Effect of Specific Nursing Intervention on Respiratory Status of Chronic Obstructive Pulmonary Disease (COPD) During Acute Exacerbation

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*Abstract: Nurses are involved in the management of COPD patients at all stages, from prevention to provision of end-of-life care. So the **aim** of the present study was to investigate the effect of implementing specific nursing intervention on the respiratory status of the COPD patients.*
Patients and methodA convenient sample consisted of 60 critically ill adult patients who were admitted to chest intensive care unit.They were diagnosed as advanced COPD .They were randomly divided into equal 30 patients for both study and control group. Two tools were designed and used to collect the necessary data for this study, First tool :respiratory status tool and
Second tool : nursing intervention tool related to advanced COPD and its management.
Resultsthe present study showed that there was statistical significant difference between study group before and after implementation of specific nursing interventionregarding arterial blood gases &pulmonary function test and there was a highly statistical significant increase in six-minute walk distance with mean ±SD beforespecific nursing intervention (81.73 ±19.14) that reached (117.87 ±23.11) afterspecific nursing intervention(P-value 0.001) among study group.
Conclusion There were positive effects of implementing specific   nursing interventionon the respiratory status of the COPD patients.
Recommendation COPD patients with moderate and severe stages must be encourage to begin in- patients pulmonary nursing intervention especially exercise training as soon as possible after stabilization of their condition to decrease exacerbation and readmissions of COPD patients .

I.   Introduction

Chronic obstructive pulmonary disease (COPD) is a common chroniccondition associated with a rapidly increasing physical, social, andeconomic burden in terms of both direct healthcare costs includinghospitalizations and medication and indirect costs (productivity loss,workabsenteeism, premature retirement)**Fletcher .et al.,(2011),and (American Thoracic Society2003).** WHO estimates that COPD will be the third leading cause of death by 2020, andthe fourth leading cause of death in 2030 behind cardiovascular disease,cancer andcerebrovascular diseases, in the burden of disease caused worldwide It is estimatedthat approximately 210 million people worldwide have COPD, and itsincidence is believed to be rising**(World Health Organization (2013) and Mannino&, Buist (2007)Mathers&Loncar (2006).**COPD is the one of the most common problem seen by chest physician and respiratory care setting,and it is one of the major health problem in societies where cigarette smoking is common**(Hilberink,2011& Fishman (2008)**.

Chronic obstructive pulmonary disease (COPD) refers to a group of disorders characterized by chronic airflow obstruction/limitation. The airwayobstruction is persistent and largely irreversible. It includes two distinct pathophysiological processes - chronic bronchitis and emphysema. Acute exacerbations of these disorders occur during the natural history of progression of this disease **(Chawla 2009&Ancochea , et al .,2009).** In advanced COPD peripheral airway obstruction ,parenchymal destruction and vascular irregularities reduce the lung 's capacity for gas exchange resulting in hypoxemia and hypercapnia**(Morton,&Fontaine (2013),**Global initiative for COPD (2009) andGlobal strategy for the diagnosis ,management and prevention of COPD(2010).There is therefore an urgentneed to develop innovative COPD management models**(Fletcher &Dahl ,2013).** There is no cure for COPD but there is a range of management and activities available to make the breathingeasier and help these types of patients to feel better.Treatments for COPD need to beregularly monitored and reviewed by doctor/nurse to make sure theyare the most suitable treatments for each stage of COPD .It is necessary to reduce risk factors such as smoking and physical inactivity **(Halpin, 2011).**

Pulmonary management is designed to reduce symptoms, optimize functional status, increase participation, and reduce health-care costs by stabilizing or reversing systemic manifestations of the disease" **(NICE,2006).**Hospital admissions after exacerbations of chronic obstructive pulmonary disease are also reduced with this intervention **(Linda et al 2010)** .In an analysis of six trials involving 219 patients with COPD exacerbations, pulmonary management significantly reduced hospital admissions and mortality, and improved exercise capacity and health-related quality of life**(Puhan&et., al.,(2009).**

