Pulmonary interstitial emphysema: selective bronchial occlusion with a Swan-Ganz catheter

(1) It is accomplished easily and quickly without fluoroscopy. (2) It comprises simple laryngoscopy with subsequent reintubation of the infant with a 0.5 mm smaller endotracheal tube to permit adjacent placement with the Swan-Ganz catheter. (3) A successful response is seen within half an hour of the procedure with ongoing improvement in the radiological findings. (4) The catheter is radiolucent and clearly marked in 5 cm increments with a sliding gate valve that prevents inadvertent deflation of the balloon. (5) Using a syringe, precise quantitation of the degree of balloon inflation is possible, and although location of the balloon is known (0.9 cm from the catheter tip) its exact position can be determined by insufflating the balloon with dilute contrast fluid. Pulmonary interstitial emphysema should be managed aggressively in the first instance by non-invasive methods. Selective bronchial occlusion utilising a Swan-Ganz catheter provides a successful alternative measure in severe disease unresponsive to standard treatment.

References

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Effect of tilting on oxygenation in newborn infants

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SUMMARY Transcutaneous (tc) PO₂ in newborn infants increased on head up tilting (median increase 0.5 kPa at term, 1.0 kPa preterm). Head down tilting was associated with an equivalent fall in tcPO₂. There was no change in tcPCO₂. Tilting of infants mechanically ventilated for respiratory distress syndrome or surgery produced no consistent change in PO₂.

Newborn infants are often nursed on a head up tilt. This study investigated whether a head up or head down tilt produced a change in PO₂ and PCO₂ in healthy prone newborns and in those with respiratory problems.

Patients and methods

Seventeen healthy term infants and seventeen healthy preterm infants (mean birth weight 1300 g) were studied at the Department of Neonatology, Ullevaal Hospital, Oslo. Each term infant lay prone and at least five tilts were performed. Each position: horizontal, 30 degrees head up, and 30 degrees head down, was held for five minutes before the next tilt. The term infants were studied on day one and day five in active and in quiet sleep. The preterm infants were studied on one day only and tilted 20 degrees head up in their incubators. Transcutaneous PO₂ and PCO₂ were measured in the intercapular region. Values were recorded every 30 seconds. Tilts associated with any body movement or change in sleep state were not included.

To investigate the possibility that tcPO₂ might be influenced by changes in skin circulation from hydrostatic pressure or reflex vasoconstriction due to a baroreceptor response we measured tcPO₂ from two electrodes, one in the intracapular region and one on the buttock in five infants. TcPO₂ values from both sites followed each other exactly (fig 1) thus ruling out a gravitational effect on local skin perfusion.

Further studies of PO₂ and head up tilting were carried out in 10 infants receiving intensive care at Hammersmith Hospital, London. Seven of these infants had an umbilical artery catheter with an oxygen electrode at the tip in the descending aorta. The remaining three infants were studied using a transcutaneous PO₂ system.

Results

Fig 1 shows a typical response with PO₂ rising and
Fig 1  Simultaneous transcutaneous PO2 measurements from the interscapular site and from the buttock of a healthy full term infant during sequential tilts.

Fig 2  Transcutaneous PO2 measurements from a full term infant through seven tilts. The sequence is indicated by the arrows.

falling with tilting head up and head down, respectively. In the term infants there was no difference between day one and day five and between sleep states. The median increase in PO2 on tilting 30 degrees head up was 0.5 kPa (95% confidence limits 0.2 to 0.8 kPa). The decrease was similar on tilting head down (median -0.6 kPa, 95% confidence limits -0.4 to -1.0 kPa). The increase in PO2 when tilting from head down to horizontal was the same as when tilting from horizontal to head up. The increase in PO2 when tilting through 60 degrees from 30 degrees head down to 30 degrees head up was twice the increase observed with a 30 degree tilt (Fig 2). These changes in oxygenation were confirmed by pulse oximetry. When tilting head up saturation increased on average by 2%, and it fell by 5% on head down tilt. The preterm infants increased their PO2 on head up tilting by a median value of 1.0 kPa (95% confidence limits 0.9 to 1.1 kPa) and this was confirmed by arterial PO2 in one case. Tilting had no effect on tcPCO2.

One preterm infant receiving slow ventilation did show a small rise in PO2 on head up tilting. None of the six preterm infants receiving mechanical ventilation for respiratory distress syndrome had an increase in PO2 with head up tilting. The two full term infants, with normal lungs, who were being mechanically ventilated did not show a rise in tcPO2 with head up tilting but did so when off the ventilator and breathing spontaneously.

Discussion

This study has shown that PO2 in healthy term and preterm newborn infants increases on head up tilting. Tilting head up causes gravity to act on the lower zones of the lungs improving the matching of
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ventilation and perfusion and slightly increasing PO$_2$. If the above effect were the only explanation one might expect the same or less effect in the preterm infant than in the term infant. The opposite was the case. Tilting presumably reduces the weight of abdominal contents on the diaphragm thus tending to increase functional residual capacity. If the functional residual capacity was not fully stabilised in many preterm infants in the first few days tilting would be expected to have a greater effect on it and on oxygenation in preterm infants than in term infants who stabilise their functional residual capacity early. Improving suboptimal functional residual capacity would increase PO$_2$.

The rise in PO$_2$ with tilting was not found in infants who were receiving mechanical ventilation because of respiratory distress syndrome. This may be due to stiffness of the lungs, pulmonary hypertension, or to the effects of mechanical ventilation. Any or all of these factors could overcome the relatively slight gravity dependent changes.$^2$

The observation that a rise in PO$_2$ with tilting was not found in two term infants with normal lungs while being mechanically ventilated could be due to positive pressure ventilation overcoming the effects of gravity on functional residual volume.

In conclusion, head up tilting increases PO$_2$ in healthy term and preterm infants, but it does not benefit infants ventilated for respiratory distress syndrome.

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References


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