Impact of Utilizing Nursing Guideline Protocol on Minimizing Ventilator Associated Pneumonia among Children at Zagazig University Hospital

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Abstract: Responsibilities of nurses for minimizing the rate of mechanical ventilator pneumonia may differ among different countries as it is a serious complication of mechanical ventilator. Mechanical ventilator pneumonia increases children's length of stay in the Intensive Care Unit and overall length of hospitalization. **This study aims** to identify the impact of utilizing nursing guideline protocol on minimizing ventilator-associated pneumonia among children. **A quasi- experimental design** was used in this study. **The present study was conducted** in both Pediatric and Neonatal Intensive Care Units at Zagazig University Hospital. **The study subjects** included two groups**. Group I**, consisted of 30 nurses providing direct nursing care for children receiving mechanical ventilation. **Group II**, included all children admitted to both Pediatric and Neonatal Intensive Care Units during a period of three months on mechanical ventilation and free from any sign of pneumonia during admission. The total number of children included in the study was 60, and they were divided into two groups, 30 children received routine nursing care (control group) and 30 children received the nursing guideline protocol to minimize ventilator-associated pneumonia (study groups). **Two tools** to collect the data were used**; the first** tool was child assessment sheet. **The second tool** was an observational checklist for nurses' performance. The study findings **concluded** that, the rates of VAP, duration of mechanical ventilation in days, as well as the length of stay in the hospital decreased significantly among children subjected to nursing guideline protocol. **The main study recommendations** :1- Development of training program should be conducted periodically for nursing staff in ICU.2- Nursing guideline protocol should be available and implemented in Egyptian ICU settings.

[Amal Eldakhakhny and Hala Zaiton **Impact of Utilizing Nursing Guideline Protocol on Minimizing Ventilator Associated Pneumonia among Children at Zagazig University Hospital]** Journal of American Science 2011; 7(12):444-453].(ISSN: 1545-1003). http://www.americanscience.org.

Key ward: Guideline protocol - ventilator associated pneumonia – children.

1. Introduction

Ventilator-associated pneumonia (VAP) is referred to nosocomial bacterial pneumonia which develops in children who receive mechanical ventilation. Ventilator-associated pneumonia occurred in about 5% of mechanically ventilated children in both pediatric (PICU) & neonatal intensive care units (NIC) at Washington University, faculty of Medicine in (USA). **(Elward et al., 2002).** The incidence of VAP in Egypt in a one year study of bacterial and fungal nosocomial infection among children in Pediatric Intensive Care Unit was 16 % . (**Elnawawy *et al.*, 2006**).

Weinburger *et al.* (2002), stated that, there are many side effects and complications associated with mechanical ventilation especially the increase risk of infection.

Measures should be taken to reduce the incidence of VAP, and several methods have been employed with varying levels of success. **Munro and Grap (2004)** mentioned that, strategies that may prevent the occurrence of VAP, and reducing the amount of bacteria within a patient's oral cavity, can be accomplished by both mechanical and pharmacological interventions. Maintenance of aseptic technique when performing endotracheal suctioning is essential to prevent contamination of the airways.

Nurses are in a unique position to prevent the transmission of nosocomial infections. **Hampton *et al.* (2005),** stated that, the use of specific nursing interventions for mechanically ventilated children could decrease average ventilation time and average length of stay with no concomitant increase in re-intubations. **Livingston (2000)**; reported that interventions to prevent VAP should begin at the time of, or if possible, before intubation and should be continued until extubation.

Nurses are constantly present at the child's bedside, so they are the primary healthcare professional responsible for monitoring the child's respiratory status. They are expected to keep an eye on any equipment required by the child, including ventilators and monitoring equipment, and to respond to monitor alarms (**Guentner, 2006**).

Therefore this study focus on the utilization of nursing guideline protocol on minimizing ventilator associated pneumonia.

Aim of the study

The present study aimed to identify the impact of utilizing nursing guideline protocol on minimizing ventilator-associated pneumonia among children at Zagazig University Hospital.

