AIR LEAK SYNDROMES IN MECHANICALLY VENTILATED NEONATES AT ABOU EL RISH HOSPITAL: TWO YEARS STUDY

Thesis

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Presented by

Yasser Kotb Ahmed Hafez

M.B.Bch.

Under supervision of

Dr. Heba Hany Abou Hussein

Assistant Professor of pediatric Medicine

Faculty of Medicine - Cairo University

Dr. Khalil Abdel Khalek Mohamed Ahmed

Lecturer of Pediatric Medicine

Faculty of Medicine - Cairo University

Dr. Ahmed Mohamed Wafaie

Lecturer of Radiodiagnosis

Faculty of Medicine - Cairo University

Faculty of Medicine

Cairo University

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ABSTRACT

Mechanical ventilation is an invasive life support procedure with many effects on the cardiopulmonary system.

Ventilator injury and oxygen toxicity are thought to be important factors in the pathogenesis of chronic pulmonary disease.

Assisted ventilation represents the hallmark of neonatal intensive care. Improvements in devices, the appearance of new techniques, better support system, the development of exogenous surfactant, and other pharmacological agents all have contributed to improving weight-specific survival rates for infants with neonatal respiratory failure.

The aim of this study was to determine the incidence of Air leak syndromes of mechanically ventilated neonates as regards morbidity & mortality in Neonatal Intensive Care Unit, Children's Hospital-Cairo University during the years 2007-2008, and to correlate such outcome with gestational age, birth weight, indications and durations of mechanical ventilation.

In this study neonates receiving mechanical ventilation (MV) accounted for (633 out of 3321) 19.06% of admissions, of whom (353 out of 633) 55.8% were males and (280 out of 633) 44.2% were females, outcome of mechanically ventilated neonates was (277 out of 633) 43.76% discharged without any sequelae while (26 out of 633) 4.11% developed PAL (of them 6 (23.08%) discharged while 20 (76.92%) died), three point five percent (22 out of 633) developed BPD (of them 11 (50%) discharged while 11 (50%) died) and (308 out of 633) 48.66% died not due to PAL or BPD. Twenty six point one percent of cases (165 out of 633) were managed with NCPAP alone while 45.8% (290 out of 633) required SIMV and 28.1% (178 out of 633) required combined NCPAP then SIMV. Mean duration of hospital stay was ranging between 1 – 58 days with a mean of 9.21 ± 8.04 days.

From this study, we concluded that, the poor outcome of mechanically ventilated patients is still a major problem in our community.

Recognition and prevention of causes of airway injury can help to ensure optimal outcomes for the critically ill neonate.

Key words: Mechanical ventilation-Neonatal intensive care unit.

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List of Abbreviation

ABG	Arterial Blood Gases
A/C	Assist/Control
BPD	Bronchopulmonary Dysplasia
b.p.m	Breath per minute
C	Compliance
CBF	Cerebral Blood Flow
CHD	Congenital Heart Disease
CLD	Chronic Lung Disease
CNS	Central Nervous System
CPAP	Continuous Positive Airway Pressure
CSF	Cerebrospinal Fluid
CT	Computerized Tomography
CDS	Cranial Ultrasound
AP	Mean Pressure Difference
ETT	Endotracheal Tube
FiO_2	Fractional Concentration Of Oxygen In Inspired Gas
FRC	Functional Residual Capacity
GA	Gestational Age
GIT	Gastrointestinal Tract
GMH	Germinal Matrix Hemorrhage
HFJV	High Frequency Jet Ventilation
HFOV	High Frequency Oscillatory Ventilation
HFPPV	High Frequency Positive Pressure Ventilation

