I. V. ANAESTHESIA WITH PROPOFOL USING A TARGET-CONTROLLED INFUSION SYSTEM: COMPARISON WITH INHALATION ANAESTHESIA FOR GENERAL SURGICAL PROCEDURES IN CHILDREN

E. DOYLE, W. McFADZEAN AND N. S. MORTON

SUMMARY

We studied 40 children undergoing general surgical procedures. They were allocated randomly to receive induction of anaesthesia with propofol 3-5 mg kg\(^{-1}\) followed by maintenance with halothane and an appropriate regional block, or induction and maintenance of anaesthesia with a computerized, target-controlled infusion of propofol with a regional block. All patients breathed a mixture of 67% nitrous oxide in oxygen via a laryngeal mask airway. Both techniques provided adequate anaesthesia and operating conditions. There were no significant differences between the groups in heart rate, mean arterial pressure and end-expired carbon dioxide concentration during anaesthesia. There was no significant difference in the recovery times of the two groups. (Br. J. Anaesth. 1993; 70: 542-545)

KEY WORDS


Propofol is associated with prompt, rapid recovery from anaesthesia when used as an induction agent in adults [1]. Compared with induction of anaesthesia with thiopentone, propofol produces earlier return of clinical indices of recovery, protective reflexes and psychomotor function [2, 3], but these differences are not observed if anaesthesia is maintained for more than 30 min using halothane [4].

In paediatric practice, it has been shown that children undergoing day-case surgical procedures under general anaesthesia with isoflurane, with or without regional block, recover more quickly if their anaesthesia is induced with propofol than with thiopentone [5, 6]. Other paediatric studies have compared propofol for both induction and maintenance of anaesthesia with thiopentone induction and maintenance with a volatile agent [7, 8]. These studies in dental and E.N.T. surgery found that propofol compared well with inhalation anaesthesia and produced significantly quicker recovery from anaesthesia. In a day-case study [8] there was a shorter time to discharge in the propofol group.

A standard technique for many brief general surgical procedures in children is to combine a general anaesthetic with an appropriate regional block to provide perioperative analgesia. This study was designed to compare a technique of induction and maintenance of anaesthesia using a propofol infusion combined with regional block, and a technique of induction with propofol followed by maintenance using halothane combined with a regional block.

PATIENTS AND METHODS

The study was approved by the local Ethics Committee and informed written parental consent was obtained. We studied 40 children of ASA grades I and II undergoing general surgical procedures expected to last less than 1 h. Exclusion criteria included age less than 1 yr, weight less than 10 kg, allergy to eggs and a surgical procedure for which an appropriate regional block could not be performed.

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<th>Patient data and details of operations in groups H (halothane maintenance) and P (propofol maintenance) (number or mean (range))</th>
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<td>Sex (M/F)</td>
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*Present address: Military Hospital, Aldershot, Hants GU11 2AN.

Correspondence to E.D.
PROPOFOL INFUSION TO MAINTAIN ANAESTHESIA IN CHILDREN

Premedication comprised EMLA cream (lignocaine 25 mg g\(^{-1}\) and prilocaine 25 mg g\(^{-1}\)) applied to the backs of both hands at least 1 h before induction. In the anaesthetic room, pre-induction measurements of heart rate, arterial pressure and arterial oxygen saturation were obtained using a Dinamap non-invasive arterial pressure monitor with an appropriate size of cuff and a Nellcor pulse oximeter. A suitable vein was cannulated with a 22- or 24-gauge cannula.

Patients were allocated randomly (by computer-generated list) to two groups of 20 patients each. Group H (halothane maintenance) received an induction dose of propofol 3-5 mg kg\(^{-1}\) (with lignocaine 0.2 mg kg\(^{-1}\)) followed by maintenance of anaesthesia with 67% nitrous oxide and 0.5-2.0% halothane in oxygen as necessary to maintain an adequate depth of anaesthesia. In group P (propofol maintenance), anaesthesia was induced and maintained with an infusion of propofol delivered by an Ohmeda 9000 infusion pump driven by a Psion II computer containing a program designed to achieve and maintain preselected blood concentrations of propofol. The initial blood targets chosen were in the range 8-14 μg ml\(^{-1}\) and these were reduced subsequently to maintain an adequate depth of anaesthesia. These patients breathed a mixture of 67% nitrous oxide in oxygen. Episodes of apnoea, cough, hiccup and involuntary movements which occurred during induction were noted.

In all patients, a laryngeal mask airway of appropriate size was used to maintain the airway during anaesthesia. An appropriate regional block was performed after induction of anaesthesia and before the start of surgery.