Research Hypotheses

1-Children who received nursing guidelines protocol have fewer incidences of VAP than those who received routine care.

2- Children who received nursing guidelines protocol spend less time on ventilator and in ICU than those who received routine nursing care.

2-Subjects and Methods

Study design

A quasi- experimental design was used in the present study.

Setting

The study was conducted in both Pediatric and Neonatal Intensive Care Units, at Children Zagazig University Hospital, Sharkia Governorate, Egypt.

Subjects of the study

The study subjects composed of two groups:

Group I –Nurses: All nurses providing direct nursing care for children on mechanical ventilator in the above mentioned settings regardless of their ages, qualification and years of experiences. (Totaled 30 nurses)

Group II- Children: All children at a period of three months who were admitted in both Pediatric and Neonatal Intensive Care Units who fulfill the following criteria:-

1- On mechanical ventilator within 24 hours.

2-Free from any signs of pneumonia during admission as proved by chest x-rays.

Children's totaled number was 60 and divided into two groups:

A-Control group: This consisted of 30 children who received routine nursing care.

B-Study group: This consisted of 30 children who received the nursing guideline protocol.

Tools of the study:

Two tools were used for data collection;

Tool I: Child`s VAP Assessment Sheet:

It was developed by the researchers and included information obtained from child`s record such as:

1-Name of the unit, child`s age and sex.

2- Admission diagnosis and indication of mechanical ventilation.

3- Length of stay on mechanical ventilator and in ICU.

4-Chest X-ray results.

Tool 2: A Structured Observational Checklist for Nurses` Practice:

An observational checklist was devolved by the researchers to evaluate nurses' practice provided to children on mechanical ventilator as guided by Centers for Disease Control.

(Centers for Disease Control and Prevention: 2003).

It included:

1-Assessment of respiratory system (2 items).
2- Suctioning from endotracheal tube (6 items.)
3-Ventilator management (10 items).
4-Infection control measures such as:
-Hand washing (7 items.)
-Protective clothes as gloves, gown and mask (6 items).
-Handling of soiled linen (5 items).
5-Provide general hygiene consists of (16 items).
6-Oral hygiene (9 items.)

Guideline Protocol

The Guideline protocol applied in this study was guided by the guideline of Centers for Disease Control and the prevention of ventilator-associated pneumonia,

(Centers for Disease Control and Prevention: 2003).

It included:

-Hand wash after contact with mucous membranes, respiratory secretions, or objects contaminated with respiratory secretions. Hand wash before and after contact with patients.

- Nosocomial bacterial pneumonias and infection control procedures used to prevent these pneumonias.

-Wearing gloves for handling respiratory secretions or objects contaminated with respiratory secretions.

-Providing subglottic suctioning before deflating the cuff of an endotracheal tube or before moving the tube.

-Elevate the head of the bed to 30 º - 45 º if not contraindicated.

-A comprehensive oral hygiene program to provide oropharyngeal cleaning and decontamination with or without an antiseptic agent.

Indicators of program success

Nursing guidelines protocol reduced both the total time children spent on mechanical ventilator and the length of stay in the ICU.

Method of data collection

1-An official permission for data collection from Zagazig University Hospital was obtained from hospital administrative personnel. Meeting and discussion were held between the researchers and the nursing administrative personnel to raise their awareness regarding aim of the research, as well as, to get their cooperation during the implementation phase of the research.

2- Development of the tools after thorough review of literatures. Tools content validity was established by a panel of five expertise in field of pediatric ICU and according to their opinion minor modifications was applied.

3-Ethical consideration: Written consent was obtained from nurses who agreed to participate in the present study after explanation for the aim of the study and confidentially of the result.

4-Pilot study:A pilot study was carried out on (10% of the sample) about three nurses and 6 children to estimate the time needed for data collection and visibility of tools.

5- Each neonate/ child was assessed for VAP by chest X-ray which done to observe the shadow of pneumonia in the chest before admission for both the control and study groups of children.

