

Oxygen Desaturation and Nursing Practices in Critically Ill Patients

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Abstract

Background: With the goal of optimizing tissue perfusion and maintaining adequate oxygen delivery, nurses play an important role in monitoring oxygenation and ventilation. Nursing practices may affect oxygen saturation in critically ill patients.

Aim of study was to determine the relationship between nursing practices and oxygen desaturation in critically ill patients.

Design: A descriptive research design was used in this study.

Setting: The study was conducted at the Critical Care Units (CCUs) of two selected Hospitals at Makah Al-Mukaramah, KSA.

Subjects; a convenience sample of 100 newly admitted critically ill patients were included in the study.

Tool of data collection was the relationship between nursing practices and oxygen desaturation in critically ill patients' tool. It consists of two parts: Part 1; nursing practices observation checklists and part 2; oxygen saturation monitoring record.

Results: It was noted that in 67% of observations, patients had their position changed by nurses once per shift, no patients had hyperoxygenation during suctioning. In addition, there were significant correlation between oxygen desaturation during, and after bathing ($r .403, p.000, r .342, p .000$).

Conclusion; nursing practices mainly suctioning, positioning and bathing affect oxygen desaturation in critically ill patients. There were significant relationships between oxygen desaturation and the procedures performed as oxygen saturation decreased during and after certain performed procedures especially suctioning.

Recommendations: Protocols should be developed regarding oxygen desaturation in critically ill patients. Adequate supervision should be provided on nurses during their practice.

Key words: Nursing practices - oxygen desaturation- critically ill patients.

I. Introduction

Critical care units (CCUs) are special departments in hospitals that provide care to patients with the most severe and life-threatening illnesses and injuries, which require constant, close invasive monitoring and support from specialist, equipment and medication in order to ensure normal body functions. Critical care nurses (CCNs) are responsible for the identification, intervention and management of clinical problems to improve care for patients and families. Foremost, CCNs are patients advocate. The American Association of Critical Care Nurses (AACN) defines advocacy as respecting and supporting the basic values, rights and beliefs of critically ill patients. In this role, critical care nurses safeguard the quality of care the patient receives and prevent the occurrence of potential complications⁽¹⁻³⁾.

A crucial goal in the care of critical patients is the maintenance, optimization of cellular, and organ health. Cellular health relies on aerobic metabolism to release energy. Oxygen saturation is an indicator of the percentage of hemoglobin saturated with oxygen at the time of the measurement. Oxygen desaturation (O_2 saturation < 95 %) occurs when tissue oxygen delivery is low enough to cause abnormal function. Tissue oxygenation depends on the arterial oxygen content of blood and the delivery of the blood to the tissues (perfusion). These are vital components to cellular health and monitoring of these components provides the health care team with a means to assess patients' status, and thus guide appropriate management "what one can measure, one can manage"⁽⁴⁾.

The more critically ill patients are, the more likely to be highly vulnerable, unstable and complex, thereby requiring intense and vigilant nursing care. CCUs' patients may develop oxygen desaturation during their hospital stay^(5,6). During hospitalization, maintaining oxygen saturation (SpO_2) is critical to the safety of patients. Patients are at risk for dysrhythmia, hemodynamic decomposition, hypoxic brain injury and death when desaturation below 70%. Critically Ill Patients with and without respiratory disorders may develop oxygen desaturation during their hospital stay. Many researchers reported the link between oxygen desaturation and

increased mortality in CCU⁽⁶⁻⁹⁾. In a study, of Smith et al. ⁽⁷⁾ the researcher reported that mortality rates increased in hospitalized patients with SpO₂ < 96%. In addition, increased mortality in emergency care patients has also been found with a low SpO₂. Therefore, SpO₂ may be a good predictor of mortality in patients with a higher frequency of low SpO₂.

Pulse oximetry is a device that enables the noninvasive measurement of oxygen saturation, as a “fifth vital sign” in clinical assessment. Pulse oximetry can detect changes in oxygen saturation rapidly, thus providing an early warning of dangerous hypoxemia therefore, it can be a useful aid to clinical decision-making, but is not sufficient for diagnosis nor a substitute for a clinical assessment by itself. Arterial blood gas measurements remain the gold standard for measurement of oxygen saturation. Using of pulse oximetry for patient assessment and monitoring is well established in critical care, emergency departments and anesthesiology ⁽¹⁻³⁾.