In thiscontext, nurses are uniquely positioned to make a substantialcontribution as they are often the first point of contact for patientsand are actively engaged throughout the disease managementprocess .The nursing role in COPD – and essentially in all chronic diseases is becoming increasingly important and is characterized by continuityof care. Nurses are involved in the management of COPD at allstages, from prevention to provision of end-of-life care**(Fletcher&Dahl (2013).**

Nurses play a key role in identifying potential candidates for patients care .pulmonary nursing care lead to statistically significant and clinically meaningful improvements in health related quality of life functional exercise capacity**(Griffith 2000&Lacasse 2002)**.Consequently the recent guidelines on the management of COPD published by the National Institute for Clinical Excellence (NICE)and British Thoracic society recommended that pulmonary care should be available for to allappropriate patient**(NICE 2006).**

II. Significant of the study:

Chronic obstructive pulmonary disease(COPD) is one of the most importantcauses of morbidity in manyhealthcare systems. It is estimated thatapproximately 210 million people worldwide have COPD, and itsincidence is believed to be rising]. The impact of the illness isrelated to its symptoms, the progressive deteriorationin lung function and frequent exacerbations. exacerbations are one of the most common causes of hospitaladmission and areresponsible for an increased demand of hospital .Exacerbations and readmissions is raised inthis type of patient; the Risk Factors of COPDExacerbation Study (EFRAM) found that 63% ofpatients were readmitted during the year followingan exacerbation.For this reason,early nursing discharge support for these types of the COPD patients is a key issue in minimizingthe impact of the current acute episode andpreventing future relapses

III. Aim of the study:

The present study aimedto investigate the effect of implementingspecific nursing interventionon the respiratory status of the COPD patients

IV. Patients and methods

Study design:A true-experimental (pre test-post test) design was used in this study.

Study variables: The independent variable is the specific nursing intervention and the dependent variable is the respiratory status of the study group.

Setting: This study was conducted in the chest intensive care unit at Assuit university hospitals .

Subjects :A convenient sample of 60 critically ill adult patients who were admitted to chest intensive care unit.They were diagnosed as advanced COPD .They were randomly divided into equal 30 patients for both study and control groups**.**

Inclusion criteria: age of the patient were 30 years and over from both sexes .

Exclusion criteria : Locomotors problem,cognitive impairment, and patients with ischemic heart disease or aortic valve disease.

Tools: Two tools were designed and used to collect the necessary data for this study ,which were developed by the researcher based on reviewing the relevant literature.

First tool:respiratory status tool which consisted of 4 parts:

Part I :sociodemographic data as sex ,education , occupation , history of present disease and smoking history (severity of the smoking measured by number of ciggerate per day)

Part II: Arterial blood gases(ABGs):PaO_2,$Paco_2$,$Hco_3$and PH.

Part III: Pulmonary functions test (PFT):is spirometeric studies including forced vital capacity (FVC),forced expiratory volume produced in first second (FXV1),Peak expiratory flow rate (PEF)and (FEV!/FVC) ratio.

Part IV: Six minute walk testmeasure outcomeby :this test is used as an index of functional status of the respiratorysystem of these patients .Patients were asked to walk as far as they could for 6 minute on a continuous flat hospital corridor and numbers of meter are walked by the patient and number of stop were recorded .If the patient is receiving oxygen therapy the therapist carry the oxygen.This test in addition to,blood gases and pulmonary function test were performed to the patient twice, before and after implementation of specific nursing intervention,and compare with control group who did not receive nursing intervention .

Second tool : Which include group ofspecific nursing intervention(short notes on anatomy &physiology of respiratory tract, early ambulation ,chest physiotherapeutic techniques(diaphragmatic breathing and pursed lip

breathing .coughing exercises),upper extremity exercises,aerobic exercises e.g. walking ,proper uses of inhalation therapy and general precautions or advices to these types of patientsbefore discharge).was developed by the researcher based on reviewing of recent literature related to advanced COPD and its management.

