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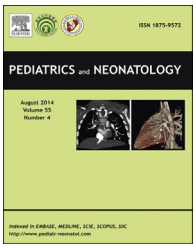

LETTER TO THE EDITOR

# Reply: Pulmonary Hemorrhage in Very-low-birth-weight Infants

We thank the authors for their comments on pulmonary hemorrhage (PH) in very-low-birth-weight infants.[1] Indeed, the timing of surfactant use and the occurrence of hemodynamically significant patent ductus arteriosus (PDA) may occur consequently. Prior to PH, no heart murmur or hemodynamically significant PDA was noted in our cases. In this study,[2] 13 patients who received surfactant therapy developed PH within 72 hours of surfactant therapy. Among these patients, half (7 /13: 53%) were diagnosed with coexistent PDA by echocardiography during PH. PDA was bidirectional shunt in five patients. For the other five patients who developed severe PH despite no surfactant use, the median age for severe PH was 3.2 days (range, 2—7 days). Only one patient was diagnosed with hemodynamically significant PDA during the occurrence of severe PH. This patient was not diagnosed with respiratory distress syndrome but he presented with thrombocytopenia soon after birth. PH developed at age 3 days and cardiac echography showed a bidirectional flow with left atrium:aortic root ratio of 1.8. The patient received PDA ligation on the next day.

Why was no heart murmur found prior to PH in these infants? One possible explanation is that the pulmonary pressure was still high in these very-low-birth-weight infants with respiratory distress syndrome. After surfactant therapy, the pulmonary compliance improved and it caused dramatically decreased pulmonary pressure. If PDA coexists, the dramatically decreased pulmonary pressure will result in significant left-to-right shunt and it may lead to PH due to volume overload. This hemodynamic change may happen quickly even prior to when hemodynamically significant PDA is found.

As mentioned by Cole et al,[3] defective coagulation function may only serve to exacerbate or prolong the hemorrhage rather than initiate it. In their study, only one (1/10: 10%) patient was found to have definite coagulopathy preceding the occurrence of severe PH. In our study, samples preceding PH were taken from 18 patients within 5—48 hours and six (33%) patients had thrombocytopenia ($<150 \times 10^9$ platelets/L). Therefore, thrombocytopenia and coagulopathy may worsen the condition of severe PH but are insufficient to cause PH without other precipitating factors.

Therefore, the incidence of severe PH is higher in patients receiving surfactant therapy with coexisting PDA. Early detection of hemodynamically significant PDA and appropriate treatment may also play an important role in the management of severe PH. The outcome of severe PH may worsen if accompanied by bleeding tendency.

## Conflicts of interest

All contributing authors declare no conflicts of interest.

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