Shandi University

Graduate College

Master of Nursing Sciences

Batch (1)

Nurses knowledge Regarding care of Patients on Mechanical Ventilator

(Omdurman Locality August -September 2017)

A thesis Submitted as Partial Fulfillment for the Degree of Master in Medical Surgical Nursing

By:

Wamda Mustafa El-Sheikh

(B.Sc.-2014, University of El Imam ElMahdi)

Supervised by:

Dr Sania Ahmed Mohammed

2017

الايـــة

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

قُلْ أَرَأَيْتُمْ إِن جَعَلَ اللَّهُ عَلَيْكُمُ اللَّيْلَ سَرْمَدًا إِلَىٰ يَوْمِ الْقِيَامَةِ مَنْ إِلَٰهٌ غَيْرُ اللَّهِ يَأْتِيكُم بِضِيَاءٍ ۖ أَفَلَا تَسْمَعُونَ (71) قُلْ أَرَأَيْتُمْ إِن جَعَلَ اللَّهُ عَلَيْكُمُ النَّهَارَ سَرْمَدًا إِلَىٰ يَوْمِ الْقِيَامَةِ مَنْ إِلَٰهٌ غَيْرُ اللَّهِ يَأْتِيكُم بِلَيْلٍ تَسْكُنُونَ فِيهِ ۖ أَفَلَا تُبْصِرُونَ (72)

الايات (71 - 72) **سورة القصص**

Dedication

to my father and mother

to my brother and my sister

to my friend and colleagues

and all who encouraged and supported me to achieve it.

Acknowledgement

I would like to express my deeply grateful and appreciate to my supervisor Dr. Sania for her kind immense contribution, continuous support and helpful suggestions supervisor during all stages of the thesis, University of Shandi , I sincerely express great thanks to my family and friends for their sacrifices and encouragement.

Abstract

Introduction: respiratory failure is caused by failure to ventilator ,characterized by increased arterial carbon dioxide or failure to oxygenated characterized by decreased arterial oxygen tension. The treatment for failure to ventilate is to increase the patient alveolar ventilation that is rate and depth of breathing, either by reversing the cause or by using mechanical ventilation invasive or non invasive.

Objectives: to assess nurses knowledge regarding care of patient on mechanical ventilation.

Method: *A descriptive cross-sectional hospital based study conducted in Omdurman locality l*
Data was collected by the researcher using structured closed ended questionnaire (composed of (22) questions part one about social demographic data, part two about knowledge questions).

The results: revealed that is (83,3%) of study sample more are female , (16,6) of them where is mal, about (53.3%) of study sample their age group less than 30 years , (46.7%) their age ranged between 30-40 years .(30%) of study sample have diploma in nursing while all most have bachelors in nursing . regarding years of experience their study sample showed (53.3%) of sample ranged from 1-5 years of experience , (46.7%) less than 1 year of experience .
Nurses who have good knowledge from all study sample regarding care of patient on mechanical ventilation , all nurses knowledgeable about mechanical ventilator, the result of study sample show nurses knowledge is poor is in sign of oxygen toxicity and also poor knowledge about causes of high pressure alarm also about respiratory acidosis.

recommendation :

To update the knowledge of nurses regarding complication and care of patient on mechanical ventilator , Increase learning courses with more knowledge about nursing care of patient on mechanical ventilator.
Increase awareness of nurses about closely observation of patient to prevent complication.

المستخلص

المقدمة : يحدث فشل في الجهاز التنفسي عن طريق الفشل في التنفس الصناعي، وتتميز بزيادة ثاني أكسيد الكربون الشرياني أو الفشل في الأوكسجين التي تتميز انخفاض التوتر الأوكسجين الشرياني. علاج الفشل في التهوية هو زيادة التهوية للمريض الذي هو معدل وعمق التنفس، إما عن طريق عكس سبب أو باستخدام التهوية الميكانيكية الغازية أو غير الغازية.

الأهداف : تقييم معرفة الممرضين بالرعاية التمريضية المقدمة للمريض الذي يعتمد في التنفس علي جهاز التنفس الصناعي .

منهجية البحث : وقد تم جمع البيانات من قبل الباحث باستخدام استمارة مغلقة مهيأة مكونة من جزئين ، الجزء الأول، عن البيانات الديموغرافية الاجتماعية، الجزء الثاني حول أسئلة المعرفة .

النتائج : أظهرت النتائج أن (83،3٪) من أفراد عينة الدراسة هم من الإناث، (16،6) منهم، حيث بلغت نسبة عينة الدراسة (53،3٪) من مجموعتهم العمرية أقل من 30 سنة، وبنسبة (46،7٪)، (30٪) من عينة الدراسة لديهم دبلوم في التمريض، في حين أن معظمهم يحملون شهادة البكالوريوس في التمريض. (53.3٪) من العينة تراوحت بين 1–5 سنوات من الخبرة، (46.7٪) أقل من سنة واحدة من الخبرة.
الممرضات الذين لديهم معرفة جيدة من جميع أفراد عينة الدراسة فيما يتعلق برعاية المريض على التهوية الميكانيكية، وجميع الممرضين على دراية الميكانيكية التنفس الصناعي، ونتيجة لدراسة عينة تظهر الممرضات المعرفة الفقيرة في علامة على سمية الأوكسجين وأيضا ضعف المعرفة حول أسباب ارتفاع ضغط إنذار أيضا حول الحماض التنفسي.

التوصيات : لتحديث المعرفة من الممرضات بشأن المضاعفات والرعاية للمريض على التنفس الصناعي الميكانيكية، وزيادة دورات التعلم مع مزيد من المعرفة حول الرعاية التمريضية للمريض على التنفس الاصطناعي.

زيادة وعي الممرضات عن مراقبة المريض عن كثب لمنع المضاعفات.

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Abbreviation

MV	Mechanical Ventilator
ARBS	Acute Respiratory Distress Syndrome
ABG	Arterial Blood Gases
VCV	Volume Control Ventilation
PCV	Pressure Control Ventilation
PEEP	Positive end expiratory pressure
IMV	Intermittent Mandatory Ventilation
SIMV	Synchronized Intermittent Mandatory Ventilation
ETT	End Tracheal Tube

Chapter One

Introduction

Introduction

Respiratory failure is caused by failure to ventilator , characterized by increased arterial carbon dioxide , or failure to oxygenated , characterized arterial oxy gen tension.

The treatment for failure to ventilate is to increase the p t ventilator ventilation , that is rate and depth of breathing , either by reversing the cause or by using mechanical ventilation , invasive or non invasive.

Mechanical ventilation is the positive or negative pressure device , that can maintained ventilation and oxygen delivery for prolonged period. Critically ill p often require artificial air way and mechanical ventilator support adequate respiratory function. Through understanding of this devices the advantages and disadvantages and the requirement for nursing is imperative in order to provide quality care.[1]

Several type of mechanical ventilation exits, they are classified according to the manner in which they support ventilator. The two general categories negative and positive for nursing is imperative in order to provide quality care.

The most common categories used to day is positive pressure ventilator. IF the p t has continues decrease in oxygenation and increase in arterial carbon dioxide level and persistent acidosis, mechanical ventilation necessary.

Condition such as thoracic or abdominal surgery , neuro muscular disorder, inhalation injury , chronic obstructive pulmonary disease , multiple trauma all may lead to Respiratory failure need mechanical ventilator. [2]

Justification

Mechanical ventilation can be lifesaving by maintain gas exchange until the underlying disorders are corrected. the patient who needs ventilator support ,need primary care ,one of the greatest contribution the nursing staff can make to decreasing cost, length of stay and mortality in patient with respiratory problem is to implement intervention that prevent or minimize complication. Because M.V is supportive rather than curative, focus of care for this patient is holistic.

