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COMBINED VERSUS CONVENTIONAL PULMONARY NURSING INTERVENTIONS ON IMPROVING SELECTED RESPIRATORY OUTCOMES AMONG LAPAROTOMY PATIENTS AT A UNIVERSITY HOSPITAL

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ABSTRACT

Abstract: Changes in pulmonary dynamics following laparotomy have been reported. Pulmonary nursing interventions (PNIs) involves several modalities such as nursing practice, nursing education and training to deliver high quality health care services. **Aim:** to compare the effect of combined versus conventional pulmonary nursing interventions on improving selected respiratory outcomes among laparotomy patients. **Design:** The research was conducted on two groups utilizing nonequivalent quasi-experimental design. **Sample:** Purposive sample of 80 laparotomy patients' were recruited. Four tools were utilized including personal and medical, dyspnea scale and chest X-ray. **Results:** The research highlighted that there was a statistically significant difference between both groups at $p \leq 0.05$ regarding the Respiratory outcomes, including the chest X-rays findings. The combined intervention group had clear air entry and chest sound along the 1st to 5th postoperative days, comparing to conventional group who experienced dyspnea at 1st and 2nd postoperative days. **Conclusion:** combined nursing interventions improved the selected respiratory outcomes through decrease inflammation, dyspnea, signs of infection and improved with clarity of chest for patients post laparotomy. **Recommendations:** Hospitals should recommend implementing protocols for combined pulmonary nursing intervention for perioperative laparotomy patients in all hospital.

Keyword: Pulmonary Nursing Intervention, Respiratory outcomes, Laparotomy

INTRODUCTION

The World Health Organization (WHO) and the World Bank, surgery is considered as an important component for global health development (WHO, 2016). Surgically treated disorders represent a significant proportion of the diseases burden (Adhkari & Schecterr, 2015). Laparotomy is considered as one of the most common Surgical Procedures (Bhasin *et al.*, 2011; Shingavi *et al.*, 2017).

Changes in pulmonary dynamics following laparotomy have been known and reported as postoperative pulmonary complications (PPCs) (Numata, *et al.*, 2018). Laparotomy surgical risk factors includes the loss of sub-diagraphmatic negative pressure resulting in decrease lung volume (Mondal *et al.*, 2016). Other risk factors are the use of opioids, analgesics, bed rest, diaphragmatic dysfunction and impaired mucociliary clearance contributes to change in ventilation pattern that might increase risk to PPCs (Yu *et al.*, 2018; Chasqueira *et al.*, 2018).

Pulmonary nursing interventions (PNIs) are multimodal approach that involves several modalities such as nursing practice, nursing education and training to deliver high quality health care services (Balentine *et al.*, 2016). It aims to reserve postoperative respiratory function and inverse physiological and/or functional changes (Chasqueira *et al.*, 2018). Relevant studies have reported that nursing intervention can improve the clinical effect and prognosis of patients being treated for severe respiratory system diseases (Long *et al.*, 2018).

Pulmonary Nursing intervention (PNI) that is provided as a routine care to all postoperative patients is restricted to early ambulation and it rarely involves deep breathing and coughing exercises. However, there are variety of comprehensive PNI that includes manual airway clearance techniques including percussion, clapping and vibration. More recently, mechanical breathing devices such as incentive spirometry (IS) are utilized (Adriana *et al.*, 2016). PNI has been advocated as an important component in the prevention and amelioration of respiratory function following laparotomy and has been regularly utilized in both pre and postoperative care (Mehany *et al.*, 2016).

Postoperative Respiratory nursing outcomes (NOC) is an integral part in the nursing evaluation for patient undergoing laparotomy. However, no study including operational definitions for the nursing outcome Respiratory Status and its applicability to postoperative adult patients was published to this date (De Almeida *et al.*, 2017). Respiratory Nursing Outcome (NOC), is indicated with different attributes like respiratory (rate, rhythm and depth), vital capacity, oxygen saturation, auscultated breath sounds, airway patency, tidal volume, achievement of expected IS, pulmonary function tests; as well as it includes abnormal indicators like accumulation of secretions, coughing, impaired expiration, adventitious breath sounds cyanosis, nasal flaring, dyspnea (at rest and dyspnea with mild exertion) restlessness, atelectasis, gasping, agonal respirations, clubbing of fingers, and fever (Moorhead, Johnson & Swanson, 2018).