There are many factors affect the oxygen therapy given to patients and lead to desaturation. Oxygen transport to tissues depends on factors such as cardiac output, arterial oxygen content, concentration of hemoglobin, and metabolic requirements. These factors should be taken into considerations when oxygen therapy is administered. Nursing practices, which are performed to maintain circulation and improve ventilation, can decrease patients' saturation. These practices include suctioning the airway, positioning, turning, and bathing ⁽¹⁻³⁾.

In a study aimed to evaluate the safety of mobilizing critically ill patients, sitting patients on the bed resulted in oxygen desaturation (SpO₂<80%)⁽¹⁰⁾. In another study, desaturation of more than 5% occurred in 6% of patients when performing patients' positioning and turning ⁽¹¹⁾. Routine suctioning via tracheal tubes maintains airway patency, facilitates the removal of airway secretions, and prevents pulmonary infection. However, tracheal suctioning is associated with many adverse effects including decreased oxygen saturation. Therefore, it is recommended that patients should be placed on pulse oximeter to assess oxygenation during and following suctioning ⁽¹⁻³⁾. Many studies have indicated that bathing decrease oxygen saturation and increases oxygen consumption in critically ill patients ^(12,13). In a systematic review of 44,597 studies, the researchers found that, oxygen saturation declined significantly from baseline during the bathing ⁽¹²⁾.

These procedures are essential to clear patients' airway, maintain ventilation and oxygenation and prevent infection ⁽¹⁻⁴⁾. However, if nursing procedures were not performed following the standards or the best practices, complications especially desaturation may be developed. There are few researches studied the relation between some of these nursing practices and desaturation in critically ill patients ^(5,6,8,9). Therefore, this study was conducted to determine the relationship between nursing practices and oxygen desaturation in critically ill patients.

Aim of study: was to determine the relationship between nursing practices and oxygen desaturation in critically ill patients.

Research question

What is the relationship between nursing practices and oxygen desaturation in critically ill patients?

II. Materials & method

Design: a descriptive research design was used in this study.

Setting:

The present study was conducted in the Critical Care Units (CCUs) of two selected Hospitals at Makah Al-Mukaramah, KSA namely; general CCU which contains 57 beds and Medical CCU (MCCU) that contains 60 beds. All patients with mechanical ventilation are on sedation protocol as unit policy.

Subjects;

A convenience sample of 100 newly admitted critical patients was recruited for the study. Patients were selected according to the following inclusion criteria; patients of both sexes, aged over 18 years, attached with pulse oximeter to monitor oxygen saturation, have normal hemoglobin level on admission, free from infection, admitted with respiratory failure & on mechanical ventilation, on sedation and the Ramsey scale⁽²⁾ was 5-6 for all patients and stay on CCUs at least for 3 days and classified as level II in the Therapeutic Interventions Score System-28 (TISS-28)⁽²⁾. Exclusion criteria; elderly, patients with carbon monoxide poisoning, hypothermia and poor peripheral perfusion especially in the hands, because these factors can interfere with the accuracy of SpO₂ measurements.

The data collection instrument was the relationship between nursing practices and oxygen desaturation in critically ill patientstool: The researcher developed this tool after reviewing the related literatures ⁽¹⁻⁶⁾ and it was used to determine the relationship between nursing practices and oxygen desaturation in critically ill patients. It consists of two parts:

Part 1; Nursing practices observation checklists; after reviewing the related literatures ⁽¹⁻⁶⁾, checklists were developed to observe patients during performance of nursing practices. This part includes observation of selected nursing practices that could lead to oxygen desaturation in critically ill patients, which are bathing, positioning, turning and suctioning. It includes observation of nurses' performance on positioning, different positions, turning patients, repositioning, suctioning (technique of suctioning, provision of oxygen before, during and after suctioning) , bathing; timing and duration of procedures, patients' response, temperature of water used in bathing, position during central venous pressure (CVP) measurement, duration of measurement were observed.

Scoring system: The observed performance was recorded using a scale of as done correctly (DC), done incorrectly (DIC) and not done (ND). A high score indicates proper practice. Proper practice was considered when the score is more than or equal 75% of total score while improper practice was considered when the score is less than 75% of the total score.

