

Effect of Routine Physiotherapy Vs early mobilization in preventing postoperative pulmonary complications in subjects with specific risk factors: A randomized controlled Study

Arijit Kumar Das*

Narasimman Swaminathan*

Reshma Praveen*

D'souza Vanita Vincent*

Aithala Sathya Moorthi**

ABSTRACT

This study compared the efficacy of Early Mobilization with routine Physiotherapy Technique (DBE + Splinted Cough) in 18 patients who had undergone upper abdominal surgery. Subjects were randomly allocated into two groups, following which one group received early mobilization and the other group received deep breathing exercises and splinted coughing. SpO₂ was documented every day from the 1st to 3rd postoperative day of surgery. Forced Expiratory values (FVC, FEV₁, and PEFr), Maximum Inspiratory Pressure and 2 minute walk test were measured on the 4th post operative day. All the parameters between two groups were compared and the results show similar values between two groups except PEFr which shows better results in Group 1. This study showed that early mobilization is as effective as routine physiotherapy in subject who underwent upper abdominal surgery and had a high risk of developing lung complications.

Key words: Early Mobilisation, Chest Physiotherapy, Pulmonary Complications, Upper Abdominal Surgery, General Anesthesia.

INTRODUCTION

Post operative pulmonary complications is defined as any pulmonary abnormality occurring in the post operative period that produces identifiable disease or dysfunction that is clinically significant and adversely affects the clinical course¹. The incidence of postoperative pulmonary complications after surgery is very well documented in literature^{2,3,4}. In upper abdominal surgery the incidence of these complications is seen to be as high as 5% to 30%⁵. The causes for

the occurrence of post operative pulmonary complications is attributed to various procedures incorporated during or after surgery as well as the medical status of the patient preoperatively and the presence of risk factors⁶.

Post upper abdomen surgery, patients develop a restricted pattern of breathing with a decrease in vital capacity (VC) and functional residual capacity (FRC)^{6,7}. This decrease in lung volumes and capacities is associated with hypoxemia, broncho-pulmonary infection, pneumonia, airway obstruction and Hypercapnia and eventually progresses to postoperative respiratory failure⁸. Subjects with various predisposing factors like old age, history of respiratory disorders, and smoking are more prone to develop postoperative complications.

Chest physiotherapy is frequently used in the prevention and treatment of postoperative pulmonary complications after major abdominal

Author's Affiliation: *Department of Physiotherapy, Father Muller Medical College, Mangalore, India, **Department of General Surgery, Father Muller Medical College, Mangalore 575002.

Reprint's request: Narasimman Swaminathan, Associate Professor/ Course Coordinator, Department of Physiotherapy, Father Muller Medical College, Mangalore - 575002, E-mail: naraswamin2001@gmail.com.

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surgery¹. It includes preoperative assessment and instructions, breathing exercises emphasizing inspiration, incentive spirometry, techniques to clear bronchial secretions and early mobilization is given with an aim of increasing lung ventilation, preventing chest infections and rehabilitation of the individual to the activities of daily living^{4,9}.

The rationale for the use of all these techniques is to promote the normal respiratory pattern and thus improve the distribution of ventilation. These techniques aid in clearing excessive or retained pulmonary secretions from the conducting airways and preventing or reversing areas of atelectasis thereby decreasing the incidence of lung infections.

Number of studies with varying quality are published in this regard and the results of these studies contradicts each other^{1,2,10}. Early mobilization is also an important treatment component of the postoperative care following upper abdominal surgery¹⁰. Low intensities of mobilization are seen to have a direct and profound effect on oxygen transport in patients with acute cardiopulmonary dysfunction¹¹. Patients in upright sitting have demonstrated a small but significant increase in PaO₂ as compared to supine lying and sitting with the bed head raised 45°¹². There is no standard definition for early mobilization and has been reported to include: moving in bed, sitting out of bed, standing, and ambulation on the spot, hallway ambulation, low intensity exercises¹³. Any upright positioning and mobilization of bed ridden patient has shown to have a positive effect on respiratory ventilation thus increasing the patients' oxygen saturation¹⁴

Hence this study has been conducted in subjects who have undergone upper abdominal surgery with predisposing factors for postoperative pulmonary complications, to find an answer to whether early mobilization is as effective as or better than routine physiotherapy in the prevention of postoperative pulmonary complications.

