

BIERS BLOCK (IV REGIONAL ANAESTHESIA)

August Bier.

WHO WAS BIER?

The simple IV regional method of providing anaesthesia of the distal arm or leg was first described by **August Karl Gustav Bier** (1861 - 1949) in 1908. After a period of wide popularity, it fell into disuse until repopularised by Holmes in 1963. Bier was an innovative and somewhat unorthodox German surgeon working in Kiel. In 1898, Bier pioneered spinal anaesthesia. He also introduced the "tin helmet" into the German Army in World War One.

WHAT CAN THE TECHNIQUE BE USED FOR?

Intravenous regional anaesthesia (IVRA) is indicated for any procedure on the arm below the elbow or leg below the knee that will be completed within 40-60 minutes. Most commonly used for the reduction of closed forearm fractures, the technique can also be applied to the lower limb (with appropriate cuff size use). Onset of anaesthesia is rapid and reasonable muscle relaxation can be obtained. Its use is limited to procedures lasting less than an hour because of increasing discomfort from the tourniquet. It is not as useful for surgical procedures as venous pressures are high, and bleeding can be troublesome.

IS IT SAFE?

Intravenous regional anaesthesia is extremely safe and problems are few. But, it is not a technique for the careless operator! The most important complications are due to the toxicity of local anaesthetics and will occur if the tourniquet suddenly deflates soon after the local anaesthetic has been injected. Nearly all adverse effects have occurred following cuff failure (or failure to inflate!) in the first few minutes of anaesthetic administration.

WHO SHOULDN'T THE TECHNIQUE BE USED ON?

The basic contraindications are:

PATIENT FACTORS

- Unco-operative patients (of any age)
- Age < 14 years
- Unstable epilepsy
- Uncontrolled hypertension (systolic > 150mmHg)
- Severe liver disease
- Homozygous sickle cell disease (OK if heterozygous disease)
- Second or third degree heart block
- Compromised circulation in the limb (eg: PVD or severe Raynaud's)
- Soft tissue injury at tourniquet site
- Fracture at tourniquet site
- Caution in crush injuries as potentially viable tissue will be subjected to further hypoxia

DRUG, EQUIPMENT & PROCEDURE FACTORS

- Inadequate equipment & resuscitation gear available
- Careful, reliable and experienced staff not available
- Procedure > 60 minutes
- Allergy to amide anaesthetics

**PAEDIATRIC CONSIDERATIONS: HOW LOW CAN YOU GO?**

Although you could theoretically perform an IV regional block on a patient of any age, you do need a patient that understands the procedure, is co-operative and can tolerate some cuff discomfort. Usually this means an age > 14 years. The other factor is the theoretical risk of persistent medullary circulation in patients < 10 years (clinical significance unknown).

WHAT EQUIPMENT IS REQUIRED?

Before you start you should get together the following bits of kit:

- Consent form
- Twin cuff tourniquet machine
- Resuscitation gear
- 2*IV lines (one in each arm)
- Prilocaine ("Citanest")
- 2*20mL syringes
- Wide Velband roll
- Cotton ball & tape
- Plaster equipment as required
- A Nurse
- The Plaster Technician
- Another Doctor may be required.
- ECG monitoring, SaO₂ monitoring if elderly with heart or lung disease.

WHAT IS THE TECHNIQUE?

- Explain the procedure and obtain consent (written preferably)
- Insert IV lines. 2*20g are OK. Need one each arm (one for procedure, one for emergency access). Distal location in fractured limb gives better results (eg; dorsum of hand).
- Measure the patients BP. Will need to inflate cuff to 100mmHg above SBP. SBP > 150mmHg a contraindication.
- Premedication: Not usually required, but often have already had IV narcotic initiated. Consider a small dose of Midazolam if very anxious.
- Wrap 2-3 layers of velband around upper arm under cuff site
- Apply twin tourniquet cuff. Note: proximal & distal cuffs coded. Secure firmly with Velcro strips & tie downs.
- Elevate affected arm to allow venous drainage for about 2 minutes
- whilst the arm remains elevated, inflate cuffs to 250mmHg. Usually both are inflated, but another technique is to inflate the proximal cuff only, then if patient cuff discomfort is a problem, inflate the distal cuff (now over anaesthetised part of arm) before deflating proximal cuff. *BETWEEN! Make sure you get this sequence absolutely correct if using this technique!*
- The cuff should be placed on the upper arm (or thigh), NEVER on the forearm (or lower leg) as adequate arterial compression cannot be guaranteed.
- Check for cuff inflation. CRUCIAL! The machine displays set pressure, not actual pressure. The cuff can deflate and the readout still show a pressure! Physically check the cuff. Palpate for a pulse (there shouldn't be one...)



TOOLS OF THE TRADE: CUFF MACHINE

The twin cuff tourniquet must be specifically designed for the purpose. Do not use a normal sphygmomanometer! Ensure that the cuffs inflate properly. Check all connections are tight & secure and there are no leaks from the system.

Especially check the proximal & distal tubes & connections into the machine. Small sliders hold the tubes secure. The machine needs to be plugged in to work, but once inflated a power loss will not deflate the cuff (eg; unplugged to go to X-ray). Note that the readout will go blank, but the cuff should still be inflated. There is a timer built-in but this will not function without power. Use your watch to document cuff time. The Resuscitation box lives on the machine. It contains oral airways, benzodiazepines, syringes, etc for treating seizures.

