support, and an active cycle of breathing techniques are some of them.⁽¹³⁾

Operational Definitions

Coronary Artery Bypass Graft Surgery

The operation known as coronary artery bypass graft surgery (CABG) is performed to treat coronary artery disease. The narrowing of the coronary arteries — the blood channels that give oxygen and nutrients to the heart muscle — is known as coronary artery disease (CAD).

Heart Rate

The wave of blood in the artery caused by the contraction of the left ventricle during a cardiac cycle is known as the heart rate. The amount of blood evacuated with cardiac contraction is reflected in the strength or amplitude of the pulse (stroke volume). An adult's pulse rate should be between 60 and 100 beats per minute.

According to the American Heart Association, a well-trained athlete's resting heart rate might range from 40 to 60 beats per minute (AHA).

Oxygen Saturation

The percentage of haemoglobin binding sites in the bloodstream occupied by oxygen is measured by oxygen saturation, sometimes known as "sats." Humans have a normal arterial blood oxygen saturation level of 95–100%.

Perceived Exertion

The rating of perceived exertion (RPE) is a scale that is used to determine the appropriate exercise intensity. It's used to track the progress and method of exercise in cardiac patients and other patients undergoing rehabilitation and endurance training.

Blood Pressure

The pressure exerted by circulating blood on the artery walls. Blood pressure is measured in two ways: systolic (measured while the heart beats, when blood pressure is at its greatest) and diastolic (measured when the heart stops beating, when blood pressure is at its lowest) (measured between heart beats, when blood pressure is at its lowest). The systolic blood pressure is written first, followed by the diastolic blood pressure (for example, 120/80).

Methodology

Study Design

- A pre and post-test experimental design was used in our study.

Sample Size

- 20 participants were selected in this study. Who met the inclusion criteria and willing to participate in the study voluntarily were recruited in the study. The samples were selected from Grecian Super Speciality Hospital, Mohali.

Time of study

- 4 months

Data collection technique

- Observation technique
- Schedule

Inclusion Criteria

- Patients with CABG post operated
- All study participants with the age group of 30 years to 70 years.
- Study participants with no endocrine abnormalities as hyper or hyperthyroidism.
- Study participants with no other organ involment.
- Study participants with gross motor power of each limb 4/5
- Study participants with GCS 15/15
- Room air patients
- Patients who undergone surgery within 1st weak of assigned of surgery
- Willing to participate in the study.

Exclusion Criteria

- History of COVID-19
- Study participants with associated neurological and psychological abnormalities as stroke, dementia etc.
- Study participants with cardiac pacemakers.
- Study participants with post- operative complication as severe alteration in blood pressure, pulse, E.C.G. abnormalities etc.
- Study participants who showed inconsistency with initial stages of exercises rehabilitation.
- Study participants with lower limb injury like traumatic injury.
- No history of previous cardiac surgery
- No any neurological disease
- No history of any previous respiratory disease

Instrumentations

- Cardiac monitor device
- Pulse oximeter
- Rate of Perceived Exertion (RPE) Scale
- Pen / pencil

Variables

Independent Variables

- Cardiac rehab exercises
- Range of Motion Exercises

Dependent Variables

- Oxygen saturation
- Heart rate
- Blood Pressure
- Rate of Perceived exertion

Protocol

A sample of 20 coronary artery bypass graft surgery (CABG) subjects who met the inclusion and exclusion criteria were given a detailed explanation about the purpose and the method of the doing study. A duly signed consent form was obtained from all the 20 subjects who voluntarily agreed to participate in the study (Appendix). Demographic details, neurological details and baseline investigations of the subjects were collected in the Evaluation Performa (Appendix). Prior to intervention, Baseline Heart rate , Oxygen saturation , Diastolic and Systolic BP and Temperature were recorded on all the following outcome measures for the pre- intervention data in the Data Collection Form (Appendix):

- Heart Rate
- Blood pressure
- Oxygen saturation
- Temperature

Procedure

The participants in the study were first examined using a predetermined methodology. All of the previously specified inclusion and exclusion criteria were applied to the study participants. If the study participant met all of the criteria, they were informed about the ongoing research as well as all aspects of the study, including the process and dangers. The study participants were then taken for the trial after signing an informed consent form.

