Recent Modalities of Intravenous Regional Anaesthesia

An Essay

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***Asmaa Ahmed Nabeeh Allam**.*

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LIST OF ABBREVIATIONS

Abbr.	Title
Ach	Acetyl-choline
ACLS	Advanced Cardiac Life Support
ASA	American Society of Anaesthesia
ATP	Adenosine Triphosphate
BDZ	Benzodiazepines
CB	Cannabinoid Receptors
c-GMP	cyclic Guanine Monophosphate
CNS	Central Nervous System
CSF	Cerebrospinal Fluid
CVS	Cardiovascular System
DBP	Diastolic Blood Pressure
G	Gauge
GA	General Anaesthesia
GABA	Gamma-Aminobutyric acid.
h	hour
HR	Heart Rate
IV	Intravenous
IVRA	Intravenous Regional Anaesthesia
Kg	Kilogram
LA	Local Anaesthetic
LAST	Local Anaesthetic Systemic Toxicity
M	Muscarinic Receptors
MAP	Mean Arterial Blood Pressure
MDA	Malondialdehyde
mg	Milligrams
Min	Minute
ml	Milliliters
ng	nanograms

NMDA	N-methyl-D-aspartate receptor
NO	Nitric Oxide
NSAID	Non Steroidal Anti-inflammatory Drugs
NTG	Nitroglycerine
SBP	Systolic Blood Pressure
VAS score	Visual Analogue Scale Score
VASC	Voltage Gated Sodium Channel
μ	mu Opioid Receptors
δ	Delta Opioid Receptors
κ	Kappa Opioid Receptors

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Abstract

This work discussed the technique. Major and minor complications of intravenous regional anaesthesia (IVRA) and the possibility of using it in the lower limb operations.

Then it discussed the pharmacology of local anesthetics, it toxicity and the adjuvants that can be used, the most important about adjuvants is the prolongation of post operative analgesia and tourniquet pain.

Keyword: intravenous regional anaesthesia (IVRA), local anaesthetics complications toxicity, adjuvants

Introduction

Intravenous regional anesthesia (IVRA) was first described by August Bier in 1908 for anesthesia of the hand and forearm. After losing popularity following the advent of brachial plexus blocks, Holmes revived the technique in 1963 when he substituted lidocaine for the use of procaine. IVRA is suitable for operations of the distal extremities, in situations where it is safe and easy to apply an occlusive tourniquet. It is mainly used for surgical procedures of the upper extremity, but it can also be used for procedures involving the lower extremity. The primary advantages of IVRA are its simplicity, reliability, and cost-effectiveness. It is a regional anesthetic technique that is easy to perform, with success rates varying between 94% and 98%. For these reasons, it remains a popular choice among anesthesiologists. Constraints of anesthetic duration and tourniquet time limit the use of this technique to short procedures (approximately 20–60 minutes). The rapid recovery of function make this technique ideally suited for surgeries performed in an ambulatory setting. ***(Flamer and Peng, 2011)***

Essentially all complications have been related to the systemic pharmacologic effects of the local agent used; Bier himself recognized the potential toxicity of local anaesthetics recommending to keep the tourniquet inflated for at least 20 min and restore blood flow gradually. Pneumatic compression of tourniquet can lead to tissue damage. Nerve is more susceptible to mechanical pressure, whereas muscle is more vulnerable to ischaemia. Really problems specifically related to the use of ischaemic tourniquets in an IVRA context have been seldom recorded. ***(Rodola et al., 2003)***

Local anaesthetic agents are used directly to block neuronal transmission. They also stabilize other electrically excitable membranes, and some examples, such as lidocaine, have clinically useful antiarrhythmic activity. They act by blocking the fast sodium channel in neuronal membranes. To do so the drug must be in the protonated form and the ion channel must be in the open state. ***(Smith, 2009)***

Intravenous Regional Anaesthesia can be used to perform local anesthesia for upper (hand and forearm) and lower limbs, simply by injecting a local anesthetic into the distal vein while using a proximal tourniquet to occlude the circulation. Lidocaine became the local anesthetic of choice for it because of the lack of cardiac toxicity and neurotoxicity. The main problem that was faced by the anesthetists was the short anesthetic and analgesic duration of lidocaine. Hence, many additives were tried to overcome this problem and to prolong its duration. Muscle relaxants, ketamine, ketorolac, and opioids are examples of these adjuvants, and their effects have been studied in details. In addition, clonidine and dexmedetomidine, when used as adjuvants in Bier's block, proved to be effective in decreasing the anesthetic requirements and prolonging the analgesic duration. ***(Youssef and El Zayyat, 2014)***

