Comparison of i.v. cannula and Stevens’ cannula for sub-Tenon’s block

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Background. Sub-Tenon’s local anaesthesia (STLA) is growing in popularity for ophthalmic surgery, and is widely regarded as safer than the alternative sharp needle techniques. Although safe, STLA is not devoid of risk. Therefore, the effectiveness of a plastic i.v. cannula was compared with the traditional metal Stevens’ cannula for delivering STLA.

Methods. In a randomized, controlled trial, the efficacy of STLA administered by either a Stevens’ sub-Tenon’s metal cannula or a standard 20 G Optiva i.v. plastic cannula was compared; 120 patients, undergoing cataract surgery, were randomly allocated to one of the two groups. After STLA, the primary outcome measure, kinesia of the globe, was recorded at 5 and 10 min.

Results. There was no significant difference in the mean total ocular movement scores after STLA performed by either the 20 G i.v. cannula or standard 19 G sub-Tenon’s cannula (P=0.10). There was also no significant difference in any of the secondary outcome measures.

Conclusions. A 20 G Optiva i.v. cannula and the Stevens’ sub-Tenon’s cannula were equally effective at providing STLA.

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The traditional sub-Tenon’s local anaesthesia (STLA), as described by Stevens, was introduced to General Hospital in 1997. In 1998, there were three postoperative complications of diplopia, requiring corrective surgery. The cause was thought to be direct trauma to the recti muscles, after deep dissection, with either the spring scissors or rigid metal Stevens’ cannula. Subsequently, the traditional STLA was modified, by eliminating any deep dissection and by replacing the metal Stevens’ cannula, with a non-rigid plastic i.v. cannula. This study compared the efficacy of a 20 G Optiva i.v. cannula with a standard 19 G sub-Tenon’s cannula in producing STLA.

Methods

A sample size calculation indicated that 120 participants were required to detect, with 90% power and P<0.05, a difference between the two groups of 0.5 in the mean of the total ocular movement score (the primary outcome measure).

Approval for the study was obtained from the Gloucestershire Research Ethics Committee. One hundred and twenty consecutive patients undergoing cataract surgery under local anaesthesia were recruited. Informed written consent was obtained from all patients. Patients were excluded if they declined to consent, had communication difficulties, were allergic to any of the drugs in the protocol, had previous cataract surgery, or were taking warfarin or clopidogrel.

Patients were randomly allocated to one of the two groups using sealed envelopes. All patients received lignocaine 2% (4 ml) with 30 IU ml⁻¹ of hyaluronidase using, in Group M, a Stevens’ cannula (metal cannula) and, in Group P, a 20 G Optiva i.v. cannula (plastic cannula).

Apart from the actual device used to deliver the local anaesthetic, all other aspects of all patients’ care in both the groups were identical. No patient was fasted and none received premedication or sedation. All patients were monitored with pulse oximetry.

Anaesthesia of the conjunctiva was achieved using two drops of tetracaine 1%. Asepsis was achieved using
1–2 ml of 5% povidone-iodine dropped onto a closed eye, until the eyelashes were soaked. The patient was then asked to blink twice.

A lid speculum was inserted. The sub-Tenon’s approach was the traditional approach, involving a direct trans-conjunctival infiltration into the sub-Tenon’s space via the infero-medial quadrant. The conjunctiva was picked up using forceps at a point 5 mm from the limbal margin to create a ‘tenting’ effect of the conjunctiva. A small ‘nick’, just large enough to accept the cannula, was made with spring scissors to reveal bare sclera and sub-Tenon’s space. The selected cannula was passed through the nick aiming to ‘rub’ along the surface of the sclera, after the bisecting line of the horizontal and vertical meridia. The selected cannula was passed until resistance was met, which was defined as rotation of the globe. At this point, 4 ml of local anaesthetic was injected.

Ocular pressure was applied digitally. Assessments were made at 5 and 10 min. If after 10 min the anaesthetist felt the block to be unsatisfactory, a further top-up of 2 ml of the original local anaesthetic solution was given.

