Impact of Nursing Guidelines for Early Tracheostomy Management for Traumatized Patients on Mechanical Ventilation

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Abstract: Tracheostomy is performed in Patients with multiple trauma can be liberated from mechanical ventilation rapidly and be transferred out of the ICU in a shorter time [(1.)]. One of the greatest contributions the nurse can make to decreasing costs, length of stay, and mortality in patients with respiratory problems is to implement interventions that will prevent or minimize complication [(2)]**.** Nursing guidelines is to outline the principles of management for patients with a new or existing tracheostomy for clinicians at the trauma ICU [(3)]**. Aim**: this study was carried out to investigate Impact of nursing practice guidelines for early tracheostomy management in mechanically ventilated trauma patient**. Design:** a quasi-experimental design**. Setting:** trauma ICU at Assiut University Hospitals. **patients:** A convenience sample of 60 patients in trauma ICU They were divided into two equals group 30 patients for each group – first group which tracheostomy was performed within the first 7 days of initiation of mechanical ventilation and the late tracheostomy group which tracheostomy was performed after 7 days of initiation of mechanical ventilation at any time. **Methods:** Both groups were evaluated daily during the three shifts using nursing guidelines. Assessment of tracheal secretions was done to detect any abnormalities in the amount, color and consistency was assessed every shift. Laboratory investigations (ABGs) were done daily from the 1st day of admission and until the 7th day of the study. Total leukocytes count and serum hemoglobin was done at the time of admission and repeated at the 4th, 7th and when needed. Culture of the respiratory secretions was done twice a week at the (4th and 7th day), to determine the effect of the implemented nursing guidelines in the reduction of tracheostomy complications. **Results:** there was highly significant difference (p<0.001) between two groups regarding to timing of mechanical ventilation and ICU length of stay. Moreover, 100%of early tracheostomy had improved while (46.7%) of late tracheostomy had improved**. Conclusion**: Nursing assessment should be a part of decision making for early tracheostomy to all trauma patients anticipated to require mechanical ventilation >7 days.

[Wafaa M. Mohammed Sweif, Mona A. Mohammed, Mervat A. Abd El-Aziz and Fatma Ahmed abd El-Aal. **Impact of Nursing Guidelines for Early Tracheostomy Management for Traumatized Patients on Mechanical Ventilation.** *J Am Sci* 2013;9(2):64-75]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 9

Keywords: Nursing; Guideline; Tracheostomy; Management; Patient; Ventilation

1. Introduction

Patients with multiple trauma often require mechanical ventilation for prolonged periods because of their inability to protect their airways, persistence of excessive secretions, and inadequacy of spontaneous ventilation[(1)]. A tracheostomy is usually performed as a surgical procedure in an operating theatre, although tracheostomies are common place in critical care units and ENT departments [(5)] . Critically ill trauma patients may require prolonged mechanical ventilator support for a variety of reasons: sever chest trauma resulting in lung contusion. An additional potential advantage of tracheostomy is reduction of dead space when compared to endotracheal tube [(10)]**.** Tracheostomy tubes are used to maintain a patent airway and to facilitate mechanical ventilation presence of these artificial airways prevents effective coughing and secretion removal, requiring periodic removal of pulmonary secretions with suctioning .In acute care situation ,suctioning is always performed as a sterile procedure to prevent nosocomial pneumonia.

The most advantages of tracheostomy over endotracheal intubation include improved client comfort and reduced laryngeal, pharyngeal, oral, and nasal damage that can be caused by long-term endotracheal tube placement the use of nasogastric or nasoenteric tubes for nutrition may not be necessary because a client can swallow effectively with a tracheostomy tube in place .Management of oral secretions is improved, and client. With the use of adaptive devices patients, are able to speak with tracheotomy tubes [(4)]. The benefits commonly ascribed to tracheostomy compared to prolonged endotracheal intubation include improved patient comfort, more effective clearance or airway secretions, improve ventilator parameters through decreased airway resistance, enhanced patient mobility increased opportunities articulated speech, ability to eat orally, decreased complications of prolonged pressure of the endotracheal tube to larynx and trachea, and a more secure airway [(9)]**.**

Complications can be directly related to placement of the tube, including stoma infection, hemorrhage, tracheomalacia, tracheoesophageal fstula, tracheoinnominate artery fistula, and tube obstruction and displacement. Leaving the tube in place for a prolonged period of time cause abnormal healing at the site of injured tracheal mucosa. Complications may be related to the inflated cuff of the tracheostomy tube or the tip of the tube, especially when it impinges of the posterior tracheal wall [(11)]. Tracheal stenosis, an abnormal narrowing of the tracheal lumen. Most commonly occurs at the level of the stoma or above the stoma (suprastomal) but below the vocal cords (subglottic). [(12)].

The essential principle when caring for patients, with a tracheostomy are based on maintaining patient safety, facilitating communication and preventing complications associated with the procedure [(6)] . One of the greatest contributions the nurse can make to decreasing costs, length of stay, and mortality in patients with respiratory problems is to implement interventions that will prevent or minimize complication [(7)]. Tracheostomy care is necessary to sustaining life, nurses play an important role in the critically ill patient breathe .The nurse must be knowledgeable and skilled in assessing patient needs, providing quick and efficient care ,evaluation results of intervention ,and supporting and teaching the patient and family techniques, equipment and procedure vary according to the patient's respiratory status [(8)]. **Nursing interventions** in the management of the patient with an artificial airway include suctioning, humidification, cuff management and communication. [(13)]. The nurse provides tracheostomy care for the client with a new or recent tracheostomy to maintain patency of the tube and reduce the risk of infection. Initially, a tracheostomy may need to be suctioned and cleaned as often as every 1 to 2 hours. Aseptic technique should be used when providing tracheostomy care in order to prevent infection after the stoma has healed, clean gloves can be used while changing the dressing and tie tapes [(14)]. Suctioning is performed to maintain a clear airway and optimize respiratory function It can be performed via a tracheostomy tube patency of the newly created airway is vital, and frequent suctioning is necessary because of increased secretion from the tracheobronchial tree caused by trauma. Suctioning of the tracheostomy must be sterile and a traumatic; a sterile disposable catheter and glove should be used for each procedure. [(15)].

