

## PRACTICES OF NURSES TOWARD PREVENTION OF VENTILATOR ASSOCIATED PNEUMONIA AT PEDIATRIC INTENSIVE CARE UNITS - GAZA STRIP

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### ABSTRACT

This is a descriptive cross-sectional study aimed to measure the practices of nurses towards prevention of ventilator associated pneumonia (VAP) at pediatric intensive care units (PICUs). The sample of the study considers census sample design including all eligible nurses (55 nurses) who are working in Pediatric Intensive Care Units (PICUs) on the four governmental hospitals in Gaza Strip. The researchers used structured observational checklist to collect data about practices of nurses toward prevention of ventilator associated pneumonia. The results showed that the overall score of practices to prevent VAP at PICUs was above moderate (77.11%), in which half of the nurses (50.9%) showed high level of practices, and slightly less than half (43.6%) of nurses showed moderate level of practices compared to only 5.5% of nurses showed low level of practices. Of which, suctioning and care of endotracheal tube/tracheotomy measures was captured the highest score (82.41%) of practices, while oral care, and hand washing practices were represented as 81.64%, and 67.28% respectively. The study findings stress on the need of hands washing before enter PICUs and the nurses should receive an adequate training about infection control in order to maintain a high quality of care and to prevent the development of ventilator associated pneumonia at pediatric intensive care units.

**KEYWORDS:** Pediatric, Nursing, Practices, VAP, ICU, Gaza strip.

### 1. INTRODUCTION

Mechanical ventilation (MV) is a core component of supportive therapy for critical care patients who cannot breathe adequately on their own. Yet while a ventilator is often a lifesaving measure, it can frequently cause complications, including the nosocomial infection (NI) known as ventilator associated pneumonia (VAP), which defined as a hospital acquired pneumonia that develops in patient in mechanical ventilation for >2 calendar days on the date of event, with day of ventilator placement being Day 1.<sup>[1]</sup> Ventilator associated pneumonia is considered as the most common hospital-associated infection (HAI) among patients at intensive care units (ICUs). Data from developing countries reveal an incidence of VAP ranges from 15.87% - 30.67%.<sup>[2]</sup> Nearly 31% of pediatric patients developed VAP with an incidence 21.3 per 1000 ventilator days, according to a study done in PICUs at Cairo University Hospital,<sup>[3]</sup> compared with 21.6% of ventilated patients in Palestinian's hospitals.<sup>[4]</sup>

Ventilator associated pneumonia is the most fatal of the HAI, with higher mortality rates than either central line infections or sepsis. Ventilated patients who develop VAP have mortality rate of 45% compared to 28% for ventilated patients who do not develop VAP.<sup>[5]</sup> Intubation and MV increase the susceptibility of pneumonia since it facilitates the colonization of bacteria in the mouth and with the absence of cough reflex due to placement of the tube in the oropharynx to the trachea and then to the lower respiratory tract.

Also, pathogenesis of VAP remains unclear, but generally associated with micro-aspirations rather than blood stream infiltrates of the lung, that entry of bacteria to the lung may be facilitated directly through the endotracheal tube (ETT) during disconnection from the ventilator circuit. In addition, most of the bacteria found in the endotracheal aspirates of patients suffering from VAP are also found in the naso-oropharynx and even in gastric secretions. As which intubated patient have direct access to the lower airway because the endotracheal tube

bypasses normal filtration mechanisms and the barrier function of the epiglottis.<sup>[6]</sup>

Most of the measures to prevent VAP including Prevention Bundle guidelines that are largely related to the daily nursing care activities; namely head of bed elevation 30 degrees or more, use of thrombo-embolic prophylaxis, use of peptic ulcer disease prophylaxis, daily interruption of sedative drug infusions with a constant assessment of readiness to extubate, and providing oral care.<sup>[7]</sup> Nurses as the most critical role in implementing most of the VAP preventive measures and the first line of defense by practicing measures have its effect directly or indirectly on the risk factors associated with VAP occurrence in ICUs, and, so early autonomous nursing interventions could contribute in prevention of such cases and ultimately reduce fatality of patients. Therefore, the study takes place as an initial step in Gaza Strip (GS) to determine the practices of nurses toward prevention of VAP at PICUs in the governmental hospitals of the study locality.

