Assessment of the efficacy of implementing of ventilator associated pneumonia protocol in NICU

Thesis

Submitted for partial fulfillment of M.Sc. Degree in Pediatrics.

By

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2013

ACKNOWLEDGMENT

I wish to express my deepest gratitude and greatest respect to **Prof. Dr. Gehan Hussein Ahmed,** Professor of Pediatrics, Faculty of Medicine, Cairo University, for her kind supervision, helpful encouragement , she gave me much of her time and valuable advice in this research.

I am extremely grateful to **Prof. Dr. Mona Mohiedden Abd el haleim,** Professor of clinical pathology, Faculty of Medicine, Cairo University, for her sincere guidance and supervision, she gave me much of her experience , support , efforts and collaboration were the causes to complete this work properly.

My deepest thanks to **Prof. Dr. Reem Mahmoud Badr el din,** Assistant Professor of Pediatrics, Faculty of Medicine, Cairo University, for her sincere cooperation and advice.

Abstract

Ventilator-associated pneumonia (VAP) is one of the commonest nosocomial infection occurring in mechanically ventilated patients in the intensive care unit (ICU). We aimed to determine the incidence of occurrence of VAP in Neonatal ICU (NICU) in Abu El-Reish children's hospital, Cairo University, and to detect the most common etiological pathogens. 32 neonates on mechanical ventilation were subjected to careful history taking, clinical examination, routine investigations (complete blood picture, arterial blood gases, C- reactive protein, serum electrolytes, liver and kidney function tests), chest x-ray at least twice, blood culture and non bronchoscopic endotracheal culture. The commonest admission diagnosis was respiratory distress syndrome (50%), Complications were observed in 59.4% of cases. The incidence of VAP was 46.9% of the studied patients and the diagnosis depends on the endotracheal aspirate culture result, radiological and clinical findings. Endotracheal culture was positive in 14 cases (43.7%), while blood culture was positive in 5 cases (15.6%) with no significant similarity between the causative organism in the blood and endotracheal culture. Endotracheal culture was more sensitive and specific in VAP diagnosis than blood culture (sensitivity 93.3%, specificity 100%). Neonates with VAP had longer duration of mechanical ventilation (p=0.004). Gram-negative organisms were the major cause of VAP in the study (86.7%) and Klebsiella pneumoniae was the predominant isolate (80%) Outcome of neonates was 40.6% died and 59.4%discharged. VAP was significantly associated with almost 3-fold higher risk of neonatal mortality.

Key words: ventilator associated pneumonia, mechanical ventilation, endotracheal culture, gram negative infection.

List of Tables

List of Figures

List of Abbreviations

A/C: Assist control.

AACN: American association of critical care nurses.

ABG: Arterial blood gases.

AIDS : Acquired immunodefficiency syndrome.

AST: Antimicrobial susciptability.

BAL: Bronchoalveolar lavage.

BPD: Bronchopulmonary dysplasia.

CDC: Center for disease control and prevention.

CMV: Cytomegalovirus.

CPAP: Continuous positive airway pressure.

CSF: Cerebrospinal fluid.

CSV: continuous spontaneous ventilation.

DVT: Deep venous thrombosis.

ECMO: Extra corporeal membrane oxygenation.

EGA: Estimated gestational age.

GBS: Group beta streptococci.

GIR: Glucose infusion rate.

List of Abbreviations, cont;

HAP: Hospital acquired pneumonia.

HFFI: High frequency flow interrupter.

HFJV: High frequency jet ventilation.

HFOV: High frequency oscillatory ventilation.

HFV: High frequency ventilation.

HIPAC: Health care infection control practice advisory committee.

HIV: Human immunodeficiency virus.

HOB: Head of bed.

HSV: Herpes simplex virus.

ICU: Intensive care unit.

IHI: Institute for healthcare improvement.

IMV: Intermittent mandatory ventilation.

IPPV: Intermittent positive pressure ventilation.

IV: Intravenous.

MDR: Multi drug resistance.

MMV: Mandatory minute ventilation.

MRSA: Methicillin resistant staphylococcus aureus.

List of Abbreviations, cont;

MV: Mechanical ventilation.

NAVA: Neurally adjusted ventilator assist.

NHSN: National hospital safety network.

NI: Nosocomial infection.

NICU: Neonatal intensive care unit.

NIPPV: Neonatal nasal intermittent positive pressure ventilation.

