Effect of Pulmonary Interventions on Hospitalization and Quality of Recovery among Elderly Patients Undergoing Upper Abdominal Surgery

Eman Shokry Abd Allah [1], Noha Gamal El-Sayed [2], Fatma Mohammed Ahmed[3], Ahmed Mohammed Said[4]
[1](Professor of Gerontological Nursing, Faculty of Nursing, Zagazig University, Egypt)
[2](Assis. Lecturer of Gerontological Nursing, Faculty of Nursing, Zagazig University, Egypt)
[3](Assis. Professor of Community Health Nursing, Faculty of Nursing, Zagazig University, Egypt)
[4](Assis. Professor of Chest medicine, Faculty of Medicine, Zagazig University, Egypt)

Abstract
Background: Elderly patients after upper abdominal surgery experience postoperative respiratory compromise, which is not only leading to pulmonary complications but also contribute to longer hospital stay and a delayed post-operative recovery. Therefore, the present study **aimed** to evaluate the effect of pulmonary interventions on hospitalization and quality of recovery among elderly patients undergoing upper abdominal surgery. **Subjects and methods:** A quasi-experimental design was used, where 80 older adults (40 cases & 40 controls) were enrolled using purposive sampling technique from Zagazig University Hospitals. Three tools were used to collect data they were: An Interview Questionnaire composed of three parts (demographic data, medical and surgical history, and current surgical profile), Observational checklist for patients' practice, and Postoperative Recovery Profile questionnaire. **Results:** The elderly in the control group stayed in the hospital longer than those in the study group, with the mean number of days being 9.4±2.0 and 11.9±4.0 days, respectively. In addition, a statistically significant difference (P=0.024) was revealed regarding the mean score of postoperative recovery in the study and control groups (12.7±3.8, 10.7±4.1) respectively. Explicitly, half of the elderly in the study group were fully or almost recovered two months after surgery, compared to 27.5% of those in the control group.
Conclusion: Application of structured pulmonary interventions facilitate recovery from surgery by preventing or remediating postoperative complications, which further decreased length of the hospital stay and assist with a return to normal activities of daily living and function post upper abdominal surgery.
Key words: Elderly, Hospitalization, Pulmonary Interventions, Quality of Recovery, and Upper Abdominal Surgery.

Tob Regul Sci.™ 2022;8(1): 1998-2009
DOI: doi.org/10.18001/TRS.8.1.153

1. Introduction

Older adults aged 60 years and over are the fastest-growing segment of the population around the world **(Wolfe et al., 2020)**. This segment represents a significant portion of the individuals undergoing abdominal surgery **(Sikder et al., 2019)**. Abdominal surgery involves the liver, stomach, pancreas, kidneys, or esophagus, among other major organs and structures **(Reeve & Boden, 2016)**. After surgery, patients are expected to recover enough to resume their physical functions, health status, as well as previous activities. The quality of recovery after surgery is considered an important measure of the early postoperative health status of patients, including

nociceptive, emotional, functional, and cognitive perspectives **(Trang et al., 2017)**. Many factors influence the recovery of patients who are undergoing abdominal surgery, such as psychological issues, age, perioperative health conditions, type of surgery, surgical incision, and postoperative pain management. These factors can facilitate or inhibit a transition process and outcomes **(Disceken & Kose, 2021)**.

Upper abdominal surgery may contribute to slow recovery, functional decline, loss of independence, prolonged length of hospitalization, and other untoward outcomes that affect the functional status and overall quality of life **(Zaker, 2019)**. It represents a major stressor resulting in a rapid health decline for patients postoperatively, requiring weeks or months for full recovery (getting back to normal). This health decline is primarily caused by a cascade of hormonal and metabolic events triggered by tissue trauma, and it may be exacerbated by postoperative complications and specific perioperative interventions. The recovery process is highly dynamic and covers multiple dimensions of health, such as symptom experiences, functional status, and well-being **(Alam, 2019)**.

