International Journal of Enhanced Research in Medicines & Dental Care, ISSN: 2349-1590
Impact Factor: 1.102, Vol. 4 Issue 4, April-2017

Randomized controlled trial of prophylactic chest physiotherapy in major abdominal surgery

Dr. Ajay Malviya[1], Dr. M L Lohiya[2], Dr. Dinesh Dutt Sharma[3], Dr. Sahi Ram[4], Dr. M. K. Chauhan[5], Dr. Lovedeep Singh Chauhan[6], Dr. Solanki RK[*1]

[1]Senior Professor and HOD, Dept. of General Surgery, Dr. S.N. Medical College, Jodhpur, Rajasthan, India.
[2]Principal Specialist, Dept. of General Surgery), Dr. S.N. Medical College, Jodhpur, Rajasthan, India.
[3]Assistant Professor, Dept. of General Surgery, Dr. S.N. Medical College, Jodhpur, Rajasthan, India.
[4]Consultant Surgeon, Dept. of General Surgery) Dr. S.N. Medical College, Jodhpur, Rajasthan, India.
[5]Ex. Senior Professor and HOD, Dept. of General Surgery) Dr. S.N. Medical College, Jodhpur, Rajasthan, India.
[6]Third Year Resident, Dept. of General Surgery) Dr. S.N. Medical College, Jodhpur, Rajasthan, India.
[*1]Professor Department of Anaesthesiology and Critical care, Dr. S.N. Medical College and attached hospitals, Jodhpur (Rajasthan) INDIA

INTRODUCTION

Post operative pulmonary complications still remain one of the leading cause of morbidity and mortality in surgical patients despite the better understanding of pathophysiology of post operative pulmonary complication.

The overall incidence of pulmonary complication's vary from 4.5- 80% particularly more after upper abdominal surgery and also depending upon the criteria for definition.

Postoperative pulmonary complications may include simple pyrexia, increase sputum production, atelectasis, bronchopneumonia, collapse, consolidation and an overwhelming pneumonic process leading to respiratory failure. These complications may be diagnosed on simple clinical examination or an x-ray evidence of atelectasis.

Chest physiotherapy has long been an established mode of treatment for pulmonary complication after abdominal surgery.

Various methods have been devised for the preoperative chest physiotherapy. However, it is a general agreement and clear from the literature that the patients receive pre operative chest physiotherapy who undergo major abdominal surgery are decrease risk of postoperative pulmonary complications [Thoren et al (1954), Laszlo et al (1973), Morran C.G. et al (1983), Bourn et al (1991), Olsen M.F. et al (1997), Roukema et al (1998)].

The pre operative chest physiotherapy include conservative regimen of coughing and deep breathing (CDB), incentive spirometry (IS), and continuous positive airway pressure (CPAP) delivered at intervals with a face mask.

AIMS AND OBJECTIVES

1. To know the effect of routine chest physiotherapy on the frequency of pulmonary complications following abdominal surgery.

2. To predict out any single and most effective physiotherapy method to prevent postoperative chest complications.

MATERIAL & METHOD

The present study was conducted on the patients admitted in various surgical wards in the Department of General Surgery, Mahatma Gandhi Hospital associated to Dr. Sampurnanand Medical College, Jodhpur.

The study included patients over 15 years of age under went elective open abdominal surgery.

The patients were randomized into two groups viz:-

1. **Treatment group** – The patients in this group were given preoperative written as well as verbal information and were further sub classified according to the nature of chest physiotherapy to be given.

   a) Patient performed breathing exercise with pursed lips, and coughing hourly and deep breathing (Group B).
   b) Patients performed or incentive spirometry (Group A).

2. **Control Group**:- This group included the patients who were not given any preoperative chest physiotherapy (Group C).

Methods

1. Assessment and stratification of patients : Before operation all patients were classified according to American Society of Anesthesiologist (ASA) Score and there were stratified in two further groups :-

   i. **High-risk group** – Age over 50 years, smoker, BMI greater than 30 Kg/M, pulmonary disease with need for daily medication and a history of other disease and reduced ventilator function.
   ii. **Low risk group –** When no specific risk factor are present.

Patients in treatment group were seen day before surgery and received pre and postoperative information and training protocols according to mode of chest physiotherapy.