Patients receiving mechanical ventilation should be placed in a semi-recumbent position at 30 to 45 degrees rather than supine to prevent aspiration, [(16)]. Mechanical ventilation (MV) is one of the most commonly applied interventions in intensive care units. Despite its life saving role, Mechanical ventilation is associated with additional risks to the patient and additional health care costs if not applied appropriately [(17)]. The nurse assesses for the presence of secretions by lung auscultation at least 2 to 4 hours. Measures to clear the airway of secretions include suctioning, chest physiotherapy, frequent position changes, and increased mobility as soon as possible. Frequency of suctioning should be determined assessment. If excessive secretions are identified by inspection or auscultation techniques, suctioning should be performed. Humidification of the airway via the ventilator is maintained to help liquefy secretions so they are more easily removed [(18)].

Repositioning the patient regularly has a number of positive effects: routine turning and positioning assists in the mobilization of secretions, prevents the development of pressure areas, joint stiffness and deformities, improves oxygenation and can encourage weaning from the ventilator [(21)]. Providing nutrition support to the mechanically ventilated patient is the standard of care. Nutrition support should be started within 24 hours [(19)]. Assess and document skin integrity at least every shift. Turn the patient from side to side q2h; reassess bony prominences for evidence of pressure injury taking care to position the limbs in proper alignment and supporting them to prevent dependent edema [(20)].

Various humidification devices add water to inhaled gas to prevent drying and irritation of the respiratory tract, to prevent undue loss of body water, and to facilitate secretion removal [(22).] Care of the stoma Provide tracheostomy care every 4 to 8 hours [(23)]. Properly care for a patient with a tracheostomy is vital because in appropriate or inadequate care may lead to complications and even death. While providing tracheostomy care, inspect the skin for signs of irritation or infection, such as erythematic, pain, or discharge. Thoroughly assess the skin around the tracheostomy for evidence of skin breakdown related to the tracheostomy device, tube securement device, or mucus and secretion [(24).] Clean the area around the tracheostomy tube with a noncytotoxic cleanser using sterile cotton – tipped applicator. Then rinse the skin with water and dry it gently with sterile gauze [(25)].

Proper oral hygiene has the potential to decrease the incidence of hospital acquired pneumonia Patient with artificial airways are extremely susceptible to developing hospital acquired pneumonia [(26)]. Oropharyngeal suction to remove any secretions that have pooled above the patient's cuff [(27)]. If infection is suspected, a swab should be taken from the site or discharge for analysis. Any suspicion of infection should be reported immediately. If infected respiratory secretions are suspected, a sputum specimen should be taken the next time the patient is suctioned or

expectorates sputum. Cotton wool, which fragment easily, should not be used**.** Barrier films may be used around the stoma site to protect the skin [(28).] General preventive measures, hand washing is a basic hygiene principle of infection control. Hand washing has proven most useful in controlling outbreaks of resistant organisms [(29)].

Aim of the study

Impact of nursing guidelines for early tracheostomy management for Traumatized patients on mechanical ventilation

2.Patients and Methods

Research design:-

A quasi experimental research design was utilized in the current study.

Setting:-

The study was conducted in the trauma intensive care unit in Assiut university hospital.

Sample:-

Convenient sample of available patients in trauma intensive care during six months from (1-5-2010 to 1-10-2010), sixty patients divided into two equal group 30 patients for each group – first group which tracheostomy was performed within the first 7 days of initiation of mechanical ventilation and the late tracheostomy group which tracheostomy was performed after 7 days of initiation of mechanical ventilation at any time.

Criteria of sample selection:-

Inclusion criteria:-

Age from18 to 60 years, early trauma patients and those who underwent tracheostomy during their ICU stay and mechanical ventilation with no more than 5 cm H_2O of positive end expiratory pressure (PEEP).

Exclusion criteria:-

- Chronic lung disease**.**
- Patients with history of previous trauma but admitted to the ICU for other reasons.
- Readmission to the ICU and trauma referrals from other hospitals.

Tools:-

Three tools were used to collect data:-

Tool (1): Patient`s assessments data:-

This tool was applied by the researcher after reviewing the related literature. It includes five parts:-

Part 1:-patient's biosocial-demographic data such as age and sex.

Part 2:- patient clinical data such as date of admission, vital signs, indication of tracheostomy, mechanical ventilation data.

Part 3:- Acute physiology and chronic health Evaluation score (APACHE II):

This tools was applied and some controversy surrounds the ideal time for reading variables, and deriving scores, which reading on admission(base line) 4th day, 7th days.

Part 4:- injury severity score (ISS):

The highest AIS score is used when a region has more than one injury. Any injury coded as 6 automatically converts the (ISS) to 75 (rang 1 to 75) which is the maximums score ($5^2+5^2+5^2$) An (ISS) of 16 or more is taken as major trauma

Part 5:- Glasgow coma scale:

The GCS (eye opening, verbal response, motor response) scores range from 3 to 15, (GCS) is calculated and then converted into number that equals on third of the raw score according to

Second tool: - "tracheostomy assessment sheet"

It include two parts:

part one: **Assessment of tracheostomy site and respiratory assessment**

Part two: this tool provide update guideline, for total care to the mechanically ventilated trauma patients who have tracheostomies, and preventive measures to lower the risk of complication due to the presence of tracheostomy **(Dougherty&Lister (2004) [(3)].**

It was composed of forty five items which include the following procedures:-

Hand washing, wear and change gloves, suctioning, change yankaur suction device elevate the head of the bed 30 to 45 degree if not contraindicated, oral hygiene, change ventilator circuit-tubing, scheduled drainage of condensate from ventilator circuit, change of heat and moisture exchangers (humidifier's water), changing nasogastric tube, and tracheostomy tube after 72 hours, and maintain tracheostomy tube cuff pressure every 2-4 hrs, care of tracheal site every shift.