MATERIAL & METHODS

Sample of 19 subjects between 40 – 60 years who have undergone upper abdominal surgery between 24/06/2009 to 10/10/2009 at Father

Muller Medical College Hospital aged 40-60 years with the history of smoking more than 20yrs, both males & females, diagnosed COPD or bronchial asthma and subjects who were haemodynamically stable were included in this study. Non smokers, subjects with respiratory insufficiency requiring artificial airway, systemic disorders, uncooperative and subjects with any musculoskeletal or neuromuscular disorders which can affect test procedure were excluded from the study. Informed consent was obtained from all the subjects. The study was approved by the institution ethical committee.

PROCEDURE

Those subjects were fulfilling the criteria were randomly assigned to both the groups, Group A (Early mobilization) n=10 and Group B (Routine Physiotherapy = Breathing exercises and splinted coughing) n=9 by using the A Randomization Plan¹⁵. Past medical history, smoking history and other demographic data were noted from the surgeon and anesthetists chart. Post operatively, on the day of the surgery vitals and oxygen saturation (SpO₂ in %) of the subjects were monitored by using Pulse Oximeter and the subjects were made to perform the particular maneuver depending on the group they belonged to, that is either Breathing exercises and splinted coughing or early mobilization under the supervision of physiotherapist thrice a day. They were also instructed to perform free ankle toe movement ten times every awake hour apart from the physiotherapy session on the day of the surgery

On the first post operative day Group 1 (Fig 1 & 2) patients received only early mobilization no other regular physiotherapy management. Treatment was given thrice a day. The average duration of the physiotherapy session was 20 minutes. Early mobilization gradually commenced in the following sequence -

- 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

Progression was made according to the vitals and subjects Rate of Perceived Exertion.

Group 2 received deep breathing exercises and splinted coughing. They were mobilized only by 3rd postoperative day. These deep breathing exercises consist of diaphragmatic breathing (deep breathing followed by splinted cough, huff, or forced expiratory maneuver). Instructions and supervision from the physiotherapist focused on bilateral basal expansion, avoiding upper chest

Table 1: Comparison of Temperature and auscultatory findings on 1st, 2nd, 3rd POD and CXR on 4th POD between the groups

	TEMPERATURE			AUSCULTATION			CXR 4th POD
	1 st POD	2 nd POD	3 rd POD	1 st POD	2 nd POD	3 rd POD	
Early Mobilization	98.6	98.6	98.6	N	N	N	N
Routine Physiotherapy	98.6	98.6	98.6	N	N	N	N

Figure 1: Sitting Side of the Bed



Figure 2: Early mobilization with drainage tube in situ



Figure: 3 Spiro meter - (for PFT) [Micro Loop Spida 5 Spiro meter]



and shoulder elevation, and maximizing expansion of the lower chest diameters during inspiration, with a three second 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.

They were also instructed to perform free ankle toe movement ten times every awake hour apart from the physiotherapy session on the day of the surgery.

OUTCOME MEASURES

At the end of the fourth post operative day, vitals, oxygen saturation (SpO₂) and pulmonary function test were performed in both the groups. Pulmonary function test was performed in the upright sitting position by using Spida 5 (Figure 3). For forced expiration tests, as per previous instruction normal breaths followed by one deep breath and forced expiration with maximal forced followed by a normal intake of breath. All

instructions were given by the same researcher throughout procedure in the language best understood by the subject. Once the subject was familiar with the maneuver, the readings were recorded. They were made to perform three trails with adequate rest. The trails were repeated if the variation was more than 10%. The Maximal Inspiratory Mouth pressure was measured by using a simple Mano Meter. (Figure 4)

Two minute walk test was performed in the hospital corridor which was of 35 meter in length. The subjects were instructed to walk as fast as possible and to cover as much as possible in two minutes. A constant encouragement was given by the researcher. They were instructed to stop the test if they felt dyspnea, fatigue, pain and any other abnormal symptoms. A stop watch was used to monitor the time. The total distance walked in two minute was recorded. Apart from this body temperature, auscultatory findings and chest 'X' ray findings were noted and documented.

