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Nurses' Knowledge, Practices and Barriers Affecting a Safe Administration of Oxygen Therapy

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Abstract: *"Oxygen therapy is like a two edged sword", at one edge oxygen is crucial for human being to survive, while at the other edge it may become toxic if it is delivered by inappropriate dose or method. This study was aiming to assess nurses' knowledge, practices and barriers affecting asafe administration of oxygen therapy. Design: A descriptive research designwas adopted to conduct this study. Subjects: A purposeful sampling technique was used to recruit 50 nurses from different departments in one of the Educational Hospitals in Cairo. Data Collection Tools: Four tools were used as follows: 1) Nurse's demographic data assessment tool, 2)Nurse's knowledge assessment tool, 3) Oxygen therapy administration assessment tool, and 4)Barriers to safe oxygen therapy administration assessment tool. Results: This study proved that, only less than tenth and less than fifth of the studied sample has satisfactory level of knowledge and adequate practices, while, the rest were ranged between average and unsatisfactory. With regard to the common barriers affecting safe oxygen therapy reported by the nurses are unavailability of protocol, lack of maintenance of the equipment used for oxygen therapy, and incomplete unclear written prescription for oxygen therapy. Conclusion: This study concluded that, a minority of the studied sample had satisfactory level of knowledge and less than fifth had adequate level of practices. The most common reported barriers were; absence of protocol for oxygen therapy could be followed, and unavailability of well-functioning equipment. Based on the results it is recommended that the hospital authority should establish relevant training courses, workshops, standardized protocol, periodic maintenance for the equipment, and clearly written and readable medical prescription for oxygen therapy.*

Key words: *oxygen therapy, nurses,barriers, safety*

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I. Introduction

In the human body, oxygen is making up 65% of body mass. Oxygen plays a very essential role in the body; as it allows humans to burn food, releasing energy. Every cell in the human body needs oxygen to survive. Cells turn glucose and oxygen into energy within their mitochondria, by a process called cellular respiration.Cellular respiration is the term used to describe the phase of the digestive process when food breaks down to supply cells with energy. During cellular respiration, cells use oxygen to break down sugar to produce Adenosine Triphosphate (ATP) which is a molecule that supplies body cells with energy***(Kelly & Michelle 2015, Ahmadi et al; 2016)***

Individuals' health status, activity level, and hydration are factors affected by how much human being needs for oxygen. Without adequate oxygen, health problems are definitely occurring. Oxygen deprivation in human body doesn't occur suddenly, it could take long time to occur, occurring over months or years. The reasons for oxygen deprivation are varied, that might result from individual's heath factors or environmental factors. The health effects of oxygen deprivation can be severe; it's even linked to tumor growth***(Sobek, 2017).***

Oxygen therapy is vital to sustain human life; it is one of the most widely prescribed drugs for patients with different health conditions. Oxygen therapy is commonly used in the emergency and critical cases. It is the first line treatment in many critical conditions. Administering oxygen depends on the needs of the patients and the points of views and decision of the medical team advising the care regimen. If oxygen therapy is given inappropriately, it could be fatal. Hence, patients must receive this therapy in an appropriate, safe, and comfortable way***(Adipa et al., 2015;Mahmoud et al., 2016; O'Driscoll et al., 2016).***

Maintenance of adequate oxygen delivery to vital organs often requires the administration of supplemental oxygen, sometimes at high concentrations. Although oxygen therapy is lifesaving, it may be associated with deleterious effects when administered for prolonged periods at high concentrations. Oxygen should be prescribed to achieve a target saturation of 94–98% for most acutely ill patients or 88–92% for those at risk of hypercapnic respiratory failure ***(Lemma, & Weldetsadik, 2015).***

Oxygen therapy, like any drug, if there is increase in its dose, this can have toxic effects on the human body, exposure to higher concentrations of oxygen;can lead to life-threatening health problems. The most common serious health problem could result from high oxygen concentration is "oxygen toxicity", also it is

called oxygen poisoning or oxygen intoxication, is defined as too much oxygen in body tissues. This results when a person inhales too much concentrated oxygen, when receiving oxygen therapy***(Parke, et al., 2013, Sobek, 2017).***

