Effect of Chest Physiotherapy along with Early Mobility after Abdominal Surgery

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ABSTRACT

The purpose of the study was to evaluate the effect of chest physiotherapy along with early mobility after abdominal surgery. The study was investigating the effect of chest physiotherapy along with early mobility and only chest physiotherapy after major abdominal surgeries on respiratory function, length of hospital stays, pain intensity, oxygen saturation level and status of functional independency (FIM).

Methodology: This was a quasi-experimental study where sixty patients with Lower abdominal surgery conveniently selected from the post-operative unit of the tertiary level specialized hospitals in Dhaka and simple random sampling was used for differentiating the groups. Thirty patients in chest physiotherapy group (control) and thirty in chest physiotherapy along with early mobility group (Experimental). It was measured the respiratory function, length of hospital stays, pain intensity, oxygen saturation level and status of functional independence.

Results: Regarding this study the mean age of the experimental group were 46.7 (± 18.12) years and mean age of control group were 43.4 (± 15.66) years. Mean length of hospital stay was 7.90 (± 2.078) days in experimental group and 11.50 (± 3.75) in control group, and the p value was 0.0016 in experimental group and 0.019 in control group so it was proved that the chest physiotherapy along with early mobilization significantly reduce the duration of hospital stay and chest physiotherapy was also effective. However it was showed that post-operative day-05 experimental group treatment was significantly effective where the p value was ≤ 0.05 ($p=0.0378$). So it was absolute showed that the treatment of experimental group was much effective. Study was showed that the effect on improving functional independency level was significantly effective of experimental group of FIM score in all parameters and also in control group also but in comparison it was showed that the experimental group was more effective than control group.

Conclusion: It was identified the significant effectiveness of chest physiotherapy (CPT) along with early mobility rather than only chest physiotherapy after abdominal surgeries. But both groups of participants were showed significant effectiveness. Participants in the CPT along with early mobility exercise after abdominal surgeries showed that it significantly reduces the duration of hospital stay and as well as increase the peripheral oxygen saturation level and also improved functional independence rather than the control group who got only chest physiotherapy.

Keywords: chest physiotherapy, early mobility, abdominal surgery.

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I. INTRODUCTION

Abdominal surgeries are performed for the diagnosis and treatment of many diseases [1] besides that could be remove cancerous tissue, to resolve visceral tissue perforations or to remove inflammatory bowel segments, benign growths, or

vascular aneurysms [2]. Postoperative pulmonary complications (PPCs) following abdominal surgery are very common and are responsible for increased morbidity and mortality as well as the length of hospital stay and health-related cost of care [1], [3]. The reported risk rates of postoperative pulmonary complications in upper abdominal

surgery range from 17% to 88%. Common postoperative pulmonary complications include atelectasis, hypoxemia, pneumonia, respiratory dysfunction, and pleural effusion [4], [1]. PPCs can be non-infectious for example atelectasis and respiratory failure; or can be infectious like pneumonia [5]. PPCs can lead to delayed patient recovery, prolonged hospitalization as well as increased morbidity and mortality [6]. Smetana states that postoperative pulmonary complications are common, serious, and expensive. Health care costs associated with the treatment of PPCs are 50% greater than the treating postoperative cardiac complications [7]. Patients who developed PPCs increased stay of 2 weeks compared to those did not develop PPCs [8]. Pulmonary impairments occurring after abdominal surgery persist as a major problem as a result of anesthesia and immobilization. It was found that Postoperative physiotherapy reduce the incidence of postoperative pulmonary complications after open abdominal surgery [9]. Breathing exercises have been routinely used in clinical practice especially in pre and post-operative chest complications [10]. Different kinds of breathing exercises aim to improve the patient's breathing pattern and increase lung expansion, respiratory muscle strength, functional residual capacity, and inspiratory reserve volume, thus preventing or treating PPCs [11].

