Effect of Open versus Closed Suction System on Cardio Respiratory Parameters for Mechanically Ventilated Patients

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Abstract

Background: Most of the critically ill patients undergoing mechanical ventilation need endotracheal tube to keep their airway open, Existence of endotracheal tube leads to blockage of spontaneous removal of secretions from endotracheal tree, resulted from suppression of cough reflex and an increase in mucus secretions, **The aim** of this study was to determine the effect of closed versus open suction system on the cardiopulmonary parameters of mechanical ventilated patient. **Design:** Comparative study research design was utilized in the study. **Sample:** A purposive of 60 adult patients aged 18 years or more from both gender divided to two groups open & closed suction group who was admitted during the study period on mechanical ventilation and met the inclusion criteria. **Setting**: Data were collected from Intensive Care Units at General Fayoum Hospital. **Tools**: Data was collected utilizing two designed tools (1) Interview assessment questionnaire which includes demographic characteristics, Present medical characteristics, Mechanical ventilator assessment questionnaire, Mechanical ventilator parameter assessment questionnaire, suction characteristics assessment questionnaire (2) Physiological outcomes follow up sheet which include Cardiac Parameter and Respiratory Parameter. **The results** revealed that, closed suctioning system has fewer physiological disturbances on physiological outcomes stability than an open suctioning system for mechanically ventilated patients .**Conclusion**: the implementation of closed suction system among the study group, according to the results of basic assessment, has been fewer physiological disturbances on physiological outcomes stability than an open suctioning for mechanically ventilated patients. **Recommendation:** This study should be repeated in a large study sample and different settings to compare the most effective method of suction.

Keywords: open suction, mechanical ventilator, closed suction-

Introduction:

The cardiac respiratory system is a vital component of human body. The cardiac and respiratory systems are always integrated as a single system that cannot function as a distinct organ. Both are interconnected in order for humans to have a normal healthy life. When a patient undergoes any cardiopulmonary surgeries, as their cardiopulmonary functions are compromised due to post anesthetic effect and due to any other adverse effects of surgery, they are transported to the intensive care unit after surgery for hemodynamic monitoring, sufficient volume therapy, and treatment with positive inotropic medications and vasopressor medicines (ICU) (**Alshahrani, 2021).**

Most of the critically ill patients undergoing mechanical ventilation need endotracheal tube to keep their airway open. Existence of endotracheal tube leads to blockage of spontaneous removal of secretions from endotracheal tree, resulted

from suppression of cough reflex and an increase in mucus secretions. Tracheo-Bronchial Suctioning (TBS) is one of the most common and important procedures, performed for the patients to manage their airways by ICU nurses as one of the treatment team members (**Yazdannik, 2019).**

Intubation and mechanical breathing greatly decrease airway secretion clearance; intubated patients require intermittent suctioning of secretions due to their inability to clear their airways spontaneously. In the ICU, tracheal suctioning is done to remove secretions from intubated patients who are on mechanical ventilation. Suctioning is thus advised in mechanically ventilated patients to minimize airway obstruction and to lessen the amount of effort necessary to breathe due to retrained secretions. Nonetheless, this maneuver has the potential to be dangerous and can result in serious and life-threatening consequences. Bleeding, infection, atelectasis, hypoxemia, cardiovascular instability, elevated intracranial pressure, and tracheal mucosa lesions are the complications of endotracheal suction (**Alshahrani, 2021).**

Airway secretions may increase in intubated patients due to the impaired mucociliary clearance, impaired cough reflex, abnormal glottic function, insufficient moisturizing, and respiratory tract infections. As with any intervention, patients should be cautiously monitored for possible complications during the endotracheal suctioning. Procedure-related changes in the cerebral and somatic tissue oxygenation, hemodynamics, and oxygen saturation can be observed in these patients. It is important to ensure maintenance of tissue oxygenation during these and other interventions performed in critically ill children (**Misirlioglu, 2021).**

Secretion management is vital to effective gas exchange, especially in the patient with an artificial airway. It is incumbent on the health-care team to ensure safe and effective secretion removal in patients with artificial airways. Artificial airway suctioning is a common procedure performed daily along the care continuum worldwide. This procedure includes patient preparation, application of suction via the introduced catheter, and post-procedure care. Although generally considered safe, the application of artificial airway suctioning through either an endotracheal tube (ETT) or tracheostomy tube is not without potential complications. Transient adverse events such as oxygen desaturation, bleeding, hemodynamic changes, and alterations in heart rate have been reported. Poor airway suctioning practices may lead to longer-term consequences, such as damage to the airway mucosa and hospital- acquired infections (**Blakeman, 2022).**

Significance of the study:

Breathing and respiratory health for granted, but the lung is a vital organ that is vulnerable to airborne infection and injury. Respiratory diseases are leading causes of death and disability in the world. About 65 million people suffer from (COPD) and 3 million die from it each year, making it the third leading cause of death worldwide (**Marciniuk, 2014).**

About 334 million people suffer from asthma, the most common chronic disease of childhood affecting 14% of all children globally. Pneumonia kills millions of people annually and is a leading cause of death among children under 5 years old. Over 10 million people develop (TB) and

1.4 million die from it each year, making it the most common lethal infectious disease. Lung cancer kills 1.6 million people each year and is the most deadly cancer. Globally, 4 million people die prematurely from chronic respiratory disease. At least 2 billion people are exposed to indoor toxic smoke, 1 billion inhale outdoor pollutant air and 1 billion are exposed to tobacco smoke. The truth is that many of us are naïve to these stark realities. (**International Respiratory Societies, 2017)**

Aim of the study:

The aim of the present study was to determine the effect of closed versus open suction system on the cardiopulmonary parameters of ventilated patient

The aim fulfilled through:

1. Assess patient's cardiopulmonary parameters.
2. Implement closed and open suction system among the study group, according to the results of basic assessment
3. Evaluate the effect of closed versus open suction system on the cardiopulmonary parameters on the occurrence of any changes on the study group.

Research hypothesis:

This study hypothesized that:

H1: A closed suctioning system has fewer physiological disturbances on physiological outcomes stability than an open suctioning system for mechanically ventilated patients

H0: An open suction system has fewer physiological disturbances on physiological outcomes stability than closed suctioning system for mechanically ventilated patients

Conceptual Framework

The theoretical and conceptual framework explains the path of a research and grounds it firmly in theoretical constructs. It can be deduced that the overall aim of the two frameworks is to make research findings more meaningful, acceptable to the theoretical constructs in the research field and ensures generalizability. They assist in stimulating research while ensuring the extension of knowledge by providing both direction and impetus to the research inquiry. They also enhance the empiricism and rigor of a research. (**Mensah, 2020)**

Agyemang, (2020) stated that, conceptual framework is a structure which the researcher believes can best explain the natural progression of the phenomenon to be studied. It is linked with the concepts used in promoting and systemizing the knowledge espoused by the researcher. It is the researcher's explanation of how the research problem would be explored**. Maxwell, (2013)** defined that conceptual framework as a tentative theory about the phenomena being studied that informs entirety of the study's design, noting that this may also be called a 'theoretical framework'. The conceptual framework presents an integrated way of looking at a problem under study in a statistical viewpoint; the conceptual framework pronounces the relationship between the main concepts of a study.**Grant and Osanloo, (2014)** highlighted **that** it is arranged in a logical structure to aid provide a picture or visual display of how ideas in a study relate to one another

This study was based on General System Theory by **Ludwig Von Bertanlaffy's in (1962)**. This theory helped to provide a common framework that created

shared and common language that scientists from different disciplines can use to communicate their findings. Simply put, system theory is used to understand how things around us work. General system theory looks at the world as a system composed of smaller subsystems. System as a representation of life phenomena are used by humanity in everyday life to describe the functioning of these phenomena. It is useful for the break down the whole process into separate task to assure goal realization.

System is a collection of independent but interrelated elements or components organized in a meaningful way to accomplish an overall goal.

This model consists of three phases, Input, Throughput and Output

Conceptual Definition:

Input: include raw material, energy and resources processed to produce the outputs of the organization. Though the process of selecting the system regulates the types and the amount of input received, some types of inputs are used immediately in their original state (**Bertanlaffy, 1962).**

Operational Definition:

In this study, input refers to the demographic data of patient with mechanical ventilator. The researcher also monitors the cardio respiratory parameter before suctioning among patient with mechanical ventilators in selected hospital as measured by tools (**I)** and **(II**).

Conceptual Definition:

Throughput: is the processes used by the system to convert raw materials or energy (input) from the environment into products or services that are usable by either the system itself or the environment (**Bertanlaffy, 1962).**

Operational Definition:

In this study, it refers to perform open and closed suction method and to assess cardio respiratory parameter among patient with mechanical ventilator

Conceptual Definition:

Output: After processing the input, the systems return the output to the environment in an altered state affecting the environment. Output is the product or service which results from the system's throughput or processing of technical, social, financial and human input (**Bertanlaffy, 1962).**

Operational Definition:

In this study, the output refers to the assessment of monitoring the cardio respiratory parameter by cardiac monitoring on during and after 15 minute from suction as measured by tools **(II**).