Oxygen therapy is an essential component of resuscitation, acute medical care, basic life support, anesthesia and postoperative care, any errors in oxygen therapy can worsen a patient's condition and can even be life threatening. The benefits and potential complications of oxygen therapy are well known; however, oxygen therapy is often done by health team members without special attention and sufficient knowledge or practice***(Kane et al., 2013, Goharani et al., 2017).***

Health team members are playing very curial role while administering oxygen therapy, as it should be delivered in attendance of physician, or nurse. The nurses have very important role in this regard as they should monitor carefully and regularly patients who are connected with oxygen therapy. Initial investigations like ABG, Hgb or Hct and chest X-ray should be done regularly based on physician prescription and assessed carefully.As well monitoring ofPR, BP, RR, level of consciousness and pulse oximetry are mandatory. The nurses should be alert regarding the physician prescription of oxygen therapy, and she/he should check in the physician prescription which should include indications, target oxygensaturation, oxygen delivery device, and range of oxygen flow or percentage of inspired oxygen andwhen oxygen is to be applied. The prescription should also be signed and dated by the physician ***(Lemma, & Weldetsadik, 2015).***

Oxygen therapy, like any other drug, is administered to the patients, so there are some barriers that could face the nurses while administering it. These barriers could be related to nurses themselves as; lack of knowledge, lack of awareness in relation to different oxygen devices.Other barriers could be linked to the hospital as;lack of continuous educationrelated to the process of oxygen therapy, lack or unavailability of proper functioning equipment, or supplies used during oxygen therapy, or absence of protocol of oxygen therapy. In addition, there are some other barriers which might be related to prescription itself as; unclear physician's prescription regarding to dose, device that should be used according to patients' condition, unclear patient's follow up mechanism ***(McLeod et al., 2015).***

Significance of the Study:

Oxygen therapy is a very vital medical treatment that could be prescribed to the patients in different critical conditions. Failure to administer oxygen therapy correctly places the patients at risk of many serious health problems as hypoxemia, respiratory dysfunction and death ***(Eastwood et al; 2012).*** Thus ensuring that oxygen therapy is administered in a correct and safe way as well in the correct time is fundamental to patients' care. Therefore, this study is conducted to assess whether oxygen therapy is administered in safe way based on nurses' knowledge and practices as well as to assess presence of any barriers that could affect the process of administering oxygen therapy.

Aim of the Study:

The current study is aiming to assess nurses' knowledge, practices and barriers affecting asafe administration of oxygen therapy.

Research Questions:

1. Do nurses have adequate knowledge affecting asafe administration of oxygen therapy?
2. Do nurses have adequate practicesaffecting asafe administration of oxygen therapy?
3. Are thereany barriers affecting a safe administration of oxygen therapy?

II. Methods:

Study Design, and Setting

A descriptive research design was used. The current study was conducted atone of the educational hospitals in Cairo in the following places; different Intensive Care Units (ICUs) as; General ICU,Stroke ICU, Emergency ICU, CCU, Vascular unit, Medical and Surgical wards. The study period was started atJuly 2017 and completed byFebruary 2018.

Sample, Type and Size

In this hospital 70 nurses were matching the inclusion and exclusion criteria, of these, seven nurses (10%) were excluded as they were involved in the pilot study, and 13 nurses refused to participate in the study. Therefore, the total number of the nurses who agreed to participate and continued till the end of the study were 50 nurses. A purposeful sampling technique was adopted to recruit nurses according thefollowing inclusion criteria:both genders, different qualifications, nurses who spent one year or more,and working as full time. Exclusion criteria; were newly recruited nurses, with less than a year, or those coming for help from other wards, and internship students.

Data Collection Tools:
Four tools were utilized to conduct this study.
First tool; Nurses' demographic data assessment tool;to assess age, gender, qualifications, years of experience, work place, attended training courses, and type of shift.

