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Comparison between Balloon Blowing Exercise and Incentive Spirometry in Patients with Chest Intubation after Trauma

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Abstract

Objective: The objective of this study was to compare the effectiveness of Balloon Blowing exercise and incentive spirometry in patients with chest intubation after trauma.

Methodology: It was a randomized controlled trial. The participants were selected on the basis of chest trauma with chest intubations who were admitted. A questionnaire which consisted of demographic (age and gender) data and measuring variables (Force vital capacity, forced expiratory volume in 1 second, oxygen saturation, respiration rate and chest expansion) was filled from the participants. Study duration was 6 weeks and patients were divided in two groups of 30 in each group. Group 1 used incentive spirometry method and group 2 used balloon blowing exercise method.

Results: Concluded that the pre and post treatment differences are found statistically significant. The pre and post differences in incentive spirometry group and balloon blowing group found a significant improvement in breathlessness with the p-value is 0.00 for FVC, FEV1, SPO, RR and Chest Expansion. The post treatment differences between two groups are found statistically insignificant. The p-values for FVC, FEV1, SPO, RR and Chest Expansion are 0.660, 1.00, 0.216, 0.927 and 0.636 respectively. Comparing these p-values at significance level 0.05 is insignificant.

Conclusion: So conclusion of the study implies that both incentive spirometry and balloon blowing exercise are equally effective.

Keywords: Balloon blowing; Incentive spirometry; Chest intubation

Introduction

Trauma is the third leading cause of death in United States and also the leading cause of death in under the age of 40. Men are more commonly injured as compare to women [1]. Blunt trauma is more common type of chest trauma as compare to penetrating trauma [2]. Chest trauma is a major source of morbidity and mortality. A severe chest injury can affect all of the organs of chest cavity. These components like skeleton (ribs, collarbone, shoulder, and sternum) and the lung and pleura, bronchial tree on the respiratory tract, esophagus and blood vessels of the chest and heart, and diaphragm are included. Frequency Chest trauma injuries estimates 12 per million people per day are found. Approximately 33% of these injuries require hospitalization. Overall, severe chest injuries in 20-25% of all deaths are directly responsible for, and chest trauma is a major contributor to mortality, others 50%.

A retrospective study analysis was done on 515 cases of chest trauma injury. They found that thoracic morbidity rate was 36% and mortality rate was 15.5%. Majority of the patients with blunt trauma had a lot of other injuries along with chest trauma. In this study only 84 patients had isolated thoracic injuries and 431 patients had multi trauma injuries with chest trauma. In all, 287 patients who had hemothorax, pneumothorax (unilaterally and bilaterally) and their combined complications developed like pulmonary contusions, cardiac contusions, ruptured diaphragms, ruptured aortas, cardiac rupture, thoraceobronchial injury, pulmonary vessels and great vessels injury. Morbidity was mainly due to atelectasis then pneumonia, acute respiratory distress syndrome, emphysema, recurrent pneumothorax and aspiration. Mortality rate is due to late arrival of patients to hospital with no vital sign or cardiac arrest and also due to acute respiratory distress syndrome developed after 72 hours of hospitalization [3].

Another study was conducted to quantitatively assess the efficacy of incentive spirometry (IS), intermittent positive pressure breathing (IPPB), and deep breathing exercises (DBEX) in postoperative pulmonary complications prevention in patients who had upper abdominal surgery. Method of database was performed and collect through the relevant citations through computerized searches and the cumulative Index to Nursing and Allied Health. Citations were based on the following selected and relevant criteria of patients undergo any type of upper abdominal surgery, any combination of IS, IPPB, and DBEX, a pulmonary complications outcome and randomized trials. Results were in favor of incentive spirometry. An incentive spirometry verse no physical activity was 0.44 and results of deep breathing exercise versus no physical activity was 0.43. Both findings were significant. Comparison between the IS verses IPPB is 0.76 (95%), IS verses DBEX is 0.91 (955) and IPPB verses DBEX is 0.94 (95%). Therefore the result is quite clear that Incentive spirometry and DBEX is found to be more effective than no physical therapy intervention in postoperative pulmonary complications prevention [4].