Method: The study was implemented through 3 phases;

Phase 1: Preparatory phase
-An official permission to conduct the study was obtained from the hospital responsible authorities in the chest intensive care unit after explaining the aim and the nature of the study.
-An approval was obtained from the local ethical committee and the study was followed the common ethical principles in clinical research.
-The tools used in this study were developed by the researcher based on reviewing the relevant literature.
-Content validity :the tools were tested for content validity by jury of 5 experts 3 in the field of critical care nursing and 2 critical care medicine from Assiut University Hospital ,and the necessary modifications were done.
-The Cronbach,s alpha coefficients test of tool (1) was 0.75 .
-A pilot study was conducted on 5 patients to test the feasibility and applicability of the tools, and necessary tool modification was done
-Protection of the human rights (ethical consideration):informed consent was obtained from each patient .The researcher emphasized that the participation is voluntary and the confidentiality and anonymity of the patients were assured through coding the data.Thepatients were assured that they can withdraw from the study at any time without any rational.

Phase 2: Implementation phase:
The specific nursing intervention was implemented in chest intensive care unit,data was collected and analyzed for outcome of both control group and studygroup.
The study groupwas subjected tospecific nursing intervention as soon as possible during hospitalization period(5-7day) following stabilizationof the patient condition .This nursing maneuver was introduce gradually according to patient tolerance and the severity of the disease .ABG and pulmonary function test were performed to the patient as a base line data,then the researcher start to teach the patient breathing exercise followed by coughing ex . at the end of the first day and advice the patient to repeat these exercise at least 2-3 every shift .at the second day encourage the patient to get up from the bed and walk around the bed for few minute .Patients were asked to walk as far as they could for 6 minute on a continuous flat hospital corridor and numbers of meter are walked by the patient and number of stop were recorded. After 2-3 hours the patient was adviced to do the upper extremity exercises,aerobic exercises e.g. walking ,proper uses of inhalation therapy.Then the researcher supervised the patient to perform these nursing maneuver during staying in the hospital .general precautions or advices were taught by the researcher to these types of patientsbefore discharge . while control group was left to the routine nursing care.Bothgroups were monitored by using tool 1from admission until discharge.

Phase 3: evaluation phase:
Patients outcomes were measured by using 3 tests (arterial blood gases,pulmonary function test and 6-minute walk test) .These tests are performed to the study group and control group before and after implementation of the specific nursing intervention ,and compare with control group who did not receive specific nursing intervention.

V. Statistics and data analysis:
Data were coded and analyzed using SPSS version 20. Descriptive analyses were conducted to determine the frequency distributions of the study variables. Pearson's Product Moment Correlation Coefficients were calculated to assess the relationship among the study variables. Differences between groups were tested using X2 and student t- test.

VI. Results
Table (1): Sociodemographiccharacteristic of studied sample

Items	Study group	Control group
Age		
35-45	24%	7.1%
46-55	16%	35.07%
56-65	40%	42,9%
66-75	20%	14.3%
Mean±SD	56.96±11.59	56.43± 9.03

Residence		
Urban	44%	33.3%
Rural	56%	66.7%
Education		
Illiterate	60%	71.8%
Read&Write	32%	23,2%
Primary school	8%	-
Secondary	-	5%
Occupation		
Not work	32%	48%
Farmer	14%	35%
Officer	-	2.6%
Worker	12%	12.8%

Table (2): Distribution of smoking and clinical data among studied sample

Smoking index	Study group	Control group
Non smoke	4%	7.1%
Mild	24%	28.8%
Moderate	44%	42.9%
Severe	28%	21.4%
Maintain therapy		
Oral bronchodilator		
No	12%	0%
Yes	88%	100%
Inhaler bronchodilator		
No	44%	0%
Yes	56%	100%
Oral corticosteroids		
No	4%	0%
Yes	96%	100%

Table(3) Distribution of the studied groups according to their duration of illness and severity of the disease .

