*IOSR Journal of Nursing and Health Science (IOSR-JNHS)*
*e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 4, Issue 4 Ver. I (July. - Aug. 2015), PP 01-07*
*www.iosrjournals.org*

# The Effect of Early Post-anesthetic Chest Physiotherapy Nursing Intervention on Patients Undergoing Upper Abdominal Surgery

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***Abstract:***
***Aim:*** *The aim of the present study was to evaluate the effects of early post an-esthetic chest physiotherapy nursing intervention (Breathing exercises ) on ventilatory functions, pulmonary complications and Length of postoperative hospitalization) in patients undergoing upper abdominal surgery (UAS).*
***Subjects and Methods:*** *Sixty consecutive patients undergoing upper abdominal surgery were recruited into the study. They were divided into two groups of equal number, both received the routine physical therapy (early ambulation ),while those only in the study group received breathing exercises after surgery, while still in the post anesthesia care unit (PACU) . The patients in both groups were evaluated on the day before surgery and on the second postoperative day. Pulse oximetry and spirometric tests were performed twice; before beginning intervention and on the second day after surgery. Information regarding Surgery duration, length of hospital stays and postoperative pulmonary complications (PPCs) were gathered from patients' medical records.*
***Results:*** *The study group showed significant improvement in FEV1 (P<0.001), FVC (P<0.05) as compared to the control group. There was an obvious reduction in occurrence of PPCs among study group compared to the control group. The length of postoperative hospitalization was significantly shorter in the study group (P<0.05) than control group.*
***Conclusion:*** *The results of this research concluded that breathing exercises during the immediate postoperative period following upper abdominal surgery seem to provide some benefit in improving ventilatory function, reducing pulmonary complications and postoperative hospital stay.*
***Key words:*** *Chest physiotherapy;breathing exercises;upper abdominal surgery; post an-esthetia care period.*

## I. Introduction

Upper abdominal surgery (UAS) and associated general anaesthesia have adverse impact on the respiratory system leading to postoperative pulmonary complications (PPCs) [1,2] Decreased lung volumes and atelectasis due to surgery-related shallow breathing, bed rest, diaphragmatic dysfunc-tion, pain, and impaired mucociliary clearance may be first events in a cascade leading to postoperative pulmonary complications. The most common complications due to these changes are atelectasis, hypoxemia, and pneumonia, which can affect up to 80% of patients submitted to UAS[3,4] increasing the length of hospital stay and treatment costs and contributing significantly to morbidity and mortality[5,6,7]

In this context, Chest physiotherapy assistance to UAS aims to preserve pulmonary function and reverse physiological and/or functional changes that may occur in the postoperative period due to these complications [8,9]. Chest physiotherapy provides a variety of interventions that improve respiratory efficiency, promote expansion of the lungs, strengthen respiratory muscles, and eliminate secretions from the respiratory system . Deep breathing exercise was one of the first methods, subsequently, a variety of manual treatments includ-ing percussion, clapping, vibration, or shaking were developed to improve bronchial drainage. More recently, mechanical breathing devices such as incentive spirometry (IS), blow bottles, intermittent positive pressure breathing (IPPB), and continuous positive airway pressure (CPAP) were introduced into clinical practice [10,1].

Chest physiotherapy has been advocated as an important component in the prevention and amelioration of PPCs following abdominal surgery and has been regularly utilized in both pre and postoperative care since the 1960s [11].

Many studies have assessed the efficacy of chest physiotherapy in patients undergoing upper abdominal surgery and the benefits consist of reversal of atelectasis, improvement of peripheral oxygen saturation and reduction of pneumonia rates. However there is no consensus among researchers on the most efficient technique for the recovery of PPCs and respiratory mechanics in these patients [12, 1, 13, and 14].

. [15] Have presented suggestive evidence that deep breathing maneuvers, rather than incentive spirometry, best increase diaphragmatic movement after surgery. Also [16].reported that the most efficient form of prophylactic chest therapy for patients undergoing abdominal surgery includes deep breathing exercises.

