Can pulmonary haemorrhage be caused by excessive fluids, coagulation abnormalities, or surfactant therapy?

Massive pulmonary haemorrhage may result from severe pulmonary oedema, one of the causes of which is reduced intravascular oncotic pressure associated with fluid overload (Bland, 1982). The role of coagulation abnormalities is “unclear”, although secondary disseminated intravascular coagulation is not uncommon (Greenough, 1999).

A Cochrane systematic review of 7 RCTs in a total of 1583 premature infants (Soll, 1998) concluded that prophylactic treatment with synthetic surfactant increased the risk of pulmonary haemorrhage, metaanalysis showing a RR of 3.28 (95% CI 1.50-7.16).

Paradoxically, there is some suggestion that surfactant may be used to successfully treat pulmonary haemorrhage, although a Cochrane review (Aziz, 2008) found no randomised or quasi-randomised trials that would allow a firm conclusion to be reached.

A case-control study in 787 VLBW neonates treated with surfactant (Pandit, 1999) found that 94 (11.9%) developed pulmonary haemorrhage. In these infants, this was associated with increased risk of death (OR 7.8, 95% CI 2.6-28) and short term morbidity (OR 4.4, 95% CI 1.3-15.7) if moderate or severe.


Evidence Level: V (fluids, coagulopathy); I (synthetic surfactant)

What is the most effective treatment for pulmonary haemorrhage?

Three studies, in 17 (Al Kharfy, 2004), 18 (Ko, 1998) and 6 (Pappas, 1996) infants found that high-frequency ventilation improved survival (59%, 72% and 100%, respectively, survived). In an earlier study in 6 infants (Trompeter, 1975), 4 (66%) survived after treatment with intermittent positive pressure ventilation.

A retrospective study in 30 infants (Dearborn, 2002) found chronic inflammation on lung biopsy in 5 patients who died. This, coupled with the finding that only 1 of the surviving infants had not received steroids, whereas the non-survivors had either not received steroids or had them stopped on hospitalisation, led the authors to recommend methylprednisolone, 1 mg/kg 6 hrly during hospitalisation and 1mg/kg daily thereafter. Treatment was continued until the BAL iron index dropped below 50/300, after which the steroids were tapered and finally stopped over a 4 week period.

A retrospective study in 42 infants (Bhandari, 1999) advised that “Large multicenter studies need to be done using standardized protocols for management of PH before any definite conclusion can be drawn” (about the most effective treatment).


Evidence Level: IV

Can surfactant treatment be beneficial in pulmonary haemorrhage?
Paradoxically, although the risk of pulmonary haemorrhage increases slightly with any surfactant therapy (Raju, 1993), a small study in 15 neonates (Pandit, 1995) found that respiratory status (as measured by oxygenation index (OI)) improved following treatment with exogenous surfactant. Mean OI improved from 24.6 at 0-3 hours presurfactant to 8.6 at 3-6 hours postsurfactant (P < .001).
Case reports have also shown efficacy for surfactant treatment in term neonates (Kaneko, 2001) and older infants (Mikawa, 1994).


Pandit PB, Dunn MS, Colucci EA. Surfactant therapy in neonates with respiratory deterioration due to pulmonary hemorrhage. Pediatrics 1995;95:32-6


Evidence Level: IV