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Effect of Nursing Care Protocol on Respiratory Complications Outcomes of Patients Undergoing Upper Gastrointestinal Surgeries

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Abstract
Background: *Postoperative pulmonary complications are a common serious complication following upper abdominal surgery leading to significant consequences including increased mortality, hospital costs, and prolonged hospitalization. Breathing exercises, Incentive Spirometer, oral care, and education are important practices in patients with upper abdominal surgery.* ***Aim****: Evaluate the effect of implementing a nursing care protocol on respiratory complications outcomes and pain of patients undergoing upper GIT surgeries.* ***Design****: Quasi-experimental study.* ***Setting****: The study was conducted In Surgical Department at Emergency and Tanta Main University hospital.* ***Subjects****: A convenience sample of 100 adult patients undergoing upper abdominal surgery were divided on a random basis equally into four Groups (25 For each group).open control group (1) open study group(2), laparoscopic control group (3), and laparoscopic study group (4). Study groups managed by the nursing care protocol implemented by the researcher, while control groups received routine nursing hospital care.* ***Tools****: three tools were used. Tool I: Structure interview schedule. Tool II: Upper gastrointestinal surgeries patient's respiratory complications outcomes monitoring tool. Tool III: Postoperative respiratory complications of upper GIT surgeries patient's assessment tool.* ***Results****: There was a statically significant difference between control and study groups of open and laparoscopic surgeries regarding breathing rate and sounds need for O_2 therapy, additional analgesics, pain score and post-operative dyspnea, pneumonia, and atelectasis.* ***Conclusions****: Multidisciplinary nursing care program for patients with upper GIT surgeries has beneficial effects on the clinical postoperative pulmonary outcomes and pain of patients undergoing upper GITs surgery.* ***Recommendations****: Multidisciplinary nursing care program should carry out as routine care for patients undergoing upper GIT surgeries.*

Key words: *upper gastrointestinal surgeries, pain, post-operative pulmonary complications, clinical outcomes, nursing care protocol, I cough program.*

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I. Introduction:

The worldwide use of surgical treatments is thought to be increasing, nearly 234 millions of patients undergoing major surgery worldwide every year [(1)]. Approximately 16% will suffer a complication within 30 days [(2)]. One set of under-reported complications are postoperative pulmonary complications (PPC). These include a spectre of clinical conditions. PPC includes postoperative hypoxia, atelectasis, bronchospasm, pulmonary infection, pulmonary infiltrate, aspiration pneumonitis, acute respiratory distress syndrome, pleural effusions and pulmonary oedema [(3)]. Depending on the severity, these can be self-limiting, require ward-based interventions e.g. antibiotics or physiotherapy, or readmission to critical care, reintubation and even death [(4)]. According to systematic review study in 2020, the incidence of PPC is anywhere ranges from 6% to 80%, depending on definitions, severity considered, and presence of risk factors[(5)]. After upper abdominal surgery (AUS), PPCs are one of the most important causes of postoperative morbidity and mortality, particularly within the first postoperative week [(6)], and according Egyptian studies, the reported incidence is between 10% and 50% of patient [(7,8)]

Atelectasis considers one of the most common post-operative pulmonary complications. It has ranged from 20% to 69%. Shallow, monotonous breathing may decrease ventilation to dependent lung regions and may contribute to the development of atelectasis. Incisional pain, residual anesthetic effects, and lying in bed for prolonged periods also contribute to post-operative pneumonia (POP). [(9)] Currently, postoperative pneumonia is

the third most common complication for all surgical procedures. Abdominal surgical patients who develop post-operative pneumonia experience a 10-fold increase in mortality over those who do not, Incidence rates for POP have been reported between 0.49% and 54.3%. [(10)]. Dyspnea: it considers a major complaint in the early post-operative period, the prevalence of dyspnea in a patient with upper abdominal surgeries is varying from 30-70% depending on the severity, pain, and physiological factors. Also, it considers as a symptom of other pulmonary complications including hypoxemia which occurs within minutes to 2 hrs. after surgery with incidence 35% – 60%.[(11)] Upper abdomen surgeries are more painful than procedures on the lower abdomen. According to the US Institute of Medicine, 80% of patients who undergo surgery report post-operative pain, with 88% of these patients reporting moderate, severe, or extreme pain levels, and nearly 50% doesn't treated inadequately. [(12)]

According to American systematic review, many strategies have been investigated methods to reduce or prevent postoperative complications such as; physiotherapy, preoperative oral care, and complementary therapy [(13)]. But, few had studied the effect of both or implementing them after surgery on post-operative pulmonary complications and pain. According to the points that previously remembered, nurses play a main role in preventing and reducing post pulmonary complications and pain, especially when they apply both education and practice, in turn, lead to better patients' outcomes and reduced utilization of health care services. So, a strategy to reduce pulmonary complications based on pulmonary care program (I COUGH) that emphasizes incentive spirometry, coughing and deep breathing, oral care , understanding (patient education), getting out of bed , and head-of-bed elevation.[(14)]. A study revealed that, for the nursing practice, the pre–I COUGH nursing practice audit revealed that 80.4% of the patients were in bed at the time of the visit, In contrast, post–I COUGH audits revealed a significant difference in practice, with 49.1% of patients out of bed ($P < .001$). Also, the mentioned study concluded that during the year before the implementation of I COUGH, the incidence of postoperative pneumonia was 3.6% and fell to 1.6% in the year after the implementation of I COUGH. [(15)]
Therefore, this study was carried out to evaluate the effect of implementing nursing care protocol on clinical outcomes of patients undergoing upper gastrointestinal surgeries.

Aim of the study is to out to evaluate the effect of implementing nursing care protocol on the respiratory complications outcomes of patients undergoing upper gastrointestinal surgeries.

Research hypothesis: Patients undergoing upper gastrointestinal surgeries who are exposed to nursing care protocol exhibit mild levels of pain, dyspnea, pneumonia, atelectasis, and increasing in the level of oxygenation more than who do not.

Operational definition:

Respiratory complications outcomes: The complications that would be might occur post upper gastrointestinal surgery and were studied in this research: the levels of oxygenation, dyspnea, atelectasis, pneumonia, and pain.

Nursing care protocol: Multidisciplinary pulmonary care program (I COUGH) which emphasizes: incentive spirometry, coughing and deep breathing, oral care, understanding (patient and family education), getting out of bed, and head-of-bed elevation.