Despite advances in perioperative care for older patients undergoing major surgery, postoperative complications continue to represent a leading cause of morbidity and mortality. Among surgical complications, pulmonary ones are the second most common type, following the complications related to surgical site infection. They may adversely influence the clinical condition and recovery of elderly patients after upper abdominal surgery **(Ruscic et al., 2017)**. Managing older patients with surgical conditions is a major challenge for hospitals. There is therefore a growing interest in providing geriatric perioperative pulmonary care interventions **(Thillainadesan et al., 2020)**. For these reasons, the present study will be designed to evaluate the effect of pulmonary interventions on hospitalization and quality of recovery among elderly patients undergoing upper abdominal surgery.

2. Subjects & Methods

2.1. Design:

A quasi-experimental design was utilized to conduct the present study.

2.2. Setting:

The sample was collected from inpatient surgical departments in Zagazig University Hospitals, Egypt.

2.3. Subjects:

The existing study enrolled 80 patients (40 cases & 40 controls) aged 60 years or above, undergoing laparotomy, have no cognitive impairment, and able to communicate.

2.4. Tools of data collection:

Three tools were used to fulfill the present study, they were:

Tool I: An Interview questionnaire composed of four parts: demographic data, medical and surgical history, and current surgical profile.

Tool II: Observational checklist for patients' practice:

After extensive literature review, the second tool was designed by the researchers and guided by **Patman et al. (2017)** to assess the practice of the following pulmonary techniques on the first, third, and fifth postoperative day (POD);

- **Breathing Retraining Exercises are included;**
  - Sustained Maximal inspiration with flow-oriented incentive spirometer (IS).
  - Pursed lip breathing.
  - Diaphragmatic (belly) breathing.
  - Localized or Segmental breathing exercise.
- **Coughing or huffing with Splinting.**
- **Early Mobilization.**

Scoring system:

In the intervention group, the items observed to be done were scored "1", while items not done were scored "0". The average of the three observations was calculated. For each type of exercise and the total checklist, the average scores of the items were summed-up and the total divided by the number of the items, giving mean scores. These were converted into percent scores. This was done at the three study phases. The following practice was considered:

- **Adequate**: If the percent score was 60% or more.
- **Inadequate**: If less than 60%.

Tool III: Postoperative Recovery Profile questionnaire [Allvin et al., 2009]

The third tool is a validated multi-dimensional questionnaire. It was developed to assess patient-reported postoperative recovery and gain knowledge about patients' health status over time. Patient's degree of recovery was calculated according to a global indicator. A higher value indicated a higher degree of recovery. This global indicator was defined by the number of questions reported as "none" and has been converted into a verbal recovery scale with five degrees of recovery. It is a 19 closed-ended item questionnaire *(1-19)* with a two-point Likert scale. It is brief, simple to comprehend, and simple to implement. The questionnaire covered the following five major dimensions of recovery:

- *Physical symptoms (5 questions):* It includes questions about pain, post-operative nausea and vomiting, fatigue, appetite, and sleeping.
- *Activity dimension (2 questions):* It includes questions about personal hygiene, and re-establishing everyday life.
- *Psychological dimension (4 questions)*: It includes questions about anxiety and worry, feeling down, loneliness, and difficulty in concentration.
- *Social dimension (3 questions)*: It includes questions about social activities, dependence on others, and interest in the surroundings.
- *Physical functions (5 questions)*: It includes questions about gastrointestinal function, bladder function, muscle weakness, mobilization, and sexual activity.
- The last question about sexual activity (Q19) in the questionnaire was omitted, as the elderly patients in the study may be single either be widowed, or divorced. *Hence,* the 18 items were adapted for elderly patients.

