Original Article

Incentive Spirometry

Effectiveness of Incentive Spirometry in Preventing Postoperative Pulmonary Complications after Laparotomy

1. Muhammad Imran 2. Ashfaq Ahmed Javed 3. Muhammad Asif

1. PG Trainee of General Surgery, 2. Head of Department / Consultant General Surgeon, 3. Consultant General Surgeon, CMH Abbottabad.

ABSTRACT

Objective: To compare the effectiveness of incentive spirometry with deep breathing exercises in preventing post operative pulmonary complications after laparotomy.

Study Design: Observational Analytic study

Place and Duration of Study: This study was conducted in the Department of General Surgery, CMH Abbotabad from Jan 2014 to Mar 2015.

Materials and Methods: Total of 100 patients fulfilled the inclusion criteria. Patients of both sex and different age groups were included in the study.50 patients underwent deep breathing exercises and 50 patients underwent incentive spirometry postoperatively in addition to deep breathing exercises for five days. ABGs and the temperature was monitored for five days postoperatively. The findings were recorded and analyzed on SPSS 20.

Results: The mean age for deep breathing exercises was 40 + 13.34 and for IS was 43+12.76..the male :female ratio was 1.34:1 for deep breathing exercises and 1.8:1 for incentive spirometry. In group A 52% had no post pulmonary complications while incidence of PPC varied with grade 01 (30%) ,grade 2 (10%) and grade 3(6%) .In group B 74% had no post operative pulmonary complication while incidence of PPC varied with grade 01(18%) ,grade 02(6%) and grade 3(2%).

Conclusion: Our study showed that the use of incentive spirometry along with deep breathing exercises decreases the incidence of postoperative pulmonary complications as compared to deep breathing exercises alone.

Key Words: Incentive Spirometry, Deep Breathing Exercises, Postoperative Pulmonary Complications.

Citation of article: Imran M, Javed AA, Asif M. Effectiveness of Incentive Spirometry in Preventing Postoperative Pulmonary Complications after Laparotomy. Med Forum 2015;26(10):24-26.

INTRODUCTION

Post operative complications including Atelectasis ,Infections including bronchitis, pneumonia .They are a major cause of morbidity and mortality postoperatively. Prolonged mechanical and respiratory failure, Exacerbation of underlying chronic lung disease are a significant cause of mortality and morbidity especially after thoracic ,cardiac and abdominal surgeries[1]. The incidence varies from 2 to 40%.[1] resulting in lengthened hospital stay. Pathophysiology of PPCs is shallow breathing and monotonous tidal volume. Other causes include anesthesia, opioid analgesia, and postoperative pain[2]. There are different modalities to prevent post operative pulmonary complications which include deep breathing exercises, physiotherapy and incentive spirometry.[3] Incentive spirometry is used as a tool for lung expansion in many hospitals worldwide. Many studies have been done to compare the incidence of post operative pulmonary complications using incentive spirometry and deep breathing exercises, but there is no clear conclusion.

Correspondence: Dr Muhammad Imran,
PG Trainee of General Surgery ,CMH Abbottabad.
contact No.: 0336-5006733
E-mail: imrangul915@gmail.com

MATERIALS AND METHODS

The study was conducted in Combined Military hospital Abbottabad from Jan 2014 to Mar 2015 after approval from the hospital ethical committee. A total of 100 patients who had undergone laparotomy were included in the study with each randomly assigned to each group by lottery method.

Exclusion Criteria:

Advanced age	age greater than 65 years
Smoking	smoking history of longer than 40 or more pack-years
COPD	Obesity
	BMI > 30 kg/m2

Surgical time of 2.5 hours or more

In group A, the patients were advised to perform breathing exercises including diaphragmatic breathing and active cycle of breathing techniques three times daily. The pts were demonstrated how to inhale and exhale to full capacity. In group B, they were trained to do IS along with breathing exercises three times daily with the attempts with IS limited to five at each session. The pts were encouraged to use the IS to full capacity. This was done for a total of five days. Arterial blood gases sample taken after first hour post operatively and

then daily at noon for five days. Temperature was recorded daily at noon for five days post-operatively. Chest x-ray erect was done on the second post op day. Cough suppressants were not advised. Data analysis was done with SPSS version 20, Statistical analysis with chi square test p value of >0.05 was considered statistically significant. Operational definition of pulmonary complication in accordance with the data is given in table 1[4].