Though the outcome measures were taken preoperatively in most of the patients, only the

Figure 4: MIP Instrument



postoperative measures were considered for statistical analysis.

DATA ANALYSIS

Repeated measures of variance was (ANOVA) used to analyze within the group difference. Mann-Whitney Test was used to compare the outcome between the groups followed by post surgical analysis. The software used for statistical analysis was SPSS 13.

RESULTS

18 subjects completed the study out of which 4 were females and 14 males.

In Group 1 (Early Mobilization), 10 subjects with a mean age of 50.30(SD 7.718) and Group 2

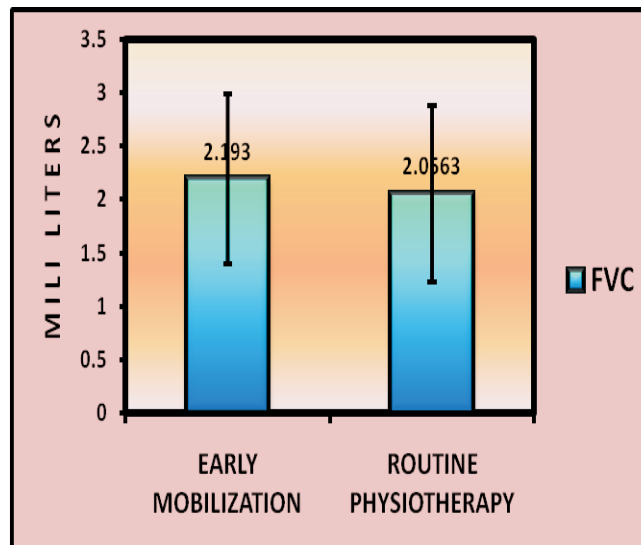
(Routine Physiotherapy), 8 subjects with a mean age of 50.25(SD 5.80) were completed the study. In Group 1 there were 2 females and 8 males. In Group 2, there were 2 females and 6 males. Figure 5

The mean FVC value on 4th post operative day in Early Mobilization and Routine Physiotherapy was 2.193(SD +.79862) and 2.0563(SD + .82904) respectively. It was statistically not significant (p = 0.534). Figure 6

The mean FEV₁ value on 4th post operative day in Early Mobilization and Routine Physiotherapy was 2.07(SD +.78) and 1.75 (SD + .76) respectively. Difference of FEV₁ values in between two groups on 4th post operative day was statistically not significant (p = 0.141).

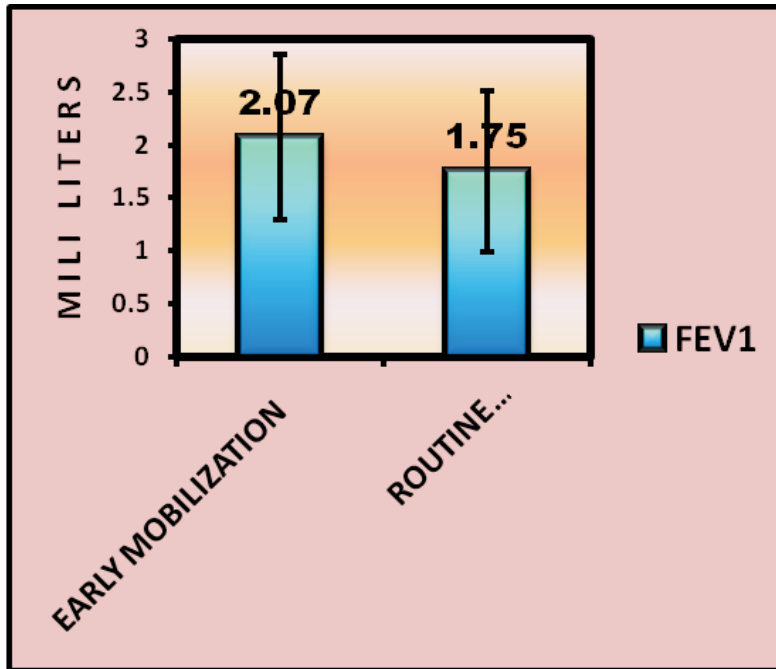
The mean PEF_R value on 4th post operative day in Early Mobilization Group and Routine Physiotherapy Group was 240.40(SD + 93.646)

