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Behavioral and Physiological Indicators of Pain During Nociceptive Procedures Among Mechanically Ventilated Patients at a University Hospital in Cairo

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Abstract
Critically ill mechanically ventilated patients experience significant and prolonged exposure to stressors from many sources related to injury or interventions. Pain is one of the stressors that can alter hemodynamics of such critically ill patients Aim of the study: to assess behavioral and physiological indicators of pain during nociceptive procedures among mechanically ventilated patients. Research Design: A descriptive exploratory design was utilized. Research questions: a):What are different behavioral indicators of pain during nociceptive procedures among mechanically ventilated patients ? b):What are different physiological indicators of pain during nociceptive procedures among mechanically ventilated patients? Setting: selected intensive care units of a university hospital in Cairo. Sample: A convenience sample of 100 critically ill patients connected to mechanical ventilators. Tools of data collection: Three tools were utilized to collect data pertinent to the current study: tool 1:Mechanically ventilated patients' demographic and medical data, tool 2: Critical Care Pain Observation tool, tool 3: Physiological indicators of pain assessment tool Results:. The current study revealed that during nociceptive procedures ,patients displayed manifestations of pain such: facial expression ,body movement, compliance with ventilator and muscle tension in percentage of:(54%,58%,45%,45%) respectively. Concerning physiological indicators the current study revealed increased means of heart rate, systolic blood pressure ,MAP, diastolic blood pressure ,respiratory rate during endotracheal suction procedure (113.69±11.50,134±17.4,95.5±12.25,76.58±10.86,21.7±7.84) respectively as compared to before and after procedure with significant statically differences as(F/P=8.651/.005,2935.012/.000,2694.048/.000,201.993/.000,488.212/.00). Conclusion: Nociceptive procedures is extremely common in ICUs ,observation of critically ill patients' behavior during those procedures is crucial .Recommendations: There is a need to ensure that pain should be recognized in critical care settings for patients with communication difficulties. Ongoing monitoring of critically ill patients vital signs during nociceptive procedures.
Keywords: Mechanical ventilation, Behavioral indicators, Pain , Nociceptive procedures

1. Introduction:

Critically ill mechanically ventilated patients usually experience pain, anxiety ,agitation and delirium as a consequence of their critical illness or routine care or both. Patients undergoing mechanical ventilation are particularly at threat for common stressors including pain from intubation, procedures, anxiety about their surroundings, bed rest ,and inability to vocalize(Lanken, Manaker, Kohl & Hanson III,2013).Uncontrolled pain in intensive care units triggers physical and emotional stress reactions and increases the length of ICU stay (Morton et al. 2005). Pain is the ultimate concern of patients in intensive care units (ICUs). Pain for these patients can cause increased sympathetic nervous activity, ventilator dyssynchrony (Batiha, 2014).

Noteworthy, appropriate pain management in critically ill patients is a significant issue in meeting their needs and maximizing the chance of recovery .Therefore the provision of pain management and comfort for all patients able and not able to communicate to health care provider an ethical issue (Kizza, 2012) .Moreover, Foreman, Milisen & Fulmer (2010) confirmed that, Pain assessment is an important part of the quality of care. Because of the nurse's presence at the patient's bedside, the critical care nurse has a unique and important role in pain assessment and management, in collaboration with the patient and his/ her family and the multidisciplinary team. As indicated by Ayasrah ,O'Neill, Abdalrahim, Sutary, & Kharabsheh (2014).

In Critical care settings there are multiple sources contributing to pain include disease, trauma, and routine nursing procedures. Care related pain is a concept includes painful procedures such as endotracheal suctioning for patients on mechanical ventilation .Mechanical ventilation, though actually lifesaving, is capable of generating complications,some of which may themselves be life threaenting.Numerous of these complications are related to endotracheal intubation (Hasan , 2010).

