

Effect of Developed Postoperative Nursing Care on Preventing Postoperative Pulmonary Complications for Liver Surgery Patients

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Abstract

Background: Post-operative pulmonary complication is common after liver surgery. Critical care nurse has a vital role in pre and postoperative education and interventions which improve Post-operative outcomes. **Aim of study:** -The aim of study was to determine the effect of developed postoperative nursing care on the preventing of postoperative pulmonary complications for liver surgery patients. **Setting:** The study was conducted in Intensive Care Unit at Assiut University Hospital. **Design:** - Quasi-experimental research design was used in this study. **Subjects:** A convenient sample was used of 60 patients in intensive care unit. **Tools:** - Three tools were used for collection of data. **Tool I** Patient interview questionnaire (**Part I:** - Socio-demographic data, **Part II:** - Medical data), **Tool II** post-operative pulmonary complications Assessment sheet **Tool III:** -Dyspnea analogue scale. **Results:** there was a statistical significant differences were existed in study group compared to control group $P < 0.001$ in relation to Pulmonary outcomes. **Conclusion:** It can be concluded that nurses had unsatisfactory level of practice regarding post-operative care. Implementing developed nursing care prevent pulmonary complications after liver surgery. **Recommendation:** - In-service training programs for the purpose of updating the knowledge and skills of nurses working with intensive care units & further studies are necessary to identify effects of Developed Postoperative Nursing Care on the Preventing of Postoperative Pulmonary Complications for Liver Surgery patients.

Key words: Developed Postoperative Nursing Care, Postoperative Pulmonary Complications, Liver Surgery. .

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I. Introduction

Liver surgery is a major operation requires close monitoring and immediate post-operative support. It incorporates a wide range of indications for surgical treatment varying from biopsy, resection to liver and liver transplantation. The most important indications for surgical treatment are liver lesions: these comprise a wide range of both benign and malignant lesions. Irreversible liver dysfunction caused by acute or chronic liver diseases, may be an indication for transplantation of the liver.¹²

Patients awaiting Liver surgery experience usually experience worries due to lack of knowledge over outcomes such as being away from family, loss of working ability, pain, inability to wake up from anesthesia, and fear of death which adversely affect their existing disease and surgery and result in prolonged recovery.⁵

Postoperative Pulmonary complications (PPCs) defined as conditions affecting the respiratory tract that can adversely influence clinical course of the patient after surgery.¹⁷ Postoperative pulmonary complications (PPCs), which are one of the most frequent complications after liver surgery, were reported to occur in 20% to 50% of patients and to affect postoperative hospitalization, perioperative mortality and long-term prognosis.^{6,20}

Postoperative nursing care of patient after Liver surgery aimed to improve gas exchange, breathing, airway clearance, Relief of pain and discomfort, assess the respiratory status by auscultation of both lungs every 2 hours to assess breath sounds. Assess color (e.g. discoloration of the fingernails or around the lips) to detect signs of hypoxia, observe signs and symptoms of cough, sputum expectorated (amount and color) and dyspnea. Maintain airway and ventilatory support, Monitor temperature and implement rewarming measures, Frequently monitor hemodynamic pressures, including arterial blood pressure, central venous pressure, Monitor urine output hourly; maintain careful intake and output records. Weigh daily. Monitor for signs of active bleeding and Monitor serum electrolytes and laboratory and Monitor neurologic status.⁷

II. Subjects And Methods

Research design:

Quasi-experimental research design was used in this study.

Setting:

The study was conducted in Intensive Care Unit at Assiut University Hospital.

Subjects:

A convenient sample was used of 60 patients in intensive care unit.

Tools for data collection:

three tools were used for data collection:

Tool I: Patient interview questionnaire tool was designed by the investigator after revising of related literature and opinions of expertise for content of validity and included the following two parts:

- **Part 1:** socio-demographic data including patient's name, age, sex, level of education,...etc.)
- **Part 2:** medical data including past health history, date of admission, medical diagnosis, type of surgery, length of stay in ICU, smoking history and postoperative complications).