Second tool: Nurses' knowledge assessment tool (self-administered), developed by the researchers after reviewing relevant and up-to-dated literatures from national and international sources. It consists of 10 items to assess nurses' knowledge in relation to the aim of administering oxygen therapy, indications, different devices used for administering oxygen therapy, signs and symptoms, indication to change in oxygen saturation, nursing precautions and nurses' interventionsthat should be done for the patients while administering oxygen therapy, signs and symptoms of oxygen toxicity, complications of oxygentoxicity, nursing precautions that should be done to prevent oxygen toxicity, and nursing interventions in case of developing oxygen toxicity.
The scoring system for knowledge assessment was done as follows; the correct response was scored 1 and the incorrect zero. The total scores of participants items were summed-up andthe total divided by the number of items. Knowledge level of the nurses was considered satisfactory if the percent score was 75% or more, 60% to < 75%, average, and below 60% unsatisfactory.
Third tool: Nursing care applied related to administration of oxygen therapy assessment tool (observational checklist), which adopted from ***(Browne, 2012*)**, itwas modified by the researchers to assess nursing care for patients before, during and after administering oxygen therapy. It contains 26 items as follows; 8 items should be done before administration of oxygen therapy, 13 items should be done during administration of oxygen therapy, and 5 items should be done after administration of oxygen therapy.
The scoring system for the observational checklist for nurses' practices was done as follows; if the nursing intervention "Done equal 1" and if "not done Zero". For each part, the scores of the items were summed-up and the total divided by the number of items. The practice level of the nurses was considered adequate if the percent score was 75% or more, 60% to < 75%, average, and below 60% inadequate.
Forth tool: Barriers to safe oxygen therapy administration assessment tool, this tool developed by the researchers after reviewing different related literatures from national and international sources, it was used to assess barriers which could face the nurses during administration of oxygen therapy, such as; unclear physician prescription for oxygen therapy, unavailability of equipment or supplies needed for oxygen therapy, lack of knowledge, lack of continuous education.
The scoring system for the above mentioned tool was done as follows; if the response was "Yes" got 1, and if the response was "No"got Zero. The scores of the items were summed-up and the total divided by the number of items, giving a mean score for the part.

Tools Validity and Reliability:
Validity of data collection tools was done to ensure that, the study contents cover all assessment items related to the study, and each tool contains assessment items that cover aim of the study and research questions. As well, the tools were reviewed for their completeness, and relevance, by experts as a Jury that consists of 3 professors from Medical Surgical Nursing specialty. The Jury judged the tools by rating each item for the degree to which it reflects the aim and research questions being studied, and the Jury recommended some modifications on the tools. After receiving the feedback from the Jury, the researchers made the recommended modifications. Then, the data collection tools were translated into simple Arabic language, after that, the Jury reassessed data collection tools one more time and ascertained that, the face and content validity of the tools, and its readiness to be used. Reliability of data collection tools was done by using Cronbach's alpha test, and value were as follows; for knowledge questionnaire = 0.87, for observational checklist = 0.89.

Ethical Consideration
After explaining the aim of the study and data collection tools to the research committee in the University, and to the hospital administration, the following approvals were obtained as follows; first from the Ethical Research Committee in the Faculty, then the hospital administration, and finally from the nurses who agreed to participate in the study, and they were asked to sign a consent form to confirm their acceptance to participate in the study,as well, the hospital name was kept based on the hospital request. In addition, the nurses were ensured about the confidentiality of their data,the researchers assured them that participation in this study was voluntary; the nurses were informed that they have the right to withdraw from the study at any time without giving any reason, and data collections tools will be tested anonymously. The researchers committed that, there is no any harmful effect for any one and it will beneficial for the nurses and the hospital administration and the research purpose. In addition, the finding will be discussed with hospital management team before publishing its results.