6- Each nurse was observed once at the morning shift (control group).

7- Each neonate/ child was reassessed for VAP at fifth day of being on mechanical ventilator.

8- The nursing guideline protocol was implemented where nurses were divided into five groups. Each group received four sessions lasting 60 minutes (one hour of each session).

9-Each neonate/ child in the study group was assessed for VAP.

10- Each nurse was re-observed after protocol implementation once in the morning shift (study group).

11-Each neonate/ child in the study group was reassessed for VAP by chest X-ray at fifth day of being on mechanical ventilator.

Statistical analysis

Data was checked, entered and analyzed by using SPSS (version 15) software computer package (special package for social science). Data was expressed as numbers and percentages for categorical variables. Range and mean ± standard deviation for continuous variables.

The scoring system for the observational checklist was conducted by giving two points for each completed item , and zero for the incomplete. Higher scores indicated higher level of practices. Total nurse's practice score was 122 points.

Chi-square (X^2), t- test, ANOVA (F- test), paired t-test and correlation coefficient (r) were used when appropriate. P value < 0.05 was considered to be statistically significant.

Results

Table 1 Shows that, 46.7%of studied children were from PICU and 53.3% were from NICU in among control group, compared to 53.3% and 46.7.9% among study group, respectively. Concerning age of children, 53.3% aged < 1 month (neonate) in among control group compared to 46.7% among study group, followed by 36.7% aged from 1-12 months among control group compared to 33.3% among study group. On other hand, 10.0% aged 1 year or more among control group compared to 20.0% among study group.

As regards to gender it was found that 56.7% were males and 43.3% were females among control group compared to 53.3% & 46.7% among study group respectively.

Regarding indications of ventilated child, among control group it was found that 46.7% of children were ventilated due to apnea, followed by 20% due to respiratory failure, while 13.2% due to respiratory distress syndrome, meanwhile both cardiac arrest and post-operation constituted 6.7%, and about 6.7% due to paralysis of respiratory muscles and sepsis. As compared to study group it was found that 40% due to apnea followed by both RDS and respiratory failure which constituted 20.0% while sepsis and paralysis of respiratory muscles constituted 13.4% and cardiac arrest were 3.3%.

It was revealed from the same table that, 46.7% of studied children had positive chest radiograph suggestive of ventilator associated pneumonia among control group and this percentage decreased to 20.0% among study group.

Table 2 Illustrated the mean duration of mechanical ventilation in days. It was 14.06 ±10.8days among control group which was decreased to 8.9 ±4.5 days among study group.

Regarding to the length of stay of the child in the ICU in days among control group it was 16.5 ±11.14

days decreased to 10.3 ± 6.4 days among study group. It was obvious that there was a statistical significant difference in the duration of mechanical ventilation and length of stay of children in the ICU throughout guideline protocol.

Table 3 Portrays nurse's practice about assessment of respiratory system as well as suctioning among studied children throughout guideline protocol. It was found that the total mean practice score regarding assessment of respiratory system was 0.2 ±0.4 in pre-guideline protocol(control group) and increased to 0.3 ±0.7 in post-guideline protocol (study group) It was found that there was no statistical significant difference among studied nurses throughout guidelines protocol. P= 0.32.

As regard suctioning, it was found that the mean score of practice regarding suctioning in pre-guideline protocol (control group) was 5.8 ±1.4, which increased to 9 ±2.3 after applying the guideline protocol (study group). A statistically significant difference was found among studied nurses throughout the use of guidelines protocol. P< 0.001.

The total mean of nurse's practice score regarding ventilator management was illustrated in **table 4**. It was found that nurse's practice score was 8.5 ± 2.1 in pre guidelines protocol(control group) and improved to reach 20.0 ± 2.4 in post guidelines protocol(study group). The same table portrays that there was a statistical significance difference among studied nurses throughout the use of guideline protocol. (P< 0.001).

