Dose of propofol for laryngeal mask airway insertion in children: effect of premedication with midazolam

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Summary
We determined the dose–response curves and effective doses of propofol for insertion of the laryngeal mask airway (LMA) in 50 unpremedicated children and in 60 children premedicated with midazolam, aged 3–12 yr. One of several doses of propofol was administered i.v. over 15 s to groups of 10 children, and conditions for LMA insertion were assessed at 60 s. The dose–response curves were parallel ($P = 0.94$), but the curve for premedicated children was shifted significantly to the left of that for unpremedicated children and propofol requirements were reduced by one-third ($P < 0.0001$). The doses required for satisfactory LMA insertion in 50% and 90% of unpremedicated patients ($ED_{50}$, $ED_{90}$) (95% confidence interval) were 3.8 (3.4–4.2) mg kg$^{-1}$ and 5.4 (4.7–6.8) mg kg$^{-1}$, respectively; those for premedicated patients were 2.6 (2.2–2.8) mg kg$^{-1}$ and 3.6 (3.2–4.3) mg kg$^{-1}$, respectively. (Br. J. Anaesth. 1996; 76: 308–309)

Key words

Insertion of the laryngeal mask airway (LMA) soon after induction of anaesthesia is facilitated by the use of propofol, which depresses pharyngeal and laryngeal reflexes. The results of a previous study in children suggested that the dose of propofol required for insertion of the LMA may be greater than that for acceptance of a face mask [1]; however, there have been no formal studies to determine dose–response curves or effective doses. Oral midazolam is an effective sedative premedicant in children [2], which is synergistic with propofol [3] and may reduce the dose required for LMA insertion. Accordingly, the aims of this study were to determine the dose–response curves and effective doses of propofol for LMA insertion in unpremedicated and midazolam-premedicated children.

Methods and results
The study was approved by the Local Ethics Committee and written consent was obtained from the parents. We studied 110 children, ASA I or II, aged 3–12 yr and undergoing general anaesthesia for minor surgical procedures. Children with body weights outside the third to 97th centiles, and those with neuromuscular disease, anatomical abnormalities of the airway or asthma were excluded. Subjects were allocated randomly to one of two main groups to receive either no premedication ($n = 50$) or premedication with oral midazolam 0.5 mg kg$^{-1}$, 30–60 min before anaesthesia ($n = 60$).

Before induction of anaesthesia, a pulse oximeter and ECG monitor were attached and children were allocated randomly to subgroups of 10, to receive one of several predetermined doses of propofol: five groups of unpremedicated patients received 3.0, 3.4, 3.9, 4.4 or 5.0 mg kg$^{-1}$, while six groups of premedicated patients received 2.2, 2.6, 3.0, 3.4, 3.9 or 4.4 mg kg$^{-1}$. To reduce pain on injection, lignocaine 10 mg was added to each 100 mg of propofol. Propofol was administered over 15 s via an i.v. cannula sited on the back of one hand, following which the lungs were ventilated with 100% oxygen for 60 s before attempting insertion of the LMA as described in the manufacturer’s instructions [4]. Conditions for LMA insertion were assessed by an anaesthetist who was unaware of the dose of propofol and the type of premedication given. Conditions were considered satisfactory if the jaw was relaxed, there was no coughing, gaging, swallowing or laryngeal spasm, and minimal or no limb movement. If conditions were considered to be unsatisfactory, anaesthesia was deepened with further increments of propofol, or an inhalation agent, or both, until the LMA was tolerated. Oscillometric arterial pressure measurement was commenced after insertion of the LMA and continued at 3-min intervals throughout surgery.

Dose–response data were analysed by probit analysis. Maximum likelihood estimates of model variables were found using a Fortran program written by one of the authors (R.D.B.); numerical algorithms group (NAG) routines were used for functional minimization. The slopes and intercepts
of the dose–response lines for unpremedicated and premedicated patients were compared using analysis of deviance, and 95% confidence intervals on ED values were found using the profile likelihood function [5]. Statistical differences in patient data were assessed by one-way ANOVA.

There were no significant differences in mean ages and weights of the children in the various propofol dose groups, or in the times from administration of midazolam to induction of anaesthesia in the groups of premedicated children. Log dose–probit response curves for unpremedicated and midazolam-premedicated children are shown in figure 1. The equations of the lines were probit = 3.8 log dose – 0.09 and probit = 3.8 log dose – 3.7, respectively. The slopes of the lines did not differ significantly (P = 0.94), but the curve for premedicated children was significantly to the left of that for unpremedicated children (P < 0.0001).

The effective doses of propofol for LMA insertion in 50% and 90% of unpremedicated children (ED_{50}, ED_{90}) (95% confidence intervals) were 3.8 (3.4–4.2) mg kg^{-1} and 5.4 (4.7–6.8) mg kg^{-1}, respectively; those for premedicated children were 2.6 (2.2–2.8) mg kg^{-1} and 3.6 (3.2–4.3) mg kg^{-1}, respectively. The differences in effective doses between unpremedicated and midazolam-premedicated children were highly significant (P < 0.001).

Comment

The results of the present study confirm that induction of anaesthesia with propofol allowed early insertion of the LMA in paediatric practice. The effective dose of propofol for insertion of the LMA in 90% of unpremedicated children exceeded 5 mg kg^{-1}, but this was reduced to less than 4 mg kg^{-1} after premedication with midazolam. Our results support the suggestion that the dose of propofol required for insertion of the LMA is greater than that required for acceptance of a face mask in children [1] and may be proportionally greater than that required for LMA insertion in adults [6, 7]. Increased induction requirements for propofol in children may be explained by a larger central volume of distribution of the drug [8, 9] and a greater cardiac output per kilogram body weight, which should result in a lower peak concentration of propofol in the blood perfusing the brain after bolus injection.

The ED_{90} propofol dose of more than 5.0 mg kg^{-1} in unpremedicated children exceeds previous recommendations for induction of anaesthesia. As propofol is known to produce cardiorespiratory depression in children at doses considerably less than this [10], hypotension or prolonged apnoea may be a problem. However, during the study we did not observe any differences in the incidence of cardiorespiratory side effects between the low and high dose propofol groups.

References