II. Materials and Method

Materials:

Research design: A quasi experimental research design was utilized to conduct the current study. **Setting**: The present study was conducted at gastrointestinal surgery department of Emergency and Tanta Main University hospital, affiliated to Ministry of Health, Gharbia governorate. **Subjects:** The study populations were adult patients with open and laparoscopic upper gastrointestinal surgery. A convenience sample of 100 adult patients were constitute the study subjects, and they were divided randomly into four equal groups 25 patient in each group; Group (1): Open study group; patients and they were exposed to the nursing care protocol, group (2): Open control group; patients were exposed to routine hospital care (deep breathing exercise and walking), Group (3): study Laparoscopic group; they were exposed to the nursing care protocol, and group (4): control Laparoscopic group; and they were exposed to routine hospital care. **Inclusion criteria** included; adult patient 18- 60 old years, from both sexes, conscious, able to move, and body mass index 18.5- 26 kg/m^2.

Tools for data collection: three tools were used to conduct this study:

Tools (I, II part one, and III part three) were developed by researcher after reviewing the related literature, and tools (II part one and III part two) were adapted by the researcher, while tool III part one was adopted by the researcher.

Tool I: Structure interview schedule characteristics.

This tool was developed by the researcher after reviewing the related literature, [(16)] and included two parts; part (A), it included patient's socio-demographic data, and part (B) Patient's clinical data: it consisted of two parts: Part (B.1), it included past health history, and part (B. 2): it was included present health history

Tool II: Upper gastrointestinal surgeries patient's respiratory complications outcomes monitoring tool. It consisted of two parts:

Part (I): Upper gastrointestinal surgeries patients hemodynamic status assessment tool: This tool was developed by researcher after reviewing relevant literature and depending on simplified acute physiology score II [(17)], and national early warning score [(18)]. It was used to assess the following items: breath rate and sound, oxygen saturation, need for oxygen therapy, cough, temperature, and white blood cells.

Part (II): Brief pain inventory tool: This tool was developed in 1994 by the pain research group at the university of Wisconsin medical school [(19)]. This tool was adapted by researcher to assess precipitating, relieving factors and pain intensity. Scoring system: consists of horizontal line ranged from 0- 10 as the following: No pain: when the total pain score level equal zero, mild pain: from (1-3), moderate pain: from (4-6), and severe pain: indicates form (7-10).

Tool III: Postoperative respiratory complications of upper gastrointestinal patient's surgeries assessment tool: it was include three parts

Part (a): Modified clinical pulmonary infection score (m CPIS) [(20)]: it was developed by Pugin et al. 1991and modified by Luna et al in 2003[(21)]. It used by the researcher for accurate and early clinical diagnosis of pneumonia infection. Scoring system: scores range from 0 to 10, where 0 – 4 means no or fair pneumonia, 5- 6 means likelihood pneumonia, and 7- 10 means severe pneumonia.

Part (b): Modified Borg dyspnea scale (MBS): it was developed Borg in 1982[(22)] and modified by Mahler and Horowitz in 1994[(23)], and it was used to assess precipitating, relieving factors, and the level of dyspnea. Scoring system**:** scores range from 0 to 10, where zero means no dyspnea and ten means extreme dyspnea.

Part (c): Development of atelectasis of upper gastrointestinal patients' surgeries assessment tool: it was used to assess the occurrence of atelectasis depending on chest x-ray in addition to one at least of: increase respiratory rate, reduced oxygen saturations and decreased breath sounds. [(17)]

Method

- **Written approval:** Hospital permission was obtained from the responsible authority of mentioned hospitals before conducting this study through official letters from Faculty of Nursing explaining the purpose of the study.
- **Ethical and legal consideration:**
  1. Approval to conduct this study was obtained from ethical committees of both faculty of Medicine and Faculty of Nursing at Tanta university
  2. An informed consent was obtained from each patient participating in the study after explanation of the aim of study and assuring them of confidentiality and privacy of data collected. Privacy of the patients and confidentiality of data were maintained by coding number**.**
- **Tools validity and reliability:** All tools were submitted to five experts in the field of surgery, and medical surgical nursing for content validity and the necessary modifications was carried out accordingly. All tools was tested using the Cronbach's coefficient alpha. The reliability of tools (one, two, and three were acceptable) (0.89, 0.93, and 0.86 respectively).
- **A pilot study**: was carried out on ten patients (10%) of the study sample to assess clarity and applicability of the tools and to identify the difficulties that encountered during data collection. Those patients were excluded from the study subjects.
- **Data collection:** Data were collected within period of 14 months from February 2019 to April 2020.
- **Actual study**; The purpose of the study was explained for each participant in the study that was conducted through four phases:

1: Assessment phase: before the surgery, an initial assessment was carried out by the researcher for all the studied groups to assess the patients who met the inclusive and exclusive criteria of this study and were assessed to collect baseline data by using tool I (1, 2.a) such as age, sex, BMI, previous disease, surgeries.

2: Planning phase: before the surgery, the priorities and outcomes were put in cooperation with study (one and three) groups' patients and expected outcome criteria included reduction of postoperative respiratory complications, pain, use of analgesics consumption, and improve the level of oxygenation.

A colored Booklet was designed based on review of related literature and written in simple Arabic language by the researcher, all steps of the booklet explained carefully, simply and clearly. Three sessions of patient's education was carried out to provide the patients with knowledge and skills. The first session: It was introductory session that included establishing of relationship, the second session; was included of theoretical information about anatomy of respiratory system, respiratory complications, physiotherapy, pain relief techniques, and oral care, and the third session how he can implement the steps of the protocol. Each patient had his special equipment's including; spirometer, Toothbrush, chlorhexidine 0.12% for mouth rinses and urine collection container for sputum collection.

3: Implementation phase: after the surgery, the nursing care protocol was implemented to the study (one and three) groups in three sessions daily and the duration of each one lasted for 25- 30 minutes as the following:

A-Deep breathing exercises (5-10 minutes/ three session/ day): The frequency of breathing was from 20-30 times and every 5 breaths the patient must take rest about 30-60 sec. to avoid hyperventilation. Ask the patient to avoid forced expiration to prevent gasping in breathing. Place the patient relaxed half lying or sitting**, B-Coughing exercise (**5-10 minutes/ three session/ day): It was done during existence the patient in the hospital. Ask the patient to take deep breathing from the nose, close the epiglottis, contract abdominal muscles, open the epiglottis, cough forcefully and expectorate secretions into tissue.

