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Research Article

Knowledge of Staff Nurses about Oxygen Therapy Working in Intensive Care Areas of Universal College of Medical Sciences Teaching Hospital Bhairahawa, Nepal

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Abstract

Background: Oxygen is a lifesaving drug prescribed to treat hypoxemia. Healthcare professionals play vital role in prescribing and administrating oxygen therapy. The staff nurses have very crucial role to play as they monitor regularly and carefully to the patients receiving oxygen therapy. So, staff nurses must have adequate knowledge about Oxygen therapy. Objective of the study was to assess the knowledge of staff nurses of Universal College of Medical Sciences (UCMS), Bhairahawa, Nepal about oxygen therapy.

Methodology: This is a descriptive study conducted in month of October 2019. The open-ended questionnaire comprised of 17 questions was used for collection of data from staff nurses working in adult and elderly intensive care areas of UCMS Teaching Hospital. Data was analyzed using SPSS version 21.

Results: Thirty-two staff nurses participated in the study. Seventy one percent defined FIO_2 correctly; 81% know normal FIO_2, around 59% defined oxygen therapy incorrectly; 62.5% correctly defined supplemental oxygen; 59% considered O_2 as drug; around 56% know when to prescribe O_2; majority know who can prescribe oxygen; most had inadequate knowledge and understanding about indication and contraindication of oxygen therapy; majority had inadequate knowledge about dosage and duration of therapy; majority didn't know normal SpO_2; participants had somewhat knowledge about methods of delivery and Long-term oxygen therapy, had knowledge about adverse effects/toxicity of oxygen therapy; around 78% know what is PaO_2 and 81% know what is SaO_2.

Conclusion: Overall knowledge of staff nurses was inadequate. Hospital authority has to develop training courses, organize workshops and continuous medical educational programs for the nurses to ensure the safe administration of oxygen therapy and standard quality of nursing care for patients receiving oxygen therapy.

Keywords: *Intensive Care; Knowledge, Nurses, Oxygen Therapy*

Introduction

Oxygen is considered as a lifesaving drug. It is included in an essential drug list of World Health Organization (WHO) [1-3]. Oxygen is prescribed essentially for patient having hypoxemia in a wide range of hospitalized patients [1,3].

Oxygen administration to patients particularly of critically ill ones is one of the most essential facets of patient care and one of the core responsibilities of the nurses. The knowledge, good practice and positive attitude of staff nurses about oxygen administration are fundamental components contributing towards optimal care of the patients in order to improve quality of life of the patient, prevent hypoxemia and acute lung injury [4].

The inadequate knowledge regarding oxygen therapy could worsen patient's condition and ultimate outcome especially in critical care situations [1]. Various studies have shown gap in knowledge of staff nurses regarding oxygen therapy [1,3,5].

Objective of the Study

Objective of the study was to assess the knowledge of staff nurses working in adult and elderly intensive care areas of Universal College of Medical Sciences (UCMS), Bhairahawa, Nepal about oxygen therapy.

Methodology

Research question

Do staff nurses working in adult and elderly intensive care areas have adequate knowledge about oxygen therapy?

Study design and settings

This is a descriptive study conducted in Teaching Hospital of Universal College of Medical Sciences (TH-UCMS), Bhairahawa, Nepal.

Sample type and size

A purposeful sampling technique was used to collect data from staff nurses. Thirty-two staff nurses consented to participate in the study.

Data collection tool

The open-ended questionnaire was developed in the light of questionnaire designed and validated by Desalu OO., *et al* [6].

The questionnaire was comprised of 17 questions:

- Question 1: What is FIO_2?
- Question 2: What is normal FIO_2?
- Question 3: What do you mean by oxygen therapy?
- Question 4: What do you mean by supplemental oxygen?
- Question 5: Is oxygen used as a drug?
- Question 6: When to prescribe oxygen?
- Question 7: Who can prescribe oxygen?
- Question 8: What are the indications of oxygen therapy?
- Question 9: What are the contraindications of oxygen therapy?
- Question 10-: In what dosages oxygen used as a medical therapy?
- Question 11: What is duration of oxygen therapy?
- Question 12: What is normal level of oxygen saturation (SpO_2)?
- Question 13: What are methods of delivery for oxygen therapy?
- Question 14: What are adverse effects/toxicity of oxygen therapy?
- Question 15: What do you mean by long-term oxygen therapy?
- Question 16: What is PaO_2?
- Question 17: What is SpO_2?