Guidelines for tracheostomy care It includes:

A- care before tracheostomy :-

Ventilate patient through an endotracheal tube until the tracheostomy is completed, place the patient in a supine position with the neck in extension, provide support under the shoulders using small pillow, inflate the tracheal tube cuff and check for leaks, clean the skin from the mandible to the clavicles with antiseptic solution, drape the chest and neck, inflate the skin with a local anesthetic, provide analgesia, prepare tracheal and pharyngeal suction equipment.

B-care during Tracheostomy:-

make a midline skin incision vertically to expose the strap muscles, retract the strap muscles laterally to expose the pretracheal fascia and thyroid isthmus, clamp the thyroid isthmus and bluntly dissect to divide the isthmus and expose the trachea, transect the thyroid isthmus and ligate it by the means of sutures bleeding may be significant so be prepared to suction, take care to control the depth of penetration to minimize the risk of injury to the posterior trachea and the esophagus, insert the tracheal tube and the

obturator. Remove the obturator, inflate the cuff with 5 to 8 mL of air, and ventilate the patient with a bag-mask. Auscultate the lungs to assess tube placement, and verify tube position with a chest radiograph, tie the tracheostomy tube in place around the neck with tracheostomy tope, clean and dress the insertion site, deliver humidified oxygen as soon as possible.

C- Care after tracheostomy:-

Maintain patient airway(frequent a traumatic suction, humidification of inspired air and oxygen, mucolytic agent, coughing and physiotherapy, occasional bronchial lavage) prevent infection and complication(Aseptic tube suction, prophylactic antibiotics, deflate cuff for 5 minutes every hours, avoid tube impinging on posterior tracheal wall) changing tracheostomy dressing, changing tracheostomy tube and tracheostomy decannulation **(Epstein, 2005).**

Third tool:-

Evaluation sheet: - the aim of this tool was to assess the patient for the presence of signs and symptoms of infection it includes two parts, 1st part composed of four items which are vital signs (temperature, pulse, respiratory rate, BP), character of tracheal secretions **(**color, amount and consistency), color of the skin and mucus membrane(Dyspnea, cyanosis) breath sound examination (normal, crackles, wheezes, coughing) **.**and signs of local infection which include purulent discharge; pain around the site, odour, abscesses, and cellulitis or discoloration.

2nd part covers the laboratory investigations it was composed of four items which include (total leucocytes count and serum hemoglobin), culture sensitivity test and arterial blood gases analysis **(30).**

Methodology

The study was applied after the official approval for data collection were obtained from the head of the trauma ICU unit, and informed consent was obtained from relatives of the patients for the study (unconscious patients). Tools developed by the researcher after reviewing the related literature.

A jury was done to test the validity of the tools composed of 7 experts (3 medical anasthiologest-anasthesia department- assuit university, one medical staff from community health medicine- Assuit University and 2 nursing staffs of critical care nursing-assuit university and one nursing staff of community).

Pilot study

A pilot study carried out on number of six patients to test the applicability and clarity of the tools. Appropriate study modifications were done prior to data collection for the actual study.

Data collection:

Started from the first of May until the end of October 2010. The data taken by the researcher 7 days every 2 hours during three shift then the data were recorded in the developed tools.

Early tracheostomy group

The researcher assessed early tracheostomy patients within the first day of admission to the hospital during the different three shifts using tool one. Which include (patient's demographic data, patient's clinical data, Acute physiology and chronic health evaluation (APACHEII, injury severity score (ISS) and Glasgow coma scale (GCS).

Then the patient received the standardized nursing guidelines:

Hand washing procedure, gloving procedure ,suctioning procedure and oral care procedure, changing suction catheter, elevation of the head of the bed at 30-45 degree, changing ventilator circuit tubing when it is visibly soiled, draining and discarding any condensate from the tubing of mechanical ventilator, using sterile water to fill the humidifiers, turning patient in bed regularly, assessing residual volume before nasogastric tube feeding, changing tracheostomy tube and nasogastric tube every 72 hours.

Late tracheostomy.

The researcher assessed critically ill trauma patient who have tracheostomy after seventh day of mechanical ventilation and received the same standardized nursing guidelines:-

Evaluation of both groups (early and late tracheostomy)

Both groups were evaluated daily during the three shifts using **tool three (1st part and 2nd part): 1st** vital signs (temperature, pulse, and BP) were assessed every two hours according to detect any abnormalities. Skin color, percussion of the chest, thorax and breathing sound was assessed every shift. Assessment of tracheal secretions was done to detect any abnormalities in the amount, color and consistency was assessed every shift. Laboratory investigations such as ABGs were done daily from the 1st day of admission and until the 7th day of the study. Total leukocytes count and serum hemoglobin was done at the time of admission and repeated at the 4th ,7th and when needed. Culture of the respiratory secretions was done twice a week at the (4th and 7th day), to determine the effect of the implemented nursing guidelines in the reduction of tracheostomy complications.

Statistical analysis:

The collected data were coded, analyzed using statistical package for social sciences (SPSS) soft ware version 16 and tabulated. Descriptive statistics as number, percent, mean, standard deviation, t- test and paired samples t.

