ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 2, Issue 1, Month: June 2023, Available at: https://hijnrp.journals.ekb.eg/

Cardiorespiratory Parameter in Open and Closed Suction for Patients on Mechanical Ventilation: Comparative Study

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Abstract

Tracheo-Bronchial Suctioning is one of the most common and an important procedure, performed for the patients to manage their airways, there are two techniques the open and closed suction system. The aim of this study was to comparing Cardiorespiratory Parameters in Open and Closed Suction for Patients on Mechanical Ventilation. Design: A descriptive research design was utilized in the study. Sample : A purposive of 60 adult patients aged 18 years or more from both genders who was admitted during the study period on mechanical ventilation and divided into two equal groups randomly. Setting: Data were collected from Intensive Care Units at general fayoum hospital. Tools: Data was collected utilizing two designed tools :interview assessment sheet which includes demographic characteristics, medical characteristics, mechanical ventilator assessment sheet, suction characteristics assessment sheet and Physiological outcomes follow up sheet include: heart rate, respiratory rate, blood pressure and oxygen saturation. **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, Cardiorespiratory Parameters*

Introduction:

Mechanical ventilation is used to rescue patients from respiratory failure, maintain oxygen and carbon dioxide reduce intracranial pressure, and prevent or reduce atelectasis and hypoxemia. However, mechanical ventilation often requires intubation or tracheostomy (or both) as well as sedation which promotes the accumulation of secretions within airways. Consequently, endotracheal suction systems are essential for routinely aspirating airway secretions to prevent bronchial obstruction and its attendant complications, including alveolar hypoventilation, hypertension, increasing the stretch of the alveolar wall, emphysematous bubbles, atelectasis, short-term arterial desaturation, and alterations in cardiopulmonary measures such as blood pressure and heart rate (**Raimundo, 2021).**

Endotracheal suction also bears several risks, including hypoxemia, arrhythmia, nosocomial pneumonia, lung hypo inflation, bronchospasm, increased intracranial pressure, and pneumothorax.

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Suction, as a short-term effect, can reduce lung compliance and intrapulmonary pressure, leading to a decrease in oxygen saturation and retention of carbon dioxide. Moreover, endotracheal aspiration may directly stimulate the trachea or indirectly lead to lung hyperinflation, which can rapidly alter heart rate and blood pressure through autonomic reflexes Thus; numerous end points of cardiopulmonary function are used to monitor patient stability during mechanical ventilation and endotracheal aspiration (**Raimundo, 2021).**

In mechanical ventilation, endotracheal aspiration can be performed with open suction systems (OSS) or closed suction systems (CSS). Conventional OSS require disconnection of patients from the ventilator to allow catheter insertion. This diminishes PEEP and oxygen supply and may lead to changes in cardiopulmonary function. In contrast, CSS do not require disconnection and hence allow maintenance of PEEP and oxygen supply during suction and improving blood oxygenation. Because CSS use catheter connected between the endotracheal tube and ventilator circuit in a constantly sterile route of entry, some have speculated that such systems protect the patient from contamination relative to OSS. In contrast with prior negative findings a recent meta-analysis associated CSS with a lower risk for ventilator-associated pneumonia. Others have noted that CSS are easier and faster to use and cause fewer physiologic disturbances. Indeed, CSS can modestly attenuate aspiration- induced increases in heart rate and arterial pressure and declines in oxygen saturation relative to OSS (**Raimundo, 2021).**

Closed suctioning was originally introduced for hygiene reasons and as a method of avoiding desaturation and reduction in lung volume during suctioning. In a closed suctioning system (CSS), the catheter is a part of the ventilator circuit and there is no need to disconnect the ventilator. Continuing connection to the ventilator helps prevent loss of both positive end-expiratory pressure (PEEP) and lung volume. Thus, it may enable volume recruitment in the lung and avert a drop in oxygenation. CSS can thus reduce the risks of hypoxemia, atelectasis and hemodynamic fluctuations (**Jung, 2021).**

