RECENT TRENDS IN THE MANAGEMENT OF VENTILATOR ASSOCIATED PNEUMONIA

Essay

Submitted For Partial Fulfillment of Master Degree in
Intensive Care

By

Shaimaa Sayed Hassan
M.B., B. Ch. (2006), Ain Shams University

Supervised By

Prof. Dr./ Amr Mohamed EL-Said
Professor of Anesthesia and Intensive Care
Faculty of Medicine, Ain Shams University

Dr./ Rasha Samir Abd El-Wahab Bondok
Assistant Professor of Anesthesia and Intensive Care
Faculty of Medicine, Ain Shams University

Dr./ Rania Magdi Mohamed Ali
Lecturer of Anesthesia and Intensive Care
Faculty of Medicine, Ain Shams University

Ain Shams University
Faculty of Medicine
2011

الطرق الحديثة لعلاج الإلتهاب الرئوي المصاحب لجهاز التنفس الصناعي

رسالة

توطئة للحصول علي درجة الماجيستير فى
الرعاية المركزة

مقدمة من

الطبيبة / شيماء سيد حسن
بكالوريوس الطب والجراحة

تحت إشراف

الأستاذ الدكتور/ عمرو محمد السعيد
أستاذ التخدير والرعاية المركزة - كلية الطب - جامعة عين شمس

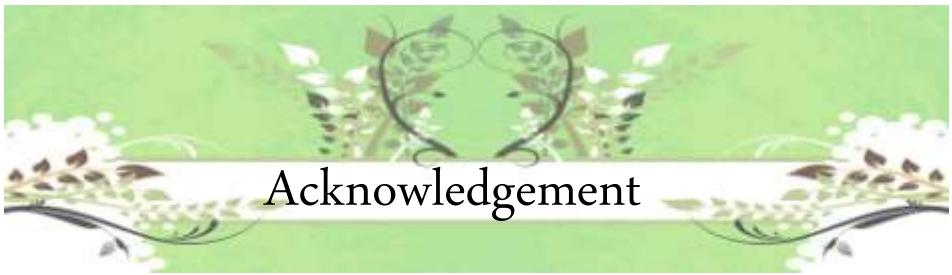
الدكتورة/ رشا سمير عبد الوهاب بندق
أستاذ مساعد التخدير والرعاية المركزة - كلية الطب - جامعة عين شمس

الدكتورة/ رانيا مجدي محمدعلي
مدرس التخدير والرعاية المركزة - كلية الطب - جامعة عين شمس

In a previous study *Hugonnet and Pittet,(2007)* investigated the association between nurse workload and infection risk in a medical intensive care unit (ICU), the higher nurse-to-patient ratio was associated with a 30% risk reduction for all ICU-acquired infections, and maintaining a nurse-to-patient ratio above 2.2 would ultimately lead to avoidance of a large proportion of all infections (population attributable fraction 26.7%).

During the past two decades, the number of nurses has decreased almost worldwide, whereas the level of patient acuity has increased *(Aiken et al., 2002a).* Time constraints can increase the probability of error by creating a busy, stressful environment with distractions and interruptions *(Sasichay-Akkadechanunt et al., 2003)*, leading to low compliance with hand hygiene recommendations *(Hugonnet et al., 2002)* and isolation procedures, or inadequate care for the ventilated patient. Cross-transmission of micro-organisms from one patient or the environment to another patient, or from one body site to another in the same patient, leads to colonization and infection. Because a large proportion of early-onset pneumonia results from early aspiration, it was not expected that staffing level


قَالُوا سُبْحَانَكَ
لاَ عِلْمَ لَنَا
إِلاَّ مَا عَلَّمْتَنَا
إِنَّكَ أَنتَ
الْعَلِيمُ الْحَكِيمُ
صدق الله العظيم
سورة البقرة الآية
(32)



Acknowledgement

All praise be to Allah *and all thanks. He has guided and enabled me by His mercy to fulfill this thesis, which I hope to be beneficial for people.*

I would like to express my deepest gratitude and sincere appreciation to Prof. Dr. Amr Mohamed El-Said*, Professor of Anesthesia and Intensive Care, Faculty of Medicine, Ain Shams University for his continuous encouragement, his kind support and appreciated suggestions that guided me to accomplish this work.*

I am also grateful to Dr. Rasha Samir Abd El-Wahab Bondok*, Assistant Professor of Anesthesia and Intensive Care, Faculty of Medicine, Ain Shams University who freely gave her time, effort and experience along with continuous guidance through out this work.*

Special thanks are extended to Dr. Rania Magdi Mohamed Ali*, Lecturer of Anesthesia and Intensive Care, Faculty of Medicine, Ain Shams University for her constant encouragement and advice whenever needed.*