Chapter 1
Technique and Complications of Intravenous Regional Anaesthesia

Different anaesthetic agents have been used in IVRA since its initial description including procaine, lidocaine, prilocaine. Researches focused on the selection of the ideal local anaesthetic for IVRA, the one that has adequate intra-operative analgesia without systemic toxicity following tourniquet deflation, hence the use of bupivacaine is dangerous due to the related to severe form of cardiotoxicity, while the use of chlorocaine had been stopped after reports of its hypersenitivity and post anaesthetic thrombophlebititis. The ideal local anaesthetic agent for this technique is the one that has good local anaesthetic activity with low cardiovascular and central nervous system toxicity. Lidocaine is the one that is most commonly used for this technique although prilocaine is better tolerated in terms of systemic toxicity. ***(Prieto-Alvarez et al., 2002)***

In a retrospective record analysis to compare the cost and effectiveness of intravenous regional anaesthesia (IVRA) with general anaesthesia (GA) for outpatient hand surgery, the costs of anaesthesia and recovery were calculated, effectiveness was measured in terms of time for anaesthesia, recovery and discharge. Recovery was faster in the IVRA group, vomiting requiring treatment occurred in 5% of the GA group, but in none having IVRA. Dizziness which delayed discharge also occurred in 5% of the GA group, but in none having IVRA. The conclusion of this study was that the cost of anaesthesia and recovery using IVRA for

outpatient hand surgery was half that of GA. Intravenous regional anaesthesia was less effective than GA in achieving satisfactory anaesthesia, equally effective in time to administer anaesthesia, and more effective in speeding recovery and minimizing postoperative complications. ***(Chilvers et al., 1997)***

Mechanism of Action of IVRA

The injected LA diffuses into the small veins surrounding the nerves and then into the vasa nervorum and capillary plexus of the nerves, leading to a core-to-mantle (centrifugal) conduction block in the nerves involved. It then spreads around the small nerves in the skin, blocking their conduction. ***(Elmetwaly et al., 2010)***

Indications

Outpatient surgical procedures with a maximum length of 1 h in the forearm or hand (standard application) and in the lower leg and foot. ***(Jankovic, 2015)***

Specific Contraindications

• Patient refusal.
• Local infection in the area to be anesthetized.
• Local nerve damage.
• Peripheral vascular diseases
• Severe decompensated hypovolemia, shock.
• Certain cardiovascular diseases, including bradycardia, second-degree AV block, any history of a tendency to syncope.
• Musculoskeletal diseases. ***(Jankovic, 2015)***

Materials and preparations

- Tow 20-mL syringes.
- Saline.
- Cotton-wool paddin
- Esmarch bandage.
- Local anesthetic.
- Disinfectant
- Pneumatic tourniquet device (double-lumen) Fig 1.1, Fig 1.2. ***(Jankovic, 2015)***

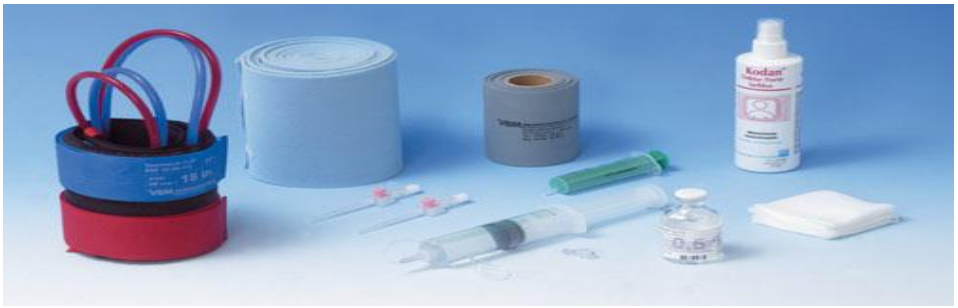

Fig. 1.1 Materials. ***(Jankovic, 2015)***