



*Compliments
S Vogel*

Positional upper airways narrowing and an apparent life threatening event

SL Tonkin, *Medical Officer, New Zealand Cot Death Association*; S Vogel, *Radiologist, Starship Children's Hospital*; L Bennet, *Senior Lecturer, The Liggins Institute*; AJ Gunn, *Senior Lecturer, Department of Paediatrics, University of Auckland, Auckland.*

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At Starship Children's Hospital, Auckland, 43 infants were assessed over an eighteen month period after being admitted because they had been found apparently not breathing, or cyanosed. These events were considered to have been ALTEs (Apparent Life Threatening Events). Of these 43 infants, sixteen had no history of previous respiratory problems or any other diagnosable illness. They were completely normal to physical examination including head size. Seven infants were being held by caregivers at the time of the ALTE while the other nine were in various restraining devices.

The circumstances of each episode were elicited, and scene reconstruction was carried out with the caregivers to replicate the position and attitude of each baby when found cyanosed and/or not breathing. In every case the infant's head was markedly flexed on the body and it was suspected that the upper airway could have been restricted or obstructed. The importance of preventing excessive head flexion, particularly in sleep, was explained to the caregivers and none of these infants had any further episodes.

Case history

At the age of three weeks this 3.275 kg breast fed boy was carried from his bassinet to his mother by his ten year old sister. She had one hand under his head and the other under his napkin. His mother noticed that he was very "scrunched up" and was alarmed to see that his face was dark blue and that it seemed his breathing had stopped. She grabbed him from his sister and when she "straightened him out" there was rapid return to normal colour and breathing.

When assessed in hospital he was noted to have a relatively large head with a protuberant occiput. Physical examination was normal, and an overnight polygraph (Edentec Mallinckrodt Inc., Missouri, USA) with leads to record heart rate, respiration, nasal airflow, and pulse oximetry was completely normal. Inspiratory radiographs of the upper airway were taken, timed using a modified Graseby (Graseby Dynamics Limited, Herts, UK) MR 10-apnoea monitor with the capsule of the monitor taped to the infant's lateral abdomen at the level of the umbilicus.¹ In Figure 1a, taken when the infant's head was in the neutral position, the upper airway was normally patent. The mother then gently flexed the infant's head towards the position that he had been in during the episode, with his jaw impinging on his chest. It could be seen by eye that the jaw was being displaced by pressure on the infant's own chest. His mother stated that the infant's head was actually more flexed than this during the original episode. Marked narrowing of the upper airway was evident on the second radiograph (Figure 1b) which shows the head flexed 25°. The mandible is displaced cephalically and posteriorly to push the tongue and soft palate towards the posterior pharyngeal wall, and the airway space was halved.



Figure 1a. Inspiration radiograph of the case with the head in the neutral position. This radiograph was taken with the infant lying supine. Note the normal upper airway shadow from the nares to the trachea.



Figure 1b. Inspiration radiograph of the case with his head flexed gently on his chest by his mother, showing narrowing of the upper airway. The mandible is pushed backward and upward by the pressure of the infant's own chest, so that the tongue presses the palate towards the posterior pharyngeal wall.

Discussion

The danger of airway obstruction from pressure on the jaw in newborns was first noted as early as 1976,² and some ALTEs have been related to the position in which infants were being held.¹ We have previously shown that timed

lateral neck radiographs provide a highly accurate, reproducible method of assessing upper airway dimensions in early infancy.^{1,4,5} The present case confirms that flexion of the infant's head onto its own chest can produce severe airway narrowing. It is highly likely that this narrowing was responsible for the alarming cyanosis in this infant.

The underlying factor allowing such airway narrowing is the immaturity of the temporomandibular joint in newborns, which allows much more antero-posterior movement than in adults.⁶ Also the infant upper and lower jaws can readily be approximated as there are no teeth present to hinder this. The likelihood of head flexion is greatly increased as the infant falls asleep and the neck muscles relax. It is important

that infants are not placed or held in positions which allow over-flexion of the head on the neck.

Correspondence. Dr Alistair Gunn, Department of Paediatrics, University of Auckland, Private Bag 92019, Auckland. Fax: (09) 308 2385; email: aj.gunn@auckland.ac.nz

1. Gunn TR, Tonkin SL. Upper airway measurements during inspiration and expiration in infants. *Pediatrics* 1989; 84 : 73-7.
2. Stark AR, Thach BT. Mechanisms of airway obstruction leading to apnoea in newborn infants. *J Pediatr* 1976; 89 : 982-5.
3. Byard RW, Burnell RH. Apparent life threatening events and infant holding practices. *Arch Dis Child* 1995; 73: 502-4.
4. Tonkin SL, Davis SL, Gunn TR. Upper airway radiographs in infants with upper airway insufficiency. *Arch Dis Child* 1994; 70: 523-9.
5. Gunn TR, Tonkin SL, Hadden W et al. Neonatal micrognathia is associated with small upper airways on radiograph measurements. *Acta Paediatr* 2000; 89: 82-7.
6. Tonkin SL, Gunn TR, Bennet L et al. A review of the anatomy of the upper airway in early infancy and its possible relevance to SIDS. *Early Hum Dev* 2002; 66: 107-21.