Contents

List Of Tables

List Of Figures

INTRODUCTION

Pneumonia is defined as inflammation and consolidation of lung tissue due to an infectious agent. Pneumonia that develops outside the hospital is considered community acquired pneumonia (CAP). Pneumonia developing 72hrs or more after admission to hospital is nosocomial *(American Thoracic Society, 2005).*

Many risk factors have been demonstrated to be associated with nosocomial pneumonia. In general., these factors can be divided into several broad categories: (1) intrinsic host factors such as age, underlying medical disorders such as pulmonary disease, and nutritional status; (2) hospital factors such as abdominal or thoracic operations, antibiotic use, immunosuppression, and treatment in an ICU; (3) equipment and device use, especially intubation with mechanical ventilation; and (4) factors that increase the risk of aspiration such as depressed consciousness *(Fishman, 2008).*

Intubation with mechanical ventilation is the single most important risk factor for the development of nosocomial pneumonia. For this reason, intubation should be used only when medically necessary, and strict adherence to equipment maintenance is critical *(Gastmeier et al., 2005).*

Ventilator-associated pneumonia (VAP) has emerged as an important challenge in the intensive care unit (ICU). Representing >25% of all ICU-acquired infections, there are 1,100000 cases annually in the United States alone. VAP also accounts for more than one-half of all antibiotic use in the ICU. Consequently, VAP is associated with substantial morbidity and costs *(Klevens et al., 2007).*

The fundamental obstacle to the diagnosis of VAP is the absence of a uniform gold standard. VAP have no one test, assay, or intervention that they can be used to either make or exclude the diagnosis reliably *(Niederman et al., 2005).*

When a patient is thought to have VAP, two steps are strongly recommended: etiologic diagnostic testing and the immediate initiation of antibiotics.

The daily management of VAP remains a challenge for physicians in the ICU. In recent years, a more dynamic approach has evolved, updating local epidemiology, evaluating VAP and diagnostic tools every day, and assessing host response using clinical and biochemical parameters *(Emili et al., 2009).*

AIM OF THE WORK

The Aim of this work is to discuss the recent trends in the management of ventilator associated pneumonia.

VENTILATOR ASSOCIATED PNEUMONIA (VAP)

Definitions

Nosocomial pneumonia or hospital acquired pneumonia is defined as an infection of the lung parenchyma that was neither present nor incubating at the time of hospital admission *(Fishman, 2008).* Mechanical ventilation is an essential feature of modern intensive care unit (ICU) care. Unfortunately, mechanical ventilation is associated with a substantial risk of ventilator-associated pneumonia (VAP). VAP is the most common nosocomial infection in the ICU, with an incidence ranging from 9% to 40%, and is associated with prolonged hospitalization, increased health care costs, and a 15-45% attributable mortality *(Safdar et al., 2005).*

VAP is defined as subtype of nosocomial pneumonia developing in mechanically ventilated patients within 48hrs or more after intubation, with an endotracheal tube or tracheostomy tube with no clinical evidence suggesting the presence or probable development of pneumonia at the time of initial

intubation. Based on differences in causes, VAP has been divided into early (≤96hrs of admission) and late onset (>96hrs of admission) *(Fishman, 2008).*

Incidence

In a systematic review of 38 prospective cohort and nonrandomized studies including approximately 48000 mechanically ventilated patients, the incidence of ventilator-associated pneumonia varied from 10 to 20% with twice the mortality of similar patients without VAP. The crude mortality for VAP has ranged from 13 to 70%, but most investigators have reported rates in the range of 20 to 40% *(Fishman, 2008).*

In the United States of America, VAP has recently been proposed as a quality-of-care indicator for hospitals because it is generally believed that VAP increases both morbidity and mortality of ICU patients *(Klompas and Platt, 2007).*

This belief is predominantly based on the results of observational studies, using a (matched) cohort design. However, a systematic approach to combine quantitatively the results of all available studies evaluated the association between the development of VAP and mortality does not exist *(Melsen et al., 2009).*

Pathogenesis of VAP

Understanding the pathogenesis of VAP is essential to devising strategies for prevention of these infections. Advances in the understanding of pathogenesis have led to the development of specific measures that can greatly reduce the risk of VAP *(Tablan et al., 2004).*

▫ *Defense Mechanisms for Prevention of Respiratory Infection in the Normal Host*

The major defense mechanisms in the normal host include anatomic airway barriers, cough reflexes, mucus, and mucociliary clearance. The ciliated mucosa of the upper respiratory tract has a major role in removing particulate matter and microbes that have gained access to the bronchial tree. Composition of airway secretions, an effective mucociliary reflex, and an effective cough below the terminal bronchioles, the cellular and humoral immune systems are essential components of host defense. Alveolar macrophages and leukocytes remove particulate matter as well as potential pathogens, elaborate cytokines that activate the systemic cellular immune response, and act as antigen-presenting cells to the humoral arm of immunity. Immunoglobulin and