Table 5 shows nurse's practice regarding universal precautions throughout guideline protocol. It was found that, the total mean practice score regarding hand washing was 6.6 ±2.2 in pre-guideline protocol (control group) compared to 6.7 ± 1.8 in post guideline protocol(study group). No statistically significant difference was found among studied nurses throughout guidelines protocol. P=1.0.

The same table illustrated that the total means score practice regarding protective clothes in control group was 3.7 ±2.4 compared to 5.2 ±1.3 in study group. It was found that, there was statistically significant difference among studied nurses throughout guidelines protocol. P= 0.01.

It was found also that, the total mean practice score was 1.3 ± 0.9 in control group and increased to 6.3 ± 0.7 in study group. No statistical significant difference was found among studied nurses throughout guidelines protocol. P< 0.001.

Nurse's practice about general hygiene among studied children throughout guidelines protocol was illustrated in **table 6**. It was found that, the total mean practice score was 12.3 ± 1.3 in pre guidelines protocol (control group) and increased to 19.4 ± 1.7 in post guidelines protocol (study group). A statistically significant difference was found among studied nurses throughout guidelines protocol. P<0.001.

Table 7 illustrated nurse's practice about oral hygiene among studied children throughout guidelines protocol. It was found that, the total mean practice score was 3.5 ± 1.3 in pre guideline protocol (control group)and improved to reach 6.4 ±0.8 in post guideline protocol (study group). A statistically significant difference was found between studied nurses throughout guideline protocol. P< 0.001.

As presented in **table 8,** the total means scores of nurses' practice throughout the guideline protocol. It was found that, total mean score was 41.7 ±14.1 in pre guidelines protocol (control group). compared to 51.6 ±3.9 in post guidelines protocol (study group). A statistically significant difference was found between pre and post guideline protocols. P< 0.001.

Table (1): Characteristics of Studied Children Throughout Guideline Protocol.

Characteristics of studied children	Control group		Study group	
	No(30)	%	No(30)	%
Attended unit:				
PICU	14	46.7	16	53.3
NICU	16	53.3	14	46.7
Age:				
< 1 month (neonate)	16	53.3	14	46.7
1-12 months (infant)	11	36.7	10	33.3
> 1 year (child)	3	10	6	20
Gender:				
Male	17	56.7	16	53.3
Female	13	43.3	14	46.7
Indication of mechanical ventilation:				
Respiratory distress syndrome	4	13.2	6	20.0
Apnea	14	46.7	12	40.0
Respiratory failure	6	20.0	6	20.0
Cardiac arrest	2	6.7	1	3.3
Paralysis of respiratory muscle and Sepsis	2	6.7	4	13.4
Post-Operation	2	6.7	1	3.3
Chest X ray(+ve)	14	46.7	6	20.0

Table (2):Duration of Mechanical Ventilation and Length of Stay in Intensive Care Unit Among Studied Children

Items	Control group	Study group	Significant test
	Mean ± SD (Range)		
Duration of MV in days	14.06 ± 10.8 (5-48)	8.9 ± 4.5 (5-20)	P < 0.05*
Length of stay in ICU in days	16.5 ± 11.14 (5-48)	10.3 ± 6.4 (5-28)	P < 0.05*

P < 0.05 significant (S) *

Table (3):Nurse's Practice about Assessment of Respiratory System As Well As Suctioning Among Studied Children throughout Guideline Protocol.