Data collection

The data was collected in month of October 2019 by three third year residents of internal medicine by visiting individual staff nurse working in adult and elderly medical intensive care unit, surgical intensive care unit and coronary care unit of UCMS.

Ethical consideration

The informed consent was taken from the participants and ethical approval was obtained from institutional review committee of UCMS.

Data analysis

The collected data was checked for completeness, accuracy and consistency. It was entered in IBM SPSS version 21 for analysis. Descriptive analysis was done.

Results

Thirty-two staff nurses participated in the study. Seventy one percent defined FIO_2 correctly; 81% know normal FIO_2, around 59% defined oxygen therapy incorrectly; 62.5% correctly defined supplemental oxygen; 59% considered O_2 as drug; around 56% know when to prescribe O_2; majority know who can prescribe oxygen; most had inadequate knowledge and understanding about indication and contraindication of oxygen therapy; majority had inadequate knowledge about dosage and duration of therapy; majority didn't know normal SpO_2; participants had somewhat knowledge about methods of delivery and Long-term oxygen therapy, had knowledge about adverse effects/toxicity of oxygen therapy; around 78% know what is PaO_2 and 81% know what is SaO_2.

Discussion

The objective of this study was to assess the knowledge of staff nurses working in adult and elderly intensive care areas about oxygen therapy. The findings of responses to each question will be shared and discussed one by one.

Response to question 1: What is FIO_2?

As per The Institute of Health Economics (IHE) report, the definition of FiO_2 is the fraction of inspired oxygen in an inhaled gas or the proportion of oxygen in the air that is inspired [7]. Sharma., *et al.* define FIO2, the fraction of inspired oxygen [8].

The responses of 23 (71.9%) participants were correct, while 9 were incorrect. Fraction of oxygen in inhaled gas, Fraction of oxygen in inspired air, Fraction of inspired oxygen, Fraction of inhaled oxygen or Percentage of inspired oxygen were considered as correct.

Response to question 2: What is normal FIO_2?

The normal FIO_2 is close to 0.21 (21%) as mentioned by Sharma., *et al.* in their article Alveolar Gas Equation and documented in IHE report too [7,8].

The responses of 26 (81.3%) participants were correct and 5 (15.6%) were incorrect, while one mentioned don't know. The FIO_2 21% in room air was considered correct.

Response to Question 3: What do you mean by oxygen therapy?

According IHE Report, Oxygen Therapy is defined as a medically supervised use/provision of pure oxygen, in greater inspired concentration than the ambient/room air (that is, the fraction of inspired oxygen [FiO_2] is greater than 21%), to treat a wide range of health problems [7]. As per 2017 Irish Guidelines, Oxygen Therapy is the administration of oxygen at concentrations greater than that in the ambient air with the intent of treating or preventing hypoxia [9].

None of respondents defined Oxygen Therapy as defined in authenticated documents but 13 (40.6) of the participants mentioned Oxygen Therapy means "Use of oxygen as a medical therapy". Their responses were considered as near correct. Nineteen (59.4%) participants' responses were incorrect.

Response to question 4: What do you mean by supplemental oxygen?

Supplemental oxygen is also known as oxygen therapy, where extra oxygen is prescribed by a physician or any authorized healthcare professional as a form of medical treatment mentioned in the literature [10,11].

Twenty (62.5%) participants' responses were "Extra oxygen to support vital body function" and considered to be correct, while 12 (37.5%) were incorrect.

Response to question 5: Is oxygen used as a drug?

According to 2017 Irish Guidelines, "Oxygen is probably the commonest drug used in the care of patients who present with medical emergencies [9].

Responses of 19 (59.4%) participants were correct and 10 were incorrect (31.3%), while 3 (9.7% didn't respond.

Response to question 6: When to prescribe oxygen?

Oxygen is a treatment for hypoxaemia as mentioned in 2016 British Thoracic Society Guidelines [12]. Masclans JR., *et al.* described "Oxygen therapy is first-line treatment for hypoxaemic acute respiratory failure (ARF)" [13].

The responses of 6 (18.75%) participants were "Hypoxemia, SPO_2 less than 90%" and found to be correct; the responses of 12 (37.50%) participants were If SPO_2 less than 90% and patient feels difficulty in breathing were considered to be near correct. While responses of 14 (43.75%) participants were incorrect.