## 2. MATERIALS AND METHODS

### 2.1 Study design

This study utilized a descriptive, cross-sectional design. This design is appropriate for describing the status of phenomena or for describing relationships among phenomena and involves the collection of data once the phenomena under study are captured during a single period of data collection.<sup>[8]</sup>

### 2.2 Study population

The study population consisted of all eligible pediatric nurses who were working at PICUs on governmental hospitals of Gaza strip during data collection period. Eligible nurses of this study include 60 pediatric nurses who were working a full-time schedule for at least three months at PICUs on governmental hospitals in Gaza strip.

### 2.3 Sampling method and sample size

Due to the relatively small number of study population, the researchers consider census sample as a sampling framework for data collection. All eligible pediatric nurses involved in the target hospitals at the time of data gathering were invited to participate in the study. The response rate was very high (91.6%) since that among total 60 eligible nurses, data were obtained from 55 subjects who consented to participate in the study.

### 2.4 Setting of the study and Period

The study has been carried out on the four governmental hospitals that have PICUs; namely European Gaza Hospital in Khanyounis, Al Rantesy pediatric hospital, Al Dora pediatric hospital, and Al Nasser pediatric hospital in Gaza city. The study was conducted from November 2017 to October 2018. Data collection has been carried out from April to June, 2018.

### 2.5 Data Collection Tool

An observation checklist consisted 27 items on preventive practices of VAP was used as a tool for data collection. The checklist covers three main domains; namely hand washing domain, suctioning and care of ETT/tracheotomy domain, and oral care domain distributed as 5, 12 and 10 items respectively. Data were gathered by the principal investigator via non-participant observer-overt technique to reduce inter-rater reliability and conserve research ethical considerations.

### 2.6 Data processing and statistical analysis

Data were entered, edited and analyzed using the Statistical Package for Social Sciences (SPSS) software version 22. Frequency and percentage were used in order to describe number and percentages of observed items of research design.

### 2.7 Ethical and administrative considerations

The study protocol was approved by the Palestinian Ministry of Health represented by Human Resources Development (HRD) and the authorized ethical body represented by Helsinki Committee in Gaza Strip. Confidentiality was ensured during and after observed checklist filling, that a written consent form, including an invitation letter, was signed by all participants at the beginning of shift.

## 3. RESULTS

### 3.1 Practices of PICUs nurses about prevention of VAP

A complete observation checklist of all participants is illustrated in Table 1. The overall of practices of nurses regarding measures of VAP's prevention at PICUs was 77.11%. The suctioning and care of ETT/tracheotomy measures captured highest score (82.41%) of practices, followed by oral care (81.64%), and hand washing (67.28%).

**Table 1: Score of practices of PICUs nurses regards prevention of VAP.**

No.	Domains of practices	Not done	Done	Rank
		%	%	
1	Hand washing	32.72	67.28	3
2	Suctioning and care of ETT/tracheotomy	17.59	82.41	1
3	Oral care	18.36	81.64	2
<b>Overall score</b>		<b>33.89</b>	<b>77.11</b>	

**3.2 Level of nursing practices regarding prevention of VAP**

As illustrated in table (2), 28 (50.9%) of PICUs nurses practice preventive measures to avoid VAP to high extent level. The table also showed that 24 (43.6%) of nurses practice preventive measures to avoid VAP to moderate extent level, and only 3 (5.5%) of nurses practice preventive measures to avoid VAP to low extent level.

**Table 2: Level of nursing practices about prevention of VAP.**

Level of practice	Range of scores	No.	%
Low	Less than 60%	3	5.5
Moderate	60 – 80%	24	43.6
High	More than 80%	28	50.9

**3.3 Observed practices of hand washing**

As presented in table (3), the overall average of practices among participants about hand washing measures to prevent VAP in PICUs was 67.28%. The highest observed practices indicated that 53 (96.4%) of nurses washed their hands after patient contact, followed by 49 (89.1%) of nurses washed their hands after contact with a source of microorganisms, while the least observed practice indicated that 11 (20.0%) of nurses washed their hands before entering PICUs.

