Anaesthesia & Periop Medicine

13.30 - 14.30  Dr Rob Stephens
  Physiological and Pharmacological principles

14.30 - 15.30  Dr Sam Bampoe
  Pain and SBA’s

15.30 - 15.45 BREAK

15.45 - 16.45  Dr Sam Bampoe
  Critical Care
What’s the Point?

- Pass finals
- Better FY Doctor
- Understand what’s going on
- Treat pain well
- Reduce suffering

- Transferrable skills
Introduction

- Website, tutorials, coming to theatre
- What you can take away from Anaesthesia
  - Acute care (BLS, fluids, pre/postop care, CVS)
  - Who’s at risk from surgery? How can we help?
  - Physical skills (cannulae, airway etc)
  - How to prescribe drugs in the real world!
  - Likely postoperative complications
Introduction

- 12 weeks: Tutorials- booklet
- Theatre 1-2-1
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**Do**
- WHO Checklist
- Phlebotomy
- Insert 2 small IV cannula: 22 or 20g
- Insert 2 large IV cannula: 18, 16 or 14g
- IV fluid bag and drip set up
- Injecting a drug through a 3-way tap
- Open & draw up drug from glass ampoule
- Draw up antibiotics
- Guedel/Oro-pharyngeal insertion
- Manual Ventilation with self-inflating bag & mask
- Chin lift / neck tilt / jaw thrust
- Connecting up self inflating bag – connections
- Oxygen masks – types and options
- Drug chart: write up analgesia for major surgery
- Drug chart: write up antiemetics for major surgery
- Connect up/turn on Oxygen cylinder
- NG tube insertion
- Putting on preoperative monitoring in the Anaesthesia Room
- Urethral / Bladder Catheterisation

**See**
- Laryngeal Mask Airway and inserting other airways
- Postoperative recovery – observe for 30 minutes
- Preoperative consultation/clinic
- USS / or USS your own neck (vessels)
- Peripheral Nerve block, Spinal or Epidural
- Pain ward round
- Cardiopulmonary Exercise Testing

**Discuss**
- ABG interpretation
- Perioperative Fluid therapy
- Treatment of perioperative hypotension
- Preassessment – shared decision making
- Transfusion – how to give safely
- Preoperative Investigations
- Basic ECG interpretation
- Jehovah’s Witness and blood

**Know**
- Airway management in emergencies/trauma
- Perioperative pain management
- Preoperative fasting guidelines
- Cardiovascular drugs to stop / continue
- Anticoagulants to stop / continue
- Theatre Ventilator- a basic understanding
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Each week

- Topic of the week - read workbook
- Article of the week
- Podcast of the week 6-9 mins
- 1-4 SBA of the week 3 mins each
- Come to theatre at least 2-3 days each 6 weeks - site specific
Physiology and …

Dr Rob Stephens
Thanks to Drs James Holding and Maryam Jadidi
Contents

- Introduction
- Pharmacology
- Physiology
  - CVS, RS, NS, Other
Introduction – the classical triad
Introduction – general principles
Hypnotic Agents
Neuromuscular Paralysis + Reversal
Analgesia
Cardiovascular Drugs – up and down
Fluids and Gasses are drugs too!
Pharmacology Introduction

- Anaesthesia ‘classical triad’
  - Hypnotic agent- unconsciousness
    - Gas or IV
  - Analgesia
  - Neuromuscular Paralysis

- Induction, Maintenance, Emergence, Recovery
- Basics of anaesthesia: podcast, download
Introduction - Principles

- Pharmacokinetics
  - What the body does to the drug
  - Absorption, distribution, metabolism, elimination

- Pharmacodynamics
  - What the drug does to the body – ie it’s effects
  - CVS, RS, GI, NS, Other, Side effects
Typical Anaesthesia

- Intravenous induction Propofol
- Short acting opioid - e.g. fentanyl
- Hypnotic ‘anaesthetic’ - e.g. propofol
- Set up of anaesthetic maintenance - e.g. sevoflurane vapour in oxygen and air
- Definitive analgesia
- Specific muscle paralysis may be needed
- Anti-emetic
- Others
Hypnosis: Propofol (and others)

IV
Redistributed out of CNS
Wears off quickly – 3-5 minutes
Metabolised

CVS  ↓MAP = CO x SVR
RS   ↓airway and resp depression
NS   ↓reflexes, Consciousness
      pain on injection
Maintenance: Volatiles
Sevoflurane (‘SEVO’)  
- Used for gaseous induction.

