Assessment the Incidence of Ventilator -associated Pneumonia for Critically Ill Patients in the Intensive Care Unit

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Abstract

Background: Ventilator-associated pneumonia (VAP) is one of the most frequent ICU-acquired infections and a very challenging infection as it continues to complicate the course of 8% to 28% of patients receiving mechanical ventilation one that must be prevented due to its high morbidity and mortality. Aim of the Study: This study was conducted to assess the incidence of ventilator-associated pneumonia for critically ill patients in the Intensive Care Unit. Materials and Methods: A descriptive exploratory design was utilized was used in this study. Setting the study was conducted at El-fayoum university hospital. The study subjects; A Purposive sample of 30 patients from both genders, with different ages and educational levels were selected for this study. Tools of the study consist of two tools, the first tool was Patient Assessment sheet, and the second tool was VAP Assessment Tool. Results: It was found that two third of the studied patient were male with mean age X’ ± SD (52.40 ± 14.40).also only two fifth of them smoker and about two third were unconscious. further about two third of studied patient had VAP in the third day of the study. Conclusion. About two thirds of studied patient were male, non smoker and unconscious. Moreover, the incidence of Ventilator associated Pneumonia increased in the fifth day than third day. Recommendations: Replication of the study using a large probability samples acquired from different geographic areas. Policies and guidelines related to infection control measures must be informed to the nurses in order to prevent ventilator associated pneumonia.

Key words: Assessment – Critically Ill Patient –Incidence-ventilator associated pneumonia.

Introduction:

Intensive care units (ICUs) are life support units intended to care for patients requiring intensive care due to organ failure, that are equipped with advanced technology, where vital signs are monitored and where treatment is administered. The majority of patients monitored in these units receive mechanical ventilation (MV) support and invasive procedures such as central venous catheterization. However, patients develop a disposition to infections as a result of these procedures (Karatas, et al, 2016).

Ventilator - associated pneumonia (VAP) is a sub-type of hospital-acquired pneumonia which occurs in people who are on intubation or mechanical ventilation that was not present at the time of admission to hospital or that occurs 48 hours after intubation and mechanical ventilation through an endotracheal or tracheotomy (Elkolaly , et al , 2019). The diagnostic clinical Triad for VAP consists of pulmonary infection signs including fever,
purulent secretions, and leukocytosis, together with bacteriologic evidence of pulmonary infection, and radiological suggestion of pulmonary infection (Abdelrazik & Salah, 2017).

The incidence of VAP in Egypt, a study conducted in surgical intensive care unit (ICU) at Zagazig University Hospitals over a period of 1 year. The study show that incidence of VAP in ICU was 9.94% while the incidence of VAP (Michael, et al., 2020). While the incidence of VAP worldwide 10–28% and 9 -27% in the United States. (Abdelhafez, 2013). Furthermore, the mortality rate attributable to VAP is 27% and Length of stay in the intensive care unit is increased by 5 to 7 days3 and hospital length of stay 2- to 3-fold in patients with VAP. Also The cost of VAP is estimated to be an additional $40000 per hospital admission per patient with the disease and an estimated $1.2 billion per year (Augustyn, 2019).

There are both preventable and non-preventable risk factors related to the emergence of VAP. The non-preventable risk factors related to VAP are age, gender, underlying previous health conditions of the patient, and risk factors that emerge as a consequence of the patient’s treatment. Preventable risk factors related to VAP are lying back, enteral feeding, insufficient subglottic aspiration, stress ulcer prophylaxis, a cuff pressure under 20 cm H2O, nasal intubation, inadequate hand hygiene, and tracheostomy (Kapucu & Özden, 2017).

Ventilator associated pneumonia (VAPs) are nosocomial infections that cause significant morbidity and mortality in ICUs and that prolong hospitalization so, the current study conducted to assess and determine the incidence ventilator associated pneumonia for critically ill patients in intensive care unit.

Aim of the Study:

This study was conducted to assess the incidence of ventilator-associated pneumonia for critically ill patients in the Intensive Care Unit.

