SURFACTANT THERAPY FOR ACUTE RESPIRATORY FAILURE IN CHILDREN

Essay

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INTENSIVE CARE

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Ibrahim T. Abd-El-Aziz

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Abbreviations

Abbreviations	Means
ABGs:	Arterial Blood Gases.
AECC:	American European Consensus Conference.
ALI:	Acute Lung Injury.
ALS:	Amyotrophic Lateral Sclerosis.
ARDS:	Acute Respiratory Distress Syndrome.
ARF:	Acute Respiratory Failure.
BiPAP:	Bilevel Positive Airway Pressure .
BPD:	Bronchopulmonary Dysplasia.
CAP:	Community Acquired Pneumonia.
CLD:	Chronic Lung Disease.
CMV:	Cytomegalovirus.
CNS:	Central Nervous System.
COPD:	Chronic Obstructive Pulmonary Disease.
CO_2:	Carbon Dioxide.
CPAP:	Continuous Positive Airway Pressure.
CRF:	Chronic Respiratory Failure.
ECLS:	Extra-Corporial Life Support.
ECMO:	Extra-Corporial Membrane Oxygenation.
Fio_2:	Fraction of Inspired Oxygen.
FRC:	Functional Residual Capacity.
GCS:	Glasgow Coma Scale.
HFNC:	High Flow Nasal Cannula.
HFOV:	High Frequency Oscillatory Ventilation.
HMD:	Hyaline Membrane Disease.
ICU:	Intensive Care Unit.
iNO:	Inhaled Nitric Oxide.
LOS:	Length Of hospital Stay.
LTOT:	Long-Term Oxygen Therapy.
MV:	Mechanical Ventilation.
NIV:	Non-Invasive Ventilation.
NMBAs:	Neuro-Muscular Blocking Agents.
NPPV:	Non-invasive Positive Pressure Ventilation.
OR:	Operating Room.
PAO2:	Partial Pressure of Alveolar Oxygen
$PaCO_2$:	Partial Pressure of Arterial Carbon Dioxide.
PaO_2:	Partial Pressure of Arterial Oxygen.
PDA:	Patent Ductus Arteriosus.
PEEP:	Positive End-Expiratory Pressure.
PFTs:	Pulmonary Function Tests.
PICU:	Pediatric Intensive Care Unit.
RDS:	Respiratory Distress Syndrome.
RF:	Respiratory Failure.
RSV:	Respiratory Syncytial Virus.
SaO2:	Arterial Oxygen Saturation.
SIMV:	Synchonized Intermittent Mandatory Ventilation.
SP:	Surfactant Protein.

Abbreviations	Means
SPo_2:	Blood Oxygen Saturation.
SRT:	Surfactant Replacement Therapy
VILI:	Ventilator Induced Lung Injury.
V/Q:	Ventilation Perfusion.
V_t:	Volume Targeted.

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Introduction

Acute respiratory failure remains the primary indication for admission to pediatric intensive care units and accounts for significant mortality, morbidity and resource utilization. Respiratory infections, in particular pneumonia and severe bronchiolitis, are the most common causes of respiratory failure requiring mechanical ventilation in children ***(Walter and Watts, 2010)***.

Alterations in endogenous surfactant play a role in the pathogenesis of many causes of acute lung injury and acute respiratory distress syndrome ***(Royall and Levin, 2009)***.

Surfactant dysfunction, destruction and inactivation have also been demonstrated in children with acute respiratory insufficiency due to bronchiolitis ***(Dargaville et al., 2011; Skeleton et al., 2011)***.

The administration of exogenous surfactant will reduce the need for mechanical ventilation and

its associated sequelae by restoring surfactant levels and function ***(Long et al., 2009)***.

Aim of the work

In this study we discussed the effect of the administration of pulmonary surfactant on mechanically ventilated children with acute respiratory failure.

Respiration is the exchange of gases between a living organism and its environment. There are three important processes that allow gas exchange to occur: ventilation, diffusion and perfusion ***(Bledsoe, 2009)***.

Ventilation is the process of moving air in and out, inspiration and expiration. When air is inhaled diffusion takes place. Diffusion is a process by which gases move between the alveoli and the pulmonary capillaries. Perfusion occurs last, it is the circulation of blood through the lungs, specifically the pulmonary capillaries ***(Bledsoe, 2009)***.

Unwanted gases, such as carbon dioxide is exhaled and blown off. Respiratory disease processes limit the body's ability to get rid of the carbon dioxide and other waste ***(Bledsoe, 2009)***.

In pediatric patients the process of respiration is the same as an adult. The anatomy is different in several ways. Airway is smaller in children younger than 8 years old. Pediatric patients' tongues are

large and they fill a small oropharynx. Young children also have a cephalic larynx, which is opposite vertebrae C_{3-4} versus C_{6-7} in adults. The pediatric epiglottises are larger and more horizontal to the pharyngeal wall than in adults. Children have fewer alveoli than do adults, which in turn mean that the younger pediatric patients have a relatively smaller area for gas exchange ***(Priestley, 2010)***.

Respiratory distress is a type of respiratory failure resulting from many different disorders that cause fluid to accumulate in the lungs and oxygen levels in the blood to be too low ***(Gehlbach, 2008)***.

The alveoli collapse due to fluid accumulation. Collapse of many alveoli interferes with the movement of oxygen from inhaled air to the blood, causing oxygen levels to the blood to decrease sharply. The movement of carbon dioxide from the blood to air that is exhaled is affected less, and levels of carbon dioxide in the blood change very little ***(Feng, 2009)***.

Respiratory failure is a syndrome in which the respiratory system fails in one or both of its gas

exchange functions: oxygenation and carbon dioxide elimination. It may be acute or chronic as well. It is characterized by life-threatening derangements in arterial blood gases and acid-base status ***(Kaynar, 2010)***.

One big difference between the two is in distress they are still breathing, not adequately but nonetheless still breathing. Respiratory failure usually signifies that the patient is not breathing. Respiratory failure is seen as the end stage of respiratory distress of any cause or with inadequate respiratory drive ***(Whitethorn, 2006)***.

Since its description in 1967 by Ashbaugh, acute respiratory distress syndrome (ARDS) has been the subject of intense investigation. This heterogeneous disorder has an incidence of 8.5-16 cases/1,000 pediatric intensive care unit (PICU) admissions ***(Vasudevan et al., 2004)***. While the outcome of pediatric ARDS has improved, the mortality rate remains high at about 22% ***(Flori et al., 2005)***.

I- Definition:

Based on the 1994 American European Consensus Criteria, ARDS is defined as (1) having acute onset (2) severe arterial hypoxemia ($PaO_2/FiO_2 \leq 200$ mmHg) for ARDS and <300 mmHg for acute lung injury (ALI), (3) bilateral radiographic infiltrates, and (4) no evidence of left atrial hypertension. Although the simplicity of this definition is attractive, it does not take into account the etiology or severity of ARDS, which are determinants of natural history and outcome ***(Prabhakaran, 2010)***.

Respiratory failure (RF) is a condition in which the respiratory system fails in one or both of its gas-exchanging functions-oxygenation of mixed venous blood and elimination of carbon dioxide ***(Markou et al., 2004)***.

The frequency of acute respiratory failure (ARF) is higher in infants and young children than in adults. This difference can be explained by defining anatomic compartments and their developmental differences in pediatric patients that