Figure 5: Comparison of Force Vital Capacity (FVC) between the groups



and 193.75(SD + 102.45) respectively. The P value between two groups was statistically significant and in Early Mobilization Group Subjects PEFR was 0.046. Difference of mean PEFR values

Figure 6: Comparison of Force Expiratory Volume in 1 st second (FEV₁) between the groups

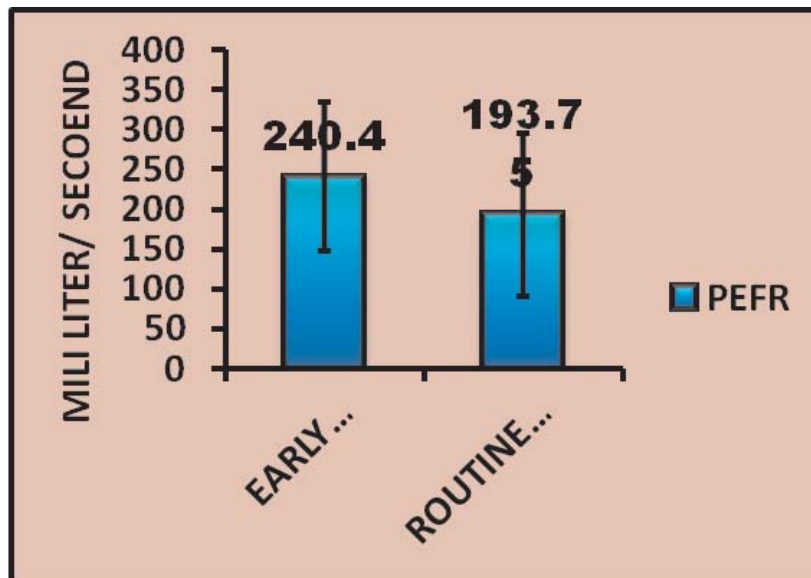


values is more than Routine Physiotherapy subjects. Figure 7

The mean MIP value on 4th post operative day in Early Mobilization and Routine Physiotherapy was 76.00(SD + 18.306) and 20.612 (SD + 20.612) respectively. The P value was 0.893. The difference of MIP values between two groups was not significant. Figure 8

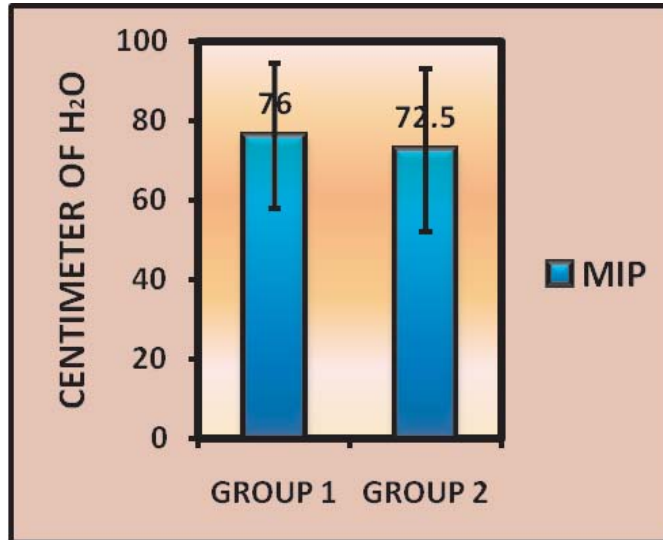
The mean 2 MIN WALK TEST value on 4th post operative day in Group 1(Early Mobilization) and Group 2 (Routine Physiotherapy) was 140.00(SD + 24.944) and 134.38 (SD + 20.255) respectively. The difference of 2 min walk distance values between two groups was not significant. Figure 9