In both groups, measurements of heart rate, arterial pressure and arterial oxygen saturation were taken at 1, 2, 3, 4, 5, 10 and 15 min after induction and at further 5-min intervals until the end of surgery. End-expired carbon dioxide concentration was measured using a Datex Capnomac Ultima when the patient had been moved into theatre and was recorded at 5-min intervals until the end of surgery. Anaesthetic agents were discontinued at the start of skin closure. At the end of surgery, patients were transferred to the recovery area breathing 100% oxygen via the laryngeal mask airway, which was removed after return of the gag reflex. The time of spontaneous eye opening was noted in the recovery area.

Before the patient was discharged to the surgical ward, the level of comfort and analgesia were assessed clinically.

Data were analysed statistically using Student's \(t\) test for normally distributed data and the Wilcoxon two-sample rank sum distribution for non-parametric data.

RESULTS

The two groups were similar in age, weight and operative details (table I). The mean dose of propofol required to induce anaesthesia in group H was 3.9 mg kg\(^{-1}\) (range 3.0-5.1 mg kg\(^{-1}\)). In group P the mean induction bolus of propofol was 3.9 mg kg\(^{-1}\) (range 2.8-5.1 mg kg\(^{-1}\)) and infusion rates of propofol for maintenance of anaesthesia ranged from 18.3 mg kg\(^{-1}\) h\(^{-1}\) to 36.2 mg kg\(^{-1}\) h\(^{-1}\) (mean 25.6 (sd 4.8) mg kg\(^{-1}\) h\(^{-1}\)). Two patients (10%) in group H and four (20%) in group P experienced pain or discomfort during induction of anaesthesia with propofol. Six (30%) of patients in group H and five (25%) in group P were apnoeic for 15-60 s after induction of anaesthesia. Involuntary movements occurred for a few seconds after induction of anaesthesia in five (25%) patients in group H and three (15%) patients in group P.

All patients were judged to be anaesthetized adequately and operating conditions were good in all cases. The mean heart rates in group P tended to be slightly faster than those in group H and the difference was just significant at the 5% level on three occasions (5, 10 and 15 min) (fig. 1).

There was no significant difference in arterial pressure between the two groups at any time (fig. 2), and no significant difference in mean end-expired carbon dioxide concentration between them except at 15 min (fig. 3).

There was no significant difference between the groups in the time taken to spontaneous eye opening after discontinuation of the maintenance anaesthetic (10.5 min (range 3-32 min) in group H; 13.5 min (range 4-36 min) in group P). The calculated blood concentration of propofol at which patients in group P awoke was in the range 0.3-2.6 μg ml\(^{-1}\) (mean 1.4 μg ml\(^{-1}\)).
normal practice in day-case surgery during the study were a reflection of the normal practice of different consultant anaesthetists in performing regional blocks in groups H and P.

We found that the two groups were similar in all respects. Induction of anaesthesia was satisfactory in both groups, with a low incidence of minor side effects. Maintenance of anaesthesia was straightforward in both groups and operating conditions satisfactory.

Spontaneous eye opening has been shown [8] to be a sensitive indicator of recovery from general anaesthesia in children; there was no significant difference between the groups in the time from discontinuation of anaesthesia to spontaneous eye opening. This finding contrasts with a study of maintenance of anaesthesia by halothane or propofol in paediatric dental outpatients [8] in which significantly earlier recovery occurred in the propofol group. In that study, the mean duration of anaesthesia was 8.1 min in the thiopentone group and 6.3 min in the propofol group, compared with 30.6 min in group H and 33.3 min in group P in our study. The cumulative effects of anaesthetic agents during longer procedures may abolish the differences observed after short procedures [4]. The use of a regional block in our patients may also have reduced any tendency to quick recovery by reducing or eliminating postoperative pain.

Borgeat and colleagues [7] compared a thiopentone–halothane technique with a propofol induction and maintenance technique for E.N.T. procedures. Their patients were paralysed and no regional block was performed. The mean durations of surgery were 35 min (thiopentone–halothane) and 37 min (propofol) and there were significantly quicker times to tracheal extubation in the propofol group.

The lack of any significant cardiovascular or respiratory differences between the groups in our study is in agreement with that of Borgeat and colleagues [7]. This indicates that maintenance of anaesthesia by means of a target-controlled infusion of propofol in children breathing spontaneously without an opioid is not unduly depressant to the cardiovascular or respiratory systems.

REFERENCES