Part 2; Oxygen saturation monitoring record: The researcher developed this tool after reviewing the related literatures ⁽¹⁻⁶⁾ and it was used to monitor patient's oxygen saturation. It includes monitoring of patients' data also as vital signs, ventilator data and oxygen saturation. Oxygen saturation was monitored using pulse oximeter for all patients. Monitoring was done before, during and immediately after procedures performed and recorded in numerical forms as measured. In addition, data related to patients' characteristics as age, sex, diagnosis, date of admission were collected.

Tool preparation, validity and reliability:

Study tool was developed after reviewing the related literatures ⁽¹⁻⁶⁾. The current study tool was submitted to five academic nursing experts in the critical care & emergency nursing to check the face and content validity of the tool, necessary modifications were carried out according to the academic nursing experts' judgment on clarity of sentences and the appropriateness of the content. Tool reliability was tested using internal consistency methods (Alpha Cronbach test). Its result was 0.851 which indicates an accepted reliability of the tools.

Pilot study

A pilot study was conducted on (10%) of patients. They were selected from the previously mentioned study settings according to inclusion criteria to assess the current study tools for its clarity, validity, applicability and the time required to fill the tool. Necessary modifications of the tool were done according to pilot results to reach the finalized form. The subjects who included in the pilot study were excluded from the total study sample.

Procedure

The study was achieved through two parts namely; observation and monitoring. This study started from the beginning of June to the end of October 2014. The researcher began with providing clear description about the nature, aim and purpose of the current study to the critical care unit administrators and nurses. Each nurse was informed that sharing in this study is voluntary. Collection of the required data was carried out through observing nurses' practices and monitoring patients' oxygen saturation.

Observing nurses' practices

The purpose of this part was to observe patients during performance of selected nursing practices that could lead to oxygen desaturation in critically ill patients. It contained observing several practices, which are bathing, positioning, turning and suctioning. It includes observation of positioning, different positions, turning patients, repositioning, suctioning (technique of suctioning, provision of oxygen before, during and after suctioning), (bathing; timing and duration of procedures, patients' response, temperature of water used in bathing), position during central venous pressure (CVP) measurement, duration of measurement. Four research assistants served as observers of practices performed by nurses in the critical care units. The researcher trained these observers. A week before the start of the study, training of research assistants on observations was carried out in the two units, using part 1 of the tool. Instructions were given for observers to not interfere with care provided. Inter-observer consistency above 90% was established before the start of observation phase. Observing nurses'

performance of procedures for critically ill patients were done once daily for a whole shift (= 12 hours) using part 1 of the tool for three consecutive days.

Monitoring of patients' oxygen saturation

Newly admitted patients were enrolled in the study according to the previously mentioned inclusion criteria. To maintain uniformity in collected measures, the pulse oximeter was placed on the index finger of the right hand of all selected patients. Then, the researcher recorded the base line data of patients' oxygen saturation using part 2 of the tool. Patients were observed during performance of the selected procedures performed by nurses, which were bathing, positioning, turning and suctioning (all patients were suctioned using open suction method). The researcher recorded patients' data (oxygen saturation) using part 2 from the tool before, during and immediately after the procedures performed. Data collection took approximately 5 months from June to October 2014.

Administrative design and ethical considerations

The study conducted over a period of 5 months from the beginning of June to the end of October 2014. Permission from the directory of ICU in the selected hospitals was obtained to conduct the study after providing explanation of the aim of the study. Informed written consent was obtained from each conscious patient or from the responsible person (if unconscious patient), it included the aim of the study, potential benefits, risks and discomforts from participation. The confidentiality, anonymity & privacy of responses were assured. The right to refuse to participate in the study was emphasized to subjects.

III. Statistical Analysis:

Data were coded and transformed sheets then were entered into the SPSS package version 19. Analysis and interpretation of data were done using the followings; Frequency, mean and standard deviation and t-test were used to test the significance of results of quantitative variables. P value was considered significant when p. value is less than 0.05 and when p value less than or equal 0.01 is considered highly significant.

IV. Results:

Table 1 shows that 47% of patients were between 51- 60 years; regarding gender 70% of patients were male. All patients were on mechanical ventilator (FiO₂ was 40-60%). There is no significant differences among patients regarding Ramsey Scale or TISS score. **Figure (1) shows the distribution of procedures performed to critically ill patients by nurses.** Regarding bathing, it was observed that about 62% of bathing procedures were performed using tap water. As for positioning, it was observed in 30 % of observations, patients were not positioned laterally. As for changing patients' position, it was noted that in 67% of observations patients had their position changed by nurses once per shift. When performing suctioning, it was observed that in 84% of observations, nurses didn't administer 100% O₂ before suction, no patients had oxygen during suctioning, while in 59% of observations nurses applied suction intermittently, and in 76% of observations nurses didn't administer 100% O₂ after suction.

