Pulmonary hemorrhage is a relatively uncommon event in the NICU. It generally is an ominous sign of severe illness. Premature infants are at greatest risk of hemorrhage. Poor outcomes are associated with pulmonary hemorrhage, so prompt recognition and treatment are critical.

NICU, neonatal, hemorrhage, pulmonary hemorrhage, respiratory distress

Neonatal Pulmonary Hemorrhage

Purpose and Goal: CNEP # 2108

- Learn about neonatal pulmonary hemorrhage
- Learn about options for treating pulmonary hemorrhage in the NICU

None of the planners, faculty or content specialists has any conflict of interest or will be presenting any off-label product use. This presentation has no commercial support or sponsorship, nor is it co-sponsored.

Requirements for successful completion:

- Successfully complete the post-test
- Complete the evaluation form

Date

- June 2019 – June 2021
Learning Objectives

- Describe the etiology of pulmonary hemorrhage
- Describe the pathogenesis of pulmonary hemorrhage
- Describe at least 2 options for treating pulmonary hemorrhage in the NICU

Introduction

- Pulmonary hemorrhage is an acute event
  - It is well recognized
  - It is a serious sign of illness
  - It can be a catastrophic event
- It is diagnosed when there is fresh blood
  - In the trachea
  - In the endotracheal tube
- It was first described as early as 1855
- In general, with pulmonary hemorrhage
  - The etiology is not well understood
  - The mortality rate is very high

Definition of Pulmonary Hemorrhage

- Pulmonary hemorrhage is defined as
  - An acute event
  - A significant event
- It is characterized by fresh blood
  - In the upper respiratory tract
- The incidence is 1-12/1000 live births
- The incidence is 50/1000 in VLBW infants
- It is present in 7-10% of neonatal autopsies
• It is present in up to 80% of VLBW infant autopsies
• Pulmonary hemorrhage can be massive
  • Associated bleeding is possible
  • In other sites of the body
  • >33% of the lungs can be affected
• Hemorrhage tends to occur soon after birth
  • Within 6 hours for term infants
  • Within 48-72 hours for preterm infants
• Mortality rates are as high as 50% in the NICU

Pathogenesis of Pulmonary Hemorrhage

• The pathogenesis of pulmonary hemorrhage
  • Is not well understood
• It is most likely hemorrhagic pulmonary edema
  • The Hct is lower than the venous Hct
    • By as much as 15-20%
  • The concentration of small proteins
    • Is smaller than in plasma
• The hemorrhagic pulmonary edema
  • Results in frank bleeding
    • Into alveolar spaces
    • Into interstitial spaces
• Several theories exist to explain this process
• One theory is that perinatal depression
  • Leads to myocardial failure
  • Which ↑ pulmonary vascular pressure
  • Which results in pulmonary edema
• Another theory is that pulmonary capillaries
  • Are under stress
  • Which leads to breakage
  • Which leads to leaking of fluid
• The most accepted theory involves a PDA
  • Decreased pulmonary vascular resistance
  • Leads to increased left-to-right shunting
• Through the patent ductus arteriosus
  • Which leads to increased pulmonary blood flow
    • Leading to pulmonary edema
    • Leading to ↑ capillary pressure
    • Leading to ↑ vascular permeability
• Other possible theories include
  • Surfactant dysfunction
  • Intrauterine neutrophil activation
• Several contributing factors have been identified
  • Lung damage
  • Hypervolemia
  • High alveolar surface tension
  • Low concentration of plasma proteins

Etiology and Risk Factors for Hemorrhage

• Many risk factors have been identified
• Maternal risk factors include
  • Toxemia
  • Infection
  • Cocaine use
  • Bleeding disorders
  • Medications
    • Anticonvulsants
    • Antitubercular drugs
    • Vitamin K antagonists
  • Lack of antenatal steroids
    • In preterm labor
• Infant risk factors include
  • Infection
  • IUGR
  • PDA
  • Prematurity
• Extreme prematurity
• Breech delivery
• Hypothermia
• Polycythemia
• Perinatal depression
• Erythroblastosis fetalis
• Bleeding disorders
• Meconium aspiration
• Respiratory distress
• Intubation at delivery
• Surfactant therapy
• ECMO or ECLS

Clinical Features of Pulmonary Hemorrhage

• The onset of pulmonary hemorrhage
  • Is characterized by oozing
  • From the nose and mouth
  • Or the endotracheal tube
• Frothy pink tinged secretions are common
  • Followed by fresh bloody secretions
• A rapid clinical deterioration and instability follows
  • Apnea
  • Cyanosis
  • Hypotension
  • Vasoconstriction
  • Poor systemic perfusion
• Abnormal chest radiograph
  • Patchy infiltrates
  • Complete opacification
• Respiratory decompensation
  • With need for intubation
  • With need for ↑ support
Other clinical signs include
- Possible shock
- A drop in hematocrit
- Bleeding from other sites

Management of Pulmonary Hemorrhage

- The goals of management are supportive
  - To identify the underlying etiology
  - To decrease and stop the hemorrhage
  - To improve gas exchange and distress
- Immediate management should include
  - Tracheal suctioning
  - Increased oxygen support
  - Positive pressure ventilation
- To help decrease pulmonary hemorrhage
  - Increase PEEP to 6-10
  - Increase mean airway pressure
  - Consider high frequency ventilation
- Vitamin K should be administered as needed
- Dopamine can be started prophylactically
  - Due to its vasoconstrictive effect
  - To help resolve pulmonary edema
- Endotracheal or nebulized epinephrine
  - Have been used for vasoconstriction
  - The dose is 0.1 ml/kg of 1:10,000 dilution
  - This treatment is somewhat controversial
- Iced saline via endotracheal tube is not recommended
- Administration of Surfactant may be beneficial
- Activated recombinant factor VII may be beneficial
- Hemocoagulase is a newer treatment option
  - Derived from Brazilian snake venom
- It is a purified mixture of enzymes
- It has a thromboplastin-like effect
- A cardiac ECHO should be obtained
  - To rule out PDA
  - Indomethacin use is controversial
    - Due to side effects
    - Due to ↓ platelet function
- Serial chest radiographs should be obtained
- Abnormalities should be promptly corrected
  - Especially bleeding disorders
    - DIC
    - Thrombocytopenia
  - Coagulation factors should be monitored
    - FFP may be indicated
    - Cryoprecipitate may be indicated
- A blood transfusion may also be indicated
  - If blood loss is large
    - PRBCs
    - Platelets
  - If signs of shock are present

**Outcomes and Prognosis**

- The outcome is dependent on the cause
- Studies show the risks of death are high
  - Mortality rates are 30-50%
- Survival with neurosensory impairment
  - Is at least doubled
  - Compared to NICU infants
- There is increased incidence of cerebral palsy
- There is increased incidence of cognitive delay
- There is also increased risk of PVL and seizures
Summary

- Pulmonary hemorrhage is rarely a true hemorrhage
- It is usually a hemorrhagic pulmonary hemorrhage
- The hemorrhage rarely causes hypovolemia
- The hemorrhage is rarely caused by coagulopathy
- The most common clinical associations are
  - Large PDA
  - Severe IVH
  - Surfactant therapy
- Pulmonary hemorrhage can be life threatening
- Prompt treatment is critical for improved outcomes

References