Desflurane

Isoflurane  
\[ CO \times SVR = MAP \]

- Gases, inhaled, little metabolised, exhaled
- CVS: \[ CO \times SVR = \downarrow MAP \]
- RS- irritant, bronchodilate
- NS - unconsciousness

- Given with Oxygen / Air / Nitrous Oxide
MAC = minimum alveolar concentration
Analgesia – later talk

- Reassure / explain etc

- Systemic
  - Simple- paracetamol 1g
  - NSAID – ibuprofen, diclofenac etc
  - Opioids eg morphine 2mg bolus
  - Others – Ketamine

- Regional – spinal / epidural / blocks

- Local - infiltration
Muscle Paralysis
Neuromuscular blockers

- Non-depolarising
  = competitive
  - Atracurium
  - Vecuronium
  - Rocuronium

- Depolarising
  = non competitive
  - Suxamethonium
Nicotinic ACh Receptor

The Acetylcholine Receptor on the motor end plate

Sodium (Na)

Potassium (K)

Diagram showing different types of receptors:

- **SOMATIC MUSCLE**
  - Nicotinic
  - Muscarinic

- **PARASYMPATHETIC**
  - Nicotinic
  - Adrenergic

- **SYMPATHETIC**
  - Nicotinic
  - To sweat glands
  - To adrenal medulla
Reversal of Paralysis

- **Neostigmine**
  - Blocks cholinesterase
  - Stimulates nicotinic and muscarinic
  - Given with an anticholinergic
  - Similar to Myaesthenia Gravis medication

- **Sugammadex**
Uppers

- Anti-muscarinic cholinergics
  - Atropine
  - Glycopyrurate 200-600µg

- Sympathetomimetics
  - $\alpha_1$ agonists
    - Phenylepherine
    - Metaraminol
  - Ephedrine
    - mixed $\alpha$ and $\beta$ adreno agonist

\[ \text{MAP} = \beta_1 \times \alpha_1 \times \beta_2 \times \text{CO} \times \text{SVR} \]
More anaesthetic or opiate / analgesia

Short acting β-blockers (labetalol, esmolol)

Short acting α blockers

GTN

MAP = CO x SVR

Clonidine - α₂ agonist clonidine
Antiemetics
Antiemetics

- **General**- IV fluids, anxiety, gastric decompress
- **Cyclizine** anti-histamine
  - S/E – tachycardia and other anti-cholinergic effects
- **Ondansatron** 5-HT$_3$ receptor antagonists
  - S/E – constipation + long QT
- **Prochlorperazine** (‘Stematil’) – DA and mACh receptor antagonist
  - S/E – extrapyramidal
- **Dexamethasone** glucocorticoid
  - S/E – deranged glucose control
Fluids and Gasses are drugs too!

- Oxygen is a ‘drug’
- Intravenous fluids- ward -NICE guidelines
  - Colloids
  - Crystalloids
- Blood and products
- Articles on website /
So Far

- Hypnosis Analgesia Paralysis
- Anaesthesia drugs cause Hypotension
- Analgesia happens during the surgery
- Paralysis might happen
- Drugs raise and lower blood pressure
- Anti emetics
Contents

- Introduction
- Pharmacology
  - Anaesthetic/ Hypnotic Agents
  - Neuromuscular Paralysis & Reversal
  - Analgesia
- Others, CVS, Gasses, Fluids
- Physiology Dr ABCD
  - CVS, RS, NS, Other
CVS physiology

\[ \text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \]

O₂ delivery

= Amount of O₂ to tissues per minute

= Cardiac Output \times O₂ content of blood \times HR \times SV \times Hb \times \text{SaO}_2 \times \text{constant}
O₂ + C₆H₁₂O₆ → CO₂ + H₂O

VO₂ peak
CVS physiology

MAP = \text{CO} \times \text{SVR}

\text{HR} \times \text{SV} \quad \text{Vaso-? constricted ? Dilated}

Pathologies:

- Low SVR: Sepsis \quad \text{Anaphylaxis}
- Low CO: Cardiogenic \quad \text{Hypovolaemia}
CVS physiology: Heart

- **Heart**
  - pumps blood ($O_2$) from lungs to tissues
  - then back to heart / lungs ($CO_2$)

- **SV** Preload / Contractility / Hr / Afterload

- **Work** = $O_2$ needs $\propto$
  - Rate
  - Contractility
  - Preload & Afterload
CVS effects..

- Anxiety, illness, walking to theatre, pain
- Induction of general anaesthesia
  - or onset of epidural/ spinal anaesthesia
- Cardiovascular - active drugs
- Intubation
- Surgical stimulation / trauma
- Haemorrhage
- Extubation
- Pain
- ?Recovery or complication
Cardiovascular changes
Induction of anaesthesia
Induction of anaesthesia

MAP = \( \downarrow \text{CO} \times \downarrow \text{SVR} \)