C-Incentive spirometer (5-10 minutes/ three session/ day): Ask the patient to sit on the edge of bed if possible, or sit up as far as he can in bed. Then hold the incentive spirometer in an upright position, then place the mouthpiece in his mouth and seal his lips tightly around it. Breathe in slowly and as deeply as possible. Rest for a few seconds and repeat steps one to 5 at least 10 times every hour. After each set of 10 deep breaths, cough up to be sure the patients' lungs are clear. Support the patients' incision when coughing by placing a pillow firmly against it.

D- Walking: Ask the patient to sit on the edge of bed if possible, or sit up as far as he can in bed. Then ask to inhales a deep breath with the feet moving for minutes and then standing up with support by family. Support the patients' incision when walking by his hand firmly against. Ask the patient to walk for 10 minutes with rest as needed.

E- Oral care by using chlorhexidine and teeth brush and semi fowler positions after surgeries (30- 45°).

4: Evaluation phase; Evaluation was done for all groups using the three tools as following:

Tool I part B.2: it was used to collect data including type of surgery, size of incision surgery, and time of surgery, **tool II** to assess vital signs, oxygenation, supporting with oxygen, precipitating and relieving factors, and the score of pain that measured, and **tool III** part 1 was used to measure the indicators of infection as temperature, WBCs, and chest x-ray including pneumonia. Part 2 to assess the precipitating and relieving factors and the score of dyspnea that measured daily, and part 3 was used to assess the occurrence of atelectasis. Both atelectasis and pneumonia were measured in the first and third post-operative day.

Limitations of the study:

Data collection was done pre and during the period of Covid 19 and this leads to a decrease in the number of patients' admission.

III. Results:

Regarding the Socio-demographic Characteristics, the table (1) **r**eveals that the more than half of the studied groups are 57% females, 51% their age from 46 - 60 years, 61% nonsmokers, and 50% of them with normal body mass index. Also, nearly third of all the studied groups are illiterate, nearly three quarters are married, and more than half of them lives in rural. There is no statistical significant difference between the studied groups regarding to their socio-demographic characteristics where $p > 0.650$ with all studied groups. For the present surgery, the figure (1) shows that cholecystectomy, gastrectomy (partial or total), and duodenectomy are the most surgeries performed with percentage 37 %, 36 %, and 10% of the studied groups respectively.

In relation to postoperative respiratory assessment, the table (2) indicates that a significant statistical difference between the open (1, 2) and laparoscopic (3,4) groups where the majority 84% and 72% of 2, and 4 groups had abnormal broth sounds on the first day respectively, and these percentages were slightly decreased on the third day, 80 %, and 60 % respectively. While, 56 % and 60% of (1, and 3) groups had abnormal breath sounds on the first day, and these percentages significantly decreased to 20 %, and 16 % on the third day respectively. Also, regarding the level of oxygenation, this table reveals that the oxygenation saturation < 95% comprises 48 %, 40 % of control (2, and 4) groups on the first day respectively and slightly decreased to 36 %, 28 % on the third day respectively, while more than two-thirds 68 % of patients in study groups have a level of oxygen > 95% on the first day. Moreover, this percentage increased to 82% in the next two days. This difference reached statistical significance between groups on the second day and highly significant statistical differences present ($p = 0.001$) for each type of surgery on the third day. Furthermore, results of table (2) reveal that less than half 48 %, and 44 % of (2, and 4) groups have pathological changes with their chest x-ray on the first day and slightly decreases to 40%, and 28% on the third day respectively, while the percentage of the pathological changes in the (2 and 4) groups obviously decreases to half 16 %, and 12% on the third day with a significant statistical difference is found where $p= 0.001, 0.036$.

Concerning the characteristic of post-operative pain, the findings of figure(2) indicate that the majority control groups depends on analgesics to reduce post-operative pain on the first day, , while 72 %, 56 % of 1, and 3 groups depends on alternative therapy basically respectively. The difference is statistically significant. Also, the figure (3) presents that, nearly half of studied groups have severe pain on the first day, and these percentages of control groups are slightly decreased to 56 %, and 40 % on the second and to 44 %, and 28 % on the third day respectively. While, nearly two-thirds 68%, 64% of study (1, 3) groups are categorized as moderate pain on the second day respectively. Moreover, severe pain significantly decreases on the third day to one-third

12 %, and 8% of 1, and 3 groups respectively. A highly statistically significant differences present among all four studied groups where = 0.003, 0.001 on the second and third day respectively**.**

As regards the PPCs, the table (3) presents astatically significant differences between the study and control groups regarding the occurrence of pneumonia. The percentage of severe infection pneumonia increased on the third day to 12 % (mean of mCPIS= 3.9), and 8 % (mean =3.5) of the control (2, and 4) groups respectively, whereas the percentage of no or fair pneumonia increases to 92 % of both study (1, and 3) groups with no any respiratory infection. Also this table shows that atelectasis on the first day, nearly half 56 %, and 48 % of control (2 and 4) groups and 36 %, and 32 % of study (1, and 3) groups have post-operative atelectasis respectively. Moreover, on the third day, these percentages slightly decreases by 8% of both control groups, while it is significantly decreases to 12 %, and 20 % in the (1, and 3) groups respectively. There are statistically significant differences on the first day between the open surgery groups where p = 0.045 and highly significant on the third day p = 0.007. Whereas, no statistically significant difference was found in laparoscopic studied groups on the first-day p= 0.087, while there is a statistically significant difference on the third -day p = 0.01. Furthermore, this table indicates that the score of dyspnea of both control groups ranges (5-8) in the first two days with slightly decreasing on the third day (5-7), while it is ranges (4-7) , and (2-5) of study groups respectively and these differences are statistical significant.

According to the relation between occurrence of post-operative pulmonary complications on the third day, the table (4) shows that both age > 46 years, males (excluded dyspnea), smoking, previous respiratory diseases, body mass index > 24,6 kg / m^2 (excluded the pain), and duration time of surgery more than 120 minutes are a significant risk factors of the occurrence of post-operative dyspnea, pneumonia and atelectasis where p < 0.05. Also**,** the findings of the table (4) indicates that the occurrence of post-operative pulmonary complications increase with illiteracy patients; 65% of them has one or more of ppc (p= 0.01), with previous respiratory disease; 62% of patients with ppc has respiratory diseases previously (p=0.02). Moreover, this table reveals that the length of incision considers a risk factor of ppc (p= 0.01). All of the patients have at least one of ppc when the length incision sizes > 20 c.m. Furthermore, this table presents 100% of patients with Whipple and distal pancreatectomy, and nearly three quarters 73% of partial hepatectomy patients have one of post-operative pulmonary complications whereas, the patients undergoing cholecystectomy, fundoplication, and proximal gastrectomy have a lower rate of post-operative pulmonary complications.