3. Results

Table (1):- represent the comparison between early tracheostomy and late tracheostomy according to bio-sociodemographic characteristics (age, sex). The mean age was (33.1 ± 18.5) in early tracheostomy and (37.6 ± 18.0) in late tracheostomy. It was noticed that (66.7%) were male while (33.3%) of patients were females in early tracheostomy and (96.7%) of patients were male and (3.3%) of patients were female in late tracheostomy. And there is no significant difference between two groups regarding to age while there were significant difference between two groups (p<0.01)regarding to sex. it was found that the highest percentage for indication of tracheostomy in the early tracheostomy for suspected prolonged intubation (50%),compared to(0.0%) for late tracheostomy. Regarding to prolonged intubation it was found that high percentage(90%) in late tracheostomy and (0.0%) in early tracheostomy.

Table (2):show the Distribution of the early tracheostomy and late tracheostomy according to their health condition(Glasgow Coma Score, Injury Severity Score and APACHE II Score) it was found that the Mean ± SD of Glasgow Coma Score for early tracheostomy in the seventh day was(12.77 ± 2.46).compared to(9.63 ± 2.76) in late tracheostomy and finding presenting highly significant difference between two groups (p <0.001),while it was found significant increase(p <0.01) between 4th and 7th day in early tracheostomy and the same in late tracheostomy.

According to Injury Severity Score it was found that the Mean ± SD in early tracheostomy was (26.30 ± 9.94), Compared to (21.50 ± 9.34) in late tracheostomy. and there were no statistical significant difference in both groups of the study .

According to APACHE II Score it was found that the Mean ± SD in early tracheostomy in the 1st ,4th and 7th day (9.50 ± 5.44),(7.40 ± 4.74)and (6.43 ± 3.73) respectively. Compared to late tracheostomy (20.67 ± 5.59),(17.80 ± 5.32)and(15.83 ± 5.25) respectively there were highly significant increase (p <0.001), while it was found significant increase(p <0.01) between 4th and 7th day in early tracheostomy and the same in late tracheostomy.

Table (3):show the Distribution of the early tracheostomy and late tracheostomy according to assessment of tracheostomy site.

According to discharges from trachea it was found that the highest percentage in early tracheostomy (56.7%) for white discharges from trachea in the first day while in the 7th day it was found that (63.3%) of early tracheostomy have white secretions , compared to late tracheostomy (16.7%). Regarding to yellow discharges from trachea it was found that highest percentage (86.7%)in late tracheostomy, compared to (10.0%)in early tracheostomy in the first day while in the 7th day was (3.3%) for early tracheostomy and (66.6%) for late tracheostomy.

Table (4): show Assessment of respiratory system (color of the skin and mucus membrane) for early and late tracheostomy. it was found that the majority of early tracheostomy were having high percentage(50%) of normal chest sound in the first day compared to (0.0%)in late tracheostomy while (76.7%) in the seventh day in early tracheostomy compared to late tracheostomy(33.3%), the finding show significantly increase (p <0.01)

Table (5): illustrates mean score and standard deviations of both groups (early and late tracheostomy) in relation to vital signs and white blood cells. It was noticed that there were highly statistical significant difference (p <0.001) in both groups (early and late tracheostomy) related to pulse. Regarding to the systolic blood pressure it was found that there were highly statistical significant difference (p <0.001) in both groups (early and late tracheostomy) related to systolic blood pressure. Regarding to the diastolic blood pressure it was found that the Mean ± SD of the early tracheostomy in the first day (71.82 ± 7.73) and (78.06 ± 11.52) in late tracheostomy. While in the 7th day it was found that the Mean ± SD for early tracheostomy (63.67 ± 6.30), compared to late tracheostomy (68.67 ± 5.93) and the finding show high statistical significant difference (p <0.01) between two groups. It was noticed that there were highly statistical significant differences(p <0.001) in both groups(early and late tracheostomy) related to temperature. as regard to white blood cells it was noticed that there were highly statistical significance differences(p <0.001) in both groups(early and late tracheostomy) related to white blood cells in the 1st, 4th and 7th day.

Table (6): Comparison between the study (early trachestomy) and control (late trachestomy) to arterial blood gases, As regard to PCO_2 showed significant increase in the first day (p <0.01) and there were no statistical difference in both groups in the fourth and seventh day of the study. Regarding to PO_2 there were no statistical significant difference in the first and fourth day and there were statistical difference in the seventh day (p <0.01) in both groups. According to HCO_3 it was found that there were highly statistical significant difference in both groups in the first day of the study, while there were significant difference(p <0.05) in the fourth day between two groups, compared to 7th day there were no statistical significant difference between two groups. As regard to PaO_2 it was found that on the 7th day there were high statistical significant difference(p <0.01) between two groups. As regard to FiO_2 it was found that the Mean ± SD of the early tracheostomy in the first day

was (51.67 ± 9.50) and (57.83 ± 7.84) in late tracheostomy, compared to seventh day (36.38 ± 10.59) in early tracheostomy and (42.40 ± 7.26) in late tracheostomy.

Table (7): show Distribution of the causative agents for infection between early and late tracheostomy. It was found that the majority of early tracheostomy were having high percentage (46.7%) of no growth in the first day, compared to late tracheostomy was (0.0%) while (33.3%) in the fourth day for early tracheostomy, compared to late tracheostomy was (0.0%). Regarding to pathogenic staph it was found that (30.0%)of early tracheostomy has pathogenic staph infection ,while (63.3%) of late tracheostomy in the first day of the study, compared to 4th day early tracheostomy has (16.7%) of pathogenic staph, while (53.3%)for late tracheostomy.

Figure (1):show modes of mechanical ventilator setting for early and late tracheostomy it was found that the majority of early tracheostomy were having high percentage (96.7%)for Ayrus, compared to (6.7%)in late tracheostomy it was found highly significant difference (p <0.001) between two groups.