The scoring system:

For each of the 18 items, each item with a "No" response was scored 1, and the "Yes" response scored 0. According to the answers of all 18 items, the total score of elderly postoperative recovery was 18. The items' scores are summed up. It was classified into five degrees of recovery as follows:

Not recovered at all	*Slightly* recovered	*Partly* recovered	*Almost fully* recovered	*Fully* recovered
< 6 points	6 points	7–13 points.	14–17 points	18 points

***2.5. Field work*:**

The fieldwork was started from the mid of April 2021 to the mid of December 2021. The fieldwork included the phases of assessment, planning, implementation, and evaluation of the pulmonary techniques training program designed according to perioperative period stages as detailed;

- **Preoperative stage:**

I. Assessment phase:

Every study subject who met the eligibility criteria was interviewed individually to collect the preoperative baseline data. The researchers explained the aim of the study briefly seeking their agreement to participate in the study, and reassured them that information obtained is strictly confidential.

II. Planning phase:

This phase entailed the framework for the program, setting the general and specific objectives of the program, allocation of the program resources, and construction of evaluation tools to measure the program effectiveness. According to the relevant literature, the researchers developed pulmonary techniques training program for elderly undergoing upper abdominal surgery according to needs and the study objectives in the form of an illustrative booklet.

III. Implementation phase:

The pulmonary techniques training program was implemented in the study setting in the form of twelve sessions including theoretical and practical content for each participant. This was intended to give more chances for discussions, interactions, and practical training. The length of each session was variable according to patients' responses and active participation, as well as the time available, and the content of each session. To ensure that the studied patients understand the content, each session was started by a summary about what was given through the previous session and the objectives of the new one, taking into consideration the use of simple language to suit the level of understanding of patients. Motivation and reinforcement techniques as praise and recognition during the session were used to enhance active participation and foster learning. The total sample was randomly assigned into intervention or control groups as follows;

Intervention (exercise) group

Patients in the intervention group were provided with a booklet and brochures containing information about the general parts of the respiratory system, postoperative pain, postoperative potential complications, recovery process, and the necessity or the importance of pulmonary techniques to the post-operative recovery period. Detailed written and pictorial instructions can direct the patients to correctly perform pulmonary techniques to be initiated immediately on regaining consciousness after surgery. The patient's adherence to the program guidelines was recorded by the researchers throughout postoperative days.

Control group (usual care)

Patients in the control group received perioperative routine hospital care which was provided for all patients undergoing upper abdominal surgery without any pulmonary techniques training.

- **Postoperative stage**

IV. **Evaluation phase:**

In this phase, the researchers evaluated the effectiveness of the pulmonary techniques training program following the study tool for all patients in the study and control group. The differences in patient outcomes between the study and control group were measured by comparing the degree of recovery two months later.

2.7. Validity

A panel of five experts in community health nursing, medical and surgical nursing, community medicine, and physiotherapy reviewed the tools' content for clarity, relevance, comprehensiveness, and understandability.

2.8. Ethical consideration:

First, the Research Ethics Committee (REC) of Zagazig University's nursing faculty approved the research protocol. Following a thorough explanation of the study's purpose, each patient verbally consented to participate. Patients were given the option to decline participation and were informed that they could withdraw at any time during the data collection interviews; they were also assured that the information would be kept confidential and used solely for research purposes. The researchers assured the patients' data would be kept anonymous and confidential.

2.9. Statistical design:

SPSS 20.0 statistical software was used for data entry and statistical analysis.
Descriptive statistics were used to present data in the form of frequencies and percentages for qualitative variables and means and standard deviations for quantitative variables. The p-value of 0.05 was used to determine statistical significance.

3. Results

As to the demographic characteristics of elderly in the study and control groups, the mean age of patients in both groups was 64.3±5.3 and 63.1±3.3 years, respectively. Moreover, 50% and 55% of the study and control groups were males, respectively. Also, 70% of the study group, compared to 67.5% of the control group lived in rural areas. As regards educational level, 52.5% of the patients in the control group were uneducated, whereas the same percentage in the study group was educated with no statistically significant differences between patients in the study and control groups regarding demographic characteristics.

For chronic diseases, 62.5% and 100% of the patients in the study group had diabetes and renal diseases, respectively While, 48% of the patients in the control group had arthritis. Regarding previous surgeries, 75% of the study group compared to 65% of the control group hadn't experienced any type of surgery before. Differences observed between both groups aren't statistically significant.