RESULTS

Table No.1: Operational Definition

Grade 1	minor atelectasis in one lung no fever hypoxemia less than 03 days duration
Grade 2	major atelectasis in one lung /minor atelectasis in both lungs hypoxemia less than 03 days no fever
Grade 3	major atelectasis in both lungs or hypoxemia more than three days or Fever more than three days

The mean age and male to female ratio was given in table 2.

Table No.2: Mean age ratio

	deep breathing exercises	incentive spirometry
Mean Age	40 + 13.34	43+ 12.76
Female:male	1.34:1	1.8:1

The result of the study is given in table 3.

Table No.3: Complications Level * Techniques of Overcoming Chest Inf Crosstabulation

Count		Techniques of Overcoming Chest Inf		
		Deep Breathing Excercises	Incentive Spirometry	Total
Complications Level	No PPC	27	37	64
	Grade-1	15	9	24
	Grade-2	5	3	8
	Grade-3	3	1	4
Total		50	50	100

The chi-square test shows that p-value=**0.207** > Alpha(level of significance)=0.05 in table 4.

In group A 52% had no post pulmonary complications while incidence of PPC varied with grade 01 (30%) ,grade 2 (10%) and grade 3(6%) .in group B 74% had no post operative pulmonary complication while incidence of PPC varied with grade 01(18%) ,grade 02(6%) and grade 3(2%).there was no mortality and the pt were discharged after post operative recovery. The values for the incidence of PPC in group 2 where decreased and were statistically significant. There was an association between incentive spirometry and the decreased incidence of post operative pulmonary complications

Table No.4: Chi-Square Test:

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.562[a]	3	0.207
Likelihood Ratio	4.637	3	.200
Linear-by-Linear Association	3.901	1	.048
N of Valid Cases	100		

DISCUSSION

Incidence of post operative pulmonary complications range from 2-40 %[5]. Atelectasis, pneumonia, tracheobronchitis, bronchospasm, exacerbation of chronic obstructive pulmonary disease, acute respiratory failure and prolonged mechanical ventilation (longer than 48 hours) can be classified as Post operative Pulmonary Complications.[6,7] It is a cause of significant morbidity and mortality in post operative patients and also increases hospital stay. Surgery related shallow breathing, bed rest, diaphragmatic dysfunction, pain, and impaired mucociliary clearance may be the first events in a cascade leading to postoperative pulmonary complication Preoperative causes leading to increased incidence of PPC include smoking, history of COPD, extreme age ,emergency surgery and blood transfusion more than 04 units preoperatively. Preoperative causes include increased time of gen anaesthesia, administration of appropriate analgesia also determine the incidence of PPC[8]. thoracic and abdominal surgery involves tissue trauma near the diaphragm causing three types of pathologies 1. Decreased respiratory muscle movements caused by incision 2. Postoperative pain restricting muscle movements 3. Reflex inhibition of phrenic nerve and other respiratory nerves restricting muscle movements.[9] postoperatively prolonged ventilation is also a cause of PPC.

Preoperative preventive measures include cessation of smoking and improving nutrition contribute to decreased PPC.[8,9,10] There is no significant difference in incidence of PPC between open and laparoscopic surgery[10].

Lung expansion techniques include chest physiotherapy, deep breathing exercises, incentive spirometry, Postural drainage, Continuous positive airway pressure. The efficacy of incentive spirometry in preventing Post operative pulmonary complications is controversial.[13] Though its use is widespread in the

world for preventing respiratory complications..Some studies show no difference in the incidence in Post operative pulmonary Complications[14,15,16] while the others show less incidence of PPC with incentive spirometry.[17,18] prevention of perioperative fluid overload causes decrease incidence of post operative pulmonary comlications[19]. Postoperative epidural or intravenous analgesia also decreases the incidence of PPC.[20] Nasogastric compression postoperatively also decreases incidence of PPC.[21]

Our study included emergency exploratory laparotomies and elective laparotomies. It showed that in patients undergoing laparotomy there was less incidence with deep breathing exercises along with incentive spirometry rather than with deep breathing exercises alone .One of the factor is the active participation of the patient in the process, and the improvement in the inspiration that can be seen objectively on the spirometer. It is less expensive and does not need many resources as chest physiotherapy or CPAP. One limitation of this study was not using lung function tests to objectively evaluate lung expansion. Further studies should be done using lung function tests to evaluate the lung expansion.

CONCLUSION

Though international studies do not show a definite advantage of IS over chest physiotherapy but our study concludes that Incentive Spirometry is an effective tool in preventing post operative pulmonary complications .It should be practiced along with deep breathing exercises to prevent postoperative pulmonary complications.

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Canet J, Gallart L, Gomar C, Paluzie G, Vallès J, Castillo J, et al. Prediction of postoperative pulmonary complications in a population-based surgical cohort. Anesthesiol 2010;113(6):1338-50
2. Bartlett RH, Gazzaniga AB, Geraghty TR. Respiratory maneuvers to prevent postoperative pulmonary complications. A critical review. JAMA 1973;224(7):1017-21.
3. O'Connor M, Tattersall MP, Carter JA. An evaluation of the incentive spirometer to improve lung function after cholecystectomy. Anaesthesia 1988;43(9):785-7.
4. Roukema JA,Carol EJ,Prins JG.The prevention of pulmonary complications after abdominal surgery in patients with non compromised pulmonary status.Arch Surg1988;123:30-34.
5. Canet J, Mazo V. Postoperative pulmonary complications. Mineveraanaesthilogica 2010.
6. Smetana GW. Postoperative pulmonary complications: an update on risk assessment and reduction. Clev Clin J Med 2009;76 Suppl 4:S60-5.
7. Joehl RJ. Preoperative evaluation: pulmonary, cardiac, renal dysfunction and comorbidities. Surg Clin North Am 2005;85(6):1061-73.
8. Jung R, Wight J, Nusser R, Rosoff L. Comparison of three methods of respiratory care following upper abdominal surgery. Chest 1980;78(1):31-5
9. Lawrence VA, Hilsenbeck SG, Mulrow CD, Dhand AR, Sapp J, Page CP. Incidence and hospital stay for cardiac and pulmonary complications after abdominal surgery. J Gen Intern Med 1995; 10: 671-8.
10. Sharma RR,Axelsson H,Oberg A,Jansson E,Clegue Fet al.Diaphragmatic activity after laparoscopic cholecystectomy.Anaesthesiol1999;91:406-13.
11. Walder B,Schafer M,Henzi I,Tramer MR.Efficacy and safety of patient controlled opiod analgesia for acute postoperative pain.A qualitative systemic review.Acta Anaesthetoid Scand 2001;45:795-804.
12. Abraham NS, Young JM, Solomon MJ. Meta-analysis of short-term outcomes after laparoscopic resection for colorectal cancer. Br J Surg 2004; 91:1111-24.
13. Overend TJ, Anderson CM, Lucy SD, Bhatia C, Jonsson BI, Timmermans C. The effect of incentive spirometry on postoperative pulmonary complications: a systematic review. Chest 200.
14. Lawrence VA, Hazuda HP, Cornell JE, Pederson T, Bradshaw PT, Mulrow CD, et al. Functional independence after major abdominal surgery in the elderly. J Am Coll Surg 2004;199(5):762-72.
15. Hall JC, Tarala R, Harris J, Tapper J, Christiansen K. Incentive spirometry versus routine chest physiotherapy for prevention of pulmonary complications after abdominal surgery. Lancet 1991;337(8747):953-6.
16. O'Connor M, Tattersall MP, Carter JA. An evaluation of the incentive spirometer to improve lung function after cholecystectomy. Anaesthesia 1988;43(9):785-7.
17. Schwieger I, Gamulin Z, Forster A, Meyer P, Gemperle M, Suter PM. Absence of benefit of incentive spirometry in low-risk patients undergoing elective cholecystectomy. A controlled randomized study. Chest 1986;89(5):652-6.
18. Dohi S, Gold MI. Comparison of two methods of postoperative respiratory care. Chest 1978;73(5): 592-5.
19. Grocott MP,Mythen MG,Gan JJ.Perioperative fluid managementand clinical outcomes in adults. Anaesth Analg 2005;100:1093-106.
20. Chumillas S, Ponce JL, Delgado F, Viciano V, Mat eu M. Prevention of postoperative pulmonary complications through respiratory rehabilitation: a controlled clinical study. Arch Phys Med Rehabil 1998;79:5-9.
21. Nelson R, Edward S,Tse B.Prophylactic nasogastric decompression after abdominal surgery. Cochrane Database Syst Rev 2007;18: CD004929.