Prolonged bed rest increased the risk of postoperative complications after surgery. Evidence shows that prolonged immobility increases the risk of venous thromboembolism, result in loss of muscle bulk and strength, increase insulin resistance, reduce pulmonary function and tissue oxygenation and increase levels of hospital-associated depression [12]. The indicating complications increase patient length of hospital stay (LOS) and, in some cases such as venous thrombo-embolization and decreased pulmonary function can be life-threatening [13]. An observational cohort study finding patients were three times more likely to have a PPC diagnosis for each day they did not mobilize away from the bedside [14]. A randomized controlled trial found that in patients following elective abdominal surgery where mobilization was delayed by three days, more physiotherapy input was required, and length of hospital stay was increased by 4.4 days (95% CI 0.3–8.8) compared with those who ambulated on the first post-operative day [15]. Chest physical therapy plays an important role in the prevention and management of postoperative pulmonary complications [16]. It includes deep breathing exercises, mobilization, postural drainage, percussion and vibration or shaking which were developed to improve bronchial drainage as well as the employment of mechanical breathing devices such as the Incentive Spirometer (IS) which has been introduced into clinical practice [17]. Chest physiotherapy after upper abdominal surgery aims to preserve pulmonary function and reverse physiological and/or functional changes that may occur in the postoperative period due to these complications [18]. Evidence shows that Chest physical therapy appears to improve oxygenation without triggering an increase in pain or other complications [19]. Another important component of care following open abdominal surgery is early mobilization for the best care of the patient [20]. Mobilization in postoperative patients may be defined as low-intensity exercise that aims to elicit cardiopulmonary

responses that enhance oxygen transport and assist in the reduction of postoperative pulmonary complications [21]. Early mobilization improved clinical outcomes in patients undergoing open abdominal surgery [9], [21]. Early mobilization forms a routine part of postoperative care and physiotherapists are heavily involved in the initiation of mobilization following UAS, with up to 91% reporting they always include mobilization in their postoperative treatment. Patients perform little mobilization outside of physiotherapy treatment in the early postoperative period [22] besides another study demonstrated about 48% of patients mobilized more than 10m on the first postoperative day [23]. The purpose of this study was to find out the efficacy of chest physiotherapy along with early mobilization on respiratory functions, length of hospital stay, pain intensity, oxygen saturation level and status of functional independence after abdominal surgery.

II. METHODOLOGY

A. Study Design and Participants

It was a quasi-experimental research design implemented from July 2019 to March 2020 and sixty participants of both genders with abdominal surgery and aged 15-70 years were selected conveniently from tertiary level specialized hospital in Dhaka. The random assigned process compiled in group allocation as 30 participants in each group.

B. Study Questionnaire

A semi-structured questionnaire was used for collecting socio-demographic and medical information and participants were well informed and explained the questionnaire properly. Noninvasive pulse-oximetry was used to measure the level of oxygen saturation within 100 percent screened with fingertip, the tool is consistent and high validity and reliability, spirometer for pulmonary function, Numerical Pain Rating Scale (NPRS) scale for measuring the pain intensity, modified FIM scale to measure the functional independency level by using only transfer and locomotion point and Borg 10 point scale of perceived exertion. Borg rating of perceived exertion (RPE) is an outcome measure scale used in knowing exercise intensity prescription. It is used in monitoring progress and mode of exercise in cardiac patients as well as in other patient populations undergoing rehabilitation and endurance training [24]. The translation and language validation of the questionnaire has complied with the standard process of WHO [25].

C. Ethical Issues

Ethical permission was obtained from the Institutional review board (BPA IPRR/IRB/01/06/ 2019/0011) of the Institute of physiotherapy, rehabilitation, and research (IPRR). Participation was voluntary, consent was obtained, and confidentiality of the information was assured.

D. Study Settings

The study setting was in different tertiary level of hospitals in Dhaka city.

E. Population and Subjects

The sample population was the patients with upper abdominal surgery at tertiary level hospitals of Dhaka city from 1st July 2019 to 30th March 2020. The inclusion criteria was patients with upper abdominal surgery, surgery undergo general anesthesia, age above 15 years and below 70 years and willingness to participate. The patient undergoing video laparoscopy, neuromuscular disease, COPD, lower abdominal surgery and unwillingness of patients were excluded.