Research Questions:

What is the incidence of ventilator-associated pneumonia for critically ill patients in the intensive care units?

Subjects and Methods:

The study was portrayed under the four main designs as follows:

1. Technical design.
2. Operational design.
3. Administrative design.
4. Statistical design.

1) The technical design:

-It includes research design, setting, subject and tools for data collection.

Research design:

A descriptive exploratory design was utilized was used in this study.

Setting:

This study was carried out at the intensive care unit (ICU) at El-Fayoum university hospital.

Subjects:

• A Purposive sample of 30 patients from both genders, with different ages and educational levels were selected for this study.
• Inclusion and Exclusion criteria:

The inclusion criteria of the current study include Adult Patients from both gender >20years old And Intubated patients While the exclusion criteria include Chest infectious patients and Immune compromised patients.

Tools for data Collection:

Data were collected using the following two tools:

Tool (I): Patient Assessment sheet:
This tool was developed by the researcher based on review of relevant recent literatures, Elpasiony et al, (2017) & Hafez, et al,(2017) and it includes patient’s age, gender, the level of education, marital status, occupation smoking, Causes of ICU admission, past medical history, allergic history, Level of consciousness and Current medication.

Tool (II) VAP Assessment tool: Modified Clinical Pulmonary Infection Score (MCPIS):

It was adopted from Bakhtiari, et al (2018) and it was used to assess the clinical diagnosis of VAP. This is a standard scale including five parameters of (body temperature, pulmonary secretion, White blood cells, Oxygenation, and a chest X-ray).

Scoring system:

Each parameter scored from 0 to 2 except oxygenation, where zero indicates normal result and 2 indicate abnormal result. While in oxygenation parameter zero indicate presence of acute respiratory distress syndrome (ARDS) and 2 indicate absence of ARDS. The score varied from 0-10. Obtaining scores over 5 in this scale reveals involvement in VAP. The score ≤ 5 indicate absence of VAP.

Field Work:

1- An official permission for conducting the study was obtained from the director of El fayoum university hospital and head of ICU department.

2- Purpose of the study was simply explained to the patient who agreed to participate in the study prior to any data collection if the patient only conscious.

3- Development of tool I &II after reviewing recent relevant literatures.

4- Data collection started and completed within 6 months from February (2019) until the end of August (2019).

5- -Data collection was done by the researcher 5 day/ weak.

6- At first day demographic and health data of all patient “age, gender, smoking, causes of ICU admission, past medical history, level of consciousness and medication” were collected using (tool I), data collected from the medical records.

7- VAP was examined using modified clinical pulmonary infection score at the first day on admission for all patients.

8- VAP was examined using MCPIS at third and fifth days using (tool II) to assess the incidence of ventilator associated pneumonia for critically ill patients.

Ethical Considerations:

Ethical approval was obtained from the scientific ethical committee of Helwan
University. In addition, written informed consent was obtained from each participant prior to data collection. The participants assured that anonymity and confidentiality would be guaranteed and the right to withdraw from the study at any time. Ethics, values, culture and beliefs were respected.

Statistical Design:

The collected data were organized, categorized, tabulated, and statistically analyzed using the statistical package for social science (SPSS) version (20). Data were presented in tables and graphs. The statistical analysis included: percentage (%), the arithmetic mean ($\bar{X}$), standard deviation (SD), chi-square ($X^2$), and Pearson correlation (r).

Results:

A) Characteristics of studied patients:

A total 30 patients were enrolled in the study with mean age $\bar{X} \pm SD (52.40 \pm 14.40)$. Also, it was noted that 60% of the studied patients were male, as regarding to an educational level it was found that 66.7% of the studied patients were illiterate, while 3.3% of them were higher education. As regarding health related data found that only (40%) of the studied patients were smokers. As regarding level of consciousness, it was found that (60%) of studied patients had severe impairment of conscious level, while (16.6%) of them had mild impairment of consciousness as illustrated in tables (1, 2).

