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SHORT COMMUNICATIONS

Propofol 1% *versus* propofol 2% in children undergoing minor ENT surgery

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Background. The induction characteristics of propofol 1% and 2% were compared in children undergoing ENT surgery, in a prospective, randomized, double-blind study.

Methods. One hundred and eight children received propofol 1% (n=55) or 2% (n=53) for induction and maintenance of anaesthesia. For induction, propofol 4 mg kg^{-1} was injected at a constant rate (1200 ml h^{-1}), supplemented with alfentanil. Intubating conditions without the use of a neuromuscular blocking agent were scored.

Results. Pain on injection occurred in 9% and 21% of patients after propofol 1% and 2%, respectively (P=0.09). Loss of consciousness was more rapid with propofol 2% compared with propofol 1% (47 s *vs* 54 s; P=0.02). Spontaneous movements during induction occurred in 22% and 34% (P=0.18), and intubating conditions were satisfactory in 87% and 96% (P=0.19) of children receiving propofol 1% or 2%, respectively. There were no differences between the two groups in respect of haemodynamic changes or adverse events.

Conclusions. For the end-points tested, propofol 1% and propofol 2% are similar for induction of anaesthesia in children undergoing minor ENT surgery.

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Rapid onset, good haemodynamic tolerance, and a short duration of action are well-established advantages of propofol 1% in children over 3 yr of age. However, pain on injection[1] and spontaneous movements during induction[2] remain of particular concern in children. Propofol 2% has recently been introduced into clinical practice, but no controlled clinical trial has been conducted comparing these two propofol concentrations in children. A potential advantage of propofol 2% could be a faster induction, and thus less pain on injection and a decreased incidence of involuntary movements. The aim of this randomized study was to compare the induction characteristics of propofol 1% and 2% in a paediatric population undergoing short ENT procedures.

Methods and results

After approval by our institutional ethics committee, written informed consent was obtained from the parents of 130 children aged 3–12 yr scheduled for elective adenoidectomy and/or adenotonsillectomy. Midazolam 0.5 mg kg^{-1} was given orally as premedication and EMLA™ cream was applied to both hands. Children were randomly assigned to receive either propofol 1% or 2% using the computer software Statmate™ (version 1.01 GraphPad Software Inc., San Diego, USA).

Propofol was given on a mg kg^{-1} h^{-1} basis by an infusion pump (Medfusion® 2010i, USA) in an absolutely blinded manner, so that the anaesthetist was not aware of the propofol concentration.

After 3 min preoxygenation, alfentanil 20 μg kg^{-1} was administered i.v. Before the propofol, lidocaine 0.5%, 1 ml was injected i.v. without a tourniquet. An i.v. bolus of propofol 4 mg kg^{-1} was then administered by the Medfusion® pump at a constant rate of 1200 ml h^{-1}. Tracheal intubation was performed 1 min after the end of the bolus, without the use of any neuromuscular blocking agent. Anaesthesia was maintained by propofol given at a preprogrammed infusion rate of 12 mg kg^{-1} h^{-1}, reduced to 9 mg kg^{-1} h^{-1} during surgery, and to 6 mg kg^{-1} h^{-1} when awaiting haemostasis. The children's lungs were ventilated with 60% nitrous oxide/oxygen throughout the procedure.

Pain on injection was considered present when the child complained about it or when they withdrew their hand during the injection. Abnormal movements were defined as purposeless movements of any part of the body during or immediately after the injection of propofol.[2] The anaesthesia induction sequence was video recorded for subsequent analysis by one of the authors who was not involved in the administration of the anaesthetic (AB). Unconsciousness was defined as the absence of a reaction to verbal stimulation (OAAS score <2). The quality of intubation was evaluated according to a validated and widely used score[3 4] (1=excellent, 2=good, 3=unsatisfactory, 4=bad). Side-effects and time of recovery (from the end of propofol infusion to extubation) were recorded.

The two sets of data were analysed using the χ^2-test and relative risks with 95% confidence intervals. An unpaired *t*-test with $P<0.05$ or a 95% confidence interval excluding 1 was considered significant.

Nine children in the propofol 1% group and eight children in the propofol 2% group were excluded because of agitation, failure to obtain venous access or technical problems. Five children had laryngospasm after the injection of propofol (Table 1). These patients were intubated with succinylcholine and removed from further study.

One hundred and eight children were analysed (propofol 1%, $n=55$; propofol 2%, $n=53$). The physical characteristics of the children and duration of surgery were comparable between the two groups.

There were no significant differences between the two groups for all primary end-points except that loss of consciousness was more rapid with propofol 2% compared with the 1% emulsion (47 s *vs* 54 s respectively; $P=0.02$).

Comment

The results of this study show that propofol 1% and 2% had comparable induction characteristics except for time to loss of consciousness (Table 1). This finding is explained by the equivalent bolus rate (1200 ml h^{-1}) used to infuse either propofol 1% or 2%. Thus, infusing propofol 2% led to administration of the induction dose in a shorter time, and to a higher propofol concentration gradient between plasma and the effect site. This may have facilitated the passage of propofol into the effect compartment, thereby shortening the exit rate constant from the central compartment.

A potential advantage of propofol 2% might have been a lower incidence of pain on injection, but this was not detected in this study (Table 1). However, the present study has shown a lower incidence of pain than that previously reported.[1] A larger number of children would need to have been studied to demonstrate any significant difference between propofol 1% and 2% in this respect. This lower incidence of propofol-related pain may be attributable in part to the administration of alfentanil before lidocaine and propofol. It has been shown that opioids decrease propofol-related pain. Furthermore, although it has been questioned,[6] the speed of injection may have influenced the results in the present study[5] as propofol was injected at a constant, albeit much slower, rate than that used clinically for administration from a syringe. In order to compare the concentration effects rather than the speed of injection, propofol was administered during maintenance of anaesthesia at a comparable rate in both groups in terms of mg kg^{-1} h^{-1}. Finally, the incidence of spontaneous movements following injection of either propofol 1% or 2% was similar to that described in the literature.[2] Although it has been suggested that these movements are of a subcortical rather than a cortical nature,[2] their cause remains unclear.

In conclusion, the present study shows that induction of anaesthesia in children with propofol 1% or 2% provided comparable clinical conditions. The difference observed in the time to loss of consciousness was probably related to the

Table 1 Side-effects and anaesthetic conditions on administration of propofol 1% and 2% in children. Data are percentages (number) unless stated otherwise

		Propofol 1% ($n=55$)	Propofol 2% ($n=53$)	*P*-value	Relative risk (95% confidence interval)
Pain on injection		9.1 (5)	20.8 (11)	0.09	0.58 (0.27–1.23)
Movement		21.8 (12)	33.9 (18)	0.18	0.73 (0.45–1.19)
Good intubation		87.3 (48)	96.2 (51)	0.19	0.69 (0.44–1.09)
Time to loss of consciousness (s)	mean (SD)	54 (2.0)	47 (2.2)	0.02	
Laryngospasm		1.8 (1/56)	7.0 (4/57)	0.36	0.40 (0.07–2.35)
Coughing		3.6 (2/55)	11.3 (6/53)	0.13	0.48 (0.14–1.60)
Erythema		5.4 (3/55)	15.1 (8/53)	0.10	0.51 (0.08–1.30)

higher concentration of propofol 2% used in one group as a single bolus for induction of anaesthesia.

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