HFV	High Frequency Ventilation
I/E ratio	Inspiratory To Expiratory ratio
IMV	Intermittent Mandatory Ventilation
IPPV	Intermittent Positive Pressure Ventilation
IVH	Intraventircular Hemorrhage
Kt	Time Constant
L	Length Of The Airway
MAP	Mean Airway Pressure
MAS	Meconium Aspiration Syndrome
MV	Mechanical Ventilation
NCPAP	Nasal Continuous Positive Airway Pressure
NICU	Neonatal Intensive Care Unit
P	Intra Alveolar Pressure
$PaCO_2$	Partial Pressure of Arterial Carbon Dioxide
PAL	Pulmonary Air Leak
PaO_2	Partial Pressure of Arterial Oxygen
PDA	Patent Ductus Arteriosus
PEEP	Positive End Expiratory Pressure
pH	Minus Log Of Hydrogen Ion Concentration
PHH	Post Hemorrhagic Hydrocephalus
Pi	Inspiratory Pressure
PIE	Pulmonary Interstitial Emphysema
PIP	Peak Inspiratory Pressure
PPHN	Persistent Pulmonary Hypertension
PPV	Positive Pressure Ventilation
PR	Driving Pressure
PSV	Pressure Support Ventilation
PT	Preterm

PVHI	Periventircular Hemorrhagic Infarction
PVL	Periventircular Leukomalacia
R	Resistance
r	Alveolar Radius
RD	Respiratory Distress
RDS	Respiratory Distress Syndrome
RLF	Retrolental Fibroplasia
ROP	Retinopathy Of Prematurity
RSV	Respiratory Syncytial Virus
$SatO_2$	Oxygen Saturation
SIMV	Synchronized Intermittent Mandatory Ventilation
st	Surface Tension
T_E	Expiratory Time
T_I	Inspiratory Time
V	Ventilation
V/Q	Ventilation/Perfusion
VILI	Ventilation Induced Lung Injury
VLBW	Very Low Birth Weight
V_T	Tidal Volume
η	Viscosity

INTRODUCTION

Mechanical ventilation is an invasive life support procedure with many effects on the cardiopulmonary system ***(Eichenwald, 2008).***

Ventilation due to atelectasis, surfactant deficiency, pulmonary hemorrhage, or retained fetal lung fluids can increase transpulmonary pressure. In turn this leads to alveolar over distention and rupture. Similarly, aspiration of blood, amniotic fluid, or meconium can facilitate alveolar over distention by a ball-valve mechanism ***(Venkatesh, 2008).***

There are many pulmonary and systemic complications of mechanical ventilation. Lung injury may result from positive pressure (barotrauma), oxygen toxicity or excessive volume changes in lung, or volutrauma, which may be manifested acutely as pulmonary air leak ***(Pinhu et al., 2003).***

Infants with respiratory distress may need only supplemental oxygen, whereas those with respiratory failure and apnea require mechanical ventilatory support. Mechanical ventilatory support offers great benefits but also incurs significant risks. The decision to initiate mechanical ventilation is complex. Because mechanical ventilation may result in serious complications, the decision to intubate and ventilate should not be taken lightly ***(Gomella, 2004).***

Pulmonary air leaks (PAL), especially pneumothorax, is a potentially severe complication of pulmonary disease in newborn infants. It is often related to therapeutic procedures such as resuscitation and mechanical ventilation ***(Meberg et al., 2007).***

In the presence of pulmonary disease, positive pressure ventilation increases the risk of air leak. The high airway pressure required to

achieve adequate oxygenation and ventilation in infants with poor pulmonary compliance (e.g. pulmonary hypoplasia, Respiratory distress syndrome (RDS), inflammation, pulmonary edema) further increases this risk. Excessive transpulmonary pressure can occur when ventilators pressures are not decreased as pulmonary compliance improves. This situation sometimes occurs with infants with RDS who improve rapidly after surfactant treatment. Mechanically ventilated preterm infants who make expiratory efforts against ventilators breaths are also at increased risk of pneumothorax ***(Venkatesh, 2008).***

Direct trauma to the airways can also cause air leak. Laryngoscope, endotracheal tubes, suction catheters and malpositioned feeding tubes can damage the lining of the airways and provide a portal of air entry ***(Venkatesh, 2008).***

Air leak occurs more frequently in males than in females and in term and post term infants than in premature ones. The incidences is increased in infants with lung disease such as meconium aspiration and RDS; in those who have had vigorous resuscitation or are receiving assisted ventilation, especially if high inspiratory pressure and/or excessive end-expiratory pressure is used ***(Kliegman et al., 2007).***

AIM OF THE WORK

Evaluation of the incidence, risk factors, management, complications, and outcomes of air leak syndromes in mechanically ventilated neonates in Children's Hospital - Cairo University, Neonatal Intensive Care Unite (NICU).