**Table 3: Number and percentage of observed hand washing practices.**

No.	Hand washing items	Not done		Done		Rank
		No.	%	No.	%	
1	Hand washing before entering PICU	44	80.0	11	20.0	5
2	Before patient contact.	21	38.2	34	61.8	4
3	After patient contact.	2	3.6	53	96.4	1
4	After contact with a source of microorganisms.	6	10.9	49	89.1	2
5	Use of alcohol rub	17	30.9	38	69.1	3
<b>Overall</b>		<b>32.72</b>		<b>67.28</b>		

**3.4 Observed practices of suctioning and care of ETT/tracheotomy**

As presented in table (4), the overall practices among participants about suctioning and care of ETT/tracheotomy measures to prevent VAP at PICUs was 82.41%. The highest observed practices indicated that all the nurses document in the patient's chart each time they perform suctioning and ETT care, followed by

53 (96.4%) of nurses discard suction tube immediately after one single use, 52 (94.5%) of nurses wear gloves when performing suctioning and ETT care, 52 (94.5%) of PICU nurses prepare sterile equipment required during suctioning, while the least observed practice indicated that 10 (18.2%) of nurses wash their hand before suctioning.

**Table 4: Number and percentage of observed suctioning and caring of ETT/tracheotomy practices.**

No.	Suctioning and care of ETT/tracheotomy items	Not done		Done		Rank
		No.	%	No.	%	
1	Hand washing before suctioning.	45	81.8	10	18.2	12
2	Wear gloves before doing any procedure.	3	5.5	52	94.5	3
3	Prepare sterile equipment required during suctioning.	3	5.5	52	94.5	4
4	Insuring environmental cleanness.	6	10.9	49	89.1	6
5	Insert the catheter into the ETT gently by using aseptic technique.	9	16.4	46	83.6	9
6	Discard suction tube immediately after one single use.	2	3.6	53	96.4	2
7	Measure the amount and characteristics of secretion.	10	18.2	45	81.8	10
8	Change circuits for every new patient or when clinically indicated.	3	5.5	52	94.5	5
9	Maintenance of adequate ETT cuff pressure.	20	36.4	35	63.6	11
10	Change humidifiers every week or when clinically indicated	7	12.7	48	87.3	7
11	Hand washing after suctioning.	8	14.5	47	85.5	8
12	Documentation.	0	0	55	100	1
<b>Overall</b>		<b>17.59</b>		<b>82.41</b>		

**3.5 Observed practices of oral care**

Table (5), showed that the overall practices of nurses regarding oral care measures to prevent VAP at PICUs was 81.64%. The highest observed practices indicated

that all the nurses suction secretions as they accumulate, if necessary, followed by 54 (98.2%) of PICUs nurses document in patient's chart each time they perform oral care, and 54 (98.2%) of nurses wore clean gloves when

they perform oral care, while the least observed practice indicated that 21 (38.2%) of nurses washed their hands before doing oral care to their patients.

**Table 5: Number and percentage of observed oral care practices.**

No.	Oral care items	Not done		Done		Rank
		No.	%	No.	%	
1	Hand washing before oral care	34	61.8	21	38.2	10
2	Wear clean gloves	1	1.8	54	98.2	3
3	Position a patient in a semi recumbent.	5	9.1	50	90.9	6
4	Clean mouth using toothbrush or gauze moistened with mouth wash and water	15	27.3	40	72.7	8
5	Rinse mouth with a clean swab	12	21.8	43	78.2	7
6	Suction secretions as they accumulate, if necessary	0	0	55	100.0	1
7	Apply water soluble jelly to patient's lips	32	58.2	23	41.8	9
8	Clean equipment and return it to its proper place	1	1.8	54	98.2	4
9	Hand washing after oral care	0	0	55	100.0	2
10	Documentation	1	1.8	54	98.2	5
<b>Overall</b>		<b>18.36</b>		<b>81.64</b>		

**4. DISCUSSION**

Ventilator associated pneumonia is a serious hospital acquired pneumonia that develops in patients who have been treated with mechanical ventilation for 48 hours or longer. The researchers arguing that nurses' performance at PICUs is sometimes like a vehicle for crossing infections among patients, because they are in direct contact with the patient 24-hours a day; and thus, nurses' activities should adhere to protocols and guidelines of preventing VAP. It is of great value to monitor and observe nurses during performing the required care and tasks, and giving them feedback about their performance. As well as, it's important that infection control team observe the nurses during their work to make sure that the nurses are doing their tasks properly and within the infection control guidelines.

