

Pulmonary apoplexy

Pulmonary apoplexy (*apoplexia pulmonum*) manifests as hemorrhagic pulmonary edema with the invasion of erythrocytes and capillary infiltrate into the lungs. It is defined as **bleeding into two or more pulmonary lobes** within the interstitial space and/or alveoli.^[1] It most often occurs in acutely ill low birth weight newborns between the 2nd and 4th day of life on mechanical lung ventilation.^[2]

Pathogenesis

Massive bleeding into the lungs is a severe complication of neonatal pulmonary edema. The main triggers are increased pulmonary capillary pressure (in heart failure), decreased intravascular oncotic pressure (in extremely premature infants, in hydrops), increased permeability of pulmonary capillaries (in sepsis) and decreased lymphatic drainage (in PIE).

- The hematocrit of the fluid aspirated from the airways rarely exceeds 0.1.
- Bleeding into the lungs is the result of capillary filtration into the interstitial space and when the interstitial space is full, the bleeding continues into the alveoli.
- If the hematocrit of the aspirated fluid is close to the venous hematocrit, the bleeding is likely from a larger blood vessel.^[1]

Clinical picture

The neonate's ventilation suddenly worsens and he or she becomes pale, dyspnoeic or even apnoeic, bradycardic, and cyanotic. Hypotonia and decreased reflexes can be present.

- Simultaneously, a pink-red discharge flows out of the oral cavity or cannula.
- However, in some cases, bleeding is the first symptom in a healthy-looking child and the overall condition worsens later.
- In regards to cardiac symptoms, one can observe tachycardia and often hear a murmur, and eventually symptoms of arrhythmias (mostly bradyarrhythmias) begin to appear. Symptoms of heart failure, hypoxemia, and MAC ensue eventually.
- One can hear muffled impaired breathing over the affected lung(s).^[1]

Differential diagnosis

- Trauma - airway injury caused by naso- or endotracheal intubation or suctioning; lung injury during chest drain insertion.
- Aspiration of maternal blood swallowed during a caesarean section.
- Coagulopathy due to sepsis or a congenital condition.
- Acute left-sided heart failure due to hypoxia/asphyxia.
- Hypervolemia caused by excessive transfusion or fluid intake.
- Congenital heart disease or congestive heart failure (PDA).
- Respiratory distress syndrome, pulmonary interstitial emphysema, pneumothorax, meconium aspiration, pneumonia (especially when caused by gram-negative bacteria).
- Surfactant administration - probably due to a rapid increase in blood flow through the lungs as lung function improves. Studies show that prophylactic administration of surfactant increases the incidence of pulmonary apoplexy and "rescue" administration does not.
- Artificial lung ventilation or oxygen therapy (oxygen toxicity).
- Hematological disorders - severe Rh incompatibility, thrombocytopenia, haemorrhagic disease of the newborn (due to vitamin K deficiency).
- Prematurity, IUGR, multiple pregnancies
- Severe hypothermia
- Infection/sepsis (and associated DIC).
- Urea cycle disorders with hyperammonemia.^[2]

Diagnosis

- Typical clinical picture: respiratory deterioration accompanied by airway bleeding.
- Laboratory examination:
 - Differential blood count (thrombocytopenia?, decreased hematocrit?, infection?);
 - Coagulation (PT, APTT, TT, FBG)
 - Acid-base balance (hypoxia?, metabolic acidosis?).
- X-ray of the lungs to rule out pneumonia, RDS, congestive heart failure, and to determine the extent of the bleeding (focal or massive - white lungs with a negative air bronchogram).
- ECHO to detect the presence of a PDA.^[2]

Therapy

- Suctioning from the respiratory tract as needed (there is a risk of clogging the cannula with blood)
- Optimization of ventilation and oxygen therapy
 - Increasing PEEP (*positive end-expiratory pressure*) to 6–8 cm H₂O – may cause a capillary tamponade
 - Increasing PIP (*peak inspiratory pressure*) as needed to ensure adequate ventilation
- General measures:
 - Maintaining blood pressure (volume expansion via fluid resuscitation and vasopressors like catecholamines)
 - Erymass (RBCs) transfusion (be careful not to administer too much fluid, as an increase in systemic pressure may worsen the pulmonary edema)
 - Correction of acidosis with bicarbonate administration under conditions of adequate ventilation
- Treatment of the primary cause.
 - Hemorrhagic disease of the newborn – intravenous vitamin K (1 mg/kg)
 - Coagulopathy – fresh frozen plasma (10 mL/kg)
 - Thrombocytopenia – platelet transfusion
 - Sepsis - antibiotics
 - PDA - ibuprofen or ligation
- Other measures:
 - High-frequency oscillatory ventilation
 - Intratracheal administration of surfactant
 - Intratracheal administration of adrenaline
 - Corticosteroids (methylprednisolone)
 - Intravenous recombinant activated coagulation factor VII (panhemostatic effect; used to treat severe bleeding in hemophilia A and B).
 - Intratracheal administration of hemocoagulase during artificial lung ventilation
 - Diuretics (furosemide) to treat volume overload^[2]

References

Related Articles

- Neonatal pneumopathies

Citations

1. HAVRÁNEK, Jiří: *Respirace*.
2. GOMELLA, TL. *Neonatology : Management, Procedures, On-Call Problems, Diseases, and Drugs*. 6. edition. Lange, 2009. 360-363 pp. ISBN 978-0-07-154431-3.