F. Process of Randomization

The convenient sampling process was applied for employing sample from the population. The random allocation was compiled for assigning subjects to both groups. As this is a non-randomized parallel group trial the EQUATOR network standards have been ensured. The study was assessor-blinded. For the consistency of the tools, the same assessor performed the pre-test and post-test evaluations.

G. Interventions

Routine chest physiotherapy procedure: It was consisted of deep breathing exercises (bilateral basal expansion exercise) followed by splinted huff and/or cough the DBEs were performed in four series of five breaths with 3 seconds of sustained breathing.

Early mobilization: (Onset <48h after surgery): It was commenced in the form of sit on the bed-sit out of the bed-walk 5 meter with assistance-walk 15 meter with assistance-walk 30 meter with assistance-walk 30 meter without assistance.

H. Data Collection Procedure

Participants were randomly assigned in intervention group (Group I) who received early physiotherapy directed to mobilization along with routine post-operative chest physiotherapy such as breathing exercises and splinted coughing, or the control group (Group II) who received only routine postoperative chest physiotherapy (they were mobilized only by the willing to move).

Data was collected through face to face interview using semi structured questionnaire including socio-demographic and medical data. The treatment was provided by the qualified chest physiotherapist. Initial assessment included oxygen saturation level, pulmonary function, pain intensity, functional independence and then it was provided only chest physiotherapy for control group and chest physiotherapy along with early mobilization exercise for experimental group. After given treatment of twice daily for first two post-operative day (POD) and then once daily for up to 7th POD and then compare the outcome by collecting data about oxygen saturation level, pulmonary function, pain intensity band functional independency level but the length of hospital stay was taken from discharge date.

Intervention were provided while subjects were awake (or drowsy but easily woken), had stable blood pressure and heart rate, no dyspnoea at rest and pain less than 8/10 in NPRS. The chest physiotherapy group got lateral basal expansion exercises, sputum clearance techniques, deep breathing, coughing (DB&C) exercises and they advised to practice the spirometer every 2 hourly. The exercises

consisted of at least three coached lateral basal expansion man oeuvres (deep breaths) followed by a cough, huff, or forced expiratory maneuver. Instruction and supervision from the physiotherapist focused on bilateral basal expansion, avoiding upper chest and shoulder elevation, and maximizing expansion of the lower chest diameters during inspiration, with a three second end inspiratory hold, followed by relaxed expiration. This was done with the subject in sitting with the physiotherapist providing bilateral proprioceptive feedback with the hands on the lower ribs. This cycle was repeated at least twice during each treatment. Subjects were encouraged to achieve one or more goals during each treatment, and are encouraged to walk at a speed where they were taking deeper breaths than at rest, at an intensity of at least 6/10 according to the Borg 10 point scale of perceived exertion.

Subjects were encouraged to perform active ankle planter flexion and dorsiflexion exercises, at least 20 times every awaking hour, whilst in bed.

A clear chest was defined as no auscultation or chest radiograph changes, normal temperature, and no sputum. Measureda standardized validated outcome measurement tool for the abdominal surgery, the mobility indicators were used as (1) first day sitting out of bed, (2) first day walking (with or without assistance, including walking on the spot), and (3) first day able to walk 30meter without assistance of another person (with or without a walking aid). Total distance walked, perceived exertion and time spent sitting out of bed were documented daily by the treating physiotherapist on a separate chart.

I. Data Analysis

SPSS (Statistical Package for the Social Sciences) software version 16 has been used to analyze the data. The socio-demographic variables have been analyzed by descriptive statistics based on the nature of the data. The non-invasive oximetry score, respirometer score, modified FIM and borg rating for perceived exertion are interval data, and the NPRS are considered as categorical data.

III. RESULTS

The baseline characteristics of the participants has described in Table 1. All participants were undergoing hepatobiliary pancreatic surgery under general anesthesia. The following results were presented here as the analytic relation of the objectives and it was presented as descriptively.

