International Journal of Public Health and Health Systems
2019; 4(3): 58-64
http://www.openscienceonline.com/journal/ijphhs

Open Science

Influence of Preoperative Physiotherapy on Respiratory Muscle Function and Quality of Life in Laparotomy Patients

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To cite this article

Anandhi Dakshinamurthy, Jagaa Jananee Krishnan Ilavazhagan. Influence of Preoperative Physiotherapy on Respiratory Muscle Function and Quality of Life in Laparotomy Patients. *International Journal of Public Health and Health Systems.* Vol. 4, No. 3, 2018, pp. 58-64.

Received: August 28, 2018; **Accepted**: December 10, 2018; **Published**: April 10, 2019

Abstract

After abdominal surgery 35% of the patients experience postoperative complications of which 9% is due to pulmonary complications. Preoperative functional status appears to be an important predictor of morbidity and mortality in these patients. Preoperative physiotherapy training may influence the preoperative functional status of the patients. Objective is to find out the effectiveness of preoperative physical therapy program to improve respiratory muscle function and quality of life in abdominal surgeries. Study design was quasi experimental design. Study type was pre- and post-test type. 20 subjects were selected according to convenient sampling method. Duration of the study was 10 days and the study was done at SRM Medical College Hospital & Research Centre, Kattankulathur. The subjects were selected according to inclusion and exclusion criteria and Group A patients received preoperative physiotherapy training protocol and Group B patients undergoing emergency laparotomy did not undergo the training. Cough grading, Numerical Pain Rating Scale, incentive spirometry, WHO Quality of life questionnaire were assessed preoperatively and on postoperative day 1 and day 7 respectively**.** There is no statistically significant (P>0.05) reduction in cough grading between the posttest day 7 mean values of Group A (0.300) to posttest mean values of Group B (1.400). The posttest mean values of incentive spirometer of day 7 in Group A is (885) and Group B is (990) but it does not show statistically significant improvement (P>0.05). The posttest mean values of day 7 in WHO Quality Of Life in the Group A (53.34) shows statistically significantly improvement (P=0.000) from the posttest day 7 mean values of Group B (1.5200). The posttest of day 7 mean values of Numerical Pain Rating Scale of Group A is (5.000) and that of Group B is (3.700) and it is statistically significant (P<0.05). This study concludes that there is significant improvement in QOL than Cough grading, incentive spirometry and pain in the laparotomy patients, who underwent preoperative physiotherapy training when compared to the patients who did not undergo preoperative training.

Keywords

Abdominal Surgery Patients, Preoperative Physiotherapy, Respiratory Function, Quality of Life

1. Introduction

Abdominal surgery is defined as any surgical operation pertaining to the contents of the abdominal cavity, its walls and orifice. Abdominal surgery statistics in the United States every year is hysterectomy: 4,98,000, cesarean section: 1.3 million, gallbladder: 7,50,000, hernia surgery: 20 million, prostatectomy surgeries: 1,00,000 to 2,00,000. Over one million cholecystectomy and 1,50,000 gastric bypass surgeries are done in the United States every year [1].

Some indications of abdominal surgery include infection, obstruction, tumors or inflammatory bowel disease. Laparoscopic surgery is not possible for all types of surgery. Some laparoscopic operations may be converted to an open surgical incision.

Common abdominal surgeries are appendectomy, inguinal hernia, exploratory laparotomy and laparos copy. Common

abdominal incisions are midline incision, kocher incision, pfannenstiel incision. Few other types of incisions in abdominal surgery patients are Equivocal incision, Inguinal incisions, Bucket handle incision, Left subcostal incision, Marwedel incision, Bevan incision, Right subcostal incision, Kehr incision, Mayo robson incision, Mcburney incision, Transverse or Davirockey incision, Thoracoabdominal incision, etc.