Pilot Study:

A pilot study is one of the important stages in a research study and it is conducted to test the applicability and feasibility of data collection tools as well as to assess potential problems and deficiencies in the study, and the whole research proposal prior to implementation of the full study. Therefore, pilot study was done by including 10% from the sample of the study, and this sample was excluded from the main sample study.The results revealed that, some modifications were needed to be done in the data collection tools after that they were ready to be used.

Field Work:

A written official letter was issued from the Dean of the Faculty of Nursing, and directed to the director of the selected hospital for approval to conduct the study. The following steps have been done in order to conduct the current study:

Assessment phase:

After obtaining the approval from the hospital administration the researcher visited theICUs, selected wards/units and checked number of the nurses in each shift, and they were as follow; In ICUs 39 nurses are working in the long day shift, while 7 nurses are working in medical and 4 in surgical wards. After that, the researcher met all of them and explained to them the aim of the study and data collection tools, as well as the process of data collection and the researcher informed the hospital administration that data collection will be done as follows; the researcher will come 2 days per week for data collection process.

Implementation phase:

In this phase the researcher disturbed three of data collection tools; nurses' demographic data tool, self-administered knowledge questionnaire and list of barriers assessment tool for all nurses who attend long day shiftsand those of night shifts were waiting for the researcher to give them the data collections tools, and the researcher asked them to fill them induring the researcher's visitwhorecollect the tools again in the same day after nurses completing filling them in.With regard to observational checklist, the researcher informed the nurses that, they will be observed by the researcher before, during, and after administering oxygen therapy to their patients, and each nurse was assessed once during this study.

Statistical analysis

Statistical analysis was done using a computer software, the Statistical Package for Social Sciences (SPSS) version (20), for this purpose. Descriptive correlation statistics were applied (Mean, Standard Deviation, Frequency and Percentages) test of significance (Chi-square) was used to test significance between variables. A statistically significant difference was considered at P- value ≤ 0.05, and a highly statistically significant difference was considered at P-value ≤ 0.001

III. Results

Table (1): Demographic Characteristics of the Nurses under the Study (n=50)

Items	No.	%
Gender:		
Male	6	12
Female	44	88
Age (in years):		
20 – <30	25	50
31 – <40	12	24
41 – <50	8	16
51 – <60	2	4
61 +	3	6
$\bar{x}$ ± SD 36 ± 12.2		
Qualifications:		
Diploma nurse	11	22
Technical Institute of Nursing	35	70
Bachelor	4	8
Experience (in years):		
1 – <10	33	66
11 – <20	12	24
21 – < 30	4	8
31 +	1	2
$\bar{x}$ ± SD 9.9 ± 8.5		
Department:		
Critical care units (general ICU/stroke unit/emergency unit/CCU/vascular unit)	39	78
Medical ward	7	14

Surgical ward	4	8
Working Shift:		
Morning	49	98
Night	1	2

As shows in table (1) the majority (88%)of the studied sample was female. While, mean age and SD 36± 12.2. With regard to their qualifications, the current study presents that, 22%, 70%, and 8% of the studied sample hadnursing diploma, technical nursing institute and Bachelor degree of nursing respectively. In relation to mean of their years of experience the sametable shows that,mean and SD 9.9 ± 8.5. Meanwhile, 78% of the studied sample is working in different critical care units; (general ICUs, stroke unit, emergency unit, CCU, vascularunits respectively. While, 14% and 8% is working in medical and surgical wards respectively.

Table (2): Satisfactory of knowledge as related to Oxygen Therapy among Nurses under the Study (n=50)

Assessment items	No.	%
Aims of administering oxygen therapy	27	54
Indications of oxygen therapy	8	16
Methods of assessing oxygen saturation in the blood	29	58
Precautions during administering oxygen therapy	40	80
Nursing interventions during oxygen therapy	25	50
Definition of oxygen toxicity	15	30
Signs and symptoms of oxygen toxicity	13	26
Complications of oxygen toxicity	9	18
Medical treatment of oxygen toxicity	22	44
Nursing interventions in case of oxygen toxicity occurrence	21	42

With regard to knowledge related to oxygen therapy in this study,table (2) presents that, 54%, 58%, 80%, and 50% of the studied sample had satisfactory level knowledge in relation to knowing aim of administering oxygen therapy, different methods used to assess oxygen saturation in the blood, precautions should be taken during administering oxygen therapy, and nursing interventions regarding administering oxygen therapy respectively.