The mean duration of hospital stay in experimental group was 7.9(±2.08) days and in control group was 11.50 (±3.75) days. In control group 50 % had no PMH 20% have DM, 10% had HD, 20% had HTN, 40% smoker and 60% non-smoker, 60% require oxygen support and 40% do not require oxygen support immediate after operation. In experimental group 40% had no medical history, 20% had DM, 10% had HD, 20% had HTN, 10% had RA; 60% of them require oxygen support after surgery and 50% of them were smoker.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS AT

BASELINE		
Variables	Control group	Treatment group
Mean Age	43.4 (±15.66)	46.7 (±18.12)
	years	years
Gender		
Male	50%	50%
Female	50%	50%
Living area		
Rural	20%	10%
Semirural	30%	30%
Urban	50%	60%
Educational level		
Illiterate	10%	10%
Primary	40%	10%
Secondary	10%	30%
Graduation	40%	40%
Post-graduation	00	10%
Marital status		
Married	90%	80%
Unmarried	10%	10%
Widowed	00	10%

TABLE 2: MEDICAL RELATED INFORMATION OF THE PARTICIPANTS

Variables	Control group	Experimental group
Duration of hospital stay	11.50 (±3.75)	7.9(±2.08)
Past Medical History (PMH)		
DM	20%	20%
HD	10%	10%
HTN	20%	20%
OTHERS	00%	10%
NA	50%	40%
Smoking history		
Smoker	40%	50%
Non smoker	60%	50%
Oxygen require		
Yes	60%	65%
No	40%	35%

TABLE 3: RELATION BETWEEN HOSPITAL STAY AND TREATMENT

Treatment given to the participants	Mean	SD	p-value	Comments
Chest therapy along with mobility exercise (E)	7.90	2.078	.0016	Both group intervention is effective, but Group 'E' is significantly more effective than group 'C'
Chest therapy (C)	11.50	3.749	.019	

It was found that the mean length of hospital stay was 7.90 (± 2.078) days in experimental group and 11.50 (±3.75) in control group, and the *p* value was less than 0.05 in both group so it was proved that the chest physiotherapy along with early mobilization significantly reduce the duration of hospital stay but both group of treatment was effective.

A. Effect on Respiratory Function

TABLE 4: SPIROMETER RATING IN EXPERIMENTAL GROUP

Experimental group				
	Pretest	Posttest POD-1	Pretest	Posttest
	POD-1	1	POD-7	POD-7
Mean	230	295(±59.86)	590	740
	(±85.63)		(±161.24)	(±137.03)
t		1.9673		2.2416
df		18		18
P value		0.0648		0.0378

It was showed that post-operative day-01 experimental group treatment was not significantly effective where *p* value was ≥ 0.05 (*p*=0.0648) however it was showed that post-operative day-07 experimental group treatment was

significantly effective where the *p* value was ≤ 0.05 (*p*=0.0378). So, it was absolute showed that the treatment of experimental group was much effective.

TABLE 5: SPIROMETER RATING IN CONTROL GROUP

Control group				
	Pretest	Posttest POD-1	Pretest	Posttest
	POD-1	1	POD-7	POD-7
Mean	195	265(±57.98)	420	495
	(±64.33)		(±161.93)	(±216.60)
t		2.5560		0.8770
df		18		18
P value		0.0198		0.3921

The post-operative day-01 control group treatment was significantly effective where *p* value was less than 0.05 (*p*=0.0198) however it was showed that post-operative day-07 experimental group treatment was not significantly effective where the *p* value was more than 0.05 (*p*=0.03921). Here its making confusion about control group but it also stated clearly that the post-operative day-01 patients usually get high power analgesics and oxygen support so that it showed effectiveness on day-01 and not effective on day-07. Originally control group treatment was less effective which is not significant and it also prove that there has great role of early mobility upon overall fitness and hospital stay also.

