Implications of changing from general to regional anaesthesia as the primary anaesthetic for elective elbow, wrist and hand surgery

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Keywords: Ultrasound guided, regional anaesthesia, supraclavicular block, brachial plexus block, axillary block, infraclavicular block

Abstract
We describe how we changed the provision of anaesthesia for forearm, wrist and hand surgery from general anaesthesia to routine ultrasound-guided regional anaesthesia. Our surgical throughput and day case rates improved, with high patient satisfaction. We now routinely recommend ultrasound-guided anaesthesia.

Introduction

The phrase ‘let’s do this case under a regional block’ has been traditionally met with a groan from surgeons and theatre staff alike. Delays were inevitable as the technique took time to perform and the patients had to be left to ‘cook’ whilst the block took effect. However, there are many potential advantages to awake upper limb surgery (Table 1).

| Advantages of regional anaesthesia | \hline
| Patients can remain conscious maintaining their own airway thus avoiding morbidity associated with general anaesthesia | \hline
| Improved post-operative analgesia | \hline
| Reduced opioid induced side effects (nausea, vomiting, respiratory depression, drowsiness) | \hline
| Aspiration of gastric contents unlikely | \hline
| Reduced nursing input required post operatively | \hline
| Earlier discharge from hospital | \hline

The techniques available that allow awake surgery of the arm include local infiltration, intravenous regional anaesthesia (Bier’s block), peripheral nerve blockade, or brachial plexus blockade.

Types of Brachial Plexus Blockade (Figure 1)

Interscalene block: this is the most commonly used block for shoulder surgery, although a unilateral phrenic nerve palsy is almost inevitable and it is frequently associated with ulnar sparing. For these reasons it is contraindicated in those with severe respiratory disease and is often inappropriate for hand surgery.

![Figure 1 Anatomical sites for different brachial plexus blockade. © 2009 American Society of Regional Anesthesia and Pain Medicine. Used with permission. All rights reserved.](image)

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Supravacular block: this covers the whole arm including the tourniquet site. Hence this block has been referred to as the 'spinal of the arm'. The brachial plexus is close together here allowing the local anaesthetic to work quickly although ulnar sparing can occur. Pneumothorax rates were reported as 0.5–6.3% but with ultrasound guidance the rates are now thought to be less than 1 in 1000. Ipsilateral diaphragmatic paralysis occurs in around 50% of patients, depending on the amount of local anaesthetic used.

Intravacular block: many anaesthetists avoid this because it is technically more challenging than the other blocks, although it maybe more reliable than supravacular blockade. For many anaesthetists it is the site of choice for running continuous brachial local anaesthetic infusions due to superior analgesia and a more comfortable catheter site reported by patients.

Axillary block: this is really 4 distinct peripheral nerve blocks (radial, ulnar, median and musculocutaneous). It is often preferred in those with severe respiratory disease because it has the lowest incidence amongst the brachial plexus blocks of phrenic nerve palsy and there is no risk of pneumothorax. As a reasonable degree of arm abduction is required, it is not always possible to perform in those with restricted shoulder movements.

Ultrasound-guided blockade
Ultrasound has advantages over previously used techniques for regional anaesthesia such as needle induced paraesthesia or nerve stimulation. Ultrasound blocks are quicker to perform, have a faster onset, longer duration of action, and a lower failure rate. Ultrasound enables the anaesthetist to direct the needle to varying points to ensure circumferential spread of local anaesthetic around a nerve (the doughnut sign) (Figure 2). This is probably the greatest advantage of ultrasound. Nerve stimulation or similar techniques can only suggest that the needle is in proximity to the nerve, the spread of the local anaesthetic is unknown.

