

Title:	Pulmonary haemorrhage		
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Recognition

Pulmonary haemorrhage (PH) is characterised by acute cardiorespiratory collapse accompanied by moderate-to-large volumes of fresh bloody secretions from the airway.^{1,2,3} Differentiate PH from small volume streaks of bloody secretions aspirated during airway suction, which may be trauma-related.

Key points in management

1. Intubate if self-ventilating. Avoid removing endotracheal tube (ETT) if ventilated. Ensure a clear airway but avoid unnecessary suction.
2. Increase mean airway pressure to provide tamponade to bleeding by increasing:
 - i. PEEP \geq 6-7 cm H₂O
 - ii. Ti 0.4-0.5 seconds
 - iii. PIP according to chest expansion, often \geq 30 cm H₂O, as accumulated lung fluid decreases lung compliance
3. Obtain IV access and ensure cross-match sent. May need O negative blood if circulatory shock present.
4. If O negative blood not available and circulatory shock present give 10ml/kg normal saline bolus
5. Give a dose of vitamin K IV
6. Correct anaemia and deranged clotting with blood, FFP, platelets
7. For persistent hypotension after circulating volume restoration, consider inotropes. See ‘Management of hypotension’ guideline
8. Once stabilised, consider:
 - i. Surfactant
 - ii. Fluid restriction and/or diuretics
 - iii. Sedation and muscle relaxation

Causes and risk factors

Pulmonary oedema is thought to arise from increased pulmonary blood flow and left heart failure.²

PH is seen more commonly in premature babies. Risk factors include: ^{2, 3}

- Intra-uterine growth restriction
- Inadequate antenatal steroids in prematurity
- Post surfactant treatment (although surfactant may be of benefit after a pulmonary haemorrhage to correct secondary surfactant denaturation)
- Large patent ductus arteriosus (PDA) with left-to-right shunting
- Hypoxia: including meconium aspiration syndrome, HIE, sepsis
- Fluid overload
- Hydrops
- Coagulopathy

The incidence of PH varies from 1 to 12 per 1000 neonates. In preterm babies the median age of onset is between day 2-4. PH may occur sooner in term babies.^{1, 2}

Clinical features

These may include:

1. Fresh blood from the airway typically seen after worsening clinical status.³
2. Reduced air entry and crackles on auscultation +/- hypoxia
3. Hypotension, shock, features of a PDA and heart failure including murmur, hepatosplenomegaly and peripheral oedema.^{1, 3}
4. Blood gases show hypercapnoea and metabolic acidosis.¹
5. Chest x-ray reveals features of pulmonary oedema with diffuse granular opacification, or may show complete white out with massive PH.³
6. Reduced responsiveness
7. Intraventricular haemorrhages associated with PH in premature infants.²

References

1. Bendapudi P, Narasimhan R, Papworth S, 'Causes and management of pulmonary haemorrhage in the neonate.' Paediatrics and Child Health 2012, Volume 22, Issue 12, pp. 528-531
2. Abou Zahr R, Ashfaq A, Marron-Corwin M, 'Neonatal pulmonary hemorrhage', NeoReviews May 2012, 13 (5) e302-e306
3. Greenough, A., Milner, A.D. 'Pulmonary haemorrhage' in: J.M. Rennie (Ed.) Robertson's textbook of neonatology. 5th edn. Churchill Livingstone, Edinburgh 2012