In relation to nurses' knowledge about oxygen toxicity, the same table reveals that, 30%, 26%, 18%, 44%, and 42% of the studied sample had satisfactory level of knowledge about; definition of oxygen toxicity, signs and symptoms of it, complications that could result from oxygen toxicity, medical treatment that could be done for those patients, and nursing interventions for patients in case of oxygen toxicity occurrence respectively.

Table (3): Distribution of Nurses' practice throughout administering oxygen therapy under the study (n=50)

Assessment item	Done		Not done	
	No.	%	No.	%
Before administering oxygen therapy:				
Verify physician prescription before administration	12	24.0	38	76.0
Wash hands	12	24.0	38	76.0
Prepare needed equipment	13	26.0	37	74.0
Introduce yourself to the patient	7	14.0	43	86.0
Identify the patient	10	20.0	40	80.0
Explain procedure to the patient	8	16.0	42	84.0
Disinfect hands	6	12.0	44	88.0
Wear disposable gloves	7	14.0	43	86.0
Total Before = 8 * 50 = 400	**75**	**18.7**	**325**	**81.3**
During administering oxygen therapy:				
Assess patient's oxygen saturation	13	26.0	37	74.0
Assess patient's respiratory status for normal and abnormal findings	10	20.0	40	80.0
Connect flowmeter to the oxygen supply	29	58.0	21	42.0
Fill humidifier with suitable amount of distilled water	34	68.0	16	32.0
Open oxygen supply before connecting oxygen device to the patient	35	70.0	15	30.0
Connect oxygen device to the oxygen setup with humidification.	36	72.0	14	28.0
Adjust flow rate of oxygen according to prescribed rate	36	72.0	14	28.0
Connect oxygen therapy device to the patient appropriately.	37	74.0	13	26.0
Connect tubing over and behind each ear with adjuster comfortable to patient.	41	82.0	9	18.0
Place tubing around the patient's head with the adjuster at the back or base of the head	42	84.0	8	16.0
Place gauze pads at ear beneath the tubing, if necessary.	45	90.0	5	10.0
Adjust the fit of the device; tubing to make patient feel comfort	44	88.0	6	12.0
Reassess the patient's respiratory status	28	56.0	22	44.0
Total During = 13 * 50 = 650	**430**	**66.1**	**220**	**33.8**
After administering oxygen therapy:				
Discard used equipment	46	92.0	4	8.0
Remove gloves	42	84.0	8	16.0

Wash hands	44	88.0	6	12.0
Document date and time of connecting oxygen therapy,	46	92.0	4	8.0
Assess patient's condition before and after intervention to assess any improvement in patient's status.	47	94.0	3	6.0
Total after = 5 * 50 = 250	**225**	**90**	**25**	**10**

Table (3) reveals that, only 18.7% of the studied sample didall nursing interventions before administering oxygen therapy completely. Meanwhile, 66.1% of themdid all the nursing interventions during administering oxygen therapy completely. With regard to nursing interventions after administering oxygen therapy, the same table shows that,90% of the studied sample did themcompletely.

Table (4): Overall Nurses'Knowledge about Oxygen Therapy under the Study (n=50)

Assessment items	No	%
Satisfactory knowledge (≥75%)	3	6
Average knowledge (60% to <75%)	9	18
Unsatisfactory knowledge (< 60%)	38	76
Total	**50**	**100**

Table (4) represents that, 76%, of the studied sample had unsatisfactory level of knowledge in relation to administering oxygen therapy. While, only 6% and 18% of the studied sample havesatisfactory and average levels of knowledge regarding administering oxygen therapy respectively.