Conceptual Definition:

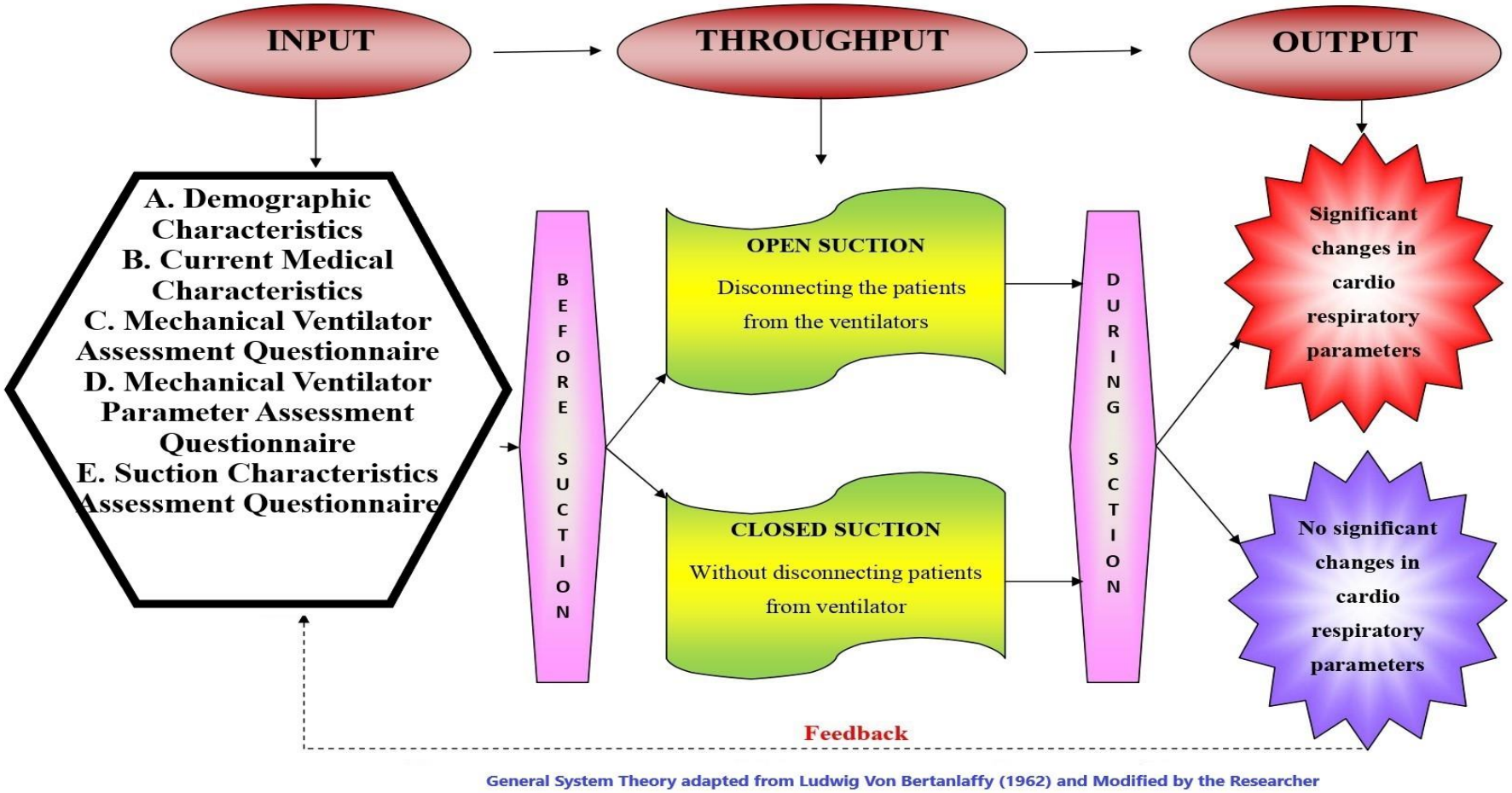
Feedback: is information about some aspect of data or energy processing that can be used to evaluate and monitor the system and to guide it to more effective performance. It refers to the environmental response of the system, Feedback may be positive, negative or neutral (**Bertanlaffy, 1962).**

Operational Definition:

In this study, refers to there is a significant different in cardiorespiratory parameter in open suction method and no significant different in cardiorespiratory parameter in closed suction

Independent variable as open suction and closed suction

Dependent variable as cardiorespiratory parameter



General System Theory adapted from Ludwig Von Bertanlaffy (1962) and Modified by the Researcher

Sample and Methods:

Design:

Comparative study research design was utilized in this study.

Setting:

The present study was carried out at the Intensive care unit General Fayoum Hospital; it receives patients from all areas of Fayoum governorate

Sampling:

A purposive sample of 60 adult patients aged 18 years or more from both genders who was admitted during the study period on mechanical ventilation. They were divided into two equal and alternative groups open suction & closed suction that group (1) which received open suction system, group (2) which received closed suction system 30 patients for each group. The patients in both groups were selected according to the inclusion criteria.