Considering the current surgical profile of the elderly in the study and control groups, neoplasms were the most common medical diagnosis among patients in the study and control groups (55% & 45%) respectively. As to type of surgery, the highly reported surgeries among the study and control groups were hepatobiliary surgeries (47.5% and 45%), respectively, followed by exploratory surgery. In addition, it was observed that the midline incision was the most prevalent type of the surgical incision among the study and control groups (47.5% & 45%) respectively. All patients (100%) in the study and control groups had general anesthesia. There are no statistically significant differences between the study and control groups regarding the current surgical profile.

Pertaining to the postoperative complications and ICU admission among patients in the study and control groups, the highest incidence of postoperative complications was in the control group compared to the study group (62.5% & 40%) respectively. Both groups also have a significant difference as regards the incidence of postoperative complications (P = 0.044). With respect to the stay in ICU, the mean hours in the study and control groups were 18.2±7.7 and 20.0±7.7 hours, respectively.

With reference to length of hospital stay and postoperative ambulation among elderly patients in the study and control groups, **Table 1** demonstrates that 85% of elderly patients in the study group stayed in the hospital for more than eight days, as compared to 92.5% of those in the control group. In addition, 70% of the elderly in the study group were ambulated on the first day after surgery, as compared to 40% of those in the control group. The same table indicates a statistically significant difference between the study and control groups regarding length of hospital stay and day of first postoperative ambulation (P<0.001 and P=0.007), respectively.

With reference to patient patients' practice of pulmonary techniques in the study group throughout the first five postoperative days, **Figure 1** displays a promotion in total practice score of pulmonary techniques among elderly patients in the study group throughout the first five postoperative days (70%, 85%, and 87.5%) respectively. Precisely, the percent of change reached 17.5% on the fifth postoperative day.

With reference to postoperative recovery scores among elderly patients in the study and control groups, **Figure 2** shows that half of the elderly in the study group were fully or almost recovered two months after surgery, compared to 27.5% of those in the control group. In

addition, a statistically significant difference (P=0.024) was revealed regarding the mean score of postoperative recovery in the study and control groups (12.7±3.8, 10.7±4.1) respectively.

According to **Table 2**, the results show statistically significant positive correlations between elderly practice level and each of the following items: breathing rate and recovery score. A statistically significant positive correlation was also found between elderly compliance to pulmonary techniques and their recovery score. Furthermore, a statistically significant negative correlation was also found between elderly patients' practice and their breathing rate.

Referring to multivariate analysis of recovery score, **Table 3** indicates that length of hospital stay, ICU admission, and smoking were statistically significant negative predictors of elderly recovery score (P<0.001). Longer hospitalization, ICU admission, and smokers all predict a lower recovery score. The model explains 77% of the variation in this score, as the value of r-square indicates.