The study had a total of twenty individuals who were assigned at random. Before and after the treatment method, the participants were assessed and reassessed, and data was obtained using an assessment instrument.

Procedure for Rate of Perceived Exerction

The modified Borg Scale was utilised to determine each subject's rate of perceived exertion (RPE). Since 1982, this 12-point scale has been used with numerical values ranging from 0 (nothing at all) to 10 (very heavy). Borg created and released this scale for the general public, and it has the same reliability and validity as the 15-point Borg Scale (Borg, 1982, 1970). Cooper, Grimby, Jones, and Edwards (1979) calculated a 0.9 1 test-retest correlation coefficient.⁽³⁶⁾

The RPE scale, according to Gutman, Squires, Pollack, Foster, and Anholm (1981), can be used to adjust exercise intensity. This was a post session design in which only the post session results on the dependent variables of RPE were analyzed.⁽³⁶⁾

Our closely controlled rehabilitative therapy progressed through four stages:

1. Chest physiotherapy:

Three or more sessions of active breathing exercises. The goal is to make airway clearance easier by releasing pulmonary secretion. Improve ventilation by retraining to a proper respiratory dynamic that makes the best use of the respiratory muscle. To improve muscle endurance. Patient supine, hips and knees flexed to release the abdominal muscle, feet flat on the bed, arms relaxed along the trunk are the reference positions.

- Breathing Control: take a deep breath that is quiet and tranquil. Patients breathe in via their nose and out through their mouths, with their lips parted.
- Deep Breathing/Thoracic Expansion Exercise: After a passive expiration, the patient is instructed to inhale deeply through the nose, keep air in the lungs for 3 seconds (inspiratory hold), and then softly exhale through parted lips until the lungs are empty.
- Huffing/Forced Expiration Technique: tightening the abdominal muscles while keeping the mouth and glottis open causes a forced but not violent expiration. Instead of coughing, a huff involves inhaling via an open mouth and throat.

2. Exercises for the lower limbs:

4 exercises, 10 repetitions per leg

The goal is to prevent muscular atrophy and weakening, joint stiffness and muscle soreness, and immobilization-related consequences. Position of reference: supine patient with upper limbs restricting surgical wound.

- Flexion and extension of the ankle
- one leg is flexed at the hip and knee with the foot flat on the bed: contralateral hip flexion with extended knee and dorsiflexed ankle
- one leg flexed at the hip and knee with foot flat on the bed: contralateral hip, knee, and ankle triple flexion, bringing knee toward chest After that, extend the leg while keeping the ankle in a neutral posture.
- hips and knees flexed, feet flat on the bed: patient elevates pelvis by engaging glutes and supporting with feet and shoulders.

3. Exercises for the upper limbs:

4 exercises, 10 repetitions per leg

The goal is to prevent muscular atrophy and weakening, joint stiffness and muscle soreness, and immobilization-related consequences.

Supine with arms relaxed along the trunk is the standard position. The patient performs the exercises in a symmetrical manner to avoid stress on the sternum:

- With the elbows flexed at 90 degrees, alternate opening and shutting the hands while keeping the wrist in a neutral position (aligned with the forearm).
- bend the elbows till the hands are in contact with the ipsilateral shoulder.
- Raise the shoulders to 90 degrees, then internal rotate the shoulder and flex the elbows until the hands meet the opposing shoulder. Finally, get back to where you started.
- Raise the shoulders to 90 degrees, then internal rotate the shoulder and flex the elbows until the hands meet the opposing elbow. The serratus anterior muscle is then activated with forward pushing motions (really upwards pushing actions because the patient is supine).

4. Standing and ambulation after transitioning from bed to chair

The goal is to avoid the negative impacts of immobility and to help people regain their independence. During hospital convalescence, simple exposure to orthostatic or gravity stress, such as occasional sitting or standing, eliminates much of the decline in exercise performance that occurs after an acute cardiac event.