HR \( \times \downarrow \text{SV} \)

ie vasodilated

**Intervention:**
- Prevent!
- Fluids
- Inotrope
- Vasopressors

**GA:**
- negative inotrope + vasodilates

**Spinal/Epidural:**
- vasodilates
Surgical stimulation

Sympathetic

$$\text{MAP} = \uparrow \text{CO} \times \uparrow \text{SVR}$$

$$\uparrow \text{HR} \times \uparrow \text{SV}$$

vasoconstricts

Intervention
Avoid!
Deepen GA
Specific Drugs

+ve inotrope
+ve chronotrope
vasoconstricts
Cardiovascular: Bleeding

Less oxygen carriage in blood \((Hb \times SaO_2)\)
Less venous return, less output
Less pressure at Atrial and Aortic stretch
Sympathetic ++ response (+renal RAS, adrenal)
Blood pressure try to maintain ...

\[ \uparrow CO \times \uparrow SVR \]
\[ \uparrow HR \times \uparrow SV \]
vasoconstricts

+ve inotrope
+ve chronotrope
vasoconstricts
Cardiovascular: Implications

Hypotension tachycardia
Less $O_2$ supply to tissues

- Heart failure/Poor Exercise Capacity
- Ischaemic Heart Disease
- Aortic/Valvular disease

- More risk, complications and death
Respiratory

Upper – Airway – above vocal cords

Lower- Trachea, lungs, muscles
Respiratory- Airway

Anaesthesia ‘Obtunds’ airway

= “Airway obstruction’
= no airflow
= no $O_2$
= Acute Badness
Keep Airway open:

- Airway manoeuvres (chin lift etc)
- Airway devices- above vs blow cords
  - Above Vocal Cords
    - eg, gudel, LMA
  - Below Vocal Cords - Into trachea = intubation, paralysis
Anaesthesia
Airway
Equipment
Guedel / Oro-Pharyngeal

- Size 4: Adult male
- Size 3: Adult female
Laryngeal Mask Airway

- 15 mm Connector
- Airway tube
- Inflation line
- Inflation Pilot Balloon
- Valve
- Cuff
- Aperture Bars

No latex symbol
Respiratory- Airway
Respiratory- Airway implications

Airway less / non patent in Anaesthesia

- Need to open airway
- Guedel / Laryngeal Mask / Intubation
Spontaneous breathing under anaesthesia vs Ventilated
- Lungs smaller \(\downarrow\) depth
- Drugs \(\downarrow\) respiratory rate
- Small airways / Alveolar collapse / atelectasis
- Can’t cough – secretions

= ‘pulmonary shunt (vs deadspace)

Hypoxaemia, persists postoperatively
CT scan of Diaphragm during awake spontaneous breathing
CT scan of Diaphragm during *anaesthesia*: Atelectasis
Respiratory- Lungs Implications

Hypoventilation or Apnoea with GA
Airways Collapse
Hypoxia

- Extra Oxygen c 30% +
- Artificial ventilation
- PEEP to open airway
Gastrointestinal

General Anaesthesia

relaxes gastro-oesophageal sphincter
Fluid up oesophagus
?into lungs
starvation
postoperative vomiting

Other drugs
eg analgesia-opioid constipation- Rx laxatives
Gastrointestinal Implications

Reflux and Aspiration
Nausea and Vomiting postop
  postoperative vomiting

- 2 hours liquid, 6 solid
- Intubation stops aspiration
- Anti-emetics
Neurology

- Many Effects
- GA = drug induced reversible unconsciousness
- Many reflexes ↓↓ (airway, gag, CN)
- Awareness
- +/- NMJ paralysis
Physiology summary

- MAP = CO x SVR
  - HR x SV
  - Vaso-? constricted ? Dilated

Pathologies:
- Low SVR: Sepsis      Anaphylaxis
- Low CO: Cardiogenic  Hypovolaemia
- RS: upper airway / lower airway
Pharmacology Summary

Introduction – the classical triad
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Fluids and Gasses are drugs too!

CVS
RS
NS

\[ \downarrow \text{MAP} = \text{CO} \times \text{SVR} \]
\[ \downarrow \text{airway and } \downarrow \text{resp fn} \]
\[ \downarrow \text{reflexes, unconscious} \]
General Advice

- Check out website for lots of material
- Come to theatre- great teaching
- Come to theatre- physiology in action
- Get involved in other areas..
  - Preassessment, CPEx, Outreach Nurses
  - ICU, pain etc etc
Thank you

www.ucl.ac.uk/anaesthesia
Google UCL Anaesthesia Student
UCL Anaesthesia Website

Google UCL Stephens
Introduction

- Anaesthesia is more than Physiology and Pharmacology!

- Surgery vs Anaesthesia

- Outside theatre
  - ICU, Pain, CPEx, Obstetrics, Research, Global Health, Extreme Environment, Disaster Medicine
CVS physiology summary

MAP = \boxed{\text{CO}} \times \text{SVR}

HR \times \text{SV} \quad \text{Vaso-? constricted ? Dilated}

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Acknowledgements

Compiled by: Andrew Pitcher
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