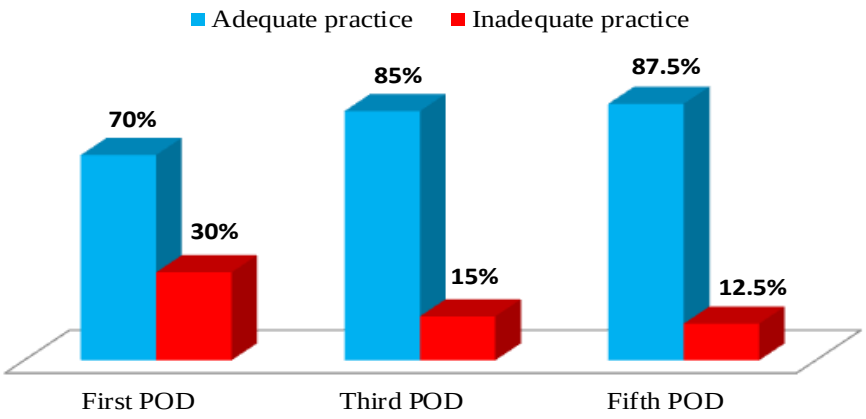


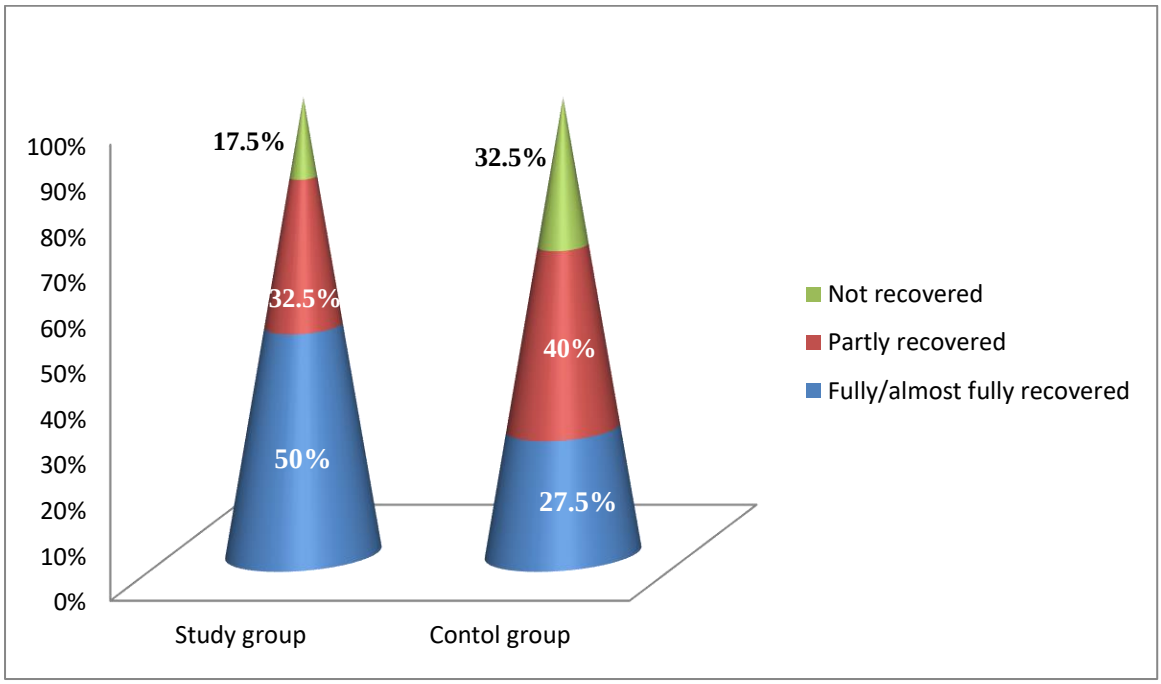
Figure 1: Pulmonary techniques practice among elderly patients in the study group throughout the first five postoperative days (N= 40)

Table 1: Length of hospital stay and postoperative ambulation among elderly patients in the study and control groups (N=80)

Items	Study group (n=40)		Control group (n=40)		X^2 test	p-value
	No.	%	No.	%		
Pre-operative days:						
<4	31	77.5	29	72.5		
4+	9	22.5	11	27.5	0.267	0.606
Post-operative days:						
<8	29	72.5	16	40.0		
8+	11	27.5	24	60.0	8.584	0.003*
Length of hospital stay (days):						
<8	6	15.0	3	7.5		
8+	34	85.0	37	92.5	1.127	0.288
Mean±SD	9.4±2.0		11.9±4.0		U=3.513	**<0.001***
Day of first postoperative ambulation:						

1	28	70.0	16	40.0		
2+	12	30.0	24	60.0	7.273	**0.007***
Mean±SD	1.4±0.6		1.7±0.7		U=2.09	**0.04***

(*) Statistically significant at p<0.05



Chi square test; 2.304
Statistically significant at p<0.05

Figure 2: Postoperative recovery among elderly patients in the study and control groups (N=80)

Table 2: Correlations between the scores of practice and compliance among elderly patients in the study group and recovery scores