Breathing exercises have been used to increase lung volume, improve gas exchange and ventilation distribution. Diaphragmatic, segmental and costal respiratory exercise may alleviate surgically induced alterations such as diminished diaphragmatic mobility and restrictive pulmonary changes through increase diaphragmatic mobility and decrease basal atelectasis [12,17].The rationale for employing breathing exercises or devices that encourage deep breathing after operation is that normal or improved respiratory patterns will be promoted, thus improving the distribution of ventilation [18.]If these aims are achieved, it should be possible to document enhanced ventilatory function and pulmonary gas exchange, and to demonstrate that the incidence of pulmonary complications is decreased, the rate of postoperative recovery increased and the clinical course of postoperative pulmonary complications improved.

Therefore the aim of the present study was to evaluate the effects of early post an-esthetic chest physiotherapy nursing intervention (Breathing exercises) on ventilatory functions, pulmonary complications and Length of postoperative hospitalization) in patients undergoing upper abdominal surgery.

**Significance of study**

Pulmonary impairments occurring after abdominal surgery persist as a major problem as a result of anesthesia and immobilization [19,18] The effects of different chest physiotherapy programs have been evaluated among these patients and none of them could be considered highly satisfactory with regard to preventing PPCs [20,21] Also the evidence on prophylactic lung expansion is limited by variable techniques, inconsistent definitions of postoperative pulmonary complications, and poor-quality trials [20] Breathing exercises routinely used in clinical practice. These exercises aim to improve the patient's breathing pattern and increase lung expansion, respiratory muscle strength, functional residual capacity, and inspiratory reserve volume, thus preventing or treating PPCs [3]. Recently, the increasing emphasis on cost effective provision of healthcare and the focus on evidence-based practice has challenged health care provider to re-evaluate and justify their traditional practices.

Therefore the new approach showed here for early post-anesthetic care aimed to evaluate the effects of early post an-esthetic chest physiotherapy nursing intervention (Breathing exercises) on patients undergoing upper abdominal surgery could verifying the benefit of this treatment modalities and establishment of proper treatment protocol for patients submitted to UAS.

**Research hypothesis:**

The following research hypothesis was formulated to achieve the aim of the study:

- The hypothesis of this study was that chest physiotherapy nursing intervention (Breathing exercises) during the immediate Postoperative period among patients undergoning upper abdominal surgery would improve the postoperative results or prevent postoperative pulmonary complications.

**Subjects and Method**

## II. Subjects

**1.1. Research design:** A quasi-experimental design was utilized.

**1.2. Setting of the study:** This study was conducted at the post-anesthesia care unit (PACU) of Menofia University Hospitals in Egypt.

**1.3, Subjects:** This study evaluated patients who had been scheduled for upper abdominal surgery at a university hospital. Sixty consecutive patients were selected from the schedule for abdominal surgery, independent of gender and age. All of them were at the preoperative stage preceding upper abdominal surgery. They were randomly as-signed to control (n = 30) and chest physiotherapy (n = 30) groups .The chest physiotherapy group received treatment at the post-anesthesia care unit, while the controls did not.

Inclusion and exclusion criteria:

- The study included all patients undergoing upper abdominal surgery. The procedures that they were about to undergo included hernia repair, gall bladder removal, large bowel removal, exploratory laparotomy or other interventions in the abdominal cavity performed by conventional laparotomy. All of the patients underwent general anesthesia. The patients should have the following characteristics: (a) age above 18 years; (b) without heart, pulmonary and/or neuromuscular disease; (c) who had not been on mechanical ventilation and/or in intensive care for more than 48 hours
- Patients undergoing videolaparoscopy surgery were also excluded, since this induces smaller changes in the postoperative breathing mechanics than laparotomy does.