Positive patient outcomes depend on an understanding of principles of mechanical ventilator and the patients care needs.

Objective:

General objective:

assess knowledge of nurses regarding care of patient on mechanical ventilation .

Specific objective:

_assess nurses knowledge about mechanical ventilator

_assess nurses knowledge about normal arterial blood gases

_assess nurses knowledge about car of patient on mechanical ventilation

Chapter One

Introduction

Mechanical ventilator

Definition :

Mechanical ventilator defined as machine help patient breath by assisting the inhalation of oxygen into the lung and the exhalation of carbon dioxide depend on patient condition.

Is the medical term for artificial ventilation where mechanical mean is used to assist or replace spontaneously breathing, this may involve machine called ventilator or the breathing maybe assisted by anesthesiologist, certified registered nurse, physician, respiratory therapist.

Mechanical ventilator is termed (invasive) if it involves any instrument penetrating through mouth (such as endo tracheal tube)[1].

Classification of mechanical ventilator :

Negative pressure (rarely used today):

The provision of air under pressure by mechanical respirator, machine designed to improve exchange of air between lung and atmosphere. The device is basically designed for administrating artificial respiration especially for prolonged period, in the event of inadequate spontaneous ventilations or respiratory paralysis.

Positive pressure ventilators:

The ventilation create positive pressure that will push air in to the patient lung and increase intrapulmonary pressure, the amount of air that is delivered depend on the amount of pressure applied.

Side effect of positive pressure:

- Decrease venous return.
- Increase intracranial pressure.
- Decrease cardiac output.

Exhalation is passive and begins when the pressure is terminated and exhalation valve open.

Type of positive pressure ventilator:

There are three types:

- Volume cycled: pressure is applied to the air way until preset volume is delivered, minute volume will remain constant to provide stable blood gases, air way pressure will increase or decrease, changes in the patient compliance and or air way resistance(must common approach for mechanical ventilator).
- Pressure cycled: this ventilator are normally pneumatically powered and apply positive pressure to the air way until preset limit is reach, also peak pressure will remain constant the volume will change as lung compliance and air way resistance change. This type of ventilator is best for intermittent therapy or continuous for patient with normal lung (post operative).
- Time cycled: commonly used in infant[(2)].

Indication of mechanical ventilation:

When the patient spontaneous ventilation is inadequate to maintain life. It's also indicated as prophylaxis for imminent collapse of other physiological function or ineffective gas exchange in lung. Because MV serves only to provide assistance for breathing and does not cure a disease, the patient underlining condition should be correctable and should resolve over time, in addition other factors must taken into consideration because MV is not without complication.

Generally MV is instituted to correct blood gases and decrease work of breathing.

Common medical indication includes:

- Acute lung injury(including ARDS, trauma)
- Apnea with asthma,
- Acute or chronic respiratory acidosis must commonly with chronic obstructive pulmonary disease.
- Acute respiratory acidosis with partial pressure of carbon dioxide more than 50mmHg and PH less than 7.25.

- May be due to paralysis of the diaphragm due to Guillain Barre Syndrome, mythnia gravis, motor nuron disease, spinal cord injury, or effect of anesthetic and muscle relaxant drugs[3].

Mode of mechanical ventilator

There are two basic mode:

Volume control:

With volume control ventilation (VCV) the inflation tidal volume is preselected, and lungs are inflated at a constant flow rate until the desired volume is delivered because there is airflow at the end of inspiration, the peak pressure in the proximal airways (peak paw) is greater than the peak pressure in the alveolar dissipated by the resistance to flow in the airways. The peak alveolar pressure is reflection of the alveolar volume at the end of lung inflation .

- Advantages

Constant tidal volume: the major advantage of VCV is the ability to deliver a constant tidal volume despite change in the mechanical properties of the lungs. When airways resistance increase or lungs compliance decrease the ventilator generates the higher pressure to deliver the volume. This maintains the desired minute ventilation in the face of abrupt or undetected changes in airway resistance of lung compliance.

- Disadvantage
  Airway pressure: at any given tidal volume, the airway pressure at the end of inspiration are higher during VCV than during pressure control ventilation (PCV) and this is mistakenly perceived as increased risk of ventilator-induced lung injury.
- Inspiratory flow:
  There are disadvantages related to the constant inspiratory flow rate during VCV. First the duration of inspiration is relatively short, and this can lead to uneven alveolar filling. In addition, the maximum inspiratory flow is limited when flow is constant, and the inspiratory

flow rate can be inadequate in patient with high flow demands, resulting in patient distress[4] .

Pressure control:

With pressure control ventilation (PCV) the desired inflation pressure is preselected, and a decelerating inspiratory flow rate provides high flows at the onset of the lung inflation, to attain the desired inflation pressure quickly. The inspiratory time is adjusted to allow enough time for the inspiratory flow rate to fall to zero at the end of inspiration. Since there is no airflow at the end of the inspiration, the end – inspiratory airway pressure is equivalent to the peak alveolar pressure.

- **Advantages :**

Alveolar pressure: the major benefit of (PCV) is the ability to control the peak alveolar pressure, which is the pressure most closely related to the risk of alveolar over distention and ventilator –induced lung injury . Clinical studies indicate that the risk of ventilator induced lung injury is negligible if the peak alveolar pressure is $\leq$ 30 cm H_2O.

Patient comfort: PCV is more likely to promote patient comfort than VCV, and this has been attributed to the high initial flow rates the longer duration of inspiration with PCV.

- **Disadvantages:**

Alveolar volume the major disadvantage of PCV is the decrease in alveolar volume that occurs when there is an increase in airway resistance or a decrease in lung compliance.

Other mode

Assist control ventilation (ACV) allows the patient to initiate a ventilator breath (assisted or patient –triggered ventilation), but If this is not possible, ventilator breath delivered at a preselected rate (control or volume-control or pressure-controlled.

Advantages:

- Reduce work of breathing.
- Allow patient to modified minute ventilation.

Disadvantages:

- Hemodynamic effect
- hyperventilation [5]

Ventilator settings:

When mechanical ventilation is initiation the respiratory therapist will ask you for the following parameters , mode of ventilation , tidal volume, respiratory rate m keep level and , inspired O_2 concentration. The following is a list of suggestion for setting up mechanical ventilation.

Assist –control ventilation

Select assist- control as the initial mode of ventilation.

It may be necessary to switch to synchronized IMV in patients who are breathing too rapidly in the assist-control mode.

Volume vs. pressure control :

The use of volume control or pressure control is largely a matter of personal preference although some patients breathe more comfortably with pressure control.

A suitable compromise is the pressure-regulated volume control mode of ventilation (PRVC), which allows for control of the tidal volume, but limits the airway pressures[6] .

Tidal volume :

The following recommendation are from the lung protective ventilation protocol,

Select an initial tidal volume of 8 Ml /kg using predicated body weight .

Reduce the tidal volume of 6ml/ kg over the next 2 hour if possible.

Monitor the peak alveolar pressure and keep it≤ 30cm H_2O (limit the risk of volutauma).

In the volume control mode, the peak alveolar pressure is the end-inspiratory occlusion pressure also called the plateau pressure.

In the pressure control mode the peak alveolar pressure is the end inspiratory airway pressure.