Abdominal surgery procedures are associated with a high risk for postoperative pulmonary complications such as atelectasis, pneumonia, bronchitis, pneumothorax, bronchospasm and worsening of an underlying chronic lung disease, which can occur upto 7 days after surgery. After abdominal surgery 35% of the patients experience postoperative complications of which 9% is due to pulmonary complications [3]. There is a shallow breathing and monotonous tidal volume in postoperative patients. Being a restrictive lung disorder there is reduction of diaphragm movement leading to reduced vital and inspiratory capacity and respiratory insufficiency.

The immediate complications are pain, basal atelectasis-minor lung collapse, primary hemorrhage, blood loss, acute myocardial infraction, pulmonary embolism, low urine output, nausea and vomiting, deep vein thrombosis, acute urinary tract infection, postoperative wound infection, pressure sores, paralytic ileus. The late complications are bowel obstruction, incisional hernia, persistent sinus, fever, etc.

Elective surgery is one in which the patient can have their admission and surgery at a predetermined and predictable time and an emergency abdominal surgery is unpredictable and require fast intervention either in the urgent or emergency setting. Repeated patients survey has demonstrated that the great majority of patients prefer to recover in their homes rather than staying in hospital.

Preoperative physiotherapy is the preparation and management of a patient prior to surgery. Preoperative physical therapy is found to bring radiological alterations, changes in auscultations, blood gases, length of hospital stay to improve quality of life. It includes both physical and psychological preparation. Inspiratory muscle training has been shown to improve muscle function, lung volume, work capacity and power output in people who are healthy. So, it will be very beneficial when taught preoperatively for surgical patients.

Preoperative functional status appears to be an important predictor of morbidity and mortality in these patients. Preoperative physiotherapy training may influence the preoperative functional status of the patients. Preoperative teaching meets the patients need for information regarding the surgical experience, which in turn may alleviate most of his or her fears. Patients who have knowledge about what to expect after surgery, and who have an opportunity to express their goals and opinions often cope better with postoperative pain and decreased mobility. Some people want as much knowledge as possible, while others prefer only minimal information because too much knowledge may increase their anxiety. Psychologically patient should prepare for their operation. The physician who will perform the procedure must explain the risks, benefits of the surgery along with other treatment options. Preoperative teaching includes instruction about the preoperative period, the surgery itself, and the postoperative period. Preoperative instruction should include information about the pain management, airway clearance and early mobilization. In a study conducted on elective upper abdominal surgery patients, a 30 minute preoperative physiotherapy session halves the incidence of PPCs and hospital acquired pneumonia. [2] Even a single preoperative physiotherapy session reduced pulmonary complications after upper abdominal surgery. [4] Face-to-face pre-operative physiotherapy education and training prior to upper abdominal surgery is memorable and has high treatment fidelity. [5]

Postoperative management includes breathing exercises, huffing, coughing, bed activities, and early mobilization. Deep breathing exercises, airway clearance techniques, upper and lowerlimb exercises, early mobilization are the mainstay of the postoperative physiotherapy management.

Though Preoperative physiotherapy helps in gaining the confidence and cooperation of the patients, improves the respiratory muscle function, and decreases the length of hospital stay, the effectiveness of preoperative physiotherapy in abdominal surgeries is not well documented. Few studies have been done in Indian population. Hence this study will focus on the importance of the same in abdominal surgeries. Thus the aim of the study is to find out the effectiveness of preoperative physical therapy program to improve respiratory muscle function and quality of life in abdominal surgeries.

2. Main Content

2.1. Methodology

Quasi experimental design, 40 subjects in age group of 30 – 50 years, both male and female and patients undergoing laparotomy both elective and emergency were conveniently selected from SRM Medical College Hospital Research Centre, SRM Institute of Science and Technology. Patients with a history of heavy smoking, alcoholism, presence of active tuberculosis, Malignancy, unwilling patients, preoperative cardiopulmonary complications were excluded from the study.

The subjects for the study were selected depending upon the inclusion and exclusion criteria. Informed consent was obtained from the subjects prior to the commencement of the study. Patients were allotted to both the groups by convenient sampling method.