**1.4, Tools:** Pertinent data for this study were collected using the following instruments:

**1.1,** Questionnaire including sociodemographic and medical data .Information concerning preoperative and intraoperative procedures and postoperative complications was gathered from the patients' medical records. These data included age,gender, weight, height, heart and respiratory rate, surgery duration, length of hospital

stay ,smoking history, preoperative morbidity, and postoperative complications.
**1. 2,** Physiologic measurement tools including:
**1.1.1,** Noninvasive oximetry to measure the level of oxygen-hemoglobin saturation.
**1.1.2,** Spirometry (Pulmonary function tests): The spirometric evaluation was per-formed using electronic spirometer (Viasys Healthcare, Made in UK): forced vital capacity (FVC, %) and forced expiratory volume in one second (FEV1, %). Data were expressed as a percentage of the predicted values for age, height, and sex.
**1.1.3,** Dyspnea analogue scale, which was developed by Borg, 1998 .It is used to provide information on intensity of dyspnea. It contains 10 items, grouped under scores from 0 to 10. Zero means no dyspnea, 0.5 means very very slight (2), 1 very slight (3), 2 slight (4), 3 moderate (5), 4 some what severe (6), 5 to 6 severe (7),7 to 8 very severe (8), 9 very very severe (9) and 10 is the maximum level of dyspnea (10).

## III. Method

- A written approval: All procedures were approved by post-anesthesia care Unit (PACU) head. The researchers introduced themselves to every participant; explain the purpose of the study then a verbal consent was obtained from each participant.
- Tools development**:** Tool (I) was designed and developed by the researcher; based on a thorough review of literature in relation to the needed knowledge and was tested for content validity by four experts in the fields of nursing and medical education, and consequently necessary modifications were made.
-Prior to the actual study, a pilot study was conducted on 10% of the study sample to test feasibility and applicability of the tools and then necessary modifications were carried out accordingly. Data obtained from the pilot study were not included in the current study.
- Sixty consecutive patients were selected from the schedule for abdominal surgery, independent of gender and age. The participants were allocated into two groups (control and study) by means of a draw according to a randomization table.
-The patients in both groups were evaluated on the day before surgery and on the second postoperative day. Pulse oximetry and spirometric tests were performed twice; before beginning intervention and on the second day after surgery. Information regarding surgery duration, length of hospital stay and PPCs were gathered from patients' medical records. The clinical signs of PPCs (dyspnea, cough, sputum and chest sound) were assessed daily by the attending surgical staff [16] Three assessments of PPCs were done by investigator at the first,second and third week after operation.
-Both groups received the routine physical therapy (early ambulation) while the patients in the study group received breathing exercises after surgery, while still in the PACU in addition to the routine therapy.
-The intervention consisted of two sessions of breathing exercises for 30 minutes each and included: passive and localized exercises, deep diaphragmatic breathing and chest wall expansion exercises. Passive and localized exercises (Localized breathing exercises associated with manual pressure per-formed by the nurse on patients' chest wall during expiration) ;deep diaphragmatic breathing (Slow deep inspiration, asking the patient to expand the diaphragmatic region, followed by slow expiration ;chest expansion exercises (Deep inspiration followed by a three-second pause at maximal inspiratory volume attained, and then slow expiration).
-Spirometry: The spirometric evaluation, was performed using electronic spirometer (Viasys Healthcare, Made in UK): forced vital capacity (FVC, %) and forced expiratory volume in one second (FEV1, %). Data were expressed as a percentage of the predicted values for age, height, and sex. During all measurements, patients were seated with back erect and supported. The lung function measurements were performed three times and the best one is reported.
-The result of the study were statistically analyzed and illustrated in tables.

**Statistical analysis**

Data was collected, tabulated and statistically analyzed using SPSS version 12 statistical program. Two types of statistics were done; descriptive (e.g. percentage (%), mean, standard deviation SD and range) and analytical; Chi-Squared ($\chi 2$) and P value $<0.05$ is considered significant.