This is problematic due to the inability of many mechanically ventilated patients to verbalize because of

endotracheal intubation, and significant impairment of non-verbal communication ,Therefore, tools selected should be appropriate to the individual, and all methods deemed likely to gather the necessary information should be used .Methods include the use of assessment tools, and behavioral and physiological cues (Coyer, Wheeler, Wetzig , & Couchman, 2007). As indicated by Kaplow & Hardin (2007) .The first step of complete pain assessment is: to identify the sources of pain such as turning and suctioning ,second: to observe behavioral and physiological indiactors that may be associated with pain

1.2. Significance of the study

Nurses who caring for such group of patients should have special assessment skills, so they must depend on evaluation of both behavioral and physiological responses to pain for achieving adequate pain control in critical care settings. As pain negatively impacts critical care patients' outcomes e.g.: hemodynamic stability and decreases bed turn over and increases duration on mechanical ventilation .Quality of pain management begins with a comprehensive assessment, reassessment and documentation of pain among health care providers. However, few studies have been done in this area. According to Badr, Morsy, & Ali (2015) findings of a study about nurses knowledge and practices regarding pain assessment and management, majority of the studied subjects (95%) were having unsatisfactory practice level regarding pain assessment and management. Especially in relation to observing patient's behavior toward pain and monitoring vital signs in percentage of (97.068% & 73.17%) respectively. Therefore, there is a need to assess pain related behavior in patients with communication difficulties. The current study was conducted to provide an evidence based data related to this problem that can be incorporated by health professionals into the future plan of care for such patients. As well, it might generate an attention and motivation for future researches into this area.

2. Subjects and Methods:

2.1. Aim of the study

The aim of this study is to assess behavioral and physiological indicators of pain during nociceptive procedures among mechanically ventilated patients at one of Cairo university hospitals

2.2. Research Questions:

Q1: What are different behavioral indicators of pain during nociceptive procedures among mechanically ventilated patients at one of Cairo university hospitals?

Q2: What are different physiological indicators of pain during nociceptive procedures among mechanically ventilated patients at one of Cairo university hospitals?

2.3. Research Design

A descriptive exploratory research design was utilized in the current study. Descriptive exploratory design is to describe phenomenon in detail, explain relationships and differences among variables (Schmidt & Brown, 2014).

2.4 Setting

This study was conducted at selected Critical Care Unit affiliated to Cairo University Hospitals These unit were: The ICUs at a hospital for burn and emergency and First Critical Care Unit.

2.5. Subject

A convenience a sample of 100 adult male and female patients admitted to the ICU connected with mechanical ventilation with age ranges from 18-60 years. The study was carried out selected intensive care units affiliated to Cairo University Hospitals, in Cairo governorate from September 2016 to January 2017. Patients receiving neuromuscular blocking agents, spinal cord injury patients, brain death motor and sensory disorders (quadriplegia), facial trauma and hemodynamic instability patients excluded from the study.

2.6. Tools for data collection

Three tools were utilized to collect data pertinent to the current study: Mechanically ventilated patient's demographic, medical data, (Critical Care Pain Observation Tool,CPOT) , and physiological indicators of pain assessment tool

The three tools were utilized for data collection; two of these tools were designed by the researcher (Mechanically ventilated patients demographic, medical data and physiological indicators of pain assessment tool), reviewed by a panel of five experts and the CPOT was dopted from (Gélinas, et al ,2006). These tools were:

2.6.1.Mechanically ventilated patients demographic and medical data e.g.: the patient's age, gender, medical diagnosis, Mode of mechanical ventilation and length of ICU stay ….etc.

2.6.2.Critical Care Pain Observation Tool (CPOT):which was developed by (Gélinas ,et al , 2006) Critical Care

Pain Observation Tool is used to assess behavioral indicators of pain.(CPOT) a behavioral pain assessment tool for uncommunicative and sedated ICU patients The CPOT is a valuable option to assess painful procedures . The CPOT cutoff score >2, for the presence of pain and CPOT has four domains, each with different behavioral categories: 1) facial expression, 2) body movements, 3) muscle tension, and 4) compliance with the ventilator for intubated patients. It includes four behaviors scored (0–2) scale, for a possible total score ranging from (0 to 8) Each behavior is rated based on the intensity of the reaction observed .(Hsiung, Yang, Lee, Dalal & Smith, 2016) & (Ghanbari, ahadorizadeh, Farmanbar & Kazemnejad, 2016).

2.6.3.Physiological indicators of pain assessment tool: this tool was designed by the investigator which will involve vital signs such as Heart rate, blood pressure and respiratory rate. before and during nociceptive procedures and 20 minutes after procedure. Oxygen saturation by pulse oximetry before, during nociceptive procedures and 20 minutes after procedures

2.7. Validity and reliability of tools

Content validity were done for the tool (1,3) to identify the degree to which the used tools measure what was supposed to be measured. Tools were examined by a panel of five medical and critical care nursing experts to determine whether the included items were clear and suitable to achieve the aim of the current study**.** While tool (2) CPOT has high intraclass correlation coefficients (0.80 to 0.93) indicating moderate inter-rater reliability. Sensitivity of 39% and specificity of 85% for a cut off score of CPOT was 2 (Gélinas & Johnston, 2007)

2.8. pilot study

A pilot study was carried out on 10 patients to test feasibility, objectivity, and applicability of the study tools. Based on the results of the pilot study needed refinements and modifications were done and pilot study subjects were excluded from the actual study sample.

