ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 10, Issue 2, 2017

Online - 2455-3891
Print - 0974-2441

Research Article

THE EFFECTIVENESS OF PRE-OPERATIVE DEEP BREATHING EXERCISE ON POST-OPERATIVE PATIENTS OF ABDOMINAL SURGERY

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Received: 27 August 2016, Revised and Accepted: 05 November 2016

ABSTRACT

Objectives: The aim was to assess the effect of routine post-operative care on 1st, 3rd, 5th, and 7th post-operative day on peak expiratory flow rate (PEFR) in patient undergone abdominal surgery (controlled group). To assess the effect of deep breathing exercises by using diaphragmatic breathing exercise during post-operative care on 1st, 3rd, 5th, and 7th post-operative day on PEFR in patient undergone abdominal surgery (study group). To compare PEFR in control and study group.

Methods: This study investigated the effects of pre-operative breathing exercises training on the vital capacity (VC) and PEFR of upper abdominal surgery patients. The patient were divided into 2 groups, control and experimental. Patient in the experimental group was given three supervised session of diaphragmatic deep breathing exercise daily. Spirometric and peak flow meter values of VC and PEFR were obtained 1 day before and 1st, 3rd, 5th, and 7th day after surgery.

Results: The data obtained were analyzed in terms of descriptive (frequency, percentage, mean and standard deviation) and inferential statistics using software SPSS-16.1 version. The analysis showed a significant difference in the pre- and post-training VC and PEFR for experimental group compared to control group.

Conclusion: Diaphragmatic deep breathing exercise improves the pulmonary functions after the abdominal surgery.

Keywords: Deep breathing exercise, upper abdominal surgery, peak expiratory flow rate, spirometer.

 DOI: http://dx.doi.org/10.22159/ajpcr.2017.v10i2.14912

INTRODUCTION

Upper abdominal surgery has a high incidence of post-operative respiratory complications. Pulmonary complications are the leading cause of morbidity and death during the post-operative period in patients who have undergone upper abdominal surgery.

The most common post-operative respiratory complication, atelectasis, manifests with low-grade fever (first 48 hrs after the procedure), malaise and diminished breath sounds in the lower lobes. If appropriate measures are not taken, it can lead to pneumonia. Patients with pneumonia can have high fever; produce thick sputum with coughing; have leukocytosis; show the presence of infiltrates on chest X-ray; experience occasional mental confusion·[1].

Upper abdominal surgery is associated with decreased lung volumes, adoption of rapid shallow pattern of breathing. There has been a decrease in maximum inspiratory and expiratory muscle pressure observed after abdominal surgery. The vital capacity (VC) is reduced by 50-60% and functional residual capacity (FRC) by 30%. Diaphragmatic activity is reduced in the post-operative period, with a shift from predominantly abdominal to thoracic breathing. The VC after upper abdominal procedures remains depressed for at least 10-14 days. There is a restrictive pattern with severely reduced inspiratory capacity, VC, plus smaller but more important decrease in FRC following abdominal surgery. This suppression of pulmonary functions is more pronounced after open abdominal surgery than laparoscopic procedure·[2].

In the hospital patient with upper abdominal surgery receive steam inhalation routinely to prevent chest complication.

Objectives of the study

1. To assess the effect of routine post-operative care on 1st, 3rd, 5th, and 7th post-operative day on peak expiratory flow rate (PEFR) in patient undergone abdominal surgery (controlled group)
2. To assess the effect of deep breathing exercises by using diaphragmatic breathing exercise during the post-operative care on 1st, 3rd, 5th, and 7th post-operative day on PEFR in patient undergone abdominal surgery (study group)
3. To compare PEFR in control and study group.

METHODS

This was an experimental study. A total of 60 patients were selected through simple random sampling technique based on inclusion criteria and then put into one of the two groups through randomization. In exclusion criteria, the patient were <18 years and more than 70 years, admitted in emergency and unconscious were not included in the study.