B) Assessment the incidence of Ventilator Associated Pneumonia by using Modified Clinical Pulmonary Infection Scores in the first, third & fifth day of study:

Incidence of ventilator associated pneumonia in the first day of the study; all studied patients were free of infection. In the third day, (60%) of the studied patient developed VAP. In the fifth day, only (16.7%) of them were free of infection as illustrated in table (3).

Discussion:

Ventilator-associated pneumonia (VAP) is the most common healthcare-associated infection (HAI) in patients receiving mechanical ventilation. VAPs are independently associated with an increased length of intensive care unit (ICU) stay, duration of mechanical ventilation and mortality. The most simplistic definition of a VAP is a new lower respiratory tract infection occurring at least 48-h following the initiation of mechanical ventilation (Hart, et al, 2019).

Regarding Demographic data for studied patients, the current study showed that more than two third of studied patient had age more than forty years old, as co-morbidity increase with age and increase the risk of ICU admission. This result consistent with Hafez, et al., (2017) in a study titled “Effect of oral care protocol on the incidence of oral cavity complication for critically ill patients.” Who stated that more than one-fifth of studied patients had age less than forty years old.

Related to gender, the present study results showed that, two third of the studied patients were males; this could due to the natural of ICU admission as emergency and increase accident among male more than female patient. This finding contradicted with Lamas, et al. (2012) in a study titled” Effects of abdominal massage in management of constipation— A randomized controlled trial” who revealed that the majority of the population were female.

Concerning educational level, the present study indicated that, about more
than two third of the studied patients were illiterate. This due to the majority of studied patient had age more than forty years, this explain that the people in the older years not interested to educate. This finding is inconsistent with Elsayy & Ahmed (2016) in a study titled "Clinical Evaluation of Comprehensive versus Routine Oral Care among Critically Ill Patients " who found that about two third of the control and study group read and write.

Concerning smoking, the present study showed that more than two third of studied patients were non smoker. This could due to the nature of ICU were general and emergency and patient who were smoker expected to admit to chest ICU more than this ICU. this result in the same line with Abbasinia, et al (2016) in a study titled" The Effect of a Designed Respiratory Care Program on the Incidence of Ventilator-Associated Pneumonia" who revealed that Two third of the sample were non smoker.

The current study revealed that neurological and respiratory problems were the majority of causes of ICU admission among studied patient. This may be due to the majority of the patient were elderly and admit because of disturbed conscious level as a complication from chronic disease like hypertension ,diabetes mellitus or hepatic disease who can't follow up for it . This result coincides with Mohammed& Sabir (2017) in a study titled "Effects of Chlorhexidine Solution Formula on Oral Health Status and Occurrence of Ventilator -Associated Pneumonia among Intubated Intensive Care Unit Patients“ who revealed that two third of studied patients developed VAP.

This finding in the same line with Mohammed& Sabir (2017) in a study titled "Effects of Chlorhexidine Solution Formula on Oral Health Status and Occurrence of Ventilator -Associated Pneumonia among Intubated Intensive Care Unit Patients“ who revealed that two third of studied patients developed VAP.

Concerning level of consciousness, the finding of the current study show that about more than two third of studied patients had severe impairment of consciousness (GCS=3-8).this result agreed with Jovanovic et al. (2015) in a study titled "Risk factor for ventilator associated pneumonia in patient with severe traumatic brain injury in a sebian trauma center" who revealed that the majority of patient were unconscious.

Regarding distribution of studied patients according to Total Modified Clinical Pulmonary Infection Scores (Vap development), The finding of the current study revealed that all patient were not developed vap at the first day of the study as this was one of the important criteria for patients to be enrolled in this study, at third day of the study, the finding of the current study reveal that more than two third of studied patient have VAP.

This finding in the same line with Mohammed& Sabir (2017) in a study titled "Effects of Chlorhexidine Solution Formula on Oral Health Status and Occurrence of Ventilator -Associated Pneumonia among Intubated Intensive Care Unit Patients“ who revealed that two third of studied patients developed VAP.