Exclusion criteria

Patients who were excluded based on the following criteria:

(a) Subjected to resuscitation or ventilator changes before Tracheal suction procedure with less than 15 minutes.

(b) Patients diagnosed with chronic obstructive pulmonary disease

Tools of data collection:

Two tools were used for data collection and the subject was divided into two group open suction (30) patient, closed suction (30) patient

Tool I: Interview assessment questionnaire: Appendix (I)

It was developed by the researcher based on the review of the literature (**KUMAR, 2014)** and consists of the following five parts that was filled by the researcher.

Part I- Demographic characteristics:

It was used to concern with demographic data of the patients such as age and gender.

Part II- Current medical characteristics:

It was used to assess present diagnosis, smoking, use of sedation, number of day in the ICU unit during assessment, past medical history and level of conscious.

Part III- Mechanical Ventilator assessment questionnaire:

It was used to assess ventilator mode and number of days on mechanical ventilator.

Part IV- Mechanical Ventilator parameter assessment questionnaire:

It was used to assess exhaled tidal volume, tidal volume setting, respiratory rate, fraction of inspired oxygen (FiO2), Positive end expiratory pressure (PEEP) and I: E ratio.

Part V- Suction Characteristics assessment questionnaire:

It was used to assess size of the suction catheter, type of suction and size of endotracheal tube.

Tool II: Physiological outcomes follow up sheet.

It was developed by the researcher based on the review of the literature e.g: monitor the patient's physiological outcomes before and two times after the suctioning procedure (immediately after and 15 minutes after Tracheal suction). Physiological outcomes consist of cardiovascular outcomes (heart rate and Blood pressure) and respiratory outcomes (SpO2 and respiratory rate)

Content Validity:

Content validity refers to the degree to which an assessment instrument is relevant to, and representative of the targeted construct it is designed to measure

(Yusoff, 2019). Face validity is a subjective decision based on the researcher's feelings, thoughts, and intuition about the functioning of the measuring instrument. It is the simplest and least precise method of determining validity which relies entirely on the expertise and familiarity of the assessor concerning the subject matter **(Sürücü & Maslakçi, 2020)**.

It was done for used tools to evaluate each item on the tool as to its degree of representation of the variable to be tested, as well as the tool over all appropriateness for use in examining the variable within the proposed study population. The content validity of the tools was done by a panel of 5 experts who reviewed the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability. Suggestions were given and modifications were done. Tool validity: Content validity as a qualitative form of validity that evaluates whether the expressions contained in the measuring instrument represent the phenomenon intended to be measured.

Reliability:

Reliability of instrument is "the extent to which the instrument yields consistent, reproducible estimates of what is assumed to be an underlying true score" **(Artner, 2021)**. The degree to which an instrument measures the same way each time it used under the same condition with the same subjects. Reliability of the tool was tested to determine the extent to which the questionnaire items are related to each other. The Cronbach's alpha model, which is a model of internal consistency, was used in the analysis. Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1. Higher values of Cronbach's alpha (more than 0.7) denote acceptable reliability.

Pilot study:

A Pilot study was carried out with 10% (not less than 10 patients) of the sample under study to test the applicability, clarity and efficiency of the tools, then the tools modified according to the results of the pilot study. Modifications included: rephrasing and rearrangement of some points. After refinement and modification, the final forms of the tools were developed. Patients whom shared in pilot study not included in the sample and replaced by other patients.

Field work:

- Meeting and discussion were held between the researcher and the nursing administrative personnel to explain the objectives and the nature of the study to gain their cooperation during the implementation phase of the study.
- Study was started and completed within three months from March (2022) to the end of May (2022).
- Patients' medical records were used to obtain the past and present medical history.
- Initial assessment was done by the researcher for all study subjects and takes their oral approval from relative to participate in the study

The study was conducted throughout three phase for patients

- Input phase (Assessment phase) **t**

-Throughput phase (Implementation phase) **tool (II)**

- Output phase (Evaluation phase)

- Input Phase (Assessment Phase).

During this stage, Patient assessment sheet was filled for the selected patient according to inclusion criteria then assigned them randomly to two study groups: group (1) open suction system, group (2) closed

suction system. The researcher collect data regarding to participants' age, gender, present diagnosis, smoking, uses of sedation, number of day in the icu, level of conscious, past medical history, mode of mechanical ventilator, number of days on mechanical ventilator, parameter of mechanical ventilator as (exhaled tidal volume , tidal volume setting, respiratory rate, fio2 setting, PEEP, I:E ratio), size of suction catheter , size of endotracheal tube , monitors the cardio respiratory parameter as (heart rate ,respiratory rate, mean arterial pressure and saturation oxygenation) before suctioning among patient with mechanical ventilators in selected hospital around 15 minute for each patient. During this phase each patient was assessed individually during study period and data collection was filled by the researcher by using tools (I) and tool (II) for both two study groups.