Items	Study group	Control group
Duration of illness		
≤10 years	40%	57.1%
10-20 years	40%	28.6%
20-25 years	20%	14.3%
Mean± SD	10.80±6.35	10 .43±8.64
Severity of disease		
Moderate	88%	71.4%
Severe	12%	28.6%

Table(4) Comparison between studied groups of COPD patients as regard arterial blood gases before and after specific nursing intervention.

Items	Before specific nursing intervention	After specific nursing intervention	P-value
PH			
Study group	7.33±0.15	7.39± 0.03	P≤0.03
Control goup	7.35 ±0.06	7.36± 0.15	N.S
Pco2			
Study group	51.27±11.15	40.80±6.19	P≤0.001
Control group	63.28±14.94	60.00±13.25	N.S
Po2			
Study group	63.42±14.80	75.16±17.22	P≤0.01
Control group	55.90±12.27	56.39±20.01	N.S
O2 saturation			
Study group	96.46±1.805	96.03±1.64	N.S
Control	95.34±2.262	95.34±1.95	N.S
Hco3			
Study group	32.07±8.21	25.73±3.50	P≤0.01
Control group	38.34±7.09	35.05±6.76	P≤0.05

Table (5) Comparison between before and afterspecific nursing interventionimplementation among studied groups regarding pulmonary function test.

Items	Before specific nursing intervention	After specific nursing intervention	P-value
1-FVC(in Liters)/m			
Study group	1.31±0.30	1.82±0.59	P<0.001
Control group	1.08±0.20	1.07±0.41	N.S
2-FVC%(%of predicted)			
Study group	34.24±14.17	47.40±16.16	P<0.001
Control group	35.57± 7.13	36.00±00	N.S
3-FEV1(in Liters)/m			
Study group	0.82±0.35	1.18±0.52	P<0.001
Control group	0.63±0.18	0.64±0..20	N.S
4-FEC1%(%of predicted			
Study group	29.44±13.14	42.92±20.21	P<0.001
Control group	23.21±7.70	23.14±7.56	N.s
5-FEV1/FVC%			
Study group	58.76±10.94	64.08±13.43	P<0.001
Control group	63.29±9.64	61.71±15.11	N.S
6-PEF.Rate			
Study group	1.68±0.55	2.46±0.85	P<0.001
Control group	1.64±0.50	1.71±0.45	N.S
7-PEF%(%of predicated)			
Study group	23.04±7.60	33.72±12.70	P<0.001
Control group	22.50±7.21	22.15±7.67	N.S

Table (6) Comparison betweenbefore and after specific nursing interventionimplementation among study group regarding six –minute walk test

Six –minute walk test	Before specific nursing intervention	Afterspecific nursing intervention	P-value
Study group			
Achieved distance in meters	81.73±19.14	117.87±23.11	0.001
No. of stops calculate/ distance	2.04±0.81	0 stop	0.05
Control group			
Achieved distance in meters	80.29±15.18	91.23 ±16.98	N.S
No. of stops calculate/ distance	3.00 ±76.98	2.76 ± 45.12	N.S

Table (1):showSociodemographic characteristic of studied sample .It was found that nearly 40% of control and study group their age ranged between 56-65 year with mean score56.96 ±11.59 and56.43 ±9.05 respectively. It is clear from this table that more half of the patient of studyand control group were came from rural area and illiterate (56%.66.7%.60%and71.8respectively).Regarding occupation high percent of study group were farmer(56%) and high percent of control group werenot work (48.7%)

Table(2): Show distribution of smoking and clinical data among studied sample it was clear from this table that high percent of both groups had moderate smoking (44%of study group &42.9%of control group).While majority of study group and all of the control group were maintain on bronchodilators and oral corticosteroids

Table (3): Show distribution of the studied groups according to their duration of illness and severity of the disease .Itis apparent from this table that mean score of duration of illness was 10.80±6.35 in the studyand 10.43±8.64 in the control group.While 88%of the enrolled patients in the study group and 71 %of control group had moderate stage of the disease.

