Local Anaesthetic Blocks in Ambulatory Orthopaedic Surgery

Patrick M Clarke

More surgery is now being performed in an outpatient setting. The growing complexity of surgical procedures challenges the anaesthetist’s ability to provide postoperative analgesia. Inadequate analgesia is a cause of delayed discharge and unexpected hospital admission. In a large prospective study, 16% of ambulatory orthopaedic patients had severe postoperative pain. Opioids are associated with nausea, vomiting and urinary retention, causing delayed discharge. Local anaesthetic techniques used as the primary anaesthetic or as an adjuvant to general anaesthesia can provide a safe and effective alternative to opioid analgesia.

Selection of local anaesthetic technique – orthopaedic surgery lends itself to peripheral and central neural blockade. Several questions need to be answered before deciding on a local anaesthetic technique (Figure 1).

- Can the block be used as the primary anaesthetic?
- Is sedation required as well?
- Can the block be used to supplement a general anaesthetic?
- Is the patient happy with a local technique?

Selection of a particular block depends on surgical procedure, use of a tourniquet, patient acceptability and operator experience.

Sedation

Sedation is useful for block placement and intraoperative sedation. Some blocks take time to site successfully and patients may become irritable and anxious and lose confidence in the anaesthetist; sedation minimizes these problems. For block placement the patient should be relaxed but conscious enough to report any paraesthesia. In a paraesthesia-seeking technique less sedation should be administered than when using a nerve stimulator to obtain motor stimulation. When a nerve stimulator is used the patient may receive more sedation but must be conscious enough to report major paraesthesia, which may indicate intraneural injection. Suitable sedation for block placement may be achieved using a combination of a short-acting benzodiazepine such as midazolam, 0.025–0.05 mg/kg, and fentanyl, 0.5–1.0 µg/kg (i.e. midazolam, 2 mg, and fentanyl, 50 µg, for a 80 kg patient).

Intraoperative sedation may be achieved with a variety of pharmacological agents ranging from intermittent boluses of benzodiazepine/opioid combinations to an infusional drug such as target-controlled propofol. In an ambulatory setting success is easily achieved using bolus techniques owing to the short dura-

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tion of surgery. There is a fine balance between patient relaxation and disinhibition. It is better to have a less sedated cooperative patient than one who is over-sedated and confused.

**Patient information**

Informed consent is paramount for local anaesthetic techniques used as the primary anaesthetic or adjuvant to a general anaesthetic. To gain the patient's confidence and minimize anxiety it is important to explain the sequence of events that will take place on arrival in the anaesthetic room or operating theatre.

Side-effects must be discussed when obtaining consent. Pain at the site of injection occurs in about 30% of patients. 10% may experience tingling or numbness for up to 48 hours. Patients must be advised not to go near hot or cold objects and to beware of trauma to a numb extremity for up to 48 hours. Rare complications such as infection and bleeding should also be mentioned. Complications specific to individual blocks should be discussed. For example, in interscalene block, hoarseness, Horner's syndrome or difficulty with coughing (secondary to phrenic nerve paralysis) should be outlined.

Patients must be told that even with a limb blocked satisfactorily for surgery some sensation of movement and touch may occur otherwise they may panic when they feel touch during surgery. The sensation can be likened to that felt following dental local anaesthesia. “Touch may be felt but pinching is not painful”.

Explain to the patient that pain will occur when the block wears off and give them advice about pre-emptive analgesia.

**Choice of equipment**

**Needles:** the popularity of needle types is often based on their likelihood of causing trauma to nerve tissue, but the incidence of peripheral nerve injury is small. Debate continues over the use of pencil-point needles, short bevelled needles or sharp needles. There are no clinical outcome studies implicating bevel design as a consistent factor in nerve injury. Evidence suggests that sharp needles cause less nerve damage, which is more rapidly repaired. Using a short bevelled block needle gives a better 'feel' of deeper tissue planes. Over-zealous seeking of paraesthesia should not take place.

When used in conjunction with a nerve stimulator in a conscious, relaxed patient, a carefully performed nerve block is unlikely to cause significant nerve injury. For single-shot techniques with needle and nerve stimulator, the Stimuplex short bevelled needle is excellent (Figure 2). It is available in various lengths, is well made and easy to hold. For a continuous catheter technique the combined Braun sheathed Tuohy needle, with side

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1 If bone graft is being harvested from non-blocked site general anaesthesia is usually necessary (e.g. iliac crest graft).

If several blocks are being considered is this acceptable to the patient or is sedation required (e.g. ankle block)?