Preoperative physiotherapy protocol was taught to the experimental group who were undergoing elective abdominal surgery.

Gain the patient confidence

Teach breathing exercise and airway clearance technique

Bed mobility exercise for early mobilization

2.2. Patient Confidence

Explanation of the aim of physiotherapy helps in the patient understanding. Teaching the exercise to be under taken post operatively and answering the patient's questions helps to allay some of the fears of the operation. Explanation about the surgical procedure, incision, pain, tubes that will be present in the post operative period was given.

2.3. Breathing Exercise and Airway Clearance Technique

Huffing /coughing technique-Patients were comfortably seated in forward lean sitting position with pillows. The patients were instructed to support the incision with hands or pillows and breathe in fully and deeply. They were asked to immediately give a strong huff /cough once or twice to clear secretions from the chest.

Breathing Exercise-Patients were comfortably seated. Patients were asked to place one hand on the chest and other hand on the epigastric region. Then they were instructed to inhale through nose for about two seconds so that the belly moves out. They were instructed to breathe out slowly through purselip.

Segmental Exercise- Segmental exercises were done unilaterally or bilaterally. The patients were made to sit, therapist placed the hands on the lateral aspect of the lower ribs to fix the patient's attention.

Lateral costal exercise- It was prior to inspiration, a quick downward and inward stretch was applied to the chest to facilitate external intercostals. These muscles move the ribs outward and upward during inspiration. Patients expanded the lower ribs against the therapist hands as they breathed in. During expiration, their ribcage was stretched downwards and inwards.

Posterior basal expansion-Patients were made to sit in forward lean sitting position. Therapist hands were placed over the posterior aspect of the lower ribs. Similar procedure as the lateral basal expansion exercise was followed.

Apical expansion-With patient in sitting position, pressure was applied below the clavicle with the fingertips as the patient breathed in and out.

2.4. Bed Mobility Exercise

Bed Mobility Exercise like turning from lying to side lying, moving in bed side to side, rolling, bridging exercises were taught.

Patients who underwent emergency laparotomy (n=20) were taken as Group B and did not undergo preoperative physiotherapy sessions. All the patients in Group A & B underwent postoperative physiotherapy protocol until discharge. Preoperative cough grading, incentive spirometry were assessed for the Group A. Pain, cough, incentive spirometry, WHOQOL were assessed on the 1st and 7th postoperative day for both the groups. WHOQOL was assessed on the 7th postoperative day for both the Groups.

Figure 1. *Incentive Spirometry.*

Figure 2. *Diaphragmatic Breathing Exercise.*

2.5. Data Analysis

Table 1. *Comparison of pretest and posttest values of day 1 & 7 of cough grading, incentive spirometry, who questionnaire, numerical pain rating scale of experimental group.*

Variables	Pre-PostTest	Mean	N	SD	T	Significance
COUGH GRADING	Pretest	1.85	20	.93330	8.865	0.000
	PosttestD1	0.00	20	0.0000		
	Pretest	1.85	20	.93330	6.941	0.000
	PosttestD7	.3000	20	.47016		
INCENTIVE SPIROMETRY	Pretest	645.0	20	109.9	1.831	.083
	PosttestD1	600.0	20	0.000		
	Pretest	645.0	20	109.9	-4.292	.000
	PosttestD7	885.0	20	227.74		
WHOQOL	Pretest	45.0	20	5.55694	-6.701	.000
	PosttestD7	53.34	20	1.97362		

Table 1 shows that there is no significant (P=0.000) reduction in the mean values of cough grading with pretest (1.85) and posttest day1 (0.00), there is significant (P=0.000) reduction in the cough grading with the mean values of pretest (1.85) and posttest day7 (0.3000) in the group A. The incentive spirometry value shows no significant (P=0.0083) reduction from the mean pretest values (645) to posttest values of day1 (600). The mean pretest values (645) shows significant (P=0.000) improvement to posttest values of day7 (885) in the group A. The pretest values (45) of WHO Quality Of Life shows significant improvement to posttest day 7 values (53.34) in the group A.