## IV. Results.

**Table (1**): Showed Physical characteristics of the subjects. It was revealed that there were no statistical significant differences between the study and the control group regarding the age, the weight and the height (P $>0.05$) and also respiratory rate, heart rate, SpO2 and surgery duration
**Figure (1):** Illustrated Comparison of duration of postoperative hospitalization between both groups the finding revealed that the mean of duration of postoperative hospitalization was 7 days for the study group and 9 days for the control group with a statistical significant difference (P-value $<0.05$) between both groups
**Table (2):** Illustrated Comparison of the ventilatory function between the study and the control group at pre and post intervention. The finding revealed that there were, non-statistical significant difference was found when

comparing the ventilatory function between both groups at the pretreatment test (P-value >0.05) which changed into a high statistical significant difference at the post treatment test for FEV1 (P-value <0.001) and a statistical significant difference for FVC (P-value <0.05) in favor of the study group.

**Table (3)** showed that the oxygen-hemoglobin saturations found from preoperative and postoperative measurements were different for the control group (95.6 ± 1.4 versus 94.1 ± 1.8, p = 0.005) and study group (95.4 ± 1.8 versus 93.7 ± 2.3, p = 0.02)

**Table (4**) illustrated that), the oxygen saturation showed lower values on postoperative day that were not different from those measured after surgery (93.6 ± 4.3 versus 93.7) while oxygen saturation increase after intervention compared with before intervention (96.0 ± 2.6 versus 93.6 ± 4.3, p = 0.02)

**Table (5)** Shows that, after first assessment the majority (73.3%, 92.3%) of study and control groups, respectively, had severe dyspnea, compared to 72.3% of the study group and 13.3% of the control group who had no dyspnea after second assessment. In the third assessment the majority (87.7%) of study group had no dyspnea compared to 26.7% of the control group. A highly significant statistical difference was found between study and control groups in relation to the above mentioned variables x2 = 30.17, 26.2, respectively.

**Table (6)** Revealed that an obvious improvement in the manifestations of respiratory infection was found in the study group for the third assessment: absence of cough (93.4) sputum
Amount, color 82.2%, 82.2%, respectively, compared with the control group, having small amount of sputum, yellow green, 50.6%, 41.2%, respectively. revealed that an obvious improvement in the manifestations ofrespiratory infection was found in the study group for the third assessment absence of cough (93.4) sputum amount, color 82.2%, 82.2%, respectively, compared with the control group, having small amount of sputum, yellow green, 50.6%, 41.2%, respectively and also indicates an obvious improvement in breath sounds for the study group .in the second and third assessment, clear sound 73.3%, 100%, while wheezing
16.7%, 0%, crepitation 10%, 0%, respectively, compared with the control group56.8 % 83.1%, 3.2%, 0%, 33.3%, 16.7%, respectively. A significant statistical difference was found between the study and control groups in relation to the above mentioned variable x2= 11.9, 15.95 respectively

**Table (1)** Physical characteristics of the subjects

| Itemss | Study group | Control group | |
|---|---|---|---|
| | Mean ± SD | Mean ±S D | |
| Age (yrs) | 50.13 ± 6.78 | 51.2 ± 5.99 | P=> 0.05 |
| Weight (Kg) | 72.46 ± 12.4 | 67.73 ± 12.01 | P=> 0.05 |
| Height (cm) | 163.46 ± 8.1 | 162.06 ± 10.45 | P=> 0.05 |
| Respiratory rate ((c/m) | 20.4 ± 3.4 | 19.8 ± 3.9 | P=> 0.05 |
| Heart rate (bpm) | 75.7 ± 13.8 | 86.8 ± 22.9 | P=> 0.05 |
| SpO2 (%) | 96.4 ± 1.9 | 96.6 ± 1.5 | P=> 0.05 |
| Surgery duration (in minutes) | 240.7 ± 50.8 | 229.7 ± 58.9 | P=> 0.05 |

SD: standard deviation, yrs: years, Kg: kilogram, cm: centimeter, P> 0.05: non-significant

