108 Correspondence

with either a partial rebreathing or a non-rebreathing circuit. *Anesthesiology* 1987;66:405-10.

- ³ Badgwell JM, McLeod ME, Lerman J, Creighton RE. End tidal pCO₂ monitoring in infants and children during ventilation with the Air-Shields Ventimeter ventilator. *Anesthesiology* 1986;65:A418.

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Drs Watkins and Weindling comment:

We thank Dr Stow for highlighting a potential source of error in the monitoring of end tidal CO₂ in neonatal intensive care.

He is correct in surmising that we were using time cycled pressure limited ventilators with continuous gas flow (Vickers Neovent and SLE Newborn 250). It is the practice in this unit to use a flow rate of 7 l/minute in all cases unless high pressure and ventilator rates dictate a higher rate. All except two readings were at this rate and it is of interest that these (at 10 l/minute) were both inaccurate. This infant did, however, also have severe respiratory disease (alveolar/arterial oxygen difference 660 mm Hg) and so it is difficult to separate the two effects. We did find good correlations between end tidal CO₂ and paCO₂ measurements in some infants with milder respiratory disease despite the continuous gas flow, and so we felt that the effect of dilution was probably minimal. Our impression is that the effect of parenchymal lung disease far outweighs other effects in these infants.

The use of time cycled, pressure limited ventilators is almost universal in neonatal intensive care units. They are cheap and simple to use, and seem to be more effective in infants with hyaline membrane disease and its complications. Experience suggests that results are better than with volume cycled devices.¹

Sampling of end tidal CO₂ from the tip of the endotracheal tube may well minimise any error due to gas flow. The majority of very low birthweight infants with hyaline membrane disease are ventilated using a 2.5 mm endotracheal tube. The luminal diameter is already critically small and considerably increases total respiratory resistance.² Any further impingement on the lumen should be avoided unless absolutely necessary.

We have already acknowledged³ the important role of end tidal CO₂ monitoring in anaesthetics, when most of the patients have normal lungs. This is clearly not the case in infants ventilated in a neonatal intensive care unit, in whom we feel end tidal CO₂ monitoring to be inappropriate.

References

- Manginello FP, Grassi AE, Schechner S, Krauss AN, Auld PAM. Evaluation of methods of assisted ventilation in hyaline membrane disease. *Arch Dis Child* 1978;53:878-81.
- Le Souef PN, England SJ, Bryan CA. Total resistance of the respiratory system in preterm infants with and without endotracheal tubes. *J Pediatr* 1984;104:108.
- Watkins AMC, Weindling AM. Monitoring of end tidal CO₂ in neonatal intensive care. *Arch Dis Child* 1987;62:837-9.

Evaluation of nebulisers

Sir,

We were interested in the paper by Tsanakas *et al.*¹ and agree that it is important to have a nebuliser with the minimum variation in output when performing bronchial challenge tests. We were concerned, however, that the authors calculated the output of the nebuliser by weighing the device before and after nebulisation. This method does not give a true idea of the output of the nebuliser. As the nebulised cloud forms there is a huge cumulative surface area formed by the aerosol droplets. Most of these droplets are returned to the nebuliser solution by a series of baffles, allowing only the finer particles to escape. At the same time some evaporation takes place. The weight loss from the nebuliser, therefore, is due to dispersion of particles of the drug, such as histamine solution, but also to evaporation. Depending on which nebuliser is used, calculating the output by weighing the device before and after nebulisation may result in an overestimate of drug output of up to 50% (unpublished observations).

To measure the output of our nebulisers we used a multi stage liquid impinger which catches the nebuliser cloud as it emerges from the nebuliser. The impinger separates the cloud into fractions comprising particles of varying sizes and we then assayed the amount of drug in each fraction, so determining not only the actual amount of drug that leaves the nebuliser but also the amount of drug in particles that are likely to reach the lungs.

Reference

- ¹ Tsanakas JN, Wilson AJ, Boon AW. Evaluation of nebulisers for bronchial challenge tests. *Arch Dis Child* 1987;62:506-8.

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Sudden and unexpected death between 1 and 5 years

Sir,

The report by Southall *et al.*¹ that one third of the deaths in their series of infants between 1 and 5 years were unexplained begs the question of why such a common phenomenon is not more widely recognised nor apparent from the Registrar General's annual mortality figures. I think that most pathologists would concede that unexplained deaths occur throughout childhood, adolescence, and adult life although not with the frequency seen during the first postnatal year.

When the sudden infant death syndrome was officially recognised by the Office of Population Censuses and Surveys (OPCS) as a distinct entity, the rise in deaths from this cause was matched by a decline in deaths from respiratory infection.² I can only suppose that the apparent rarity of unexplained deaths between 1 and 5 years has a