Comparison of two standard techniques of general anaesthesia for day-case cataract surgery

A. Moffat and P. M. Cullen

Summary

We have assessed general anaesthesia for day-case cataract surgery in 40 patients more than 60 yr of age. The patients were allocated randomly to receive either an infusion of propofol or etomidate–vecuronium–isoflurane anaesthesia. Patients in the propofol group experienced significant reductions in mean arterial pressure (42%) during anaesthesia. In the etomidate–vecuronium–isoflurane group there was a significant increase in both mean arterial pressure (19%) and heart rate (21%) with intubation. During maintenance of anaesthesia in this group, mean arterial pressure and heart rate decreased to 88% and 80% of awake values. Both techniques produced similar reductions in intraocular pressure. Recovery times from cessation of anaesthesia to spontaneous eye opening and ability to give correct date of birth were significantly shorter in the etomidate-isoflurane group. Two hours after surgery there were no significant differences between the groups and cognitive mental function tests were similar to preoperative values. All patients were deemed fit for discharge home 2 h after surgery. We conclude that it is feasible to provide general anaesthesia for day-case cataract surgery. Etomidate–vecuronium–isoflurane anaesthesia appeared to be superior to propofol in this age group as it was associated with less hypotension and a more rapid recovery. (Br. J. Anaesth. 1995; 74: 145–148)

Key words


In the USA more than 80% of cataract surgery is performed on a day-case basis under local anaesthesia; the impetus has come from the insurance companies because it is cheaper than inpatient surgery [1].

In the UK the majority of cataract operations are performed under general anaesthesia on an inpatient basis [2]. The main disadvantages of this practice are longer waiting lists and increased costs. It is estimated that between 20% and 40% of cataract patients in the UK are acceptable for day-case surgery [3]. While local anaesthesia is suitable for this type of operation, patients or surgeons may still request general anaesthesia. These attitudes are unlikely to change in the short term, therefore the use of day-case cataract surgery would increase if safe general anaesthesia was readily available.

The ideal general anaesthetic technique for day surgery should provide safe and adequate operating conditions with minimal complications, particularly nausea and vomiting, and swift recovery of psychomotor function. Propofol has become the drug of choice in many day-case units because of its smooth and rapid recovery characteristics and low incidence of nausea and vomiting [4].

The aim of this study was to determine the feasibility of general anaesthesia for day-case cataract surgery using either an infusion of propofol or etomidate–vecuronium–isoflurane anaesthesia.

Patients and methods

The study was approved by the hospital Ethics Committee and informed consent was obtained from 40 patients, ASA I–III, aged more than 60 yr, undergoing cataract extraction and lens implantation under general anaesthesia (table 1). Two weeks before surgery patients attended a preoperative assessment clinic where routine blood tests, ECG, chest x-ray and a medical examination were performed. Each patient also received a detailed medical questionnaire to be completed and submitted on the day of hospital admission.

Patients arrived in hospital the afternoon before surgery and were assessed by the anaesthetist with regard to fitness and willingness to take part in the study. Cognitive mental function was assessed using the mini-mental state test (MMS) [5]. MMS is a valuable and reliable screening test of cognitive function. It concentrates on the cognitive aspect of mental function and excludes questions concerning mood, abnormal mental experience, and the form of thinking.

Premedication comprised metoclopramide 10 mg 1 h before operation. Sedative drugs were avoided. On arrival in the induction room patients were allocated randomly to receive either infusion an-
aesthesia with propofol (group 1) or etomidate-
vecuronium–isoflurane anaesthesia (group 2). Before
induction, topical anaesthesia (1 % amethocaine) was
applied to the non-operative eye and intraocular
pressure (IOP) measured using a Perkins tonometer.

Routine monitoring equipment was then attached
which included ECG, non-invasive automatic ar-
terial pressure monitor and pulse oximeter. An i.v.
cannula was inserted under local anaesthesia. In
group 1, anaesthesia was induced and maintained
with propofol using a computer-controlled infusion
device. A mathematical model which describes the
pharmacokinetic behaviour of propofol in adults was
incorporated into the computerized infusion system
[6]. The system allowed the operator to select and
maintain a target blood concentration of propofol.
We chose an initial target plasma concentration of
6 μg ml⁻¹ reducing to 4 μg ml⁻¹ after 10 min. A
laryngeal mask was inserted and the patients allowed
to breathe spontaneously a mixture of 70 % nitrous
oxide in oxygen throughout the procedure.

In group 2 anaesthesia was induced with etomidate
0.25 mg kg⁻¹, and vecuronium 0.075 mg kg⁻¹ was
used to facilitate intubation. The lungs were
ventilated with 70 % nitrous oxide in oxygen supple-
mented with 0.5–1 % isoflurane to maintain an-
aesthesia.