Inspiratory flow rate

Select an inspiratory flow rate of 60l /min if the patient is breathing quietly or has no spontaneous respirations.

Use higher inspiratory flow rates (e.g,≥ 80l/min for patient with respiratory distress .

I :E Ratio

- The I :E Ratio should be ≥ 1: 2
- If I:E Ratio is< 1:2 , the option for increasing the I:E ratio include: increasing the inspiratory flow rate, decreasing the tidal volume or decreasing the respiratory rate if possible .

  Respiratory rate:

  If the patient has no spontaneous respiration set the respiratory rate to achieve your estimate of the patients minute ventilation just prior to intubation, but do not exceed 35 per minute.

  If the patient is triggering each ventilator breath, set the machine rate just blow the patient spontaneous respiratory rate.

  After 30 minute check the arterial PCO_2, and adjust the respiratory rate if necessary to achieve desired PCO_2.

  For patient who breathing rapidly and have an acute respiratory alkalosis or evidence of occult PEEP, consider switching to synchronized IMV(SIMV) as mode of ventilation.

PEEP:

Set the initial PEEP to 5cm H_2O to prevent the collapse of distal airspace at end expiration. Further increase in PEEP may be required if either of the following condition is present: a toxic level of inhaled oxygen ($> \%60$) is required to maintain adequate oxygenation (Sa $O_2 \geq 90\%$) or hypoxemia refectory to oxygen therapy[6].

Arterial blood gases

Normal values:

P H	7.35 – 7.45
PCo_2	35- 45
Po_2	80 – 100 mm Hg
O_2 saturation	95 – 100%
HCo_3	22-26 m Eg
Base Excess	+ or -2

The step of ABG analysis:

Step 1: analyze the PH

The first step in analyzing ABG is to look at PH , normal blood PH is 7.55 to 7.45 if the PH falls below 7.35 it is asdic. If the blood PH rise above 7.45 , it laccolitic.

Step 2: analyze the Co_2

The second step is to examine the PCo_2 below 35 is alkalosis, above 45 is acidic.

Step 3: analyze the HCo_3

The third steps is to look at the HCo_3 level , if the HCo_3 is below 22, the patient is acidotic. If the HCo_3 is above 26, the patient is alkalotic.

Step 4: match the Co_2 or HCo_3 with match either the PCo_3 or the HCo_3 with the PH to determine, for example, if PH is acidosis, and the Co_2 is Acidosis , then the acid – basis distance is being caused by the respiratory system. This is respiratory acidosis- if the PH is alkalotic and HCo_3 is alkalotic, the acid – base distance is being caused by metabolic (or renal) system.

Endotracheal suction of mechanically Ventilated adult:

Endotracheal suction is component of bronchial hygiene therapy and MV and involves mechanical aspiration of pulmonary secretion from patient artificial preparation suction event, and follow up care.

patient preparation:

the patient should deceive hyper oxygenation by delivery of 100% O_2 for 30 second prior to suction.

The section event :

The placement of suction catheter through the artificial airway trachea and the application of negation pressure as the catheter is being withdrawn. Sterial technique should be used. Each pass of suction catheter into artificial airway considered suction event. The duration of each suction event should be approximately 10 -15 second suction pressure should be set as low as possible[(7)].

Weaning the patient from the ventilator:

Respiratory weaning the process of withdrawing the patient from dependence on the ventilator take place in three stages:-

Patient gradually removed from the ventilator, then from the tube and finally from oxygen, the weaning is started when the patient is recovery

from the acute stage of medical or surgical problems and the cause of respiratory failure is sufficiently reversed.

Successful weaning involve collaboration among the physician respiratory therapist and nurse, each heath care provider must understand the scope and function of other team member in relation to conserve the patient strength, use resource efficiently and maximize successful outcome[8].

Criteria for weaning

Careful assessment is required to determine whether the patient is ready to be removed from mechanical ventilator.

If the patient is stable and showing sign of improvement or reversal of the disease or condition that caused the need for mechanical ventilator, weaning indices should be assessed.

These indices include:

-vital capacity: the amount of air expired after maximum inspiration used to take deep breathing, vital capacity should be 10-15 ml-kg to meet the criteria for weaning.

- Maximum inspiratory pressure: used to assess the patient respiratory muscle strength, it also known as negative inspiratory pressure and should at least 20CMH_2O.

Tidal volume: volume of air that is inhaled from the lunge during effortless breath, it is normally 7 to 10 ml-kg.

Minute ventilation: equal to respiratory rate multiplied by tidal volume normal is about 6L-min.

Rapid shallow breathing index used to assess the breathing pattern calculated by dividing the respiratory rate by tidal volume, patient with indices below 100 breath, min are more likely to be successful at weaning .

Other measurement used to assess readiness for weaning include pao_2 of greater than 60mmHg with Fio_2 less 40%, stable vital sign and arterial

blood gases are also important predictor of successful weaning. Once readiness has been determined the nurse record baseline measurement of weaning indices to monitor progress[9] .

Patient preparation:

Adequate psychological preparation is necessary before and during weaning process, patient need to know what is expected of them during procedure they are often frightened by having to breathe on their need reassurances that they are improving, and will enough to handle spontaneous breathing, the nurse explain what happen during weaning and what role of patient will play in procedure.

The nurse emphasize that someone will be with near the patient at all time and answer any question simply and concisely, proper preparation of the patient can decrease weaning time.[3]

Method of weaning:

- Assist control maybe use as resting mode for patient undergoing weaning trial. This mode provides full ventilator support by delivering preset tidal volume and respiratory rate.
- Intermittent mandatory ventilation (IMV): allow patients to use their own muscles of ventilation to help prevent muscle atrophy.
- Synchronized intermittent mandatory ventilation (SIMV):
  Delivers preset tidal volume and number of breath pre –minute. Between ventilator delivered breaths the patient can breathe spontaneously with no assistance from the ventilator on those extra breathe as the patient ability spontaneously increases, the preset number of ventilator breathe is decreased and the patient does more work of breathing. SIMV is indicated if patient is satisfied all the criteria for weaning but cannot sustain adequate spontaneous ventilation for long period.
- Continuous positive airway pressure (CPAP):

Mode allows the patient to breathe spontaneously while applying positive pressure throughout the respiratory cycle to keep the alveoli open and promote oxygenation.

- Weaning trial using T- piece or tracheotomy mask are normally connected with patient disconnected from ventilator, resaving humidified oxygen only, and performing all the work of breathing. This method of weaning is usually used when the patient is awake and alert, is breathing without difficulty, has good gas exchange and cough reflex and homdinamicaly stable, if the patient appear to be tolerating the T-piece trail, second set of arterial blood gas measurement is drawn 20 minute after the patient has been on spontaneous ventilation if clinical stable, the patient usually can be extubated within 2-3 hours of weaning and allowed spontaneously ventilation by mask with humidified oxygen, patient who have prolonged ventilation assistance usually require more gradual weaning it may take days or week.
- They are weaned primarily during the day and placed on the ventilator at night to rest.[6]

Weaning form the tube:

Weaning form the tube is considered wean the patient can breathe spontaneously, maintain adequate airway by effective coughing secretion, swallow, and move the jaw. If frequent section is needed to clear secretion, the weaning unsuccessful, secretion clearance and aspiration risk are assessed to determine if active pharyngeal and laryngeal reflexes are intact[10] .

Weaning from oxygen:

The patient who has been successful weaned from the ventilator and tube and has adequate respiratory function is then weaned from oxygen, the Fio_2 is gradually reduced until the Pao_2 in the range 70-100mmHg while the patient on room air, supplemental oxygen is recommended[10].