3. Protection of human rights

An official permission to conduct the proposed study was obtained from the research ethical committee and from hospital administrators to conduct the study. Participation in this study was entirely voluntary; each patient /relative had the right to accept participation in the study or not. Informed consent was obtained patient or their relatives. Anonymity and confidentiality were assured through coding the data, every participant had the right to withdraw from the study at any time; subjects were assured that the data will not be reused in another research without second /other new permission

4. Procedure:

The study was conducted through two phases: designing phase and technical phase.

4.1-Designing phase:

It involved construction of different data collection tools, obtaining official agreements to conduct the study, then, it was ended by conduction of the pilot study. After obtaining the official permission to proceed with the proposed study, actual implementation was initiated by obtaining a list of patients who admitted to critical care departments and connected with mechanical ventilators, and met the inclusion criteria. Then patients/relatives (in case of unconscious patient) who agreed to participate in the study were interviewed individually by the investigator to explain the nature and purpose of the study. A pilot study was carried out on five patients admitted to the ICU to test feasibility, objectivity, and applicability of the data collection tools and the five patients of the pilot study were included in the current study.

4.2-Technical phase

Data of the current study were collected from September 2016 to January 2017, once official permissions were granted. A total number of 100 patients who fulfilled the criteria of inclusion were recruited into the present study.The researcher visited the selected settings on daily basis during the Morning shifts, Each patient kept on 30 minutes duration during the assessments period eligible patients for the study or their relatives were informed individually about the purpose and nature of the study, and the researcher obtained written consents from those who accepted to share in the study. Eligible patients assessed for demographic and medical data assessment tool using (Appendix A). Then CPOT using (Appendix B) behavioral indicators of pain assessed among mechanically ventilated patients immediately before endotracheal suctioning procedure, during and then 20 min after procedure. As well as CPOT assessed among mechanically ventilated patients before position change procedure ,during and then 20 min after procedure ,CPOT assessed among mechanically ventilated patients before ABG sampling procedure ,during and then 20 min after procedure and CPOT assessed among mechanically ventilated patients before oropharngeal suctioning procedure ,during and then 20 min after procedure. Physiological indicators of pain using (Appendix C) was recorded from monitor immediately before

and during nociceptive procedures (Endotracheal suctioning, Position change, ABG sampling , Oropharngeal suctioning) and 20 minutes after procedures then recorded and 20 minutes after procedures.

5. Statistical data analysis

After completion of data collection, data were analyzed using SPSS program version 20; First, to analyse the data we used descriptive statistics: frequency measures for the qualitative variables. Dispersion measures for the continuous variables done such as means and standard deviations;. Second, "repeated measures analysis of variance (ANOVA) Statistical model was used and Friedman ANOVA test was performed for non-parametric data. General liner Model repeated measures for physiological parameters done. A significant level value was considered when P value is $P \leq 0.05$.

6. Results:

6.1. Figure (1) showed that 33% of the studied sample were in the age group of ≥ 60 years old, and 31% were in the age group of 40 < 50 years old with a mean age of : 49.34 ± 13.95. Figure (2) showed that more than two thirds (68%) of the studied sample were males.

6.2. Figure (3) showed that more than one half (51%) of the studied sample had received controlled ventilation mode.

6.3. Table (1): more than one quarter (34%) of the studied sample admitted with neurological emergencies (Ischemic stroke , subarachnoid hemorrhage) and also approximately one quarter (24%) admitted with traumatic emergencies (road traffic accident, disturbed conscious level). Figure (4) showed that almost all of the studied sample (94%) didn't have previous neurological diseases & more than three quarters (88) didn't have past surgical history.

6.4. Figure (5): shows that, more than two one third (40%) of the studied sample stayed from 11 to 20 days in the ICUs, with a mean length of ICU stay of 21.18±11.20.

6.5. Table (2) reveals that the total mean CPOT scores was higher during procedures as compared to before, after procedures (1.63±1.30,4.04±1.89,1.28±1.01) respectively, with statistical significance difference in the total mean scores as (F/P=107.249/0.000).