Table(4): Show Comparison between studied groups of COPD patients as regard arterial blood gases before and after specific nursing intervention.This table show that there was statistical significant difference between study group before and after implementation of specific nursing interventionregarding PH,Pco2 ,Po2,&Hco3 P-value (0.03,0.001 ,0.01&0.01).While there was no statistical significant difference between control group before and after implementation of f specific nursing interventionregarding majority of arterial blood gases.

Table (5): Illustrates comparison between before and after specific nursing intervention implementation among studied group regarding pulmonary function test.It was found that there was statistical significant difference between study group before and after implementation of nursing intervention regarding all items of pulmonary function test.Whileno statistical significant difference between control group before and after implementation of nursing intervention regarding all items of pulmonary function test.

Table (6): Illustrates comparison between pre and after nursing protocol implementation among studied groups regarding six –minute walk test.It was clear from table that there was a highly statistical significant increase in six –minute walk distance with mean ±SD before specific nursing intervention(81.73±19.14) that reached (111.87±23.11) afterspecific nursing intervention(P-value 0.001) among study group.Also there was statistical significant decrease in the number of patients stop while walking with P-value 0.05 .

VII. Discussion

Nurses are uniquely positioned to make a substantialcontribution as they are often the first point of contact for patientsand are actively engaged throughout the disease managementprocess. Nurses are involved in the management of COPD at all stages, from prevention to provision of end-of-life care.So the aim of the present study was to determine the effect of implementing specific nursing intervention onthe respiratory status of the COPD patients .

In the present studyitwas foundthat majority of the studied sample in the middle age, more half of the patients of study and control groups were illiterate and came from rural area.Regarding occupation high percent of study group were farmer and high percent of control group were not working.this results supported by **(Ignatavicius, & Workman, (2006)**who stated that COPD typically affects middle age to older adults.Also **(Ghanem et al .,(2003)** reported that 60%of the cases with COPD were from rural areas ,40% of cases study were from urban areas .It was found also that majority of the patients of both group were smoker ,were received bronchodilators and were maintained on oral corticosteroids. These results may attributed to majority of the studied sample their duration of disease more than 10 years and on moderate tosevere stageof illness .this result was in line with Health Quality Ontario(2013) who stated that the most common risk factor for COPD—and the primary cause of COPD in 80% to 90% of cases—is exposure to tobacco smoke.Also **(Ijiri   et al .,(2014)** mentioned that all subjects were current smokers (50 [36–80] pack-years),and the subjects of this study were onregular medication consisted of inhaled long-acting muscarinic antagonists (n=32) and inhaled long-acting β2-adrenergic receptor agonists (n=30). Twenty subjects had received inhaled corticosteroids.

Regarding arterial blood gases (ABG)**(Ignatavicius, & Workman, (2006)** stated thatserial ABGs are monitored to evaluate respiratory status, increased PaCO2 and decreased PaO2. ABGs should be performed in all patients in moderate and severe stages of the disease (FEV1less than 40%)or when respiratory failure or right –sided heart failure are present**(Global initiative for COPD 2010). (Marini, et al.,2009 ,Kaplow ,2010 and Brower et al .,2013)**mentioned that (ABG), is the gold standard to determine level of oxygen , carbon dioxide and PHto identify acid base disturbances ,hypoxemia and to monitor the effectiveness of the therapy.The present study mentioned that statistical significant improvement nearly in all items of ABGof the study group after implementation of specific nursing intervention comparing to beforeimplementation of specific nursing intervention, this comparable to the study of **(El-sayed ,(2003) ,Abd-Elhafez ,GN., (2014)**and **(Ahmed., et al.,(2014)**who reported that there were marked improvement in arterial blood gases reflected by a highly statistical significant difference was found between the both group after performed chest physiotherapy maneuvers .Also this result was supported by**(Emtner et al.,2011)** who stated that arterial oxygen saturation (SaO2) was significantly increased in treatment group than control group**(Andersson et al .,(2011)**mentioned that there were small changes in heart rate,dyspnea, exertion, and oxygen saturation during the study in all patients.While **(Hofmery et al.,(2012)** reported that there were no significant differences in SaO2between group of the study .

