

Pharmacodynamics of Local Anaesthetic drugs

What the drug does to the body -
Effects on Body Systems

Pharmacodynamics of Local Anaesthetic Drugs

- Effects on excitable cells
 - CNS
 - Smooth muscle in blood vessels
 - Cardiac muscle
 - Striated muscle
- Hypersensitivity reactions

Adverse effects of LA drugs 1

TOXICITY = OVERDOSE

- **High blood concentration** of LA drug
 - Type 1 ADR
 - Addative effect: $1+1=3$
- **Actual overdose**
 - Dose delivered $>$ Body mass-related MSD
- **Relative overdose**
 - Correct body mass-related dose BUT delivered directly into circulation

Excitable cells

Smooth Muscle Cells

In cardiovascular system
and glands

- Vasoconstriction
- Cardiac muscle contraction
- Glandular secretion

Nerve cells

- Peripheral nerves
 - Autonomic
 - Sensory
 - Motor
- Central nervous system
 - Brain
 - Spinal cord

If a truly toxic dose of LA is introduced into the general circulation

- Membrane activity of any excitable cells may be reduced or lost
 - The activity of the CNS (brain + spinal cord) is depressed
 - This shows, initially, as anxiety, restlessness, and tremors
 - and is rapidly followed by progressive loss of consciousness, coma and ultimately death
 - The activity of heart muscle is depressed.
 - This shows as bradycardia (slow heart beat), with eventual cessation of heart beat

MSD of LA for 70Kg or >70Kg person

- Lidocaine = 200mg
- Bupivacaine = 150mg
- Mepivacaine = 400mg
 - (200mg for a child of 70Kg)
- Prilocaine = 400mg
- Levo-bupivacaine = 150mg
- Ropivacaine = 250mg

But many patients weigh < 70 Kg

- Therefore, calculate the MSD from
- mg (of LA drug) / Kg (of body mass)
 - Lidocaine = 3mg/Kg
 - Bupivacaine = 2mg/Kg
 - Mepivacaine = 6mg/Kg
 - 3mg/Kg in a child
 - Prilocaine = 6mg/Kg
 - Levo-bupivacaine = 2mg/Kg
 - Ropivacaine = 4mg/Kg

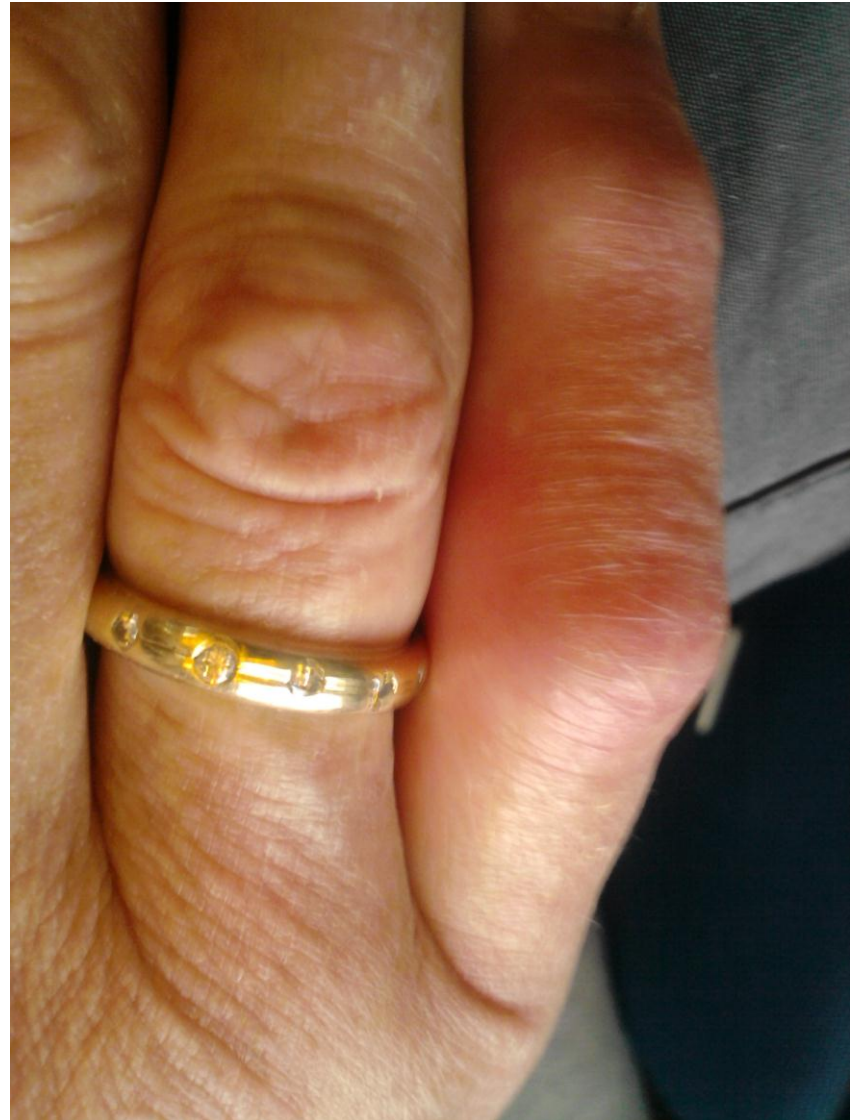
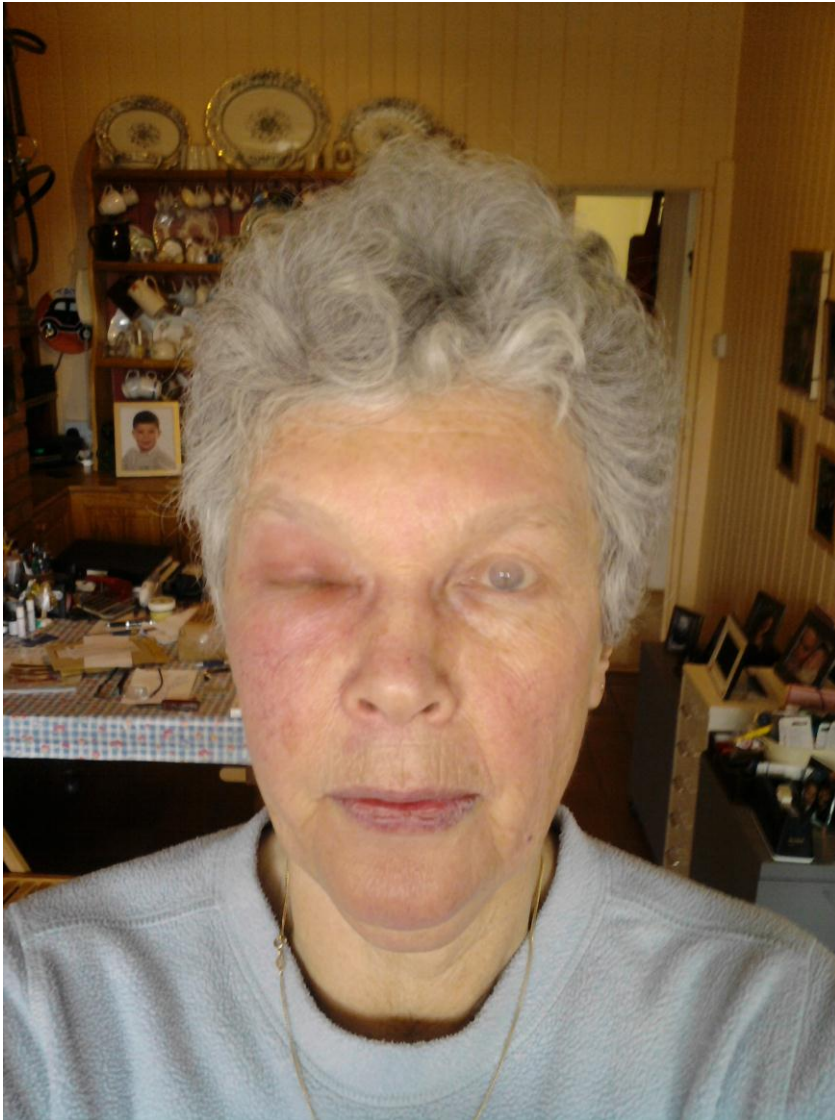
Prevention of LA toxic reaction