- Throughput Phase (Implementation Phase)

During this phase, the researcher stated the open suction method for group (1) for each patient until the number of patients completed to 30 patient that the researcher assess the patient immediately after open suction then after 15 minute after suction .The data collection was done on 1 day for each patient in afternoon shifts that the researcher assesses the cardio respiratory parameter as heart rate, Blood pressure, SpO2 and respiratory rate. During this phase each patient was assessed individually during study period and data collection was filled by the researcher by using tool (II) for this study groups.

The second stage in the implementation, the researcher stated the closed suction method for group (2) for each patient until the number of patients completed to 30 patient that the researcher assess the patient immediately after suction then after 15 minute after suction .The data collection was done on 1 day for each patient in afternoon shifts that the researcher assesses the cardio respiratory parameter as heart rate, Blood pressure, SpO2 and respiratory rate. During this phase each patient was assessed individually during study period, and data collection was filled by the researcher by using tool (II) for this study groups

- Output Phase (Evaluation Phase)

During this phase, Evaluation was done to the assess the cardio respiratory parameter which included cardiac monitoring as (heart rate, Blood pressure) and respiratory monitoring as (SpO2 and respiratory rate) on immediately after suction then after 15 minute from the end of suction to evaluate the effect of open suction on Physiological outcomes on the group (1). During this phase each patient was evaluated individually during this period and data collection was filled by the researcher by using tool (II) for this study groups

The second stage in the Evaluation was done to the assess the cardio respiratory parameter which included cardiac monitoring as (heart rate, Blood pressure) and respiratory monitoring as (SpO2 and respiratory rate) on immediately after suction then after 15 minute from the end of suction to evaluate the effect of closed suction on Physiological outcomes on the group (2). During this phase each patient was evaluated individually during this period and data collection was filled by the researcher by using tool (II) for this study groups

Ethical consideration:

The ethical research considerations in this study include the following:

- Approval of the study protocol was obtained from scientific research ethical

committee in faculty of nursing at Helwan University before starting the study.

- The purpose of the study was explained to the patient relative and oral consent was obtained from them to participate their patients in this study. They were given an opportunity to withdraw from the study without giving a reason and they were assured that anonymity and confidentiality of information was protected. Ethics, values, culture, and beliefs were respected.

- The study facilitation letter to conduct the study was received from the Department of postgraduate studies at Faculty of Nursing - Helwan University and was sent to director of critical care department at General Fayoum Hospital.

- An official permission was obtained from the administrative authorities and the nurse supervisor of intensive care units of the selected hospital to the current study.

-The researcher assured maintaining anonymity and confidentiality of all patients' data.

- Confidentiality was maintained on data collection forms by using codes to identify participants instead of names or any other personal identifiers.

Statistical Analysis:

The collected data were organized, categories, tabulated and statistically analyzed using the Statistical Package for Social Sciences (SPSS), version 24. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Qualitative categorical variables were compared using chi-square test.

Result

Table (1): Demographic characteristics for studied patient in both open suction, closed suction (N=60)

Variables	Open Suction		Closed Suction		Total		Tests	
							X^2/t	P-value
Age	N	%	N	%	N	%		
18 <30	2	6.7	0	0.0	2	3.3	2.497	0.287
40<50	2	6.7	1	3.3	3	5.0		
>50	26	86.7	29	96.7	55	91.7		
Mean age	47.45±5.67		49.86±6.13		34.33±5.91			
Gender	N	%	N	%	N	%		
Male	12	40	15	50	27	45	0.606	0.436
Female	18	60	15	50	33	55		

>0.05 Non significant <0.05* significant <0.001* High significant

Table (1) show that, the mean age of the patient with open suction in the present study were 47.45±5.67 while the patient with closed suction were 49.86±6.13 respectively (55%) of them were female and there was non statistically significance differences between closed and open suction regarding demographic characteristics. That indicates there was no significant difference between two study groups regarding demographic characteristics which indicated to good randomization

Table (2): Comparison between open & closed suction system regarding Mean ± SD for effect of suction on heart rate for mechanically ventilated patient. (N=60)

Heart rate (beat/min.)	Open Suction	Closed Suction	T-test	
	Mean ± SD	Mean ± SD	t	P-value
Before Suction	87.4 ± 9.02	84.77 ± 7.55	1.266	0.225
Immediately After Suction	103.67 ± 25.21	85.13 ± 8.98	3.793	<0.001*
15 minutes After Suction	100.70 ± 17.58	84.60 ± 8.03	4.562	<0.001*