Response to question 7: Who can prescribe oxygen?

As 2017 Irish Guidelines, Oxygen should be prescribed by a doctor in the patient's drug KARDEX to ensure safe and effective delivery of oxygen therapy to the patient [12]. According to Uttar Pradesh State Oxygen Operational Guidelines, Oxygen can be administered by any qualified nurse, paramedics, doctor, in accordance with policy for administration of medicines [14]. Piryani., *et al.* mentioned "O_2 should be prescribed, administered and monitored by well trained staff. Ideally the oxygen must be prescribed by registered medical practitioner" [15].

The responses of 19 (59.4%) participants were "Doctors, Medical Officer or above, Nurses" and found to be correct; while 11 (34.4%) mentioned "Any Medical Person, Medical Person, All Medical Persons" and considered to be correct. Answers of 2 respondents were incorrect.

Response to question 8: What are the indications of oxygen therapy?

Oxygen is indicated in patient with hypoxemia whatever cause may be with aim to achieve normal or near-normal oxygen saturation for all acutely ill patients except those at risk of developing type II respiratory failure or those receiving terminal palliative care. The target saturation is 94 - 98% for most acutely ill patients or 88 - 92% for patient-specific target range for those who are at risk of developing type II respiratory failure [7,12].

It is observed from the responses of the participants regarding indication of oxygen therapy that they had inadequate knowledge as well as understanding about indication of oxygen therapy (Table 1).

Indications of oxygen therapy mentioned by the participants	Participants No
Chronic Obstructive Pulmonary Disease (COPD)	14
Asthma	9
Difficulty in breathing/Shortness of breath	8
Metabolic acidosis	7
Decrease SPO_2/If SPO_2 Below 90%	7
Hypoxemia	6
Low cardiac output	6
Cardiac disease/Cardiac Patient	6
Hypoxia	5
Pneumonia	5
If CO_2 high in COPD/ CO_2 retention	5
Increase respiratory rate/Rapid breathing	5
Peri-post cardiac and respiratory arrest	4
Respiratory arrest	4
Road Traffic Accident (RTA)/Post Traumatic	3
Neuro case	3
Restlessness	3
Respiratory Distress	2
Poisoning	2
Shock	2
Respiratory Failure	1
If saturation is not maintained	1

Table 1: *Indications of oxygen therapy mentioned by the participants.*

Response to question 9: What are the contraindications of oxygen therapy?

There is no absolute contraindication of oxygen therapy [16]. In patients with Paraquat poisoning or bleomycin lung injury oxygen administration be targeted to achieve oxygen saturation (SpO_2) of 88 - 92% [17].

It is seen from the responses of the participants regarding contraindication of oxygen therapy that participants had inadequate knowledge as well as understanding about the contraindication of oxygen therapy (Table 2).

Contraindications of oxygen therapy mentioned by the participants	Participants No
Preterm baby/Pre-mature baby	8
Trauma to lungs	5
Untreated pneumothorax/Pneumothorax	5
Tension pneumothorax	4
Eustachian tube dysfunction	4
Claustrophobia	4
Patient on pace maker	4
Increased O_2 flow in COPD	4
High fever	3
COPD	3
Paraquat Poisoning	3
Congenital spherocytosis	2
Pulmonary fibrosis from bleomycin	2
Retinopathy	1
Loss of hypoxic drive	1
If normal SPO_2	1
height of seizure	1
High flow	1
Seizure	1
Brucella	1
Epidural pain	1
No response	2

Table 2: *Contraindications of oxygen therapy mentioned by the participants.*

Response to question 10-: In what dosages oxygen used as a medical therapy?

Initiate oxygen therapy in acutely breathless patients who are not at risk of developing Type II respiratory failure having SpO_2 of < 85% with a reservoir mask at 15L/min. The oxygen therapy can be adjusted to maintain a target saturation of 94 - 98% once the patient is stable (using nasal cannulae at 1 - 6 L/min or a simple face mask at 5 - 10 L/min) [7,9,12]. High-flow nasal oxygen using specialized equipment should be considered as an alternative to reservoir mask treatment in patients with acute respiratory failure without hypercapnia [9,12]. If patients having COPD or other risk factors for Type II respiratory failure, aim is to maintain a saturation of 88 - 92% pending blood gas results but adjust to 94-98% if the PCO_2 is normal [9,12].

The responses of the participants regarding dosage of oxygen were incorrect. It means they had lack of knowledge in this aspect (Table 3).