6.3.Table (3) reveals that during nociceptive procedures patients exhibited indicators of pain behaviorally such as facial expression, body movements ,compliance with ventilator and muscle tension in percentage of:(54%,58%,45%,45%) respectively, and the greatest indicator of pain were body movements.Morover facial expression, body movements ,compliance with ventilator and muscle tension indicators after procedures were lower than before procedures in percentage of (35%,36%,21,13% & 36%,44%,27%,14%) respectively.

6.4.Table (4) reveals that a significance statistical difference between CPOT indicators before ,during and after procedures (X^2=159.89 , P=.000 ,X^2= 46.30 , P=.000 ,X^2= 73.26 ,P=.000 and X^2= 88.19 ,P=.000 respectively).

6.5.Table (5) reveals that physiological indicators such as heart rate, systolic blood pressure ,MAP, diastolic blood pressure ,respiratory rate and oxygen saturation during endotracheal suction procedure were higher means (113.69±11.50,134±17.4,95.5±12.25,76.58±10.86,21.7±7.84) respectively as compared to before & after procedure with significance statistical difference(F/P=8.651/.005,F/P=2935.012/.000,F/P=2694.048/.000, F/P=2401.993/.000, F/P=488.212/.000 and F/P =81400.890/.000 respectively), However oxygen saturation was lower mean 94.65±3.87 during procedure as compared to before and after procedure.

6.6.Table (6) reveals that MAP and RR were higher means (92.55± 5.83 , 25.33±8.54) as compared to before & after ABG procedure with significance statically difference in the(F/P=564.241/.000,F/P=864.970/.000,F/P=1503.374/.000,F/P=4882.232/.000,F/P=81.717/.000,F/P=18079.905/.000) respectively.

6.7.Table (7) reveals that heart rate ,MAP, diastolic blood pressure & respiratory rate during procedure were higher means (112.17±22.16, 118.82±13.17, 93.29±10.08, 24.17±7.08) respectively as compared to before & after procedure ,however oxygen saturation was lower mean 95.76±1.43 during procedure with significant(F/P=605.665/.000,F/P=1195.24/.000,F/P=2004.852/.000,F/P=1616.598/.000,F/P=233.161/.000,F/P=143361.501/.000) respectively.

6.8.Table (8) reveals that systolic blood pressure ,MAP, diastolic blood pressure ,RR during procedure were higher means (103±12.3, 117.87±12.31 , 86.75±13, 72.81±11.39 ,18.43±7.73) as compared to before & after oropharngeal suction procedure with significant statistical difference(F/P=1736.047/.000,F/P=1460.778/.000,F/P=838.503/.000,F/P=744.963/.000,F/P=132.047/.000,F/P=60957.953/.000)respectively.

7. Discussion

The current study delineated that majority of the studied sample were older adult males with mean age 49.34 ±13.95. This findings is in agreement with with a study by Gélinas, Arbour, Michaud, Vaillant, & Desjardins (2011) which showed that older adult more than half of the studied sample were males, and mean age was

between 59 to 60 years. Concerning behavioral indicators of pain the current study revealed that critically ill mechanically ventilated patients displayed manifestations of pain increasing during nociceptive procedures which can be seen in the important variations for each indicators on the CPOT. Body movement is the greatest indicator of pain increased during nociceptive procedures as evidenced by protection (slow, cautious movements, touched or rubbed the site of the pain and sought attention through movements) to restlessness (pulled tube, moving limbs and attempting to sit up), Facial expression is second indicator of pain increased as evidenced by frowning, brow lowering, orbit tightening, levator contraction and eyelid tightly was the indicator followed body movement. Third indicator of pain lack of compliance with the ventilator .Finally, muscle tension increased during procedures compared with before and after procedures.

The findings of a study by Gélinas, Fortier, Viens, Fillion & Puntillo (2004). support the findings of the current study that found body movements were clearly the most recorded behavior, nurses recorded information such as tries to sit movements directed towards the endotracheal tube and touches the pain site. Notes on patients' compliance with the ventilator included on patients' biting the endotracheal tube, coughing, activating alarms, and not being "well ventilated.Morover findings of a study by Vázquez & et al (2009) found that Facial expression was the indicator that increased ,since it occurred in half of that observations body movements increased in more than one third; adaptation to the ventilator, occurred in 33% and muscular tension had an increase of less than one quarter of the observations.