Table (1): Frequency distribution of studied groups undergoing upper gastrointestinal surgery according to socio-demographic characteristics (N=100.(

Variables	Open surgery groups (N=50)						χ2 P	Laparoscopic surgery groups (N=50)				
	Study group1 (n=25)			Control group 2(n=25)				Study group 3 (n=25)		Control group 4 (n=25)		χ2 P
	N		%	N		%		N	%	N	%	
Age in years: 18-30 31-45 46-**60**	4 8 13		16.0 32.0 52.0	2 9 14		8.0 36.0 56.0	MCET 0.844	4 10 11	16.0 40.0 44.0	5 7 13	20.0 28.0 52.0	MCET 1.000
Sex: Males Females	11 14		44.0 56.0	10 15		40.0 60.0	MCET 0.774	12 13	48.0 52.0	10 15	40.0 60.0	0.680 0.777
Marital status Married Not married	21 4		84.0 16.0	19 6		76.0 24.0	FE 0.667	19 6	76.0 24.0	20 5	80.0 20.0	FE 0.667
Residence: Rural Urban	15 10		60.0 40.0	14 11		56.0 44.0	0.682 0.634	14 11	56.0 44.0	16 9	64.0 36.0	0.333 0.564
Educational level: Illiterate not Illiterate	7 18		28.0 72.0	8 17		32.0 68.0	MCET 0.850	8 17	32.0 68.0	9 16	36.0 64.0	MCET 0.786
Body mass index: 18.6- 24.5 24.6 – 26	12 13		48.0 52.0	11 14		44.0 56.0	MCET 1.000	12 13	48.0 52.0	15 10	60.0 40.0	MCET 0.722
Tobacco smoking: Smoker Non smoke	8 17		32.0 68.0	10 15		40.0 60.0	0.995 0.758	10 15	40.0 60.0	11 14	44.0 56.0	FE 1.000

*Significant at P < 0.05 MCET = Monte Carlo exact test FE = Fisher exact test

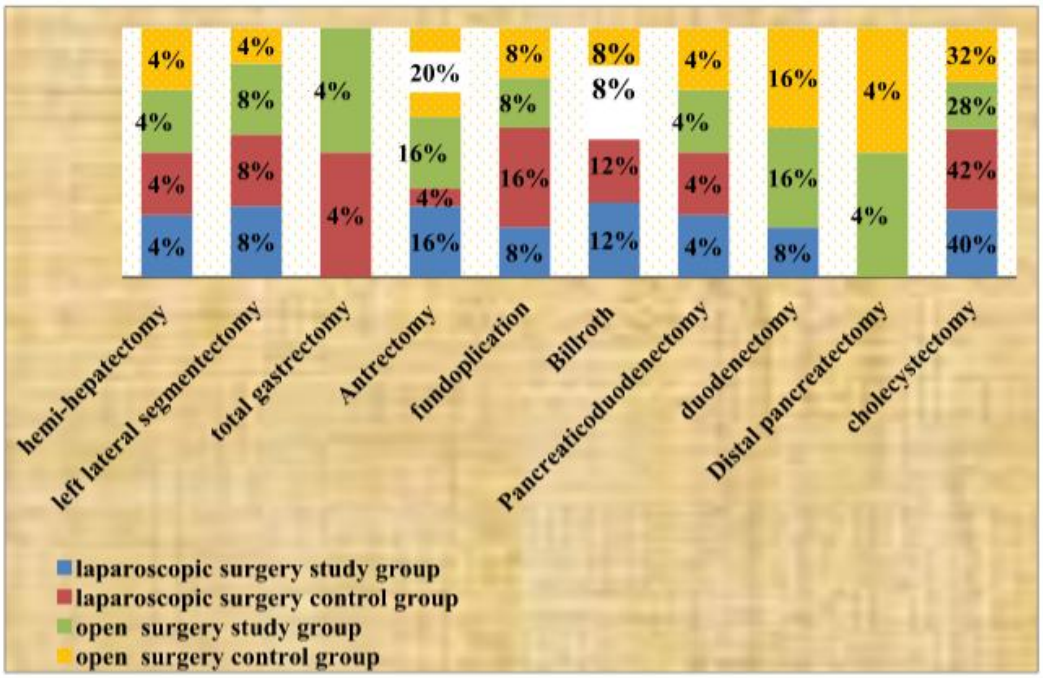

Figure (1): Percent distribution of the studied groups undergoing upper GITs surgeries according to the name of surgery (n=100)

Table (2): Frequency distribution of post-implementation of protocol of care study (one and three) and control groups undergoing upper gastrointestinal surgeries according to respiratory system assessment (n=100).

ITEMS	Open surgery groups (n=50)												Laparoscopic surgery groups (n=50)											
	Study group 1 (n=25)						Control group 2 (n=25)						Study group 3(n=25)						Control group 4(n=25)					
Day	1st		2nd		3rd		1st		2nd		3rd		1st		2nd		3rd		1st		2nd		3rd	
Breath sounds	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Clear	10	40	16	64	20	80	4	16	10	40	5	20	10	40	18	72	21	84	7	28	9	36	10	40
Decreased	13	56	9	36	4	16	16	64	11	44	15	60	13	52	7	28	4	16	12	48	12	48	10	40
Absent	1	1	0	0	1	0	5	20	4	16	5	20	2	8	0	0	0	0	6	24	4	16	5	20
Control VS Study group	1ST day				2ND day				3RD day				1ST day				2ND day				3RD day			
χ^2 P	0.056				**0.039**				**0.001***				0.161				**0.001****				**0.001****			
oxygen saturation	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
< 95%	7	28	2	8	1	4	12	48	10	40	9	36	8	32	4	16	0	0	10	40	8	32	7	28
≥ 95%	18	72	23	92	24	96	13	52	15	60	16	64	17	68	21	84	25	100	15	60	17	68	18	72
Control VS Study group	1st day				2nd day				3rd day				1st day				2nd day				3rd day			
χ^2 P	0.072				**0.032***				**0.001****				**0.996**				**0.01***				**0.001****			
Chest X ray	first day				third day				first day				third day				first day				third day			
Normal (n: %)	17	(68%)			21	(84%)			13	(52%)			15	(60%)			18	(72%)			22	(88%)		
Abnormal (n:%)	8	(32%)			4	(16%)			12	(48%)			10	(40%)			7	(28%)			3	(12%)		
χ^2 P	0.1802								**0.001***								0.218				**0.036***			

*Significant (P=0.05) ** high significant at p < 0.01 #: oxygen saturation.