- ▶ Inject dose of prilocaine and note the time. Inject as soon as limb ischaemia confirmed. The sequence of nerve conduction loss is as follows: paraesthesia develops first, then loss of pain sensation. The arm goes blue & mottled as autonomic nerves are blocked. Light touch & pressure may still be felt (warn the patient that this can be normal).
- ▶ Good anaesthesia can take up to 5-6 minutes. Remove IV from anaesthetised arm and keep firm pressure applied for 5 minutes to stop bleeding.
- ▶ Perform the required procedure.



TOOLS OF THE TRADE: LOCAL ANAESTHETIC AGENTS (PRILOCAINE)

Prilocaine is an amide anaesthetic and is the only agent that should be used for IVRA. There have been no fatalities reported with its use. It is the least toxic LA with the highest therapeutic index. High tissue binding and "low" cardiac & CNS toxicity combine to make it the drug of choice. A high volume-low concentration technique is employed. The maximum dose of prilocaine is 3mg/kg. It comes in a solution of 0.5% (5mg/mL), so usual maximum volumes:

- ▶ 80kg patient ~ 50mL
- ▶ 70kg patient ~ 40mL
- ▶ 60kg patient ~ 35mL
- ▶ 50kg patient ~ 30mL

Draw up maximum dose in syringe/s so that cannot inadvertently give overdose. *Rough rule of thumb: 1/2mL per kg bodyweight*

► WHAT LEVEL OF MONITORING IS REQUIRED?

As a general rule, a reliable, capable nursing or medical staff should be with the patient at all times to monitor the cuff and the patient. ECG monitoring may be required if there is a history of heart disease. SaO₂ monitoring may be required if there is a history of respiratory disease. Fit, young, healthy patients require only close visual observation.



TIME CRITICAL: WATCH THE WATCH

Duration of inflation should be carefully monitored. The cuff should be left inflated for a minimum of 20 minutes (to allow good tissue binding of prilocaine), but should be left on for no longer than 1 hour (to prevent limb ischaemia). It has been suggested that if the cuff is reinflated after 15-20 seconds for a further 1 minute (to allow more gradual release of prilocaine into the circulation) that this reduces the possibility of systemic toxicity. There is no evidence for this, and most clinicians would just simply deflate the cuff in one go.

WHAT OBSERVATIONS ARE REQUIRED AFTERWARDS?

Firstly advise the patient not to lift the arm, as poor proprioception and muscle strength can mean they damage the plaster or themselves. Patients should be observed for 30-60 minutes, looking for return of normal perfusion & neurological function. Compartment syndrome & neuropraxia should be specifically looked for. Local anaesthetic toxicity is rare (and usually occurs within the first few minutes if the cuff fails). Symptoms may include paraesthesia (especially circumoral), dizziness, tinnitus, muscle twitching, ALOC, seizures and cardiorespiratory arrest. Treat along standard protocol (ABCs, oxygen, IV diazepam/midazolam, etc)

WHEN CAN THE PATIENT GO HOME?

Once neurovascular function has returned to normal, compartment syndrome & neuropraxia have been ruled out, the adequacy of the procedure has been verified and discharge instructions understood.

WHAT DISCHARGE INSTRUCTIONS SHOULD BE GIVEN TO THE PATIENT?

The following instructions should be discussed with the patient:

- **Elevation:** Most important. A sling should be arranged before discharge. Exercises in a sling should be discussed. A printed Sling Discharge Information Sheet should be given.
- **Analgesia:** Appropriate & regular analgesia should be given. Don't be skimpy. Good analgesia gives better outcomes. Discuss the drugs you are prescribing, including the side effect profiles.
- **Neurovascular Complications:** Should be discussed. Severe pain, paraesthesia, loss of function or any concerns should prompt review. A printed Fracture Reduction Discharge Information Sheet should be given.
- **Discharge Letter:** Should be given for GP follow-up within 24-48 hours. They can perform a POP check
- **Orthopaedic Follow-up:** Remember to arrange outpatient follow-up. As a general rule, the Orthopaedic service wants to be informed of wrist fracture manipulations done in the ED, so that any that may need operative intervention can be identified early.
- **Printed Information:** Sling, POP and specific fracture Discharge Information Sheets should be given. Don't forget a GP letter.

THE LEAST YOU NEED TO KNOW

- IV regional anaesthesia (IVRA ~ Biers Block) is a safe and effective form of anaesthesia when performed properly
- It requires a co-operative, alert and mature patient
- Be aware of the contraindications list
- Check SBP before commencing IVRA
- Have IV access in the opposite arm
- Only use prilocaine 0.5% (5mg/mL) @ maximum dose 3mg/kg
- Staff member with patient at all times
- Check & monitor cuffs carefully
- Do not deflate cuffs for at least 20 minutes
- Do not leave cuffs up for more than 1 hour
- Have resuscitation gear to hand for treating seizures
- Monitor appropriate to clinical situation
- Good patient explanation helps
- Make sure discharge instructions are understood
- If you are unfamiliar with the technique, do not blindly proceed- get help from senior staff!



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- Dr Leo Marneros Staff Specialist GCH ED
- E-mail: vertical@qldnet.com.au
- Mobile: 0416 085 665