There is some evidence[1] that a NGT increases airway resistance in small preterm neonates, but not in older heavier ones.[2] Total tidal volume in well neonates is not affected by an NGT.[3] However, it is difficult to extrapolate from these studies to the clinical significance of an NGT in older, larger children with bronchiolitis. Expert opinion varies. Nicolai and Pohl[4] and Sporik[5] argue ''from first principles'' that the nasogastric (NG) route be avoided because of the theoretical risk of increased airway resistance. However based on the same studies cited by Sporik, Milner came to the conclusion that the NG route is acceptable in infants over 2 kg.

The case series reported by Sammartino *et al* and Vogel *et al* show that there is widespread use of the NG route in many units.[6 7] However, no conclusions can be drawn from their data regarding the safety of NG fluids versus the intravenous route.

No studies were identified assessing the likelihood of electrolyte disturbance in children with bronchiolitis given intravenous rather than nasogastric fluids.

In infants with bronchiolitis, there is no good quality evidence that rehydration by the NG route is more or less safe than via the intravenous route. A randomised controlled trial is needed.

CLINICAL BOTTOM LINE

- There is no good quality evidence for or against the use of nasogastric fluids in infants with bronchiolitis. (Grade D)
- Physiological studies would suggest that use of a nasogastric tube be limited to infants >2 kg. (Grade D)
- Until good quality evidence is available, local guidelines should be followed. (Grade D)

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Are methylxanthines effective in preventing or reducing apnoeic spells in infants with bronchiolitis?

Report by
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A 2 week old infant, born at 36 weeks gestation was admitted to the paediatric ward in November with a 24 hour history of runny nose, cough, and episodes of shallow breathing and apnoeas. This was thought to be due to bronchiolitis, and the consultant paediatrician suggested starting the baby on caffeine (theophylline derivative with less side effects). As the resident middle grade doctor, I knew that caffeine has been used widely in neonatal units for apnoea of prematurity, but I wondered if there was any evidence for its use in this clinical situation.

Structured clinical question

In infants with bronchiolitis [patient] does caffeine [intervention] reduce or prevent apnoeas [outcome]?

Search strategy and outcome

Cochrane database of systematic reviews: No directly relevant study found, but there was one systematic review on the efficacy of methylxanthines in reducing apnoea of prematurity[1] and another systematic review on the prophylactic use of caffeine to prevent postoperative apnoea following general anaesthesia in ex-preterm infants.[2]

Medline plus (no limits): Search terms: Infants *and* bronchiolitis/respiratory syncytial virus infections/virus/infection

Table 2 Theophylline derivatives for bronchiolitis induced apnoea

Citation	Study group	Study type (level of evidence)	Outcome	Key results	Comments
Tobias (2000)	7 infants with RSV associated apnoea Gestational age 28–32 weeks Age at presentation 14–64 days	Retrospective review (level 4)	Prevention of mechanical ventilation	No infant had episodes of apnoea or bradycardia from 2 to18 hours after the initial loading dose	Initial dose of caffeine base was 10 mg/kg and if further doses are needed, given as 5 mg/kg as second dose and 2.5 mg/kg as third dose
Johnston and Kuzemko (1992)	2 infants 1. RSV positive. Gestational age 33 weeks. Post conceptional age 40 weeks 2.Echo virus type 2. Gestational age 36 weeks. Post conceptional age 37 weeks	Case report (level 4)	Prevention of mechanical ventilation	Respiration became regular with disappearance of apnoea immediately after administration of aminophylline	5 mg/kg of iv aminophylline followed by 5–7 days of oral theophylline
DeBuse and Cartwright (1979)	1 infant with RSV positive bronchiolitis. Gestational age 29 weeks. Post conceptional age 38 weeks.	Case report (level 4)	Prevention of mechanical ventilation	No apnoeic episodes occurred 9 hours after administration of theophylline	Oral theophylline. Loading dose of 10 mg/kg in aliquots, then 4 mg/kg 6 hrly ×24 hours followed by 1 mg/kg