Items	Practice score		Compliance score	
	r	p-value	r	p-value
Breathing rate	-0.213	**0.020***	-0.666	<0.000
Recovery score	0.250	**0.006***	0.528	**<0.001***

(*) Statistically significant at p<0.05

Table 3: Best fitting multiple linear regression model for the recovery score of elderly patients in the study group

Items	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value	95% Confidence Interval for B	
	B	Std. Error				Lower	Upper
Constant	30.01	0.96		31.199	<0.001	28.11	31.91
Control group	-2.00	0.36	-0.27	-5.498	<0.001	-2.72	-1.28
No. of chronic diseases	-0.66	0.22	-0.14	-2.928	0.004	-1.10	-0.21
length of hospital stay	-0.29	0.06	-0.24	-4.527	<0.001	-0.42	-0.16

ICU admission	-1.40	0.33	-0.19	-4.302	<0.001	-2.05	-0.76
Smoking	-0.64	0.14	-0.20	-4.734	<0.001	-0.91	-0.37

r-square=0.77 Model ANOVA: F=65.23, p<0.001
Variables entered and excluded: age, gender, education, income, No. of medications, Melbourne score, and time

4. Discussion

Because the population is rapidly ageing, the proportion of surgeries involving elderly patients is increasing globally (Han et al., 2019). In terms of demographic characteristics of the elderly in the study and control groups, the current study found no significant differences in gender, mean age, residence, educational level, income, and marital status, similar to a previous study in Jordan conducted by Jalil et al. (2021). These findings could be explained by the fact that random allocation eliminates selection bias between study and control groups.

Regarding patients' **previous hospitalization and previous surgeries**, the current study results revealed that three-quarters of elderly in the study group and nearly two third of elderly in the control group had no previous surgeries. Possible explanation of such result is the lack of access to better health care which might delay discovering of health problems.

As to **type of surgery**, the current study illustrated that the highly reported surgeries in the study and control groups were hepatobiliary surgeries. This finding might be interpreted by the fact that aging is usually associated with decreased contractility of the gall bladder, increased cholesterol and phospholipid content of the bile, and increased biliary tract diameter ***(Spangler et al., 2014)***. These findings are in accordance with a prospective study in Minia, Egypt carried out by ***Henden Cam et al. (2018),*** reported that cholecystectomy was the most common abdominal surgery among geriatric patients.

Concerning **the surgical incision**, similar to a previous study in São Paulo, Brazil carried out by ***Possa et al. (2014)***, the results of the current study indicated that the midline incision was the most prevailing type of surgical incision among the study and control groups. This result might be due to that hepatobiliary surgeries and exploratory surgery were the most reported, where the incision is usually in the right upper abdomen or across the mid-upper abdomen.

Turning to the **postoperative complications**, the current study indicated that less than half of the study group and less than two third of the control group experienced various postoperative complications. This finding might be attributed to advanced age which is frequently associated with significant comorbidity and limited functional reserve, both of which increase the risk of serious postoperative complications. In the same stream, ***Simões et al. (2018)*** carried out a study in Sao Paulo, Brazil and revealed that 34.4% of studied patients developed major complications during postoperative period.

Considering the **length of hospital stay**, the present study indicated that the mean duration of hospital stay was significantly lower in the study group than in the control group (7.90±2.078 and 11.50±3.75, respectively). Such result might be attributed to that improved postoperative pulmonary functions and decreased incidence of respiratory complications among elderly patients in the study group were behind this difference. In the same context, ***Kabir et al. (2021)*** conducted a study in Dhaka, Bangladesh, and concluded that the mean length of hospital stay in

the experimental group was 7.90 (± 2.078) days and 11.50 (±3.75) in the control group, with a p value of 0.0016 in the experimental group and 0.019 in the control group, demonstrating that the breathing exercises combined with early mobilization significantly reduced the duration of hospital stay after abdominal surgeries.