Table 2 (a & b) shows the duration of each procedure (time taken for each procedure performed for critically ill patients by nurses), it was observed that the 98% of bed bathing lasted between (10-20) minutes, while 64% of changing patients 'position lasted (<10)minutes the mean duration 6.70 minutes , also it was observed that 91% of suction procedures lasted (<10)minutes with the mean duration 3.78 minutes which is a long duration ,and 38% of CVP measuring lasted between(10-20)minutes with the mean duration 14.22 minutes. There were negative correlation between the duration of bathing & suctioning and the level of oxygen saturation (r .265, p .009 and (r .281, p .027) respectively.

Table 3 Shows the relationship Between Nursing Practices and oxygen desaturation in critically ill patients. There were significant relationships between oxygen desaturation and the procedures performed as oxygen saturation decreased during and after procedures performed especially with suctioning. In addition, there were significant correlation between oxygen saturation during, and after bathing (r .403, p.000, r .342, p .000), oxygen saturation and during measuring CVP (r 0.261, p .009) oxygen saturation and during changing patients' positions (r.244, p.014) and oxygen saturation during and after suctioning (r .383, p .000, r .298, p.003) respectively which ** were significant at the 0.01 level and *at the 0.05 level.

Table (1) distribution of critically ill patients by their demographic characteristics

Item	Characteristics (no = 100)	No.	%
Gender	Male	70	70
	Female	30	30
Age (year)	18-30	12	12.0
	31-40	8	8.0
	41-50	33	33.0
	51-60	47	47.0

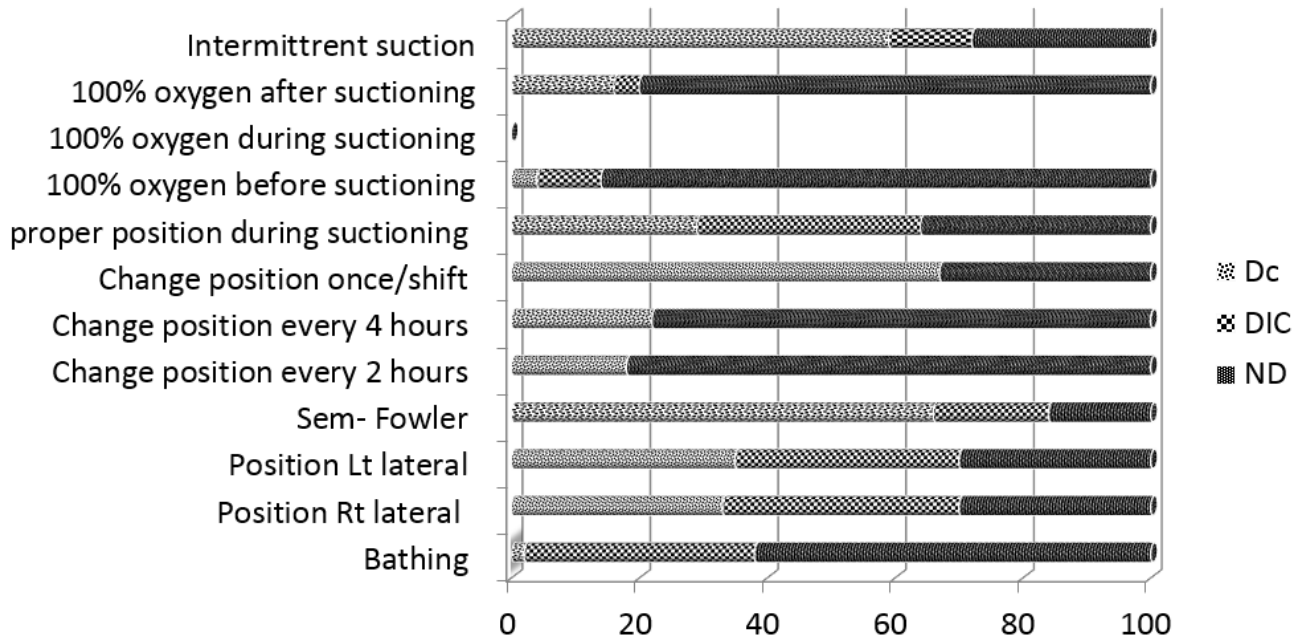


Figure (1) distribution of procedures performed to critically ill patients by nurses
Key words: (DC) done correctly - (DIC) done incorrectly - (ND) not done