Table 3 Theophylline derivatives and apnoea due to other causes

Citation	Study group	Study type (level of evidence)	Outcome	Key results	Comments
Henderson-Smart and Steer (2001)	192 preterm infants in 5 trials	Systematic review (level 1a)	Reduction in apnoea and use of IPPV	RRR for apnoea 0.45 (95% CI 0.31–0.60). RRR for IPPV 0.34 (95% CI 0.12–0.97)	3 studies used caffeine and 2 studies theophylline
Henderson-Smart and Steer (2001)	78 ex-preterm infants undergoing general anaesthesia for surgery. Gestational age 30–32 weeks. Post conceptual age 40–44 weeks	Systematic review (level 1a)	Reduction in the incidence of apnoea and bradycardia in the postoperative period	RRR 91% (95%CI 66 to 98). ARR 58%. No infant in either control or treatment group required intubation	Intravenous caffeine in a single dose during general anaesthesia. Dosage 5–10 mg/kg
Lim *et al* (2003)	42 term infants requiring PGE1 infusion for duct dependent congenital heart disease	RCT (level 1b)	Reduction in intubation for apnoea	6/21 required intubation in the placebo compared to 0/21 in the aminophylline group (p = 0.02)	6 mg/kg iv aminophylline followed by 2 mg/kg iv 8 hourly for 72 hours

and apnoea/apnea *and* caffeine/xanthine/methylxanthine/phosphodiesterase inhibitors/theophylline

There was one retrospective review[3] and two case reports[4 5] (in the form of letters to the editor) directly addressing the problem (table 2). There was also one randomised controlled trial on the usefulness of aminophylline in reducing apnoeas and intubation in term infants during prostaglandin E1 infusion.[6]

Searches were performed in August 2004.

Commentary

Recurrent apnoea is a common problem in otherwise well preterm infants. By term equivalent age, infants have usually ''outgrown'' their tendency to spontaneous apnoea. However, with an additional stress, such as infection (for example, bronchiolitis) or administration of drugs that depress the central nervous system (for example, general anaesthesia, prostaglandin), then apnoea and oxygen desaturations can recur.

Caffeine is recognised to reduce apnoea and the need for mechanical ventilation in preterm infants with apnoea of prematurity.[1] In addition caffeine prevents apnoea, bradycardia, and episodes of desaturation in growing preterm infants following general anaesthesia,[2] while aminophylline, which is another widely used theophylline derivative, was found to be effective for the prevention of apnoea and intubation during prostaglandin E1 infusion in term infants[6] (table 3). While these data are supportive, there may be significant differences in the mechanism of apnoea in general anaesthesia and viral induced apnoea.

We could only find three reports[3–5] involving a total of 10 infants, all of whom were born preterm and presented with bronchiolitis associated apnoeas approximately around term equivalent age. These reports have concluded that theophylline derivatives are effective in reducing the incidence of apnoeas and avoided the need for mechanical ventilation in this clinical situation (table 1).

Caffeine has a more favourable therapeutic index than aminophylline. No major adverse effects were reported from the studies included in the systematic reviews.[1 2] Jitteriness, tachycardia, and raised blood glucose are the common side effects, but routine drug level monitoring is not necessary at standard dosage.[7]

While these three reports claim that the use of caffeine helped avoid intubation in infants with viral infection induced apnoea, there are no data from randomised controlled trials confirming these benefits. As intubation for apnoea in bronchiolitis is uncommon, a large multicentre trial would be needed.

CLINICAL BOTTOM LINE

- In addition to its proven efficacy in apnoea of prematurity, caffeine has also been shown to reduce the incidence of apnoea in ex-preterm infants following general anaesthesia and in term infants following prostaglandin infusion.
- There is only limited evidence from case reports for the use of caffeine in infants presenting with bronchiolitis associated apnoeas.

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Are newer macrolides effective in eradicating carriage of pertussis?

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You are assessing a toddler who has presented with paroxysmal cough with a whoop and post-tussive vomiting. A clinical diagnosis of ''whooping cough'' is made and this is duly confirmed on pernasal swab cultures that reveal the growth of *Bordetella pertussis*.

From history, you note that he is allergic to penicillin and has been given erythromycin for a previous episode of