**Fig (1): Comparison of duration of postoperative hospitalization between both groups**

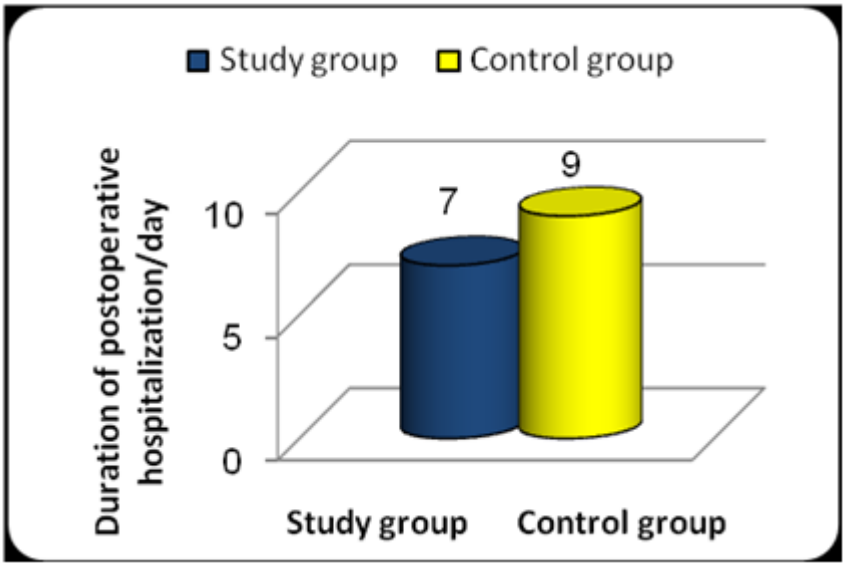

**Table (2): Comparison of the ventilatory function between the study and the control group at pre and post intervention**

| | FEV1 | | | FVC | | |
|---|---|---|---|---|---|---|
| | Mean ± SD | | | Mean ± SD | | |
| | Pre | Post | % of improvement | Pre | Post | % of improvement |
| Study group | 42.94±3.46 | 54.84±5.26 | 21.47 | 52.78±2.28 | 61.56±4.08 | 12.96 |
| Control group | 42.81±2.89 | 45.86±3.65 | 4.77 | 54.43±2.18 | 56.96±2.47 | 2.92 |
| P-value | >0.05 | <0.001 | <0.001 | >0.05 | <0.05 | <0.05 |

**Table (3) Oxygen-hemoglobin saturation before and after the operation in the control and study groups**

| Control group | | | p | study group | | |
|---|---|---|---|---|---|---|
| | Before surgery | After surgery | | Before surgery | After surgery | p |
| SatO2 (%) | 95.6 ± 1.4 | 94.1 ± 1.8 | p = 0.005 | 95.4 ± 1.8 | 93.7 ± 2.3 | p = 0.02 |
| mean ± SD | 95.6 ± 1.4 | | | 95.4 ± 1.8 | | p = 0.70 |
| | | 94.1 ± 1.8 | | | 93.7 ± 2.3 | p = 0.60 |

**Table (4). Oxygen-hemoglobin saturation before and after the intervention in the study group**

| study group | | | | | | |
|---|---|---|---|---|---|---|
| | Before surgery | Before intervention | p | After intervention | After surgery | p |
| SatO2 (%) mean ± SD | 95.4 ± 1.8 | 93.6 ± 4.3 | p = 0.033 | 96.0 ± 2.6 | 93.7 ± 2.3 | p = 0.53 |
| | 95.4 ± 1.8 | | | 96.0 ± 2.6 | | p = 0.97 |
| | | 93.6 ± 4.3 | | 96.0 ± 2.6 | | p = 0.02 |
| | | 93.6 ± 4.3 | | | 93.7 ± 2.3 | p = 0.70 |

**Table (5): Severity of dyspnea experienced by the study and control groups in the three Assessment periods**

| Group | Study | | | control | | | X2 / p-value | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1s | 2nd | 3rd | 1s | 2nd | 3rd | 1s | 2nd | 3rd |
| | No% | No% | No% | No% | No% | No% | | | |
| Severity of dyspnea | | | | | | | x2=2.44n.s<br>Fisher=.424 | x2=30.173***<br>=p<br>□□0.005. | x2=26.2***<br>p-value<br><.005 |
| None | - - | 21 72.3 | 27 87.7 | - - | 4 13.3 | 8 26.7 | | | |
| Mild | - - | 9 27.7 | 3 12.3 | -- | 20 60.0 | 20 66.6 | | | |
| Moderate | - - | -- | -- | -- | 6 26.7 | 2 6.7 | | | |
| Severe | 24 73.3 | -- | -- | 27 92.3 | -- | -- | | | |
| Maximal | 6 26.7 | -- | -- | 3 7.7 | -- | -- | | | |
| *x - + SD | 6.10+.70 | 25.7+.333 | 020+.088 | 5.60+1.06 | 1.6+1.02 | 1.20+.08 | | | |
| x2 values | x2 = 57.411*** | | | x2 = 44.195*** | | | | | |