With respect to **first postoperative ambulation**, results of the present study revealed that more than two third of the elderly in the study group and less than half of the control group ambulated on the first POD. Such results might be attributed to that preoperative counseling along with training can foster early mobilization among elderly patients undergoing abdominal surgery. This finding is in agreement with a prior study carried out in Pakistan by ***Samnani et al. (2014)***, who stated that preoperative counseling and support of health professional staff improve compliance with early mobilization.

The current study revealed a high practice level regarding pulmonary techniques among elderly patients with statistically significant improvement in the practice scores throughout the first five postoperative days. Possible reason for such results is offering elderly patients with visual feedback about the inspired air-flow through the use of an incentive spirometer device are thought to increase their motivation to be compliant with modalities. These findings are in accordance with Turkish study, carried out by ***Ünver et al. (2018)***, who reported that receiving preoperative education about breathing exercises affected patients' exercise performance status positively (the exercise application rate among surgical patients).

Similar to an Indian study carried out by ***Kaur et al. (2020)***, the results of the current study demonstrated a statistically significant negative correlation between elderly Melbourne scores and the postoperative recovery scores. Such a finding might be due to the fact that post-operative pulmonary complications, e.g., atelectasis, pneumonia, or pulmonary dysfunction, remain the major cause of worsening the outcome of patients during the hospitalization period or after discharge, and subsequently post-operative morbidity and mortality.

Limitation of the Study

Purposive sampling technique could be considered as a limitation.

5. Conclusion

According to the current study findings, hepatobiliary surgeries and ASA class 2 account for a large proportion of patients. Longer hospitalization, ICU admission, smoking, and having a higher ASA class were all risk factors for slower postoperative recovery. There is evidence that elderly patients who received preoperative pulmonary technique training had adequate postoperative practice, high compliance with the intervention, a shorter hospital stay, fewer pulmonary complications, and a subsequent better and faster recovery. Finally, the use of various pulmonary interventions proved to be effective in shortening hospital stays and improving the quality of recovery following upper abdominal surgery.

Acknowledgment

The authors would like to thank elderly who participated in this study and wish all the best for them in their life.

Declaration of Conflicting Interests

The author(s) declare(s) that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. **Alam R. (2019).** Development of a Patient-Reported Outcome Measure of Recovery After Abdominal Surgery: A Conceptual Framework. McGill University (Canada). ProQuest Dissertations Publishing, 28254714. P. 22-24.
2. **Allvin R., Ehnfors M., Rawal N., Svensson E., and Idvall E.** Development of a questionnaire to measure patient-reported postoperative recovery: content validity and intra-patient reliability. J Eval Clin Pract.2009;15(3):411-419.
3. **Disceken F.M. and Kose G.** Association of preoperative pain beliefs with postoperative pain levels in abdominal surgery patients. *Journal* of *clinical nursing*.2021;*30*(21-22): 3249-3258.
4. **Han B., Li Q., and Chen X.** Effects of the frailty phenotype on post-operative complications in older surgicalpatients: a systematic review and meta-analysis, *BMC Geriatrics*.2019*;* 19 (141): P. 1-9. https://doi.org/10.1186/s12877-019-1153-8.
5. **Henden Cam P., Baydin A. Yuruker S., Erenler A.K., and Senguldur E.** Investigations of Geriatric Patients with Abdominal Pain Admitted to Emergency Department. Current Gerontology and Geriatric Research. 2018; 1:1-8.
6. **Jalil R.A., Al-Najjar H., Abou Chaar M.K., Al-Masri M., Daoud F., Al-Ebous A., and et al.** The impact of a perioperative pulmonary care bundle implementation on postoperative outcomes in 1,665 surgical cancer patients: experience from a tertiary referral cancer center in Jordan. *Patient Safety in Surgery*.2021; 15(1): 1-7.
7. **Kabir M.F., Jahan S., Hossain M.Z., Chakrovorty S.K., Sarker A.H., Hossain M.A., and et al.** Effect of Chest Physiotherapy along with Early Mobility after Abdominal Surgery. *European Journal of Medical and Health Sciences*.2021; 3(1): 150-156. https://doi.org/10.24018/ejmed.2021.3.1.687.
8. **Kaur A., Kalyani C.V.,** and **Kusum K.** Effect of Incentive Spirometry on Recovery of Post-Operative Patients: Pre Experimental Study. Journal Of Nursing Practice.2020; 3(2): 220-225.
9. **Manzano R.M., Carvalho C.R., Saraiva-Romanholo B.M., and Vieira J.E.** Chest physiotherapy during immediate postoperative period among patients undergoing upper abdominal surgery: a randomized clinical trial. *Sao Paulo Med J*.2008;126(5):269-73.DOI: 10.1590/s1516-31802008000500005. PMID: 19099160.
10. **Patman S., Bartley A., Ferraz A., and Bunting, C.** Physiotherapy in upper abdominal surgery – what is current practice in Australia?. *Arch Physiother*. 2017;7(11). https://doi.org/10.1186/s40945-017-0039-3.
11. **Possa S.S., Amador C.B., Costa A.M., Sakamoto E.T., Kondo C.S., Vasconcellos A.M. & et al.** "Implementation of a guideline for physical therapy in the postoperative period of upper abdominal surgery reduces the incidence of atelectasis and length of hospital stay." Revista Portuguesa de Pneumologia (English Edition) 20.2 (2014): 69-77.
12. **Reeve J. and Boden I.** The physiotherapy management of patients undergoing abdominal surgery. *New Zealand Journal of Physiotherapy*.2016;44(1):33-49. https://doi.org/10.15619/NZJP/44.1.05
13. **Ruscic K., Grabitz S., Rudolph M., and Eikermann M.** Prevention of respiratory complications of the surgical patient, *Current Opinion in Anaesthesiology*. 2017;30(3):399-408 doi: 10.1097/ACO.0000000000000465