Figure (2): Show timing of mechanical ventilation for early and late trachestomy

According to timing of mechanical ventilation(MV)it was found that the highest percentage in early tracheostomy(53.3%)were have 4 to 6 days on mechanical ventilation, compared to late tracheostomy (93.3%)were have more than 7 days on mechanical ventilation.

Figure (3): the figure illustrates of both groups (early and late tracheostomy) in relation to length of stay in trauma intensive care unit, it was found that the Mean ± SD of the late tracheostomy was(49.3 ± 10.4)and (16.9 ± 5.4) in the early tracheostomy, there were highly significant increase (p <0.001).

Fig (4) show Distribution of the study and control groups according to patient's condition, it was found that the highest percentage of patients were improved (100%) in early tracheostomy, compared to late tracheostomy (46.7%).

Table (1): Distribution of the study (early tracheostomy) and control (late tracheostomy) according to bio-sociodemographic characteristics

Sociodemographic characteristics	Early (n= 30)		Late (n= 30)		*P*-value
	No.	%	No.	%	
Age: (years)					
< 30	17	56.7	13	43.3	NS
≥ 30	13	43.3	17	56.7	
Mean ± SD	33.1 ± 18.5		37.6 ± 18.0		NS•
Sex:					
Male	20	66.7	29	96.7	< 0.01*
Female	10	33.3	1	3.3	
Indication for tracheostomy:					
Suspected prolonged intubation	15	50.0	0	0.0	<0.0001***
Chest toilet	3	10.0	3	10.0	NS
Difficult extubation	6	20.0	0	0.0	< 0.05*
Fr. Mandible	2	6.7	0	0.0	NS
Injury of the trachea	4	13.3	0	0.0	NS
Prolonged intubation	0	0.0	27	90.0	<0.0001***

Chi-square test • Independent samples t-test Statistical significant difference (P < 0.05)

Table (2): Distribution of the study (early tracheostomy) and control (late tracheostomy) according to their health condition (Glasgow Coma Score, APACHE II score and Injury Severity Score)

Item	Early (n= 30)	Late (n= 30)	*P*-value
	Mean ± SD	Mean ± SD	
Glasgow Coma Score:			
1st day	9.77 ± 2.45	8.57 ± 2.40	NS
4th day	10.53 ± 2.73°	9.17 ± 2.57°	NS
7th day	12.77 ± 2.46###	9.63 ± 2.76##	<0.001***
APACHE II Score:			
1st day	9.50 ± 5.44	20.67 ± 5.59	<0.001***
4th day	7.40 ± 4.74°°°	17.80 ± 5.32°°	<0.001***
7th day	6.43 ± 3.73###	15.83 ± 5.25###	<0.001***
Injury Severity Score: (baseline)	26.30 ± 9.94	21.50 ± 9.34	NS

Independent samples t-test

NS: Not significant * Significant ** High significant *** Highly significant

Paired samples t-test ◦ 1st vs. 4th day # 1st vs. 7th day

Table (3): Distribution of the study (early tracheostomy) and control (late tracheostomy) according to assessment of tracheostomy site

Assessment of tracheostomy site	Early (n= 30)		Late (n= 30)		*P*-value
	No.	%	No.	%	
Readiness or rash:					
1st day	0	0.0	0	0.0	--
4th day	0	0.0	1	3.3	NS
7th day	0	0.0	3	10.0	NS
Discharges from trachea:					
White:					
1st day	17	56.7	0	0.0	<0.001***
4th day	15	50.0	3	10.0	<0.001**
7th day	19	63.3	5	16.7	<0.001***
Yellow:					
1st day	3	10.0	26	86.7	<0.001***
4th day	3	10.0	23	76.7	<0.001***
7th day	1	3.3	20	66.6	<0.001***
Thick mucous:					
1st day	0	0.0	4	13.3	NS
4th day	0	0.0	4	13.3	NS
7th day	0	0.0	5	16.7	NS

Independent samples t-test
NS: Not significant * Significant ** High significant *** Highly significant

Table (4): Assessment of respiratory system (color of the skin and mucus membrane) for early and late tracheostomy

Days	Respiratory assessment		Early (n= 30)		Late (n= 30)		*P*-value
			No.	%	No.	%	
1st day	Color of skin and mucous membrane	Dyspnea	0	0.0	7	23.3	< 0.05*
		Cyanosis	0	0.0	1	3.3	NS
	Breath sound	Normal	15	50.0	0	0.0	< 0.001***
		Wheezing	0	0.0	1	26.7	< 0.01**
		Coughing	10	33.3	10	33.3	NS
		Crackle	5	16.7	26	86.7	< 0.001***
4th day	Color of skin and mucous membrane	Dyspnea	0	0.0	6	20.0	< 0.05*
	Breath sound	Normal	19	63.3	4	13.3	< 0.001***
		Coughing	8	26.7	9	30.0	NS
		Crackle	4	13.3	17	56.7	< 0.001***
7th day	Color of skin and mucous membrane	Dyspnea	0	0.0	4	13.3	NS
	Breath sound	Normal	23	76.7	10	33.3	< 0.01**
		Coughing	5	16.7	7	23.3	NS
		Crackle	2	6.7	12	40.0	< 0.01**

NB. One patient experienced more than one symptom
Chi-square test NS: Not significant * Significant ** High significant *** Highly significant

Table (5): Comparison between the study and control groups in relation to vital signs and white blood cells