Hypothesis

H_0 (null hypothesis): There will be no any significant relationship between deep breathing exercises and respiratory function of patients' undergone abdominal surgery.

H_1 (research hypothesis): There will be significant relationship between deep breathing exercises and respiratory function of patients' undergone abdominal surgery.

Procedure

Procedure was explained, demonstrated to the patients from an experimental group whereas patients from control group were continued with routine pre- and post-operative care. Consent was

obtained from all subjects. Diaphragmatic deep breathing exercise was introduced to the operative patient of experimental group and procedure was explained, and they were asked to practice diaphragmatic deep breathing exercise as much as possible constant supervision, encouragement, and support were given to the these patient's by the investigator during intervention for 7 days. Everyday lung condition was assessed before and after using diaphragmatic breathing exercise and in control group and everyday assessed for lung condition for 7 days by peak expiratory peak flow meter and spirometer.

VC

The VC measurement was taken with the patient assuming the full support sitting position. This was to allow maximum relaxation of the patient. The patient was instructed to clamp his lips tightly around the mouthpiece of the spirometer and then take deep breath in through the nose and then blow out as much as possible through the mouthpiece into the spirometer. The spirometer maneuvers were performed thrice, and the highest of the three values was recorded in liters.

PEFR

The patient assuming the full support sitting position with the lips tightly clamped round the mouthpiece of the peak flow meter to prevent leakage of air. The patient was instructed to inhale maximally, then to blow out quickly and forcefully into peak flow meter. The highest of the three trails was recorded in liter per minutes.

Analysis and interpretation

The data were analyzed in terms of descriptive (frequency, percentage, mean and standard deviation) and inferential statistics using software SPSS-16.1 version.

Majority 24 (80%) patients were maintaining respiratory rate between 16 and 24 resp/min. On the 7th post-operative day in an experimental group whereas in the control group only 20 (66.66%) patients were maintaining respiratory rate between 16 and 24 resp/min.

Majority 30 (100%) patients were having clear lung sounds by 7th post-operative day in experimental group, whereas in control group, only 23 (76.66%) patients were having clear lung sounds by 7th post-operative day.

Highest VC between 2501 and 3000 ml reported on 7th day by 30 (100%) patient in the experimental group, whereas in control group, only 18 (60%) patients reported VC between 2501 and 3000 ml.

On day 1 no patient was reported PEFR more than 100 L/min, but on 7th day 25 (83.33%) patients were reported PEFR >100 L/min in the experimental group, whereas in the control, 17 (56.56%) patients reported PEFR in between 91 and 100 L/min.

MAJOR FINDINGS AND DISCUSSION

Pre-interventional mean score for control and experimental group was calculated and was observed that temperature, diastolic Blood pressure, systolic blood pressure are near to same values in both groups where as in the post interventional mean score vital capacity, PEFR values in the control group was not that much satisfactory than the experimental group (Table 1 and 2).

Post interventional scores

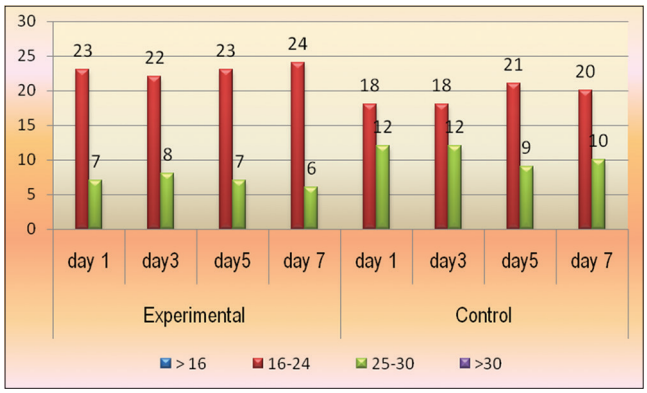
- Post-operative period majority 24 patients belongs to experimental group were able to maintain respiratory rate between 16 and 24 by 7th post-operative day, whereas in control group, 20 patients were maintain respiratory rate between 16 and 24 respiration per minute (Graph 1).
- All 30 patients from experimental group were having clear lung sounds by 7th post-operative day and 23 patients from control group 23 patients reported normal lung sounds (Graph 2).
- VC of patients in experimental group on 1st post-operative day was recorded to 2000 -2500 milliliter in 23 patients and reached to 3001-4000 ml in all 30 patients by 7th post-operative day. Comparing to control group on 1st post-operative day VC was recorded to 2000-2500 ml among 19 patients and no patient reached to VC 3001-4000 ml by 7th post-operative day (Graph 3).
- Majority 25 patients reached to PEFR more than 100 L/min by 7thpost-operative day comparing to control group; no patient was recorded PEFR more than 100 L/min by 7thpost-operative day (Graph 4).
- All 30 patients from both experimental and control group were reported to have oxygen saturation between 96% and 100%.

