

INTRAVENOUS REGIONAL ANAESTHESIA - BIER'S BLOCK

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Intravenous regional anaesthesia (IRVA) was first described by Augustus Bier in 1908; his technique was repopularised by Holmes in 1963. The administration of intravenous local anaesthetic in an isolated limb by means of an ischaemic cuff is a simple and effective technique, with a low incidence of failure and high degree of safety.

Clinical Application

IVRA is ideally suited to operations of the distal arm or leg (i.e. below the elbow or knee), such as reduction of a radial or ulna fracture. IVRA is useful for only short surgical procedures; performed in 40 minutes or less (the length of operating time is limited by tourniquet pain, which usually develops after 40 to 60 minutes).

IVRA is often a safer option than general anaesthesia, particularly if the patient is elderly, or has cardiovascular or respiratory disease. Of particular importance in hypertensive patients, the tourniquet cuff used must be sealed and inflated to the correct pressure (see below).

Contraindications to IVRA

- Severe Raynaud's Disease (intermittent arteriolar vasospasm of the distal limbs after cold or emotional stimuli).
- Sickle Cell Disease (IVRA is relatively contraindicated, unless meticulous exsanguination of the limb takes place prior to cuff inflation).
- Crush injury to the limb, IVRA may provoke further tissue damage secondary to hypoxia.
- Age - young children are generally not amenable to IVRA alone, however in combination with sedation and additional analgesia it can be used successfully.
- Patients should be starved, as there may be a possibility of conversion to a general anaesthetic, alternatively the patient may require sedation in addition to IVRA to improve co-operation.

Equipment Required For IVRA

- A single or double tourniquet cuff that has been checked to ensure that it **does not leak**, and can be inflated 50 to 100mmHg above the patient's systolic blood pressure.
- Two intravenous cannulae, one for venous cannulation distal to the tourniquet and one for cannulation in the opposite arm to allow access to the circulation if required in the event of complications.
- Full resuscitation equipment and ECG monitoring at all times including immediately after tourniquet deflation.

Drugs Required For IVRA

Prilocaine is the local anaesthetic agent of preference because of its high margin of safety (it has a high therapeutic index). 40ml of 0.5% prilocaine is recommended, although larger volumes will be required for lower limb IVRA (60ml). The maximum dose is 400mg for a 70kg adult (approximately 6mg/kg) which equates to 80ml of 0.5% solution.

Lignocaine is a useful alternative agent. On average 40ml 0.5% lignocaine is required. The maximum dose is 250mg for a 70kg adult (approximately 3mg/kg), which equates to 50ml of a 0.5% solution. Only plain solutions of prilocaine or lignocaine should be used (without adrenaline).

Bupivacaine is unsuitable for IVRA and should never be used due to its cardiotoxic profile (leading to ventricular arrhythmias and death).

IVRA Technique (Figure 1)

- Attach patient to ECG monitor and measure the blood pressure.
- Insert a cannula as distal as possible in the limb to be operated upon.
- Insert a second cannula into the opposite arm for intravenous access (in case of emergency).
- Exsanguinate the limb either with an Esmarch rubber bandage or by simply elevating the limb for several minutes, with brachial / popliteal artery occlusion.

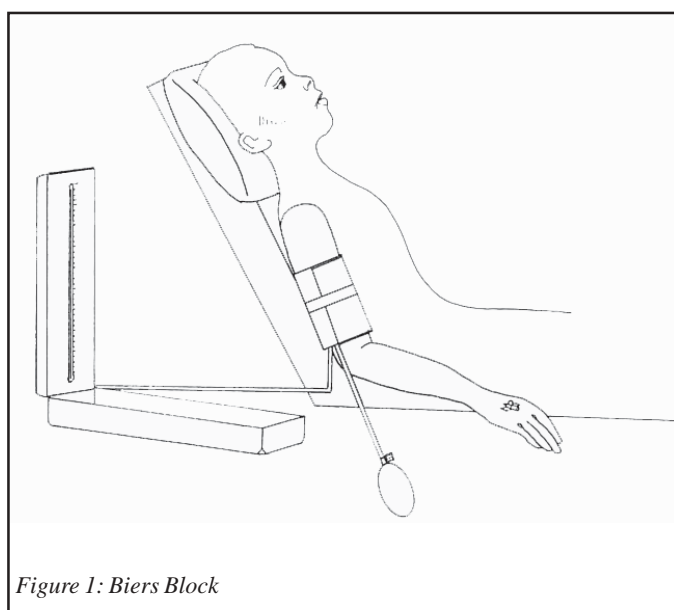


Figure 1: Bier's Block

- Protect the upper part of the limb with wadding before placing and inflating the tourniquet to 50 - 100mmHg above their systolic blood pressure (typically 200 to 250mmHg). Check for an absent distal pulse on the limb (radial or dorsalis pedis). During the operation the tourniquet should be observed continuously to check for unintentional slow deflation.

- Inject the local anaesthetic solution slowly via the IV cannula and inform the patient that the limb will feel a little strange and become mottled in appearance. An assistant gripping the forearm during local anaesthetic injection will ensure the most of the anaesthetic solution is retained distally.

- Surgical preparation and draping may proceed about 5 minutes after local anaesthetic injection.

- The tourniquet must remain inflated for a minimum of 20 minutes from the time of local anaesthetic injection.

- Surgical procedures lasting longer than 40 minutes may result in the patient complaining of tourniquet pain, this can be reduced by the use of a double cuffed tourniquet - initially the uppermost cuff is inflated and this can be switched to the lower cuff. The addition of 150mcg clonidine to the local anaesthetic solution may reduce tourniquet discomfort and thus improve conditions. Alternatively, intravenous analgesia such as fentanyl, or ketorolac can be administered (via the emergency IV cannula in the other hand).

- At the end of the procedure the IVRA cannula is removed and the cuff deflated - close observation of the patient is crucial at this point, as this may result in systemic release of local anaesthetic. The patient's blood pressure should be measured and ECG monitoring continued for at least 10 minutes following cuff deflation.

Complications

IVRA is generally a safe technique. The most important complication to recognise is a leaking or accidentally deflated tourniquet cuff - this will result in a large volume of local anaesthetic being rapidly introduced into the circulation. The patient may develop dizziness, nausea, vomiting, tinnitus, perioral tingling, muscle twitching, loss of consciousness, and convulsions. Avoidable deaths have occurred.

Management of Systemic Toxicity of Local Anaesthetics

- **Airway** - Maintain the patient's airway, administer 100% oxygen and call for help. Turn the patient onto their side; lower their head if possible to prevent aspiration.
- **Breathing** - start ventilation if breathing inadequate. Intubate if indicated.
- **Circulation** - pulse check. If in cardiac arrest start CPR. Assistant to start monitoring ECG, pulse oximetry, and blood pressure.
- **Convulsions** - IV 5mg diazepam or 50mg - 200mg thiopentone. Muscle relaxation if required.
- **Hypotension** - IV ephedrine 3-6mg increments, elevate legs, IV fluid bolus

Summary

IVRA is a simple and effective regional anaesthetic technique to perform, provided that the cuff is checked, and its' pressure monitored.

Resuscitation and monitoring equipment should be readily available when conducting IVRA.

References

1. Gentili M Bonnet F Bernard JM. Adding clonidine to lidocaine for IVRA prevents tourniquet pain. *Anesthesia Analgesia* 1999;**88**:1327-30.
2. Haasio J Hippala S Rosenberg PH. Intravenous regional anaesthesia of the arm. *Anaesthesia* 1989;**44**:19 -21.