The results showed that the overall practices of measures to prevent VAP at PICUs was above moderate (77.11%), in which half of the nurses showed high level of practices, and less than half of nurses showed moderate level of practices. When comparing these results with other studies, we found that the results obtained by Aqel *et al.*<sup>[9]</sup> showed that the practices level of nurses towards VAP prevention was 41.7%, while Yaseen and Salameh<sup>[10]</sup> on their study reported that the main barriers that restrict prevention of VAP were lack of VAP courses (74.2%) shortage of qualified nurses (74.2%), lack of knowledge during studying in the college (50.5%), failure to change gloves between patients (55.9%), improper hand washing (57%), lack of time (48.4%) and not wearing personal protective equipment (36.6%).

On other hand, the observed practices of hand washing showed that 80% of nurses do not wash their hands before entering PICUs, 94.5% of nurses wear gloves before doing any procedure, 94.5% prepare sterile equipment required during suctioning, 94.5% change

circuits for every new patient or when clinically indicated, 85.5% wash their hands after suctioning, 96.4% wash their hands after contact with patients, and 98.2% clean equipment after use and return it to its proper place. The results obtained by Said<sup>[11]</sup> showed that 100% of nurses did not wash their hands before entering ICU, 83.3% wash their hands before contact with patients, 66.7% wash their hands after contact with patients, 66.7% wash their hands after contact with a source of microorganisms, 83.3% of nurses use sterile gloves during ETT suction, 90% of nurses use clean gloves when doing oral care, 80% perform oral care, and 73% clean equipment after usage.

These results reflected high performance of nurses in most of the aspects of nursing care to protect themselves and the patients. The weakest point was clear in washing hands before entering PICU, and that could be related to the structure of these units, and to overcome this problem each unit should have washing tools at the entrance gate to the unit such as tap water and soap or alcohol for hand rub, so everyone should wash hands before entering the unit.

Observation of suctioning and care of ETT/tracheotomy showed high level of practices (82.41%). Bagheri-Nesami and Amiri<sup>[12]</sup> showed that 90.4% of nurses prefer using kinetic beds, 65.4% use ETT with extra lumens for the drainage of subglottic secretions, and 82.2% put the patient in semi-recumbent position. In addition, Rello *et al.*<sup>[13]</sup> reported that the administration of prophylactic agents for gastric ulcer and deep vein thrombosis, hand hygiene, staff education, using the protocol for weaning the patients from MV were among the measures performed to prevent development of VAP. Other preventive measures reported by Muscedere *et al.*<sup>[14]</sup> included oral intubation, using kinetic beds, using closed suction system, changing the humidifiers weekly or for

each patient, changing the suction system for every new patient and using gloves.

Furthermore, providing oral care consider one of important pillars in preventing of VAP at intensive care units.<sup>[7]</sup> In our study, the results showed high level (81.64%) of oral care practice at PICUs on governmental hospital of Gaza strip, with the highest observed practices (100%) was suctioning of secretions if accumulate, and the least (38.2%) was washing hands before doing oral care to their patients. Said<sup>[11]</sup> conclude in his observation study that 100% of nurses did not wash their hands before entering ICU, 83.3% wash their hands before contact with patients, 66.7% wash their hands after contact with patients, 66.7% wash their hands after contact with a source of microorganisms, 83.3% of nurses use sterile gloves during ETT suction, 90% of nurses use clean gloves when doing oral care, 80% clean patient's mouth using toothbrush or gauze moistened with mouth wash, and 73% clean equipment after usage. The study had several limitations. Data obtained on observation checklist were collected by a non-participant observer-overt technique as which there was Hawthorne effect could be occur during observation of participants.