If lungs have sufficient capacity, then it helps the patient to create endurance by allowing lungs to slowly expand with large amount of

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oxygen in order to meet patient's body needs. Lung like muscles can be exercised to increase its function and capacity by balloon blowing and incentive spirometry. Balloon blowing is less expensive technique as compared to incentive spirometry. This was the reason I choose to assess which is more effective.

Null hypothesis

There is no difference between the effectiveness of incentive spirometry and ballooning exercises in patients with chest intubation.

Alternate hypothesis

Incentive spirometry is more effective than ballooning exercises in the management of patients with chest intubation.

Rationale of the study

By reviewing all these studies we found that incentive spirometry and balloon blowing exercises were very effective in post pulmonary complications prevention. Rationale of my study is just to compare both methods of breathing to find out which is most effective. Author arrange the patients in two groups. One group used balloon blowing exercise method and another group used incentive spirometry exercise method.

Methodology

Randomized controlled trial with group 1 use of incentive spirometry method and in group 2 use balloon blowing method at Sheikh Zyed Hospital Rahim Yar Khan Pakistan**.** The study was completed over a time period of 6 weeks. Sample size of 60 patients with Chest Intubation, age is 20- 40 of both sexes. Each group has 30 patients and group one did incentive spirometry while group two done balloon blowing exercises. Simple Convenient Sampling was done.

Inclusion criteria

All the patients of 20-40 age, who have chest intubation after trauma and admitted in surgical ward.

Exclusion criteria

Patients having age less than 20 years and more than 40 years, and those who don't have chest intubation after trauma. Patient admitted in nor surgical wards.

Data collection procedure

A Performa was filled before and after 3 days of therapy.

Data analysis procedure

Demographic data was analyzed using descriptive statistics, frequency, percentage, mean, median and standard deviation. Effect of incentive spirometry and balloon blowing was analyzed using inferential statistics.

Paired t-test was used for the pre and post treatment values in group 1 and group 2 separately. Independent T test was used for the analysis of the data. Data was entered and analyze by using SPSS version 21.

Data collection tool

Demographic Performa includes age, gender and address. Clinical Performa includes FVC (L), FEV1 (L), chest expansion (cm), oxygen saturation, respiration rate (per/mint). The data was collected by a Scale (modified Dyspnea scale).

Results

Results of treatments (within groups and between groups) are presented with graphs.

Baseline groups

There are 22 male (73.33%) and 8 females (26.67%) in the first group and there are 20 male (66.7%) and 10 female (33.3%) subjects in the second group.

Descriptive statistics

Table 1 represents the descriptive statistics in standard group 1 with the mean ± standard deviation of age (31.00 ± 6.011), modified borg dyspnea (4.36 ± 2.32), forced vital capacity (3.07 ± 0.760), forced expiratory volume in 1 second (2.27 ± 0.524), oxygen saturation (91.23 ± 2.51), chest expansion (4.81 ± 0.610), respiration rate is (27.18 ± 2.42).

Table 2 represents the descriptive statistics in standard group 2 with the mean ± standard deviation of age (31.70 ± 7.27), modified

	N	Minimum	Maximum	Mean	Std. Deviation
Age	30	21.00	40.00	31.00	6.011
Modified Borg Dyspnea	30	1.0	10.0	4.36	2.32
Forced Vital Capacity	30	1.70	4.50	3.07	0.760
Forced expiratory volume in 1 second (FEV1)	30	1.30	3.10	2.27	0.524
Peripheral capillary nbc c oxygen saturation (SpO2)	30	85.00	96.00	91.23	2.51
Chest expansion pre	30	3.00	5.50	4.81	0.610
Respiration Rate Pre	30	23.5	31	27.18	2.42