>0.05 Non significant <0.05* significant <0.001* High significant

Table (2) shows that, there was no a change in the heart rate among patient on closed suction which was mean heart rate was 84.77± 7.55 then 85.13±8.98 then 84.60±8.03 that indicate the suction did not effect on the heart rate in compared to the patient on open suction, there was highly statistically significant difference in the heart rate through assess phases before, immediately and after 15 from suction which mean was 87.4±9.02 then 103.67±25.21 then 100.70±17.58. That indicate the open suction has bad effect on heart rate

Table (3): Comparison between open & closed suction system regarding Mean ± SD for effect of suction on **MABP** of mechanically ventilated patient. (N=60)

MABP (mm/Hg)	Open Suction	Closed Suction	T-test	
	Mean ± SD	Mean ± SD	t	P-value
Before suction	95.42 ± 10.81	95 ± 8.2	0.168	0.867
Immediately After suction	102 ± 14.88	96.78 ± 9.26	1.622	0.110
15 minutes After suction	99.25 ± 15.48	96.73 ± 9.42	0.761	0.450

>0.05 Non significant <0.05* significant <0.001* High significant

Table (3) shows that, there was no a change in the MABP among patient on closed suction which was 95± 8.2 then 96.78±9.26 then 96.73±9.42 that indicate the suction did not effect on the MABP in compared to the patient on open suction there was difference in the MABP through assess phases before, immediately and after 15 from suction 95.42±10.81 then 102±14.88 then 99.25±15.48. Respectively that indicate the open suction has bad affect on MABP

Table (4): Comparison between open & closed suction system regarding Mean ± SD for effect of suction on the **Respiratory rate** of mechanically ventilated patient. (N=60)

Respiratory rate (c/min.)	Open Suction	Closed Suction	T-test	
	Mean ± SD	Mean ± SD	t	P-value
Before suction	15.07 ± 5.00	13.80 ± 1.19	1.351	0.182
Immediately After suction	19.67 ± 1.83	14.20 ± 1.03	14.282	<0.001*
15 minutes After suction	21.46 ± 2.25	14.00 ± 1.17	16.085	<0.001*

>0.05 Non significant <0.05* significant <0.001* High significant

Table (4) shows that, there was no a change in the respiratory rate among patient on closed suction which was mean respiratory rate was 13.80± 1.19 then 14.20±1.03 then 14.00±1.17 that indicate the suction did not affect on the respiratory rate in compared to the patient on open suction there was difference in the respiratory rate through assess phases before, immediately and after 15 from suction which mean was 15.07±5.00 then 19.67±1.83 then 21.46±2.25. That indicate the open suction has bad affect on respiratory rate

Table (5): Comparison between open &closed suction system regarding Mean ± SD for effect of suction on the **Oxygen saturation** of mechanically ventilated patient. (N=60)

Oxygen saturation percentages	Open Suction	Close Suction	T-test	
	Mean ± SD	Mean ± SD	t	P-value
Before Suction	98.43 ± 1.74	98.97 ± 0.72	1.555	0.125
Immediately After Suction	93.23 ± 3.33	98.13 ± 2.32	6.619	<0.001*
15 minutes After Suction	95.73 ± 3.2	98.53 ± 2.00	4.062	<0.001*

>0.05 Non significant <0.05* significant <0.001* High significant

Table (5) shows that, there was no a change in the oxygen saturation percentages among patient on closed suction which was mean Oxygen saturation percentages was 98.97± 0.72 then 98.13±2.32 then 98.53±2.00 that indicate the suction did not effect on the Oxygen saturation percentages in compared to the patient on open suction there was difference in the oxygen saturation percentages through assess phases before, immediately and after 15 from suction which mean was 98.43±1.74 then 93.23±3.33 then 95.73±3.2. That indicate the open suction has bad affect on Oxygen saturation percentages

Table (6): Relation between present diagnosis and cardiorespiratory parameter in closed suction methods

Open Suction	present diagnosis						ANOVA	
	ARDS		Bronchial asthma		Pneumonia			
	Mean	SD	Mean	SD	Mean	SD	f	P-value
Heart rate Immediately After suction	80	0	84.50	5.21	86.82	11.32	0.258	0.855
Heart rate 15 minutes After suction	82	0	84.38	5.34	85.91	10.42	0.170	0.916
MABP Immediately After suction	105	0	91.88	5.94	94.23	9.63	3.119	0.043*
MABP 15 minutes After suction	108	0	91.88	5.94	94.27	9.65	3.087	0.045*
Respiratory rate Immediately After suction	14	0	13.88	1.36	14.45	0.82	0.474	0.703
Respiratory rate 15 minutes After suction	15	0	14.38	1.51	13.73	1.35	0.714	0.553
Oxygen saturation Immediately After suction	100	0	99.00	0.53	97.09	3.08	1.441	0.254
Oxygen saturation 15 minutes After suction	100	0	99.38	0.74	97.64	2.69	1.491	0.240