Comprehensive perioperative (PNIs) should be prescribed for each patient to decrease postoperative respiratory infection (PRI), and reduced hospital stay by an average of 1-3 days (Mistry *et al.*, 2017). Therefore, the current study compares the effect of two different PNIs, Routine care (Conventional intervention) that involves early ambulation with or without breathing and cough exercises versus Comprehensive (Combined intervention) that involves, not only early ambulation and breathing along with cough exercises but also chest physiotherapy (clapping and rubbing) and the IS; on the post-laparotomy respiratory outcomes.

Significance of the study

Post-operative Pulmonary complications (PPCs) are most common after laparotomy and have significant impact on morbidity and mortality rate (Miskovic & Lumb, 2017). The incidence of postoperative respiratory infections after laparotomy is up to 80% (Fernandez-Bustmante *et al.*, 2017). Data are scarce regarding the prevention of postoperative atelectasis in Sub Sahran Africa (Tyson *et al.*, 2015). Statistics shows that patients were infected with respiratory infection after laparotomy through one week after abdominal surgery at El-Minia University hospital (AbuBakr *et al.*, 2018).

Nurses have an active role in preventing PPCs and in providing perioperative patients' education and training (Oster & Oster, 2015). Although conventional interventions appear to be effective, studies about combined pulmonary intervention is scarce (Long *et al.*, 2018).

Results of this study may provide guidance to comprehensive pulmonary intervention needed in clinical practice and should be included in the nursing curriculum as well as it will highlight the need for further nursing researches. Therefore the aim of this study was to compare the effect of combined versus conventional pulmonary nursing interventions on improving selected respiratory outcomes among laparotomy patients

Aim of the study

The aim of this study was to compare the effect of combined versus conventional pulmonary nursing interventions on improving selected respiratory outcomes among laparotomy patients at the university Hospital.

RESEARCH METHODOLOGY

The following research hypotheses were formulated based on the study of laparotomy patients' who receive combined pulmonary nursing interventions. As a result they experience better respiratory outcomes than patients who received conventional nursing interventions

- Patients who receive combined pulmonary nursing interventions will show more chest X-ray clearance than patients who received conventional nursing interventions.

A. Research Design

Two group quasi experimental nonequivalent research designs were adopted in this research. The first group (G1) received Combined Nursing intervention which includes airway clearance techniques such as

percussion, vibration, deep breathing, coughing exercises, IS and early ambulation. The second group (G2) received conventional intervention which includes early ambulation, with or without breathing and cough exercises.

Setting

This research was conducted at selected surgical department at Minia University Hospital, Egypt.

Sample

A Purposive sample consisting of 80 patients were enrolled in this research according to the following inclusion and exclusion criteria.

Inclusion and exclusion criteria: The study included all adult male and female patients who had undergone abdominal surgery that require 5 days of hospital stays, with age from 18 to 60 years, and the patients who are able to communicate. All the patients with major abdominal surgeries or Emergency abdominal surgeries, Preoperative respiratory tract infection, Psychological disorders that affect respiration, Patients with asthma and chronic obstructive pulmonary disease Uncontrolled chronic debilitating diseases and Immobilized patients were excluded.

Sample size is done by the following equation

$n = t^2 \times p(1-p)/m^2)$

$n=(1.96)^2 \times 0.052(1 - 0.052)/ (0.05)^2 = 75.74$ add 5 cases = 80 patients.

Tools for Data Collection

Four tools were utilized to collect data for this research which include:

1. Personal and medical data tool: includes demographic and medical characteristics.

2. Post-operative respiratory assessment tool: include vital signs, respiratory assessment (rate, depth and rhythm), Chest sounds, Oxygen saturation by noninvasive pulse oximetry.

3. Dyspnea Scale: used to evaluate the severity of dyspnea between postoperative patients with abdominal surgeries. Adopted from Fletcher *et al.,* (1959) scores and ranged from 0 to 4.

4. Chest Radiograph (X-ray): It was done by a technician and the report is written by a Radiologist. The report includes the airway clarity, tracheal position, and lung demarcation.

Tools reliability and validity

Face validity of the study tools were tested by a panel of five experts' faculty members in the field. Reliability test showed good with high cronbach alpha coefficients; 0.88, 0.89 for tool 2, tool 3 (Sun *et al.*, 2007).

Procedure

1. Preparatory phase: Formal approval and permission was obtained and informed consent of the participants who were willing to participate in the study was taken to ensure ethical protection. Tools of the study were developed and tested for validity and reliability and pilot study was done. Random assignments to the study subjects with 40 patients in each group (routine and advanced pulmonary nursing interventions) and homogeneity between groups was ensured. The researcher introduced to the patient who was met the inclusion criteria individually, explained the nature of the study for 20 minutes to collect personal and medical data.

2. Implementation phase

a. Preoperative phase: The researchers divide study set into 8 groups of 5 patients. Each interactive session took 40-50 minutes, and it was divided into 3 parts; firstly, started by explaining the components of the tools, the importance of pulmonary intervention and its respiratory outcomes; secondly, the researchers filled the demographic data sheet, thirdly, it was followed by pre-operative training about the PNIs including of breathing and coughing exercises and early ambulation for both groups along with demonstration regarding the use of IS and chest physiotherapy for patients assigned to combined intervention group only, each subgroup had two preoperative sessions for training. Demonstration and re-demonstration were done to ensure that the participant were able to perform the procedures adequately. Each participant was informed to perform and repeat the pulmonary nursing care interventions daily from the 1st to 5th day postoperative every 4 hours daily.

b. Postoperative phase: The researcher implement the pulmonary nursing interventions that she taught preoperatively to the patients in both groups that include breathing and cough exercises and the IS, and chest

physiotherapy (percussion and vibration procedure) to the combined intervention group. In this phase the respiratory assessment sheet was filled at day 1 postoperatively to ensure postoperative baseline for both groups (1& 2) and their subgroups

3. Evaluation phase: firstly, the researcher evaluated and followed the respiratory outcomes from 2nd to 5th day using the respiratory assessment tool that include the patients temperature, respirations, chest sounds. These were assessed for clearness or presence of wheezing, oximeter reading, and RTIs signs and symptoms. Secondly, the researcher evaluated the chest conditions of both groups by using chest radiography (X-Ray) that is done by a technician.

RESULTS

Results were divided to 2 parts as follow

Part I: Socio-demographic characteristics of the studied patients

Table 1 illustrated that the mean age of the group 1, was 56.81±6.01 years while the mean age of the group 2 was 56.82±6.01 years. More than 50% of them were females, and were married. According to level of education 40.0% of group 1 and 35.0% of group 2 were illiterate.

Table 1: Number and percentage distribution of socio-demographic characteristics among the studied

Socio-demographic characteristics	Groups			
	Combined intervention (n=40)		Conventional intervention (n=40)	
	No.	%	No.	%
Age				
Mean ± SD	56.81 ± 6.01		56.82 ± 5.01	
Sex:				
Male	13.0	32.5	15.0	37.5
Female	27.0	67.5	25.0	62.5
Educational level				
Illiterate	16.0	40.0	14	35.0
Read and write	12.0	30.0	13.0	32.5
Secondary school	7.0	17.5	7.0	17.5
University	5	12.5	6	15.0
Marital status:				
Single:	19.0	47.5	20.0	50.0
Married:	21.0	52.5	20.0	50.0

Table 2 displays that; 85.5% of the combined group left the hospital before seven days

Table 2: Comparison between combined and conventional interventions group regarding the length of hospital stay

Number of days	Groups	
	Combined intervention (n=40)	Conventional intervention (n=40)
	%	%
• <7 days	85.0	32.5
• >7 days	15.0	67.5

Part II: Comparison between the two groups regarding the selected respiratory outcomes.

Figure 1 clarifies that; the values of pulse and respiratory rates for the combined intervention group was within the normal ranged from 85 b/m and 24r/m to 91 b/m & 21 rpm respectively during the 1st and the 5th postoperative days, comparing to the conventional group.

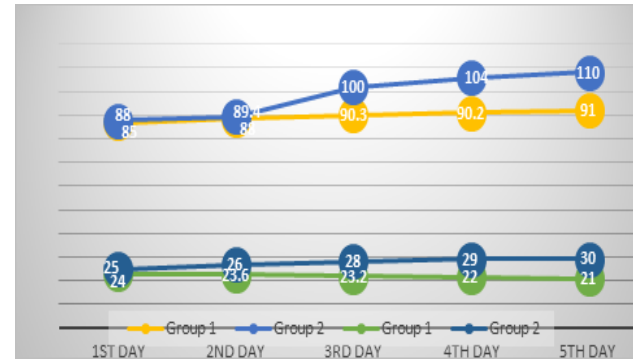

Figure 1: Comparison between the combined intervention group with conventional group regarding pulse and respiratory rates along the 1st to 5th postoperative days (n=80)

Table 3 shows that postoperative respiratory outcomes 100%, 100%, 90.5%, 85.5%, 86.5% respectively of the conventional group with clear airways and chest sound along the 1st to 5th postoperative days, compared to group 2. There were high statistically significant differences between both groups regarding clarity of chest sound at p≤ 0.05.

