Adrenaline vasoconstrictor and local anaesthetics

Adrenaline (epinephrine) is a **potent vasoconstrictor** commonly used as an **adjuvant to local anaesthetics** . Its primary role is to **prolong the duration of anaesthesia** , **reduce systemic absorption** , and **minimize toxicity** by confining the local anaesthetic to the site of injection.

Mechanism of Action

- **Adrenaline acts on ?-adrenergic receptors** , causing **vasoconstriction** of blood vessels at the injection site.
- This **reduces local blood flow** , leading to:
  - Slower absorption of the anaesthetic
  - Prolonged action at the site of injection
  - Decreased risk of systemic toxicity
  - Reduced intraoperative bleeding (relative ischemia)

Clinical Effects of Adrenaline with Local Anaesthetics

Prolonged local anaesthetic effect
Decreased rate of systemic absorption
Localized drug action with reduced systemic toxicity
Improved surgical field visibility due to reduced bleeding

Clinical Use

Adrenaline is commonly added to local anaesthetics in:

- **Nerve blocks**
- **Infiltration anaesthesia**
- **Dental procedures**

Not recommended in:

- **Spinal (intrathecal) or epidural anaesthesia with bupivacaine**
- **Anaesthesia in end-arterial areas** (e.g., **fingers, toes, ears, nose, penis**)

  Risk of **ischemia and tissue necrosis**

Pharmacokinetics

- **Reduced perfusion** at the injection site leads to:
  - Lower concentration gradient between endoneural space and capillaries
  - Reduced diffusion of anaesthetic into systemic circulation

Alternative Vasoconstrictors

- **Norepinephrine** – occasionally used but less common
- **Felypressin** – a **vasopressin analogue** , used when epinephrine is contraindicated
  - **No arrhythmogenic action**
  - **Less reactive hyperemia**
  - **Higher risk of coronary artery vasoconstriction**

Adverse Effects of Catecholamine Vasoconstrictors (e.g., Adrenaline)

- **Reactive hyperemia** after washout
- **Cardiostimulation** if systemically absorbed
  - Tachycardia
  - Hypertension
  - Arrhythmias

Dosage and Concentration

Adrenaline concentrations in local anaesthetic solutions:

Ratio	Concentration (µg/mL)	Example Max Volume
1:80,000	12.5 µg/mL	20 mL (250 µg)
1:100,000	10 µg/mL	25 mL (250 µg)
1:200,000	5 µg/mL	50 mL (250 µg)

Expression : Adrenaline concentration is written as the ratio of grams per mL.
E.g., **1:100,000** = 0.01 mg/mL or 10 µg/mL.

Maximum Safe Dose

- **250 micrograms** of adrenaline is considered a general maximum safe dose in local anaesthesia.
- This corresponds to:
  - **20 mL of 1:80,000** , or
  - **50 mL of 1:200,000**

High yield Points

- Always **avoid adrenaline** in **end-artery regions** .
- **Monitor cardiovascular status** , especially in cardiac patients.
- Use **lowest effective concentration** to minimize systemic effects.
- Be aware of **drug interactions** (e.g., tricyclic antidepressants, MAO inhibitors).