- Know the body mass-related MSDs for LA drugs
 - i.e.: the mg/Kg dose for each LA
- Calculate the MSD of LA for the patient
 - e.g.: a 50kg person can have no more than 150mg Lidocaine, *could* have 300mg of Mepivacaine, *but only* 100mg Bupivacaine
- Prepare enough syringes of LA but do not exceed the patient's MSD of LA drug
 - i.e.: max of 7.5ml of 2% Lidocaine, OR 14ml of 3% Mepivacaine, OR 30ml of 0.5% Bupivacaine for the 50Kg person
- Always aspirate the syringe before depositing any LA solution

Adverse effects of LA drugs 2

- **Faint**
- **Hypersensitivity**
 - Type 2 ADR
 - Bizarre and often non-predictable effect
 - Local effect
 - Urticaria within area of use
 - Systemic effects
 - Generalised hypersensitivity (urticaria, hives)
 - Anaphylaxis

Hypersensitivity reaction to bee venom



Anaphylaxis

- *Rare* but possible with LA drugs
- **Life-threatening**
- Rapid fall in BP + angio-oedema
 - Feeling faint, breathing difficulties, D+V, facial wheals etc
- **Patient requires**
 - **Adrenaline:**
 - 0.5ml of 1:1000 adrenaline solution, administered by IM injection
 - Repeat adrenaline dose after 5 mins if necessary
 - Removal to hospital by ambulance

Adrenaline [1mg / ml] administration

- **Dose administered per injection depends on patient's body weight**
 - Rule of thumb: 10 microgram Adr / Kg body weight
 - Small Child 15 kg = 150 micrograms Adr.
 - Large Child / Small Adult = 300micrograms Adr.
 - Larger Adult >60kg = 500 micrograms Adr.
- **Anapen**
 - 500 micrograms (0.5mg) / 250 micrograms (0.25mg) / 125 micrograms (0.125mg)
- **Epipen**
 - 300 micrograms (0.3mg) / 150 micrograms (0.15mg)
- **Jext (*safety system*)**
 - 300micrograms (0.3mg) / 150 micrograms (0.15mg)

What to do if you suspect ADR

- Stop injection
- Put patient into recovery position
- Monitor breathing and circulation
 - Administer 1:1000 adrenaline if necessary
- Removal to A+E as necessary
 - + details of amount and type of drug used
- Record event in patient's notes
 - Letter to GP