Anaesthesia for strabismus surgery: a regional survey

R. Dell¹ and B. Williams²*

¹Department of Anaesthesia, Hospital for Sick Children, Toronto, Ontario, Canada M5G 1X8.
²Department of Anaesthesia, Bristol Royal Infirmary, Bristol BS2 8HW, UK
*Corresponding author

Surgical correction of strabismus is a common procedure in ophthalmic practice and the commonest in paediatric ophthalmic surgery.¹ The eyes should be immobile during surgery, as the absence of muscle tone is a requirement for the conduct of the forced duction test (FDT). In this test, mechanical restriction to movement is assessed by grasping the sclera of the eye with a forceps near the corneal limbus and moving the eye into each field of gaze by traction. The test is performed in order that the surgeon may differentiate between a paretic muscle and a restriction impeding ocular movement. For this reason, some surgeons prefer neuromuscular block during the FDT to eliminate the effects of variation in muscle tone caused by varying depth of anaesthesia. The FDT is of greatest value in patients who have previously undergone strabismus surgery, in those where it is thought there may be paralysis of one of the ocular muscles and in those who have had some form of orbital trauma.

Most of the literature on intraoperative problems in ophthalmic anaesthesia focuses on the oculocardiac reflex (OCR) and its prevention. Some literature draws attention to the risk of succinylcholine triggering malignant hyperpyrexia (MH) in those with localized areas of muscle weakness, such as strabismus and ptosis.² But there are few reports concerning the requirement for neuromuscular blocking drugs during FDT, and avoidance of succinylcholine because of its interference with this test.

Methods and results

A questionnaire was forwarded to anaesthetic departments in the South West region for distribution to all anaesthetists. We enquired about the grade of anaesthetist and their ophthalmic anaesthetic experience. Questions included method of induction, how the airway was secured and use of neuromuscular blocking drugs. Responses to these questions were analysed within three different age groups of patients: group A 0–3 yr, group B 4–12 yr and group C more than 12 yr.

We received 264 replies from a total of 379 anaesthetists in the region, a response rate of 70%. Fifty of these were discounted because of insufficient data. Two hundred and fourteen responses were studied from 107 consultants, 18 non-training career grade anaesthetists, 54 specialist registrars and 19 senior house officers. Sixteen questionnaires were completed except for the grade of anaesthetist and these were included in the analysis.

Neuromuscular blocking drugs were used commonly to facilitate securing the airway in group A (68%) but much less so in groups B and C (45% and 40%, respectively). When neuromuscular blocking drugs were used, non-depolarizing agents were preferred to succinylcholine in all groups.

Table 1 Are neuromuscular blocking drugs used to facilitate securing the airway?

<table>
<thead>
<tr>
<th>Group</th>
<th>0–3 yr</th>
<th>Group B</th>
<th>4–12 yr</th>
<th>Group C</th>
<th>12+ yr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=211)</td>
<td>(n=214)</td>
<td>(n=214)</td>
<td>(n=214)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>143 (68%)</td>
<td>96 (45%)</td>
<td>85 (40%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>68 (32%)</td>
<td>118 (55%)</td>
<td>129 (60%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agent used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Succinylcholine</td>
<td>49 (34%)</td>
<td>19 (20%)</td>
<td>13 (15%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-depolarizing agent</td>
<td>94 (66%)</td>
<td>77 (80%)</td>
<td>72 (85%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of patients with non-paralysed extraocular muscles at forced duction test</td>
<td>117 (55%)</td>
<td>137 (64%)</td>
<td>142 (66%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

© British Journal of Anaesthesia
groups (66%, 80% and 85%, respectively), with the use of the latter most frequent in the youngest age group (34%). The proportion of patients with non-paralysis of the extraocular muscles at the time of the FDT was 55% in group A, 64% in group B and 66% in group C.

The majority of respondents in group A used anticholinergic drugs. Forty-five (21%) administered them as part of premedication and 139 (66%) i.v., either at or after induction. Their use decreased with increasing age to 7% and 55% in group B and 3% and 48% in group C.

I.v. induction was the method of choice for all three groups and this preference increased with age, from 65% in group A to 96% in group B and 98% in group C. When an inhalation technique was used, halothane was the agent of choice, with sevoflurane a close second. Control of the airway was most commonly achieved by tracheal intubation in group A (71%) whereas the laryngeal mask airway (LMA) was preferred in groups B and C (60% and 70%, respectively).

An open section of the questionnaire allowed the respondent to record whether the surgeon asked for: (i) a particular anaesthetic technique to be used; (ii) a particular drug to be given or omitted; (iii) a particular set of conditions to be met at any point in the procedure.