As well, the present study revealed that heart rate and diastolic BP,systolic ,MAP increased during nociceptive procedures with statically significant difference. These findings are consistent with study by Vázquez & et al (2009) which also revealed that slight variations in the physiological variables during the postural change regarding baseline with statistically significant differences. In addition to physiological variables alert the staff that the patient may be in pain during a painful procedure.Similar results have been found in previous research (Payen et al., 2001; A¨ıssaoui et al., 2005; Young et al., 2006; G´elinas and Jonhston, 2007).

The current study revealed that total mean CPOT scores were higher means during procedures as compared to before and after procedure with a significance statically difference . This finding in agreement with a published study by Vázquez, Pardavila, Lucia, Aguado, Margall, & Asiain (2011) which found the total mean score on the CPOT scale positioning procedure was increased during procedure as compared to before, after the procedure. As well, Gélinas, Fillion, Puntillo, Viens, & Fortier (2006) findings lent support to results , found higher behavioral scores during positioning than at rest in unconscious critically ill patients. Such results emphasize that pain behaviors are observable even if a patient cannot report pain. Both the values for the physiological variables and the CPOT scores return to normal 10 min after the procedure and may even be lower than at baseline; this may indicate that the patients are more comfortable after the procedure has been carried out.

From researcher's point of view, critical care nurse spent most of time bedside the patients providing care ,though it seems challenging skills to assess pain for critically ill populations whom nonverbal ; therefore should seek for alternatives to assess pain symbols (nonverbal cues) in that self-reports are not available. .

In conflicting findings by Chen, H. J., & Chen, Y. M. (2015) " validation of the physiologic indicators in the ventilated adult patient" there was no significant correlation between patient's self-report of pain intensity and heart rate and blood pressure. As recommended by other scholars and researchers, heart rate and blood pressure can only be used as a clue for further pain assessment. If pain is suspected, further appropriate assessment is necessary to provide accurate judgment

8. Conclusion

Based on findings of the current study; it can concluded that: Pain is a real problem in critically ill patients. In order to be accurately managed, it must first be adequately assessed. Noteworthy they often exposed to routine procedures inducing a significant increase in pain. Nociceptive procedures such as (endotracheal suction) is extremely common in the ICUs,which potentially cause serious physical and psychological effects. The current study revealed that critically ill patients exhibited manifestations of pain during nociceptive procedures with different behavioral and physiological indicators. Critical care nurse needed to fully understand the behavioral and the physiologic variations of pain .Although today's guidelines strongly suggest the use of a standardized behavioral pain scale to nurses who care for uncommunicative patients further research is still ;therefore CPOT may improve the management of pain among ventilated patients by providing a systematic approach to pain assessment to guide interventions of such group of patients.

Based on the findings of the present study, the following recommendations are suggested:

1- Pain assessment should be recognized in acute care settings for patients with communication difficulties
2- CPOT can be recommended as valuable instrument for assessing pain in the ICUs for detecting pain related behavior
3- Replication of the study on a larger Probability sample from different geographical areas in Egypt
4- Ongoing monitoring of critically ill patients during routine nursing procedures
5-Protocols or unit guidelines that prioritize a trial of analgesia before nociceptive procedures.

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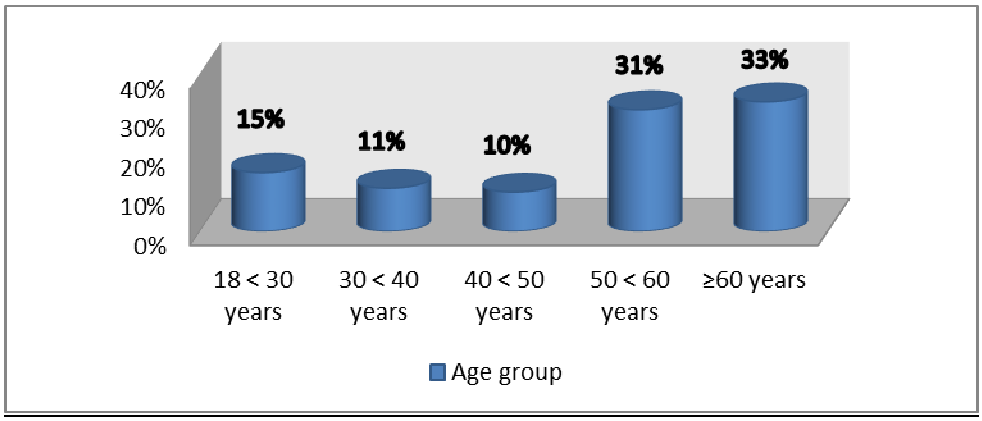