Table 3: Comparison between group 1 and group 2 regarding to the auscultator breathing sound along the 1st to Five Days Postoperative (n= 80)

Auscultator Reading from 1st to 5th days	Groups		
	Combined intervention (n=40)	Conventional intervention (n=40)	
	%	%	
Breathing sound			
1st day			
• Clear	100.0	100.0	-
2nd day			
• Clear	100.0	100.0	-
3rd day			
• Clear	90.5	23.0	37.602*
• wheezing	9.5	77.0	
4th day			
• Clear	85.5	13.0	31.745*
• Wheezing	14.5	87.0	
5th day			
• Clear	86.5	14.0	32.125*
• Wheezing	13.5	86.0	

*** Highly statistical significance differences at p≤ 0.05*

Table 4 shows that there are high statistically significance differences between both groups regarding the breathing depth and rhythm along the 1st to 5th postoperative days at $p \leq 0.05$.

Table 4: Comparison between the Group 1 and Group 2 regarding to their Breathing Rhythm and Depth in the 1st Five Postoperative Days (n=80)

Breathing Rhythm and Depth	Groups									
	1st day		2nd day		3rd day		4th day		5th day	
	Group 1 (n=40)	Group 2 (n=40)	Group 1 (n=40	Group 2 (n=40)	Group 1 (n=40)	Group 2 (n=40)	Group 1 (n=40)	Group 2 (n=40)	Group 1 (n=40)	Group 2 (n=40)
	%	%	%	%	%	%	%	%	%	%
Breathing rhythm										
Regular	65.0	73.0	90.5	28.5	92.5	27.5	87.5	23.0	87.5	12.5
Irregular	35.0	27.0	9.5	71.5	7.5	72.5	12.5	77.0	12.5	87.5
X^2	(6.750)*		(7.105)*		(5.475)*		(4.075)*		(5.425)*	
Breathing depth										
Normal	62.0	78.5	91.5	25.5	90.5	12.5	92.0	15.0	88.5	14.0
Shallow	38.0	21.5	8.5	74.5	9.5	87.5	8.0	85.0	11.5	86.0
X^2	(6.870)*		(7.105)*		(5.147) *		(5.201)*		(5.425)*	

** Highly statistical significance differences at p≤ 0.05*

Table 5 presents the dyspnea scale and it shows that combined c group has been free from dyspnea all the 5 postoperative days (62.5%, 87.5%, 92.5%, 90%, 87.5% respectively) while group 2 shows different grades of dyspnea along the 1st three postoperative days as they suffered grade I and II on the 1st postoperative day (22% and 15%), grade II has increased to 36% in the 2nd postoperative day, and it reached 25% in the 3rd postoperative day.

Table 5: Comparison between Group 1 and Group 2 Regarding the Dyspnea Grades along the 1st Five Postoperative Days (n=80)

Dyspnea grade	Combined intervention (n=40)		Conventional intervention (n=40)	
	No.	%	No.	%
1st day				
Grade 0	25.0	62.5	3.0	7.5
Grade I	10.0	25.0	22.0	55.0
Grade II	5.0	12.5	15.0	37.5
X^2 (*P*-value)	59.038*			
2nd day				
Grade 0	35.0	87.5	4.0	10.0
Grade I	5.0	12.5	36	90.0
Grade II	0.0	0.0	0.0	0.0
X^2	59.651*			
3rd day				
Grade 0	37.0	92.5	5.0	12.5
Grade II	3.0	7.5	25.0	62.5
Grade III	0.00	0.00	10.0	25.0
X^2	41.550*			
4th day				
Grade 0	36.0	90.0	32	80
Grade III	4.0	10.0	8	20
Grade IV	0.0	0.0	0.0	0.0
X^2	NS			
5th day				
Grade 0	35.0	87.5	30	75
Grade III	5.0	12.5	10	25
Grade IV	0.0	0.0	0.0	0.0
X^2	NS			

**Highly statistical significance differences at p≤ 0.05*

Table 6 reveals that, there were high statistical significant differences in the oxygen saturation among both groups. The range was between 93.7±1.1 to 96.0±0.76 respectively, among the combined group comparing to group 2 who was ranged from 93.1±1.2 to 90.1±1.6 during the 1st to 5th day postoperative.

Table 6: Comparison between both groups Regarding their Peripheral Oxygen Saturation Measurements along the 1st to Five Postoperative Days (n=80)

Peripheral Oxygen Saturation Measurements	Groups		*t*
	Combined intervention (n=40)	Conventional intervention (n=40)	
	Mean±SD	Mean±SD	
1st day	93.7 ± 1.1	93.1 ±1.2	2.774
2nd day	94.9 ±0.73	93.6 ± 1.1	2.951
3rd day	94.8 ± 0.59	92.1 ± 1.5	3.816*
4th day	94.8 ± 0.59	91.4 ± 1.6	5.562*
5th day	96.0 ± 0.76	90.1 ± 1.6	8.813*

NS: Not significant

Table 7 shows that there are statistically significant differences between both groups in the chest x-ray findings regarding signs of inflammation and accumulation of secretion as group 2 showed higher frequency in signs of inflammation (75%) and accumulation of secretion (82.5%) and only (15%) of group 2 chest x-ray showed clear airways.

