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Research Article

**EFFECTIVENESS OF POST-OPERATIVE RESPIRATORY
MUSCLE TRAINING FOR IMPROVING PULMONARY
HEALTH AFTER CORONARY ARTERY BYPASS GRAFTING**Dr Maryyam Rehan¹, Dr Ammara Zafar², Dr Aniq Ejaz²¹RIC, Rawalpindi²House Officer (Gen Surgery Ward)**Article Received:** August 2020**Accepted:** September 2020**Published:** October 2020**Abstract:**

Introduction: Coronary artery disease is the leading cause of mortality and morbidity of both men and women accounting for over one third of total deaths. **Objectives:** The main objective of the study is to analyse the effectiveness of post-operative respiratory muscle training for improving pulmonary health after coronary artery bypass grafting. **Material and methods:** This randomized clinical trial study was conducted in RIC during March 2019 to March 2020. The data was collected from those patients who underwent CABG. The data was divided into two parts, one was control group and one was study group. **Results:** The data was collected from 50 patients of surgery and both groups contain 25 patients. The demographic data was collected from both groups and the baseline values are same. Student's t-test was used to compare the means of hours of stay in the ICU in group A and group B patients. **Conclusion:** It is concluded that preoperative respiratory physiotherapy could have a positive effect on the improvement of quality of respiratory performance in patients undergoing open cardiac surgery.

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INTRODUCTION:

Coronary artery disease is the leading cause of mortality and morbidity of both men and women accounting for over one third of total deaths. Coronary heart disease (CHD) is the leading cause of death world-wide. Although men have higher rates than women at all ages, and coronary disease occurs up to 10 years later in women CHD is a major cause of death for both sexes: the World Health Organisation estimates that 3.8 million men and 3.4 million women around the world die from it each year. Despite recent improvements, the mortality rate in the UK remains amongst the highest in the world and coronary prevention is a priority.¹

In recent years, gender issues have received increasing attention in international health policy. For example, the recognition that medical research was largely based on the experiences of young white men led to initiatives to make research more gender sensitive in the United States, Canada, Australia and South Africa. It is therefore important that those caring for patients with CHD have an understanding of the gendered nature of health and illness.²

In order to cope the disease, coronary artery bypass grafting (CABG) was introduced as a novel advanced treatment in which, the patient undergoes general anesthesia. Usually the surgeon carries out sternotomy procedure and then the patient is attached to a cardio-respiratory bypass machine³. There is a high incidence of pulmonary complications (PC) after such surgeries. The global average prevalence of PC following CABG surgery was estimated to be 2-4% and the most common complications were reported as: atelectasis (27-95%), pleural effusion (16.6-88%) and phrenic nerve paralysis (30-75%). Probability of PC following the CABG is not clearly determined in Iran, however the incidence of PC following the general surgery has been reported as 50%, approximately⁴.

At present, various thoracic cavity physiotherapy techniques are used in order to increase the respiratory volumes, improve oxygenation and decrease respiratory complications after CABG⁷; however, despite the common use of respiratory exercises in

patients after CABG in different countries, there is still insufficient scientific evidence for their efficacy⁵.

Objectives

The main objective of the study is:

- to analyse the effectiveness of post-operative respiratory muscle training for improving pulmonary health after coronary artery bypass grafting.

MATERIAL AND METHODS:

This randomized clinical trial study was conducted in RIC during March 2019 to March 2020. The data was collected from those patients who underwent CABG. The data was divided into two parts, one was control group and one was study group. The patients in group A underwent physiotherapy 15 days before the surgical operation, with an emphasis on strengthening inspiratory muscles, and thoracic cavity physiotherapy was carried out based on the surgical ward routines. However, patients in group B received only postoperative physiotherapy based on surgical ward routines.

Preoperative therapy consisted of breathing exercise, neck and shoulder mobilization and exercises to strengthen muscles. Post-operative therapy consisted of manual techniques, techniques to clean the lungs, breathing exercise and expansion of the lungs. Patients of group A received physiotherapy prior to surgery but group B only receives physiotherapy after surgery. Evaluation of respiratory function was carried out by trained physiotherapists, using spirometry parameters and arterial blood gases.