Response to question 11: What is duration of oxygen therapy?

There is no fixed duration of oxygen therapy. It depends upon patient's condition and underlying disease and associated comorbidities. If the patient is clinically stable and the oxygen saturation is above the target range or in the upper limit of the target range for some time (usually 4 - 8 hours), oxygen concentration should be stepped down and the new delivery system can be used if required and flow should be continued. If the patient is stable, the process can be repeated and the patient can eventually be weaned off from oxygen [12].

It is obvious from the responses of participants that they had inadequate knowledge (Table 4).

Response to question 12: What is normal level of oxygen saturation (SpO_2)?

The normal oxygen saturation (SpO_2) in healthy individual is 97% to 99% measured with pulse oximeter. It is an indirect estimation of arterial oxygen saturation (SaO_2) [18].

It is evident from the responses of participants that they had insufficient knowledge about SpO_2 (Table 5).

Response by the participants						
Nasal cannula	2 liters	2 - 6 liters	2 - 3 liters	2 - 3 liters	2 - 4 liters	5 - 8 liters
	5	5	2	1	1	1
Face mask	6 liters	5-8 liters	5-8 liters			
	6	8	1			
Ambu bag	10 liters	3 liters	10 - 12 liters			
	3	2	1			
Asthma	28%	Only name				
	3	1				
COPD	24%	Only name				
	3	1				
Low flow	2 - 6 liters					
	2					
High flow	10 liters					
	2					
SPO_2	94 - 96%					
	1					
CO_2 retention	88 - 92%					
	2					
Till the SPO_2 is maintained up to 92%						
1						
No response						
3						
According to patients' need and equipment provided						
5						

Table 3: *Response to Question 10-: In what dosages oxygen used as a medical therapy?*

Duration of oxygen therapy mentioned by the participants	Participants No
Till saturation is not maintained	9
According to patients need/As per need of the patient/As long as patient need	5
Depend on condition of the patient/Depend on medical condition	5
15 hours every day	3
COPD-15 hours every day	3
Until patient's condition gets better/Until treated/Until patient needed	3
Till saturation returns to normal	1
Till saturation is not maintained on room air	1
When SPO_2 in between SPO_2 range	1
No response	1

Table 4: *Duration of oxygen therapy mentioned by the participants.*

SPO_2	24-28%	74-104%	75-100%	80-100%	90-100%	95%	95-100%	96-100%	98-100%	No response
Participants	3	3	10	1	1	3	4	3	1	3

Table 5: *Normal level of oxygen saturation (SpO_2) mentioned by the participants.*

Response to question 13: What are methods of delivery for oxygen therapy?

Oxygen delivery systems are categorized into low-flow and high-flow systems. Low-flow systems provide lower oxygen flow than the actual inspiratory flow which is 30 L/min. High-flow oxygen delivery systems provide higher oxygen flows. Low-flow Oxygen delivery devices include Nasal cannula, Simple face mask, Non-rebreather mask, Transtracheal oxygen catheter while High-flow Oxygen delivery devices include Rebreather mask, Venturi mask. High-flow nasal cannula [19].

It is apparent from the responses of participants that they had somewhat knowledge about methods of delivery (Table 6).

Methods of Delivery mentioned by the participants	Participants No
Face mask	31
Nasal cannula	28
Invasive ventilator	14
Non-invasive ventilator/CPAP	6
Tracheostomy	6
Ambu mask	5
Non-rebreathing mask	3
Rebreathing mask	3
Incubator for infant	2
Nebulization	1
Simple face mask	1

Table 6: *Methods of delivery mentioned by the participants.*

Response to question 14: What are adverse effects/toxicity of oxygen therapy?

Hundred percent oxygen can be tolerated for about 24 - 48 hours at sea level without any severe tissue damage. Prolonged exposures make certain tissue injury. Symptoms may include disorientation, breathing problems, and visual changes such as myopia and cataract formation.

Central nervous system signs and symptoms include headache, irritability and anxiety, dizziness, disorientation, hyperventilation, hiccups, cold shivering, fatigue, tingling in the limbs, visual changes such as blurring and tunnel vision, tinnitus and hearing disturbances, nausea, twitching and tonic-clonic seizure [20].

Pulmonary toxicity signs and symptoms include mild tickle sensation on inhalation, mild burning on inhalation, uncontrollable coughing, hemoptysis, dyspnea, rales, fever, hyperemia of the nasal mucosa, CXR shows inflammation and pulmonary edema [20].