Table (2-a) Duration of procedures performed to patients by critical care nurses

Procedure	Duration						Mean duration in minutes Mean ± SD	t/p
	<10 minuets		10-20 minuets		>20 minuets			
	No.	%	No.	%	No.	%		
Bathing	0	0.0	98	98.0	2	2.0	10.30±1.36	t = 550.4797 p<0.0001**
Changing position/turning	64	64.0	35	35.0	1	1.0	6.70±3.91	t = 166.4191 p<0.0001**
Suctioning	91	91.0	9	9.0	0	0.0	3.78±3.27	t = 176.2753 p<0.0001**
Supine position for measuring CVP	8	8.0	38	38.0	54	54.0	14.22±9.68	t = 82.4662 p<0.0001**

*significant at p < .05

**highly significant at p < 0.01

Table (2-b) Correlation between duration of procedures performed to patients by critical care nurses and oxygen saturation

Duration of procedures	SpO2	
	r	p
Bathing	.265 - **	.009
Changing position	.178	.280
Suctioning	.281-*	.027
Supine position for measuring CVP	.252	.054

** . Correlation is highly significant at the 0.01 level. , * . Correlation is significant at the 0.05 level.

Table (3) The Relationship Between Nursing Practices and Oxygen Desaturation in Critically Ill Patients.

Procedures	Spo2 reading			t test	p-Value
	Before	During	After		
Bathing	96.00±2.8	94.5±2.12	94.50±0.7	t1 = 4.2710*	P≤0.0001
Pearson Correlation	.177	.403**	.342**	t2 = 5.1972*	
Sig.	.077	.000	.000		
Positioning (supine position during CVP measurement)	98.33±1.11	95.66±4.12	95.00±1.50	t 1= 6.2575*	P≤0.0001
Pearson Correlation	0.035	0.261 **	.052	t = 17.8453*	
Sig.	.733	.009	.612		
Changing position	96.52±3.07	95.15±2.63	95.15±3.60	t1 = 3.3890*	P = 0.0008 P= 0.0042
Pearson Correlation	.006	.244*	.062	t 2= 2.8956*	
Sig.	.950	.014	.540		
Suctioning	96.57±3.14	90.97±9.28	91.22±3.73	t1 = 5.7161*	P ≤ 0.0001
Pearson Correlation	.047	.383**	.298**	t2 = 10.9728*	
Sig.	.641	.000	.003		

t1 before and during procedures , t2 before and after procedures , t*significant at p < .05.

** . Correlation is highly significant at the 0.01 level. , * . Correlation is significant at the 0.05 level.

V. Discussion

Oxygen saturation is one of the important vital signs to be measured and monitored for critically ill patients. Many factors could contribute to oxygen desaturation; one of the important factors is nursing practices⁽¹⁴⁻¹⁶⁾. This study was conducted to determine the relationship between nursing practices and oxygen desaturation in critically ill patients. There is a relationship between patients' medical diagnosis and oxygen desaturation as many diseases can lead to oxygen desaturation⁽¹⁴⁻¹⁶⁾. Therefore, all patients in the current study were selected as having respiratory failure and on mechanical ventilation. In respiratory disorders, perfusion and/or oxygen are diminished causing hypoxia and oxygen desaturation. As in Creteur⁽¹⁷⁾ study, the level of SpO₂ may drop rapidly in patients with pulmonary disorders. Depending on individual pulmonary, Creteur found that level of SpO₂ might be relatively higher at rest, even though the level drop between the procedures and drops considerably during range of motion exercises or nursing practices⁽¹⁷⁾.

Nursing practices include suctioning, positioning, turning, and bathing can lead to oxygen desaturation. From the current study findings, it was noted that nursing practices mainly suctioning, positioning and bathing might affect oxygen desaturation of critically ill patients. Oxygen desaturation occurred during and after procedures performed especially with bathing and suctioning, during CVP measurement. There were negative correlations between the duration of bathing & suctioning and oxygen desaturation.