During this phase, the patient does the following actions:

- Using a rod, shift from supine to sitting on the side of the bed with legs dangling.
- transition from a sitting position on the edge of the bed to a standing position (with or without therapist support)
- achieving a sitting position on a chair next to the bed (with or without direct assistance)
- ambulation in the hospital room or on the ward (with or without assistance).

Table No. 1.1 Demographic details of the patients.

Demographic details	N	Mean ± S.D
Age (Years)	20	60.16±6.40
Sex	20	0.89±0.31
Weight(kg)	20	74.17±2.49
Height(cm)	20	165.47±2.95
POD	20	5.63±1.53

POD: Post Operative Day

Table No. 5.2 Comparison between pre and post heart rate

	Heart Rate (bpm)
	Mean \pm S.D
Pre	76.53 \pm 4.31
Post	80.53 \pm 3.80

Pre: Pre Session

Post: Post Session

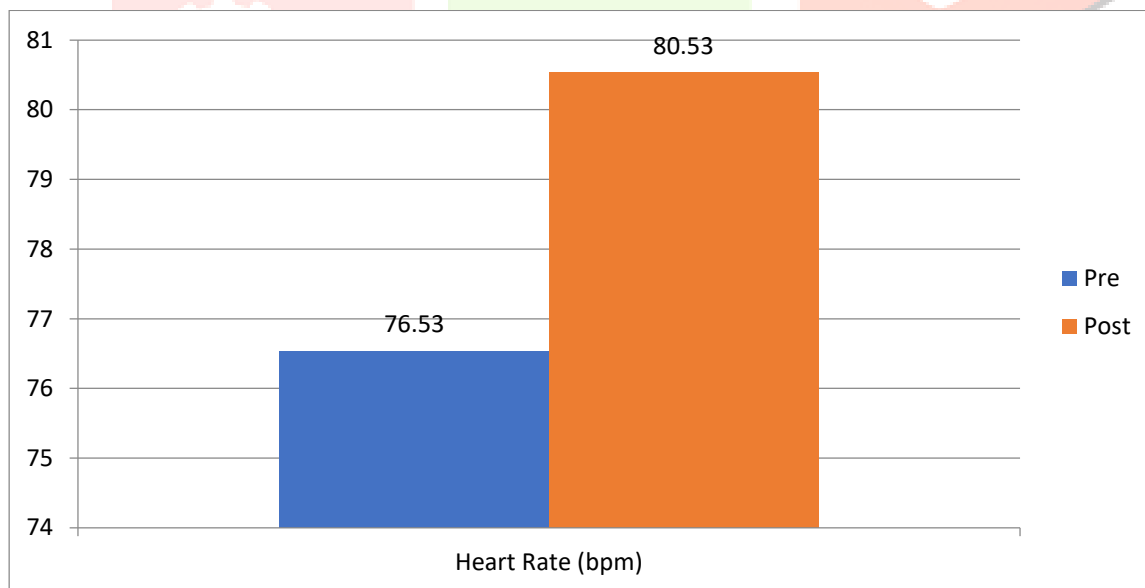
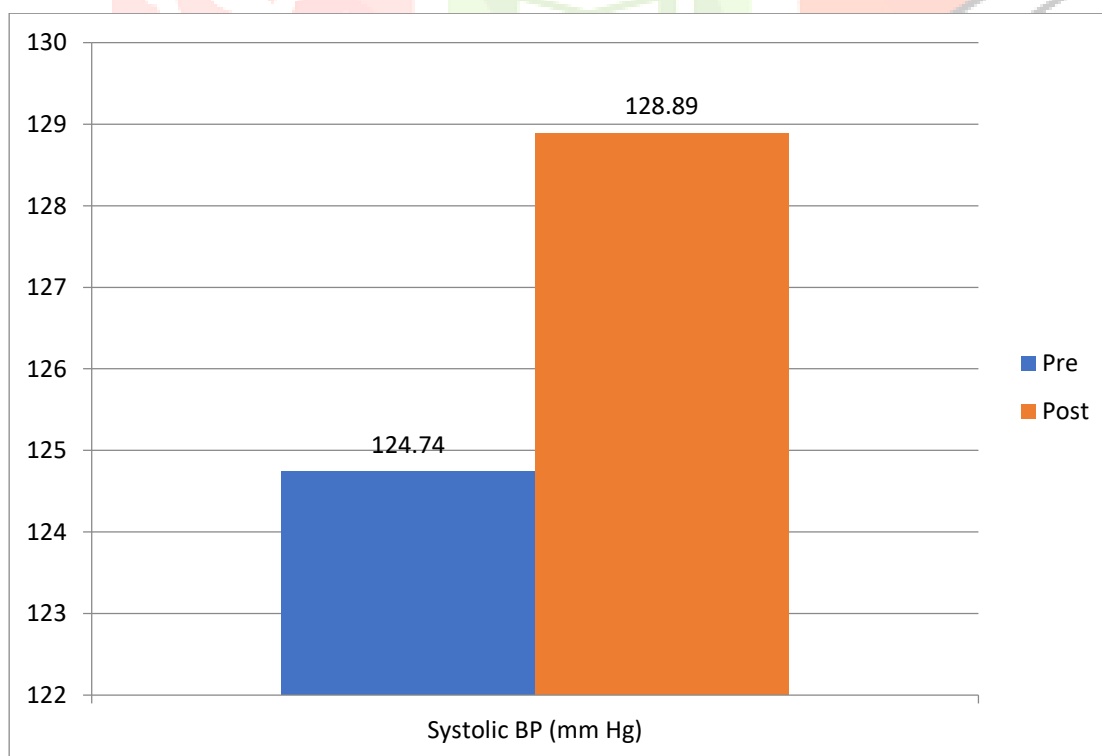
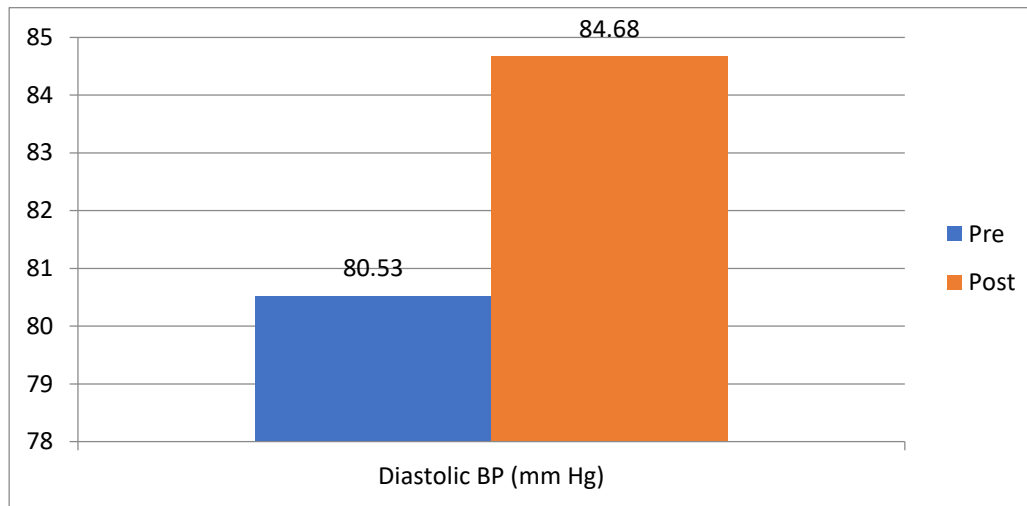
Graph No. 5.1 Comparison between pre and post heart rate

Table No. 5.3 Comparison between pre and post blood pressure

	Blood Pressure (mm Hg)
	Mean ± S.D
Pre Systolic BP (mm Hg)	124.74±5.21
Post Systolic BP (mm Hg)	128.89±5.51
Pre Diastolic BP (mm Hg)	80.53±5.26
Post Diastolic BP (mm Hg)	84.68±6.07