B. Pain Status Difference between Groups

TABLE 6: PAIN STATUS IN EXPERIMENTAL GROUP BEFORE AND AFTER TREATMENT

Treatment group				
	Pretest	Posttest POD1	Pretest	Posttest
	POD1		POD7	POD7
Mean	6.9	6.8(±1.135)	2.7 (±1.159)	2.6 (±1.26)
	(±0.74)			
t		0.2335		0.1843
df		18		18
P value		0.8180		0.8558

Study showed that the experimental group treatment regards post-operative status of pain on day-01 and day-07 was not effective and here was also confounding issues as high power analgesics, pathedine and other types of relaxants and antibiotic. So it's important to do follow-up study for pain issue.

TABLE 7: PAIN STATUS IN CONTROL GROUP BEFORE AND AFTER TREATMENT

Control group				
	Pretest	PosttestPOD1	Pretest POD 7	Posttest
	POD1			POD 7
Mean	6.1 (±0.737)	6.3 (1.159)	3.4 (±1.074)	3.4 (±1.074)
t		0.4602		t = 0.0000
df		18		18
P value		0.6509		equals 1.0000

The study showed that the control group of treatment was not significantly effective on post-operative day-01 and day-07 also.

The study found that the effect on improving functional independency level was significantly effective of experimental group of FIM score in all parameters and also in control group also but in comparison it was showed that the experimental group was more effective than control group.

TABLE 8: EFFECT ON FUNCTIONAL INDEPENDENCY LEVEL IN BETWEEN GROUP

	Treatment given to the participants	N	Mean	SD	t	df	P value
FIM score in transfer to toilet	Chest physiotherapy along with early mobilization (E)	30	6.80	.632	4.25	18	.001
	Chest Physiotherapy (C)	30	5.60	.699		17.82	.051
FIM score in transfer taking shower	Chest physiotherapy along with early mobilization (E)	30	5.50	.849	1.10	18	.0028
	Chest Physiotherapy (C)	30	5.00	1.154		16.54	.0586
FIM score in transfer in waking	Chest physiotherapy along with early mobilization (E)	30	6.80	.422	1.34	18	.0196
	Chest Physiotherapy (C)	30	6.40	.843		13.23	.0502
FIM score in staring	Chest physiotherapy along with early mobilization (E)	30	5.80	.789	2.61	18	.0018
	Chest Physiotherapy (C)	30	4.80	.919		17.58	.028

C. Effect on Peripheral Oxygen Saturation Level Between Groups

TABLE 9: PAIRED SAMPLES STATISTICS IN CONTROL GROUP

	Mean	N	SD	t	df	P value
Peripheral oxygen saturation of the participants in POD1 pretest %	89.60	30	2.50	-10.17	9	.001
Peripheral oxygen saturation of the participants in POD1 posttest%	94.20	30	2.74			
Peripheral oxygen saturation of the participants in POD7 %	93.50	30	2.42	-7.14	9	.001
Peripheral oxygen saturation of the participants in POD7 posttest %	96.90	30	2.08			

TABLE 10: PAIRED SAMPLES STATISTICS IN TREATMENT GROUP

	Mean	N	SD	t	df	P value
Peripheral oxygen saturation of the participants in POD1 pretest %	92.02	10	3.85	-4.33	9	.0001
Peripheral oxygen saturation of the participants in POD1 posttest%	94.80	10	2.66			
Peripheral oxygen saturation of the participants in POD7 %	96.90	10	1.59	-4.88	9	.0001
Peripheral oxygen saturation of the participants in POD7 posttest %	98.40	10	1.17			

The study showed that both experimental and control group treatment was effective in sense of O₂ saturation on day-01 and day-07 also. So it was showed that chest physiotherapy and along with early mobility both was effective for this parameter but experimental was more effective than control group.

D. Overall Statements

Chest physiotherapy and along with early mobility treatment was significantly effective for the management of post-operative abdominal surgery patients but combine treatment was more effective than only chest physiotherapy. It also proved that early mobility exercises is highly required for minimizing pain, improving oxygen saturation, decreasing hospital stay and other parameter. So it's

recommending to use combine treatment for this type of cases.

E. Discussion

The studies showed that chest physiotherapy along with early mobility exercise significantly reduce the duration of hospital stay. In compare, breathing exercises have an effect on the worth of the hospital stay and recovery of these patients [25].