*** = p □ □ 0.005.

**Table (6): Manifestation of chest infection in the study and control groups during first, second and third assessment**

| Group | Study | | | control | | | X2 / p-value | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1s | 2nd | 3rd | 1s | 2nd | 3rd | 1s | 2nd | 3rd |
| | No% | No% | No% | No% | No% | No% | | | |
| **Cough** | | | | | | | | | |
| No | 8 27.0 | 17 55 | 28 93.4 | 1 3.3 | 9 30 | 1 3.3 | x2=13 | 8.6 * | 22.4 ** |
| Dry | 16 50.6 | 2 6 | 1 3.3 | 20 66.7 | 15 50 | 13 46.1 | | = p | p □ □ 0.01 |
| Productive | 6 22.4 | 11 39 | 1 3.3 | 9 30 | 6 20 | 16 50.6 | | □□ 0.005 | |
| **Sputum** | | | | | | | . | | |
| Amount | | | | | | | | | *** |
| Small | 7 24.3 | 9 30.0 | 4 13.4 | 11 39 | 9 30 | 16 50.6 | x2=2.7 | x2=6.3* | x2=26.8 |
| Copious | 20 66.7 | 1 3.3 | 1 3.3 | 17 55 | 16 50.6 | 6 22.4 | | = p | p □ □ 0.001 |
| No sputum | 3 10 | 20 66.7 | 25 83.3 | 2 6 | 5 19.4 | 8 27.0 | | □ □ 0.005 | |
| Colour | | | | | | | | | |
| White | 9 30 | 3 10 | 1 3.3 | 10 33.4 | 9 30 | 10 33.4 | x2=.39 | 7.4 * | 29 *** |
| Yellowgree | 19 64 | 9 30 | 4 13.4 | 18 60 | 15 50 | 12 41.2 | | = p | p □ □ 0.001 |
| No colour | 2 6 | 18 60 | 24 82.2 | 2 6.7 | 6 20 | 8 27 | | □ □ 0.005 | |
| **Chest sound** | | | | | | | | ** | ** |
| Clear | - - | 22 73.3 | 30 100 | 0 0 | 17 56.8 | 25 83.1 | 48x2= .6 | x2=11.9 | x2=15.95 |
| Absent | 1 3.3 | - - | - - | 3 10.0 | 2 6.7 | - - | | Linear= | Linear= |
| Wheezing | 4 13.4 | 5 16.7 | - - | 5 16.7 | 1 3.2 | - - | | 1.28 | 4.7* |
| Crepitation | 25 83.3 | 3 10.0 | - - | 22 73.3 | 10 33.3 | 5 16.7 | | p □ □ 0.01 | p □ □ 0.01 |
| x2 | 58.00*** | | | 18.5*** | | | | | |

**1st , 2nd, 3rd** ( first, second and third week assessment after operation)

## V. Discussion

The aim of the present study was to evaluate the effects of early post an-esthetic Chest physiotherapy nursing intervention (Breathing exercises) on ventilatory function, pulmonary complications and Length of postoperative hospitalization) in patients undergoing upper abdominal surgery.

This study was demonstrated that chest physiotherapy nursing intervention (Breathing exercises) performed immediately after upper abdominal surgery significantly improved the ventilatory function (FEV1 and FVC), reduced postoperative pulmonary complications and length of postoperative hospitalization.

