COMPARISON OF RECOVERY FROM ANAESTHESIA INDUCED IN CHILDREN WITH EITHER PROPOFOL OR THIOPENTONE

C. J. RUNCIE, S. J. MACKENZIE, D. S. ARTHUR AND N. S. MORTON

SUMMARY
We studied 102 children undergoing day-case surgery, allocated randomly to receive either thiopentone 5 mg kg\(^{-1}\) or propofol 3 mg kg\(^{-1}\) i.v. at induction of anaesthesia. They then inhaled nitrous oxide and halothane in oxygen until a laryngeal mask airway could be inserted. Thereafter, halothane was substituted by isoflurane and analgesia provided by regional nerve block. Recovery from anaesthesia was assessed by the time taken to reach clinically-defined criteria and by calculation of sedation, pain and vomiting scores. In children aged less than 5 yr, only the time to spontaneous eye opening was shorter after propofol induction (P < 0.05). In children aged 5—11 yr, times of spontaneous eye opening, giving name and discharge were shorter after propofol induction (P < 0.05). These results indicate that propofol hastened early recovery in children undergoing day-case surgery, but earlier discharge occurred only in older children.

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KEY WORDS

Propofol has been used since 1984 in adult anaesthesia and has been shown to produce more rapid recovery than thiopentone. It has therefore become popular for day-case anaesthesia. Formal studies of recovery in adults have shown earlier return of clinical criteria of recovery, protective reflexes and psychomotor function after propofol induction [1]. If anaesthesia is maintained with halothane for more than 30 min, however, indices of recovery are similar whichever induction agent is used [2].

In children, early recovery is also more rapid after induction of anaesthesia with propofol than after thiopentone [3]. Recent studies have compared propofol for both induction and maintenance of anaesthesia with thiopentone induction and maintenance by volatile agent [4, 5]. Thus it is not known if induction of anaesthesia with propofol followed by inhalation maintenance in children enhances all aspects of recovery, allowing earlier discharge after day-case surgery. The aim of this study was to compare recovery after propofol and thiopentone induction in children having short general surgical procedures as day-cases with anaesthesia maintained by isoflurane and analgesia provided by local anaesthetic nerve block.

PATIENTS AND METHODS
The study was undertaken in the day-case unit of a regional paediatric hospital. We studied 102 patients, ASA grades I or II, anaesthetized for short general surgical procedures by two of the authors (D.S.A. and C.J.R. or D.S.A. and S.J.M.) after approval from the Hospital Ethics Committee and written informed parental consent. Children having procedures completed in the anaesthetic room (examination under anaesthesia or release of tongue-tie) were excluded. Patients were studied in two age groups: less than 5 yr and 5—11 yr inclusive.

Premedication comprised EMLA emulsion cream (lignocaine 25 mg g\(^{-1}\) and prilocaine 25 mg g\(^{-1}\)) applied to the dorsa of both hands at least 1 h before induction. Within each age group, patients were allocated randomly (by computer-generated random numbers) to receive either thiopentone 5 mg kg\(^{-1}\) or propofol 3 mg kg\(^{-1}\) i.v. Increments were given as required to allow the child to tolerate the face mask. Lignocaine 0.3 mg kg\(^{-1}\) was added to the propofol to reduce injection pain. All children then inhaled 67% nitrous oxide and an increasing concentration of halothane in oxygen via a Rees T-piece or Bain attachment. A laryngeal mask airway was inserted and an appropriate regional nerve block performed.

After transfer to theatre, all patients received 66% nitrous oxide and 1—1.5% isoflurane in oxygen for maintenance of anaesthesia. Isoflurane was discontinued as the dressings were applied and the laryngeal mask removed; patients were then given 100% oxygen and transferred to the recovery area in the lateral position with the operative site uppermost. Children remained in the recovery area until they could open the eyes spontaneously and they then returned to the adjacent recovery ward.

The following times were recorded by the anaesthetists: start of induction; start of surgery; iso-
flurane discontinued. Thereafter, patients were assessed by the recovery staff, unaware of the induction agent used, who recorded the following times: spontaneous eye opening; giving own name when asked; oral fluid intake; first analgesia; discharge. In addition, they assessed sedation, pain and vomiting by simple four-point scores at 0, 5, 15, 30, 60 and 90 min. Sedation was scored as eyes open spontaneously (1), to speech (2), to shake (3) and unrousable (4). Pain was scored as none (0), mild (1), moderate (2) and severe (3) and vomiting as none (0), nausea only (1), one vomit (2) and more than one vomit (3). For each child, an overall sedation score was calculated as the sum of the six scores obtained during the recovery period. Pain and vomiting scores were calculated similarly. Children were discharged when they were awake and alert, tolerating solids and mobilizing and communicating appropriately for their age.

Data were analysed statistically by the Mann–Whitney test (Minitab statistical software, Pennsylvania, U.S.A.). P < 0.05 was taken as significant.

RESULTS

For both age-groups, patient characteristics and operative details were comparable for the two induction agents (table I). The sole exception, in the older children, was that patients receiving propofol were significantly younger than patients receiving thiopentone, although their median weights were not significantly different. One patient in each age group suffered transient hypoxaemia (SpO₂ < 90%) during induction as a result of laryngospasm or breath-holding; each induction agent was involved in one incident.