Items		Early (n= 30)	Late (n= 30)	*P*-value
		Mean ± SD	Mean ± SD	
Pulse	1st day	118.71 ± 19.37	140.03 ± 17.07	< 0.001***
	4th day	109.49 ± 12.64	130.77 ± 10.67	< 0.001***
	7th day	101.30 ± 10.27	122.33 ± 12.28	< 0.001***
Respiration	1st day	26.40 ± 6.57	35.31 ± 6.44	< 0.001***
	4th day	22.74 ± 2.60	30.29 ± 4.15	< 0.001***
	7th day	19.99 ± 1.87	26.57 ± 3.87	< 0.001***
Systolic blood pressure	1st day	128.78 ± 11.40	142.88 ± 12.78	< 0.001***
	4th day	120.01 ± 9.77	134.72 ± 10.97	< 0.001***
	7th day	113.11 ± 9.12	125.56 ± 7.59	< 0.001***
Diastolic blood pressure	1st day	71.82 ± 7.73	78.06 ± 11.52	< 0.05*

Items		Early (n= 30)	Late (n= 30)	*P*-value
		Mean ± SD	Mean ± SD	
Pulse	1st day	118.71 ± 19.37	140.03 ± 17.07	< 0.001***
	4th day	109.49 ± 12.64	130.77 ± 10.67	< 0.001***
	7th day	101.30 ± 10.27	122.33 ± 12.28	< 0.001***
Respiration	1st day	26.40 ± 6.57	35.31 ± 6.44	< 0.001***
	4th day	22.74 ± 2.60	30.29 ± 4.15	< 0.001***
	7th day	19.99 ± 1.87	26.57 ± 3.87	< 0.001***
Systolic blood pressure	1st day	128.78 ± 11.40	142.88 ± 12.78	< 0.001***
	4th day	120.01 ± 9.77	134.72 ± 10.97	< 0.001***
	7th day	113.11 ± 9.12	125.56 ± 7.59	< 0.001***
	4th day	69.18 ± 9.28	74.83 ± 8.60	< 0.05*
	7th day	63.67 ± 6.30	68.67 ± 5.93	< 0.01**
Temperature	1st day	38.12 ± 0.87	39.04 ± 0.72	< 0.001***
	4th day	37.46 ± 0.46	38.36 ± 0.42	< 0.001***
	7th day	37.04 ± 0.22	37.87 ± 0.33	< 0.001***
WBCs	1st day	12.14 ± 5.14	22.27 ± 6.06	< 0.001***

Table (6): Comparison between study (early tracheostomy) and control (late tracheostomy) according to arterial blood gases

Arterial blood gases		Early (n= 30)	Late (n= 30)	*P*-value
		Mean ± SD	Mean ± SD	
PH	1st day	7.42 ± 0.08	7.44 ± 0.07	NS
	4th day	7.44 ± 0.06	7.45 ± 0.05	NS
	7th day	7.44 ± 0.06	7.44 ± 0.06	NS
PCO_2	1st day	33.55 ± 6.86	40.69 ± 8.90	< 0.01**
	4th day	35.17 ± 4.36	37.65 ± 6.22	NS
	7th day	35.30 ± 3.27	37.38 ± 4.96	NS
PO_2	1st day	106.47 ± 37.22	97.10 ± 30.15	NS
	4th day	120.10 ± 30.20	108.27 ± 22.49	NS
	7th day	128.27 ± 28.99	107.03 ± 25.69	< 0.01**
HCO_3	1st day	22.36 ± 5.99	27.80 ± 5.14	<0.001***
	4th day	24.12 ± 4.48	26.96 ± 4.03	< 0.05*
	7th day	25.20 ± 4.19	26.89 ± 4.17	NS
FiO_2	1st day	51.67 ± 9.50	57.83 ± 7.84	<0.01**°
	4th day	45.50 ± 8.34	50.67 ± 6.79	<0.05*°
	7th day	36.38 ± 10.59	42.40 ± 7.26	<0.05*°

Independent samples t-test
NS: Not significant * Significant ** High significant *** Highly significant

Table (7): Distribution of the causative agents for infection between study and control groups

Culture	Early (n= 30)		Late (n= 30)		*P*-value
	No.	%	No.	%	
1st day:					
Gram +ve bacteria:					
MRSA	0	0.0	4	13.3	NS
Non-pathogenic staph	6	20.0	0	0.0	< 0.05*
Pathogenic staph	9	30.0	19	63.3	< 0.05*
Gram positive staph	0	0.0	2	6.7	NS
Gram -ve bacteria:					
Klepsiella	1	3.3	5	16.7	NS
Non-lactose fermenter	0	0.0	0	0.0	--
No growth	14	46.7	0	0.0	<0.001***
4th day:					
Gram +ve bacteria:					
MRSA	0	0.0	6	20.0	< 0.05*
Non-pathogenic staph	15	50.0	2	6.7	<0.001***

Pathogenic staph	5	16.7	16	53.3	< 0.01**
Gram positive staph	0	0.0	3	10.0	NS
Gram -ve bacteria:					
Klepsiella	0	0.0	2	6.7	NS
Non-lactose fermenter	0	0.0	1	3.3	NS
No growth	10	33.3	0	0.0	< 0.01**

Chi-square test NS: Not significant * Significant ** High significant *** Highly significant

