Objectives:

- Definition
- Indications & contraindications
- Procedure
- Complications (Prevention & Treatment)
IntraVenous Regional Anesthesia (IVRA), or “Bier block,” was first introduced in 1908 by the German surgeon August Bier.
A Bier block essentially consists of injecting local anesthetic solutions into the venous system of an extremity that has been exsanguinated by compression or gravity and that has been isolated by means of a tourniquet from the central circulation.
Indications

- Surgical procedures involving the arm below the elbow (open procedures or closed reductions)
- Surgical procedures involving the leg below the knee (open procedures or closed reductions)
- Surgical procedures that will be completed within 40-60 minutes
Contraindications

- The only absolute contraindication to IVRA is patient refusal.

- Relative contraindications include the following:
  - Compound/ comminuted fractures
  - Inability to locate peripheral veins
  - Local skin infections
  - History of allergy to local anesthetics
  - Patients with severe vascular injuries to the extremity
  - Preexisting vascular arteriovenous shunts
  - Sickle cell disease/ Raynaud's disease
  - Surgery planned for >1 hour are typically not good indication for IV regional anesthesia due to occurrence of Tourniquet pain.
Equipement

1. Local anesthetic agents: lidocaine, 0.25%–0.1%
2. Double tourniquet
3. One 20- or 22-gauge intravenous extracatheter
4. One 500-mL or 1-L bag of intravenous solution connected to an infusion set to be connected to the intravenous cannula to maintain its patency until the anesthetic solution is injected in the isolated extremity
5. (ASA) monitors
6. Resuscitation equipment
7. Two pneumatic tourniquets of appropriate size for the selected extremity
8. One Esmarch bandage
9. Sterile skin preparatory set
10. A 30- or 50-mL Luer lock syringe
11. One graduated measuring cup for the mixing of solution
12. Adhesive tape, various sizes
Advantages:
Easy to administer
Low incidence of block failure
Safe technique
Rapid onset and recovery
Muscle relaxation for the surgeon
**Procedure**

1. **An indwelling plastic catheter is inserted** into a peripheral vein as far distally as possible.

2. **A double-pneumatic tourniquet is placed on the proximal cuff high on the upper arm**.

3. **The entire arm is elevated to allow passive exsanguination**, and a rubber *Esmarch* bandage is wrapped around the arm spirally from the fingertips of the hand to the distal cuff of the double tourniquet to exsanguinate the arm.
4. **The axillary artery is digitally occluded**, and while pressure is maintained on it, the proximal pneumatic cuff is inflated to **50–100 mm Hg** above the systolic arterial blood pressure, after which the Esmarch bandage is removed.

5. Following inflation of the proximal cuff and removal of the Esmarch bandage, **30–50 mL of 0.5% lidocaine HCl are injected** via the indwelling plastic catheter.

6. To the level of the procedure table, the intravenous cannula in the surgical extremity is withdrawn, and pressure is quickly applied over the site using sterile gauze.

7. **About 25–30 minutes after the onset of anesthesia or when a patient complains of tourniquet pain, the distal cuff is inflated and the proximal cuff is deflated** to minimize the development of tourniquet pain.
Lower Extremity IVRA
The only significant difference is that the IVRA technique for the lower extremity requires relatively larger volumes of local anesthetic solutions by virtue of the obvious size disparity between upper and lower extremities. This is necessary to more completely fill the larger vascular compartment of the lower extremity from the distally placed intravenous cannula to the proximal tourniquet (100 mL vs. 50 mL).
Complications

- Complications may be classified either as drug or equipment
- **Drug related:**
  Lidocaine is the most commonly utilized local anesthetic for IVRA, Excessive plasma concentrations of lidocaine, result in peripheral vasodilation and diminished cardiac contractility, usually seen clinically as hypotension.
  Tx: Consider lipid emulsion therapy
Prevention:
- Ensure appropriate drug selection
- Minimize Drug leakage

* Lidocaine becomes tissue bound in 30min, the cuff should not be deflated before 30mins to prevent systematic toxicity.
• Prilocaine, is associated with the formation of methemoglobin (MetHb), which occurs about 4 to 8 hours after its administration.
• Policaine is metabolized to orthotoluidine, an oxidizing compound capable of converting hemoglobin to MetHb.
• Tx: methylene blue
Device related:
- Systemic hypertension may result from tourniquet inflation that is sustained or prolonged.
- Tourniquet Pain: Due to direct pressure of the tourniquet applied to nerves, which subsequently exhibit histologic changes resembling crush injuries. It is recommended that tourniquet time not exceed 2 hours to reduce the likelihood of capillary and muscle damage secondary to tissue acidosis.
Compartment syndrome may occur rarely following IVRA, may be due both to the large volume of local anesthetic injected and to inadequate or incomplete exsanguination of the limb prior to performing the block. 
Tx: Fasciotomy
Video

- https://www.youtube.com/watch?v=S_9dTd2FoA0
References

- https://en.wikipedia.org/wiki/Intravenous_regional_anesthesia
- Morgan and Mikhail Clinical Anaesthesiology