Top 10 care essentials for ventilator patients

Care essential 1: Review communications:

Communication among care providers promotes optimal outcomes. For mechanically ventilated patients, care providers may include primary care physicians, pulmonary specialists, hospitalists, respiratory therapists, and nurses.

To make sure you're aware of other team members' communications about the patient, find out the goals of therapy for your patient when obtaining report. Why is she on a ventilator? To improve oxygenation? Boost ventilation? Permit sedation? Reverse respiratory muscle fatigue? Why is she on your unit? Because she has an underlying condition that complicates weaning from the ventilator? What is her do-not-resuscitate status?

Communicating with the patient is essential, too. Provide writing tools or a communication board so she can express her needs. Ask simple yes/no questions to which she can nod or shake her head[11] .

Care essential 2: Check ventilator settings and modes:

When you enter the patient's room, take vital signs, check oxygen saturation, listen to breath sounds, and note changes from previous findings. Also assess the patient's pain and anxiety levels.

Read the patient's order and obtain information about the ventilator. Compare current ventilator settings with the settings prescribed in the order. Familiarize yourself with ventilator alarms and the actions to take when an alarm sounds. Locate suction equipment and review its use. Look for a bag-valve mask, which should be available for every patient with an artificial airway; be sure you know how to hyperventilate and hyper oxygenate the patient[11].

Ventilator settings and modes:

Generally, ventilators display ordered settings and patient parameters. Check the following settings:

- *respiratory rate*, the number of breaths provided by the ventilator each minute. Manually count the patient's respiratory rate, because she may be taking her own breaths at a rate above the ventilator setting.
- *fraction of inspired oxygen (FiO_2)*, expressed as a percentage (room air is 21%).
- *tidal volume (TV or V_T)*, the volume of air inhaled with each breath, expressed in milliliters
- *peak inspiratory pressure (PIP)*, the pressure needed to provide each breath. Target PIP is below 30 cm H_2O. High PIP may indicate a kinked tube, a need for suctioning, bronchospasm, or a lung problem, such as pulmonary edema or pneumothorax.

To find out which ventilation mode or method your patient is receiving, check the ventilator itself or the respiratory flow sheet. The mode depends on patient variables, including the indication for mechanical ventilation.

Modes include those that provide specific amounts of TV during inspiration, such as assist-control (A/C) and synchronized intermittent mandatory ventilation (SIMV); and those that provide a preset level of pressure during inspiration, such as pressure support ventilation (PSV) and airway pressure release ventilation. PSV allows spontaneously breathing patients to take their own amount of TV at their own rate. A/C and continuous mandatory ventilation provide a set TV at a set respiratory rate. SIMV delivers a set volume at a set rate, but lets patients initiate their own breaths in synchrony with the ventilator.

Some patients may receive adjuvant therapy, such as positive end-expiratory pressure (PEEP). With PEEP, a small amount of continuous pressure (generally from +5 to +10 cm H_2O) is added to the airway to increase therapeutic effectiveness. In many cases, PEEP is added to reduce oxygen requirements.

Finally, determine if a capnography monitor is recording the patient's partial pressure of exhaled carbon dioxide (pCO_2). Capnography, which reflects ventilation, can detect adverse respiratory events, such as tracheal-tube malpositioning, hypoventilation, and ventilator circuit problems. The capnography waveform should be square; generally, the value should be in the normal pCO_2 range of 35 to 45 mm Hg. (See *Normal capnography waveform* by clicking the PDf icon above.) To better understand your patient's ventilation status, check for trends in waveforms and values rather than focusing solely on single events. [11]

Care essential 3: Suction appropriately

Patients receiving positive-pressure mechanical ventilation have a trache-ostomy, endotracheal, or nasotracheal tube. Most initially have an endotracheal tube; if they stay on the ventilator for many days or weeks, a tracheotomy may be done. Tracheotomy decisions depend on patient specifics. Controversy exists as to when a tracheotomy should be considered; generally, patients have tracheotomies before being managed on a med-surg unit.

Although specific airway management guidelines exist, always check your facility's policy and procedure manual. General suctioning recommendations include the following:

Suction only as needed—not according to a schedule

- Hyper oxygenate the patient before and after suctioning to help prevent oxygen desaturation.
- *Don't* instill normal saline solution into the endotracheal tube in an attempt to promote secretion removal.
- Limit suctioning pressure to the lowest level needed to remove secretions.
- Suction for the shortest duration possible.

If your patient has an endotracheal tube, check for tube slippage into the right mainstem bronchus, as well as inadvertent extubation. Other

complications of tracheostomy tubes include tube dislodgment, bleeding, and infection. To identify these complications, assess the tube insertion site, breath sounds, vital signs, and PIP trends. For help in assessing and managing tube complications, consult the respiratory therapist.

If your patient has a tracheostomy, perform routine cleaning and care according to facility policies and procedures.[11]

Care essential 4: Assess pain and sedation needs

Even though your patient can't verbally express her needs, you'll need to assess her pain level using a reliable scale. Keep in mind that a patient's acknowledgment of pain means pain is present and must be treated. Two scales that help you evaluate your patient's sedation level are the Richmond Agitation Sedation Scale and the Ramsay Sedation Scale.

Should you restrain an agitated ventilator patient to prevent extubation? Research shows self-extubation can occur despite physical restraints. It's best to treat agitation and anxiety with medication and nonpharmacologic methods, such as communication, touch, presence of family members, music, guided imagery, and distraction.[11] .

Care essential 5: Prevent infection

Ventilator-associated pneumonia (VAP) is a major complication of mechanical ventilation. Much research has focused on how best to prevent VAP. The Institute for Healthcare Improvement includes the following components in its best-practices VAP prevention "bundle":

- Keep the head of the bed elevated 30 to 45 degrees at all times, if patient condition allows. Healthcare providers tend to overestimate bed elevation, so gauge it by looking at the bed frame rather than by simply estimating.
- Every day, provide sedation "vacations" and assess readiness to extubated, indicated by vital signs and arterial blood gas values

within normal ranges as well as the patient taking breaths on her own.

- Provide peptic ulcer disease prophylaxis, as with a histamine-2 blocker such as famotidine.
- Provide deep vein thrombosis prophylaxis, as with an intermittent compression device.
- Perform oral care with chlorhexidine daily.

Other measures that decrease VAP risk include extubating the patient as quickly as possible, performing range-of-motion exercises and patient turning and positioning to prevent the effects of muscle disuse, having the patient sit up when possible to improve gas exchange, and providing appropriate nutrition to prevent a catabolic state. Assess the patient's tolerance when she performs an activity by checking vital signs, oxygenation status, and pain and agitation levels.

Keeping bacteria out of oral secretions also reduces VAP risk. Use an endotracheal tube with a suction lumen above the endotracheal cuff to allow continuous suctioning of tracheal secretions that accumulate in the subglottic area. Don't routinely change the ventilator circuit or tubing. Brush the patient's teeth at least twice a day and provide oral moisturizers every 2 to 4 hours[11] ..

Care essential 6: Prevent hemodynamic instability:

Monitor the patient's blood pressure every 2 to 4 hours, especially after ventilator settings are changed or adjusted. Mechanical ventilation causes thoracic-cavity pressure to rise on inspiration, which puts pressure on blood vessels and may reduce blood flow to the heart; as a result, blood pressure may drop. To maintain hemodynamic stability, you may need to increase I.V. fluids or administer a drug such as dopamine or norepinephrine, if ordered.