Only nine positive responses were recorded in this section. In three, surgeons had requested neuromuscular block for surgery and in two others, one requested avoidance of the use of succinylcholine and one requested the eyes to be immobile in neutral gaze. In another, the surgeon requested the use of topical non-steroidal drugs. One surgeon was considering immediate postoperative adjustment of sutures which required an anaesthetic technique allowing for prompt recovery in the operating theatre.

**Comment**

As with many forms of surgery, the anaesthetist and surgeon need to form a common consensus in their approach to the patient, such that the anaesthetic is administered safely and the conditions are optimal for successful surgery. In recent years, new drugs and equipment have had an impact on ophthalmic anaesthetic practice (e.g. EMLA, propofol and the LMA) and changes in ophthalmic surgery have also had implications for the anaesthetist. In strabismus correction, these include increased use of day-care facilities, forced duction testing and the adjustable suture technique.

Surgeons at our regional eye teaching hospital who specialize in strabismus surgery have increasingly requested that neuromuscular block be used as part of the anaesthetic technique in order that muscle tone is absent or kept to a minimum during the FDT. Eye movement under general anaesthesia is well documented and in non-aligned eyes this tendency is increased such that divergent squints diverge more and convergent squints converge less. Some workers have recommended that surgical correction of strabismus be carried out with neuromuscular block as part of the anaesthetic technique to eliminate the degree of eye movement produced by varying and unpredictable depth of anaesthesia, and also to offer some protection against the OCR, this varying with the blocker used.

The use of succinylcholine for elective intubation is declining but it remains a popular short-acting blocker in children, despite its rare life-threatening side effects. In this survey, its use appeared to be in broad agreement with that of Robinson, Jerwood and Stokes. In strabismus surgery, succinylcholine is contraindicated when FDT is contemplated because it produces a prolonged increase in extraocular muscle tone. The force required to rotate the globe as part of the FDT is increased after the use of succinylcholine. This effect can be present for up to 20 min, a feature either not appreciated or discounted in the interest of the ease and speed of intubation which it produces. In addition, when the use of succinylcholine is contemplated, its increased potential for triggering MH in strabismus surgery should be remembered. While few would argue against the need for FDT to be carried out under general anaesthesia, the requirement for neuromuscular block as part of the general anaesthetic technique, although increasing in some centres, remains controversial.

The high incidence of OCR in strabismus surgery with its potential for cardiovascular instability can be reduced by administration of an anticholinergic agent but their use is not without controversy. This might account for almost 50% of respondents choosing not to use them prophylactically in the older age groups. The importance of a gradual increase in traction on extraocular muscles to reduce the incidence of OCR has been demonstrated. Braun, Feise and Muhlendyck also showed that this manoeuvre produced an initial bradycardic response followed by a counter-regulatory tachycardia on release of the stimulus, and that fatigue of the OCR occurs with subsequent stimulation.

The popularity of the LMA for securing the airway, and its commonplace use in adults and older paediatric patients, was reflected in this survey, despite most anaesthetists agreeing that tracheal intubation remains the safer option, particularly when access to the airway is restricted, as in strabismus surgery. Increased potential for problems with the LMA in the smaller child probably accounts for the method of choice for securing the airway in this group of patients. In older patients, the experience and confidence of the individual anaesthetist tend to be the deciding factors on how the airway is secured. Our survey also demonstrated the increasing tendency to use IPPV with the LMA.

An interesting finding was that a significant number of patients (55% in group A, 66% in group C) may be undergoing strabismus correction under suboptimal conditions, in that residual tone in the extraocular muscles can lead to inaccurate interpretation of the FDT. This situation can occur when no neuromuscular blocking drug is given before the FDT; when a short-acting neuromuscular blocking drug is administered to facilitate securing the airway and
Anaesthesia for strabismus surgery

its effect is no longer present during the FDT; or when succinylcholine has other adverse effects. In contrast with our experience in a regional specialist centre, surprisingly few respondents experienced specific requests from surgeons for a particular anaesthetic drug or technique in the conduct of anaesthesia for strabismus surgery. Perhaps this reflects the difference between ophthalmologists in a regional centre who specialize in strabismus surgery and general ophthalmologists in smaller departments where either the FDT is a less common procedure or the effect of neuromuscular blockers on its interpretation are considered to be less of an issue.

Acknowledgements
We thank Mr David Perkins, audit facilitator, for help with analysis of results and Mr Richard Harrad, Consultant Ophthalmic Surgeon, for support and surgical advice.

References