This finding contradict with Karatas, et al. (2016) in a study titled "An assessment of ventilator-associated pneumonias and risk factors identified in the Intensive Care Unit" who revealed that one fifth(15.4%) of the studied patients developed ventilator associated pneumonia. In the end, it is important to know that prevention of VAP very important skill to improve patient outcome and decrease mortality and morbidity for critically ill patient in intensive care unit.
Table (1): Frequency distribution of studied patients as regards their demographic characteristics (N=30).

<table>
<thead>
<tr>
<th>Items</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 20 - &lt;40 yrs</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>• 40 - &lt; 60 yrs</td>
<td>15</td>
<td>50.0</td>
</tr>
<tr>
<td>• ≥ 60 yrs</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Mean (SD)</strong></td>
<td></td>
<td>52.40 (14.40)</td>
</tr>
<tr>
<td><strong>Gender:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Male</td>
<td>18</td>
<td>60.0</td>
</tr>
<tr>
<td>• Female</td>
<td>12</td>
<td>40.0</td>
</tr>
<tr>
<td><strong>Level of education:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Illiterate</td>
<td>20</td>
<td>66.7</td>
</tr>
<tr>
<td>• Diploma</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td>• Higher-education</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Occupation:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Yes</td>
<td>19</td>
<td>63.3</td>
</tr>
<tr>
<td>• No</td>
<td>11</td>
<td>36.7</td>
</tr>
</tbody>
</table>

Table (2): Frequency distribution of studied patients as regards their health related data (N=30).

<table>
<thead>
<tr>
<th>Health related data</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smoking:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Yes</td>
<td>12</td>
<td>40.0</td>
</tr>
<tr>
<td>• No</td>
<td>18</td>
<td>60.0</td>
</tr>
<tr>
<td><strong>Diagnosis:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Respiratory problem</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td>• Renal problem</td>
<td>4</td>
<td>13.33</td>
</tr>
<tr>
<td>• Neurological</td>
<td>10</td>
<td>33.33</td>
</tr>
<tr>
<td>• Cardiac Problem</td>
<td>2</td>
<td>6.67</td>
</tr>
<tr>
<td>• GIT problem</td>
<td>2</td>
<td>6.67</td>
</tr>
<tr>
<td>• Trauma</td>
<td>2</td>
<td>6.67</td>
</tr>
<tr>
<td>• Others</td>
<td>1</td>
<td>3.33</td>
</tr>
<tr>
<td><strong>Level of consciousness:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mild impairment</td>
<td>5</td>
<td>16.67</td>
</tr>
<tr>
<td>• Moderate impairment</td>
<td>7</td>
<td>23.33</td>
</tr>
<tr>
<td>• Sever impairment</td>
<td>18</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Table (3): The incidence of Ventilator Associated Pneumonia in the first, third & fifth day of study for studied patients. (N=30).

<table>
<thead>
<tr>
<th>VAP Incidence</th>
<th>First day</th>
<th>Third day</th>
<th>Fifth day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td><strong>Free</strong></td>
<td>30</td>
<td>(100)</td>
<td>12</td>
</tr>
<tr>
<td><strong>Infected</strong></td>
<td>0</td>
<td>(0.0)</td>
<td>18</td>
</tr>
</tbody>
</table>
Conclusion:

About two thirds of studied patient were male, non smoker and unconscious. Also neurological and respiratory problems were the majority of causes of ICU admission. Moreover, All patient on admission were free of infection. the incidence of Ventilator associated Pneumonia increased in the fifth day than third day.

Financial support

No funding was received

Conflict of interest

No

Recommendations:

- Replication of the study using a large probability samples acquired from different geographic areas.
- Periodic monitoring of nurses and implementation implementing an educational program about prevention guidelines.
- Policies and guidelines related to infection control measures must be informed to the nurses in order to prevent ventilator associated pneumonia.
- Adequate supplies and facilities should be available in such critical unit.

References:


