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COMPARISION OF INCENTIVE SPIROMETER VS BALLOON BLOWING ON PULMONARY FUNCTION IN POST SURGICAL UPPER ABDOMINAL CONDITION'S.

Physiotherapy

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ABSTRACT

Objective: The objective of this study is to compare incentive spirometer vs balloon blowing on pulmonary function in post-surgical upper abdominal conditions, Improvement in peak expiratory flow rate, Level of dyspnoea. **Methodology:** subjects were assigned to group A (n=15), group B (N=15), through simple random sampling technique (lottery method). Data was collected at baseline on the day of discharge on above-stated outcome measures, by using peak expiratory flow meter, dyspnea scale. Group-A performed routine respiratory physiotherapy + incentive spirometer and Group-B performed routine respiratory physiotherapy + balloon blowing exercise + incentive spirometer. **Results:** There is an increase in the peak expiratory flow rate and decrease in dyspnea values for both group A and group B when compared to pretest. Compared to group A, group B shows a little more effective. **Conclusion:** There was an overall increase in PEFR in both group A and group B when compared to their baseline values. So, it is concluded that IC + BBE IS beneficial in decreasing dyspnea level in upper abdominal surgery patients.

KEYWORDS

IS – incentive spirometer, BBE – balloon blowing exercises, PEFR – peak expiratory flow rate.

INTRODUCTION

Abdominal surgical procedures range from exploratory laparotomy to organ repair or removal, addressing issues such as infections, tumors, and hernias.

Postoperative pulmonary complications (PPCs) in upper abdominal surgery range from 17% to 88%, including atelectasis, pneumonia, respiratory failure, and tracheobronchial infection, with pneumonia being the main cause of mortality. [1]

The incentive spirometer, a medical device promoting sustained maximal inspiration (SMI), provides visual cues for inspiratory effort, aiding therapists in guiding patients and enabling patients to monitor their own performance.

Inflating balloons engages the respiratory muscles, which collaborate to adjust the dimensions of the thoracic cavity during various phases of breathing.Basic respiratory muscles are the diaphragm, the internal intercostal, and the external intercostal.

Steadily blowing up several balloons, one after another, effectively exercises these muscles, building lung capacity and stamina.[2]

The intercostal muscles helped lift and expand the ribs and diaphragm, aiding in oxygen inhalation and carbon dioxide exhalation. Inflating balloons improved lung expansion and air intake. Regular balloon exercises activated the transverse abdominis and diaphragm.

The diaphragm's main role was to draw air into the lungs, and fully engaging it during balloon exercises increased lung air intake.[3]

Promoting the practice of balloon-blowing offered a cost-effective substitute for respiratory exercises, potentially lowering the risk of major illnesses by strengthening the body's respiratory muscles.[4]

MATERIALS AND METHOD

METHODS STUDY

- **Study Design** - Randomized clinical trail
- **Study Setup**- Department of physiotherapy, Department of gastroenterology
- **Sample Size**- 30
- **Sampling Method** – Simple Random Sampling (lottery method)
- **Study Duration**- 3 months

Meterial Required For The Study

Spirometer
Balloon
Peak Expiratory Flow Meter
Bp apparatus
Pulse oximeter
Papers

Inclusion criteria

Post upper abdominal surgery subjects
Including both genders male and female
Between age 30 and 60 years of age

Exclusion Criteria-

AGE GROUP in Below 30 and above 60 years of age
Subjects who had chronic diseases like cancer, congestive cardiac failure etc.,
Subjects with oral lesions
Subjects who cannot follow the instruction Eg ., deaf and dumb , psychiatric patient and blind patients
Individuals are not willing to participate in the study

Outcome Measures

Peak expiratory flow rate is measured through peak expiratory flow meter in (l/min)Level of dyspnoea through the Dyspnoea scale

Study procedure

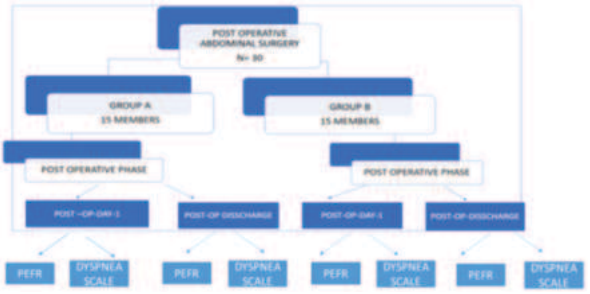
The study was conducted in the Gastroenterology department SVIMS after obtaining ethical clearance from the Institutional Ethics Committee (code : 1547).