Tool II: post-operative pulmonary complications Assessment sheet. This tool will be developed by the researcher based on reviewing of the relevant literature (**Alspach 2006, smeltzer & Bare 2010, and Morton 2009**) Include the following: Hemodynamic assessment parameters, Respiratory system assessment, laboratory investigation, Pulmonary function tests using Spirometer (Tidal volume)

Tool III: -Dyspnea analogue scale. This tool adopted from (**Borg, 1998**)

TOOLS VALIDITY AND RELIABILITY

- Content validity was used for the modified tools to determine whether the tools covered the aim or not. It reviewed by a jury of 5 experts four professors from faculty of Nursing, sohag University & one from Helwan University. Reliability was done by using Cronbach test and retest. It was used to examine whether the tools had internal consistency or not. The test was done and the agreement percentage was 96%.

PILOT STUDY

A pilot study was carried out on 5 randomly selected patients to test the applicability of the study and to test clarity and applicability of the designed questionnaires, as well as to estimate the time needed for each tool, modifications were done for the used tools then the final form was developed. Patients of the pilot study were included in the study's subjects.

FIELD WORK AND PROCEDURE

Ethical considerations:

The research approval was obtained from the director of Assiut University Hospitals to conduct the study in their facilities before the study. The researchers clarified the purpose and aim of the study to patients included in the study. Oral consent was obtained from patients to ensure willingness to engage in the study. The researcher maintained of patients anonymity and confidentiality of subjects' data was secured. Patients were informed that they could withdraw from the study at any time without penalty.

Procedure:

The procedure enclosed 3 sections: preceding or preparatory phase, implementation phase and evaluation phase.

The Preparatory phase:

The preparatory phase includes two essential phase's assessment and planning:

1. Assessment phase; the researchers interviewed with patients included in the study before the procedure to explain aim of the study and take their approval to participate in the study, then the basic assessment was done and data was collected.
2. Planning phase; involved extensive reviewing of the recent related literature to develop tools for data collection and prepare simplified leaflets related to developed nursing care . It contained many pictures, and some words to assist patients in understanding and for it to be accessible at home. The researchers developed it in the Arabic language. The exercises were chosen based on simplicity and on its effectiveness to prevent pulmonary complications.

The implementation phase:

The implementation phase for data collection started as following: The selection of the patients, the collection of data lasted over a period of 18 months, starting from beginning of October 2017 to end of March 2019. The questionnaire sheet was designed by the investigator. Data used was collected three days from the intensive care unit from 9:00 am to 9:00 pm where the program was implemented.

It was necessary for the investigator to introduce himself pre-operative for the patients and explain the purpose of the study and the post-operative care .The data was collected in a simplified Arabic language. The time used for finishing the Patient interview questionnaire ranged between 15 - 30 minutes for each patient according to patient's physical and mental readiness.

Teach the patient how to do breathing and coughing exercises by tacking a deep breath in slowly through his nose and hold his breath for 3 second and breath out part of the lips just enough to let a steady steam of air out ,the breath out should be twice as long as the breath in and keep the lips pursed .

Teach the patient how to use the incentive Spirometer by put the mouthpiece in his or her mouth and close your lips tightly around it don not block the mouthpiece with your tongue,inhale slowly and deeply through the mouthpiece to raise the indicator when you cannot inhale any longer, remove the mouthpiece and hold your breath for at least 3 seconds then exhale normally repeat this steps 10 to12 times/ hour when you awake or as directed.

In postoperative phase Encourage the patient to assume a comfortable position with good body alignmentEncourage and assist the patient to turn, cough, and take deep breath& use the incentive Spirometer, Assist the patient with percussion and vibration exercise for two times daily, assess drainage tube for site , amount , color and dressing around it. Ensure that the drainage tubing doesn't kink, loop, or interfere with the patient's movements.