I. **Incentive spirometry**
II. **Breathing Exercise**
III. **Control Group:-** Patients in the control group included those who had not received any information or training before and after operation. Treatment was with held unless a pulmonary complication was diagnosed. Patient who developed pulmonary complications were given chest physiotherapy and routine care as per need.

Observation in the postoperative ward.

The patients were shifted to post operative ward when they were awake, conscious able to follow verbal commands, able to cough, with stable vital signs. In postoperative ward the patients were followed in every morning and evening till they were discharged from the hospital.

In postoperative ward oxygen saturation were measured daily for the first 6 days. In these patients saturation were recorded as 98 percent as an assumed maximum level without oxygen therapy FVC and PEFR were measured on every I^{st}, 3^{rd} & 6^{th} postoperative days. The patients were observed for respiratory complications like sore throat, laryngeal oedema, respiratory insufficiency, fever, chest pain, tachypnoea, cough, atelectasis and broncho pneumonia.

OBSERVATION

Prophylactic pre operative chest physiotherapy were performed in 50 patients posted for major abdominal surgery. An attempt was made to establish a co-relation between post operative lung complications and various risk factors and following results drawn from the present study.

Table No. 1: Age & Sex

Age & Years	Total Patients	Male	Female	Percentage
15-25	14	9	5	28
26-35	9	7	2	18
36-45	10	4	6	20
46-55	9	3	6	18
56-65	5	2	3	10
66-75	3	1	2	6

Table No. 2 (A) Age Distribution and Pulmonary Complications

Age	Group A			Group of B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
15-25	4	0	0	1	1	0	9	6	66
26-35	3	1	33	3	0	33	3	2	66
36-45	2	1	50	2	1	50	6	4	66
46-55	4	2	50	2	1	50	3	2	66
56-65	2	2	100	1	1	100	2	2	100
66-75	0	0	0	1	1	100	2	2	100
TOTAL	15	6	40	10	5	50	25	18	464

Table No. 2 (B) Age Distribution and Pulmonary Complications

Age	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
<55	13	4	30.7	8	3	37.5	21	14	66.6
>55	2	2	100	2	2	100	4	4	100

Table No. 3 (A) Body Weight and Pulmonary Complications

Wt. Kg.	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
14-50	2	0	0	3	1	33	9	5	55.5
51-60	4	1	25	4	2	50	10	8	80
61-70	5	2	40	3	2	66	5	4	80
71-80	3	2	66	0	0	0	0	1	100
81-90	0	0	0	0	0	0	0	0	0
91-100	1	1	100	0	0	0	0	0	0
Total	15	6	40	10	5	50	25	18	72

Table No. 3 (B)

Age	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
<70 Kg.	11	3	27.2	10	5	50	24	17	68
>70 Kg.	4	3	75	0	0	0	1	1	100

Table No. 4 Sex Distribution and Pulmonary complication

Sex	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
Male	7	4	57.14	5	3	60	14	12	85.17
Female	8	2	25	5	2	40	11	6	54.55

Table No. 5 Smoking and Complication

Addiction	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
Smoker	3	3	100	1	1	100	10	9	90
Tobacco Chewer	1	1	100	1	1	100	2	2	100
Non Smoker	11	2	18.18	8	3	37.5	13	7	53.85

Table No.6 Smoking number of Pack/ Year

No. of Pack Year	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
>5	10	0	0	0	0	0	1	0	0
6-10	0	1	0	0	0	0	2	2	100
11-15	1	2	100	1	1	100	1	1	100
16-20	2	0	100	0	0	0	2	2	100
21-25	0	0	0	0	0	0	1	1	100
>26	0	0	0	0	0	0	3	3	100

Table No.7 Type of Incision

Type of Incision	Group A			Group B			Group C		
	No. of Pts.	Comp.	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
Kocher (Rt. Subcostal)	6	2	33	6	2	33	6	3	50
Mid Line	7	4	57.1	3	2	66	19	15	78.9
Rt. Paramedian	0	0	0	1	1	100	0	0	0
Transverse	2	0	0	0	1	0	0	0	0