Table (5): Overall Nurses' Practices about Administration of Oxygen Therapy under the Study (n=50)

Assessment items	No	%
Adequate practices (≥75%)	9	18
Average practices (60% to <75%)	20	40
Inadequate practices (< 60%)	21	42
Total	**50**	**100**

Table (5) indicates that, 18%, of the studied sample had adequate level of practices in relation to administering oxygen therapy. Meanwhile, 40%, and 42% of them had average and inadequate levels of practices respectively.

Table (6): Barriers affecting a Safe Administration of Oxygen Therapy as reported by the Nurses under the Study (n=50)

Items	No.	%
Lack of knowledgerelated to oxygen therapy as; aim, indications, precautions	32	64
Unfamiliar by using different oxygen devices	26	52
Lack of awareness related to patient's follow up mechanisms for assessing oxygen saturation in blood.	34	68
Lack of training courses	43	86
equipment and supplies	37	74
Lack of periodic maintenance of equipment/devices	47	94
Unavailability of standardized protocol for oxygen therapy	50	100
Unclear and incomplete written prescription for oxygen therapy.	46	92
Oral prescription to oxygen therapy only	27	54

Table (6) shows that, some barriers were reported by the nurses under study as follows; 64%, 52%, and 68%, of themmentioned that, lack of knowledge related to oxygen therapy, being unfamiliar by using different oxygen devices, and lack of awareness about patient's follow up mechanisms while receiving oxygen therapy respectively. Meanwhile, 86%, 74%, 94%, and 100% of the studied sample stated that, lack of training courses, lack of equipment/supplies, lack of periodic maintenances, not well functioning equipment, and unavailability of standardized protocol for oxygen therapy affect on administration of oxygen therapy to their patients respectively.

Table (7): Relation between Demographic Data of the Studied Sample and theirKnowledge inrelation to Administering Oxygen Therapy (n=50)

Demographic data	Knowledge levels						X^2	P value
	Satisfactory		Average		Unsatisfactory			
	No	%	No	%	No	%		
Gender:								
Male	0	0.00	1	16.6	5	83.3	0.464	0.793
Female	3	6.8	8	18.1	33	75		
Age (in years)								
20 – <30	2	8	6	24	17	68		
31 – < 40	0	0.00	0	0.00	12	100	63.575	0.010*
41 – < 50	0	0.00	3	37.5	5	62.5		
51 – < 60	0	0.00	0	0.00	2	100		
61 +	1	33.3	0	0.00	2	66.6		
Qualifications:								
Diploma nurse	0	0.00	0	0.00	11	100	19.286	0.001*
Technical Institute of Nursing	1	2.8	9	25.7	25	71.4		
Bachelor	2	50	0	0.00	2	50		
Experience (in years):								
1 – < 10	2	6.0	6	18.1	25	75.7		
11 – < 20	0	0.00	2	16.6	10	83.3	30.752	0.161
21 – < 30	1	25	1	25	2	50		
31 +	0	0.00	0	0.00	1	100		
Department:								
ICU	2	5.1	8	20.5	29	74.3	2.337	0.674
Medical	1	14.2	1	14.2	5	71.4		
Surgical	0	0.00	0	0.00	4	100		
Working Shift:								
Morning	3	6.1	9	18.3	37	75.5	0.322	0.851
Night	0	0.00	0	0.00	1	100		

Table (7) shows that, there were statistically significant relations between level of knowledge of the studied sample and their age as well as their qualification at P= 0.010 and 0.001 respectively. While, the current study proved that, there were no statistically significant relations between level of knowledge and gender, years of experience, working place, andworking shift.