Patients were assessed, by anaesthetic trainees or ophthalmic surgeons allocated to the operating list, who were unaware of which cannula had been used to administer the STLA. The primary outcome measure, the degree of movement of the globe, was assessed in medial, lateral, upward, and downward planes. Each was scored 0, 1, and 2 for ‘no movement’, ‘reduced movement’, and ‘normal movement’, respectively, giving a maximum total ocular movement score of 8. The degree of ptosis was scored 0, 1, and 2 for ‘no movement’, ‘reduced movement’, and ‘normal movement’, respectively, giving a maximum score of 2. The levels of discomfort experienced, by the patient, while receiving the local anaesthetic and during the surgery itself, were noted by recovery nurses, when the patient had returned to the day unit, using a verbal rating score (0–10). Finally, the surgeon scored each block for ‘surgical’ adequacy, again using a verbal rating score (0–10). The data were compared using unpaired Student’s t-test.

### Results

Sixty patients were recruited into each of the two groups, and all patient data were included in the statistical analysis.

Mean ages were 79.7 yr in Group M and 76.2 yr in Group P. There were 22 males (36%) in Group M and 18 (30%) in Group P.

The mean for all total ocular movement scores was 0.97 in Group P and 0.63 in Group M. The difference was not statistically significant (P=0.10; Table 1). The mean for all ptosis scores was 0.15 in Group M and 0.28 in Group P. The difference was not statistically significant (P=0.08; Table 1).

### Discussion

Ophthalmic regional anaesthesia, for cataract surgery, needs to be safe, effective, and well tolerated. STLA is the safest of the ophthalmic regional eye blocks performed, except for topical, with few complications. STLA has been gaining in popularity, all through the 1990s, over the sharp needle techniques, such as peribulbar, retrobulbar, and retro-peribulbar. All the sharp needle techniques carry risks such as orbital haemorrhage, globe perforation, brainstem anaesthesia, and diplopia. STLA is not devoid of risk. It is known to cause diplopia as a result of direct muscle trauma and globe perforation, which was attributed to compromised sclera and scarring from previous vitreoretinal surgery.

There are few contradictions to a traditional STLA, except for patient refusal and those with a ‘buckle’ in the infero-nasal quadrant. Other relative contraindications include patients on clopidogrel or warfarin. It is reliably and quickly effective, and provides good analgesia. With topical anaesthesia, discomfort is reported in about a third of patients, and it would appear to be a relatively unsatisfactory technique in this era of increasing patient

#### Table 1 The outcome measures in i.v cannula group (Group P) and Stevens’ cannula group (Group M)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean Group P</th>
<th>Mean Group M</th>
<th>Difference (P–M)</th>
<th>95% CI of difference</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ocular movement score (0–8)</td>
<td>0.97</td>
<td>0.63</td>
<td>0.34</td>
<td>(–0.07, 0.74)</td>
<td>0.10</td>
</tr>
<tr>
<td>Ptosis (0–2)</td>
<td>0.28</td>
<td>0.15</td>
<td>0.13</td>
<td>(–0.02, 0.28)</td>
<td>0.08</td>
</tr>
<tr>
<td>Chemosis (0–2)</td>
<td>0.52</td>
<td>0.67</td>
<td>-0.15</td>
<td>(–0.36, 0.06)</td>
<td>0.16</td>
</tr>
<tr>
<td>Haemorrhage (0–2)</td>
<td>0.48</td>
<td>0.37</td>
<td>0.09</td>
<td>(–0.12, 0.35)</td>
<td>0.32</td>
</tr>
<tr>
<td>Surgical operating conditions (0–10)</td>
<td>8.50</td>
<td>8.23</td>
<td>0.27</td>
<td>(–0.15, 0.69)</td>
<td>0.21</td>
</tr>
<tr>
<td>Pain score with block (0–10)</td>
<td>0.95</td>
<td>0.52</td>
<td>0.43</td>
<td>(–0.09, 0.96)</td>
<td>0.10</td>
</tr>
<tr>
<td>Pain score with surgery (0–10)</td>
<td>0.18</td>
<td>0.10</td>
<td>0.08</td>
<td>(–0.14, 0.31)</td>
<td>0.47</td>
</tr>
</tbody>
</table>
Sub-Tenon’s block

expectation.8 Undoubtedly, the peribulbar technique is effective, but one has to balance this against the potentially serious risks.