Using paired "t" effectiveness of diaphragmatic deep breathing exercises were assessed which indicates (Tables 3 and 4);

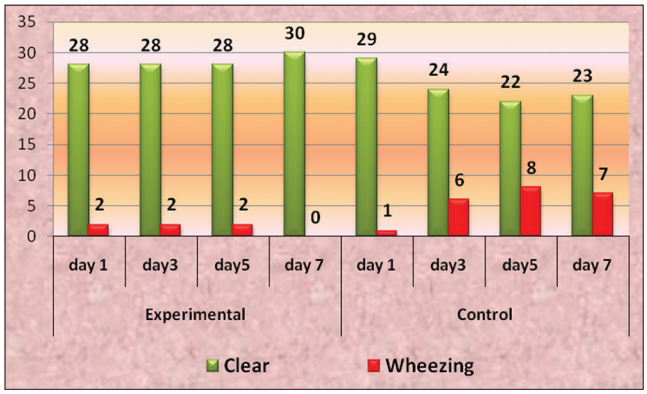
Table 1: Pre-interventional mean scores in both the experimental and the control group (n=60)

S. No.	Aspects	Mean±SD	
		Control group	Experimental group
1	Respiratory rate	22.33±3.15	23.4±2.47
2	Temperature	98.16±0.46	98.2±0.55
3	Systolic blood pressure	117.33±7.84	117±7.49
4	Diastolic blood pressure	76.6±8.08	77±5.95
5	VC	3448.83±117.55	3326.5±141.08
6	PEFR	375.66±25.41	368±35.56
7	Pulse oxymetry %	96.43±4.78	97.16±4.76

SD: Standard deviation, PEFR: Peak expiratory flow rate, VC: Vital capacity



Graph 1: Distribution of patients in control and experimental group according to post-interventional respiratory rate



Graph 2: Distribution of patients in control and experimental group according to post-interventional lung sounds

Table 2: Post-interventional scores in both the experimental and the control group (n=60)

S. No.	Aspects	Mean±SD			
		Control group			
		Day 1	Day 3	Day 5	Day 7
1	Respiratory rate	23.93±1.85	23.33±2.84	22.86±3.13	22.8±2.95
2	Temperature	98.33±0.71	98.5±0.77	98.7±0.95	98.4±0.77
3	Systolic blood pressure	124±8.55	117±8.17	117.33±6.91	115.66±5.04
4	Diastolic blood pressure	81±7.11	79.46±7.31	78.33±6.47	74.66±5.07
5	VC	2483±161.23	2515±187.80	2541±187.18	2565.5±169.67
6	PEFR	79±7.23	80.66±6.66	86±6.61	90.33±8.33
7	Pulse oxymetry %	96.63±1.37	96.73±1.43	97.83±0.83	98.46±1.06

SD: Standard deviation, PEFR: Peak expiratory flow rate, VC: Vital capacity

Table 3: Effectiveness of diaphragmatic deep breathing exercises in terms of comparison of pre- and post-interventional scores in the experimental group