Effects on eyes include in premature babies, retinopathy of prematurity and retrolental fibroplasia, retinal edema and cataract formation (long-term exposure) [20].

It is clear from the responses of participants that they had knowledge about Adverse effects/toxicity of oxygen therapy (Table 7).

Response to Question 15: What do you mean by long-term oxygen therapy?

Long-term OT is the provision of oxygen supplement over a minimum of 15 hours per day including overnight period [1]. NICE guidelines recommend that people should breathe supplemental oxygen for at least 15 hours a day and preferably 20 hours a day [21].

Long-term oxygen therapy (LTOT) ≥ 15 h/day improves survival in hypoxemic chronic obstructive pulmonary disease (COPD). LTOT 24 h/day is often recommended but may pose an unnecessary burden with no clear survival benefit compared with LTOT 15 h/day [22].

It is obvious from the responses of participants that they had somewhat knowledge about long-term oxygen therapy (Table 8).

Response to question 16: What is PaO_2?

PaO_2 is the partial pressure of oxygen in arterial blood, measured via an arterial blood sample; a normal range is approximately 75 - 100 mmHg [7].

The responses of 3 (9.4%) participants were Arterial Partial Pressure of O_2 and found to be correct and the responses of 22 (68.7%) were near correct i.e. Partial Pressure of O_2, Tension of oxygen in our blood. While responses of 5 (15.6%) participants were incorrect and 2 didn't respond.

Adverse effects/toxicity of oxygen therapy mentioned by the participants	Participants No
Dry mouth	17
Retinopathy in premature baby	6
Red eyes	6
Headache	5
Irritation: skin around face due to face mask/ nose due to nasal cannula	5
Dry nose / sore nose	4
Flushing face	4
Tiredness / fatigue	3
Hallucination	3
Stroke due to vasoconstriction	2
Seizure	2
Nose bleeds	2
Rhinitis	2
Air trapped in esophagus	1
Dizziness	1
No response	2

Table 7: *Adverse effects/toxicity of oxygen therapy mentioned by the participants.*

Meaning of long-term oxygen therapy mentioned by the participants	Participants No
Supply of oxygen for long term and person may depend on it	7
For improvement of patient with chronic respiratory failure	6
Improve survival in COPD/For survival of patient with COPD/For improvement of patient with COPD	4
When O_2 is increased	4
O_2 prescribed for at least 18 hours per day e.g. COPD patient	3
Domiciliary oxygen therapy	2
COPD, Asthma	2
Supply O_2 to maintain SPO_2	1
18 hours per day	1
Lifelong supply of O_2	1
Oxygen for long-term to cure condition like COPD	1

Table 8: *Meaning of long-term oxygen therapy mentioned by the participants.*

Response to question 17: What is SaO_2?

The amount of oxygen carried in the blood (the average amount of oxygen bound to each hemoglobin molecule), expressed as a percentage of the maximal binding capacity. Normal saturation is 95 to 100% [7].

The responses of 19 (59.4%) participants were Saturation of O_2 in arterial blood and found to be correct and 7 (21.9%) were near correct i.e. Saturation of O_2, Saturation of O_2 in blood. While responses of 6 (18.7%) participants were incorrect.

Overall, the findings of this study are consistent with other studies conducted recently. The nurses working at University Teaching Hospital of Kigali had poor level of knowledge of oxygen administration [16]. The study conducted by Aloushan., *et al*. demonstrated that there was a clear gap of knowledge among nurses and paramedics related to oxygen therapy [1]. Mayhob F M M in his study reported more than two third of nurses working in intensive care had unsatisfactory level of knowledge regarding administration of oxygen therapy [23].

Conclusion

This study concluded that, overall knowledge of staff nurses was inadequate. On the basis of the findings of this study, it is recommended to the hospital authority to develop training courses, organize workshops and continuous medical educational programs for the nurses to ensure the safe administration of oxygen therapy and standard quality of nursing care for patients receiving oxygen therapy. Furthermore, oxygen therapy protocol must be developed or adopted and implemented in order to ensure that nurses are administering oxygen therapy carefully. The limitations of this study are small sample size and only nurses working in adult and elderly intensive care areas of one teaching hospital, so the findings may not be generalized for nurses working elsewhere in same hospital and other hospitals too.

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