After explaining the detailed procedure of the study, an informed consent was obtained from the subjects. They were randomized in the pre-operative phase by the lottery method into group A and B.

In the post-operative phase: For group A – incentive spirometer along with free exercises.

For group B – incentive spirometer and balloon blowing exercises along with free exercises.

Free exercises like breathing exercises, upper limb free exercises, lower limb free exercises were given.



Studyprotocol

PROTOCOL

Group A	GROUP B
• Spirometer • From day 1 to discharge • 4 Times per day • For each session - 5 inspiration and 5 expiration ,relax	• Spirometer along with balloon • From day 1 to discharge • 4 times per day • For each session - 5 inspirations, 5 expirations ,relax 3 min gap, blow balloon 5 times • (Replace the balloon for every 2 days due to reduce the resistance , replace with new one)

Statistical Analysis And Results

Statistical analysis

Participant data was analysed by intension to treat All continuous data was assessed for normality. Continuous data was described as using mean (SD) if normally distributed and median (IQR) when the distribution is skewed. Discontinuous outcomes was presented as risk ratios with 95% confidence intervals using chi-square. Difference between the groups will be compared using standardised techniques to assess for the effectiveness of randomization. Differences in the outcomes will be compared within and in between the groups. P value of less than 0.05 will be considered statistically significant

RESULTS

The results were analysed using SPSS 21. version for the statistical analysis of the study . in the present study, a total of 30 individuals were included who fulfilled inclusion criteria. Out of 30 individuals 15 were grouped in group A and 15 were grouped in group B. 2 outcome measures were taken such as Peak expiratory flow rate is measured through peak expiratory flow meter in (l/min) and Level of dyspnoea through the Dyspnoea scale. Outcome measures were taken before and at discharge day. and the values were tabulated using MS excel. Chi-square was used to compare the difference between pre and post intervention outcomes.

Demographic Data

Table – 1 Shows The Demographic Data Dyspnea

N=30	MEAN	SD
AGE	44.5	8.36
BMI	35.6	4.17
PEFR	133.3	22.79
DYSPNEA	7.0	0.81

Table – 2 Comparision Of Dyspnea With In And Between Group A And Group B

Group		$\chi 2$	df	P-VALUE
GROUP-A		9	6	0.17
GROUP-B		14.02	6	0.02
Between groups		22.15	10	0.01

- chi square test was used to examine the association between groups (IS and IS+balloon blowing) there is an insignificant association at 5% significance level between IS and IS+ BALLOON BLOWING
- Incentive spirometer had no statistical significant difference i.e., $=\chi 2=9, df=6, p=0.17$
- Incentive spirometer + balloon blowing had significant difference i.e., $\chi 2=14.02, df=6, p=0.02$
- The effect of treatment between groups (IS and IS + BALLOON BLOWING) showed statistical significance i.e., 0.01 (or)$p<0.05$

(1) PEFR

Table – 3 Comparision Of Pefr With In And Between Group A And Group B

- chi square test was used to examine the association between groups (IS and IS+balloon blowing) there is an insignificant association at 5% significance level between IS and IS+ BALLOON BLOWING
- Incentive spirometer had no statistical significant difference i.e., $\chi 2=43.75, df=36, p=0.18$
- Incentive spirometer + balloon blowing had no significant difference i.e., $\chi 2=62.5, df=56, p=0.26$
- The effect of treatment between groups (IS and IS + BALLOON BLOWING) showed no statistical significance i.e., 0.23 (or)$p>0.05$

Group	$\chi 2$	df	P-VALUE
GROUP-A	43.75	36	0.18
GROUP-B	62.5	56	0.26
Between groups	80.28	72	0.23

Table -4 To Examine The Difference With In And Between The Groups (AAND B)

Statistical significant difference was seen in dyspnea but in PEFR there is substantially increase in volume of air that is expiratory flow rate is increased but it is not showing any statistical significance changes

		$\chi 2$	df	p value
	GROUP-A	9.00	6	0.18
DYSPNEA	GROUP-B	14.02	6	0.02
	GROUP-A	43.76	36	0.17
PEFR	GROUP-B	62.51	56	0.25