14. **Samnani S.S., Umer M.F., Mehdi S.H., and Farid F.N.** Impact of Preoperative Counseling on Early Postoperative Mobilization and Its Role in Smooth Recovery. *Int Sch Res Notices.* 2014:250536. doi:10.1155/2014/250536pmid:27351013
15. **Sikder T., Sourial N., Maimon G. Tahiri M., Teasdale D., Bergman H., and et al.** Postoperative Recovery in Frail, Pre-frail, and Non-frail Elderly Patients Following Abdominal Surgery. *World J Surg.*2019;43:415–424. https://doi.org/10.1007/s00268-018-4801-9
16. **Spangler R., Van Pham T., Khoujah D., and Martinez J.P.** Abdominal Emergencies In The Geriatric Patient. *Int J Emerg Med.* 2014; 7:43. https://doi.org/10.1186/s12245-014-0043-2
17. **Thillainadesan N., Yumol M. F., Hilmer S., Aitken S.J.,** and **Naganathan V.** Interventions to Improve Clinical Outcomes in Older Adults Admitted to a Surgical Service: A Systematic Review and Meta-analysis, *Journal of the American Medical Directors Association.* 2020, IN PRESS, https://doi.org/10.1016/j.jamda.2020.03.023
18. **Trang N.T.T., Thosingha O., and Chanruangvanich W.** Factors associated with recovery among patients after abdominal surgery. *Journal of Nursing Science.* 2017;35(1):4–12.
19. **Ünver S., Kıvanç G., and Alptekin H.M.** Deep breathing exercise education receiving and performing status of patients undergoing abdominal surgery. *International journal of health sciences.*2018;*12*(4):35.
20. **Wolfe J.D., Wolfe N.K., and Rich M.W.** Perioperative care of the geriatric patient for noncardiac surgery. *Clinical cardiology.*2020; *43*(2): 127–136. https://doi.org/10.1002/clc.23302
21. **Zaker A.A. (2019*).*** Functional Abilities of Patients Post Major Abdominal Surgery. Published thesis for the Degree of Master of Nursing Science, Egypt. The University of Alexandria.P.14.