Table No.8 Type of Surgery

Type of Incision	Group A			Group B			Group C		
	No. of Pts.	Comp.	%	No. of Pts.	Comp	%	No. of Pts.	Comp	%
Cholecystec-tomy	7	2	28.6	6	2	33	6	3	50
Peptic. Per. Rep	1	1	100	1	1	100	8	8	100
Enterick Per Rep.	2	1	50	1	0	0	5	3	60
Caecal Per. Rep.	0	0	0	0	1	0	1	1	100
Rt./ Hemicolectomy	1	1	100	1	0	100	0	0	0
Choledocoduodenostomy	1	0	0	0	0	0	0	0	0
Liver injury Rep.	0	0	0	0	0	0	1	1	100
Pyo Peritoneum Drain	0	0	0	0	0	0	1	1	100
Sigmoid Perf. Rep.	0	0	0	0	0	0	1	1	100
Incisiional H. plasty	1	0	0	0	0	0	0	0	0
Cystogastro-stomy	0	0	0	1	1	100	0	0	0
Ileo-Ileal Res. Anastomosis	2	1	50	0	0	0	0	0	0
Ileal Stricto Plasty	0	0	0	0	0	0	1	0	0
Ileal Band Excision	0	0	0	0	0	0	1	0	0

Table No.9 Length of Incision

Lenghth in CM	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
10-May	6	1	16.67	7	3	42.86	7	3	42.8
11-15	0	0	0	0	0	0	3	2	66.6
16-20	6	2	33	3	2	66	12	100	83.3
21-25	2	2	100	0	0	0	2	2	100
26-30	1	1	100	0	0	0	1	1	10

Table No. 9 (B) Length of Incision

Lenghth in CM	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
<20	12	3	25	10	5	50	22	15	68.1
>20	3	3	100	-	-	-	3	3	100

TABLE NO. 10 (A)

Duration In Minute	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
50-70	2	0	0	4	1	25	3	1	33
71-90	6	2	33	4	2	50	9	6	33
91-110	2	1	50	1	1	100	4	3	75
111-130	4	2	50	1	1	100	5	4	80
131-150	0	0	0	0	0	0	4	4	100
151-170	1	1	100	0	0	0	0	0	0

Table No. 10 (B)

Duration In Minute	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
50-110	10	3	30	9	4	44.4	16	10	62.8
111-70	5	3	60	1	1	100	9	8	88.8

Table No. 11 Relation between Analgesic and Respiratory Compilations

Analgesic	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
Diclofenac sodium	12	6	50	8	4	50	19	14	73.6
Tramadol HCL	1	0	0	0	0	0	2	2	100
Epidural Sensorician	1	0	0	0	0	0	0	0	0
Pracoxib Sodium	1	0	0	2	1	50	4	2	50

Table No. 12 Relationship Antibotic & P.O. complication

Name of Antibiotic	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
Cefuroxime	3	0	0	2	0	0	4	4	50
Cefriaxon	7	3	42.8	5	3	60	16	16	81.25
Cefipime	1	0	0	0	0	0	0	0	0
cefotaxim	3	2	66.6	3	2	66.6	1	1	100
Sulbactum Cefoparazone	0	0	0	0	0	0	1	1	0
Ceftizoxime	1	1	100	0	0	0	2	2	100

Table No. 13 Ambulation Time

Ambulation Time in Hours	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
18-25	5	1	20	2	0	0	1	0	0
25-30	5	2	40	4	2	50	10	7	70
31-36	4	2	50	6	3	50	8	6	75
37-42	0	0	0	3	0	0	0	0	0
43-48	1	1	100	0	0	0	6	5	83.3

Table No. 14 Pulmonary Complicaton

Nature of Complication	Group A			Group B			Group C		
	No. of Pts.	Comp	%	No. of Pts.	Comp	%	No of Pts	Comp	%
Temprature >38 C	15	6	40	10	5	50	25	19	76
Dry Cough	15	4	26.6	10	3	30	25	9	36
Productive Cough	15	2	13.3	10	1	10	25	9	36
Atelectasis	15	1	6.6	10	1	10	25	3	12
Basal Pneumonia	15	1	6.6	10	1	10	25	7	28
Pleural Effusion	0	0	0	0	0	0	25	1	4

DISCUSSION

The results of the present study further strengthens the fact that proper preoperative chest physiotherapy before and after abdominal surgery definitely reduces the incidence and severity of postoperative chest complication, as already documented by various workers (Thoren et al 1954, Laxzlo et al 1973, Morron C.G. et al 1983, Olsen M.F. et al 1997). In the present study we have also observed the nature of chest physiotherapy, in the firm of incentive spirometry (Group A) is marginally better than coughing and deep breathing (Group B).