The duration of postoperative hospitalization between both groups the finding exposed that the mean of duration of postoperative hospitalization was 7 days for the study group and 9 days for the control group with a statistically significant difference (P-value <0.05) between both groups [11]. So, it was showed that the duration of hospital stays significantly lower in treatment group (early mobility) than the control group (conventional chest physiotherapy).

Study reported early mobilization to be a beneficial intervention for patients following UAS [26]. In compare, highlighting the benefits of early mobilization away from the bedside when performed at sufficient intensities [27] and in contrast, another study showed that delaying early mobilization caused an increase in PPCs [28].

In spirometer rating: showed that post-operative day-01 experimental group treatment was not significantly effective where p value was ≥ 0.05 ($p=0.0648$) however it was showed that post-operative day-07 experimental group treatment was significantly effective where the p value was ≤ 0.05 ($p=0.0378$). So it was absolute showed that the treatment of experimental group was much effective.

Study found that ambulation does not significantly increase minute ventilation once the effects of position are taken into consideration. The most likely explanation for ambulation not significantly increasing minute ventilation is that post-operative patients are not being exercised at a high enough intensity [29]. There are also some clinicians who contemplate that if patients are able to walk, there is no need for them to perform deep breathing exercises because ambulation have similar effect to deep breathing exercises on tidal volume has perhaps been reinforced by the findings of studies conducted in patients following cardiac surgery, which concluded that deep breathing exercises offer no advantage over ambulation alone in the prevention of post-operative pulmonary complication. As a result of such findings, it is possible that physiotherapists may choose to Use ambulation on its own in wider post-operative populations.

Another study showed that breathing exercises have a positive effect on FVC, the treatment group was submitted

to a protocol of localized breathing exercises combined with manual pressure applied by the physical therapist to the patient's thoracic cage during expiration, deep diaphragm breathing, and thoracic cage expansion exercises such as fractional inspiration [30].

Breathing exercises, recently described as respiratory strategies, encompass diaphragm exercise, pursed-lip breathing, changes in body posture to favor ventilation, and active upper and lower limb exercises combined with breathing. The lack of standardization of the types of exercises, number of series, repetitions, intervals, frequency, and times may have influenced the outcome of the studies [25].

Regarding this study it was showed that the effect on improving functional independency level was significantly effective of experimental group of FIM score in all parameters and also in control group also but in comparison it was showed that the experimental group was more effective than control group.

This Study showed that both the chest physiotherapy and chest physiotherapy along with early mobility have no significant effect on pain.

This study found that effective in sense of O₂ saturation on day-01 and day-07 also. So, it was showed that chest physiotherapy and along with early mobility both was effective for this parameter but experimental was more effective than control group.

This study is supported by a randomized control trail Chest physiotherapy during the immediate postoperative period following upper abdominal surgery was effective for improving oxygen-hemoglobin saturation without increased abdominal pain. Breathing exercises could be adopted at post-anesthesia care units with benefits for patients [30]. CPT acting with thoracic expansion exercises and diaphragmatic breathing exercises immediately after the UAS seems to improve oxygenation without triggering increase in pain or other complications.

Study recommended that in their study, pulmonary physiotherapy should be supported with mobilization [30]. It has been suggested that early mobilization seems to be more effective than deep breathing exercises for the prevention of PPCs [31]. Study with the patients with upper abdominal surgery reported that daily frequency and duration of mobilization and walking greater than 5 meters on day have positive effects on reducing the length of stay [32]. Another study concluded that mobilization involving an upright position is most beneficial in the early postoperative period and produces evidence of improvement in pulmonary function [33].

IV. CONCLUSION

The result of this experimental study has identified the significant effectiveness of chest physiotherapy (CPT) along with early mobility rather than only chest physiotherapy after abdominal surgeries. But both groups of participants were showed significant effectiveness. Participants in the CPT along with early mobility exercise after abdominal surgeries showed that it significantly reduces the duration of hospital stay and as well as increase the peripheral oxygen

saturation level rather than the control group who got only chest physiotherapy.

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