STLA is tolerated well by patients. There is little doubt that many patients dislike needles, especially when associated with close proximity to the eye. It would also appear that the discomfort experienced by patients undergoing sub-Tenon’s block is less than that experienced from peribulbar block.9 The discomfort is probably related to a volume effect of the local anaesthetic solution, causing pressure, and the tendency of local anaesthetics to sting. Therefore, the device used probably has little influence upon discomfort. However, what is quite clear is the visible relief on the faces of a good proportion of patients whom are told that there will be ‘no needle used’ and that instead a ‘bendy plastic tube will be placed beside the eye’. The explanation that there are no sharp needles around is comforting to many and is carried through into the anaesthetic room.

Consequently, sub-Tenon’s is the safest of the regional eye block techniques.10 In addition to having few contraindications, STLA is effective, well tolerated by patients, and produces excellent operating conditions. However, although a safer alternative than the established sharp needle techniques, it is not absolutely devoid of any complications, such as diplopia or globe perforation.5,6

Following case reports of postoperative diplopia due to direct trauma of the recti muscles, some anaesthetists in Cheltenham evolved the technique for STLA in two particular aspects.6 Deep dissection with spring scissors was no longer employed. The tips of the scissors were only used to confirm passage into the sub-Tenon’s space and were passed just a few millimetres through the conjunctival ‘nick’, while remaining ‘in view’ at all times sub-conjunctivally. The avoidance of deep dissection was to minimize the risk of damage to any deep structures, such as recti muscles or staphyloma. In addition, an i.v. cannula, rather than a rigid sub-Tenon’s cannula, was used. Either device need only be passed until resistance is met, and then hydro-dissection alone will suffice.11 It is not necessary to achieve great depth, because it is recognized that short cannulae will produce a distribution of local anaesthetic similar to longer cannulae, and will provide a similar quality block.12

Despite the apparent success of the i.v. cannula as a delivery device, there have been some sceptics who were not convinced of the efficacy. It was postulated that the less rigid plastic delivery device may generate less forward projection of the local anaesthetic injectant, allowing greater back leakage with lost local anaesthetic. The hypothesis was that this resulted in a less effective block, presumably through loss of, and lack of spread of, local anaesthetic solution. This study was set up to, and succeeds in, refuting this scepticism.

This study has helped confirm that this ‘new’ technique is equally efficacious, as the traditional approach, although one can only surmise (and continue to audit) its superior safety. It is certainly hoped that these developments will prevent the complication of diplopia from recurring. If one does not employ blind ‘deep’ dissection and one uses a compliant cannula, it would appear likely that complications must be reduced. Our study does not prove this. However, there have been no further incidents of diplopia reported. It would also appear unlikely that globe perforation could occur, even with a distorted globe, secondary to either previous surgery or the presence of staphyloma.

A potential weakness of the study was the choice of assessors for the movement of the globe and ptosis of the eyelid. Whichever anaesthetic trainee or ophthalmic surgeon was allocated to the operating list was enlisted. It was felt that a very simple scoring system would reflect the practical day-to-day administration of STLA; hence the simplicity of the required observations of movement of both the globe and eyelid. Observers had only to judge between ‘no movement’, ‘normal movement’, or simply ‘reduced movement’, when compared with the normal eye. There is an element of subjectivity involved, but errors should have translated equally into each group.

Finally, changing from the traditional Stevens’ cannula to an i.v. cannula incurs cost savings. An i.v. Optiva cannula costs less than a Stevens’ cannula.

In conclusion, this study demonstrates that the 20 G Optiva i.v. cannula was equally effective as a Stevens’ cannula in establishing ophthalmic regional anaesthesia by the sub-Tenon’s route. Either device provided equally good operating conditions, with excellent akesia for the surgeons, and pain-free surgery for patients. It is surmised, although not proven, that this less rigid and more compliant delivery system will result in less complications.

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References
1 Guise P. Sub-Tenon anaesthesia. A prospective study of 6,000 blocks. Anaesthesia 2003; 58: 964–8
7 Freiman B, Freidberg M. Globe perforation associated with sub-Te
non's anesthesia. *Am J Ophthalmol* 2001; 131: 520–1
9 Nielsen J, Wiig Allerod C. Evaluation of local anesthesia tech-
10 Kumar CM, Dowd T. Complications of ophthalmic regional blocks, their treatment and prevention. *Ophthalmologica* 2006; 220: 73–82
13 Tokuda Y, Onda K, Oshitomi F, Inouye J, Amano S, Oshika T. Comparison of sub-Tenon's anesthesia by different delivery tech-