In respect to ventilatory function, as an outcome reflecting respiratory muscle strength, postoperative results of this study were consistent with the study of [17] who found a positive effect of breathing exercises on FVC. The aims of the exercises were to increase flow volume, decrease the respiratory rate, and consequently promote lung expansion [22, 23]. This may be attributed to an improvement in the diaphragm strength, as evidenced by the greater percentage of improvement in FEV1 in the study group, and improvement in respiratory mechanics that led to better expansion of the chest which reflected as increase in the ventilatory function leading to early recovery of respiratory function impairment which consequently shortened the duration of postoperative hospitalization.

By way of explanation, lung function is typically measured as FVC and FEV1 because the integrity of all components of pulmonary mechanism can be reflected through FVC values that measure the maximal volume output of the respiratory system. FEV1 values can be used to evaluate how much the preserved function of expiratory muscles because it depends mainly on the strength of the expiratory muscles and the diameter of the upper airways [24]

In respect to the clinical signs of PPCs ( dyspnea, cough, sputum and chest sound ) , the findings of the present study supported earlier work in which the use of postoperative physiotherapy regimes with, or without, the use of incentive spirometry appear to be effective following surgery compared with no physiotherapy input. Interventions that increase lung volume such as deep breathing exercises, incentive spirometry and continuous positive airway pressure (CPAP) are associated with lower frequency of PPCs [18]. [10] Showed that patients received chest physical therapy after esophagectomy had a lower frequency of respiratory complications (15% vs. 37%, $p<0.05$). Similarly chest physiotherapy has been shown to prevent or even to improve breathing complications such as secretions, atelectasis and pneumonia, using a variety of techniques [9, 8].

Together with postoperative care, respiratory physiotherapy techniques such as breathing exercises, percussion and vibration seem to pro-vide some benefit in reducing pulmonary complications[25,26,27,14].. Indeed the risks, severity and frequency of postoperative complications after abdominal surgery can be reduced by the proper use of therapeutic maneuvers that improve lung volume. [28, 1, 29, 5].In the present study, the observed improvement of oxygen-hemoglobin saturation after physiotherapy came in accordance with the results of the study by [17]. Thoracic expansion exercises and diaphragmatic breathing exercises immediately after the UAS appears to improve oxygenation without triggering increase in pain or other complications [12, 17]. We noticed that the saturation increased even with the decay on the second day after surgery. It is reasonable to suggest that patients would benefit from additional chest exercises during and after their PACU stay. We believe that with additional exercises, this oxygen-hemoglobin saturation improvement should last longer, although new studies would be necessary.

Regarding length of hospital stay, the present study showed significant shorter duration of postoperative hospitalization in study group than control group. In agreement with the results of the current study [30] showed significant shorter duration of postoperative hospitalization as compared to the control group after thoracic surgeries. From our point of view shortening of the duration of postoperative hospitalization in the current study may be an indication of reduction of the incidence or the severity of post-operative pulmonary complications in these patients.

The topic of breathing exercises during the post-anesthesia care period seems to be quite new in the literature, and it could be reasonable to suggest that this study represents a second report showing improvement in the postoperative results or prevent postoperative pulmonary complications after breathing exercises in the PACU, among these patients. Considering the controversy in the literature regarding physiotherapy techniques and the new approach showed here for early post an-esthetic care, it is reasonable to believe that additional research involving physiotherapy in the PACU ought to bring interesting findings.

## VI. Conclusions:

Consistent with other studies, the results of this research concluded that breathing exercises during the immediate postoperative period following upper abdominal surgery seem to provide some benefit in improving ventilatory function, reducing pulmonary complications and postoperative hospital stay.

## VII. Recommendations for practice and research

Based on the findings of the current study, the following recommendations can be suggested:

1. Together with postoperative care, breathing exercises should be adopted at post-anesthesia care units for patients submitted to UAS.
2. Additional studies to address the numbers, techniques and intervals of physiotherapy procedures that could be applied to benefit these patients is recommended but must be evaluated within the context of the study's limitations, including a small sample size, and a relatively short study period.
3. Well-designed trials are needed to clarify the magnitude of benefit and the comparative effectiveness of different modalities of chest physiotherapy for these patients.

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