Table 7: Comparison between combined intervention Group and conventional intervention Groups regarding Chest Radiograph (X Ray) at the 5th Day (n=80). Postoperative

Chest X-ray Findings	Groups					
	Combined intervention (n=40)		Conventional intervention (n=40)		X^2	*P-value*
	No.	%	No.	%		
Clear airways	40	100	6.0	15.0	42.076*	0.000**
Trachea well placed	40	100	40	100	NS	
Presence of signs of inflammation	8.0	20	30.0	75	40.08*	0.000**
Accumulation of secretion	6.0	15.0	33.0	82.5	42.076*	0.000**
Lung demarcation	40	100	40	100	NS	

**Highly statistical significance differences at p≤ 0.05*

DISCUSSION

Eighty patients were included in the study divided into 2 groups i.e. combined and conventional intervention groups with mean age of 56.81 ± 6.01 & 56.82 ± 6.01 respectively. More than half of the total subjects were females. This may be because Cholecystitis was the most common laparotomy surgery done among both groups, and its incidence is higher in females. These findings are supported by Qureshi *et al.*, (2018), who illustrated that the percentage of female was higher in all the age groups than male regarding laparotomy. Also, results confirmed by Bhandari *et al.*, (2017) who reported that cholecystitis and gallstones incidence are higher in adulthood. Ukkonen, (2017) added that cholecystitis was one of the most common indications for laparotomy among surgical patients.

Considering the effect of pulmonary nursing intervention (PNIs), findings in the present study demonstrated that there were statistically significant differences between the combined versus conventional interventions groups regarding patients' respiratory rate, rhythm and depth with deep regular rhythm along the 1st five days postoperative among the group 1 who received combined intervention. This might be because Incentive Spirometer and chest physiotherapy helped them to get rid of sputum retention, that resulted from staying in supine position. This a accordance with Guner & Korkmaz, (2015) who found that there was a positive effect on respiratory rate after application of percussion and vibration, and deep breathing preoperatively. Miskovic & Lumb, (2017) also described that postoperative chest infection is manifested by rapid, shallow bubbly respirations among the control group.

The highest percentage of the combined Intervention group had clear chest sound, opposite to the conventional group who showed slight wheezing on auscultation, this might be due to application of chest physiotherapy along with incentive spirometry that improved clearance of bronchial secretion from lung periphery to more proximal branch thus aiding expectoration which enhanced pulmonary hygiene. This finding is matched with Abd Elgaphar & Soliman, (2015) who concluded that preoperative chest physiotherapy for patients undergoing upper abdominal surgery had clear chest sound at the second and third assessment, compared with the conventional group with crepitation and crackles.

Combined nursing intervention group shows 0 grade at the dyspnea level and normal peripheral oxygen saturation measurements with the pulse oximeter in comparison to the conventional intervention group. This may be rationalized that combined intervention is comprehensive and affect the lung clearance, better than routine intervention. These results are supported by Tyson *et al.*, (2014), who established that, combining deep breathing and coughing exercises and IS were efficacious in reducing the effects of anesthesia or hypoventilation, mobilizing secretions and re-expanding areas of collapsed lung, postoperatively and improving gas exchange, and oxygenation consequently along with the maintenance of normal functional residual capacity was expected to prevent PRI. In addition, Yağlıoğlu *et al.*, (2015) represented oxygen saturation of arterial blood improved after practicing pulmonary hygiene techniques and using incentive spirometer.

Reports of chest x-rays at the end of 5th postoperative day showed significant difference between combined intervention group and routine intervention group regarding the signs of inflammation, accumulation of secretions and chest clarity. In the same context Miskovic & Lumb, (2017) reported that combined preoperative PNIs help in preventing postoperative lung infections and maintain lung clarity and function.

CONCLUSION

Combined nursing interventions that includes multiple pulmonary care, has resulted in improving selected respiratory outcomes through decrease inflammation, dyspnea, signs of infection and improve clarity of chest for patients post laparotomy.

RECOMMENDATION

Regular training and educational programs about the combined pulmonary nursing interventions care measures should be developed by the health team members especially the nursing staff because they are the ones implementing them.

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