2 The Stimuplex short bevelled needle.

3 Braun catheter.

4 Patient attached to nerve stimulator.
### Upper limb block

<table>
<thead>
<tr>
<th>Block site</th>
<th>Primary anaesthesia</th>
<th>Adjunct to general anaesthesia</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Volume of local anaesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plexus blocks</td>
<td>Yes</td>
<td>Yes</td>
<td>Broad coverage</td>
<td>Variable block until experienced</td>
<td>20–40 ml</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block at elbow</td>
<td>Possibly</td>
<td>Yes</td>
<td>Add on to brachial block if patchy</td>
<td>Does not cover tourniquet</td>
<td>5 ml/nerve</td>
</tr>
<tr>
<td>Block at wrist</td>
<td>Possibly</td>
<td>Yes</td>
<td>Easy</td>
<td>Does not cover tourniquet</td>
<td>3–5 ml/nerve</td>
</tr>
<tr>
<td>Distal block</td>
<td>Yes</td>
<td>No</td>
<td>Easy</td>
<td>None</td>
<td>5 ml</td>
</tr>
<tr>
<td>Other</td>
<td>Yes</td>
<td>No</td>
<td>Easy</td>
<td>Bloodless field not obtained</td>
<td>30–40 ml</td>
</tr>
</tbody>
</table>

**Median, Ulnar, Radial**

**Block at elbow**
- Femoral, obturator, lateral cutaneous nerve of thigh; **Sciatric, Saphenous, sural, superficial peroneal, deep peroneal, posterior tibial.**

**Block at wrist**
- Femoral, obturator, lateral cutaneous nerve of thigh; **Sciatric, Saphenous, sural, superficial peroneal, deep peroneal, posterior tibial.**

**Distal block**
- Femoral, obturator, lateral cutaneous nerve of thigh; **Sciatric, Saphenous, sural, superficial peroneal, deep peroneal, posterior tibial.**

**Other**
- Femoral, obturator, lateral cutaneous nerve of thigh; **Sciatric, Saphenous, sural, superficial peroneal, deep peroneal, posterior tibial.**

Injection port and catheter is useful and well made (Figure 3). It is particularly useful following surgery when a continuous physiotherapy machine is required (e.g. post shoulder release).

**Nerve stimulator:** there is little evidence that postoperative nerve injury is reduced by the use of nerve stimulators. There are also few studies to verify improved success of blocks. Ultrasound-guided block needles improve success in block placement. It is mandatory to use a nerve stimulator in some approaches to the brachial plexus (e.g. interscalene block because of proximity of the major blood vessels and CSF). The negative lead of the nerve stimulator should be attached to the needle and the positive lead attached to an ECG sticker at least 10 cm away from the limb to be anaesthetized (Figure 4). A current of 1 mA is used initially. Once the needle tip approaches the nerve/s to be blocked the current should be reduced to about 0.4 mA. Muscle twitching in the appropriate muscle group at this current indicates close proximity of the needle tip to the nerve. Muscle twitching at lower currents may indicate intraneural placement of the needle, though the patient will usually let you know if this occurs!

### Useful blocks in the ambulatory setting

**Upper limb blocks:** ambulatory orthopaedic surgery lends itself to the use of nerve blocks as both primary anaesthetic and as an adjunct to general anaesthesia (Figure 5). The main limiting factor

### Lower limb blocks

<table>
<thead>
<tr>
<th>Block site</th>
<th>Primary anaesthesia</th>
<th>Adjunct to general anaesthesia</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Volume of local anaesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal blocks</td>
<td>Yes</td>
<td>Yes</td>
<td>Useful in avoiding central blockade</td>
<td>None</td>
<td>20 ml</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Experience required</td>
<td>20 ml</td>
</tr>
<tr>
<td>At knee</td>
<td>No</td>
<td>Yes</td>
<td>Useful analgesia</td>
<td>Sometimes patchy</td>
<td>15 ml</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10 ml</td>
</tr>
<tr>
<td>At ankle</td>
<td>No</td>
<td>Yes</td>
<td>In sick patients</td>
<td>5 injections</td>
<td>20–30 ml</td>
</tr>
<tr>
<td>Distal</td>
<td>Yes</td>
<td>Yes</td>
<td>Easy</td>
<td>None</td>
<td>5 ml</td>
</tr>
<tr>
<td>Other</td>
<td>Yes</td>
<td>No</td>
<td>Easy</td>
<td>No bloodless field</td>
<td>30–40 ml</td>
</tr>
</tbody>
</table>

1Femoral, obturator, lateral cutaneous nerve of thigh; **Sciatric, Saphenous, sural, superficial peroneal, deep peroneal, posterior tibial.**

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for use as a primary anaesthetic is the use of tourniquets. The tourniquet must be placed on an anaesthetized part of the limb. With brachial plexus block this is easily accomplished, but with isolated nerve blocks the use of a tourniquet rules out blocks as the primary anaesthetic. If surgery takes less than 10 minutes a tourniquet may be tolerated, particularly with the use of sedation (e.g. carpal tunnel decompression under local infiltration).