As regard pulmonary function test,there were statistical significant improvement in FVC ,FVC % ,FEV1 and FEV% after implementation of specific nursing intervention in the study group this improvement may be related to the effect of exercisetraining of nursing intervention .This result was on line with **(Ahmed, et al.,(2014)** who clarifies that statically significant difference between studied groups regarding to expiratory volume in 1second (FEV!) and vital capacity (VC) While **(EL-sayed (2003) and Nabil ,(2001)** mentioned that a slightly significant change in pulmonary function test after exercise program in patient group this may be related to the anabolic steroid which added to exercise program.Moreover**(Stocke et al ., (2010)** reported that in two treatment groups showed similar improvements in FVC and FEV.

In patients with severe COPD, a decline in walkingdistance is a stronger predictor of mortality than lung functionand occurs independently of change in lung function**(Pinto-Plata et al .,(2004)&Casanova et al.(2008)** ,the present study revealed thatstatistical significant increase in the six –min walk distance with mean ± SD (81.72 ±19.14) before nursing intervention to (111.86±23.11) after nursing intervention (P≤ 0.001) this result mean that patients of the study group could readily benefit from the nursing intervention and the walk distance is an actual measure of a physical capacity. This result was on line with**(Chen ,et al.,(2012)**who mentioned thatAssessment of exercise capacity allows one todetermine the severity of disease and its changes with timeor treatment and is important in the management ofpatients with COPD. Both Peak Oxygen Uptake (peak VO2),from the distance walked during a six-minute walk test (6 MWT) areused for assessing the response to therapeutic interventions. 6MWT, a submaximal exercise test, represent a usefulmarker for exercise capacity and dynamic hyperinflation ofCOPD patients and, is used forevaluation of the severity of the disease

and the degree ofdisability of COPD patients.6MWT can be also used as follow up in terms of the changes of walking distance.

Also this result agreed with**(Aitlen,LM., & et al.,(2015)**who stated thatfor patients withCOPD physical function as measured byusing the 6-minute walk test (6MWT), 6-minute walk distance improved by 75 m or more during the study.This study was on line with **(Chen ,et al.,(2012)** who mentioned that the walking distance in 6MWT waspositively correlated with pre-exercise IC , andpositively related to % predicted value of pre-exercise FEV1It means that walking performance is related toanatomical and airflow limitation. The change in IC afterexercise directly correlates with post-exercise desaturation .It was noticed from the present study that there was a little improvement on the respiratory status of the patients of the study group, this may be due to short duration of the study ,severity of the disease and the patients were in the exacerbations phase .

Conclusion :based on the result of this study ,it can be concluded that :the majority of the studied sample in the middle age, more than   half of the patients of study and control group were illiterate and came from rural area.There were positive effects attributable to the performed nursing protocol , better scores of blood gases as well asrespiratory function test were observed among the study group than the control group.the present study revealed that statistical significant increase in the six –min walk distance with mean $\pm$ SD (88.79 $\pm$19.14) before nursing protocol to (121.71$\pm$23.11) after nursing protocol (P$\geq$ 0.001) among study group .

VIII.   Recommendations

Based on the finding of the present study ,the following recommendations are suggested :

-COPD patients with moderate and severe stages must be encourage to begin   in- patient pulmonary nursing intervention especially exercise training as soon as possible after stabilizationof their condition to decrease exacerbation and readmissions of COPD patients .

- Discharge support for the most seriously ill COPD patients is a key issue in minimizing the impact of the current acute episode and preventing future relapses.

-Teaching and training program should be given to all nursing personnel dealing with these types of patients to improve their knowledge and skills.

-Replication of this research on larger probability sample acquired from different geographical areas in Egypt for generalization .

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