Figure (1): Percentage Distribution of the Studied Sample as Regards to Age Group, (N=100)

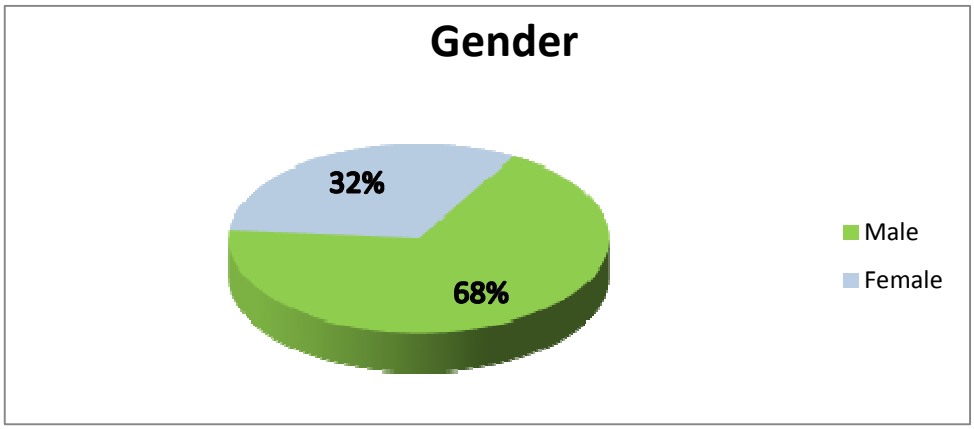

Figure (2): Percentage Distribution of the Studied Sample as Regards to Gender, (N=100)

CM: controlled Mode
SIMV: Synchronized intermittent mandatory
CPAP: Continuous Positive Airway Pressure

CM: controlled Mode
SIMV: Synchronized intermittent mandatory
CPAP: Continuous Positive Airway Pressure

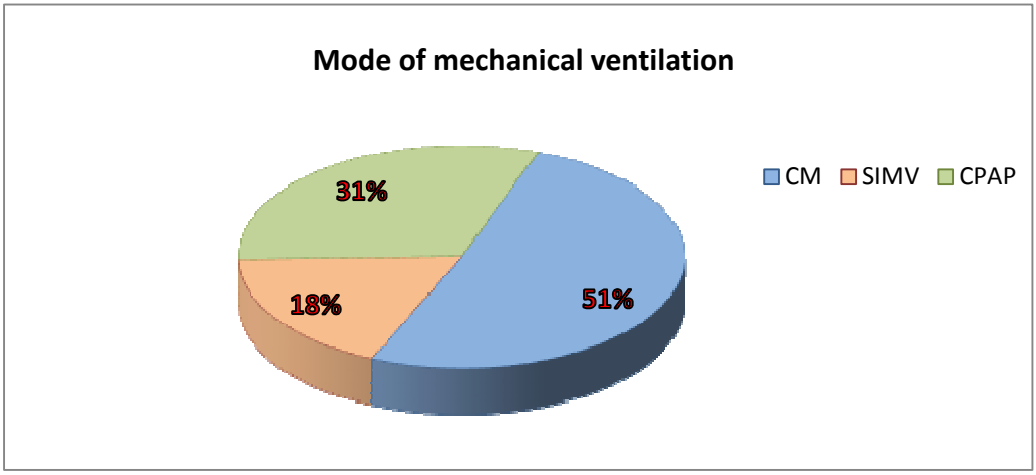

Figure (3): Percentage Distribution of the Studied Sample as Regards to mode of Mechanical Ventilation , (N=100)

