The Anaesthesia Machine

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Objectives

Anaesthesia machine
   Definition
   Components
Standards

Hands - on
Oxygen supply warning devices
Safety features
Anaesthetic Machine check

Hands – on
Trouble shooting
Our Specialty
Anaesthesia and Resuscitation

- Who has done ALS?
- ALS principles?
- R = simple, A = apparently complex

OXYGEN
How different is it?

Uncontrolled unresponsiveness

Controlled unresponsiveness
R ➤ A?

Uncontrolled unresponsiveness

Controlled unresponsiveness
How does R become A?

• D – reversibly insensible
• Circulation – accessed for control
• Breathing - Assisted/controlled
• Airway - Secured

Machines to do (AM) and check (monitors)
Anaesthesia machine

• What is it? / What does it do?

• What does it consist of?
Anaesthesia machine

• **What is it? / What does it do?**
  • Accurately and continuously delivers gas and vapour mixtures of the desired composition

• **What does it consist of?**
  • Power supply
  • Gas supply (+ pressure guage, regulator, flow meters) and suction
  • Breathing system
  • Ventilator
  • Scavenging
  • Monitoring
  • Other features – flush, oxygen supply failure alarm and suction apparatus
Identify these
And these
Pipelines and outlets

Oxygen
Nitrous Oxide
Air
Suction
Anaesthetic Gas Scavenging
Pressure Gauges
Flowmeters
Rotameter block

- Oxygen
- Nitrous oxide
- Air
Electronic flow control

- Airflow display
- Oxygen concentration
- Oxygen flow display
- Agent concentration display
- Oxygen pipeline pressure display
- Main rotary control knob
Vaporiser Cassette
Vaporizers
Common Gas outlet
Identify the Gas outlet selector
Check before each case - BGE
Oxygen flush
Spot the Suction
Circle and Soda lime
Bag in bottle ventilator
**Valve Function**

**Valve open:** Fully open, the valve provides very little resistance to exhalation.

**Valve closed:** Fully closed, the valve will open at a pressure of 60 cm H₂O.

In between fully open and fully closed, the pressure can be adjusted to allow positive pressure ventilation if required.

Arrows indicate direction of gas flow.
Selector and APL valve - Why?
Standards

• F1161-94 standard of the ASTM
• A newly manufactured anaesthesia machine must have
  – An oxygen analyser
  – A breathing pressure monitor
  – An exhaled tidal volume monitor, or capnograph, which functions automatically when this machine is in use
  – A prioritized alarm system
Now get your hands on a real machine in theatre!
What is this?
Oxygen supply warning devices

• Originally introduced to prevent the unobserved emptying of oxygen cylinders before piped gases were in common use.

• Characteristics
  – Loud audible warning
  – Are activated by falling oxygen pressure (\(<\) 2 Bar)
  – Have a valve system which cuts off all non oxygen containing gases and reduces their flow to maintain minimum conc. of oxygen
  – Are designed so that the alarm cannot be reset without restoring the oxygen supply
Safety features in the anaesthesia machine

- Hypoxic Guards – mechanical and electronic control
- Vaporiser control knob, locking mechanism, keyed filling mechanism
Checking the machine – Why?
Checking the machine – Why?

- To prevent hypoxic brain damage and death due to anaesthetic misadventures
- Our primary professional responsibility
- To pass Primary FRCA OSCE stations
- Part of RCOA competency based training
- NHS CNST and quality improvement requirement
Check what? How often?

• At the start of every operating session?

• Before every case?
Check what? How often?

• At the start of every operating session?
  – Self inflating bag, auto check, gas supplies, suction, breathing system, ventilator, scavenging, monitors and airway equipment

• Before every case?
  – Suction, breathing system, ventilator and airway equipment
  – Anti hypoxia device if using nitrous oxide
Don’t Forget – BGE-AIR

• Bag – self inflating
• Gas outlet – common or auxiliary
• Equipment
  – Airway equipment - ?difficult airway
  – Infusion – ? TIVA
  – Resuscitation
The 2 bag Test

• When?
  – After individually checking breathing system, ventilator and vaporizer

• How?
  – Attach patient end of breathing system to bag
  – Ventilate manually with 5L/min
  – Turn on ventilator, check for volume loss with minimum gas flow and vaporisers on
Testing for leaks

- The Occlusion method
- The Evacuated Bulb test
Documentation of checks

• Check at the beginning of each operating theatre session. –Anaesthetist’s responsibility
• Record routine checking of anaesthetic machine
• ‘First user’ check after servicing to rule out errors in reassembly of machines during servicing
• Record weekly check of the oxygen failure alarm
• Faults may develop during anaesthesia inspite of machine check
The Preoperative Equipment Check

- The necessary check will include everything to deal with planned and unexpected events. To ensure nothing is omitted, the mnemonic SAD MIMES is suggested:
- Suction
- Airway equipment
- Drugs: emergency and routine
- Machine (covered in the previously)
- Intravenous cannulae and fluids
- Monitors
- Emergency devices and drugs to deal with unexpected problems
- Special: regional block equipment, ultrasound machine etc.
Resources

• E-learning anaesthesia – category 06 – equipment essentials – subcategories 23 – 28, both inclusive

• AAGBI guidelines
Now let’s see if the checklist works!
Troubleshooting
Problem 1

Failure of the ventilator bellows or reservoir bag to stay full.

Why?
Reason 1 – Insufficient gas flow

Pipeline, cylinder pressure or connection failure

Insufficient fresh gas flow

Vaporizer not sealed or not closed after filling

Inadvertent activation of an auxiliary common gas outlet (ACGO) system
Reason 2 – Leak within circuit

- Gas sampling port left open
- Gas sampling return not connected to circle circuit
- Damaged reservoir bag
- Cuff leak, movement of endotracheal tube, poor connections
Problem 2

Despite a seemingly adequate pipeline supply pressure, gas flow and an absence of leaks, mechanical ventilation is absent or poor.

What could it be?
Problem 2
Enjoy your career in Anaesthesia