Procedures in Practice

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STANDARD INTRAVENOUS REGIONAL ANALGESIA

Intravenous regional analgesia is a useful method of anaesthetising the arm for the manipulation of fractures and for minor surgical procedures. The technique has been simplified for use in the accident and emergency and orthopaedic departments at this centre and is routinely carried out by the casualty officer or junior orthopaedic doctor who is manipulating a fracture or operating on an injured arm.

Preparing the patient and equipment

Doses of anaesthetic agents

	Bupivacaine 0.25%*	Prilocaine 0.5%†
Child (7-10 years)	15 ml	15 ml
Child (11-13 years)	20 ml	20 ml
Adolescent (14-17 years)	30 ml	30 ml
Adult	40 ml	40 ml

*Calculated on dose of 1.5 mg/kg body weight.

†Calculated on dose of 3 mg/kg body weight.

No premedication is required and the patient does not have to fast. He must, however, be co-operative, and during the procedure each stage of the anaesthetic method should be explained by the doctor. Children aged under 7 years are usually unsuitable because of difficulty in obtaining co-operation. Serious side effects are rare, as described below, but it is essential to have resuscitation equipment readily available should one occur. Because this method of anaesthesia depends on isolating the limb from the general circulation the pneumatic tourniquet to be used should be checked for any leakage before the procedure. The blood pressure must also be recorded before the procedure.

The upper arm is fully exposed and a pneumatic tourniquet cuff applied over wool padding. The tourniquet is inflated to 50 mm Hg to allow the veins of the hand to become prominent, and a 23-gauge butterfly-type needle is inserted into a vein on the dorsum of the hand. Accurate venepuncture is essential.

The tourniquet is deflated and the arm raised for one minute to encourage venous drainage. The use of an Esmarch bandage to exsanguinate the limb is necessary only if this is required to facilitate surgery.

The tourniquet is inflated to at least 50 mm Hg above the systolic blood pressure, but for normotensive patients we routinely use a cuff pressure of between 200 and 250 mm Hg. The arm may now be lowered to a comfortable position. The tourniquet pressure gauge should be observed regularly throughout the anaesthetic by an attending nurse.

An intravenous injection of the selected anaesthetic agent is given over 20 seconds through the indwelling needle. The table shows the appropriate doses of bupivacaine 0.25% (Marcain) and prilocaine 0.5% (Citanest) for use in adults and children. We have used these doses routinely over the past four years.

After the injection the hand feels either warm or cold, and then the forearm and hand begin to tingle. The tingling is followed by the appearance of areas of pallor and other areas of redness or cyanosis on the skin of the forearm. Six to eight minutes after the injection the arm is usually anaesthetised, with complete analgesia from elbow to finger tip and partial analgesia between the cuff and the elbow. Muscular relaxation usually occurs 10 minutes after injection and occurs more reliably with bupivacaine than with prilocaine.

In children additional reassurance that the anaesthetic method has worked is recommended. This is best done by asking the child to prick the anaesthetised skin himself with a needle, which he finds quite painless, thus increasing his confidence in the technique.

Manipulation of the fracture or the operation may now be carried out. We have found that operations that take longer than 45 minutes are associated with unacceptable discomfort at the site of the cuff, and we would therefore recommend that this procedure using a single-cuff technique is not suitable for any operation that will take longer than 40 minutes.

After the operation

When the operation or manipulation has been completed and if necessary a plaster cast applied the tourniquet is deflated in one stage (some anaesthetists reinflate the tourniquet after a few minutes and then deflate again, but this is not our practice); deflation of the tourniquet must not be carried out within the first 20 minutes after the anaesthetic injection. Sensation and power will gradually return to the forearm and hand over the subsequent 10 minutes, when the patient may be discharged from hospital.

Contraindications

Adrenaline should never be used with the anaesthetic agent in an intravenous block. Sickle-cell disease or trait and vascular disease of the arm (Raynaud's disease and scleroderma) are absolute contraindications, as is hypersensitivity to local anaesthetic agents. Cellulitis in the limb rules out Bier block owing to the risk of spread of infection and small-vessel thrombosis.

Side effects

Side effects from this procedure may be minor—those not upsetting the patient but possibly indicating slight systemic toxicity of the anaesthetic agent—or major, when there may be a serious risk to the wellbeing of the patient.

Minor side effects are noted most commonly shortly after deflation of the tourniquet cuff and include ringing in the ears, a metallic taste in the mouth, slight drowsiness, and generally feeling funny. In addition, a few patients complain of tingling or burning in the fingers or hand for about a minute. The incidence of these minor systemic side effects is around 10% for prilocaine and 20% for bupivacaine.

Major side effects have not occurred in over 7500 procedures at this hospital; in particular, we have never had to resuscitate a patient or admit any patient to hospital as a result of side effects. Major side effects when using prilocaïne have not been reported in Britain, but 11 cases of convulsions either during or after the procedure when using bupivacaine have been reported, the incidence being between two and seven in 10 000 cases. The management in these circumstances is to give an intravenous bolus of diazepam 10 mg. Continuing convulsions indicate the need for a further 10 mg bolus of diazepam, but uncontrolled convulsions will need urgent intensive treatment including the use of more potent anticonvulsant agents. There are now three reported cases of convulsions leading to death after intravenous regional analgesia using bupivacaine, but none when prilocaïne has been used. In all three cases an automatic tourniquet was used, and in one of these the tourniquet failed during the procedure: hence the importance of checking the equipment first.

We have not had any cases of tourniquet palsy associated with this procedure, although radial nerve weakness may be noted for up to eight hours, possibly due to a local effect of the anaesthetic agent.

Modifications for special circumstances

Procedures around elbow joint—For operations around the elbow and for the reduction of simple elbow dislocations without fracture of the radial head or neck this anaesthetic method is less reliable in producing analgesia. Improved analgesia may be obtained by giving the anaesthetic agent into a vein in the antecubital fossa instead of into the dorsum of the hand. It is also essential to apply the tourniquet high in the arm to avoid mechanically obstructing reduction of the elbow dislocation.

Prolonged procedures—During prolonged operations or manipulations patients experience increasing discomfort from the site of the tourniquet cuff. To counteract this a double-cuff technique may be used, with the proximal cuff applied high on the arm and inflated first and the second cuff applied below and inflated only once the analgesic has taken effect. The first cuff may then be deflated, and the tourniquet is therefore now applied over a partially or completely anaesthetised area. This may allow procedures taking up to one hour to be carried out. We do not use the double-cuff technique routinely but recommend its use for any procedure that may take over 30 minutes.

Physiological saline

Improving the analgesic effect—In general we find the drug dosage regimens given above to be satisfactory. Occasionally an improved analgesic effect may be obtained by giving a follow-up injection to the anaesthetic injection of up to the same volume again of physiological saline.

Use in the legs—This procedure may also be used to provide analgesia in the legs. Unfortunately, a thigh tourniquet is often uncomfortable and limits the use of this method. We have found that a calf tourniquet (applied well below the neck of the fibula to avoid the common peroneal nerve), using the same dosage of anaesthetic agent and the same tourniquet cuff pressures as for the arm, is successful for some operations on the feet.

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