Recovery times are detailed in table II. In the younger age group, early recovery (as indicated by

### Table I. Patient characteristics (median (interquartile range)) and operative details

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Weight (kg)</th>
<th>Sex (M:F)</th>
<th>Operations</th>
<th>Regional blocks</th>
<th>Anaesthesia</th>
<th>Surgery time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiopentone</td>
<td>Propofol</td>
<td></td>
<td>Silent block</td>
<td>Caudal block</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 29)</td>
<td>(n = 27)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Table II. Recovery times (median (interquartile range)) and 95% confidence intervals for the differences between groups

<table>
<thead>
<tr>
<th>Age &lt; 5 yr</th>
<th>Thiopentone</th>
<th>Propofol</th>
<th>95% confidence interval</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isoflurane off to eyes open (min)</td>
<td>21 (15–26)</td>
<td>17 (13–19)</td>
<td>1, 9</td>
<td>0.024</td>
</tr>
<tr>
<td>Eyes open to oral intake (min)</td>
<td>15 (3–38)</td>
<td>5 (4–8)</td>
<td>-1, 25</td>
<td>0.11</td>
</tr>
<tr>
<td>Eyes open to first analgesia (min)</td>
<td>40 (24–52)</td>
<td>33 (28–68)</td>
<td>-12, 20</td>
<td>0.9</td>
</tr>
<tr>
<td>Eyes open to discharge (min)</td>
<td>95 (77–125)</td>
<td>88 (74–111)</td>
<td>-7, 24</td>
<td>0.35</td>
</tr>
<tr>
<td>Age 5–11 yr</td>
<td>Thiopentone</td>
<td>Propofol</td>
<td>95% confidence interval</td>
<td>P</td>
</tr>
<tr>
<td>Isoflurane off to eyes open (min)</td>
<td>30 (22–35)</td>
<td>20 (14–22)</td>
<td>4, 15</td>
<td>0.003</td>
</tr>
<tr>
<td>Eyes open to oral intake (min)</td>
<td>16 (10–26)</td>
<td>16 (10–26)</td>
<td>-3, 29</td>
<td>0.18</td>
</tr>
<tr>
<td>Eyes open to first analgesia (min)</td>
<td>49 (38–70)</td>
<td>39 (28–63)</td>
<td>-8, 27</td>
<td>0.2</td>
</tr>
<tr>
<td>Eyes open to discharge (min)</td>
<td>117 (88–158)</td>
<td>86 (70–105)</td>
<td>10, 50</td>
<td>0.004</td>
</tr>
</tbody>
</table>
the time from discontinuation of isoflurane to spontaneous eye opening) was more rapid after propofol. Other indices of recovery did not differ significantly between the two groups. In the older age group, times to spontaneous eye opening, giving name and discharge were shorter after propofol induction. Times to first oral intake and first analgesia did not differ significantly between groups, but there was a trend in favour of propofol.

In the younger children, postoperative pain scores were significantly greater after propofol (table III).

### DISCUSSION

More rapid recovery after induction with propofol than after thiopentone has been well documented in adult outpatient anaesthesia, but not in children. This study was prompted by the authors’ clinical impression that the benefits of propofol were less obvious in children and concern that its greater cost was therefore difficult to justify. Our aim was thus to compare propofol with the standard agent, thiopentone, as part of an anaesthetic technique in common use in this unit.

Possible weaknesses in our methodology include the sequential use of both halothane and isoflurane, the inclusion of children younger than 3 yr and significantly greater pain scores after operation in the young children after induction of anaesthesia with propofol. The literature on the recovery characteristics of halothane and isoflurane in children is complicated by induction with inhalation in most studies [6, 7]. In adults, however, spontaneous ventilation of halothane for 30 min after i.v. induction [2] abolished the improvement in recovery seen with propofol. We therefore hoped to avoid both this confounding factor and the airway irritability and desaturation during isoflurane induction [8] by administering halothane until surgical ventilation of halothane for 30 min after i.v. induction [2] abolished the improvement in recovery seen with propofol. We therefore hoped to avoid both this confounding factor and the airway irritability and desaturation during isoflurane induction [8] by administering halothane until surgical ventilation was reached and then changing to isoflurane [9].

Children younger than 3 yr were included as it was the authors’ initial impression that the younger the child, the smaller were the differences between propofol and thiopentone. The safety of propofol in this age group has been well documented [10], as has this hospital’s clinical experience [11-13]. As Puttick and Rosen have shown that recovery times are more sensitive than the Steward scoring system [4], we used only the former in this study.

The importance of the difference in pain scores between the two groups in younger children is unclear. An explanation for this difference may be that inguinal hernia and hydrocele operations were more common in the group receiving propofol. Children undergoing these procedures often require oral analgesia with paracetamol after operation for peritoneal pain, despite successful regional nerve block. The presence of pain is a possible explanation for the more rapid early recovery in younger children after propofol.

In children younger than 5 yr, only the time to spontaneous eye opening was shorter after propofol than after thiopentone induction. A trend in favour of propofol for other recovery times did not reach statistical significance. In children aged 5–11 yr, times of spontaneous eye opening, giving name and discharge were shorter after propofol. These results are in broad agreement with those of other studies. The degree to which our results can be generalized to paediatric outpatient anaesthesia for other procedures or using other techniques is not clear. Nevertheless, they do suggest that selective use of propofol in older children may allow increased throughput in paediatric day-case units, while moderating increases in cost.

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