**Service change: How we provide an awake hand surgery service**

In our tertiary referral centre prior to 2009, surgery was performed under general anaesthesia, with or without supplementary nerve-stimulated axillary blockade. There was no regular anaesthetist allocated to this list. In January 2009 we started offering all patients undergoing upper limb surgery by a single consultant surgeon the option to have their surgery awake under ultrasound-guided supravacular block by a dedicated consultant anaesthetist. By May 2009 our service was fully established and the majority of patients were opting for awake surgery. We have reviewed the impact of the awake hand surgery service on the patients and the hospital.

The concept of awake surgery is discussed with patients in the hand clinic. Those who are medically unfit patients or who want to discuss the anaesthetic are referred to the anaesthetic preassessment clinic; otherwise, the patient first meets the anaesthetist on the day of surgery in a dedicated preadmission suite.

All blocks are undertaken in the anaesthetic room as we do not currently have a block room. A trained member of staff monitors the patient during the operation whilst the anaesthetist and the Operating Department Practitioner (ODP) administer the next block. Blocking the next patient in advance ensures that the time between cases is no more than that needed to clean the theatre and to prepare the surgical equipment for the following case. Sedation is offered to all patients, normally ≤ 2mg of midazolam is required if requested by the patient.

A case requiring general anaesthesia (GA) mid way through the list can cause disruption to flow. To prevent delays, the regional case following the GA is blocked during the case before the GA case. This blocked patient is monitored in recovery whilst awaiting surgery to avoid any delay.

Different anaesthetic agents are used according to the type of surgery. For soft tissue surgery we use prilocaine for the supravacular block and bupivacaine for distal blocks. Prilocaine ensures a fast onset block that lasts for the duration of surgery but will then wear off an hour or two later allowing the patient to regain some motor function whilst the distal bupivacaine blocks provide longer lasting analgesia. For cases of longer duration or bony operations we administer a mix of lignocaine with adrenaline and bupivacaine for the supravacular block. These blocks take slightly longer to take effect but then provide a longer-lasting dense motor and sensory block.

**Audit of the effects of introduction of regional anaesthesia**

We retrieved information from the theatre database for the Consultant Hand Surgeon over two, one year periods:

1. Prior to the Regional Block Service (GA year – 2008)
2. After the Regional Block Service (RA year – 2010)
For the GA year, we included only lists for which the consultant surgeon was present. In the RA year, we included only lists where both the consultant surgeon and the consultant anaesthetist were present.

Surgical review of cases between the 2 time periods showed there were no changes in operative case mix or surgical technique. Neither was there a change to admission or theatre management. We, therefore, attribute all advances to the introduction of awake regional anaesthesia and the presence of a regular consultant anaesthetist.

The median number of cases for each list in both years was 5. The 'GA year' comprised 80 lists with 149 patients whilst the 'RA year' covered 27 lists with 140 patients.

<table>
<thead>
<tr>
<th></th>
<th>GA Year</th>
<th>RA Year</th>
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<tbody>
<tr>
<td>Median cases per list (range)</td>
<td>4.9-7</td>
<td>5.3-8</td>
</tr>
<tr>
<td>Number of patients</td>
<td>149</td>
<td>140</td>
</tr>
<tr>
<td>Number of lists</td>
<td>30</td>
<td>27</td>
</tr>
</tbody>
</table>

There was no difference in late starts or over runs between the two years.

**Figure 4** Surgical start time for 1st patient on the list from commencing anaesthetic.

**Day Surgery Incidence**

The day surgery increased from 49% in the GA year to 70% in the regional year. 76% of all awake regional cases were discharged home on the same day of surgery. [Figure 5]. This is a substantial improvement, due to reliable post-operative analgesia and the elimination of general anaesthesia-associated side effects. The saved bed cost would, hypothetically, more than pay for the cost of the ultrasound machine and extra staff member.

![Anesthesia type before and after introduction of the new service](image1)

![Percentage number of patients discharged on the same day as surgery](image2)

**Operating List utilisation**

In the GA year 8 patients had a general anaesthetic (usually patient choice) whilst 18 patients had a general anaesthetic and regional block, most of whom needed a GA due to iliac crest bone harvesting. The majority (102) had a block with or without sedation. Four sets of notes from the 'Awake Year' could not be found (Figure 3).