High levels of inspiratory pressure with PSV and PEEP increase the risk of barotrauma and pneumothorax. To detect these complications, assess breath sounds and oxygenation status often. To help prevent these conditions, use the lowest pressure level for ventilator-delivered breaths and adjust the level as tolerated[11].

Care essential 7: Manage the airway

The cuff on the endotracheal or tracheostomy tube provides airway occlusion. Proper cuff inflation ensures the patient receives the proper ventilator parameters, such as TV and oxygenation. Following hospital policy, inflate the cuff and measure for proper inflation pressure using the minimal leak technique or minimal occlusive volume. These techniques help prevent tracheal irritation and damage caused by high cuff pressure; always practice them with an experienced nurse or respiratory therapist. Never add air to the cuff without using proper technique.

When performing mouth care, suction oral secretions and brush the patient's teeth, gums, and tongue at least twice a day using a soft pediatric or adult toothbrush. Use a tonsil suction device if your patient needs more frequent suctioning.

With assistance from an experienced colleague, change the tracheostomy tube or tracheostomy ties and endotracheal tube-securing devices if they become soiled or loose. Incorrect technique could cause accidental extubation.

Care essential 8: Meet the patient's nutritional needs

For optimal outcomes, ventilator patients must be well nourished and should begin taking nutrition early. But like any patient who can't swallow normally, they need an alternative nutrition route. Preferably, they should have feeding tubes with liquid nutrition provided through the gut. If this isn't possible, the healthcare team will consider parenteral nutrition.

Patients with tracheostomy tubes may be able to swallow food. Follow the physician's orders and consult speech and respiratory therapists.

Care essential 9: Wean the patient from the ventilator appropriately

As your patient's indications for mechanical ventilation resolve and she's able to take more breaths on her own, the healthcare team will consider removing her from the ventilator. Weaning methods may vary by facility and provider preference. Although protocols may be used to guide ventilator withdrawal, the best methods involve teamwork, consistent evaluation of patient parameters, and adjustment based on these changes.

Some patients may need weeks of gradually reduced ventilator assistance before they can be extubated; others can't be weaned at all. Factors that affect ease of weaning include underlying disease processes, such as chronic obstructive pulmonary disease or peripheral vascular disease; medications used to treat anxiety and pain; and nutritional status[11] ..

Care essential 10: Educate the patient and family

Seeing a loved one attached to a mechanical ventilator is frightening. To ease distress in the patient and family, teach them why mechanical ventilation is needed and emphasize the positive outcomes it can provide. Each time you enter the patient's room, explain what you're doing. Reinforce the need and reason for multiple assessments and procedures, such as laboratory tests and X-rays. Communicate desired outcomes and progression toward outcomes so the patient and family can actively participate in the plan of care.

Caring for a patient on mechanical ventilation requires teamwork, knowledge of care goals, and interventions based on best practices, patient needs, and response to therapy. Mechanical ventilation has become a common treatment, and nurses must be knowledgeable and confident when caring for ventilator patients[11]..

Chapter Three

Study design

Methodology

Study design:

A descriptive cross-sectional hospital based study conducted in Khartoum state to assess Nurse's knowledge regarding care of patient on mechanical ventilator .

Study period:

The study was being carried during the period (august - September 2017).

Study area:

Khartoum state is one of the eighteen states of Sudan. Although it is the smallest state by area (22,142 km^2), it is the most populous (5,274,321 in 2008 census). It contains the country's largest city by population, Omdurman, and the city of Khartoum. The capital city contains offices of the state, governmental and non-governmental organizations, cultural institutions, and the airport. The state lies between longitudes 31.5 to 34 °E and latitudes 15 to 16 °N.

Study setting:

This study was conducted in the. Omdurman teaching hospital in ICU unit

Study population:

The populations of this study consisted of all Nurses who work in the selected hospitals ICU unit

Inclusion criteria:

Permanent staff of Nurses with fixed Job in ICU unit

Nurses have experience of more than 6 months in ICUunit .

Sample size and Sampling technique:

Sampling technique:

All nurses were enrolled in the study.

Sample size:

The sample size was calculated according to use the all entire population as the sample About (30)

Data collection technique and tools:

Data collection tools:

Data was collected by the researcher using structured closed ended questionnaire (composed of (22) questions part one about social demographic data, part two about knowledge questions).

Score of knowledge:

The full score was 4 which calculated from frequency and percent as follows:

Score = frequency x100/30

Evaluation Measure	Measurement Range
Good knowledge	≥ 75
Satisfied knowledge	51- 74)(
Poor knowledge	≤ 50

Data collection technique:

The data of the questionnaire was fulfilled by the participants, after 24 hours it was handled to the researcher, revised and coded before data entry.

All data collection was managed by the researcher, the data was collected during the period of 5days 3times per week, attending the morning and afternoon shifts.

Data analysis:

Data was coded then analyzed by simple statistic method ,then different measure was used (frequency, percentages, and figure .

Ethical consideration:

The proposal was approved by the ethical scientific committee permit ion was taken from the director of hospital and head nurse , verbal permeation was taken from participant and then chance to refuse and stop if they wish

Chapter Four

Result

Result:

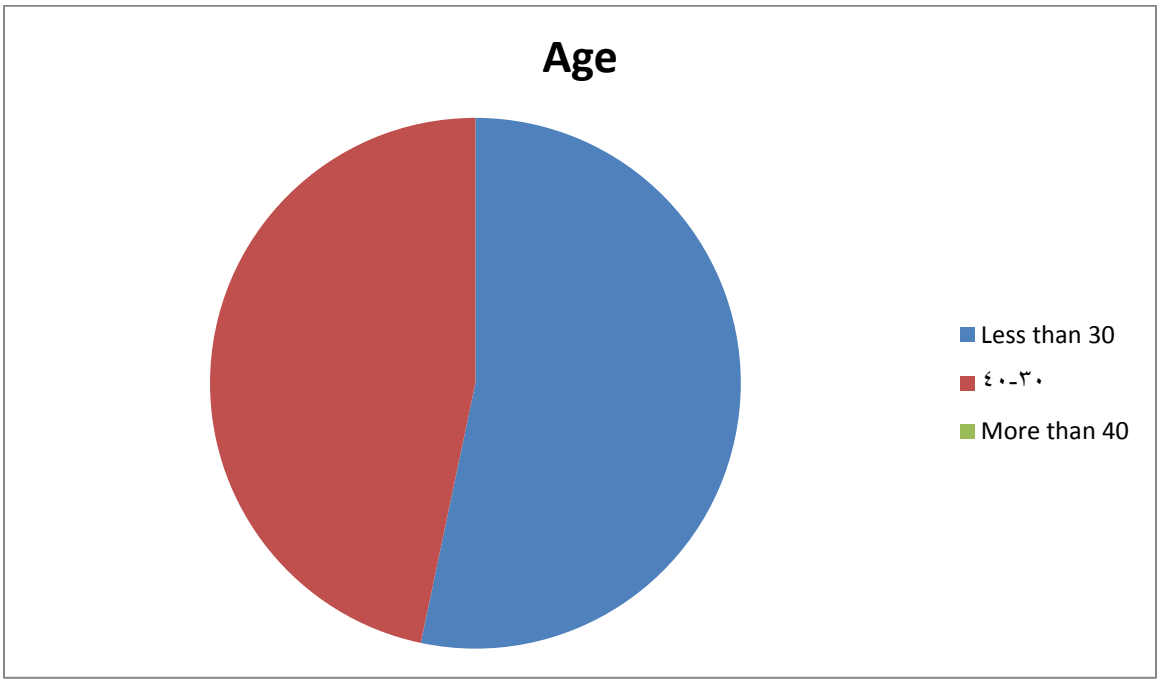

Figure (1) :

The above figure showed the age of nurses less than 30 years 53.3% - 30-40 64% .