Student's t-test analyses were used to compare the study variables at a confidence interval of 95%, using SPSS.

RESULTS:

The data was collected from 50 patients of surgery and both groups contain 25 patients. The demographic data was collected from both groups and the baseline values are same. Student's t-test was used to compare the means of hours of stay in the ICU in group A and group B patients (Table 01).

Table 01: Demographic variables of selected patients

Variables	Groups		P-Value
	Expression (n=25)	Control (n=25)	
Age; Years, mean (SD)	53.5 (10.9)	59.3 (10.45)	0.096
Gender; Female, frequency (%)	12 (36.7)	11 (33.3)	0.97
Smoking; Yes, frequency (%)	10 (30)	11 (33.3)	0.51
Diabetes mellitus; Yes, frequency (%)	12 (36.7)	9 (26.6)	0.29
Body Mass index (BMI); mean (SD)	25.8 (4.7)	26.7 (4.9)	0.46
Duration of operation, Hours ; mean (SD)	2.5 (0.23)	2.7 (.36)	0.82

In order to neutralize the effect of each patient's initial status in relation to respiratory function, spirometry and ABG parameters were measured in both groups before rehabilitation and surgery. The two groups were evaluated and compared regarding the differences in each parameter before and after rehabilitation per patient. Mean difference of PCO₂ concentration (of ABG parameters) in group A was significantly more than that in group B. It was observed no difference in the other parameters of ABG between two groups (Table 02). Mean difference of PCO₂ concentration (of ABG parameters) in group A was significantly more than that in group B.

Table 02: Mean for all outcomes for both study groups

Outcome		Groups		Difference between interventions
		Group B	Group A	Post minus pre-operative
		Control (n=25)	Expression (n=25)	Expression- Control
Spirometry indicators	FEV1	79.1 (13.4)	80.03 (12.4)	3.9 (-0.46 to 7.9)
	FVC	81.1 (10.6)	84.5 (8.96)	5.03* (1.3 to 8.7)
	PEF	74.0 (15.9)	68.5 (14.3)	5.7 * (1.979 to 9.4)
ABG parameters	pH	7.3 (0.06)	7.38 (0.05)	-0.01 (-0.05 to 0.031)
	PCO ₂	39.8 (7.7)	41.57 (3.44)	5.17* (1.43 to 8.9)
	PO ₂	106.9 (24.5)	149.9 (34.9)	2.53 (-23.9 to

DISCUSSION:

The complications of lung function impairment can be caused by various factors, one of which is pain. Owing to the presence of pain, shallow breathing may occur in patients, which will restrict their chest movement following cardiac surgery with median sternotomy⁵. The muscles for breathing, i.e. mainly the diaphragm, are important for inspiration. Surgeries in the chest might involve the muscles and nerves⁶. Dysfunction of the respiratory muscles preoperatively might prolong mechanical ventilation after cardiac surgery, such as coronary artery bypass grafting (CABG), mitral valve replacement, and aortic valve replacement, and reduce respiratory muscle strength, which has been known to be a determinant of reduced functional capacity postoperatively. Decreases in respiratory muscle strength can be measured using the maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) produced in the oral cavity; this has been reported in hospitalised patients after cardiac surgery⁷.

Conversely, the reported recovery time after discharge ranged from 6 to 8 weeks in some studies but was unknown in other studies. Respiratory muscle exercises have been provided for the treatment of patients before and after cardiac surgery for improving their respiratory muscle strength and preventing complications. Studies have shown favourable useful effects of respiratory muscle training before and after surgery to re-establish and improve inspiratory muscle strength, increase forced vital capacity (VC), and reduce the incidence of pneumonia and hospitalisation⁸.

Conversely, other studies have not found any effect. After surgery, lung function improves progressively; however, a postoperative decrease of lung function from 6% to 13% has been reported as compared with that in the preoperative period⁹. Numerous factors that affect postoperative lung function have been reported, e.g. postoperative inflammatory reaction, pleural variations, and atelectasis¹⁰.

CONCLUSION:

It is concluded that preoperative respiratory physiotherapy could have a positive effect on the improvement of quality of respiratory performance in patients undergoing open cardiac surgery.

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