**Figure 3** Anaesthesia type before and after introduction of the new service.

In the RA year 8 patients had a general anaesthetic (usually patient choice) whilst 18 patients had a general anaesthetic and regional block, most of whom needed a GA due to iliac crest bone harvesting. The majority (102) had a block with or without sedation. Four sets of notes from the 'Awake Year' could not be found (Figure 3).

In the GA year the median time from start of anaesthetic to start of surgery for the first patient of the day was 13 minutes. This time increased to 25 minutes when we started the list with a case performed solely under a regional block in the RA year. (Figure 4). We attributed the increased anaesthetic time to a supraventricular block taking longer to perform and work when compared with a general anaesthetic.

Assessing overall theatre utilisation (the time the theatre was not being used for surgery between 08.30 and 18.00); the mean time theatre was unused in the GA year was 114 minutes/day and in the RA year this was 106 minutes/day. The time saved in the RA year by the quicker turnaround mitigates the longer start time at the beginning of the list.

**Recovery**

The median time spent in the recovery ward during the GA year was 50 minutes. In the RA year our blocked patients spent a median of 35 minutes and those requiring a GA and a block spent 55 minutes.

We considered 35 minutes to be longer than needed for the blocked patients. Further investigation attributed this delay to factors including postering, ward nurse availability and accumulation of documentation rather than any clinical need of the patient to stay in recovery.

**Discharge time**

We were surprised to find only a small improvement in the time patients spent post operatively on the day ward prior to discharge home. The GA year patients stayed on the ward for a median of 130 minutes whilst the RA year patients stayed a median of 120 minutes. Further investigation highlighted 'transport' as by far the most common cause of delay in discharge once patients are clinically ready to go home.
Consent and patient engagement

Awake anaesthesia allows patients to engage with their condition and its management. Many patients appreciate the ability to see their pathology and to see the techniques used for its treatment. During the operation the surgeon has the opportunity, if the patient wishes, to show the pathology and explain its significance. Arthroscopic and fluoroscopic images can be explained. An understanding of the surgical procedure and the surgeon’s thought processes may have a very positive influence on a patient’s post-operative attitudes and recovery. Another advantage for the surgeon is that the post-operative ward round was much shortened as the majority of patients have been discharged home before the end of the operating day. The usual post-operative physical checks for swelling having been undertaken by the trained day surgery nurses and the explanation of pathology, treatment and follow up had already been given in the operating theatre.

The Patient’s Perspective

In the early phase of our awake service, most patients expected a general anaesthetic and so a block was only offered for those who questioned the need for a GA. As the benefits of awake surgery became more apparent to us, the threshold at which we would suggest awake surgery dropped. Patients are now told that ‘we normally do this...’ and very few choose the GA option.

Our confidence in recommending this mode of anaesthesia to patients has been validated by patient feedback. We contacted 56 of 60 consecutive patients who had undergone awake surgery two days after their operation and asked a set of questions about their experience.

Pain during block administration.

Most patients found the supraclavicular injection less painful than the 22g cannula put in the back of their hand. (Figure 6).

![Figure 6: Patients experience of regional block insertion.](image)

Post-operative pain

In the recovery ward, 98% of patients had no pain or mild pain. During the first post operative night, 67% reported either no pain or mild pain. Moderate pain was reported by 20% and severe pain by 13%. In the 38 patients who had any post-operative pain, the recalled time to onset was a mean of 12.7 hours.

Overall satisfaction

As measured on a 4 point scale rating (completely satisfied/dissatisfied), 91% were ‘completely satisfied’ with a further 7% being ‘satisfied’ with our overall service. 91% of our patients would choose to have awake surgery again when asked if they would ‘given what you know now’.