BP: Blood Pressure

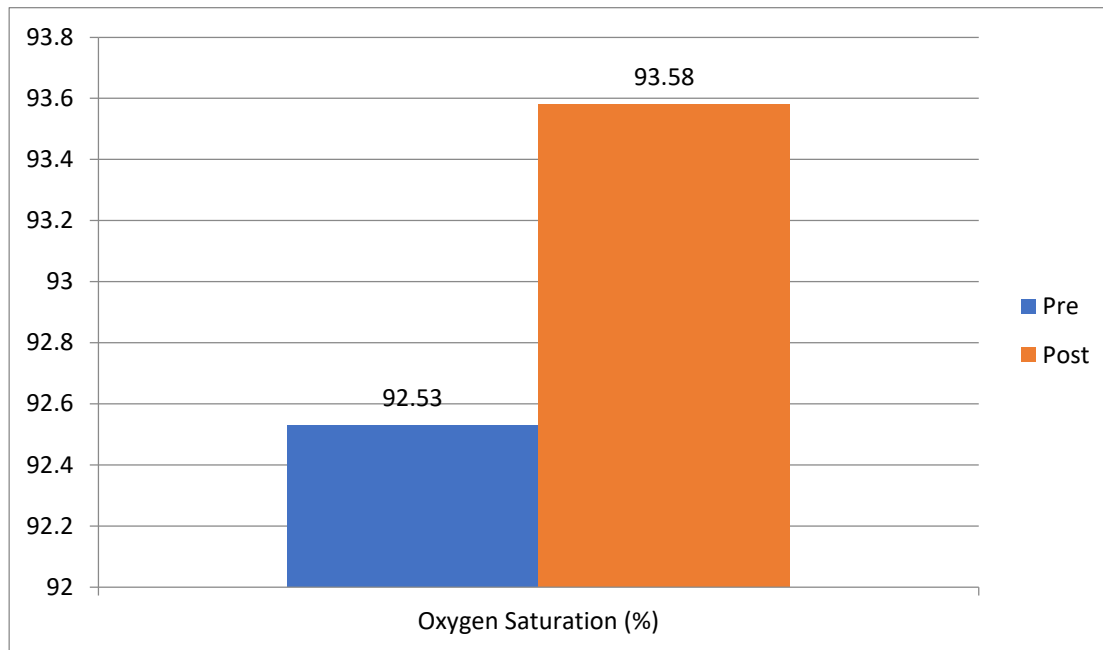
Graph No. 1.2 Comparison between pre and post systolic blood pressure

Graph No. 1.3 Comparison between pre and post diastolic blood pressure**Table No. 1.4 Comparison between pre and post oxygen saturation**

	Oxygen saturation
	Mean \pm S.D
Pre	92.53 \pm 2.19
Post	93.58 \pm 2.29

Pre: Pre Session

Post: Post Session

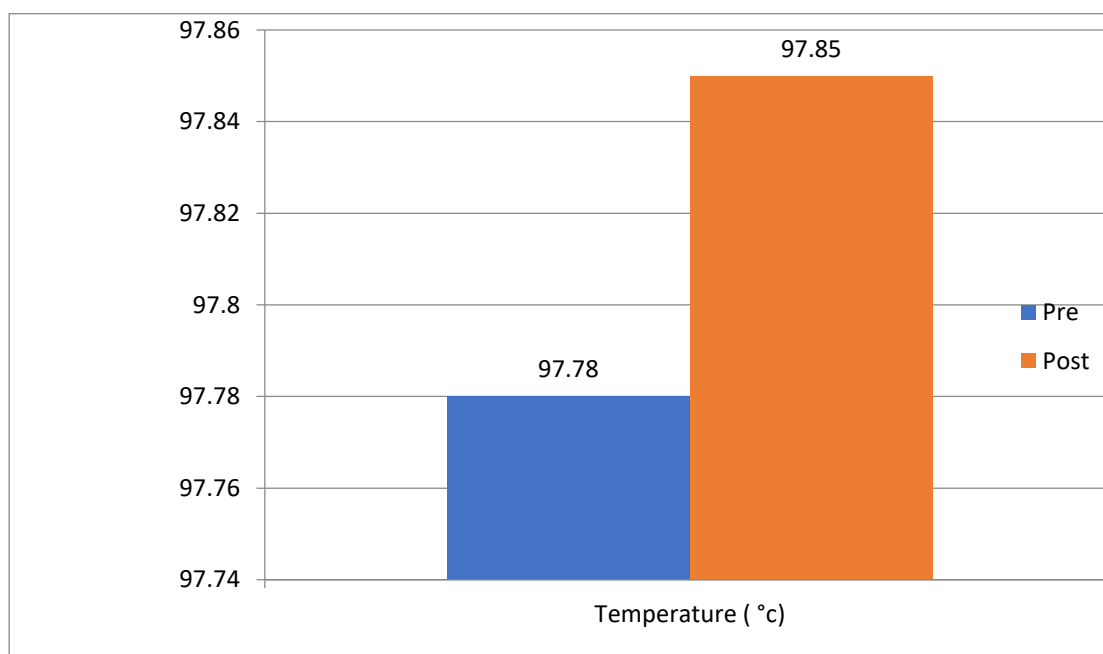
Graph No. 1.4 Comparison between pre and post oxygen saturation**Table No. 1.5 Comparison between pre and post temperature**