Items	Control group		Study group		X^2	P- value
	No(30)	%	No(30)	%		
1- **Assessment of Respiratory system:** -Assess respiratory rhythm	2	6.7	5	16.7	0.65	0.42
-Assess movement of the chest wall. (symmetric bilaterally and coordinated with breathing)	0	0.0	0	0.0	0.0	1.0
Total Mean ± SD (range)	0.2 ±0.4 0-2		0.3 ±0.7 0-2		Paired- t 1.0	0.32
2- **Suctioning from the ETT:** -Wash hands	12	40.0	20	66.7	4.29	0.03*
-Wear gloves and mask	20	66.7	25	83.7	2.22	0.13
-Insert the catheter into the Endotracheal tube gently by using aseptic technique	10	33.3	15	50.0	1.71	0.19
-Time of suctioning not exceed than 15 seconds	20	66.7	26	86.7	3.35	0.06
-Used proper size of catheter	20	66.7	23	76.7	0.74	0.39
-Discard suction tube immediately after one single use	0	0.0	0	0.0	0.0	1.0
- **Record and report**						
Amount	0	0.0	0	0.0	0.0	1.0
Characteristics of secretions	12	40.0	20	66.7	4.29	0.03*
Respiratory status	10	33.3	17	16.7	3.3	0.069
Child's response to procedure	4	13.4	9	30.0	2.45	0.11
Total Mean ± SD (range)	5.8 ±1.4 4-8		9 ±2.3 6-14		paired t 10.7	< 0.001**

P < 0.05 significant (S) * P < 0.01 highly significant (H.S) **

Table (4):Nurse's Practice Regarding Ventilator Management Among Studied Children Throughout Guideline Protocol.

Items	Control group		Study group		X^2	P value
	No(30)	%	No(30)	%		
Ventilator management:						
-Humidifiers should always be stored clean and dry	30	100.0	30	100.0	0.0	1.0
-Humidifiers should always be filled with sterile water	30	100.0	30	100.0	0.0	1.0
-Laryngoscope is disinfected after each child use	30	100.0	30	100.0	0.0	1.0
-Ventilator is disinfected after each child use	30	100.0	30	100.0	0.0	1.0
Perform suctioning of the child airway						
-Endotracheal tube	30	100.0	30	100.0	0.0	1.0
-Oropharyngeal	30	100.0	30	100.0	0.0	1.0
-And nasopharyngeal as needed	30	100.0	30	100.0	0.0	1.0
-Monitor arterial blood gases with each ventilator change and with any clinical change	20	66.7	27	90.0	4.81	0.02*
Monitor all ventilator setting, including						
-Mode	0	0.0	0	0.0	0.0	1.0
-Oxygen saturation	10	33.3	26	86.7	17.78	0.001**
-Tidal volume rate	0	0.0	0	0.0	0.0	1.0
-Adjust level of humidifier water	5	16.7	20	66.7	7.94	0.004*
-Monitor temperature of humidifier as body temperature	5	16.7	20	66.7	7.94	0.004*
-Change ventilator tubing a	6	20.0	9	30.0	0.8	0.37
Total Mean ± SD (range)	18.5 ±2.1 14-24		20.0 ±2.4 18-24		paired t 3.16	0.003*

P < 0.05 significant (S) * P < 0.01 highly significant (H.S) **

Table (5):Nurse's Practice About Universal Precaution Throughout Guideline Protocol.

Items	Pre (n =30)		Post (n=30)		X2	P value
	No	%	No	%		
1- Hand washing:						
- When visibly soiled	20	66.7	26	86.7	3.35	0.06
- Before child contact	10	33.3	15	50.0	1.71	0.19
- After child contact	10	33.3	15	50.0	1.71	0.19
- After contact with a source of microorganisms	20	66.7	30	100.0	12.0	0.001*
- Before performing an invasive procedures	10	33.3	15	50.0	1.71	0.19
- After removing gloves	10	33.3	10	33.3	0.0	1.0
- Alcohol rub is used-	19	63.4	22	73.4	0.69	0.4
Total Mean ±SD (range)	6.6±2.2 4-10		6.7±1.8 6-10		paired t 0.0	1.0
2- Protective clothes: a- Gloves - Contact with surfaces and article visibly soiled	10	33.3	15	50.0	1.71	0.19
- Performing vein puncture	18	60.0	20	66.7	0.29	0.59
- Handling specimen	0	0.0	10	33.3	12.0	0.001*
- Remove and discard gloves after each individual task before leaving bed	0	0.0	5	16.7	5.36	0.02*
b- Gown - Wear moisture-proof apron or gown whenever there is the potential of a body fluid contacting your clothes	18	60	18	60.0	0.0	1.0
c- Mask - Whenever there is the possibility of splash of any type of body fluid	10	33.3	20	66.7	6.67	0.009*
Total Mean ±SD (range)	3.7±2.4 0-8		5.2±1.3 2-8		Paired-t 3.4	0.01*
3 - Handling of soiled linen:						
- Put on gloves and wear a plastic apron during bed making	0	0.0	10	33.3	12.0	0.001**
- Linens are kept away from body to avoid contamination	10	33.3	20	66.7	6.67	0.009*
- Placing linens on chair, tables or on the floor are avoided	0	0.0	5	16.7	5.36	0.02*
- Soiled linens are kept in leak proof bags	0	0.0	5	16.7	5.36	0.02*
- Shake or toss linens are avoided	10	33.3	20	66.47	6.67	0.009*
Total Mean ±SD (range)	1.3±0.9 0-2		6.3±0.7 6-8		paired t 21.7	< 0.001**

