INTRODUCTION

Hand surgery accounts for approximately 1/5 of all operations in our general orthopaedic department. Traditionally, these patients have been operated on in regional or general anaesthesia. A substantial amount of the time when the patient is in the operating theatre is taken up with anaesthetizing the patient and waking him up after surgery. It seems possible that the use of local anaesthesia given before the patient is brought to the operating theatre could reduce this time and thus make the use of the operating theatres more efficient.

Another benefit of operating in local anaesthesia is that the patient is able to tighten and relax muscles on demand. This can give the surgeon useful information, such as the ability of the tendons to glide in the tendon sheath, the tension and hold of a tendon suture, and the rotation of a metacarpal or phalanx. As adrenaline has been added to the local anaesthetic, bleeding is minimal, making a tourniquet unnecessary. It has been shown that this is safe and useful, and it is an advantage when surgery is expected to take longer than 15–20 minutes. Pain due to the tourniquet increases substantially after surgery.
make sure that the tension on a tendon suture is adequate and that the tendon does not catch on a pulley. If one is unsure which tendon ends are to be joined, this becomes clear when the patient tries to flex one finger at a time.

On excision of the trapezium for arthrosis of the first carpometacarpal joint, we infiltrated approximately 20 ml volarly and dorsally around the bone and injected 2 ml into the joint.

Study

122 patients were treated with this method from March 2012 to March 2013. Children, demented patients, and those who did not speak Norwegian were not considered suited for wide awake surgery. Surgeons noted their evaluation of intra-operative bleeding and oedema, and overall inconvenience and overall advantages with the method. All patients, except one, were contacted by telephone the next day by a nurse. In answer to a structured questionnaire they reported overall quality of care, pain on administration of the anaesthetic, pain during the operation, and whether there had been other discomfort during the procedure. A numerical scale from 0 (best or least) to 10 (worst imaginable or most) was used to record all responses. Patients were also asked whether they would choose the same form of anaesthesia, in case of a subsequent procedure or would prefer general anaesthesia.

In order to evaluate the patient flow in the operating theatre, the recordings from the study period were compared to those that had been noted for the year 2010. These patients had received regional block or a general anaesthesia. We selected only procedures where the operating technique is fairly standardized and only operations performed by trained hand surgeons during normal working hours during the study and control periods.

Phentolamine antidote to adrenaline vasoconstriction was available, but was never required. Statistical evaluation was performed with the Student’s t-test for independent samples, bivariate correlation analysis, and the Chi square test, as appropriate. Patients during the wide awake study period gave their written consent to participate. The protocol was reviewed by the Regional medical ethics committee who considered that their approval was not required.

RESULTS

Patients gave a mean evaluation (0 = best; 10 = worst) of 0.1 (SD 0.6) for the general care they had received. The mean score for pain during injection of lidocaine was 2.4 (SD 2.2), pain during surgery 0.9 (SD 1.5),
and for other discomfort during surgery 0.5 (SD 1.4). A total of 113 stated that they would like to have wide awake anaesthesia if they were to be operated at a later time. Eight replied that they would prefer general anaesthesia.

Surgeons evaluated (0 = least; 10 = most) drawbacks because of intra-operative bleeding and oedema at 1.6 (SD 1.8) and 0.4 (SD 1.1), respectively. They evaluated drawbacks in general from operating this patient wide awake at 1.0 (SD 1.6), and advantages in general at 6.5 (SD 4.3). The surgeons’ highest estimation of general advantage was recorded for tendon suture, with a mean score of 9.9 (SD 0.5).

The mean amount of anaesthesia injected at various types of surgery is recorded in Table 1. Additional intra-operative anaesthesia was required in 16 of the 103 surgeries performed by trained hand surgeons and 12 out of 19 surgeries performed by surgeons in training (p < 0.001). The need for supplementary anaesthesia fell significantly during the study period (p < 0.05; Fig. 1).

The surgeons spent an average of 6 (SD 3) minutes administering the anaesthetic before the patient was brought to the operating theatre. Patients reported that full sensibility had returned after 8.5 (SD 4.2) hours. There was no statistically significant association between this time and the amount of anaesthetic that had been given.

The time the patient had spent in the operating theatre before and after the actual surgery was calculated for the wide awake study period and compared to that noted for the control period. It was a mean of 46 (SD 15) minutes

![Fig. 1. The number of wide awake surgeries during each 3-month period of the study and the number of patients requiring additional intra-operative anaesthetic.](image)

Table 1. Mean (range) ml anaesthetic used at wide awake surgeries and the number requiring additional anaesthetic

<table>
<thead>
<tr>
<th>Procedure</th>
<th>n</th>
<th>Mean ml initial anaesthetic</th>
<th>Number requiring additional anaesthetic</th>
<th>Mean ml additional anaesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubital tunnel release</td>
<td>6</td>
<td>27 (20-40)</td>
<td>3</td>
<td>12 (5-20)</td>
</tr>
<tr>
<td>Simple trapeziectomy</td>
<td>20</td>
<td>25 (16-35)</td>
<td>10</td>
<td>8 (1-17)</td>
</tr>
<tr>
<td>Thumb ulnar colat. lig. rupture</td>
<td>8</td>
<td>14 (8-24)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pinning metac/phalanx fracture</td>
<td>24</td>
<td>18 (7-22)</td>
<td>7</td>
<td>8 (3-14)</td>
</tr>
<tr>
<td>Interphalangeal arthrodesis</td>
<td>6</td>
<td>18 (14-24)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Extensor tendon suture (hand)</td>
<td>8</td>
<td>16 (10-22)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flexor tendon suture (hand)</td>
<td>10</td>
<td>20 (13-24)</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Tenolysis</td>
<td>4</td>
<td>16 (8-22)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Soft tissue tumor</td>
<td>7</td>
<td>13 (4-22)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>29</td>
<td>18 (7-44)</td>
<td>7</td>
<td>11 (5-20)</td>
</tr>
</tbody>
</table>

