Effect of humidification on inhalation induction with isoflurane in children

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Summary
A well practised technique is important in achieving quiet induction of anaesthesia in children, but the volatile agent used also influences the process. Isoflurane results in more airway problems than halothane but recent studies have described several ways of improving the acceptability of isoflurane for inhalation induction of anaesthesia. We have studied the effect of humidification of inspired gases on respiratory complications and hypoxic episodes during induction. Forty-one children undergoing inhalation induction of anaesthesia with isoflurane and nitrous oxide in oxygen were allocated randomly to receive either humidified or non-humidified gas. Humidification did not result in a lesser incidence of problems. These findings are contrary to the results in a similar study in a predominantly adult sample which demonstrated a significantly lower incidence of complications using humidified gases. (Br. J. Anaesth. 1994; 73: 587-589)

Key words
appropriate. If a cupped hand was used a face mask was substituted when the child's eyelash reflex was absent. Induction was judged complete when the child was breathing regularly and had small central pupils.

The assessor recorded the presence of coughing, laryngospasm, sounds caused by secretions in the airway, breath-holding (apnoea greater than 15 s), restlessness requiring restraint, the lowest SpO2 value recorded using a Datex Satelite pulse oximeter and the time taken to complete induction. Data were analysed using the unpaired Student's t test, the Mann-Whitney U test and chi-square test with Yates' correction.

**Results**

The ages and weights of the children in the two groups were comparable. Restlessness was significantly more common in the humidified group (table 1). Other complications were similar in the two groups. In one patient in the humidified group, induction was abandoned because of airway obstruction caused by large tonsils. The induction sequence was prolonged in one child from each group because of laryngospasm.

**Discussion**

Irritation of the upper airway may be a serious problem during inhalation induction of anaesthesia with isoflurane. In children particularly, such irritation may activate upper airway reflexes resulting in airway complications, prolonged induction times and arterial desaturation [1, 2, 5]. Induction with halothane causes fewer respiratory problems but may be associated with other hazards, including arrhythmias, myocardial depression and rarely, halothane hepatitis. A simple, safe and clinically effective means of reducing respiratory complications associated with isoflurane induction would therefore be valuable in paediatric anaesthetic practice.

van Heerden and colleagues [4] achieved an eight-fold reduction in the incidence of complications during inhalation induction with isoflurane using humidified rather than dry anaesthetic gases. In their study, carried out largely in adults, the frequency of "complicated" inductions also decreased with humidified isoflurane (from 45 % to 9 % of patients). Our study was designed to determine if humidification would produce a similar decrease in complications in children. The design anticipated an incidence of upper airway complications of 40–50 % in the control group [1, 6] and 10 % in the humidified group. The number of patients in the groups provided a power of 90 % to detect a difference of this size when the probability level for rejecting the null hypothesis was 5 %.

The results failed to show any clinically significant difference between the two groups and clearly do not support our hypothesis that humidification reduces upper respiratory tract irritation and airway complications. The data also do not suggest that humidification had a beneficial effect which might become apparent if a larger group were studied.

In keeping with common paediatric anaesthetic practice, we used an Ayre's T-piece rather than the Magill breathing system used by van Heerden and colleagues [4]. It could be argued that this may have altered the temperature and humidity of the gases and that the studies are therefore not strictly comparable. The narrow bore fresh gas delivery tube of the T-piece has a lower thermal mass and a smaller surface area for heat loss than the large corrugated tubing of the Magill attachment and should cause less cooling of gases. We believe therefore that the use of the T-piece is unlikely to have reduced the temperature or humidity of the gases delivered to the patient and that the studies are comparable in this respect.

As with other aspects of paediatric anaesthesia, the lack of effect of humidification may represent a real difference between children and adults. It is also possible that because most of the children studied were undergoing ENT procedures, a proportion of the complications we observed was related to physical causes which may not have responded to humidification. Other factors could contribute to the different findings. Our overall incidence of individual complications was approximately 25 % rather than the 50 % found in other studies of isoflurane induction of unpremedicated children [1, 6]. We also noted a relatively low incidence of arterial desaturation; only 17 % of our children had saturations less than 95 % compared with other studies where saturations decreased to less than this value in approximately 50 % of children [3, 6]. This may reflect the beneficial effect of trimethazino pre-medication [3].

Irrespective of the explanation, our findings provide no suggestion for using humidification as a means of reducing complications associated with inhalation induction with isoflurane in children.

**References**