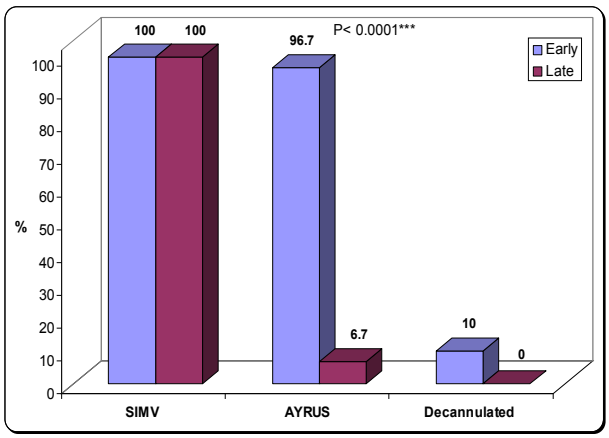

Fig. (1): Mode of ventilation

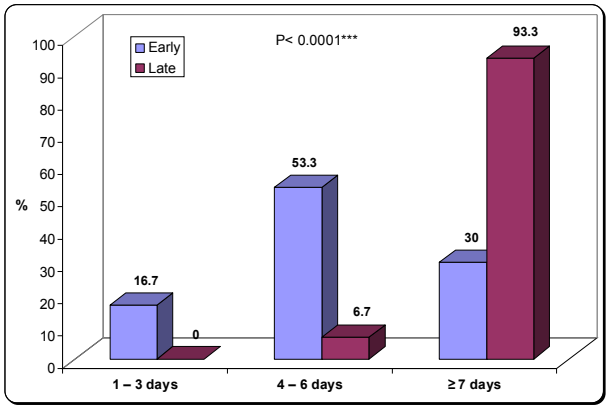

Fig. (2): Timing of mechanical ventilation

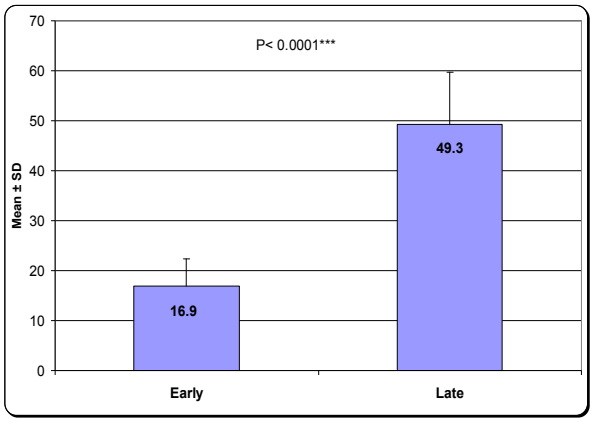

Fig. (3): Length of stay in trauma intensive care unit

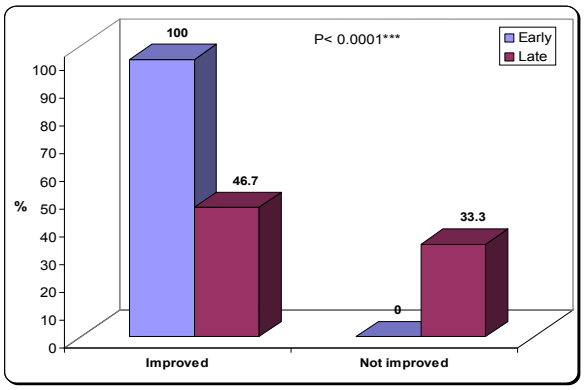

Fig. (4): Patient's condition

4. Discussion

Head trauma patients constitute about 50% of all neurosurgical. Majority of the patients admitted to ICU have low GCS scores and require prolonged ventilation. **Sofi, 2010** [(40)] Tracheostomy facilitates weaning by reducing dead space and airway resistance and by improving secretion clearance. This reduces the likelihood of tube obstruction by inspissated mucus, makes the patient more comfortable, requiring less sedation and reducing the likelihood of aspiration through improved glottic function **Pierson, 2005** [(43)]

Tracheostomy care and tracheal suctioning are high risk procedures. To avoid poor outcomes, bedside nurses who perform them must adhere to evidence based guidelines. The assessment and management process is very individualized and discussion with othetr team members involved in the patient care can greatly facillate the nursing intervention. **Dikeman & Kazandjian, 2004[(46)].** Despite the integral role played by tracheostomy in the management of trauma patients admitted to intensive care units (ICU).its timing remains subject to considerable practice variation.

The present study investigates the implementation of nursing practice guidelines for early tracheostomy management of mechanically ventilated trauma patients in ICU in assuit university hospital.

The result of the current study revealed that significance differences (p<0.001) in both groups As regard to male sex which there 60% male. These results were agreed by **Ahmed & Kwo, 2007** [(44)]. who found that the significance difference in male sex. As

regared to indications for trachestomy there were significant difference (p<0.001) between (early versus late group) according to prolonged intubation this result in line with **May and Bortner, 2002** [47]who reported this significant difference.

Regarding the Glasgow coma score and injury severity score the results of the current study revealed that there were high statistical significant difference(p<0.001) between two groups in the 7th day of the study early tracheostomy show improvement in GCS than late tracheostomy, and APACHE II score the results of the current study revealed that highly statistical significant difference (p<0.001) between two groups in all study intervals, this results supported, **Gotter *et al.*, 2006**[48] who development a system to rate a patients risk for tracheostomy that included factors such as Glasgow coma scale, injury severity score, age and they concluded that patients with 90% risk for tracheostomy undergo early tracheostomy with in 72 hours of admission.

As regard to tracheostomy site the results of the current study revealed that early and late tracheostomy were clean, these results supported by **Willam, A J, MD 2010** [10] found that changing tracheostomy dressing with sterile equipment under clean conditions minimizing risk of infection and granulation tissue formation. Regarding to discharges from trachea the current study results found significant difference (p<0.001)of the early tracheostomy with white secretion (56.7%) and significant difference (p<0.001) of the late tracheostomy (86.7%) with yellowish secretion, these results supported by **Rotstein and Evans,2008** [38] and **Solouki *et al.*, 2009** [41] who reported that the presence of pus in tracheal suction indicating presence of respiratory tract infection.