Table (8): Relation between Demographic Data of the Studied Sample and their Practices in relation to Administering Oxygen Therapy (n=50)

Demographic data	Level of practices						X^2	P value
	Adequate		Average		Inadequate			
	No	%	No	%	No	%		
Gender:								
Male	0	0.00	2	33.3	4	66.6	2.291	0.318
Female	9	20.4	18	40.9	17	38.6		
Age (in years)								
20 – <30	5	20	8	32	12	48		
31 – < 40	1	8.3	4	33.3	7	58.3	37.112	0.601
41 – < 50	2	25	5	62.5	1	12.5		
51 – < 60	1	50	0	0.00	1	50		
61 +	0	0.00	3	100	0	0.00		
Qualifications:								
Diploma nurse	0	0.00	1	9.0	10	90.9	32.080	0.000*
Technical Institute of Nursing	5	14.2	19	54.2	11	31.4		
Bachelor	4	100	0	0.00	0	0.00		
Experience (in years):								
1 – < 10	7	21.2	12	36.3	14	42.4		
11 – < 20	1	8.3	6	50	5	41.6	16.192	.881
21 – < 30	1	25	2	50	1	25		
31 +	0	0.00	0	0.00	1	100		

Department: ICU Medical Surgical	 7 2 0	 17.9 28.5 0.00	 14 4 2	 35.8 57.1 50	 18 1 2	 46.1 14.2 50	3.343	0.488
Working Shift: Morning Night	 9 0	 18.3 0.00	 19 1	 38.7 100	 21 0	 42.8 0.00	1.531	0.465

In the present study, table (8) reports that, there wasa statistically significant relation between level of practice of the studied sample and their qualifications. Meanwhile, the current study proved that, there were no statistically significant relations between level of practice and gender, age, years of experience, department, andworking shift among the studied sample.

IV. Discussion

It is essential to provide optimal oxygen therapy to patients who need it, and for most of the patients the major risk is giving insufficient oxygen therapy that can lead to cardiac arrhythmias, tissue damages, renal damage and eventually cerebral damage.

In the present study there were 50 nurses were included, the majority of them were females and halfof them their age ranged between 20 to less than 30 years. More than two third of them graduated from technical institute of nursing, and two third of them have less than 10 years of experience.

The current study stated that, slightly more than half of the studied sample had satisfactory level of knowledge in relation to some items related to administration of oxygen therapy as; aim of administering oxygen therapy, different methods used to assess oxygen saturation in the blood, as well nursing interventions for the patients who are receiving oxygen therapy. Meanwhile, the majority of the studied sample had satisfactory level of knowledge regarding to precautions that should be taken during administration of oxygen therapy. In addition, this study reported that, less than one fifth of the studied sample had satisfactory level of knowledge in relation to indications of oxygen therapy, and slightly more than quarter in relation signs and symptoms of oxygen toxicity and less than fifth for its complications.

These resultscould be attributed to lack of education, lack of awareness about seriousness of oxygen therapy, shortage of the nursing staff in comparison to the number of patients. In agreement with this finding,***Dogan, & Ovayolu, (2017),Goharani et al., (2017)***in a very recent study stated that, to ensure safe and effective administration of oxygen therapy, the nurses should have proper knowledge and sufficient understanding of it.

The present study results stated that, almost one quarter of the studied sample their level of knowledge allocated between satisfactory and average levels. Meanwhile, slightly more than two third of them had unsatisfactory level of knowledge in relation administration of oxygen therapy. These findings may be attributed to; lack of continuous education, lack of awareness about seriousness of oxygen therapy, shortage of nursing staff in comparison to the number of admitted patients. This finding is in the same context with that ***Hemati et al; (2016),*** who mentioned that, unsatisfactory nurses' knowledge level could result from shortage of nursing staff, failure to attend training courses, lack of up-to-date knowledge resources. In addition, ***Cousins et al; (2016)*** stated that, presence of knowledge practice gab is a common phenomenon among health team members. In addition, ***Katsenos & Contantopoulos (2011)*** indicated that, formal training about appropriate oxygen therapy is an essential for improving nursing skills.

This study finding showed that, only less than fifthof the studied sample did all general preparation steps before administrating oxygen therapy completely, while almost three quarter of them did all steps that should be done to connect patient with oxygen, and the majority of them did the steps after finishing oxygen therapy completely.