Patients with mechanical ventilation need suctioning to keep the airway open through removal of accumulated pulmonary secretions. Suctioning may be needed in patients along the continuum of care⁽¹⁸⁻²¹⁾ and it can be administered 8 to 17 times daily for each patient under mechanical ventilation. Although suctioning is a vital procedure, it may results in complications such as bleeding, tracheal mucosal injury, infection, and increase in intracranial pressure, atelectasis, cardiac dysrhythmia, hemodynamic changes and oxygen desaturation. Afshari et al.⁽²²⁾ stated that low knowledge of nurses about suctioning is the main cause for most of suction complications, despite the evidence-based protocols and instructions.

Oxygen saturation decreased during and after suctioning in the current study, which can be attributed to many reasons; tracheal suctioning is an invasive and blind, procedure, therefore, patients need to be hyper-oxygenated before, during and after suctioning that was lacking in the current study. In addition, nurses took a long time in performing suctioning as noted from the observations while patients are away from oxygen support, which resulted in desaturation. Therefore, suctioning may be considered as detrimental when it cause physiological derangement for patients such as reduced SpO₂.

The current study results is in agreement with the study of Jiang et al⁽¹⁹⁾ who found significant differences in SpO₂ during suction that can lead to arrhythmia. Jansson et al⁽²⁰⁾ assessed the effect of suctioning on oxygen saturation and carbon dioxide (CO₂) in the arterial blood. No significant fall in PaCO₂ was noted in patients but there was a highly significant drop in oxygen saturation when patients were suctioned until they were clinically clear of tracheobronchial secretions⁽²¹⁾. Jansson et al suggested that nurses should be aware of the marked drop of oxygen saturation during prolonged suctioning and the potential dangers associated with this drop⁽²⁰⁾.

The current study findings are in agreement with the study of Eastwood, Connel, and Considine⁽²³⁾ who observed the nursing practice over the three quarter hours of the day. Researchers stated that the management of oxygen therapy varied between nurses reflected that nurses did not always promote effective oxygenation as documented SpO₂ was high and observed SpO₂ was less than documented. Episodes of desaturation occurred while suctioning were administered and nurses did not always respond appropriately⁽²³⁾.

Hyperoxygenation is the increasing in oxygen concentration to 100% for a short period before, during and after suctioning. Before and after suctioning hyperoxygenation should be used to prevent oxygen desaturation especially in critically ill patients^(5-7,18). In the current study, hyperoxygenation was applied during suctioning in only four percent of observations of suction performed by nurses. These study findings are similar with the results of Kelleher and Andrew⁽²¹⁾ who stated that critical care nurses do not adhere to the best practice recommendations when performing suctioning like hyperoxygenation and infection control practices⁽²¹⁾. In the same line, Overend⁽²⁴⁾ found that levels of partial oxygen pressure, and oxygen saturation were significantly higher in patients who received hundred percent oxygen for one minute before and after suction. In patients who did not receive hundred percent oxygen before and after suctioning, falls in partial oxygen pressure and oxygen saturation were noted but were not significant⁽²⁴⁾.

Based on the Grading of Recommendations Assessment, Development, and Evaluation (GRADE), criteria, it was recommended that; in preparation for the suctioning event (suction pass), delivery of 100% oxygen in adult patients for 30– 60 seconds prior to the suctioning event is suggested and this can be accomplished using an Manual Rebreathing Bag (MRB) or the ventilator. If the ventilator method is used, preoxygenation must last at least 2 minutes. Return to the previous oxygen setting should be done after suctioning is completed. A positive end-expiratory pressure (PEEP) attachment should be on the MRB at the appropriate setting, or in-line suctioning should be used in patients who do not tolerate suctioning with hyperoxygenation to avoid loss of PEEP and desaturation⁽²⁾.

Prolonged suctioning can lead to severe hypoxemia, hemodynamic instability, and ultimately cardiac arrest. Therefore, hyperoxygenation before and after each subsequent pass of the catheter for at least 30 seconds, and before reconnection to the ventilator is recommended. It is recommended that to hyper-oxygenate the patient for at least 1 min after each suction event by following the same technique(s) used for pre-oxygenation. As for the duration of each suctioning event, aspiration of secretions should not exceed 10 to 15 seconds and in patients with tracheostomy, suction should be performed for a briefer period of 3 to 5 seconds because of the very short device⁽²⁾.