>0.05 Non significant <0.05* significant <0.001* High significant

Table (6) showed that, there was difference in between MABP Immediately After suction and present diagnosis which mean was 105 ±00 then 91.88 ±5.94 then 94.23±9.63. That indicate the present diagnosis has bad effect on MABP Immediately After suction **and also** there was difference in between MABP 15 minutes after suction and present diagnosis which mean was 108 ±00 then 91.88 ±5.94 then 94.27±9.65. That indicate the present diagnosis has bad affect on MABP 15 minutes after suction

Discussion:

One of the greatest common nursing procedures utilized in critical care setting is an endotracheal suctioning. The two ways for endotracheal suctioning are open and closed suction

In critically ill patients, endotracheal suctioning has side effects such as arterial blood oxygen desaturation, erratic respiratory rate, bradycardia and transient elevations in arterial blood pressure. The use of the endotracheal suctioning procedure on a regular basis is linked to a reduced heart rate and oxygen saturation **(Chegondi, et al., 2018).**

Hence the present study was conducted to determine the effect of closed versus open suction system on the cardiopulmonary parameters of ventilated patient. Regarding to **demographic of the studied sample**, the present study showed that the majority of studied patients receiving open and closed suction aged between (40- <50) years and more than half of them were female patients; **This could be as a result of** female patients admitted to ICU units more than males due to the high prevalence of chronic diseases among female patients in General Fayoum Hospital.

Regarding to **assess the effect of closed and open suction system on the heart rate and MABP of ventilated patient** , there was no a change in the heart rate among patient on closed suction which was mean heart rate was 84.77± 7.55 then 85.13±8.98 then 84.60±8.03 that indicate the suction did not effect on the heart rate in compared to the patient on open suction there was highly significant difference in the heart rate through assessment phases before or and immediately and after 15 from section which mean was 87.4±9.02 then 103.67±25.21 then 100.70±17.58. That indicate the open suction has bad effect on heart rate **and also** there was no a change in the MABP among patient on closed suction which was mean MABP was 95± 8.2 then 63.78±9.26 then 96.73±9.42 that indicate the suction did not effect on the MABP in compared to the patient on open suction there was difference in the MABP through assess phases before or and immediately and after 15 from section which mean was 95.42±10.81 then 102±14.88 then 99.25±15.48. That indicate the open suction has bad effect on MABP

This could be as a result The increase in **HR** and **MABP** seems to be due to the blockage of the tracheal tube by the suction catheter in open suction which cause hypoxia, stimulus the cough reflex and leads to sympathetic activity resulting in blood pressure and heart rate increase, airway irritation by suctioning tube movement, accompanied anxiety pain and stress which are caused by TS procedure itself. **This explanation consistent with Rass**,**2020 which study titled** Hemodynamic response during endotracheal suctioning predicts awakening and functional outcome in subarachnoid hemorrhage patients, in neurological intensive care unit of a tertiary care hospital (Medical University of Innsbruck) that endotracheal suctioning (ES) is routinely performed in mechanically ventilated patients to prevent airway obstruction. The nociceptive stimulus usually triggers the cough reflex and leads to sympathetic activity resulting in blood pressure and heart rate increase

This explanation consistent also with Ug˘ras, 2012 which study titled The Effects of Open and Closed Endotracheal Suctioning on Intracranial Pressure and Cerebral Perfusion Pressure that The disconnection of the ventilator circuit and reconnection of the patient to the ventilator before and after suctioning can cause movement of the endotracheal tube, which stimulates the tracheal and laryngeal afferent nerves, thus leading to cough. The stimulation of the cough reflex results in a Valsalva's maneuver, thus leading to a transient increase in intrathoracic and intra-abdominal pressure and, concomitantly, an increase in ICP and a decrease in cerebral perfusion pressure .The second cause is the mechanical stimulation of the catheter during suctioning. The fear, pain, and stress experienced by patients can cause stimulation of the sympathetic nerve system, leading to an increase in blood pressure and heart rate. While use closed suction were avoiding the patients' separation from the mechanic ventilator during suctioning, thus preventing any possible development of hypoxemia and hypotension

Regarding to **assess the effect of closed and open suction system on the Respiratory rate of ventilated patient** , there was no a change in the **Respiratory rate** among patient on closed suction which was mean **Respiratory rate** was 13.80± 1.19 then 14.20±1.03 then 14.00±1.17 that indicate the suction did not effect on the Respiratory rate in compared to the patient on open suction there was difference in the Respiratory rate through assess phases before or and immediately and after 15 from section which mean was 15.07±5.00 then 19.67±1.83 then 21.46±2.25. That indicate the open suction has bad effect on Respiratory rate, **This could be as a result that** patient during closed suction not disconnect MV and MV is controlled on respiratory Rate and not induced any effect on value in contrast in open suction patient became disconnect from MV and induce rapid in respiratory rate