End-tidal carbon dioxide was monitored in both
groups using a Datex Multinex 4000 and maintained
at approximately 5 kPa in group 2. In the spon-
aneously breathing patients, end-tidal carbon di-
oxide was maintained at 6–8 kPa. Oxygen saturation,
ECG and non-invasive arterial pressure were re-
corded throughout the procedure. IOP was measured
again in both groups after induction of anaesthesia.
A period of 5 min was allowed to elapse between
insertion of the laryngeal mask or intubation and
measurement of IOP. Topical anaesthesia with 1 %
amethocaine was applied to the operative eye before
surgical incision. General anaesthesia was main-
tained in both groups until after IOP had been
measured in the non-operative eye at the end of
surgery.

Recovery times were recorded from discontinu-
ation of anaesthesia to the time when spontaneous
eye opening occurred and patients were able to give
their correct date of birth. Two hours after surgery
patients were assessed for nausea and vomiting,
ability to converse normally, walk unaided and retain
oral fluids. Cognitive mental function tests (MMS
state test) were repeated and the score compared with
the preoperative value.

The results were analysed using a paired Student's
 t test for parametric data and multiple analysis
of variance of non-parametric data. P < 0.05 was
considered significant.

Results
The two groups were comparable in age, weight and
height (table 1). The changes in heart rate and
arterial pressure recorded during the procedure are
shown in figures 1 and 2. There were significant
group differences in both of these variables after
induction of anaesthesia, intubation/laryngeal mask
insertion and maintenance of anaesthesia. Patients in
the propofol group experienced greater decreases in
mean arterial pressure during induction and main-
tenance of anaesthesia (P < 0.01) while patients in
the etomidate group showed a significant increase in
arterial pressure and heart rate at intubation (P <
0.01). Propofol was associated with lower mean
arterial pressure throughout the procedure (P <
0.01). There were no significant differences in IOP
between the groups despite strict control of end-tidal
carbon dioxide in the etomidate–isoflurane group

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient characteristics (mean (range))</th>
</tr>
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<tbody>
<tr>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td>(propofol)</td>
<td>(etomidate–isoflurane)</td>
</tr>
<tr>
<td>(n = 20)</td>
<td>(n = 20)</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>72 (60–86)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>67 (47–94)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>167 (150–191)</td>
</tr>
</tbody>
</table>

Figure 1 Mean arterial blood pressure (MAP) during propofol (●) and etomidate–isoflurane (○) anaesthesia (mean, std). Ind = Induction, Int/LMA = intubation and insertion of the laryngeal mask airway (LMA). **P < 0.01.

Figure 2 Heart rate (HR) during propofol (●) and etomidate–isoflurane (○) anaesthesia (mean, std). Ind = Induction, Int/LMA = intubation and insertion of the laryngeal mask airway (LMA). **P < 0.01.
General anaesthesia for cataract surgery

Table 2  Mean (sd) intraocular pressure (mm Hg) in each group. **P < 0.01 compared with preinduction values

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (propofol)</th>
<th>Group 2 (etomidate–isoflurane)</th>
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<tbody>
<tr>
<td>Preinduction</td>
<td>15.3 (4.5)</td>
<td>14.3 (3.5)</td>
</tr>
<tr>
<td>Postinduction</td>
<td>12.4 (5.6)</td>
<td>11.1 (3.2)</td>
</tr>
<tr>
<td>End of surgery</td>
<td>10.4 (5.3)**</td>
<td>9.5 (4.6)**</td>
</tr>
</tbody>
</table>

Table 3  Recovery times (mean (sd)) and mini-mental state score (MMS) (mean (range)) in the two groups. **P < 0.01 between groups

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (propofol)</th>
<th>Group 2 (etomidate–isoflurane)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to eye opening</td>
<td>15 (6.8)</td>
<td>8 (3.3)**</td>
</tr>
<tr>
<td>Time to correct DOB</td>
<td>17 (6.8)</td>
<td>11 (4.4)**</td>
</tr>
<tr>
<td>Preoperative MMS</td>
<td>28 (25–30)</td>
<td>28 (24–30)</td>
</tr>
<tr>
<td>Postoperative MMS</td>
<td>28 (25–30)</td>
<td>27 (25–30)</td>
</tr>
</tbody>
</table>

In both groups there was a significant decrease in IOP between awake values and values at the end of surgery (P < 0.01).

Recovery times from cessation of anaesthesia to spontaneous eye opening and ability to give correct date of birth were significantly shorter in the etomidate–isoflurane group (P < 0.01) (table 3). MMS scores after operation did not differ significantly from preoperative values in either group (table 3).