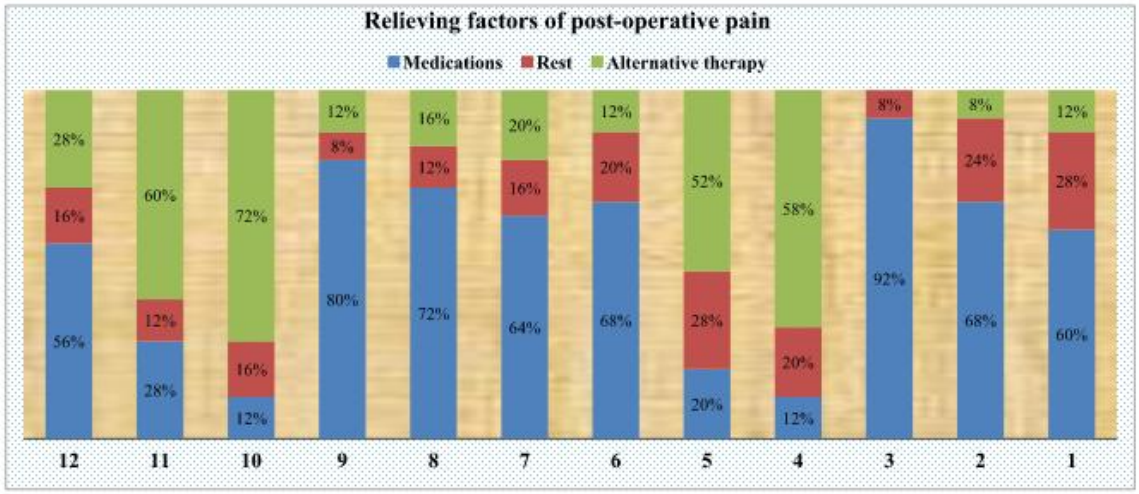

Figure (2): Frequency distribution of the studied groups undergoing upper GITs surgery according to relieving factors of pain (N=100)

Control group VS Study group	Open surgery groups (n=50)			Laparoscopic surgery groups (n=50)		
	1st day	2nd day	3rd day	1st day	2nd day	3rd day
χ^2 P	0.093 2.343	5.985 **0.019***	13.386 **0.001****	3.83 0.074	6.519 **0.032***	11.688 **0.001****

*Significant (P=0.05) ** high significant at p < 0.01

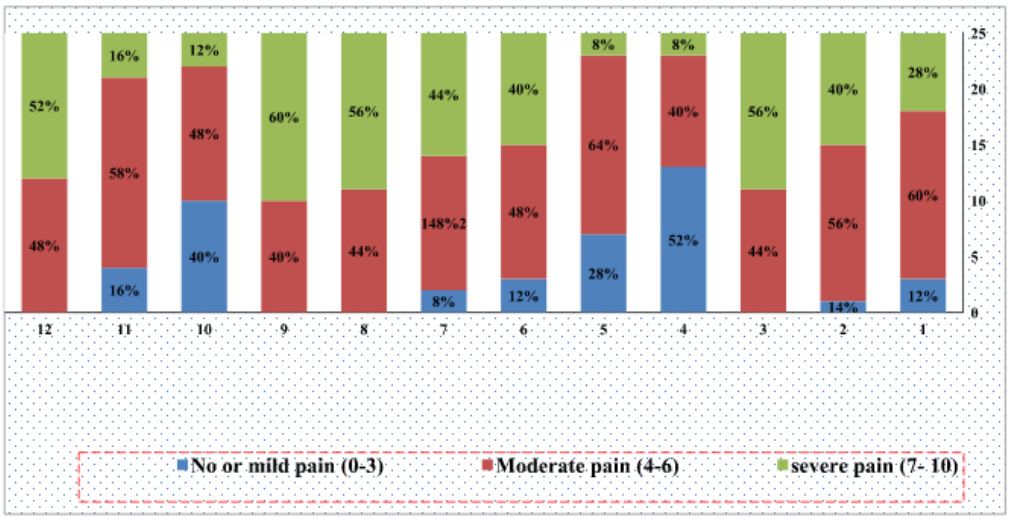

Figure (3): Frequency distribution of the studied groups undergoing upper GITs surgery according to pain score measured by modified brief pain intensity score (m BPI) (n=100).

Control VS Study group	Open surgery groups (n=50)			Laparoscopic surgery groups (n=50)		
	1st day	2nd day	3rd day	1st day	2nd day	3rd day
χ^2 P	0.725 0.695	12.523 **0.00****	15.243 **0.001****	1.725 0.323	MCET **0.003****	MCET **0.001****

*Significant (P=0.05) ** high significant at p < 0.01 MCET: Monte Carlo exact test

Table (3): Comparison between control and study groups of patients undergoing upper gastrointestinal surgeries according to occurrence of post-operative pulmonary complication (n=100)

Items	*Open surgery groups y(N=50)*				*Laparoscopic surgery groups (N=50)*			
	Study group 1 (N=25)		Control group 2 (N=25)		Study group 3 (N=25)		Control group 4 (N=25)	
m CPIS	Mean ±SD		Mean ±SD		Mean ±SD		Mean ±SD	
First day	1.730± 1.441		2.414± 0783		1.929±1.271		1.790 ± 0.725	
Third day	1.352± 0.677		3.971± 0.989		2.401± 0.372		3.570± 0.823	
Control VS Study	First day		Third day		First day		Third day	
t P	3.923 **0.0393**		10.364 **0.001****		FE 1.000		11.855 **0.001****	
	first day	third day	first day	third day	first day	third day	first day	third day
Atelectasis	N %	N %	N %	N %	N %	N %	N %	N %
Absent	17 (68%)	20 (80%)	11 (44%)	13 (52%)	16 (64%)	21 (84%)	13 (52%)	15 (60%)
Present	8 (32%)	5 (20%)	14 (56%)	12 (48%)	9 (36%)	4 (16%)	12 (48%)	10 (40%)
Control VS Study	First day		Third day		First day		Third day	
χ2 P	4.159 **0.045***		5.311 **0.007***		2.914 0.087		6.211 **0.012***	
Dyspnea score	1st day	2nd day	3rd day	1st day	2nd day	3rd day	1st day	2nd day	3rd day	1st day	2nd day	3rd day
Range	4- 7	4 -7	3 -5	5- 8	5- 8	5- 7	4 – 7	3 – 7	2 – 5	5- 8	5- 8	4- 7
Mean ± SD	5.48± 0.96	4.48± 0.81	3.50± 0.8.2	6.7 5±1.04	6.48 ±0.65	6.28 ±0.74	4.80+ 1.04	4.02 ±0.91	3.02 +0.80	6.50 ±0.76	6.11 ±0.75	5.88 ±1.44
Study vs control	1ST day		2ND day		3RD day		1ST day		2ND day		3RD day	
t p	6.287 **0.00***		7.512 **0.00***		7.512 **0.000***		4.349 **0.001****		5.262 **0.001****		5.658 **0.001****	

*Significant (P=0.05) ** high significant at p < 0.01 t: t test student

Table (4) Percent distribution of the occurrence post-operative pulmonary complications (PPCs) according to the bio-socio- demographic data among the studied groups on the third day (n=100).