During open endotracheal suctioning and disconnection of a ventilator, patients may be exposed to a sudden unintended withdrawal of PEEP, which may induce repeated lung derecruitment and hypoxia. However, CSS can prevent alveolar derecruitment and maintain appropriate oxygenation through a steady functional residual capacity (FRC). Regional lung derecruitment after endotracheal suction has been measured by electrical impedance tomography. The results demonstrated that FRC decreased by 58 _ 24% of baseline at disconnection and 10% further during open suctioning (**Jung, 2021).**

Significance of the study:

The study was conducted in Intensive Care Units at king Fahd General Hospital (KFGH) and King Abdul-Aziz Hospital (KAAH) that tracheal suctioning is essentially performed procedure in mechanically ventilated patients. Based on reviewing the related literature the researcher observed that until now there are no concrete evidences of one system being better than the other(open vs closed TS). Therefore, the study was performed to evaluate the different effect of OSS and CSS on physiological outcomes stability of the mechanically ventilated patient CSS demonstrated substantial physiological benefits over OSS in the mechanically ventilated patients. The important basic physiological outcomes, Sp02 and HR, were significantly more stable during the use of CSS compared to OSS, as the OSS required an interruption of pressure support. Thus, the hypothesis was accepted, and the researcher recommends using of the CSS at all ICUs communities. (**Alsomali, 2019).** So the aim of the study was to determine the effect of closed versus

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open suction system on the cardiopulmonary parameters of ventilated patient

Aim of the study:

The aim of the present study was to comparing Cardiorespiratory Parameters in Open and Closed Suction for Patients on Mechanical Ventilation

Research hypothesis:

Research question

Is there a relation between Cardiorespiratory Parameters in Open and Closed Suction for Patients on Mechanical Ventilation?

Sample and Methods:

Design:

Comparative descriptive l 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. The intensive care unit containing (17) beds are occupied with patients. . The total numbers of nurses are: (1) head nurse, (10) Bedside nurses. Each bed have (1) monitor, (1) suction machine, (1) syringe pump, and (1) infusion pump, (1) ventilator.

Sampling:

A purposive sample of 60 dult 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.

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

Sampling technique:

Based on sample size equation 60 adult patients aged 18 years or more from both genders. The sample size was calculated by adjusting the power of the test to 80% and the confidence interval to 95% with margin of error accepted adjusted to 5% (**Steven equation, 2012)**.

$$n = \frac{N \times p(1-p)}{\left[\left[N-1 \times \left(d^2 \div z^2\right)\right] + p(1-p)\right]}$$

- N= Total population
- Z= Z value “1.96”
- D= Standard Error
- n= sample size

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:

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: age and gender.

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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:

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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 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.

-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

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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 (60)		Tests	
							X^2/t	P-value
Age	No	%	No	%	No	%		
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								
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

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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 effect on MABP

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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 effect 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 effect 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

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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 effect on Oxygen saturation percentage

Table (6): Relation between age and cardiorespiratory parameter in open suction methods

Open Suction	Age						ANOVA	
	18 <30		18 <30		18 <30			
	Mean	SD	Mean	SD	Mean	SD	f	P-value
Heart rate Immediately After suction	135.00	32.53	106.00	5.66	101.08	24.65	1.781	0.188
Heart rate 15 minutes After suction	131.00	29.70	100.00	0.00	98.42	15.63	3.808	0.035*
MABP Immediately After suction	100.00	7.07	107.50	3.54	101.73	15.86	0.150	0.862
MABP 15 minutes After suction	95.00	7.07	112.50	3.54	98.56	16.11	0.824	0.450
Respiratory rate Immediately After suction	20.00	0.00	19.50	2.12	19.65	1.92	0.040	0.961
Respiratory rate 15 minutes After suction	20.50	0.71	21.50	2.12	21.54	2.37	0.186	0.831
Oxygen saturation Immediately After suction	92.00	5.66	91.00	1.41	93.50	3.30	0.655	0.528
Oxygen saturation 15 minutes After suction	93.50	9.19	94.00	0	96.04	2.79	0.889	0.423

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

Table (6) showed that, there was statistically significance contrast relation between Heart rate 15 minutes after suction and age, at (p 0.035).