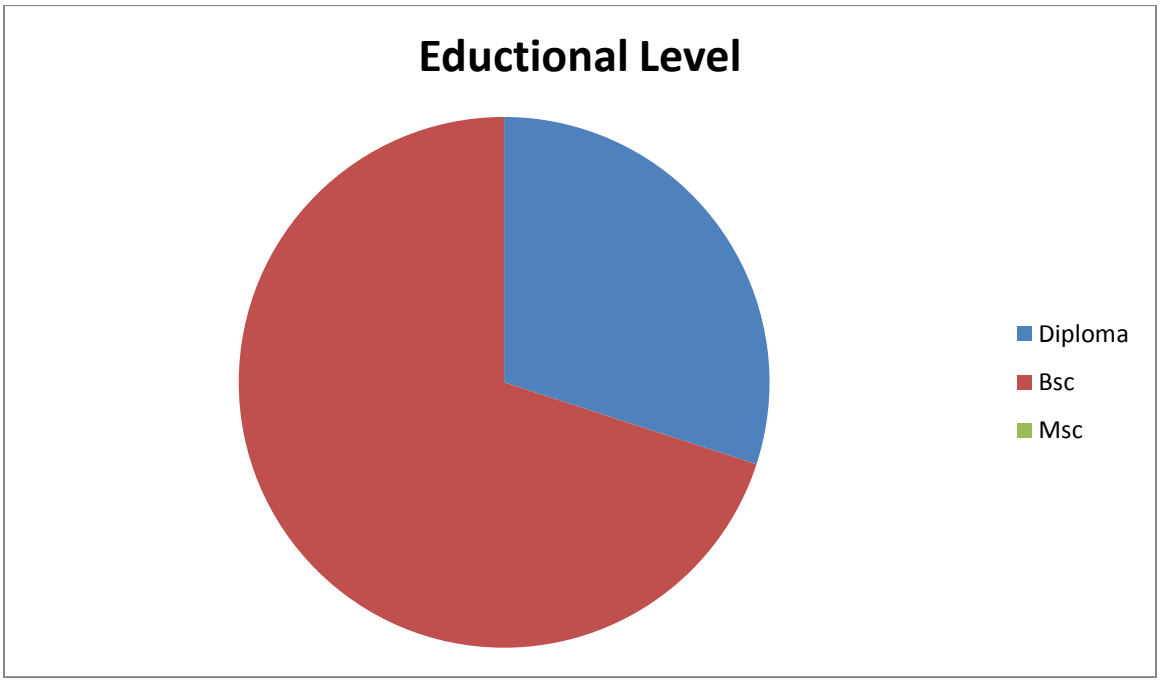

Figure (2) :

The above figure showed the proportion of graduate nurses of ICU in Diploma 30% and 70% Bachelor.

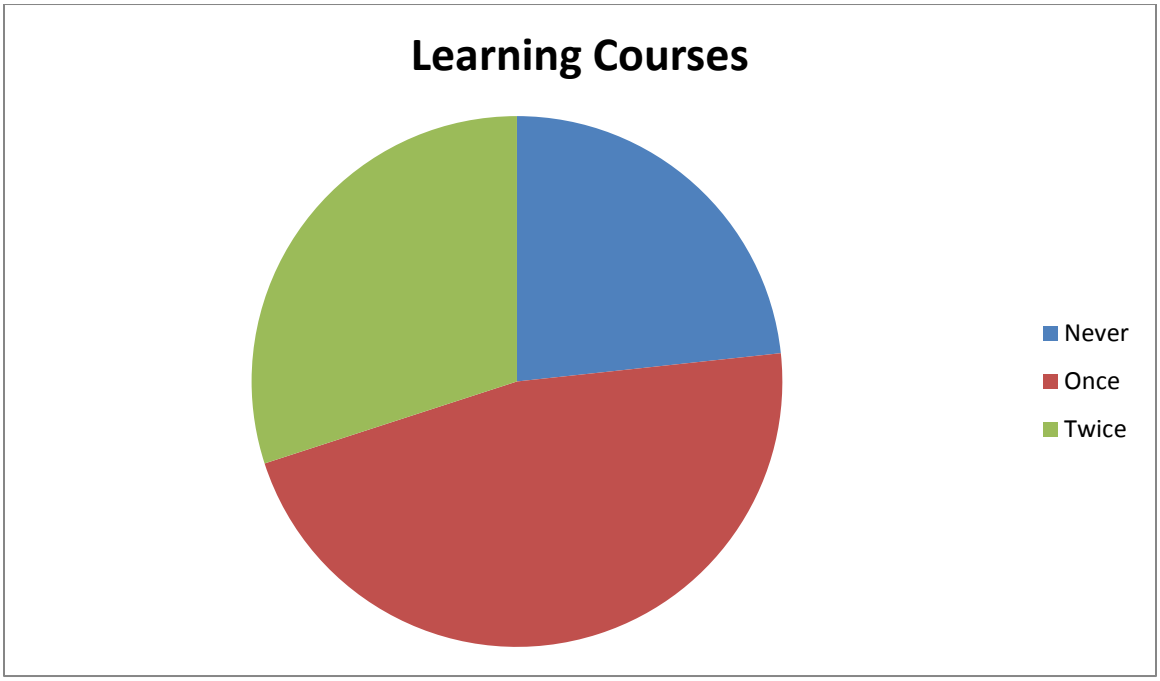

Figure (3) :

The above figure showed 23.3% never been to learning courses , 46.7% took once of learning courses and 30% took twice courses.

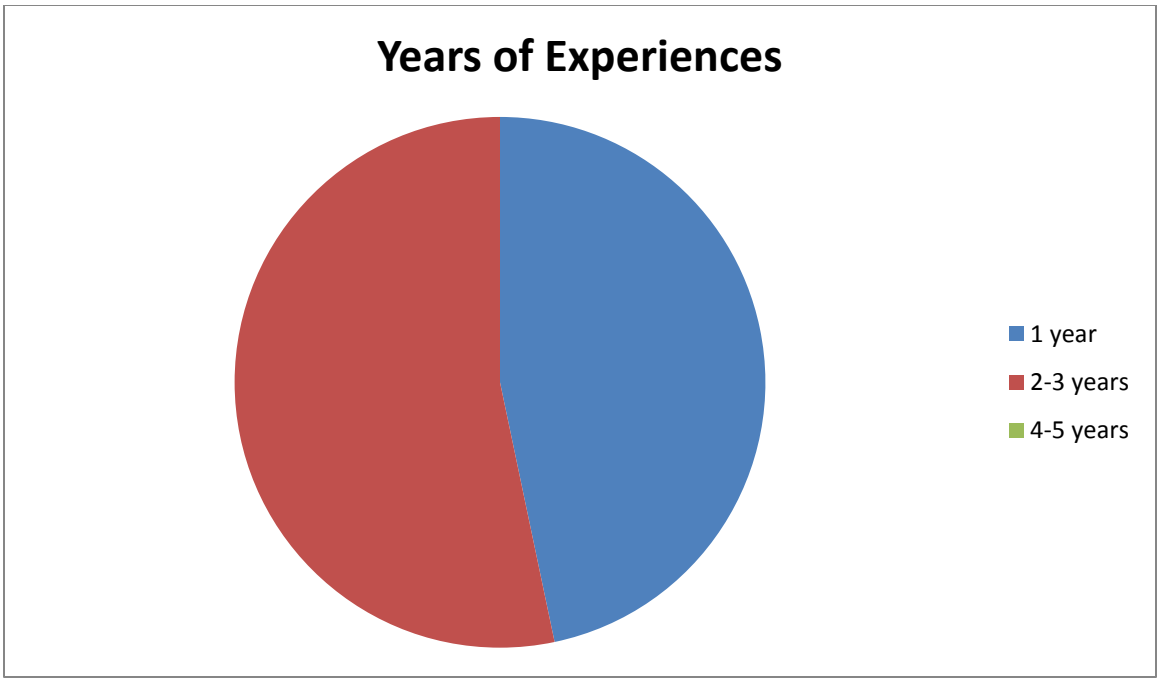

Figure (4) :

Table above figure illustrated 46.7% of nurses have 1 year of experiences and 53.3% have 2-3 years of experiences.