This explanation consistent with Elsaman , 2017, **which study titled** Effect of Application of Endotracheal Suction Guidelines on Cardiorespiratory Parameters of Mechanically Ventilated Patients , in Main university Hospital, University of Alexandria, Egypt. Current study shows that the mean RR in the OSS during and immediately after TS is significantly higher than the mean of RR in the CSS. The results of the current study could be attributed to the issue that the all patients are on MV, and the ventilator is the responsible for controlling of breathing for patients in intensive care unit, thus making the respiration more rapid or slower

Regarding to **assess the effect of closed and open suction system on the Oxygen saturation of ventilated patient**, there was no a change in the Oxygen saturation % among patient on closed suction which was mean Oxygen saturation %was 98.97± 0.72 then 98.13±2.32 then 98.53±2.00 that indicate the suction did not affect on the Oxygen saturation % in compared to the patient on open suction there was difference in the Oxygen saturation % through assess phases before or and immediately and after 15 from section which mean was 98.43±1.74 then 93.23±3.33 then 95.73±3.2. That indicate the open suction has bad effect on Oxygen saturation %**.**

This could be as a result that the

open suction approach, the suction tube disconnects from the mechanical ventilator, resulting in decreased oxygenation and hypoxia. As a compensatory response to the lack of blood oxygen saturation, hypoxia stimulates the adrenergic nerve system, which controls cardiovascular and hemodynamic responses such as tachypnea and also closed suction system reduces desaturation and lung collapse by allowing breathing to continue while suctioning so desaturation, lung collapse, and bacterial contamination are all caused by open system suctioning..

Also consistent with Thabet 2019, **which study titled** Effectiveness of Suctioning Methods on Cardiorespiratory Parameters among Critically ill Children Undergoing Mechanical Ventilation, in Aswan University Hospital. That the results of the current study indicated that, the mean of Oxygen saturation was higher in the closed method compared with the open method with a highly statistically significant difference between the two methods during, immediately, and 5-min after suctioning. And in a close endotracheal suction system, the catheter is a part of a ventilator circuit without the need to disconnect the ventilator and thus improve Oxygenation; significantly reduce signs of hypoxemia; subsequently the hemodynamic parameters as heart rate, systolic and diastolic blood pressure

Regarding to **Relation between cardio respiratory parameter and present diagnosis in closed suction methods** there was difference in between MABP Immediately After suction and present diagnosis which mean was 105 ±00 then 91.88 ±5.94 then 94.23±9.63. That indicate the present diagnosis has bad effect on MABP Immediately After suction and also there was difference in between MABP 15 minutes after suction and present diagnosis which mean was 108 ±00 then 91.88 ±5.94 then 94.27±9.65. That indicate the present diagnosis has bad effect on MABP 15 minutes after suction**. This could be as a result that in respiratory diseases** pulmonary function tests decreased then increased pulmonary obstruction then the elasticity of arterial is degraded then the blood pressure raise

This explanation in agreed with Zekavat (2021), which study titled Elevated Blood Pressure Increases Pneumonia Risk: Epidemiological Association and Mendelian Randomization in the UK blood pressure elevations may result in pulmonary function alterations predisposing to the development of pneumonia. Several prior observational studies have linked hypertension with decreased performance on pulmonary function tests, reduced lung function, and increased pulmonary obstruction. The study extends these observations to show that increased blood pressure may causally lead to increased pulmonary obstruction representing a putative mechanism toward heightened pneumonia risk. Together, these studies and others suggest several mechanisms that may link hypertension and pulmonary obstruction: both may involve physiological degradation of arterial and airway elasticity, endothelial and vascular dysfunction may also influence pulmonary vascular endothelial cells and lead to pulmonary vascular dysfunction resulting in lung tissue destruction and airway obstruction, and systemic inflammation associated with hypertension may additionally alter pulmonary function.

Conclusion

The study was conducted on 60 patient whom divided into two equal groups open suction& closed suction group , they were with mean age as 34.33±5.91 and more than half of them were female patients and majority of them on mechanical ventilator mode Assist/Control, The results of this study supported the hypothesis which stated, as following: The implementation of closed suction system among the study group, according to the results of basic assessment, has been fewer physiological disturbances on physiological outcomes stability more than an open suctioning for mechanically ventilated patients.

Recommendations

Based on the previous findings, the followingrecommendations are suggested:

- This study should be repeated in a large group sample and different settings to compare the most effective method of suction.

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