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Helwan International Journal for Nursing Research and Pratctice
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Table (7): Relation between age and cardiorespiratory parameter in closed suction methods

closed Suction	Age				ANOVA	
	40<50		>50			
	Mean	SD	Mean	SD	f	P-value
Heart rate Immediately After suction	74	0	85.52	8.89	1.624	0.213
Heart rate 15 minutes After suction	72	0	85.03	7.81	2.694	0.112
MABP Immediately After suction	90	0	97.02	9.51	0.527	0.474
MABP 15 minutes After suction	93	0	96.88	9.55	0.203	0.656
Respiratory rate Immediately After suction	14	0	14.21	1.05	0.038	0.848
Respiratory rate 15 minutes After suction	13	0	14.03	1.18	0.743	0.396
Oxygen saturation Immediately After suction	99	0	98.10	2.35	0.141	0.710
Oxygen saturation 15 minutes After suction	99	0	98.52	2.03	0.055	0.817

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

Table (7) showed that, there was no statistically significance relation between heart rate, mean arterial pressure, respiratory rate, (oxygen saturation) by pulse oximeter and age in closed suction, at (p*>0.05)*

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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

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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

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 2, Issue 1, Month: June 2023, Available at: https://hijnrp.journals.ekb.eg/

the hemodynamic parameters as heart rate, systolic and diastolic blood pressure

Regarding to **Relation between cardio respiratory parameter and age in closed and open suction methods.** There was statistically significance contrast relation between Heart rate 15 minutes after suction and age. There was highly statistically significance contrast relation between Respiratory rate Before suction and age and There is no statistically significance between heart rate, mean arterial pressure, respiratory rate, oxygen saturation by pulse oximeter and age in closed suction **This could be as a result that** when the age increase the physiological function of human decrease.

This explanation in agreed with Akhtar (2018) , which study titled Principles of geriatric critical care in **,** University Printing House, Cambridge CB2 8BS, United Kingdom**,** Age-related changes in respiratory function are defined by decreased strength of the respiratory muscles, a decrease in the elastic recoil of the lung, and a decrease in chest wall compliance Together these changes lead to decreases in lung volume and combined lung and chest wall compliance because age-related decreased chest wall compliance is proportionally larger than the increased lung compliance, the net compliance of the respiratory system is decreased, and therefore, resting work of breathing is increased and the diaphragm and abdominal muscles contribute proportionally more to the work of breathing than the thoracic muscles when compared with younger patients

Agreed also with Mutz (2022), which study titled Age-related changes in physiology in individuals with bipolar disorder, in UK Biobank Age-related changes in blood pressure, pulse rate, several body composition measures and, to a lesser extent, FEV1/FVC ratio differed between female cases and controls. In males, we found some evidence of differences in age-related changes in hand-grip strength, blood pressure and pulse rate, although most formal tests were not statistically significant. The other physiological measures followed comparable trajectories with age in cases and controls, it is also consistent with **Raveewan ,2022** which study titled Physiologic Changes in The Elderly, there are changes in the respiratory system, both in terms of structure and lung mechanics, which may not be noticeable change in normal conditions. But it results in the elderly having higher potency of respiratory failure when they have acute illness or respiratory infection. Therefore, the elderly has higher risk of intubation; prolong ventilator, longer hospitalization, morbidity and mortality outcome.

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 following recommendations are suggested:

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

ISSN 2786-0183
Helwan International Journal for Nursing Research and Pratctice
Vol. 2, Issue 1, Month: June 2023, Available at: https://hijnrp.journals.ekb.eg/

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