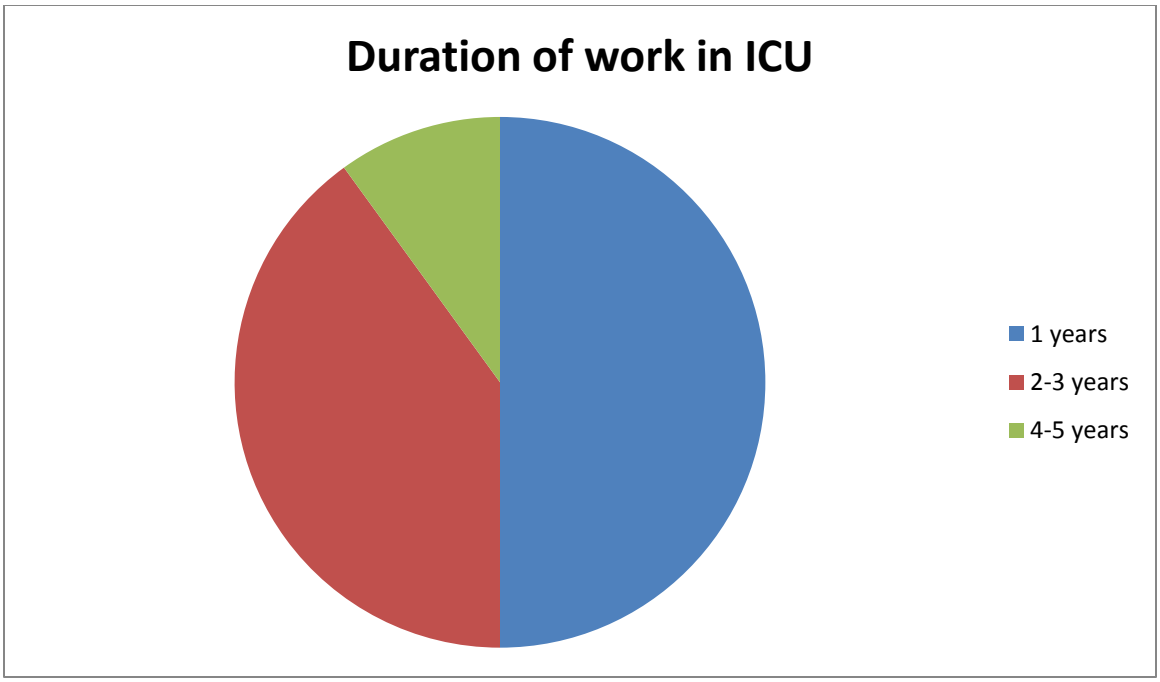

Figure (5) :

The figure table showed duration of nurses work in ICU one year 50% , 40% work for 2-3 years , 10% work for 4-5 years.

1/ Age :

Age	Frequency	Percentage
Less than 30	16	53.3 %
30 – 40 years	14	46.7 %
More than 40	0	

2/ Educational Level :

Educational Level	Frequency	Percentage
Diploma	9	30 %
BSC	21	70 %
MSC	0	

3/ Learning Courses :

Learning Courses	Frequency	Percentage
Never	7	23.3 %
Once	19	46.7 %
Twice	9	30 %

4/ Years of Experience :

Years of Experience	Frequency	Percentage
1 years	7	46.7 %
2 – 3 years	19	53.3 %
4 – 5 years	0	

5/Duration of work in ICU :

Duration of work in ICU	Frequency	Percentage
1 years	15	50 %
2 – 3 years	12	40 %
4 – 5 years	3	10%

6/ Definition of M.V :

Definition of M.V	Frequency	Percentage
Yes	30	100 %
No	0	

7/Indication of M.V

Indication of M.V	Frequency	Percentage
Good	25	83.3 %
Satisfies	5	16.7 %
Poor	0	

8/ Made of M.V

Made of M.V	Frequency	Percentage
Good	25	83.3 %
Satisfies	5	16.7 %
Poor	0	

9/ **Important parameters in Ventilator setting :**

Important parameters in Ventilator setting :	**Frequency**	**Percentage**
Good	24	80 %
Satisfies	6	20 %
Poor	0	

10/ Sign of Oxygen Toxicity:

Sign of Oxygen Toxicity	**Frequency**	**Percentage**
Good	15	50 %
Satisfies	10	33.3 %
Poor	5	17.7 %

11/ Causes of high pressure alarm :

Causes of high pressure alarm	**Frequency**	**Percentage**
Good	23	76.6 %
Satisfies	5	16.7 %
Poor	2	6.7 %

12/ Normal ABG :

Normal ABG	**Frequency**	**Percentage**
Good	21	70 %
Satisfies	9	30 %
Poor	0	

13/ Sing of Respiratory Acidosis :

Sing of Respiratory Acidosis	Frequency	Percentage
Good	17	56.7 %
Satisfies	12	40 %
Poor	1	3.3

14/ Sing of Respiratory Alkalosis:

Sing of Respiratory Alkalosis	Frequency	Percentage
Good	25	83.3 %
Satisfies	5	16.7 %
Poor	0	

15/ Method of weaning:

Method of weaning	Frequency	Percentage
Good	22	73.3 %
Satisfies	24	80 %
Poor	0	

16/ Criteria of weaning :

Criteria of weaning	Frequency	Percentage
Good	24	80 %
Satisfies	6	20 %
Poor	0	

17/Technique of Suction :

Technique of Suction	Frequency	Percentage
Yes	30	100 %
No	0	

18/Duration of Suction :

Duration of Suction	Frequency	Percentage
Good	13	43.3 %
Satisfies	12	40 %
Poor	5	16.7 %

19/ Follow up can Section :

Follow up can Section	Frequency	Percentage
Good	25	83.3 %
Satisfies	5	16.7 %
Poor	0	

20/ Complication of ETT suction :

Complication of ETT suction	Frequency	Percentage
Good	24	80 %
Satisfies	5	16.6 %
Poor	1	3.3 %

21/Care of Patients on M.V :

Care of Patients on M.V	Frequency	Percentage
Good	19	63.3 %
Satisfies	10	33.30 %
Poor	1	3.3 %

22/Complication of M.V :

Complication of M.V	Frequency	Percentage
Good	22	73.3 %
Satisfies	0	
Poor	8	26.7 %

Chapter Five

Discussion
Conclusion
Recommendation

Discussion:

Nursing care is important in survival for patient on mechanical ventilation. The competence of the nurse in charge is very crucial in such patient care.