Table 2. *Comparison of posttest values of both experimental & control group values of day 1 & 7 of cough grading, incentive spirometry, who questionnaire, numerical pain rating scale.*

VARIABLES			MEAN	N	SD	T	SIG
COUGH GRADING	EXP& CNTRL	POST TESTD1	0.000	20	0.000	-2.042	0.000
			0.300	20	0.65695		
	EXP& CTRL	POST TESTD7	0.300	20	0.47016	-7.148	0.216
			1.400	20	0.50262		
INCENTIVESPIROMETRY	EXP& CTRL	POST TESTD1	600.0	20	0.000	-1.648	.532
			600.0	20	0.000		
	EXP& CNTRL	POST TESTD7	885.0	20	227.00	2.538	.532
			990.0	20	171.372		
WHOQOL	EXP	POST TESTD7	53.3400	20	1.97362	1.372	0.000
	CNTRL	POST TESTD7	51.5200	20	5.59639		
NUMERICAL RATINGSCALE	EXP& CNTRL	POST TESTD1	8.800	20	0.76777	2.538	0.001
			7.550	20	2.06410		
	EXP& CNTRL	POST TESTD7	5.000	20	1.12390	2.729	0.005
			3.700	20	1.8092		

Table 2 shows that the cough grading is significantly (P=0.000) reduced between posttest day 1 values of group A (0.000) to posttest values of group B (0.300). There is no significant (P=0.532) reduction in cough grading between the posttest day 7 values of group A (0.300) to posttest values of group B (1.400). There is no significant (P=0.532) change in the incentive spirometry between the posttest day 1 values of group A (600) and group B (600). The posttest values of day 7 in group A is (885) and group B is (990) but it does not show statistically (P=0.532) significant improvement.

The posttest values of day 7 in WHO Quality Of Life in the group A (53.34) shows significantly (P=0.000) improvement from the posttest day 7 values of group B (1.5200). The posttest day 1 values of Numerical Pain Rating Scale of group A is (8.800) and that of group B is (7.550) and it is statistically significant (0.001). The posttest of day 7 values of Numerical Pain Rating Scale of group A is (5.000) and that of group B is (3.700) and it is statistically significant (0.005).

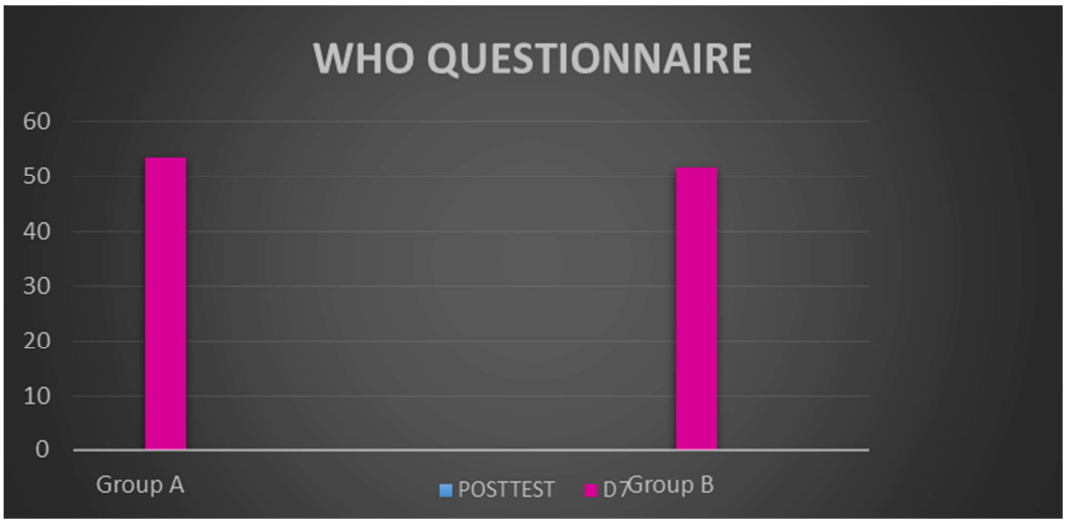

Figure 3. *Comparison of posttest values of day 7 of both experimental & control group of who questionnaire.*