Figure 7: Comparison of PEFR between the Groups



The mean SPO₂ value on 1th post operative day in Early Physiotherapy Group and Routine Physiotherapy Group was 99.90 (SD + .316) and 98.88 (SD + 1.642) respectively.

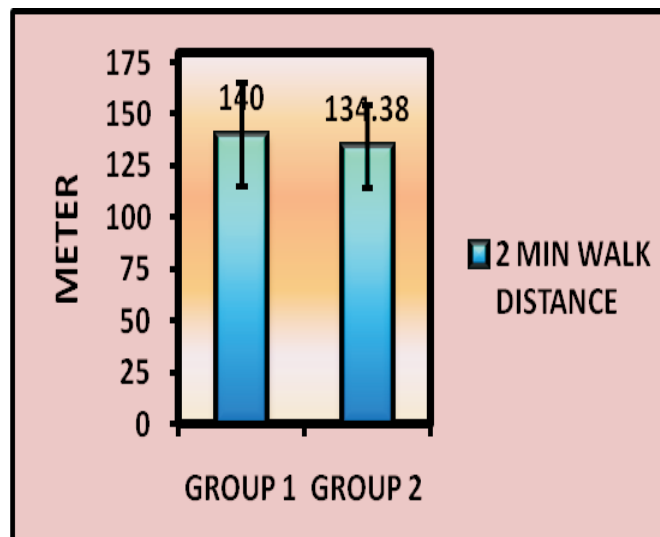
Figure 8: Comparison of Maximum Inspiretory Pressure (MIP) between the groups



Clinically Early Mobilization Group patients had better SpO₂ in compare to Routine Physiotherapy Group on 1st POD. E a r l y

Mobilization Group patients had better SpO₂ in compare to Routine Physiotherapy Group on 2nd POD. The mean SPO₂ value on 3th post operative day in Early Mobilization Group and Routine

Figure 9: Comparison of 2 Min Walk Distance between the groups



Physiotherapy Group was 100.00(SD + 0.000) and 99.63(SD + 0.744) respectively. On the 1st POD, 2nd POD and 3rd POD the difference of SpO₂ between two groups are statistically not significant. Figure 10

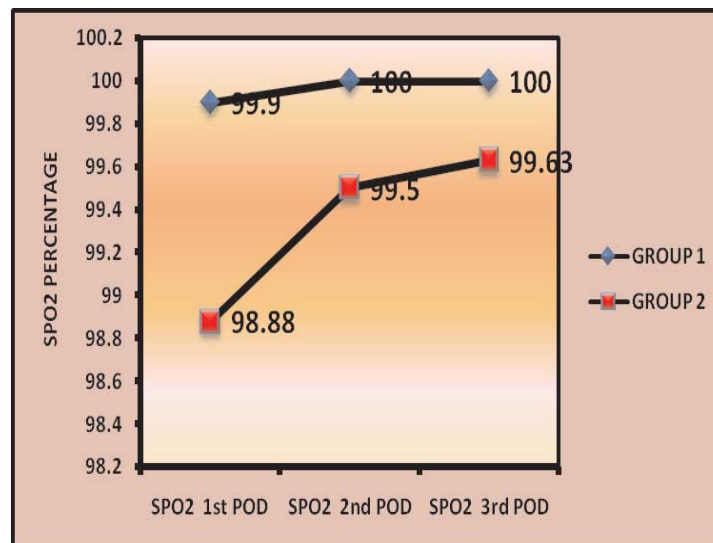
N = NORMAL

TEMPERATURE ON FAHRENHEIT

DISCUSSION

The role of physiotherapy in prevention and correcting postoperative pulmonary complications are yet to be established. In this context, this study aimed to compare the routine physiotherapy with early mobilization to prevent pulmonary complications. To identify the efficacy of two