For proximal upper limb surgery, the block of choice is the interscalene brachial plexus block. Shoulder arthroscopy, manipulation and arthroscopic rotator cuff repair may be extremely painful postoperatively. Interscalene anaesthesia is ideal. It is relatively easily performed using a nerve stimulator, the plexus usually being superficial at this level.

Most ambulatory orthopaedic surgery is performed on the distal part of the arm. In the forearm, removal of internal fixation devices is a commonly performed procedure. For forearm surgery the axillary approach to the brachial plexus is reliable and effective and may be used as the primary anaesthetic. Hand surgery is easily performed under axillary brachial plexus blockade.

The axillary approach is safe and reliable. Occasionally abduction at the shoulder joint is difficult, making an axillary approach impossible. In this situation, supraclavicular, infracavicular or subcoracoid approaches to the brachial plexus may be used. Both supra- and infracavicular approaches carry the risk of pleural puncture; the subcoracoid approach does not. In conjunction with a nerve stimulator the plexus is easily identified and block may be successfully achieved.

Nerve blocks at the elbow may be used to supplement brachial plexus blockade. Occasionally a nerve may be ‘missed’, requiring further block at the elbow. However, some anaesthetists consider that the likelihood of nerve damage is increased by attempting to block a partially anaesthetized nerve because parasthesia is decreased. The nerves at the elbow are superficial and paresthesia must not be sought over-zealously.

Distal nerve blockade at the wrist is usually used only as an adjunct to general anaesthesia due to use of a tourniquet. Surgery on the finger may be performed under ring block. A bloodless field is achievable using a finger tourniquet applied by the surgical team following block.

Bier’s block is useful for simple forearm manipulations. Most surgeons do not use it for open procedures (e.g. excision of Dupuytren’s contracture) because anaesthetic may ooze into the operative field.

Local infiltration is a useful anaesthetic tool. It may be used with a tourniquet for short procedures. It is valuable as an adjunct to general anaesthesia and for postoperative analgesia.

Lower limb blocks (Figure 6) are under-used. They are most appropriate when used with a general anaesthetic. Proximal lower limb surgery is unusual other than for removal of internal fixation devices (several performed in the ambulatory setting). Removal of small screws usually benefits from simple local infiltration by the surgeon. Most lower limb ambulatory orthopaedic surgery is distal. Commonly performed distal lower limb orthopaedic operations include bunion and bunionette excision, Zadek’s procedure, removal of metalwork from distal tibia and fibula, excision of soft tissue lesions (e.g. Morton neuroma). Owing to the use of proximal tourniquets local anaesthetic techniques are not commonly used as the primary anaesthetic. However, local blocks are an excellent adjunct to general anaesthesia.

**Anaesthesia for Reconstructive Free Flap Surgery**

Jane Quinlan

Reconstructive free flap surgery is a complex method of wound closure for large wounds not amenable to linear (primary) closure. It involves the transfer of free tissue (skin, muscle, bone, bowel or a combination) to a site of tissue loss where its circulation is restored via microvascular anastomoses. A muscle flap produces a more even contour and better aesthetic appearance than that achieved by a simple skin graft and provides a better defence against infection. The defect may be caused by trauma, infection or extensive surgery (e.g. mastectomy, head and neck cancer). The site and size of the defect determines which flap is used. The most commonly used flaps are the gracilis muscle for lower leg trauma; latissimus dorsi and rectus abdominis for breast reconstruction; and pectoralis major and radial forearm flap for head and neck reconstruction.

In patients with lower third tibial defects, free tissue transfer is typically required. The bony injury should be repaired and adequate debridement achieved before skin and muscle coverage begins. This should occur within the first 6 days after injury before colonization of the wound and the risk of complications increases. In patients with multiple trauma, any life-threatening injuries must be addressed first and the patient’s haemodynamic status stabilized before reconstructive surgery is contemplated.

**Flap transfer**

The free flap is transferred with its accompanying artery and vein, which are then reattached to vessels at the donor site using microvascular techniques. The stages of flap transfer are:

- flap elevation and clamping of vessels
- primary ischaemia as blood flow ceases and intracellular metabolism becomes anaerobic (this is dependent on surgical time and lasts 60–90 minutes)
- reperfusion as the arterial and venous anastomoses are completed and the clamps released
- secondary ischaemia is subsequent to hypoperfusion of the flap (minimized by appropriate anaesthetic management).

**Primary ischaemia**

With cessation of blood flow, the flap becomes anoxic. In the presence of anaerobic metabolism, lactate accumulates, intracellular pH drops, ATP decreases, calcium levels rise and pro-

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