In Afshari et al⁽²²⁾. conducted a study to compare the effects of the open and closed system suctioning methods on percentage of oxygen saturation in patients under mechanical ventilation. In this study, hyperoxygenation were done for all patients for two minutes by 100% oxygen before and after suctioning procedure, and suctioning was performed one time (ten seconds). The researchers found a significant difference in arterial oxygen saturation between the open and closed methods and the percentage of oxygen saturation showed a more reduction in open suctioning method compared with closed system.

Body positions affect oxygenation especially in critically ill patients as positioning and mobilization of patients contribute to improved oxygenation, secretion removal, and airway patency. Studies demonstrate improved oxygenation in patients with acute respiratory failure who were placed in the prone position, which is attributed to recruitment of collapsed lung areas related to body position change, allowing dependent lung regions to have improved perfusion and ventilation. However, prone positioning involves multiple personnel and specialized beds or equipment, and only specially trained staff to prevent the many complications related to prone positioning which is not available in many hospitals should perform it⁽²⁶⁻²⁹⁾. Therefore, mobilization in critical care units in many hospitals include mainly; semi-fowler position, lateral positions (right and left) and turning.

Al-Tawfi et al⁽²⁹⁾ stated that patients with mechanical ventilation benefit from having the head of the bed (HOB) elevated 30 degrees at all times as it promotes lung expansion, prevent ventilator-associated pneumonia (VAP) and prevent the aspiration that can occur in the recumbent position in intubated patients. In addition, keeping the HOB elevated 30 degrees, is included in the ventilator bundle to prevent VAP. Göcze et al (2013)⁽²⁶⁾ studied the impact of the semi recumbent position on hemodynamic status in critically ill patients. The results suggested that patients at risk might need positioning at 20° to 30° to overcome the negative effects of improper positioning, especially in the early phase of intensive care unit admission⁽²⁶⁾.

In a study of Scholes and Albarran⁽²⁵⁾ which aimed to determine the effect lateral position on oxygenation, no significant change was found in the mean PaO₂, and oxygen saturation, between the supine and decubitus positions in the overall group. However, there was an increase in the mean PaO₂ in the right lateral position than in the supine position. Nine patients who improved in the right lateral position had significantly higher mean PaO₂ during the right lateral position than in the supine position, which are in line with the findings of the current study⁽²⁵⁾.

In a study for Pohlman and colleagues⁽¹¹⁾ who examined the effect of sitting position, turning and other activities on patients receiving mechanical ventilation, researchers found that fifty-three percent of the patients had a positive improvement, as the patients' fraction of inspired oxygen was greater than sixty percent in more than third of all activities. Adverse events occurred in sixteen percent of all activities and included desaturation of more than five to six percent of patients. However, this study affirms that it is safe and feasible to perform in-bed and mobilization very early in a patient's ICU stay even with physiological challenges but monitoring is essential during patients' mobilization.

Critically ill patients positioning remains a nursing intervention for ventilated patients not only to improve oxygenation but also to prevent pressure ulcers. In the current study, patients were not positioned laterally in thirty percent of observations, and patients turning occurred once per shift in sixty seven percent of observations. Repositioning or Turning every 2 hours requires care to avoid desaturation and extubation. Nurses tend to keep patients in semi-Fowler position as long as they can; patients can remain for 6-8 hours in that position, as nurses have the perception that Fowler or Semi-Fowler position is the ultimate position for improving oxygenation. In addition, prolonged positioning in any one-position leaves a patient at risk for developing a pressure ulcer, and turning can result in the dislodging of various tubes or lines. The critical care staff should be well trained in proper positioning, monitoring oxygen saturation and tubes & lines during turning. Ultimately, the critically ill patient should progress to weight bearing positions, sitting up in a chair, and, with physical therapy, to ambulation that improves overall physical reconditioning toward a return into independent functioning.

In the same line, patients in the current study were kept in supine (flat) position for a long period in because of measuring central venous pressure (CVP). Several studies found that CVP measurements are accurate when the HOB is elevated to any angle between 0 and 60 degrees or when the patient is in a 20-degree or 90-degree lateral position with the HOB flat, measurements in all these positions are accurate only when the correct angle-specific reference is used^(2,30-33). Positioning the patient in supine position with head of bed (HOB) between 0 and 60 degrees, lateral position 20, 30 or 90 degrees or prone is performed before central venous pressure (CVP) measurements^(2,30-33).