Figure 10: Comparison of MEAN SpO₂ with in 1st , 2nd and 3rd POD between the groups



different techniques, subjects with history of smoking more than 20 years or diagnosed with COPD or asthma were included in this study with the fact that these subjects have an overall increased rate of postsurgical complications of about 26- 78 % In order to assess the occurrence of pulmonary complications, pulmonary function test was used in this study along with oxygen saturation as suggested measures. Similar outcome measures have been used in previous studies ^{4,5}.

Though it is proved that there will be significant reduction on Forced Vital Capacity in postoperative patients, in this study these measures were used to quantify the respiratory impairment. Apart from these parameters, the

temperature was noted from the nursing chart and auscultatory findings as per the researcher.

The Preoperative measurements were not considered for analysis since most of the subjects that were included underwent emergency laprotomy procedure. The randomization procedure used in this study was from www.randomization.com (No-10181) ¹⁵

There was no significant difference in the parameters such as FVC, FEV₁, and MIP between the groups except PEFR. The early mobilization group had statistically better PEFR when compared to routine physiotherapy group which was contributed to the effect of gravity. The clinical improvement in the SpO₂ of the early mobilization group was also attributed to the

effect of gravity which was explained by Dean¹³. Both groups with respect to temperature and chest x-rays did not show any significant difference with regard to pulmonary complications. To measure the functional capacity, monitor the treatment effectiveness, and to establish prognosis in upper abdominal surgery a 2 min walk test is used. In this study on the 4th post operative day at the end of the treatment session 2 min walk test was done and it was found that the comparison of distance parameter between two groups is not significant statistically. This study was mainly done to demonstrate the efficacy of early mobilization and routine physiotherapy and comparison between two techniques in the management of patients who have undergone upper abdominal surgery.

Though there was no statistically significant difference in most of the parameters used in this study, the early mobilization group had higher values when compared to routine physiotherapy group. This shows that early mobilization has a positive effect in preventing pulmonary complications.

All the outcome measurements in this study were taken postoperatively because maximum subjects had undergone emergency upper abdominal surgery so it was not possible to take preoperative outcome measures. This study included subjects with more than 20 years of smoking history along with COPD and Asthma subjects, with most of the male subjects. This might have affected the outcome, in either way.

CLINICAL IMPLICATIONS

Early mobilization is also as effective as routine physiotherapy to prevent pulmonary complications on upper abdominal surgery. This technique is easy for the patients to understand and can be stated by other healthcare professionals also.

CONCLUSION

Early Mobilization statistically has all most equal effects but clinically has better effects when

compared to routine physiotherapy (DBE+ Splinted Coughing) for preventing post operative pulmonary complication. More studies with large number of patients should be conducted to find out the efficacy of Early Mobilization in preventing post operative pulmonary complications.

List of abbreviations

BP: Blood Pressure, **COPD:** Chronic Obstructive Pulmonary Diseases, **HR:** Heart Rate, **SPO₂:** Oxygen saturation in percentage, **PaO₂:**

Partial Pressure of Oxygen, **PFT:** Pulmonary Function Test, **POD:** Post Operative Day, **PPC:** Postoperative Pulmonary Complication., **RR:** Respiratory Rate, **PEFR:** Peak Expiratory Flow Rate, **FVC:** Forced Vital Capacity, **FEV₁:** Forced Expiratory Volume in one second, **MIP:**

Maximal Inspiratory capacity

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