



PRE-OPERATIVE INCENTIVE SPIROMETRY; EFFECTIVENESS TO IMPROVE POST-OPERATIVE OXYGENATION IN PATIENTS UNDERGOING CABG SURGERY

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ABSTRACT... Introduction: Coronary artery bypass surgery is associated with post-operative complications like, atelectasis, pneumonia, plural effusion, pulmonary edema which effect on post operative oxygenation of patient resulting in delayed recovery and prolong hospital stay. **Materials and method:** A total of 170 patients included in the study. **Study Design:** Randomized control trial. **Setting:** Department of Cardiac Surgery, Chaudary Pervaiz Elahi Institute of Cardiology Multan. Period: January 2016 to June 2016. **Objective:** To Compare postoperative oxygenation outcomes in patients undergoing CABG with and without pre-operative spirometry. **Results:** Oxygenation variables pre-operative mean PO₂ and SD in C group was 93.27 ± 5.04 and in I group 97.29 ± 2.31 . Similarly pre-operative PCO₂ in C group was 41.73 ± 3.22 and in I group was 38.78 ± 2.99 . Mean A-a gradient and SD in C group was 7.42 ± 1.70 and in I group 4.56 ± 1.11 . At the time of shifting from theater mean PO₂ in C group was 91.22 ± 4.64 and in I group was 98.20 ± 2.00 , similarly mean PCO₂ and SD in C group was 43.18 ± 3.47 and in I group 39.65 ± 1.15 . Mean A-a gradient and SD in C group was 8.02 ± 1.30 and in I group 3.87 ± 0.88 . After four hours mean PO₂ and SD in C group was 92.00 ± 5.05 and in I group 99.04 ± 1.15 . Mean PCO₂ after four hours in C group was 42.34 ± 4.08 and in I group 37.29 ± 2.93 . As concerned to A-a gradient mean and SD was 7.12 ± 1.70 and in I group 5.84 ± 1.92 . **Conclusion:** Preoperative incentive spirometry have improved postoperative oxygenation and reduce the incidence of postoperative complications following CABG.

Key words: Incentive Spirometry, CABG, PO₂

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INTRODUCTION

Pulmonary complications are involved in coronary artery bypass surgery, these complications adversely affect the oxygenation of patient which delayed patient's recovery, and prolonged hospital stay.¹ The incidence of these abnormality is associated with altered respiratory physiology and presence of risk factors², pleural effusion, pulmonary edema, early postoperative pneumonia are major radiological changes which can be describe post-operative pulmonary complications.³ These changes in normal ventilation are one of the highly damaging risk factor, because it is inherent in thoracic surgery.⁴ Delayed recovery is most common in patients who had coronary artery bypass surgery.⁵ The cause of delayed recovery and prolonged hospital stay is difficult to understand because it can be caused by variety of factors, for example,

pulmonary effusion, pain, general anesthesia, chest wall abnormalities, ascites, diaphragmatic malfunction or dysfunction.⁶ Moreover, when internal mammary artery is dissected, there is seen one sided blockage of blood supply to the intercostals muscles and phrenic nerve resulting in respiratory muscle dysfunction.⁷ Some techniques are also used to prevent pulmonary complications, like deep breathing exercise incentive spirometry, early mobilization and positive airway pressure.^{8,9} In a recent research for clinical trial of high risk individuals undergoing CABG, Hulzebos et al discovered that intensive inspiratory muscle training (7 times a week, for at least 2 weeks before the day of surgery) has deterred these postoperative complications of CABG and also reduced the incidence of hospitalization after CABG. In many studies pre-operative incentive spirometry is used to reduce

the post operative pulmonary complications and to improve post operative oxygenation, but results are not sufficient to support this equipment to reduce pulmonary complications.