Overall Incidence:

The overall incidence of postoperative chest complications after major abdominal surgery has ranged from 4.5 – 80%. Overall incidence of pulmonary complications in the present study was 40% in group A (6 out of 15 patients), 50% in group B (5 out of 10 patients) and 72% in group C (18 out of 25 patients). These results thus establishes a correlations between preoperative chest physiotherapy and incidence of postoperative chest complications.

It was also observed in our study that the nature of postoperative pulmonary complication was more severe in the form of atelectasis, Basal pneumonia in Group C, in comparison to Group A & B, as evident from Table 15, also reported by Olsen M.F. et al (1997), Ricksten S.E. et al (1986), Morran C.G. et al (1983).

The non-pulmonary factors that predispose the patients to postoperative chest complications can be sub divided into 5 areas.

1. General factor, age, sex, body weight and smoking habits.
2. Disease related factor – Pre operative pulmonary disease.
3. Type of surgery – Length and site of the incision.
4. Type of anesthesia – Duration of anesthesia and concentration of anesthetic agent used.
5. Adequacy of pain relief in postoperative period.

We have observed that as the age advances. There are more chance of post operative complications. The incidence of postoperative chest complications is less in patients of < 55 years of age (group A 30.7% group 37.5%, Group C 66%) in comparison to patients over the age of 55 years (group A 100%, group B 100%, group C 100%) (Table 2 B).

There is male preponderance in favour of for postoperative chest complications (group A 57.4%, group B 60%, group C 85.71%) as compared to females (Group A 25%, Group B 40%, Group C 54.53%).

We observe that as the body weight increases there are more chance of postoperative pulmonary complications. The incidence of pulmonary compilations is less in patients weighting < 70 kg. body weight (Group A 27.2%, Group B 50%;, Group C 68%) in comparison to patients weighting > 70 Kgs. Body weight (group A 75%, group C 100%).

The heavy smokers have more incidence of postoperative pulmonary compilations as compare to non-smokers. The incidence of postoperative chest complications is less in non smokers (group A 18.18%, group B 37.5%, group C 53.85%) in comparison to smokers (group A 100%, group B 100%, group C 100%).

Higher incidence of pulmonary complications in smokes as compared to non smokers has also been reported by Latimer et al (1971), Laszto et al (1973) (smoker 53% non smoker 22%), Tisi G.M. (1979), Morran C.G. et al (1983) (smoker 44%, Non smoker 21%).

The universal response to abdominal surgery is the development of hypoxemia lasting for at least seven days. Latimer et al (1971) believed that this hypoxemia represents the increase in shunting that occurs as a result of malliary or micro atelectasis.

The incidence of postoperative chest compilations is less in patients of ileal surgery 41.69% in comparison to peptic perforation repair 100%, liver injury repair 100%, cystogastrostomy 100% and right hemicolectomy 100%).

The incidence of postoperative chest complications is proportional to the length of incision. The duration of anesthesia is much more significant than the type of route of administration of anesthesia. Latimer et al (1971) found 29%, incidence of pulmonary complications (Macro atelectasis) if the procedure lasted for 3.5 hours and 100% when anesthesia time lasted longer than 3.5 hours.

In the present study the incidence of postoperative chest complications is less if duration of anesthesia < 110 minutes (group A 30%, group B 44.4%, group C 62.5% in comparison to patients in whom duration of anesthesia is > 100 minute (group A 60%, group B 100%, group C 88.8%).

In the present study we have given the postoperative pain relief with IM/IV or epidural narcotics or non-steroidal anti inflammatory, local anesthesia drugs at regular intervals and or patients demand basis.

Olsen M.F. et al (1997), Scheidegger et al also reported the effect of early versus late mobilization on pulmonary function in 51 patients after abdominal surgery. Patients who begin walking on the day of operation had better pulmonary function than those who did not.