Thisresult may be due to that; the nurses are not fully aware by the importance of all steps in the three stages before, during and after oxygen therapy, as they thought that the preparation steps and finishing steps are not important to be done, and they might not know how proper preparation and finishing of the proceduresswill affect positively on the patient's condition. These findings are in the same line withthose of ***Kord et al; (2015)and Shehab et al; (2016),*** who mentioned that, lack of training programe to improve nurses' awareness about the importance of could be a cause for this result. In addition, ***Doyle and McCutcheon, (2015),***clarifiedthat,there are many benefits related to oxygen therapy, as well, there are also hazards and side effects. Therefore, all health team members involved in the administration of oxygen should be aware of all steps that should be done for the patient throughout the process of administrating oxygen.

The present study revealed that, the entirestudied sample reported that, there are some barrierswhich could affect safe administration of oxygen therapysuch as unavailability of standardized protocol about oxygen therapy. As well,the majority of them reported that, there are other barriers affecting safe administration of

oxygen therapy as; lack of training courses, lack of periodic maintenance for equipment used for oxygen therapy, absence of complete and readable written prescription for oxygen therapy.

These results might have happened due to that both physicians and nurses were not aware that oxygen therapy should be considered as drug so all administration steps and doses should be written completely in order to maintain patient safety and obtain proper benefits from oxygen therapy. This finding is supported by that of ***Goharani et al., (2017),Gunathilake et al., (2014)***who recently indicated that, all health team members specially nurses should be given special attention to written prescription rather than oral prescription for oxygen therapy, as well, prescribing right oxygen dose, right flow rate, right devices according to the patient's condition, and right monitoring method for patient's oxygen saturation in order to maintain safe oxygen therapy. In addition, ***Cousinset al. (2016)*** stated that, knowledge of oxygen therapy and the equipment used to deliver oxygen may also be barriers to optimal administration.

These study findingsrevealed that, there were statistically significant relations between age of the studied sample as well as their qualifications and their level of knowledge. With regard to the relation of the remaining items of demographic characteristics of the studied sample and their level of knowledge, the current study reported that, there were no statistically significant relations between genders, years of experience, work place, and nurses' level of knowledge. This finding is interpreted as; when the nurses are getting older this means that they gain too much knowledge in different nursing skills. In agreement with this finding is ***Padma & Lakshmi (2016),***mentioned that, work place has significant effect on nurses' knowledge level.

As well, this study indicated that, there was a statistically significant relation between qualifications of the studied sample and their level of practices. Meanwhile, the finding of this study showed that, there were no statistical relations between gender, age or years of experience, work place, and level of practices among the studied nurses. This finding is interpreted as; the better the qualification the better nurses' performance.In disagreement with this result,***Hemati et al, (2016),*** stated that, in this study there was a significant correlation between age and nurses' practices, but education, and work shift were not correlated with nurses' practices,similarly, with ***Kord et al;(2015),***whoclarified that nurses' age was directly and significantly correlated with the adherence rate to standardized protocol of oxygen therapy.

V. Conclusion

This study concluded that, a minority of the studied sample had satisfactory level of knowledge and less than fifth had adequate level of practices. In relation to the barriers that might affect safe administration of oxygen therapy; the entire studied sample reported that, there is no any protocol for oxygen therapy that could be followed. As well, the majority of them reportedlack of training courses, unavailability of well-functioning equipment and incomplete written prescription for oxygen therapy which are the most serious barriers facing them. Finally, the current study proved that, there was a statistically significant relation between nurses' age and their qualifications, as well between their qualifications and their levels of practices in relation to administering oxygen therapy.

VI. Recommendations:

Based on the findings of the current study, it is recommended that, to ensure appropriate use of oxygen therapy by nursing staff, the hospital authority should establish training courses, workshops, continuous educational programs to ensure safe administration of oxygen therapy and standard quality of nursing care for patients receiving oxygen therapy. In addition, oxygen therapy protocol should be implemented in order to guarantee that the nurses are administering oxygen therapy safely.

Limitation of the study:

This study was conducted using a limited sample size, so the results may not be generalized for other hospitals.

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