NNIS: National nosocomial infection surveillance.

NP: Nosocomial pneumonia.

PAV: Proportional assist ventilation.

PCR: Polymerase chain reaction.

PEEP: Post end expiratory pressure.

PIP: Peak inspiratory pressure.

PMA: Post menstrual age.

PNA: post natal age.

PTV: Patient triggered ventilation.

List of Abbreviations, cont;

RDS: Respiratory distress syndrome.

ROC: Receiver operator characteristics.

ROP: Retinopathy of prematurity.

RSV: Respiratory syncytial virus.

SDD: Selective digestive tract decontamination.

SIMV: Synchronized intermittent mandatory ventilation.

SIPPV: Synchronized intermittent positive pressure ventilation.

TB: Tuberculosis.

TCPLV: Time cycled pressure limited ventilation.

TLC: Total leucocytic count.

V /Q: Ventilation /Perfusion.

VAP: Ventilator associated pneumonia.

VCV: Volume controlled ventilation.

VG: Volume guarantee.

VRE: Vancomycin resistant enterococci.

VTV: Volume target ventilation.

WHO: World health organization.

Contents:

Introduction

Nosocomial infections (NIs) are important causes of morbidity and mortality in pediatric hospitals. Multiple factors contribute towards exposing children to the risk of infection when hospitalized, and some of them differ from those in adults ***(Calvalcante et al., 2006).***

Mechanical ventilation (MV) of the newborn infant has increased the neonatal survival; however, this increased survival has come at the expense of increased morbidity ***(Donn and Sinha, 2006).***

Device-associated infections, such as catheter-associated urinary tract infections, and ventilator-associated pneumonia (VAP) pose the greatest threat to patient safety in intensive care units (ICUs), ***(Kwak et al., 2010).***

ICU ventilated patients with ventilator associated pneumonia have a 2 to 10 folds higher risk of mortality than patients without it (***Cavalacanti et al., 2005).***

An established relationship exists between VAP and aspiration of colonized oropharyngeal secretion, due to inadequate glottic closure around endotracheal tubes, especially in those nursed supine. Suctioning has also been implicated in VAP through direct contamination due to inadequate hand washing (***Berdal et al., 2007).***

Ventilator-associated pneumonia (VAP) is defined as pneumonia occurring more than 48 hours after the initiation of endotracheal intubation and MV including pneumonia developing even after extubation ***(Chastre and Fagon, 2002).***

Ventilator associated pneumonia is difficult to diagnose, and the precise role of invasive testing is controversial ***(Alp and Voss, 2006).***

Diagnosing VAP requires a high clinical suspicion combined with examination, radiographic examination, and microbiologic analysis of respiratory secretions ***(Koenig and Truwit, 2006).***

Strategies to prevent VAP are likely to be successful only if based upon a sound understanding of pathogenesis and epidemiology ***(Safdar et al., 2006).***

Aim of work:

The aim of this work is to determine the incidence of occurrence of ventilator associated pneumonia in neonatal ICU in Abu El-Reish children's hospital, Cairo University, and to detect the most common etiological pathogens.

Newborn admission in neonatal care units

The availability of neonatal intensive care has improved outcomes for high-risk infants including those born preterm or with serious medical or surgical conditions. Neonates considered by the physician to need the services of the special care unit (for any reason) should be admitted ***(Goodman et al., 2002).***

Indications for admission:

Table (1): Indications for admission in NICU.

- Prematurity ≤34 weeks of gestation
- Low birth weight <1.800 grams
- Cardiopulmonary problems: central cyanosis, apnea, respiratory distress, meconium suctioned below the vocal cords, bradycardia.
- Neurologic problems: seizures, impaired consciousness, severe hypotonia, low 5 minutes apgar score.
- Hematologic problems: pallor, polycythemia , petechiae and purpura.
- Hyperbillirubinemia requiring treatment.
- Neonatal infection
- Gastrointestinal and urinary problems: delayed passage of meconium beyond 48 hours, bile stained vomitus or any sign of intestinal obstruction, delayed passage of urine beyond 24 hours, abdominal masses.
- Metabolic problems: hypoglycemia, dehydration, electrolyte disturbance.
- Congenital malformation: chromosomal disorders, pierre robin syndrome, osteogenesis imperfecta, bilateral choanal atresia.

(Fanaroff and Martin , 2006).