In both groups the patients were observed by the researcher for signs and symptoms of complications occurrence. Information related todischarge instructions for medication taking and time, nutritional instruction, obesity, stop smoking ,return to work .

Administrative and Ethical considerations:

The study was ethically approved from the dean of the faculty of Nursing and the manager of Assiut University Hospitals.

Statistical Design:

All collected data were organized, categorized, tabulated, entered, and analyzed by using SPSS (Statistical Package for Social Sciences); Data entry and statistical analysis were done using SPSS 20.0 statistical software package. Quality control was done at the stages of coding and data entry. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables and means and standard deviations and medians for quantitative variables.

Qualitative categorical variables were compared using chi-square test & Independent samples t-test P >0.05 show non-significant*P<0.05 show significant, **P<0.01 moderate significant ***P<0.001 highly significant.

III. Results

Table 1: revealed that there was no statistically significant difference between the study group and control group P >0.05 regarding to demographic characteristicsreceptively

Table 2 :-Shows that, there was no statistically significant relation between the study group and control group regarding to past history at (0.237) receptively .while shows that there was statistically significant diffarence between the study group and control group regarding to length of stay in ICU at (0.000).

Table 3:-represents that there was no statistical significant difference between study group and control group regarding to all hemodynamic on preoperative day and first day postoperative. Furthermore, there was statistically significant relation between the study group and control group regarding toSpO₂in first day and third day. Moreover, there was statistically significant difference between the study group and control group regarding to temperature and respiratory rate in second day , and there was statistically significant difference between the study group and control group regarding to blood pressure,SpO₂, respiratory rate,heart rate and temperature in third day at(0.003,0.007,0.038,0.000,0.001,0.021).

Table 4:- Shows thatthere was statistically insignificant relation between the study group and control group regarding to arterial blood gases in preoperative day and first day postoperative at (p= > 0.05) while significant in pco₂ and ph at first day postoperative at (0.024,0.000). Shows that, there was statistically significant relation between the study group and control group regarding to PH, PaO₂ and SaO₂ in second (p= < 0.05)and there was statistically significant relation regarding to HCO₃,ph, spo₂at third day(0.000,0.005,0.000).

Table 5 :-Shows that, the study group has low incidence of complication and dyspnea than control group it represent in the statistically significant relation at dyspnea and no occurrence of complication at (0.002*, 0.000*).

Table 1: Socio-demographic characteristics for both study and control groups (n=60).

	Study group (n= 30)	Control group (n= 30)	P-value
	Mean ± SD	Mean ± SD	
Age (years)	31.00 ± 8.65	30.80 ± 7.76	0.925
Weight (kg)	79.60 ± 11.93	77.10 ± 12.42	0.430
Height (cm)	167.60 ± 5.67	164.10 ± 6.92	0.136
BMI	28.18 ± 2.75	28.49 ± 3.30	0.696

Table 2: Medical and clinical assessment data for study & control groups (no= 60)

ITEM	Study (n= 30)		Control (n= 30)		P-value
	No.	%	No.	%	
Length of stay in ICU (days)					
Mean ± SD	3.20 ± 0.61		5.50 ± 1.22		0.000*
Past health history:					
HCV & liver cirrhosis	3	10.0	0	0.0	0.237
No	27	90.0	30	100.0	
Type of surgery:					
Liver resection	24	80.0	30	100.0	0.024*
Liver transplantation	6	20.0	0	0.0	

Table 3: Comparison between study & control groups regarding Vital signs and hemodynamic parameters of three days post-operative (no= 60)