The results of the current study revealed that significant difference (<p0.001) in normal breath sound in early trachestomy and late trachestomy at the 1st day Comparing with the seventh day the results of the current study were agreed by **Steven and Jonothon,2006** [31] **and Grossman and Fein,2008** [34] who said that abnormal breath sound might indicate presence of chest infection in many patients, which needs more assessment and intervention. Regarding to crackles sound the results of the current study revealed that only (16.7%) of early tracheostomy group had crackles sound at the first day of the study, while a larger percentage (86.7%) of the late tracheostomy group had crackles sound at the first day. Comparing with the seventh day only (6.7%) of the early tracheostomy group had crackles sound at the seventh day, while the majority (40%) of the late tracheostomy group had crackles sound at the seventh day. The results revealed a statistical significance difference (p<0.001) between both groups. As reported by **Marik, 2005** [35] crackles sound reflect underling inflammation and congestion **Safelar *et al.*,2005** [42] reported that between 100 and 150 ml of secretion can accumulate within a 24- hours, which need continuous assessment.

The finding of the current study related to body temperature revealed that there were highly statistical significance(p<0.001) decreases in early tracheostomy than late tracheostomy. These results supported by **Winters and Munro,2004** [33] who said that assessment of temperature is a basic yet important parameter to monitor, as an elevated temperature can signal the patient's response to infection, **Meduri *et al.*, 2009** [36] found that (86%) of patients with fever in ICU were infectious in origin. As regard to vital signs (pulse, blood pressure and respiratory rate) the results of the current study revealed that there was highly statistical significant difference (P<0.001) between two groups in all study days, early tracheostomy improves respiratory rate, these results supported by **Mascovici *et al.*,2002** [45] whom found that tracheostomy result in a significant reduction in the respiratory resistive work, intrinsic positive end expiratory pressure and the inspiratory pressure –time product, which is considered to be proportional to the oxygen cost of breathing. Regarding to white blood cells the results of the current study revealed that there is highly statistical significant difference (p<0.001)between early and late tracheostomy in all days of the study, early tracheostomy improves white blood cells. These results not in similar with **Dunham and colleagues 2006** [32] **.**whom found that no differences in mortality and nosocomial pneumonia between early and late tracheostomy and **Arabi *et al.*, 2004** [1] whom found that early tracheostomy reduce ventilator – associated pneumonia or colonization incidence.

regarding to the Arterial blood gases the results of the current study revealed that $PaCO_2$ was high significant difference(p<0.001) in the 1st day and high statistical difference (p <0.001) in the 7th day in early trachestomy group versus late trachestomy , as regarded to P_aO_2 and Fio_2 these results supported by **Sofi K.,2010**[40] who found that tracheostomy improves PaO_2 and lung mechanics. the results of the current study revealed that respiratory secretion culture (50.0%)of the early tracheostomy group had gram positive bacteria (p <0.005) at the 1st day increased to (66.7%)at the 4th day while (83.3%)of the late tracheostomy group had gram positive bacteria (p <0.001) at the 1st day increased to (90%)at the 4th day (p <0.01) these results similar to what was reported by **Bennani *et al.*, 2009** [37] who found that (68.18%) of patients were gram positive bacteria in culture. Regarding to the modes of mechanical ventilator setting for early and late tracheostomy it was found that the majority of early tracheostomy were having

high significant difference (p <0.001) for Ayrus, compared to late tracheostomy. This on line with **Pierson 2005** [43] who reported that effect of early trachestomy on weaning versus late trachestomy.

Regarding to timing of tracheostomy the results of the current study revealed that (16.7%)of early tracheostomy patients and(0.0%)of late tracheostomy patients had weaned from mechanical ventilation from 1 to 3 days while (53.3%)of early tracheostomy patients and(6.7%)of late tracheostomy patients had weaned from mechanical ventilation from 4 to 6 days and (30%) of early tracheostomy and (93.3%) of late tracheostomy patients had weaned from mechanical ventilation in more than 7 days, while (10%)of early tracheostomy and(0.0%) of late tracheostomy patients had Decannulated from tracheostomy from 4 to 6 days, the results showed significant reduction in duration of mechanical ventilation and timing of tracheostomy. As reported by **Rumbak and colleagues 2004** [39] **and Terrangni, *et al.*,2010** [46] whom found that early tracheostomy was associated with significantly less mortality, unplanned extubation, oral and laryngeal trauma and a shorter duration of mechanical ventilation and **ICU** admission. **Janeen J. 2010** [49] showed a decreased duration of mechanical ventilation with earlier tracheostomy.

Regarding to length of stay in ICU the current study results found that early tracheostomy patients had shorter length of stay in the ICU than late tracheostomy these results supported by **Sofi *et al.*, 2010** [40] who found that early tracheostomy had shorter duration in ICU stay and **Rumbak *et al.*,2004** [39] who found that there was ,on average a 10 –day reduction in the need for ventilatory support in the patients receiving early tracheostomy. As regard to patient's condition the current study revealed that (100%) of early tracheostomy had improved while(46.7%)of late tracheostomy had improved , these results supported by **Sofi K. *et al.*,2010** [40] who found that early tracheostomy showed improvement than late tracheostomy.

Conclusion and recommendations

In our study we found that early tracheostomy in trauma ICU patients was associated with a Significant reduction in the duration of mechanical ventilation and ICU length of stay. Early tracheostomies have been shown to reduce hospital stay. However to realize the benefits of early tracheostomy without performing unnecessary tracheostomies, appropriate patients must be identified early at the time of admission. Tracheostomy was a critical factor in weaning and discharge. Late tracheostomy was an independent predictor of prolonged ICU stay. Hospitals should implemented nursing protocols for tracheostomy patient on mechanical ventilation.

Based on the current study finding it was recommended that:

- Training and education program should be developed to the nursing staff about the standardized care that should be delivered to the trachestomatized mechanically ventilated patients.
- The nurse should be able to participate in decision making by perform daily patient assessment for early detection of any signs of complications at critical care units.
- apply a written policy in every ICU about the standardized nursing care that should be delivered to every patient in the unit.

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