MATERIALS AND METHODS

It was randomized control trial conducted from January 2016 to June 2016. Ethical approval was taken from the Department of Academic Affairs of Ch. Pervaiz Elahi institution of cardiology before starting the research work. One hundred and seventy (170) patients undergoing CABG surgery were included in the study. Patients were randomly assigned into two equal groups using binary number generator system. Informed consent was taken from patients. 170 Patients will be categorized into group C (control group) and group I (Incentive spirometry group) Group I was perform preoperative incentive spirometry while group C patient was not. The researcher was following all patients to observe preoperative incentive spirometry and postoperative recovery to see oxygenation. All the data was entered and analyzed using computer program SPSS version 10. Descriptive statistics was used to calculate mean and standard deviation for age, weight, height, BMI, and oxygenation variables (pre-operative, and post operative PO₂, PCO₂ and A-a gradient). Frequencies and percentages were calculated for gender and groups.

RESULTS

A total of 170 patients included in the study 77 (45.3%) were male and 93 (54.7%) were female. All patients were divided in two equal groups, C group (control group) and I group (Incentive spirometry group) 85 patients in each groups. Mean age and SD of patients in C group was 39.33 ± 12.21 and in I group 39.44 ± 12.06 (Table-I). As concerned to the weight, mean weight and SD in C group was 71.79 ± 13.03 and in I group it was 75.20 ± 11.33 , similarly mean height and SD in C group was 166.60 ± 13.71 and in I group 166.85 ± 17.39 (Table-I). Mean BMI and SD was 28.36 ± 6.06 . As concerned to the oxygenation variables pre-operative mean PO₂ and SD in C group was 93.27 ± 5.04 and in I group 97.29 ± 2.31 . Similarly pre-operative PCO₂ in C group was 41.73 ± 3.22 and in I group was 38.78 ± 2.99 . Mean A-a gradient and SD in C group was 7.42 ± 1.70 and in I group 4.56 ± 1.11 (Table-II). At the time of shifting from theater mean PO₂ in C group was 91.22 ± 4.64 and in I group was 98.20 ± 2.00 , similarly mean PCO₂ and SD in C group was 43.18 ± 3.47 and in I group 39.65 ± 1.15 . Mean A-a gradient and SD in C group was 8.02 ± 1.30 and in I group 3.87 ± 0.88 (Table-III). After four hours mean PO₂ and SD in C group was 92.00 ± 5.05 and in I group 99.04 ± 1.15 . Mean PCO₂ after four hours in C group was 42.34 ± 4.08 and in I group 37.29 ± 2.93 . As concerned to A-a gradient mean and SD was 7.12 ± 1.70 and in I group 5.84 ± 1.92 (Table-IV).

Groups	Mean Age \pm SD	Mean Weight \pm SD	Mean Height \pm SD	Mean BMI \pm SD
Control group	39.33 ± 12.21	71.79 ± 13.03	166.60 ± 13.71	26.20 ± 5.29
Incentive Spirometry group	39.44 ± 12.06	75.20 ± 11.33	166.85 ± 17.39	28.36 ± 6.06

Demographic Table

Groups	Pre-Operative PO ₂ Mean \pm SD	Pre-Operative PCO ₂ Mean \pm SD	A-a Gradient Mean \pm SD
Control Group	93.27 ± 5.04	41.73 ± 3.22	7.42 ± 1.70
Incentive Spirometry Group	97.29 ± 2.31	38.78 ± 2.99	4.56 ± 1.11

Table-I. Oxygenation

Groups	On Shifting PO ₂ Mean \pm SD	On Shifting PCO ₂ Mean \pm SD	A-a Gradient Mean \pm SD
Control Group	91.22 ± 4.64	43.18 ± 3.47	8.02 ± 1.30
Incentive Spirometry Group	98.20 ± 2.00	39.65 ± 1.15	3.87 ± 0.88

Table-II. Oxygenation

Groups	After Four Hours PO2 Mean \pm SD	After Four Hours PCO2 Mean \pm SD	A-a Gradient Mean \pm SD
Control Group	92.00 \pm 5.05	42.34 \pm 4.08	7.12 \pm 1.70
Incentive Spirometry Group	99.04 \pm 1.15	37.29 \pm 2.93	5.84 \pm 1.92