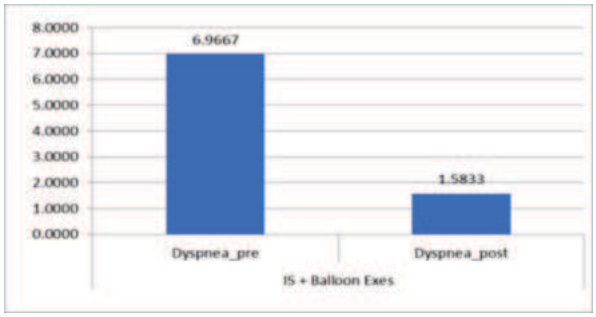
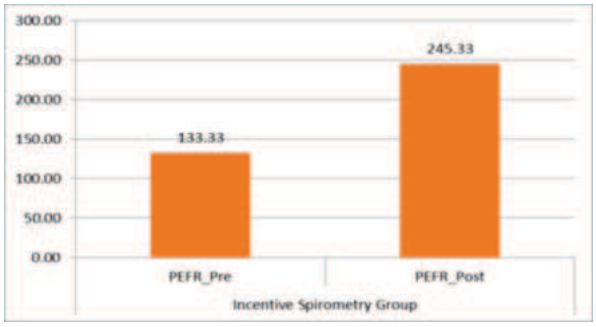


Table-5

Dyspnea shows the difference between pre and post test values. Decreases the post test values are seen in dyspnea score after post test compared to pre test



Incentive spirometer shows the difference between pre and post test values. Increases the post test values are seen compared to pre test values

DISCUSSION

Lung muscles can be strengthened through activities like balloon blowing and incentive spirometer, with balloon blowing being more cost-effective. Numerous studies discuss pulmonary rehabilitation exercises' positive effects on postoperative pulmonary complications, yet there's a gap in directly comparing incentive spirometer and balloon blowing in postoperative upper abdominal surgery. This study compared their effects on various outcome measures in such patients, revealing a statistically significant difference in dyspnea between the two groups.

Previous studies suggest that balloon blowing exercises demonstrate comparable effectiveness to incentive spirometer use, indicating potential for substitution.

A Jan 2022 study by Hafiza Muriam Ghani et al. compared balloon blowing exercise and incentive spirometer use post-thoracotomy, finding no significant difference in pulmonary outcomes between the groups, supporting the interchangeability of both methods.[5]

A 2016 RCT by Ali Rafaqat found significant improvements in breathlessness for both the incentive spirometer and balloon blowing groups in chest intubation patients post-trauma, supporting the equivalence of both methods.[6]

Seong-Dae et al.'s 2016 RCT suggests that both inspiration and expiration exercises, either separately or combined, can enhance pulmonary function, indicating that balloon blowing with deep inspiration followed by deep expiration is comparable to incentive spirometer's deep inspiratory mechanics in pulmonary rehabilitation outcomes.[7]

Arunima Sreeletha et al.'s study found balloon therapy to be more effective in reducing respiratory symptoms compared to spirometry in children with respiratory problems, with both interventions showing improvement in pulmonary function alongside routine treatment.[8]

Malik et al.'s randomized controlled study found that adding incentive spirometer to routine physiotherapy following lung resection did not reduce postoperative pulmonary complications.[9]

Kyndall et al.'s quasi-experimental study in September 2010 revealed that balloon-blowing exercises during breathing reduced post-thoracotomy pain by inducing relaxation in the neuromuscular and parasympathetic nervous systems, along with decreasing resting muscle tone.[10]

Lee et al.'s studies on balloon-blowing intervention and expiratory muscle strengthening training both resulted in significant increases in Peak Expiratory Flow (PEF), aligning with the findings of this study, which also demonstrated enhanced PEF through expiratory muscle strengthening training using balloons.[11],[12]

Limitations of Study:

There was no follow-up of patients in this conducted study for longer period of time.

Biomarkers of patients, like x-ray, ABG were not studied in this study because it was not permitted because of stability of studied post-op patients.

Simple commercially available balloons of good quality were used in this study, because there is no study available yet on standardization of balloons regarding use in respiratory physiotherapy.

Recommendations:

It is recommended for future researchers to conduct this study on populationwith particular condition of upper abdominal surgery patients, with pulmonary condition, with specific age group, with long follow-up so that results could be generalized.

CONCLUSION:

The findings of this study conclude that Balloon Blowing, Incentive spirometer and routinely done respiratory physical therapy is little more effective on mentioned outcome measures as compared to incentive spirometer and respiratory physical therapy, in studied patients. Therefore, it can be suggested that Balloon blowing, incentive spirometer can be recommended as to improve respiratory muscle training in the hospital phase in subjects with upper abdominal surgeries. Hence the Alternate hypothesis is accepted.

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