Demographic data:

The results revealed that is (83,3%) of study sample more are female , (16,6) of them where is mal, about (53.3%) 0f study sample their age group less than 30 years , (46.7%) their age ranged between 30-40 years .(30%) of study sample have diploma in nursing while (70%) have bachelors in nursing . regarding years of experience their study sample showed (53.3%) of sample ranged from 1-5 years of experience , (46.7%) less than 1 year of experience .

On the other hand this results showed (23.3%) of study sample never took learning courses , (46.7%) took once learning , (30%) took twice learning courses .regarding duration of work in ICU (50%) 1 years,(40%) 2—3 years , (10%) 4—5 years.

Nurses knowledge regarding nursing care of patient on Mechanical ventilation :

Nurses who have good information or knowledge from all study sample regarding care of patient on mechanical ventilation in ICU in Omdurman teaching hospital are more knowledgeable in proportion (100%) regarding definition of MV , (100%) good knowledge regarding classification of MV ,also about (83.3%) of study sample their knowledge is good in indication of MV , in other hand (83.3%) more knowledgeable about mode of MV , (80%) of study sample have good knowledge about important parameter in ventilator sitting, (50%) of sample knowledgeable regarding sign of oxygen toxicity ,(76.6%) good knowledge about high pressure alarm . (70%) from study sample were knowledgeable about normal ABG and (56.7%) of nurse knowledgeable regarding sign of respiratory acidosis, in addition (83.3%) good knowledge in sign of respiratory alkalosis .

Also (73.3%)their knowledge good about method of weaning , (80%) about criteria of MV , (100%) of study sample are good knowledge in

suction technic from ETT ,(80%) have good knowledge about complication of suction from ETT,

Also(63.4%)have good knowledge about essential care for patient on MV,(73.3%) have good knowledge about complication of MV.

On other hand the nurses result show(16.7%) have satisfied knowledge about indication of(16.7%) have satisfied knowledge about mode of MV , (20%) of nurses have satisfied information in important parameter in ventilator sitting ,about (33.3%) about sign of oxygen toxicity , (16.6%) about high pressure alarm ,(30%)of nurse satisfied knowledge about normal ABG , (43.3%) have satisfied knowledge in sign of respiratory acidosis,(16.7%) have satisfied knowledge about sign of respiratory alkalosis,(26.7%) have satisfied knowledge about method of weaning and (20%) about criteria of weaning, (40%) have satisfied knowledge about duration of suction, (16.7%) satisfied knowledge about flow up care of suction, (16.7%) have satisfied knowledge about complication of suction from ETT(33,3%) have satisfied knowledge about essential care for patient on MV .

Finally, the result of study sample showed the nurses knowledge is poor in sign of oxygen toxicity proportion (16.7%) , (6.7%) of sample is poor in high pressure alarm , about(3.3%) poor information about respiratory acidosis , also (16.7%) their knowledge is poor about duration of suction , (3.3%) had poor in complication of suction from ETT , (3.3%) poor in essential care for patient on MV , (26.7%) about complication of MV

Conclusion:

According to findings of the current study, it was concluded that, the total evaluation knowledge was found good with percentage of (83%), while the evaluation of satisfied knowledge (43.3%) that means the nurses knowledge is more knowledgeable , also result show good knowledge in definition , classification of MV , indication and mood of MV, were satisfied knowledge in sign of respiratory acidosis in proportion (43.3%),

The result revealed the nurse had poor knowledge in complication of MV , duration of suction , sign of oxygen toxicity , causes of high pressure alarm in machine

Recommendation:

Based on the results of study I recommended:

- To update the knowledge of nurses regarding complication and care of patient on MV.
- Increase learning courses with more information about nursing care of patient on MV.

Increase awareness of nurses about closely observation of patient to prevent complication.

Appendix

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Shandi University

Faculty of nursing science

Msc medical surgical nursing

Nurses knowledge regarding care of patient with mechanical ventilator in Omdurman teaching hospital These research is conduct for master degree in medical surgical please answer by true or false :

1- Age:

a) less 30 years ( )
b) 30- 40 years ( )
c) more than 40years ( )

2- Educational level :

a) diploma ( )
b) Bsc ( )
c) Msc ( )

3- Learning Courses :

a) Never ( )
b) once ( )
d) twice ( )

4-Years of experience :

a) less than 1year ( )
b) 1-5 years ( )
c) 6-10 years

5- Duration of work in ICU

a) One years ( )
b) 2 – 3 years ( )
c) 4 – 5 years ( )

6- Machine help patient breath by assisting the inhalation of oxygen to lung and exhalation of carbon dioxide depend on patient condition .

e) Yes ( )
f) No ( )

7- Indication for Mechanical ventilation :

g) acute respiratory distress syndrome ( )
a) acute sever asthma ( )
b) Paralysis of the diaphragm dute to guillin Barr syndrome ( )
c) respiratory acidosis ( )

8- important parameter in ventilator:

a) Mode of ventilator ( )
b) Tidal volume ( )
c) Respiratory rate ( )
d) Positive End Expiratory Pressure ( )

9- sign of oxygen toxicity:

a) Flushed face ( )
b) Dry cough ( )
c) Dyspnea ( )
d) Chest pain ( )

10- High pressure alarm due to:

a) Increase secretion
b) Patient pitting the tube
c) Water in ventilator tube

11- mood of MV :

a) SIMV mood ( )
b) IMV mood ( )
c) Pressure control ( )
d) ventilation ( )

12- Normal rang of ABG is :

a) PH 7.35 - 7.45 ( )
b) PCo_2 35 – 45 mmHg ( )
c) HCo_3 22 – 26 mEq/L ( )
d) PO_2 80 – 100 mmHg ( )

13- sign of respiratory acidosis

a) restlessness ( )
b) blurred vision ( )
c) confusion ( )
d) headache ( )

14- sign of respiratory alkalosis:

a) dyspnea ( )
b) chest pain ( )
c) acute decrease in co2 ( )

15- Method od weaning :

a) Intermittent mandatory ventilation ( )
b) Synchronized Intermittent mandatory ventilation ( )
c) Continuous positive air way pressure ( )
d) using T, piece, using Tracheotomy tube ( )

16 _Criteria for waning is :

a) showing sign of improvement ( )
b) Reversal of the disease or condition caused need for Mechanical ventilation ( )
c) Maximum inspiratory pressure at list 20 cmH_2O ( )
d) PO2 and ABG with Normal rang ( )

17- Suction of endotracheal tube is aseptic technique:

a) Yes ( )
b) No ( )

18 -Duration of suction is :

a) 10 – 15 ( )
b) 7 - 12 ( )
c) 10 – 12 ( )

19- Fallow up care for suction:

a) Hyper oxygenated by delivery of 100 % oxygen ≥ 1 mint ( )
b) Hyper ventilated patient by increasing the respiratory rate & tidal volume ( )
c) Monitor for adverse reaction ( )

20- Complication of suction from End tracheal tube is :

a- Hypoxemia ( )
b- atelectasis ( )
a) c-Blood pressure fluctuation ( )

21- the top care essentials for ventilator Patients is :

a- Check Ventilator setting & mode ( )
b- Suction appropriately ( )
c- Prevent infection & assess pain and sedation need ( )
d- Prevent hemodynamic instability ( )

22- complication of MV ;

a) ventilator associated pneumonia ( )
b) barotrauma ( )
c) hemodynamic effect ( )