Parameter		PPC present (n=34) (n) (%)		PPC absent (n=66) (%)		χ2 *p*
Age	< 46	10	29%	39	59%	7.910 **0.005***
	≥46	24	71%	27	41%	
Sex	Male	20	58%	23	35%	3.346 0.052
	Female	14	42%	43	65%	
Literacy	Illiterate	20	65%	11	35%	5.387 **0.01***
	not Illiterate	14	20%	55	80%	
Smoking	smoker	25	64%	14	36%	25.818 **0.001***
	nonsmoker	14	23%	47	77%	
Previous respiratory disease	Yes	21	62%	46	69%	4.239 **0.02***
	No	13	38%	20	31%	
Surgery time	< 120 min	24	70%	58	88%	3.897 **0.040***
	>120 min	10	30%	8	12%	
Length of incision in open surgery	< 20 cm	29	43%	25	57%	6.185
	> 20 cm	6	100%	0	0%	**0.01***
Duodenectomy	10	6	60%	4	40%	0.073
Fundoplication	10	1	10%	9	90%	**0.048***
Billroth	10	3	30%	7	70%	0.406
Total gastrectomy	2	1	50%	1	50%	0.567
Proximal gastrectomy	14	3	21%	11	79%	0.225
Cholecystectomy	37	6	16%	31	84%	**0.004***

Left lobectomy	7	5	71%	2	29%	**0.043***
Hemihepatectomy	4	3	75%	1	25%	**0.013**
Whipple	4	4	100%	0	0%	0.266
Distal pancreatectomy	2	2	100%	0	0%	0.113

*Significance at level P < 0.05 ** high significant at p level < 0.01

IV. Discussion

Postoperative pulmonary complications (PPCs) constitute one of the commonest complications following anesthesia and upper abdominal surgery (AUS), they prolong hospital stay and add to the healthcare burden. Incidence of PPC varying from two to forty percent as reported in the English literature [(24).] Therefore, this study would be carried out to improving postoperative patient's outcomes by implementing nursing care protocol that aimed to preventing or reducing the occurrence of post-operative pulmonary complications and pain.

Regarding the age, the findings of the current study show that the age grouped for forty six to sixty years old was comprised nearly half of studied patients, this finding is justified by the effect of aging physiological changes on the functions of the gastrointestinal system; motility, enzyme and hormone secretion, digestion, and absorption. [(25)] The results of the current study are in agreement with study in 2017 that reported the mean age was fifty five point five years old [(26)] . On the other hand, the current study was contraindicated with other studies that showed that more than two thirds of abdominal surgery patients that their mean age were sixty nine years with range, and another study concluded that mean was sixty one year-old.[(27)]

As regards the sex, the findings of the current study indicate that more than half of the studied groups were females. The findings of the current study were supported by study reported that sixty six percent of patients undergoing gastrectomy were females [(28)], These findings can be explained by Female hormones are important factors modulating the susceptibility to stress, gut motility, and visceral pain perception. Furthermore, Estrogen increases biliary cholesterol secretion causing cholesterol super-saturation of bile [(29)]. **Also, the** results of current study show that more than half of the studied samples were nonsmokers. That's can be interpreted by the female distribution of the samples. These results were in the line with a study 2016 reported that about half of patients undergoing upper abdominal surgery were nonsmokers [(30)]. In the other hand, the results of current study didn't agreed with other results' studies that stated more than half of the patients with abdominal surgeries were smokers. [(31)]

Moreover, Biogeographic data related to the body mass index (BMI), the current study illustrate that half of the studied groups had normal range. The findings were supported by study reported that the mean of BMI measured twenty four kg/m^2 [(32)]. On the other hand, another study concluded that more than two-thirds of upper abdominal surgery samples were obese. [(33)] **Also,** the current study findings indicate that cholecystectomy and partial gastrostomy are the most surgeries performed. . These results can be attributed to female and advanced age which considers independent main risk factors of gallbladder disease. In addition, liver disease is an important risk factor for the development of gall stones. These findings are in agreement with a study in 2017 mentioned that cholecystectomy, Gastric Sleeve, and splenectomy were the most frequent of laparoscopic upper abdominal surgeries [(7)].

In contrasts, one study reported that pancreatico-duodenectomy, hepatectomy, gastrectomy, and cholecystectomy were the most surgical procedures of upper abdominal surgery respectively [(35)].

Concerning the breath sounds, the current study findings reveal a significant difference between the studied groups. This can attributed to breathing coughing exercises that contribute to expel secretions of bronchioles and increased alveolar ventilation. Also, in laparoscopic surgery, carbon dioxide (CO2) pneumothorax can develop due to a congenital defect in the diaphragm. These results are supported by study to identify the effect of using incentive spirometry (IS) on postoperative breathing pattern among abdominal surgical patients that concluded that the majority of the control group had abnormal breathing sounds in the first day and sixty five percent on the second day, while the most of the IS group had normal breathing sounds[(36)]. In contrasts, these results were not in the same line with study among patient with abdominal surgery that found none of the patients (IS and breathing) had abnormal breath sounds versus only fifteen percent of the control group. [(37)].

In relation to oxygen saturation, the present study indicates that a highly significant increase in Spo_2 level of the study (one and three) groups compared with the control groups. This result can be explained by incomplete lung re-expansion, reduced chest wall and diaphragmatic movement, and postoperative have pain that increases oxygen consumption, Also, these findings can attribute to, age and smoking habits as risk factors. [(11)].The results of the current study are in accordance with other studies that found that the early mobilization and deep breathing exercises improve the oxygen saturation among the experimental.[(38,39)] On other hand, the results of the current study are not in line with the result of study that reported postoperative incentive

spirometer (IS) did not demonstrate any effect on postoperative hypoxemia, Sao_2 level, and no significant differences were observed in mean of Sao2 level between the control and IS groups at 24)postoperative hours. [40] The difference with the current study results can be attributed to the technique that used (only IS), and the inclusion criteria of the sample, BMI > 30 kg/m^2.