Patient information leaflet

In response to previous feedback from patients we have developed a patient information leaflet with information about how we do the block, why we do the block, what patients should expect their blocked arm to feel like, care of the blocked arm and how to contact us if concerned. Side effects and potential complications are also mentioned although all patients are fully consented on the day of surgery. 100% of the patients were satisfied with the amount and quality of information they were given regarding their block.

Discussion

The introduction of an ultrasound regional anaesthetic service has led to high levels of patient satisfaction without detriment to theatre throughput and has considerably improved day surgery rates. These results have given both consultant surgeon and anaesthetist confidence to recommend this service. Patient information leaflets are now routinely given to the patient by the surgeon in the hand clinic when they are booked for theatre or by the pre-assessment clinic.

Our service has evolved with the results of the audit. We now start each list with a case requiring simple infiltration anaesthesia by the surgeon, such as a carpal tunnel or trigger finger release. This maintains theatre productivity whilst the anaesthetic team blocks the second case, aiming to have the patient ready for theatre by the time the first case finishes. We hope this has reduced dormant theatre time. Many of our regional patients now avoid recovery altogether being discharged directly back to the ward from theatre.

References


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**Book Review**

**Oxford Specialist Handbooks: Day Case Surgery**

*Edited by Ian Smith, Douglas McWhinnie and Ian Jackson*

Published by Oxford University Press


This is the must have book for rapid reference and guidance to all aspects of Day Case Surgery. By design, it is aimed at all stakeholders including surgeons, anaesthetists, nurses, allied health care professionals and trainees of all the aforementioned vocations. It will also prove an invaluable reference work for managers and administrators. Comprehensively, it covers all aspects of day and shortest stay surgical practice. Ranging from its organization to discharge of patients to and integration with primary care. This first edition follows the same successful style of the previously published Oxford Specialist Handbooks series. Topics covered range from the organization of services to ambulatory anaesthesia, surgery, perioperative nursing as well as teaching and training. The book is in the usual white coat pocket size format but in this instance lacks a hardwearing protective cover utilized by others in the same series.

The book is organized into 20 chapters which are broadly subdivided into background, history and organization issues, pre-operative assessment and selection criteria, anaesthesia and surgery, day case nursing, developing and evolving with services and teaching and training. Summarizing the basic principles without excessive detail, subjects are clustered into manageable bite size sections sprinkled with gems of experience and expertise. The diagrams, figures and pictures are clear, well labelled and augment the pages of explanation and facts. Each chapter is well written and contains a succinct review of the area and is presented in an easy to read bulleted format. This allows the reader to cover topics quite rapidly. It is written by national and international experts in Ambulatory Surgery in a simple and well balanced format. The pictures are in black and white: the summary pages and figures are laid out and attractively presented.

The book has a very broad appeal and delivers a common reference work for the whole multidisciplinary team. It summarizes and reviews subjects for the senior and experienced as well as providing an excellent revision aide to trainees. There is no doubt that it would also prove extremely useful for medical students and foundation year doctors as they contemplate career selection and sub specialist interests. At the end of each chapter there are the cardinal references listed for those who would like to investigate topics in greater depth.

Summarising the major anaesthetic and surgical procedures which are performed in the day surgery setting, it does not go into huge detail and assumes certain baseline knowledge. For example, the section on Gynaecology is brief and lists like this will prove helpful for examination preparation and information recall.

The later chapters which include 'Pushing the Boundaries', 'Outcome Measures', 'Developing Day Surgery Units', 'Patient Safety' and 'Patient Experience' will prove of great interest. They are not only relevant to the multidisciplinary short stay surgery team and their immediate management but will also prove a powerful resource for the nascent Clinical Commissioners from General Practice. They deliver great insight into these thorny topics and discuss quite sensitive issues such as outcome measures and patient safety which are so relevant to modern medical care in a risk averse society.

The editors are to be congratulated on delivering this valuable addition to the available literature.

I would highly recommend this book to all individuals involved in Day and Short Stay Surgery as well as having copies available in the units themselves.

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