Table 1: Group-1 base line statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	30	20.00	40.00	31.70	7.27
Modified Borg Dyspnea Scale	30	1.0	10.0	4.63	2.15
Forced Vital Capacity	30	1.30	4.60	2.75	0.77
Forced expiratory volume	30	1.30	3.70	2.15	0.54
Peripheral capillary oxygen saturation (SpO2)	30	84.00	94.00	90.73	2.34
Chest Ex_pre	30	3.00	5.50	4.60	0.77
Respiration Rate Pre	30	24.0	31.00	27.43	1.98

Table 2: Group-II baseline value of variables.

borg dyspnea (4.63 ± 2.15), forced vital capacity (2.57 ± 0.77), forced expiratory volume in 1 second (2.15 ± 0.54), oxygen saturation (90.73 ± 2.34), chest expansion (4.60 ± 0.77), respiration rate is (27.43 ± 1.98). These statistics in both tables are similar indicating that the groups are comparable.

The results of paired sample t-test for group 1 are presented in Table 3. The pre and post treatment differences are found statistically significant. The p-value is 0.00 for FVC, FEV1, SPO, RR and Chest Expansion. Comparing these p-values at significance level 0.05 is significant. This implies that use of spirometry is found effective.

The results of paired sample t-test for group 2 are presented in Table 4. The pre and post treatment differences are found statistically significant. The p-value is 0.00 for FVC, FEV1, SPO, RR and Chest Expansion. Comparing these p-values at significance level 0.05 is significant. This implies that balloon blowing exercises are found effective.

The significance or p-values compared at significance level 0.05 are insignificant (Table 5) as p value for all variables is greater than 0.

The post treatment differences between two groups are found statistically insignificant. The p-values for FVC, FEV1, SPO, RR and Chest Expansion are 0.660, 1.00, 0.216, 0.927 and 0.636 respectively. Comparing these p-values at significance level 0.05 are insignificant. This implies that both spirometry and balloon blowing exercise are equally effective (Table 6).

Discussion

Jackie A Thomas have recorded that incentive spirometry had a significant effect on patients health verses no physical activity. In this study incentive spirometry verses no physical activity found to be good. Comparison between the Incentive spirometry verses intermittent positive pressure breathing is 0.76 (95%) and incentive spirometry verses deep breathing exercises is 0.91 (95%). Both findings were significant for pulmonary complications prevention [5]. Incentive spirometry is basically an inhalation based method of breathing that encourages patients to increase lung volume by continuous use post operatively [6]. This is a prophylactic treatment of choice in many hospitals settings. This study was based on 4 systemic reviews and 1 clinical practice to know how much this could be use prophylactically. Incentive spirometry is effective in post operatively pulmonary prophylaxis.

Another study was conducted on the patients of the upper abdominal and laparoscopic surgeries. Objectives were to assess the effectiveness of incentive spirometry with no other therapy in abdominal surgery and to evaluate incentive spirometry with no therapy and adverse events on spirometry parameter in those post-operative patients [7]. Meta- analysis 1160 patients of study concluded that a very low evidence that support the ineffectiveness of incentive spirometry in patients who undergo upper abdominal or laparoscopic surgery [7]. Morbidity after abdominal surgery is due to post-operative pulmonary complications development is very relevant [8]. Controlled

	N	Mean ± Std. Deviation		Sig. (2-tailed)
Forced Vital Capacity (FVC)	30	Pre	3.07 ± 0.76	0.000
	30	post	3.31 ± 0.75	0.000
Forced Expiratory Volume (FEV1)	30	Pre	2.27 ± 0.52	0.000
	30	post	2.51 ± 0.45	0.000
Peripheral capillary oxygen saturation (SpO2)	30	Pre	91.23 ± 02.51	0.000
	30	post	93.70 ± 02.36	0.000
Respiration Rate	30	Pre	27.18 ± 02.42	0.000
	30	post	24.96 ± 02.35	0.000
Chest Expansion	30	Pre	4.81 ± 0.61	0.000
	30	post	5.48 ± 0.56	0.000

Table 3: Paired t-tests (pre and post) for group-1.