Discussion

Induction of anaesthesia with propofol produced a 20% decrease in mean arterial pressure with a further 22% decrease during maintenance of anaesthesia. There were no significant changes in heart rate. Insertion of the laryngeal mask did not evoke a haemodynamic response. Arterial hypotension is a uniform response to induction of anaesthesia with propofol and reported changes range from 15 to 55% [7–9]. These changes result from both reduced cardiac output and decreased systemic vascular resistance [7–9]. The magnitude of the change in arterial pressure is related to a number of factors including age, premedicant drugs, hypovolaemia, heart disease and antihypertensive drug therapy. Preoperative factors include drug dose, speed of injection, concurrent administration of nitrous oxide or opioids, and lack of surgical stimulation [10,11].

A combination of these factors will have contributed to the marked reduction in mean arterial pressure of 42% in group 1 patients. Despite its predisposition for producing arterial hypotension, propofol appears to be well tolerated in both the elderly and patients with ischaemic heart disease [11–13]. This may be explained in part by the fact that although propofol decreases cardiac output and arterial pressure, it also reduces oxygen demands. Propofol reduces myocardial oxygen requirements without producing ischaemia [12,13].

Induction of anaesthesia with etomidate 0.25 mg kg−1 and vecuronium 0.075 mg kg−1 had minimal effects on mean arterial pressure or heart rate. There was however a significant haemodynamic response to intubation with a 19% increase in mean arterial pressure and a 21% increase in heart rate. During maintenance of anaesthesia with isoflurane–nitrous oxide, mean arterial pressure and heart rate decreased to 88% and 80% of awake values, respectively. These findings are in broad agreement with other studies [14–16]. In theory, both the hyperdynamic response to intubation in the etomidate group and hypotension in the propofol group could have detrimental effects in elderly patients with limited cardiovascular reserve, but no untoward effects were observed.

Surgical requirements for intraocular surgery include immobility of the eye and a low IOP. In the present study propofol and etomidate were equally effective at lowering IOP (table 2). Propofol has been shown to lower IOP more effectively during induction of anaesthesia and intubation than thiopentone [17]. Factors which increase IOP include carbon dioxide retention, suxamethonium and high systemic venous pressure [18]. It is interesting to note that despite the high end-tidal carbon dioxide levels in the propofol group, IOP remained low. The surgeon found no subjective difference in operating conditions provided by the two types of anaesthesia.

Recovery from anaesthesia was smooth in both groups. Only one patient in the etomidate group complained of nausea. No patient in either group vomited. The low incidence of nausea and vomiting in our study may be attributable in part to the use of the antiemetic metoclopramide before, and omission of narcotic analgesics during and after operation.

Recovery times were significantly shorter in the etomidate–isoflurane group (table 3). This may reflect increased depth of anaesthesia in the propofol group to avoid the risk of coughing as this group was allowed to breathe spontaneously using a laryngeal mask. Investigators have compared immediate recovery after propofol, thiopentone and methohexitone when used to induce and maintain anaesthesia of short duration using an incremental dose technique. In each comparative study propofol was associated with more rapid emergence from anaesthesia [19,20]. Recovery has also been assessed in studies comparing continuous infusion of propofol with inhalation anaesthesia. Recovery after propofol was faster only if the inhalation agent was preceded by thiopentone induction [21].

All patients were able to converse normally, walk unaided and retain oral fluids 2 h after surgery. MMS scores were similar to preoperative values in both groups (table 3). This is in contrast with the findings of other investigators who demonstrated significant impairment of cognitive mental function after operation in patients who received i.v. sedation for cataract extraction under local anaesthesia [5]. The avoidance of sedative premedicant drugs and the use of shorter-acting anaesthetic agents may explain the lack of effect on cognitive mental function in the present study.

A recent study of cataract surgery comparing general anaesthesia with local anaesthesia found that local anaesthesia was 15 times cheaper in material, led to a faster throughput of patients and halved the expenditure on staff [22]. The current practice in
most day-case units is that the ophthalmologist gives local anaesthesia. However, a joint working party from the College of Ophthalmologists and the College of Anaesthetists recommended that an anaesthetist should be present during local anaesthesia for intraocular surgery [23]. If these recommendations are implemented the cost benefits of local anaesthesia over general anaesthesia for day-case cataract surgery will be considerably reduced.

In conclusion, with proper preoperative assessment and avoidance of long-acting sedative drugs and narcotic analgesics, day-case general anaesthesia for cataract surgery is feasible, safe and potentially cost effective. Both anaesthetic techniques provided good operating conditions and rapid smooth recovery. Etomidate–vecuronium–isoflurane anaesthesia would appear to be superior to propofol in this age group as it produced less hypotension and more rapid recovery.

Acknowledgements
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References