As regards to the chest x-ray, the results of the current study reveal that nearly half of both control groups had new pathologic changes during their hospitalization compared with twelve percent of both study groups on the third day. Our study was in agreement with another study for the effect of early ambulation on PPCs and concluded that twelve point five percent of the study group had positive chest x-ray findings, while fifty five percent of the control group had positive chest x-ray findings. [41]

The current study findings indicate that more than two-thirds of control groups were in need of medications to relieve the pain (less consumption in the laparoscopic control group), these results are in agreement with study reported that nearly two thirds of patients stated that their pain was relieved by analgesics [42].This depending to reduce the can be attributed to weak of patient's knowledge about alternative therapy and fear that it might fail or be harmful

[42], and nurse's attitude or knowledge and beliefs about medicines, in general, and non-pharmacological pain treatment methods (NPMs). [43]

Additionally, the pain score, the current study indicates to significant difference between the control (two, and three) groups and study (one, and three) groups during their hospitalizations. These findings may be due to the damage of phrenic nerve by the acidic environment created by CO2 [44].Also, both inadequate combination analgesics, smoking, younger age, female, and obesity consider risk for severity pain [45, 46]. The findings of the current study are in line with study concluded that a significant decrease in pain score of patients undergoing abdominal surgery, the pain core was eight point three and decreased to three point seven in the subjects with deep breathing exercises and Incentive spirometer [47]. But, a study about effectiveness of incentive spirometry in patients following thoracotomy reported that there was no difference observed in the modes of postoperative pain scores between the studied groups [48].

Postoperative pneumonia, the current study findings show a significant difference between the study and control groups and the incidence of pneumonia was higher in the open control group than laparoscopic control group. The current study finding can attributed to physiotherapy performed may prevent the accumulation of sputum. In addition, oral hygiene may contribute in reducing oral pathogens, smoking that can lead to impaired clearance of airway secretions and increased ability of alveolar macrophages to release superoxide anion that can damage cells and increased susceptibility to alveolar collapse [49], and the use of a nasogastric tube, blood transfusion, and absence of preoperative oral care may increase pop [50]. The results of the current study are in agreement with a study about the effect of breathing exercise and incentive spirometry (IS) of patients undergoing upper laparoscopic surgery and concluded that postoperative pneumonia was two point seven percent in the intervention group and seven percent in control group [51]. Another study tested the effectiveness of perioperative oral hygiene in the reduction of postoperative respiratory tract infections and concluded that four point six percent in the oral care group and nine pint three percent in the control group experienced postoperative pneumonia [52].

In addition, by concerning the postoperative atelectasis, the findings of the current study indicate that the occurrence of atelectasis was more often in control groups (especially in open control group) than the study groups. These results can be attributing to several reasons, pre-operative factor, such as older ages that associated with reduction in chest wall compliance and increased air trapping; obesity that associated with increased work of breathing as a consequence of increased airways resistance [53], smokers show more pronounced gas exchange impairment in the wake state than healthy subjects do, and this difference persists during anesthesia and hyperinflation of the lungs may make them resist collapse [54]. After induction of anesthesia, the diaphragm is relaxed and displaced cephalad, loss of surfactant or impaired surfactant function and absorption of gas from alveoli behind closed or intermittently closed airways. [55]

The findings of current study are in the same line with a study concluded that thirty six percent of patient undergoing laparoscopic Gastrectomy developed atelectasis [57]. Another study in 2020 are supported the current study which showed that breathing exercises can reduce the incidence of atelectasis seven point five percent in test groups and seventy percent in the control group [58] . **On the other hand**, the finding of study in 2020 tested the effect of pre-operative physiotherapy of upper abdominal surgery and concluded that atelectasis was founded in nine point eight percent of the intervention group, while seven point six percent of the control group with no significant difference [59].

Regarding the dyspnea, the current study findings reveal that the rest was the first choice of control groups with level of dyspnea more than six, while dyspnea score of study groups was nearly four with depending on physiotherapy basically. These findings can be attributed to firstly, reduction pain level, and improvement of oxygenations by breathing, cough exercises, and early ambulation, and secondly, the high

incidence of PPCs in control groups which may lead to breathlessness and that what a study in 2018 reported that indicated the major cause of post-operative dyspnea was atelectasis (seventy two percent), and pneumonia (twelve percent)[60]. Also, during laparoscopic surgery, there may be an increased alveolar-arterial CO_2 tension as a result of CO_2 absorption. Furthermore, another explanation for the occurrence of dyspnea is obesity. Respiratory system compliance in the obese can be reduced by up to 35% due to (I) the restrictive effect of mass loading on the chest wall. [61]

The results of the current study are in the same line with the Egyptian study who stated that seventy three percent of the study group (chest physiotherapy) had a severe level of dyspnea on the first day and the score was declined to moderate, and mild level on the second, third day respectively [62] In contrasts, our study indicated that the level of dyspnea had strongly declined in the study groups, while a another study concluded that deep breathing exercises outcome among patient with abdominal surgery had prevented to develop dyspnea zero percent of study group versus ten percent of control group.[37]

The current study findings show that the incidence of ppcs is lower in laparoscopic surgery than laparotomy. These findings can be attributed to many factors such as less in duration time of surgery, intraoperative bleeding, length of incision, and level of pain. Many studies were compared the postoperative pulmonary functions for both types. For one, a systematic review study in 2014 for effects of laparoscopic cholecystectomy (LC) on lung function concluded that Laparoscopic cholecystectomy seems to be associated with less postoperative derangement of lung function compared to the open procedure; forced vital capacity (FVC), forced expiratory volume in 1 s and forced expiratory flow and partial pressure of oxygen at 24 or 48 h after surgical treatment showed reductions that were significantly greater in open cholecystectomy compared with LC [62]

Concerning the risk factors of occurrence PPCs, the results of the current study reveal that the age > forty six years old considers risk factor of ppc. The expected thought of this association, the physiological aging of the respiratory system leads to a decrease in the elasticity of the parenchyma and pulmonary complacency, in the strength of the muscles involved in respiration, and a decrease in the alveolar [63]. Also, the current study findings show that smokers are risk for ppc; this increased risk may be associated with that smoking could increase closing capacity, impaired tracheobronchial clearance of pulmonary secretions, and important mechanism in the pathogenesis of pneumonia is the adherence of pathogens to the respiratory mucosa. The interaction between the epithelial and bacterial surfaces occurs, whose expression increases in response to cigarette smoke [64].