In the WHOQOL, mean values of group A and group B of posttest day 7 values with P = 0.00

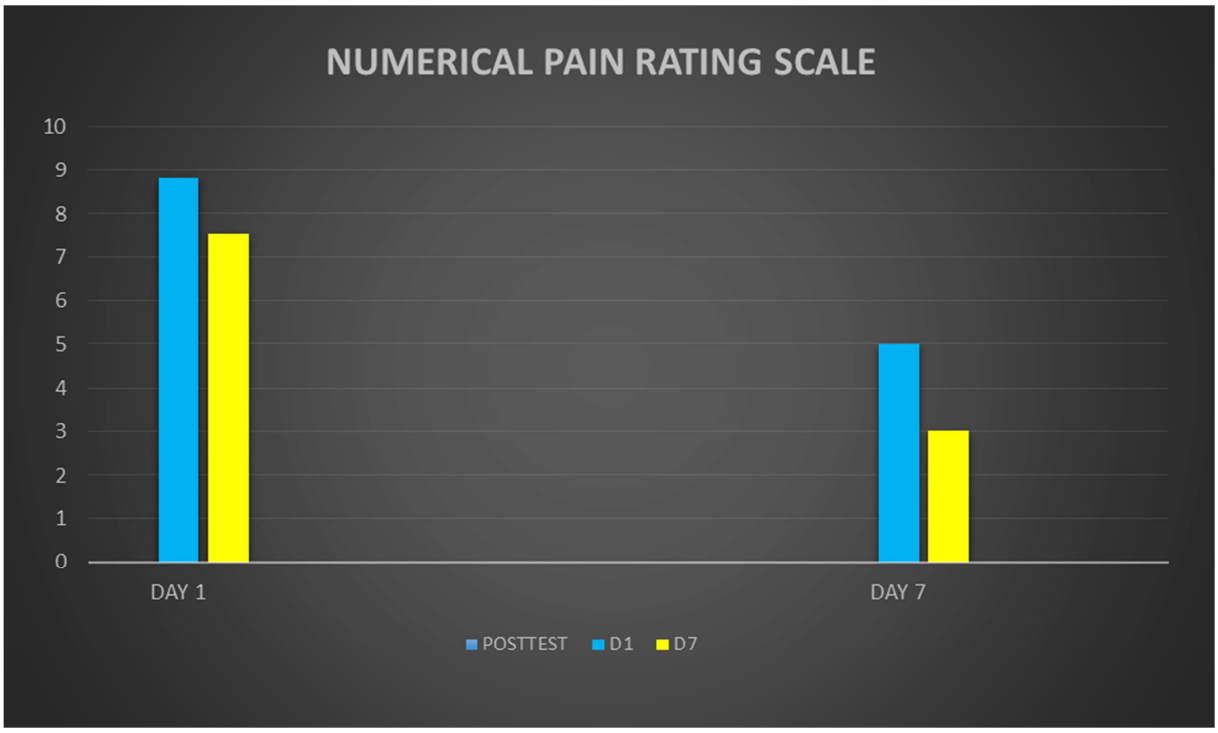

Figure 4. *Comparison of posttest values of day 1 & 7 of both experimental & control group of numerical rating scale.*

In numerical pain rating scale mean value of group A & group B of post operative day 1 and 7 with P = 0.00

3. Discussion

The objective of this study was to assess the influence of preoperative physiotherapy training on the respiratory muscle function and quality of life in laparotomy patients. Sjaakpouwels et al. suggested that preoperative physiotherapy might be effective in improving the physical fitness of patients. Prior to major abdominal surgery, preoperative chest physiotherapy seems effective in reducing pulmonary complications [6].