A correlation between the antibiotic and the incidence of postoperative chest complications is established in the present study. We find that incidence of pulmonary compilations is lowest with cefuroxime group A 0, group B 0, group C 50% and highest with Ceftizoxime 100%.

SUMMARY AND CONCLUSION

An overall incidence of postoperative pulmonary complications after major abdominal surgery in (incentive spirometry) group A 40% as compared to (coughing and deep breathing) group B 50% (control group) group C 72%.

The relationship of pulmonary complications with various risk factors was seen on follows.

1. As the age increases the incidence of postoperative pulmonary complications also increase.
2. Male patients had higher incidence of pulmonary complication as compared to female.
3. Obese patients had high incidence of pulmonary compilations.
4. Smokers had higher incidence of postoperative pulmonary complication as compared to non-smokers.
5. The incidence of pulmonary complications is proportional to the length of incision.
6. Site of incision also influenced the incidence of pulmonary complications. The incidence of pulmonary complications is high with upper mid line incision.
7. Maximum incidence of pulmonary complications was seen after upper abdominal surgery.
8. The incidence of post operative pulmonary complications increases as duration of anesthesia increase.
9. Early mobilization was seen in the treatment group as compared to the control group.
10. All patients had a profound reduction in FVC and PEFR on first postoperative day. Difference between the treated patients and the control group in FVC, PEFR, Oxygen saturation was significant on the first three postoperative days.

BIOGEOGRAPHY

[1]. Aldren CP, Barr LC, Leach RD. Hypoxaemia and postoperative pulmonary complication, Br. Sug. 1991; 78%1307-08.
[2]. Ali. J. Weisel RD et al consequences of postoperative alterations in respiratory mechanics. Am. J. Surg. 1974; 128:376-82.
[3]. Anderson WH, et al Prevention and postoperative pulmonary complications. Use of isoproterenol and intermittent positive pressure breathing on inspiration. JAMA 1963; 186: 106-06.
[4]. Bartlett BH, et al studies on the pathogenesis and prevention of postoperative pulmonary complications. Surg. Gynecol Obstet 1973, 137-925-33.
[5]. Bateman et al (1979). Regional lung clearance of excessive bronchial secretions during chest physiotherapy in patients with stable chronic airways obstruction. Lancet, 1, 264.
[6]. Beeker A, et al the treatment of postoperative pulmonary atelestasis with intermittent positive pressure breathing. Surg. Gynecol Obstet 1960; 11:517-22.
[7]. Bourn J, Jenkins S. Post-operative respiratory physiotherapy indications for treatment. Physiotherapy 1992; 78:80-5.
[8]. Castillo R, Haas A, Chest physical therapy: comparative efficacy of preoperative and postoperative in the elderly. Arch Phys Med Rehabil 1985; 66:376-9.
[9]. Christensen EF, Schultz P, Jensen OV et al. postoperative pulmonary complications and lung function in high-risk patients : a comparison of three physiotherapy regimens after upper abdominal surgery in general anesthesia. Acta Anaesthesiol Scand 1991; 35:97-104.
[10]. Crawford BL, Blunine WP, Elliott AGP. The value of self administered peri-operative physiotherapy. Ir J Med Sci 1990; 159:51-2.
[11]. Gracey Dr. Divetie MB, Didier EP (1979) – Preoperative pulmonary preparation of patients with chronic obstructive pulmonary disease: Chest, 76, 123 – 129.
[12]. Laszlo G, Archer GG, Darrell JH, Dawson JM, Fletcher CM. The diagnosis and prophylaxis of pulmonary complications of surgical operation. Br. J. Surg 1973; 62:129-34.
[13]. Owens WD, Felts JA, Sqitznagel EL Jr. ASA Physical status classifications: a study of consistency of ratings. Anesthesiology 1978; 49:239-43.
[14]. Stock MC, Downs JB, Gauer PK, Alster JM, Imrey PB. Prevention of postoperative pulmonary complication with CPAP, incentive spirometry, and conservative therapy, Chest 1985; 87:151-7.
[15]. Torrington KG, Sorenson DE, Sherwood LM. Postoperative chest percussion with postural drainage in obses patients following gastric stapling. Chest 1984; 86:891-5.