P < 0.05 significant (S) * P < 0.01 highly significant (H.S) **

Table (6): Nurse's Practice About General Hygiene Among Studied Children Throughout Guideline Protocol

Items	**Control group**		**Study group**		**X^2**	**P value**
	No(30)	%	No(30)	%		
Provide general hygiene: - wash hands	0	0.0	10	33.3	12.0	0.001**
-Prepare the necessary linen	30	100.0	30	100.0	0.0	1.0
-Fill the bath basin one-half full of warm water	20	66.7	30	100.0	0.0	1.0
-Place the rubber sheet on bed	0	0.0	5	16.7	5.36	0.02*
-Start with eyes, wipe each eye from the inner to outer aspect of the lid with water only	0	0.0	10	33.3	12.0	0.001**
-Clean the ears gently by using moisten cotton balls with water only	5	16.7	10	33.3	2.22	0.13
-Cleanse the face by warm water only	20	66.7	30	100.0	12.0	0.001**
- Wash head with soap and water	10	33.3	20	66.7	6.67	0.009*
Place child in bed and dry the head quickly	10	33.3	20	66.7	667	0.009*
-Remove the napkin and clean the buttocks	30	100.0	30	100.0	0.0	1.0
-Wash infant's body	10	33.3	20	66.7	6.67	0.009*
-Dry infant carefully especially the skin folds	5	16.7	10	33.3	2.22	0.13
-Dress the infant	30	100.0	30	100.0	0.0	1.0
-Clean the finger nails and toe nails	0	0.0	5	16.7	5.36	0.02*
Clean the equipment	0	16.7	10	33.3	2.22	0.13
-Recording for: Time Observations	0 10	0.0 33.3	0 20	0.0 66.7	0.0 6.67	1.0 0.009*
Total Mean ±SD (range)	12.3±1.3 10-14		19.4±1.7 16-22		paired t 30.7	< 0.001**

P < 0.05 significant (S) * P < 0.01 highly significant (H.S) **

Table (7):Nurse's Practice About Oral Hygiene Among Studied Children Throughout Guideline Protocol.

Oral hygiene	Control group		Study group		X^2	P value
	No(30)	%	No(30)	%		
-Wash hands	0	0.0	10	33.33	12.0	0.001**
-Apply disposable gloves	10	33.3	20	66.7	6.67	0.009*
Position the child on his/her side	5	16.7	20	66.7	15.4	0.001**
-Clean child's mouth using toothbrush or sponge toothetts moistened with peroxide and water	0	0.0	5	16.7	5.36	0.02*
-Rinse child's mouth with a clean swab	17	56.7	28	93.4	10.76	0.001**
-Suction secretions as they accumulate, if necessary	15	50.0	26	86.7	0.07	0.79
-Apply water soluble jelly to child's lips	0	0.0	25	83.4	42.86	0.001**
-Clean equipment and return it to its proper place	5	16.7	10	33.3	2.22	0.13
-Record and report procedure and any abnormal observation	0	0.0	5	16.7	5.36	0.02*
Total Mean ±SD (range)	3.5±1.3 2-6		6.4±0.8 6-8		paired t 11.0	<0.001**

P < 0.05 significant (S) * P < 0.01 highly significant (H.S) **

Table (8) Total Means Scores of Nurses' Practice Throughout The Guideline Protocol.