S. No.	Aspects	Mean±SD					Paired t-test			
		Pre-test	Post-test							
		Day 1	Day 1	Day 3	Day 5	Day 7	Day 1	Day 3	Day 5	Day 7
1	Respiratory rate	23.4±2.47	23.4±2.17	23.86±2.16	23.4±2.41	23.2±2.00	0.05, NS	0.75, NS	00, NS	0.40, NS
2	Temperature	98.2±0.55	98.3±0.65	98.26±0.58	98.06±0.25	98.0±0.01	1.36, NS	0.42, NS	1.61, NS	1.98, NS
3	Systolic blood pressure	117±7.49	123.66±8.08	121.66±6.98	116±9.32	117±7.49	3.08, S	2.45, S	0.44, NS	0.01, NS
4	Diastolic blood pressure	77±5.95	83±12.73	81.33±7.29	77.93±6.65	77.93±6.20	4.53, S	2.36, S	0.51, NS	0.59, NS
5	VC	3326.5±141.08	2452.66±177.37	2543±137.76	2689±135.87	2812.76±92.23	19.41, S	19.60, S	16.85, S	16.63, S
6	PEFR	368±35.56	80.33±6.55	88.53±8.51	102.3±12.83	119±14.22	46.03, S	43.90, S	42.03, S	44.12, S
7	Pulse oxymetry %	97.16±4.76	96.53±1.79	97.93±8.51	98.53±1.16	99.13±0.77	0.68, NS	0.86, NS	1.61, NS	2.27, NS

SD: Standard deviation, PEFR: Peak expiratory flow rate, VC: Vital capacity

Table 4: Effectiveness of diaphragmatic deep breathing exercises in terms of comparison of pre- and post-interventional scores in the control group

Sr. No	Aspects	Mean±SD					Paired t-test			
		Pre-test	Post-test							
		Day 1	Day 1	Day 3	Day 5	Day 7	Day 1	Day 3	Day 5	Day 7
1	Respiratory rate	22.33±3.15	23.93±1.85	23.33±2.84	22.86±3.13	22.8±2.95	2.44, NS	0.81, NS	0.73, NS	0.68, NS
2	Temperature	98.16±0.46	98.33±0.71	98.5±0.77	98.7±0.95	98.4±0.77	1.30, NS	1.31, NS	3.51, S	2.85, NS
3	Systolic blood pressure	117.33±7.84	124±8.55	117±8.17	117.33±6.91	115.66±5.04	3.08, NS	2.03, S	0.64, NS	0.77, NS
4	Diastolic blood pressure	76.6±8.08	81±7.11	79.46±7.31	78.33±6.47	74.66±5.07	2.25, NS	0.88, NS	0.23, NS	2.19, NS
5	VC	3448.83±117.55	2483±161.23	2515±187.80	2541±187.18	2565.5±169.67	1.23, NS	0.65, NS	3.43, S	6.7, S
6	PEFR	375.66±25.41	79±7.23	80.66±6.66	86±6.61	90.33±8.33	2.86, NS	3.98, S	6.79, S	10.74 S
7	Pulse oxymetry %	96.43±4.78	96.63±1.37	96.73±1.43	97.83±0.83	98.46±1.06	0.22, NS	3.34, S	2.80, NS	2.06, NS

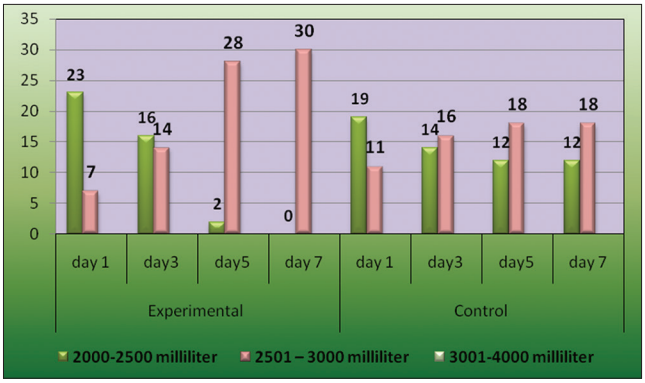
SD: Standard deviation, PEFR: Peak expiratory flow rate, VC: Vital capacity, NS: Nonsignificant, S: Significant

- Respirator rate findings are nonsignificant 0.05 at df = 29 till 7th post-operative day
- Temperature is nonsignificant – 0.75 at df = 29 till 7thpost-operative day
- VC - 16.63 significant on 1st, 3rd, 5th, and 7thpost-operative day
- PEFR - 44.12 significant on 1st, 3rd, 5th, and 7th post-operative day.