Table 2. Mean (range) minutes of operating time and total theatre time for selected types of surgeries during the wide awake study period and during a control period of one year when general or regional anaesthesia was used

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Wide awake (minutes)</th>
<th>Control period (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Surgery</td>
</tr>
<tr>
<td>Cubital tunnel release</td>
<td>4</td>
<td>44 (23-75)</td>
</tr>
<tr>
<td>Simple trapeziectomy</td>
<td>15</td>
<td>53 (30-88)</td>
</tr>
<tr>
<td>Thumb ulnar colat. lig. rupture</td>
<td>7</td>
<td>35 (25-58)</td>
</tr>
<tr>
<td>Interphalangeal arthrodesis</td>
<td>5</td>
<td>49 (26-93)</td>
</tr>
</tbody>
</table>
during the wide awake study period and 55 (SD 22) minutes during the control period \( (p < 0.001) \). However, when the mean duration of surgery and the total time in the operating theatre were calculated for four types of surgery where it was felt that a comparison could be made, it was found that in many instances the reduction in time spent before and after surgery in the wide awake group was cancelled out by a shorter operating time during the period where the patients had received general or regional anaesthesia (Table 2).

The time between leaving the operating theatre and discharge was 67 (SD 32) minutes for the 59 wide awake patients where data on this had been recorded.

**DISCUSSION**

Patients were happy with the wide awake surgery. Only 7% stated that they would have preferred general anaesthesia. This is similar to the findings of others.\(^9,16,17\) Many of our patients had probably never had a general anaesthetic and did not know what it entails, other than that they would have been unconscious.

The most uncomfortable part of the procedure was the actual injection of the anaesthetic. It has been shown that this can be done almost painlessly. Key points are reported to be to use buffered lidocaine that has been heated to body temperature, to use a 27 gauge needle, to pass the needle through the skin at 90 degrees, to wait a few seconds after injecting a small volume subcutaneously, and to always have a ridge of raised or blanched skin 0.5-1 cm in front of the needle tip.\(^18-22\) In this way the pain can be reduced to the initial pinprick as the needle passes through the skin.\(^20,21\) We did often not adhere to all these guidelines and could probably have reduced pain and discomfort if we had done so.

Many of our patients needed additional anaesthetic during the procedure. The number was significantly lower among those treated by a trained hand surgeon and also fell significantly as we gained more experience. Koege and co-workers reported having to give additional intra-operative anaesthetic in 10% of cases.\(^17\) Others have pointed out the gains to be achieved by formally teaching the correct procedure to students and residents.\(^20,23\) There are many variations on the recommended details on administering the local anaesthetic.\(^11,16,18-20,23,24\) Many recommend higher volumes than we employed in the beginning of our study period.

We found that, in general, the advantages of the wide awake approach in hand surgery far outweigh the drawbacks. This was particularly true for tendon surgery where it was possible for the patient to assist during surgery by tightening and relaxing muscles when asked. Bezuhly et al. performed extensor indicis proprius to extensor pollicis longus transfers as wide awake surgery and found it very useful to evaluate the tension of the transfer intra-operatively.\(^13\) Higgins et al. re-did the suture in seven out of 102 flexor tendon sutures because intraoperative active movement of the finger demonstrated bunching or gapping at the suture site.\(^25\) We often let the patient watch his finger move actively before applying the bandages after tendon surgery. In this way he sees what is mechanically possible and we hope that it will be an encouragement during the postoperative training period.

The local oedema from the injected fluid had completely disappeared by the time of surgery. Bleeding in the operative field was only a very minor problem in the great majority of cases.\(^25\)

Like others, we found that non-surgical time in the operating theatre is reduced statistically significantly in wide awake surgery, indicating greater efficiency.\(^13\) This could also be achieved in institutions where it is possible to give a regional block or general anaesthetic before the patient is brought to the theatre. We have not found reports comparing the surgery time when using wide awake and conventional anaesthesia. Such a comparison is difficult without a randomized study. We have attempted an historical comparison. On the whole, surgery times were longer during the wide awake period. We excluded operations not performed by trained hand surgeons, and also those undertaken outside of normal working hours when the logistics of the operating theatres are different from the usual routine during the day. Even so, the conclusion must be very uncertain as the numbers are small and even the few types of surgery that we have selected for the comparison do often not proceed in an absolutely standard fashion. In spite of this, it seems possible that the gains in non-surgical time are lost in slightly longer surgery times. In addition, the surgeon must spend a few minutes giving the anaesthetic.

Clear advantages with wide awake surgery, however, are that one can operate also when an anaesthetist is not available. There is no need for preoperative testing for general anaesthesia. Close observation in a recovery ward is unnecessary as no sedation has been given and the patient can be discharged early. The need for analgesics postoperatively may also be reduced as no pain is felt for some hours after surgery.\(^26\)

We conclude that wide awake surgery is fully acceptable to most patients. It has a number of advantages over
general or regional anaesthesia, but we feel it is unlikely to improve the efficiency of the operating theatre.

**DECLARATION OF INTEREST**

The authors have no conflicts of interest.

**REFERENCES**