This study shows that the cough grading which was assessed to find out the effectiveness of the ability to cough, is significantly reduced on the post-operative day 1 in the Group A, which underwent preoperative physiotherapy training and Group B, which did not undergo preoperative training.

But the cough grading was improved though not statistically significant, on the day 7, in Group B than in Group A.

Similar results were obtained by Pasquine. P. et. al. 2006 who demonstrated that the pulmonary function (FVC, FEV1

and PEFR) on the 1st postoperative day when compared to the preoperative period had a significant decrease [7]. Dias. C. et al. 2008 stated that a reduction of the effectiveness of the cough reflex and increased risks associated with the retention of sputum are caused by impaired mucociliary clearance [8]. The ability to cough is reduced possibly owing to the postoperative pain, analgesics, duration of anesthesia and surgery.

The incentive spirometry values show reduction from pretest values to posttest values of day 1 in Group A which underwent preoperative physiotherapy training.

This is due to the fact that in the post operative period there is shallow, monotonous breathing without sighs and prolonged immobility.

According to Martinez et al. 2015 the anesthesia and pain are responsible for respiratory muscle dysfunction [9].

The incentive spirometry values improve from the postoperative day 1 to day 7 in both the groups. But when the postoperative day 7 mean values were compared, Group B showed improvement than Group A which underwent preoperative training, but it is not statistically significant ($P>0.05$).

The incentive spirometry is a mechanical device, which encourages patients to take long, slow, sustained maximal inspirations to achieve, maximal inflating pressure in the alveoli and maximal inhaled volume and also helps to maintain the patency of smaller airways. In the postoperative period, it provides low level resistance training to the diaphragm and minimizes fatigue thereby improving inspiratory muscle strength and enhances lung expansion.

Hall. et. al. 1996 showed that incentive spirometry was the most efficient prophylaxis against pulmonary complications in high risk patients after abdominal surgery [10]. Kundra. et. al. 2010 showed that incentive spirometry improved lung function significantly in the preoperative period; in the postoperative period the lung function parameters decreased both in the Preoperative Exercise Therapy Group and in the controls, but far less in the group that had received Preoperative Exercise Therapy in the form of preoperative incentive spirometry [11].

The WHOQOL Questionnaire of laparotomy patients showed statistically significant improvement on postoperative day 7 in the Group A who underwent preoperative physiotherapy training, than Group B who did not undergo preoperative physiotherapy training.

Our results are supported by Lia-Na Hsueh. et. al. 2011 who stated that postoperative HRQOL may depend not only on their postoperative health care but also their preoperative functional status [12].

The mean values of Numerical Pain Rating Scale on postoperative day1 and postoperative day 7 showed a reduction of pain from day 1 to day 7 in both Group A and B, but the reduction of pain is significantly reduced in Group B than Group A.

Amaravadi Samapth Kumar et. al. 2016 showed a highly statistically significant improvement seen in pulmonary function from 2nd to 5th postoperative day when compared to the preoperative period [13].

Dronkers et al. 2010 reported no significant differences in postoperative complications and length of hospital stay between a short term intensive training Group and functional activities group [14].

Fagveik Olsen et. al. 1997 showed a significant difference in postoperative pulmonary complications in patients who received prophylactic chest physiotherapy prior to major abdominal surgery: of these patients, 6% had postoperative pulmonary complications, compared to 27% in the control group ($P<0.01$) [15].

This study concludes that the Quality of life is significantly improved in the preoperative training group when compared to the group which did not undergo preoperative training.

4. Conclusion

This study concluded that cough grading, incentive spirometry values and pain are not significantly improved in the laparotomy patients who underwent preoperative physiotherapy training when compared to the group which did not undergo preoperative training. It also concluded that there is significant improvement in Quality of life in the laparotomy patients, who underwent preoperative physiotherapy training when compared to the patients who did not undergo preoperative training.

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