## 5. CONCLUSION

Ventilator associated pneumonia is considered the most common hospital-associated infection among patients at PICUs. Nurses who are working at PICUs are the first line of defense in preventing hospitalized-acquired infection by practicing autonomous nursing interventions that contribute positively to prevention of VAP and ultimately reduce fatality of patients.

The findings of this study stress the need of hands washing before enter PICUs with soap and water or alcohol-based glycerin for hand-rub to prevent transmission of pathogens from nurses' hands to the patients. Furthermore, the study concluded that in order to maintain high quality of practices, nurses who are working at PICUs should receive an adequate training, and should be monitored periodically to maintain high quality of care in order to prevent the development of ventilator associated pneumonia.

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## DECLARATION OF INTERESTS

The authors declare that they have no competing interests.

## REFERENCES

- Center for Disease Control and Prevention (CDC). Pneumonia (Ventilator-associated [VAP] and non-ventilator-associated Pneumonia [PNEU]) Event. Device-associated Module, 2019. Retrieved from: [https://www.cdc.gov/nhsn/PDFs/pscManual/6pscVA\\_Pcurrent.pdf](https://www.cdc.gov/nhsn/PDFs/pscManual/6pscVA_Pcurrent.pdf). [Accessed on 20.01.2019].
- Ranjit, S. & Bhattarai, B. Incidence and risk factors for ventilator-associated pneumonia in Kathmandu University Hospital. *Kathmandu University Med*, 2011; 33(1): 28-31.
- Galal, Y., YouSsef, M., Ibrahim, S. Ventilator-associated pneumonia: Incidence, risk factors and outcome in Pediatric Intensive Care Units at Cairo University Hospital. *Journal of Clinical and Diagnostic Research*, 2016; 10(6): SC06-SC11.
- Ruzieh, M., Al-Ardeh, M., Nazzal, Z. Incidence and risk factors of ventilator associated pneumonia (VAP) in Palestine hospitals. Master Thesis, Al Najah National University. Palestine, 2013.
- Curtin, L. Preventing ventilator-associated pneumonia: A nursing-intervention bundle. *American Nurse Today*, 2011; 6(3).
- Chang, I., & Schibler, A. Ventilator associated pneumonia in children. *Pediatric Respiratory Reviews*, 2016; 20: 10-16.
- Tolentino, A., Ruppert, S., Shiao, S. Evidence-based practice: use of the ventilator bundle to prevent ventilator associated pneumonia. *American Journal of Critical Care*, 2007; 16(1): 20-27.
- Polit, D. & Beck, C. *Nursing Research: Generating and Assessing Evidence for Nursing Practice, Measurement and Data Quality*, 9<sup>th</sup> ed. Wolters Kluwer Health, Lippincott Williams & Wilkins, 2012.
- Aqel, S., Musa, M., Ameen, E., Jabareen, B., Enaya, A. Oral care knowledge, attitude and practices of unconscious mechanically ventilated patients at West Bank governmental hospitals. Master Thesis, Al-Najah National University, 2016.
- Yaseen, R. & Salameh, T. Saudi critical care nurses' knowledge of and barriers toward adherence to prevention of ventilator associated pneumonia guidelines, *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 2015; 4(2): 65-69.
- Said, A. Knowledge and practice of intensive care nurses on prevention of ventilator associated pneumonia at Muhimbili National Hospital, Dar Es-salaam, Tanzania, Muhimbili. Master Thesis, University of Health and Allied Sciences, Ethiopia, 2012.
- Bagheri-Nesami, M. & Amiri, M. Nurses' knowledge of evidence-based guidelines for preventing ventilator associated pneumonia in intensive care units). *Journal of Nursing and Midwifery Sciences*, 2014; 1(1): 44-48.
- Rello, J., Lode, H., Cornaglia, G., Masterton, R. A European care bundle for prevention of ventilator-associated pneumonia. *Intensive Care Med*, 2010; 36(1): 773-780.

14. Muscedere, J., Dodek, P., Keenan, S., Fowler, R., Cook, D., Heyland, D. Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: prevention. *Journal of Critical Care*, 2008; 23(1): 126-137.