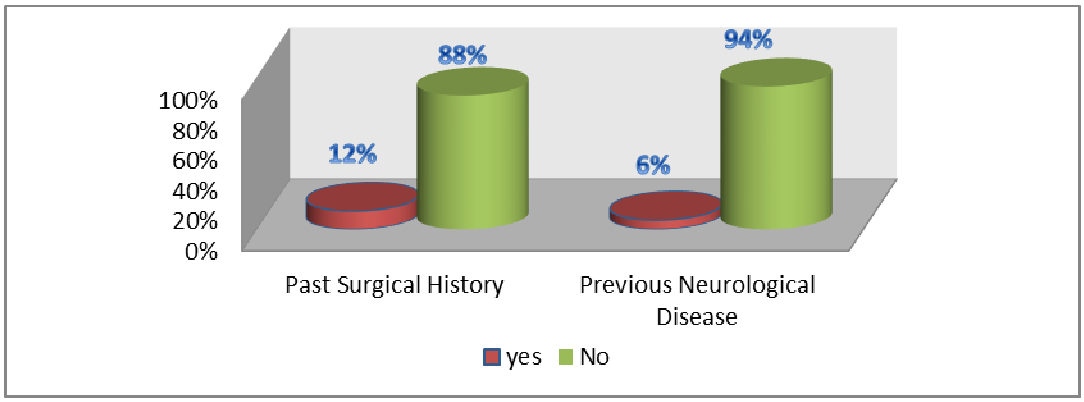

Figure (4): Percentage Distribution of the Studied Sample as Regards to Past Surgical History and Previous Neurological Diseases, (N=100)

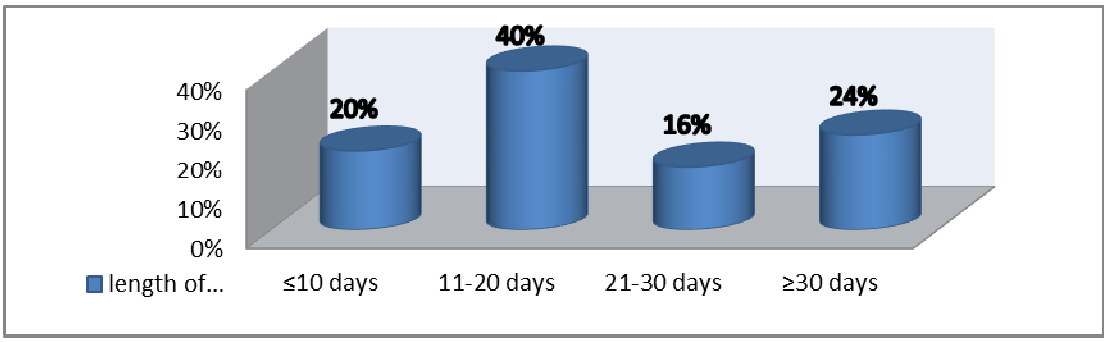

Figure (5): Percentage Distribution of the Studied Sample as Regards of Length of Stay, (N=100)

Table (1):Percentage Distribution of the Studied Sample as Regards to their Medical Diagnosis, (N=100)

N & % / Medical diagnosis	N	%
Cardiovascular emergencies	12	12
Respiratory emergencies	15	15
Neurological emergencies	34	34
Gastrointestinal emergencies	8	8
Trauma (RTA*/DCL**)	24	24
Shock	7	7
Total	100	100

RTA: Road Traffic accident *DCL: Disturbed conscious level

Table (2):One Way ANOVA for Total Mean CPOT Scores Before, During & After Nociceptive Procedures, (N=100)

Behavioral Pain assessment / $\bar{X}$ ±SD	$\bar{X}$ ±SD	F value	P value
Total mean CPOT* scores before nociceptive procedures	1.63±1.30	107.249	.000*
Total mean CPOT scores during nociceptive procedures	4.04± 1.89		
Total mean CPOT scores after nociceptive procedures	1.28 ±1.015		

Table (3), Percentage Distribution for Different CPOT Indicators Before, During & After Nociceptive Procedures,(N=100)

CPOT indicators / N&%		Immediately Before procedures		During procedures		after procedures 20 minutes	
	Value	N	%	N	%	N	%
Facial expression indicator							
Neutral, relaxed	0	63	63	1	1	65	65
Tense	1	36	36	45	45	35	35
Grimace	2	1	1	54	54	0	0
Body movements indicator							
Absence of movements	0	56	56	30	30	64	64
Protection, cautious movements	1	44	44	58	58	36	36
Restlessness/Agitation	2	0	0	12	12	0	0
Compliance with ventilator indicator							
Tolerating ventilator, no alarm activated	0	64	64	34	34	76	76
Coughing but tolerating	1	27	27	45	45	21	21
Fighting the ventilator	2	9	9	21	21	3	3
Muscle tension indicator							
Relaxed	0	86	86	40	40	84	84
Tense, rigid	1	14	14	45	45	13	13
Very tense or rigid	2	0	0	15	15	3	3
Total		100		100		100	