Total score	Control group	Study group	Paired t-test	p-value
Total practice	Mean ±SD range		12.5	<0.001**
	41.7±14.1 30-52	51.6±3.9 44-60		

Discussion

Ventilator-associated pneumonia (VAP) is nosocomial pneumonia that develops later or within 48 hours in mechanically ventilated patients after initiating ventilation (**Elward *et al.*, 2007)**. Therefore, pediatric nurse should be skillful, highly trained especially when caring for children on mechanical ventilator.

In relation to the characteristics of the studied children, it was noted that more than half of subjects were at the neonatal period compared to study group were less than half at neonatal stage, followed by infant stage. As regard the indications of mechanical ventilation .It was found that the most common problems were apnea followed by respiratory failure and respiratory distress syndrome throughout guideline protocol this result may be due to that this the main causes of problems related to respiratory system which needed to be placed on MV.

In relation to chest radiograph, it was found that there is statistical significance difference related to the shadow of pneumonia among control and study group which indicate VAP. The incidence of the ventilator associated pneumonia decreased to less than half among study group. This shows the importance of using guideline protocol on reducing the incidence of ventilator associated pneumonia. This finding agrees with **Bigham *et al.* (2009)** who found in their study that ventilator associated pneumonia rate was reduced after program implementation.

Regarding mean duration of mechanical ventilation and length of stay of the child in ICU in days, for study group it decreased in post guidelines protocol than pre guidelines protocol, and there was a statistical significance difference in duration of mechanical ventilation and length of stay of the child in ICU throughout guideline protocol. This could be related to the fact that using guideline protocol has been demonstrated to be safe and effective in reducing time of mechanical ventilation. This finding agrees with studies done by **Henneman (2005)** and **Galley (2006)** as they showed similar results in relation to ventilation time and length of stay in ICU when nurses directed guideline protocol for minimizing rate of ventilator associated pneumonia.

In the present study a significant decrease in the VAP rates was found from the pre intervention period to the post intervention period. This finding agree with **Bigham *et al.* (2009)** who mentioned that ventilator-associated pneumonia is significantly associated with increased pediatric intensive care unit length of stay, mechanical ventilator days, and mortality rate.

Schleder (2004) and **Hunter (2006)** stated that, VAP is associated with increased length of ventilator dependence, pediatric intensive care unit (PICU)and hospital stay. In the current study, analysis of data showed the impact of utilizing the guideline protocol on minimizing ventilator associated pneumonia among pediatric patients in both PICU and NICU at Zagazig University Hospital.In addition VAP rate decreased more among study group than the control one as well as in post than pre program implementation.

.Nurses constitutes the highest percentage of

personnel working in hospital; hence any defect in their role will affect the quality of care given to the patient. Therefore, they require continuous training programs as well as follow up their care provided to the patient. The goals of continuous training for nurses are to enhance their knowledge,
practice, and attitude and ultimately to promote the quality of health care delivered to the public. **Zack *et al.* (2002)** reported that, training programs should be widely employed for infection control in the intensive care unit setting and can lead to substantial decreases in cost and patient mortality attributed to hospital-acquired infections. On the other hand, a study by **Wiebelans (2001)** emphasized on training programs for nurse's personal as a method for continuous updating and renewal of their knowledge and skills to maintain and improve competence.

Nurse's performance of mechanical ventilation management and care either in control group or in pre program implementation for the study group were in adequate. This inadequate performance may be attributed to the lack of opportunity for continuous education available in the hospital to improve the nurses` practice, shortage of equipments in the hospital, lack of special courses regarding this field.In addition nurse's work overload, lack of supervision and absence of the good role of the head nurse regarding close observation and reinforcement.