Head of bed (HOB) elevation can be at any angle from 0 (flat) to 60 degrees if the patient is in the supine position. Ravel et al⁽³⁴⁾ stated that reliable cardiac output (CO) measurements have been obtained only in the supine position with a backrest at 20 or 45 degrees and even in the prone position. In comparison with the flat, supine position using a standardized approach; clinically significant changes in CO may occur in the 20 degree lateral position that may limit concurrent CVP. Therefore, in different positions, the use of position-specific reference is critical to accurate CVP measurement.

Bathing can bring about different effects: on thermal regulation, microbiology, oxy-hemodynamic balance, hospital costs, and client satisfaction. In combination with the lack of in scientific publications about the oxy-hemodynamic effects of bathing on adult critical patients, these factors, explain the importance of bathing in critical care units. In addition, bathing is an intervention that can be viewed from different aspects; hence, bathing can be analyzed as a hyperthermia treatment, thus receiving a treatment aspect, or be investigated as a daily practice essential in nursing activities, and like any other activity as a basic human need that is not free from causing harm to the patients^(12,13).

Therefore, bathing; is an important therapeutic procedure and despite it is little appreciated and discussed in many clinical areas. Bathing affects patients' oxygenation especially in critically ill patients. The analysis of the impact of water temperature during bathing on SpO₂ variation is extremely relevant, because it permits a critical and reflexive evaluation of the technique. Thus, possible side effects of bathing can be minimized, providing high-quality care to critical patients. In addition, some patients' SpO₂ could be improved, which could enhance their recovery process^(12,13,35,36).

From the current study findings, during bathing of more than half of patients the temperature of water was improper and there was a significant drop on SpO₂ during bathing. These study results were in agreement with the study findings of Enferm et al (2010)⁽¹³⁾ who measured the oxygen saturation before, during and after bathing patients in intensive care and found that heated and constant water temperature during the bed bath is able to minimize the fall of SpO₂ that occurs while handling patients during procedures⁽¹⁵⁾. There was an agreement about the initial temperature of bed bathing water for critical patients, ranging from 37°C to 40°C. Environmental temperature play a role during bed bathing as it affects the temperature of the water, and both together affect body temperature in addition to the other physiological and pathological factors, which are peculiar for critical patients, leading to a challenge in maintain patients' hemodynamic stability.

In the current study, 10.30 minutes was the mean duration of bathing. Many studies did not present the duration of bed bathing. However, based on the records of some studies that published the bathing time variable, the global average total bathing time was calculated as 20 minutes and 14 seconds. In a study aimed to compare the traditional basin bed bath with a prepackaged disposable bed bath in terms of time and quality of bath, the researchers found that mean bath times were 12.8 minutes for disposable baths and 14.4 minutes for traditional baths. The effect of bathing duration on oxygen saturation could be attributed to improper water temperature and the long duration on supine flat position during bathing.

Critically care nurses play an important role in care of critically ill patients; fulfilling patient needs especially oxygenation needs and monitoring the critically ill patient oxygenation level. There are many factors that could be assessed and monitored to prevent oxygen desaturation in critically ill patients. Among these factors are the nursing practices performed for the patients. Critical care nurses should have basic knowledge and skills to identify, monitor and prevent the occurrence of oxygen desaturation in critically ill patients.

VI. Conclusion

From the results of this study, it can be concluded that the nursing practice mainly suctioning, positioning and bathing may lead to oxygen desaturation of critically ill patients. There were significant relationships between oxygen desaturation and the procedures performed as oxygen saturation decreased during and after procedures performed especially with suctioning, bathing and CVP measurement. There were negative correlation between the duration of bathing & suctioning and the level of oxygen saturation. There were significant correlation between oxygen saturation during, and after bathing, oxygen saturation and during measuring CVP, oxygen saturation and during changing patients' positions and oxygen saturation during and after suctioning.

Recommendations

It can be recommended that; protocols should be developed regarding oxygen desaturation in critically ill patients. Adequate supervision should be provided on nurses during their practice. The results of this study may guide health care team to improve the quality of care provided for critically ill patients. Guidance should be provided to critical care nurses through workshops to be more knowledgeable about oxygen saturation and factor affecting it. In-service training program should be carried out for all nursing practices to train nurses regarding best practices in procedure performance. For further researches, the same study could be replicated in more hospitals with larger sample size, in different health sectors. A study could be carried out to evaluate the effectiveness of oxygen desaturation on patients' outcome.

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