Table-III. Oxygenation

DISCUSSION

A total of 170 patients included in the study 77 (45.3%) were male and 93 (54.7%) were female. All patients were divided in two equal groups, C group (control group) and I group (incentive spirometry group) 85 patients in each groups. Mean age and SD of patients in C group was 39.33 ± 12.21 and in I group 39.44 ± 12.06 . As concerned to the weight, mean weight and SD in C group was 71.79 ± 13.03 and in I group it was 75.20 ± 11.33 , similarly mean height and SD in C group was 166.60 ± 13.71 and in I group 166.85 ± 17.39 . Mean BMI and SD was 28.36 ± 6.06 . As concerned to the oxygenation variables pre-operative mean PO₂ and SD in C group was 93.27 ± 5.04 and in I group 97.29 ± 2.31 . This result suggests that with use of spirometry technique, the preoperative oxygenation of patients was improved as PO₂ is evidently enhanced. Similarly pre-operative PCO₂ in C group was 41.73 ± 3.22 and in I group was 38.78 ± 2.99 . A study conducted by Ahmadreza et al in Iranian population and showed that incentive spirometry caused a mark able improvement in PO₂ and PCO₂. As stated earlier spirometry technique improved PO₂, similarly on the other hand when PCO₂ was considered there was considerable decrease in PCO₂ showing improved preoperative oxygenation. Mean A-a gradient and SD in C group was 7.42 ± 1.70 and in I group 4.56 ± 1.11 . Mean A-a gradient result also states that spirometry has increased preoperative oxygenation. In a study by Mordian et al showed that incentive spirometry can improve PaO₂ and SaO₂ on post-operative day of CABG.¹⁰ On the other side, there are different results reported by Afrasiabi et al. showed that the incentive spirometry does not have significant effect on improvement of post-operative oxygenation.¹¹ Brage also reported that improvement in post operative oxygenation with the use of incentive spirometry is not permanent, this improvement is reversible after short time.¹² At the time of shifting

from theater mean PO₂ in C group was 91.22 ± 4.64 and in I group was 98.20 ± 2.00 , similarly mean PCO₂ and SD in C group was 43.18 ± 3.47 and in I group 39.65 ± 1.15 . Hence, spirometry not only increased preoperative but when results for PO₂ and PCO₂ were taken after shifting the patient after operation the overall oxygenation was still improved in the I group than C group. Mean A-a gradient and SD in C group was 8.02 ± 1.30 and in I group 3.87 ± 0.88 . Another proof of how spirometry can improve oxygenation of the I group. In a study it is reported that incentive spirometry improve oxygenation at third post operative day in our study after four hours mean PO₂ and SD in C group was 92.00 ± 5.05 and in I group 99.04 ± 1.15 . Mean PCO₂ after four hours in C group was 42.34 ± 4.08 and in I group 37.29 ± 2.93 . As concerned to A-a gradient mean and SD was 7.12 ± 1.70 and in I group 5.84 ± 1.92 . These results taken after four hours of surgery suggest the same figures and it is well established by now that PO₂ is better and PCO₂ is decreased in I group as compared to C group.

However there was no record of pulmonary infection in any group of patients and no difference in their hospital or ICU stay.^{13,14}

Although breathing exercise is performed by almost every CABG patient, but different studies all over the world has shown that in some countries this treatment is not much efficient.^{15,16,17,18} The physical treatment costs and has its own adverse effects.¹⁹

During our study, preoperative, at the time of shifting and 4th day after CABG surgery pulmonary function measurements were taken. Like previous investigations, a marked reduction in lung volume was evident on fourth day after surgery.^{20,21} Moreover the spirometric variables were also improved in patients who performed breathing exercise on the fourth day as

compared to the control group, however effect on oxygenation was more obvious. Different studies which involved control group patients who did not receive any breathing physiotherapy is limited these days. Recruited lung tissue in the form of stunt is grafted on zone where oxygenation is still poor because of less perforation as compared to ventilation.^{22,23}

Mixed venous oxygen tension or cardiac output and efficiency of hypoxic pulmonary vasoconstriction are non-pulmonary factors which contribute to affect the arterial oxygenation.²⁴

CONCLUSION

Preoperative incentive spirometry have improved postoperative oxygenation and reduce the incidence of postoperative complications following CABG.

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*“Two things define you:
Your patience when you have nothing,
and your attitude when you have everything.”*

Unknown

AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Dr. Aamir Furqan	Manuscript writing, data collection and data analysis	
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