		Temperature
		Mean \pm S.D
Pre		97.78 \pm 0.52
Post		97.85 \pm 0.52

Pre: Pre Session

Post: Post Session

Graph No. 1.5 Comparison between pre and post temperature



This chapter deals with the result of data of result analysis of intervention comparing pre variables with post variables. Patient's were analyzed for different-different variables (heart rate, blood pressure, oxygen saturation, temperature) pre and post interventional.

In this study 20 patient's (18 male, 2 female) participated. Mean age of patient's are 60.16 ± 6.40 , mean of sex 0.89 ± 0.31 , mean of weight 74.17 ± 2.49 kg, mean of height 165.47 ± 2.95 cm, mean of POD 5.63 ± 1.53 .

Paired T test are used to calculate the values of variables between the pre and post intervention. The mean of pre heart rate 76.53 ± 4.31 beats/min and post heart rate 80.53 ± 3.80 beats/min, mean of pre systolic blood pressure 124.74 ± 5.21 mm Hg and postsystolic blood pressure 128.89 ± 5.51 mm Hg, Mean of pre diastolic blood pressure 80.53 ± 5.26 mm Hg and post diastolic blood pressure 84.68 ± 6.07 mm Hg, Mean of pre oxygen saturation 92.53 ± 2.19 % and post oxygen saturation 93.58 ± 2.29 %, mean of pre temperature 97.78 ± 0.52 °C and post temperature 97.85 ± 0.52 °C.

After statistically analysis

Comparison of Pre-intervention and Post-intervention of Heart Rate

Analysis of data by paired t test indicated that there was a significant difference between pre- intervention and post-intervention values of heart rate ($t= -11.69, df=18$). Descriptive statistics (mean and standard deviation) were also calculated (see Table 5.2, Fig 5.1). Mean \pm standard deviation valves for heart rate are indicated as follows:

Pre-intervention heart rate: 76.53 ± 4.31

Post-intervention heart rate: 80.53 ± 3.80

Comparison of Pre-intervention and Post-intervention of Blood Pressure

Analysis of data by paired t test indicated that there was a significant difference between pre- intervention and post-intervention value of systolic blood pressure ($t= -18.91, df=18$). Descriptive statistics (mean and standard deviation) were also calculated (see Table 5.3, Fig 5.2). Mean \pm standard deviation valves for heart rate are indicated as follows:

Pre-intervention systolic blood pressure: 124.74 ± 5.21

Post-intervention systolic blood pressure: 128.89 ± 5.51

Analysis of data by paired t test indicated that there was a significant difference between pre- intervention and post-intervention value of diastolic blood pressure ($t= -10.22, df=18$). Descriptive statistics (mean and standard deviation) were also calculated (see Table 5.3, Fig 5.3). Mean \pm standard deviation valves for heart rate are indicated as follows:

Pre-intervention diastolic blood pressure: 80.53 ± 5.26

Post-intervention diastolic blood pressure: 84.68 ± 6.07

Comparison of Pre-intervention and Post-intervention of Oxygen Saturation

Analysis of data by paired t test indicated that there was a significant difference between pre- intervention and post-intervention values of oxygen saturation ($t= -4.72, df=18$). Descriptive statistics (mean and standard deviation) were also calculated (see Table 5.4, Fig 5.4). Mean \pm standard deviation valves for heart rate are indicated as follows:

Pre-intervention oxygen saturation: 92.53 ± 2.19

Post-intervention oxygen saturation: 93.58 ± 2.29

Comparison of Pre-intervention and Post-intervention of Temperature

Analysis of data by paired t test indicated that there was a significant difference between pre- intervention and post-intervention values of temperature ($t = -3.63$, $df = 18$). Descriptive statistics (mean and standard deviation) were also calculated (see Table 5.5, Fig 5.6). Mean \pm standard deviation values for heart rate are indicated as follows:

Pre-intervention temperature: 97.78 ± 0.52

Post-intervention temperature: 97.85 ± 0.52

Discussion

CABG surgery is a type of cardiac surgery that involves rerouting blood around obstructed arteries to improve blood flow and oxygen to the heart.

The study was done to check the effectiveness of pre and post physical rehabilitation on oxygen saturation, heart rate and perceived exertion in patients following coronary artery bypass grafting surgery. The study lasted four weeks in total. The result was compared with pre and post interventions.

Twenty participants were selected in this study who met the inclusion criteria and were willing to participate in the study voluntarily. The samples were selected from Grecian Super Speciality Hospital, Mohali. The measurement tools which were used were the Cardiac monitor device, Pulse oximeter and Rate of Perceived Exertion (RPE) Scale in the study to check oxygen saturation, heart rate, blood pressure and perceive exertion along with this modified Borg scale being used.

Physiotherapy intervention was used for chest physiotherapy, upper limb exercises and lower limb exercises. Chest physiotherapy includes the Active Cycle of Breathing Technique. 4 exercises for the lower limb and 3 exercises for the upper limb were used to improve the mobility of the patients.

Daniel da Costa Torres & Priscila Maria Ramos dos Santos found that it will be possible to introduce an early mobilization protocol in the ICU routinely unit and sensitize the medical board about the importance of proper physiotherapy conduct.⁽³⁷⁾ Gaurav Kapoor et al found that 2 minute step test and 6 minute walk test has an additional advantage on CABG patients recovery before and after exercise using terky's method.⁽³⁸⁾ vittorio SALA et al concluded that oxygen saturation and heart rate was improved after a single session of physical therapy in cardiac surgery.⁽³⁹⁾ Elena et al monitored oxygen saturation, heart rate, blood pressure and pain in thoracic wound in cardiac surgery patients after the physiotherapy rehabilitation.⁽³⁹⁾

Dennis T. Mangano et al found that CABG is the leading cause of death in patients due to impact of ageing and other changes in patients demographic changes.⁸⁾ Dmitry Vladimirovich below found that abdominal risk factors increased upto 70% in early cardiac surgery patients.⁽⁴⁰⁾ B Koerbemacher et al concluded in the study that anxiety and depression increases in post CABG surgery upto 40% and 24%.⁽⁴¹⁾ R. Gosselink et al stated that physiotherapy plays an important role in patients who are admitted in the intensive care unit. It increases the chance of survival.⁽⁴²⁾

Through this study, it was found that physical therapy plays an important role in recovery from post surgery. It incorporates fast recovery and speedy healing of the patients. It was also found during the study that male patients were better as compared to the female patients who underwent the CABG surgical procedure.

Limitations of the study:

The sample size was small to check the effectiveness of physical therapy in heart rate, oxygen saturation, temperature and blood pressure. Future research with large size can be done.

Session of therapeutic exercises can be increased.

Area included in the study was small.

Future scope of the study:

Study can be conducted with a larger sample size.

Similar effect can be compared on both genders.

Conclusion:

The result shows that there was a significant improvement in the oxygen saturation post early cardiac rehabilitation in patients who underwent CABG surgery. With change in other domains as Heart rate, Temperature, Blood pressure and rate of perceived exertion.

This study concluded that Early cardiac rehabilitation exercises is effective in improving oxygen saturation in patients with CABG surgery.

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