Table (4), Friedman ANOVA Between CPOT Indicators Before, During and After Nociceptive Procedures ,(N=100)

CPOT indicators	(X^2)	P
Facial expression indicator	159.89	.000*
Body movements indicator	46.30	.000*
Compliance with ventilator	73.26	.000*
Muscle tension indicator	88.19	.000*

*P ≤ 0.05

Table (5),Liner Model Repeated Measures for Physiological Indicators of the Studied Sample Before ,During & After ETT Suction Procedure, (N=56)

$\bar{X}$ ±SD / Physiological indicators		Assessment				
		Before ETT* suction $\bar{X}$ ±SD	during ETT suction $\bar{X}$ ±SD	after ETT suction $\bar{X}$ ±SD	F	Pvalue
Heart rate		102.7 ± 12.51	113.69±11.50	103.44±14.14	8.651	.005*
Blood pressure	Systole	128.12 ±17.52	134 ± 17.4	128.7 ±16.04	2935.012	.000*
	MAP	93 ± 15	95.5 ± 12.25	93.4 ±14	2694.048	.000*
	Diastole	75.36 ± 12.36	76.58 ± 10.8	75.92 ± 11.6	2401.993	.000*
Respiratory rate		20.14±6.63	21.7±7.84	20.12±6.58	488.212	.000*
Oxygen saturation		97.2 ±1.89	94.65±3.87	97.56± 2.29	81400.890	.000*

P ≤ 0.05 ETT: endotracheal suction

Table (6):Linear Model Repeated Measures for Physiological Indicators before during & after ABG Procedure, (N=9)

$\bar{X}$ ±SD / Physiological indicators		Assessment				
		Before ABG* $\bar{X}$ ±SD	During ABG $\bar{X}$ ±SD	After ABG $\bar{X}$ ±SD	F	P
Heart rate		113.33±13.91	113.67±13.47	111.89±15.46	564.241	.000*
Blood pressure	Systole	117.22 ±10.92	117.22±10.92	113.89±14.09	864.970	.000*
	MAP	88.33 ±8.54	92.55 ± 5.83	91.89± 7.02	1503.374	.000*
	Diastole	73.44± 5.85	78.33 ± 3.53	78.33± 3.53	4882.232	.000*
Respiratory rate		24.56 ± 7.94	25.33 ±8.54	25.33±8.57	81.717	.000*
Oxygen saturation		96.67 ±2.5	96.67± 2.5	98±1.5	18079.905	.000*

*P ≤ 0.05*ABG: arterial blood gases

Table (7):Linear Model Repeated Measures for Physiological Indicators before during & after Position Change Procedure, (N=18)

$\bar{X}$ ±SD / Physiological indicators	Assessment				
	Before position change $\bar{X}$ ±SD	During position change $\bar{X}$ ±SD	After position change $\bar{X}$ ±SD	F	P
Heart rate	99.08± 16	112.17 ±22.16	98.05± 16.88	605.665	.000*
Blood pressure					
Systole	114.±13.74	118.82±13.17	110.89±15.83	1195.24	.000*
MAP	89.17±8.29	93.29± 10.08	90±9.40	2004.852	.000*
Diastole	75.89±7.12	80±10.6	80±9.18	1616.598	.000*
Respiratory rate	22.23±6.51	24.17± 7.08	22.88±5.38	233.161	.000*
Oxygen saturation	97.52±1.23	95.76± 1.43	97.52±1.12	143361.501	.000*

*P≤ 0.05

Table (7):Linear Model Repeated Measures for Physiological Indicators before during & after oropharngeal suction Procedure, (N=17)

$\bar{X}$ ±SD / Physiological indicators		Assessment				
		Before OP* suction $\bar{X}$ ±SD	During OP suction $\bar{X}$ ±SD	After OP suction $\bar{X}$ ±SD	F	P
Heart rate		97.62 ±9.82	103±12.3	96.56±7.36	1736.047	.000*
Blood pressure	Systole	115.87±12.5	117.87±12.31	115.37±12.5	1460.778	.000*
	MAP	85.25±11.60	86.75 ±13	84±11.2	838.503	.000*
	Diastole	71±10.03	72.81±11.39	69.56±11.15	744.963	.000*
Respiratory rate		16.43±4.85	18.43± 7.73	17.81±5.96	132.047	.000*
Oxygen saturation		98.31±2	98.31± 1.92	98.93± 1.12	60957.953	.000*

*P≤ 0.05 *OP: oropharngeal