The present study clarified that there was a statistically significant difference among nurses in both control and study groups as well as between pre and post guidelines protocol regarding ventilator management and infusion preparation as well as universal precaution as protective clothes (gloves, mask, and gown) and handling of soiled linen. As stated **by Pediatric Affinity Group (2009)** the care of the ventilator includes clearing the circuit of condensate and preventing condensate from draining into the patient's airway, heated ventilator circuits, changing ventilator circuits when visibly soiled as preventing contamination of the equipment to reduce VAP. **Foxman (2003)** found in his study that the level of nurses' performance related to infection control had improved after implementation of the program

. Gloves are used as protective barrier to prevent contamination when touching blood, body fluid, secretion, excretion, mucous membranes and non intact skin; also gloves are used to protect the patient from the health care worker's flora **(Solotkin, 2002).** Similarly, the present study showed no significant difference between studied nurses regarding pre and post guidelines protocol performance related to hand washing. **Woodrow (2000)** emphasized that proper hand washing technique is the single greater measure that can be employed to prevent the spread of infection. Similarly**, Taylor (2001)** indicated that, hand washing is the safest way for nurses to protect themselves and their patient. In addition, a study by **Elkin *et al.* (2000)** in USA evaluated the efficacy of a training feed back intervention program on hand washing. It was found that performance of nurses improved after trainingal program. In the same line**, Foglia *et al.* (2007)** stated that the trainingal intervention and efforts to improve adherence to hand hygiene for children have been associated with decreased in VAP rates.

Mechanical oral care interventions aim to physically remove dental plaque and debris from the oral cavity (**Grap *et al.*, 2004)**. Although nurses have used foam swabs for many decades, the toothbrush is more effective in removing dental plaque. However, success depends on how often the toothbrush is used and for what duration (**Franklin *et al.*, 2000 and Pearson *et al.*, 2002).** In the present study, statistically significant difference was found among studied nurses throughout guideline protocol related to general hygiene and oral hygiene. This finding is in the same line with **Munro *et al.* (2009)** who mentioned that good oral hygiene and the use of antiseptic oral decontamination, reduces the bacteria on the oral mucosa and the potential for bacterial colonization in the upper respiratory tract. This reduction in bacteria has been shown to reduce the potential for the development in ventilator-associated pneumonia for patients on mechanical ventilation. Also, **Bauer (2000)** reported that patient's hygiene occur through complete bed bath, oral care, eye care and skin care**. Perry and potter (2002)** revealed that good personnel hygiene reduces transmission of infection. In the same line, **Woodrow (2000)** illustrated that poor hygiene with lack of bathing and cleanness are the most common causes for skin problem. This finding goes in the same line with **Fields (2008)** who showed in his study, that the VAP rate dropped to zero within a week of beginning the every-8-hours tooth brushing regimen in the intervention group, the study was so successful that the control group was dropped after 6 months, and all intubated patients' teeth were brushed every 8 hours, maintaining the zero rate until the end of the study.

Conclusion

Based on the results of the present study it could be concluded that there was a highly statistically significant differences regarding the level of nurses' practices in study group than the control group.

In addition, VAP rates were minimized in studied children after application of the guideline.

The total time spent on mechanical ventilation and the length of stay in the ICU by patients was reduced among study group compared to control group.

Recommendations

1- Nursing guideline protocol used for minimizing rate of VAP is an effective strategy in the management of mechanical ventilation for critically ill children.
2- Training program for nurses should be conducted periodicaly.
3- Booklet about nursing guideline protocol for prevention ventilator associated pneumonia should be available at PICU.
4- Adequate highly qualified nurses for observation and guidance should be present.
5- Nurses- patient ratio should be 1-2.
6- Finally, nursing research is an important means of improving nursing skills, which in turn will strengthen the nurse's voice in the interdisciplinary team and enhance patient care.

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11/25/2011