Hemodynamic parameters		study group	control group	P value
Temperature	Preoperative	36.98 ± 0.08	36.98 ± 0.50	1.000
	1 st day	36.38 ± 0.12	36.34 ± 0.31	0.515
	2 nd day	36.59 ± 0.03	37.04 ± 0.07	0.000*
	3 rd day	36.25 ± 0.15	37.11 ± 0.17	0.021*
Heart rate (beat/min)	Preoperative	75.70 ± 7.81	77.60 ± 6.84	0.243
	1 st day	91.40 ± 11.15	96.50 ± 10.32	0.071
	2 nd day	85.10 ± 7.37	88.60 ± 13.11	0.207
	3 rd day	75.40 ± 7.65	82.60 ± 8.97	0.001*
Systolic BP (mm .Hg)	Preoperative	125.00 ± 5.09	123.00 ± 6.51	0.190
	1 st day	101.00 ± 3.05	102.00 ± 4.07	0.286
	2 nd day	113.00 ± 6.51	113.00 ± 6.51	1.000
	3 rd day	123.00 ± 4.66	119.00 ± 5.48	0.003*
Diastolic BP (mm.Hg)	preoperative	80.00 ± 7.88	82.00 ± 7.61	0.321
	1 st day	66.00 ± 4.98	65.00 ± 5.09	0.445
	2 nd day	73.00 ± 6.51	73.00 ± 7.94	1.000
	3 rd day	78.00 ± 6.10	72.00 ± 5.48	0.007*
Respiratory rate	Preoperative	19.61 ± 0.89	19.80 ± 1.10	0.223
	1 st day	27.80 ± 3.24	27.60 ± 3.64	0.348
	2 nd day	23.20 ± 2.02	24.80 ± 3.72	0.043*
	3 rd day	20.00 ± 1.29	22.60 ± 3.500	0.000*
SpO ₂	Preoperative	98.90 ± 1.06	99.30 ± 0.92	0.124
	1 st day	95.90 ± 2.67	98.00 ± 1.88	0.001*
	2 nd day	98.00 ± 1.82	98.60 ± 1.22	0.139
	3 rd day	99.72 ± 0.81	99.00 ± 1.022	0.038*

Table 4: Comparison between study & control groups regarding Arterial blood gases in first, second & third day post- operative (no= 60)

ABG	DAYS	Study (n= 30)	Control (n= 30)	P-value
		Mean ± SD	Mean ± SD	
PH	Preoperative	7.36 ± 0.02	7.37 ± 0.02	0.281
	1 st day	7.42 ± 0.06	7.35 ± 0.07	0.000*
	2 nd day	7.40 ± 0.05	7.37 ± 0.04	0.024*

	3 rd day	7.36 ± 0.01	7.39 ± 0.05	0.005*
PaCO ₂	preoperative	36.50 ± 1.59	37.60 ± 2.04	0.024*
	1 st day	36.10 ± 10.98	31.80 ± 10.89	0.133
	2 nd day	34.90 ± 8.22	39.60 ± 5.81	0.013*
	3 rd day	40.40 ± 3.78	38.30 ± 7.08	0.157
PaO ₂	preoperative	71.20 ± 8.40	70.60 ± 5.95	0.751
	1 st day	120.80 ± 78.88	185.30 ± 106.27	0.010*
	2 nd day	68.90 ± 11.58	87.30 ± 36.61	0.011*
	3 rd day	74.90 ± 8.88	75.00 ± 14.94	0.975
HCO ₃	preoperative	21.61 ± 0.88	21.94 ± 1.05	0.192
	1 st day	18.16 ± 2.63	17.39 ± 3.45	0.335
	2 nd day	18.99 ± 1.79	18.15 ± 2.35	0.125
	3 rd day	20.35 ± 1.71	18.30 ± 2.31	0.000*
SaO ₂	Preoperative	99.00 ± 0.91	99.40 ± 0.93	0.098
	1 st day	98.70 ± 1.51	98.70 ± 1.29	1.000
	2 nd day	98.80 ± 1.35	97.80 ± 1.35	0.006*
	3 rd day	99.80 ± 0.61	98.60 ± 1.52	0.000*

Table 5: Comparison between the study & control groups regarding to post-operative complications (n=60)

Complications	Study Group (n= 30)		Control Group (n= 30)		P-value
	No.	%	No.	%	
Bleeding & infection	3	10.0	6	20.0	0.472
Dyspnea	0	0.0	9	30.0	0.002*
Fever	0	0.0	3	10.0	0.237
Infection	0	0.0	3	10.0	0.237
No	27	90.0	9	30.0	0.000*

IV. Discussion

Postoperative pulmonary complications (PPC) substantially increases the risk of morbidity, mortality, length of hospitalization and has significant financial implications. Risks of postoperative pulmonary complications can be broadly divided into patient related, procedure related, anaesthesia related and postoperative care related. (Surjyaetal2015)

The prevention of PPC requires comprehensive multidisciplinary approach that include preoperative risk stratification and optimizations, intra-operative lung protective strategies, greater utilization of regional analgesia and avoidance of opioid analgesia, balancing intravenous fluid, minimising blood and blood product transfusion, fast tracking protocol for enhanced recovery, vigilance monitoring, physiotherapy and lung expansion manoeuvres including use of non-invasive ventilation in selected patients and other supportive care such as nutritional support, glycemic control, selective gastric drainage, thrombo-prophylaxis and early empirical antibiotic therapy in suspected infection and sepsis. (Ulka etal2015)

Regarding socio demographic characteristic The present study showed that the mean age of studied patients in study and control groups were at (31.00 ± 8.65-30.80 ± 7.76). The majorities of them were male, married and completed secondary education. The result of the study indicated that there was no significant difference between study and control group regarding socio demographic characteristic which indicated randomly selection of the study group. These findings were supported by Samah.M and Gehan H(2015) who conducted " The Effect of Early Post-anesthetic Chest Physiotherapy Nursing Intervention on Patients Undergoing Upper Abdominal Surgery" in Egypty confirmed that It was revealed that there were no statistical significant differences between the study and the control group regarding the age, the weight and the height and also respiratory rate, heart rate, SpO₂ and surgery duration

The present study showed , there were no significant statistical difference found between the study and control groups on preoperative day regarding Temperature , heart rate (HR), systolic and diastolic blood pressure (BP), mean arterial pressure (MAP), central venous pressure (CVP) and pulseoximetry pre -operative day. On the same line Stiller, et al. (2010) who conducted "efficacy of breathing and coughing exercises in the prevention of pulmonary complications after coronary artery surgery" reported that no significant differences between 3 groups using (routine chest physiotherapy and prophylactic chest physiotherapy) as regard temperature at any stage of treatment during fourth postoperative day. Regarding type of surgery, the present study showed that the liver resection surgery was more prevalent in the study and control groups. This may be related to the fact that the majority of hepatic carcinoma or tumor was the current diagnosis. This was an agreement with Yang,etal2017 who conducted " Comparison between liver resection and liver transplantation

on outcomes in patients with solitary hepatocellular carcinoma meeting United Network for Organ Sharing (UNOS) criteria: a population-based study of the Surveillance Epidemiology and End Results (SEER) database " reported that Liver Transplantation used as a second-line treatment for very early HCC but liver resection is the first line used.

The present study showed , there were no significant statistical difference found between the study and control groups on preoperative day regarding Temperature , heart rate (HR), systolic and diastolic blood pressure (BP), mean arterial pressure (MAP), central venous pressure (CVP) and pulseoximetry pre -operative day. On the same line **Stiller, et al. (2010)** who conducted "efficacy of breathing and coughing exercises in the prevention of pulmonary complications after coronary artery surgery" reported that no significant differences between 3 groups using (routine chest physiotherapy and prophylactic chest physiotherapy) as regard temperature at any stage of treatment during fourth postoperative day.