Furthermore, the current study findings indicate that males and previous respiratory disease are more likely to have PPCs. In addition, the educational level of patients another risk factor. Awareness of the complications, the ability to understand and comprehend the nature of the disease and follow the advice of the treating physician would influence the lung function in the immediate postoperative period and prevent the development of PPCs and that is clear by a study in 2020 that concluded low health literacy is associated with poor health outcomes may have an important role in determining surgical outcomes [65, 66].

The current study are in accordance with the findings of study in 2020 to identify the risk factors for postoperative pulmonary complications following gastrointestinal surgery, that stated seventy percent of patients had upper GITs, forty percent of them had ppcs, and both of age more than forty, and smoking, illiteracy, and previous respiratory disease are significant risk factor of ppcs. While, there were a slightly higher percentage of male patients with PPCs [67]. Another study was in the same line that suggest age is inversely related to the pulmonary function decline observed one day after laparoscopic cholecystectomy, which might be explained by the increment of the pain threshold or the decrease of postoperative inhibitory reflexes occurring with aging.[68]

In contrasts, another study about laparoscopic cholecystectomy concluded that the procedure was associated with a marked decline in forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) in the immediate postoperative period; and there was no significant difference in loss of lung function according to age ($p = 0.18$), sex ($p = 0.33$), or smoking history ($p = 0.58$). Despite the marked loss in lung function in the immediate postoperative period, no major pulmonary complications occurred. [69] Also, the findings of study in 2020 who studied the effect of physiotherapy on postoperative atelectasis concluded that age, male sex, BMI > 25, pneumonia, and smoking are not risk factors for postoperative atelectasis. [70]

Also, the current study findings show that the majority of patients with incision length more than twenty cm were more likely to had ppcs and severe pain; this can be attributed to severity of pain that increased obviously with longer incisions, and increased the consumptions of analgesics. The results of current study supported by a study that reported that the greater the surgical size, the greater the risk for PPC, the PPC occurred in seventy percent of the patients with of major incision surgery size, and twenty seven percent with medium size. [71] Moreover, the current study indicated that the post-operative pulmonary complications were more common in the patients underwent hepatectomy, Whipple, and pancreases surgical procedures. These results may be explained by firstly, prolonged time of ischemia during a hepatectomy. The mechanism

explaining the link between hepatic ischemia and PPCs could be the massive release of reactive oxygen species factors and cytokine production. Also, it has been shown that acute kidney injury leads to a pro inflammatory and pro apoptotic pathways activation which then leads to an inflammatory response in the lung.

Secondly, intra-operative blood loss and blood transfusion that increased the circulatory overload and suppresses host immunity by reducing natural killer cell function and decreasing the function of macrophages and monocytes. Thirdly, the use of vasopressor surgery has been shown as a risk factor of PPC that could lead to inadequate lung perfusion in the intraoperative time and then to PPCs. [(72)] Also, the closer the surgical incision is to the diaphragmatic muscle, the greater the reduction in postoperative pulmonary function variables, particularly for lung volumes. Because the anatomic site of the stomach and liver, manipulations for its surgical removal induces local phrenic nerve stimuli by eliciting a reflex inhibition of diaphragmatic activity. A study had suggested that delayed postoperative pain, which is associated with postoperative diaphragm dysfunction, might have favored the occurrence of pulmonary atelectasis and pneumonia [(73)]. The current study findings are in agreement with a study about donor right hepatectomy (DRH) concluded that postoperative pulmonary complications were significantly more common in the open DRH (sixty percent) than in the laparoscopic DRH (thirty percent) group [(74)]. Also, a conclusion study for liver restriction (LR) reported that the overall PPCs were observed in (fifty seven percent) in the open LR group and in (thirty one percent) in the laparoscopic LR group [(75)]

Finally, the current study findings proved that related to the incidence of pneumonia, atelectasis, the level of dyspnea, and pain score were obviously decreased; and related to the level of oxygenation, it was increased for the predetermined groups than those in the matching group "routine hospital care group". And this allow to accept the hypothesis of the current study that patients undergoing upper gastrointestinal surgeries who are exposed to nursing care protocol exhibit mild levels of pain, dyspnea, pneumonia, atelectasis, and increasing in the level of oxygenation more than those who do not**.**

V. Conclusion:

The conclusions of the current study based on findings are:

- Reduction of the pain score and the level of dyspnea and increased the level of oxygen saturation as well as decreased in the incidence of pneumonia and atelectasis in the open surgery study group (one) and laparoscopic surgery study group (three) than the control groups of both open and laparoscopic surgeries.
- The laparoscopic surgery study group outcomes of the incidence pneumonia, atelectasis, and level of dyspnea and pain score were lower than the open surgery study group.
- The laparoscopic surgery control group outcomes of the incidence pneumonia, atelectasis, and level of dyspnea and pain score were lower than the open control study group.
- The level of oxygenation saturation was higher in the laparoscopic surgery study group than laparoscopic surgery control group. As well as, the level of oxygenation saturation was higher in the open surgery study group had than the open surgery control group.
- Age more than forty six, smoking, literacy, length of incision more than twenty c.m, and duration time of surgery more than two hours are risk factors of PPCs
- Patients undergoing Whipple, partial hepatectomy and distal pancreatectomy, and Duodenectomy surgery are more likely to develop post-operative pulmonary complications.

Recommendations: In light of the current study findings, the following recommendations are suggested:
Recommendations for patients: Education about oral care and physiotherapy should be added to pre and post-operative patients' care. And simple illustrated booklet includes nursing care protocol should be given to all the upper GITs surgery patients, care givers and family members
Recommendations for nurses: Nurses must focus on the respiratory assessment to observe the changes in the respiratory indicators , nursing care protocol (I cough) should be carried out as a routine care for patients with upper GITs surgeries, all patients should be assessed and considered them at risk of postoperative pulmonary complication and pain, and nurses that working in the gastrointestinal surgery unit and deal with patients, should update their knowledge and practice about the chest physiotherapy pain management using non-pharmacological methods.
Recommendations for future studies: Identify the risk factors of PPCs and reducing the modifiable factors such as smoking and obesity, study the effect of this protocol of care on the other PPCs such as plural effusion, implementation it with more sessions and longer period of follow up, the effect of nursing protocol care on the consumption of analgesics and replication of the study by using large probability sample size.

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