	N	Mean ± Std. Deviation		Sig. (2-tailed)
Forced Vital Capacity (FVC)	30	Pre	2.75 ± 0.77	0.000
	30	post	3.23 ± 0.70	0.000
Forced Expiratory Volume (FEV1)	30	Pre	2.15 ± 0.54	0.000
	30	post	2.51 ± 0.46	0.000
Peripheral capillary oxygen saturation (SpO2)	30	Pre	90.73 ± 02.34	0.000
	30	post	94.36 ± 01.71	0.000
Respiration Rate	30	Pre	27.43 ± 01.98	0.000
	30	post	25.01 ± 01.79	0.000
Chest Expansion	30	Pre	4.60 ± 0.77	0.000
	30	post	5.56 ± 0.77	0.000

Table 4: Paired t-tests (pre and post) for group-2.

Levene's Test for Equality of Variances		
	F	Sig.
FVC_post	0.116	0.735
FEV1_post	0.083	0.774
SPO_post	1.733	0.193
RR_post	3.458	0.068
ChestEx_post	3.787	0.057

Table 5: Levene's test for equality of variances for group-1 and 2.

		Mean ± Std. Deviation	p
FVC_post	Equal variances assumed Group 1	3.31 ± 0.75	0.660
	Equal variances assumed Group 2	3.23 ± 0.70	0.660
FEV1_post	Equal variances assumed Group 1	2.51 ± 0.45	1.000
	Equal variances assumed Group 2	2.51 ± 0.46	1.000
SPO_post	Equal variances assumed Group1	93.70 ± 02.36	0.216
	Equal variances assumed Group 2	94.36 ± 01.71	0.217
RR_post	Equal variances assumed Group 1	24.96 ± 02.35	0.927
	Equal variances assumed Group 2	25.01 ± 01.79	0.927
ChestEx_post	Equal variances assumed Group 1	5.48 ± 0.56	0.636
	Equal variances assumed group 2	5.56 ± 0.77	0.636

Table 6: Independent t-tests (post) for group-1 and group-2.

studies review that no treatment modalities can prevent from atelectasis post operatively. But some studies review that lung physiotherapy is the most recommended prophylactic treatment of choice in respiratory complications prevention after abdominal surgery.

Our study is quite similar with these studies. Use of incentive spirometry in chest trauma makes the patients free from breathlessness. Our study found that incentive spirometry could be used as a prophylactic treatment of choice in post operatively in laproscopic, upper abdominal surgeries and any respiratory illnesses. This is the best method to prevent the post-operative pulmonary complications like atelectasis, haemothorax, pneumothorax and acute respiratory distress syndrome.

Overend Tj worked on evidence based examining the systemic review of (n=46) on incentive spirometry basically. But this study concluded that according to evidence based examinations incentive spirometry does not helpful in incidence of post-operative complications prevention [9]. Aforementioned study is not in the support of my study. By randomized controlled trail of this study found that incentive spirometry good in patients of chest trauma for pulmonary complications prevention. By comparing incentive spirometry with no therapy, incentive spirometry group found to be good and quick recovery report.

Conclusion

Chest trauma patients of Sheikh Zayed Hospital, Rahim Yar khan reported maximum shortness of breath and breathing difficulties. Results concluded that there is no significant difference between balloon blowing exercises and incentive spirometry and according to previous studies this study support that use of incentive spirometry and balloon blowing exercises should be used by patients after chest trauma.

The post treatment differences between two groups are found statistically insignificant. So this study concluded that null hypothesis is accepted and alternative hypothesis is rejected.

So conclusion of the study implies that both incentive spirometry and balloon blowing exercise are equally effective so, further studies should be done either one of this method of breathing exercises should be recommended for patient's good recovery.

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