The present study showed , there was no statistical significant difference between study group and control group regarding to all hemodynamic on preoperative day and first day postoperative. Furthermore, there was statistically significant relation between the study group and control group regarding to SpO₂ in first day and third day. Moreover, there was statistically significant difference between the study group and control group regarding to temperature and respiratory rate in second day , and there was statistically significant difference between the study group and control group regarding to blood pressure, SpO₂, respiratory rate, heart rate and temperature in third day. On the same line **Samah.M and Gehan H (2015)** who conducted " The Effect of Early Post-anesthetic Chest Physiotherapy Nursing Intervention on Patients Undergoing Upper Abdominal Surgery " reported that no significant differences between the oxygen saturation showed lower values on postoperative day that were not different from those measured after surgery while oxygen saturation increase after intervention compared with before intervention .

Incentive spirometer Shows that, there was statistically significant difference in the second and third days between the study group and control group regarding to tidal volume at (0.001,0.000). while no statistically significant relation in preoperative and first day postoperative. This mean that the use of incentive spirometer and inspiratory muscle training is clinically useful in improving postoperative outcomes in patients undergoing liver surgery. this finding supported by Manzano R Metal 2018" who conducted that "Chest physiotherapy during immediate postoperative period among patients undergoing upper abdominal surgery: randomized clinical trial" reported that The control and chest physiotherapy groups presented decreased spirometry values after surgery. and Mark R Elkins 2012 who conducted that " preoperative inspiratory muscle training is clinically useful in improving postoperative outcomes in patients undergoing cardiothoracic and upper abdominal surgery" protocol for a systematic review" reported that Adequate preoperative respiratory muscle strength may help protect against the development of postoperative pulmonary complications . On the opposite side **Paulo do Nascimento Junior 2014** who conducted that "Incentive spirometry for prevention of postoperative pulmonary complications in upper abdominal surgery" who reported that There is low quality evidence regarding the lack of effectiveness of incentive spirometry for prevention of postoperative pulmonary complications in patients after upper abdominal surgery and We found no statistically significant differences between the participants receiving IS compared to those receiving physiotherapy in the risk of developing a pulmonary condition or the type of complication.

According to the study about 50% of control group had dyspnea and atelectasis which is one of the most common pulmonary complications encountered following liver and abdominal operations in agreement with (**Gaurav and Lena 2012**) who conduct " Postoperative Pulmonary Complications: Pneumonia and Acute Respiratory Failure " reported that upper abdominal surgery has incidence (16%-20%) of pulmonary complication

Regarding length of hospital stay, the present study indicated that there was a significant difference detected between both groups regarding of average length of ICU stay This in agreement with **Valkenet et al. (2011)** who conducted " The effects of preoperative exercise therapy on postoperative outcome: a systematic review." reported that an exercise therapy preoperatively could be effective for decreasing rates of post-operative complication and length of hospital stay after cardiac or abdominal surgery.

The present study show that, there were statistically significant relation between socio demographic characteristics of study group related to complication postoperative & education. While, there were no statistically significant relation between socio demographic characteristics of study group related to complication postoperative with age, sex & marital status. These results disagreement with **Kurfirst, et al (2014)**. Who conducted "Health-related quality of life after cardiac surgery-the effects of age, preoperative conditions and postoperative complications". Reported that The most frequent postoperative complications in the group of older patients were previously described as heart failure, dysrhythmia, postoperative bleeding, ventilation problems, neurophysical disorders, myocardial dysfunction, and renal failure.

V. Conclusion

Based upon the study findings, the study concluded that applying Developed Postoperative Nursing Care (chest physiotherapy) was effective in Preventing of Postoperative Pulmonary Complications For Liver Surgery patients

Recommendation: - In-service training programs for the purpose of updating the knowledge and skills of nurses working with intensive care units & further studies are necessary to identify effects of Developed Postoperative Nursing Care on the Preventing of Postoperative Pulmonary Complications for Liver Surgery patients.

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