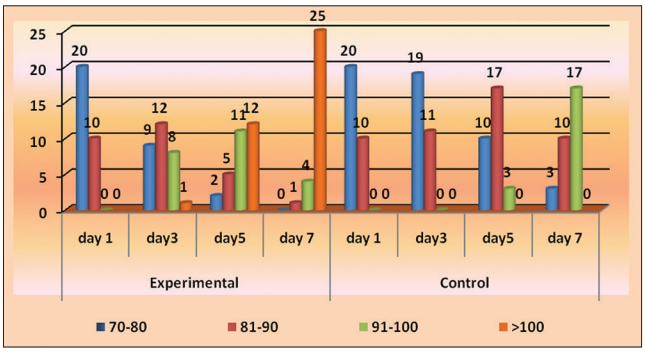
Paired t-test calculations for VC, PEFR are significant in experimental group on 1st, 3rd, 5th and 7th day, hence null hypothesis is rejected, and research hypothesis is accepted.

The resting blood pressure of patients who participated in this study was within the range considered to be for normotensive individuals. This implies that the clinical conditions for which surgery was indicated in the patients did not cause significant increases in their blood pressure as well as pulse and respiration.

The statistically significant difference in VC and PEFR pre and post breathing exercise training in both the groups implies that breathing exercise training improved the pulmonary function of the patients. This observation can be explained by the fact that breathing exercises actively exert the ventilator muscles, thereby increasing the strength of the ventilator muscles through motor units' recruitment. Increase in strength of abdominal muscles enhances their ventilator activity [3,4].



Graph 3: Depicting distribution of patients in control and experimental group according to post-interventional vital capacity



Graph 4: Cylindrical diagram depicting distribution of patients in control and experimental group according to post-interventional peak expiratory flow rate

There was statistically significant difference in the PEFR of the upper abdominal surgery patients in this study. PEFR requires a sudden and forceful expiration brought about by strong contraction of the upper portion of the abdominal muscle group. The closer the incision site is to the diaphragm, the higher the tendency to alteration in pulmonary mechanism due to pain accompanying incision which reduces the contraction of the muscle group.

A similar study found which was conducted in 2009 by Sanya and Akinremi. Department of Physiotherapy, College of Medicine, University of Ibadan, Nigeria. On "effects of breathing exercise training on selected pulmonary indices in post-abdominal surgery patients." In their study the patient were divided into 4 groups, (1) comprised 16 elective lower abdominal surgery patient, (2) 17 elective lower abdominal surgery patients, (3) 10 emergency upper abdominal surgery patient, (4) 12 emergency lower abdominal surgery patient. The elective abdominal surgery patient received deep breathing exercise training 1 day pre-surgery and assessed for 6 days after surgery, while the emergency abdominal surgery patients received the training after surgery. VC and PEFR were measured daily after exercise. This study concluded that breathing exercise training improved VC and PEFR of the abdominal surgery patient for four groups and this study also show same result [5].

CONCLUSION

This study concludes that:

a. Breathing exercises training increase the VC and PEFR of abdominal surgery patients
b. Pre-surgery breathing exercises training enhanced the VC and PEFR of the abdominal surgery patients after the operation
c. Lower abdominal surgery patients had significantly higher improvement in VC and PEFR than the upper abdominal surgery patients.

This study, therefore, recommends that pre- and post-operative breathing exercise training should be carried out routinely on abdominal surgery patients.

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