Draw over anaesthesia

Nuts and Bolts

Steve Pickering
AGO 2018
Boston
This talk:

• Background
• Describe a basic draw over system
• Technical differences
• Clinical differences
In the old days, not very long ago......

Equipment:
- Suction
- IV, Drugs

- Anesthesia machine + breathing circuit

Monitor
Monitor

Equipment:
- Suction
- IV
- Drugs

Compressed Gases

Boyles Machine

Breathing Circuit

CGO PT
Anesthesia machine + breathing circuit

Equipment:
- Suction
- Monitor
Inhalational systems must:

1. Deliver volatile agent
2. Prevent re-breathing CO₂
3. Add oxygen
4. Provide IPPV if needed
Continuous Flow—Boyle’s Machine

1. Vaporizer adds anesthetic agent
2. Prevents re-breathing of expired CO₂
3. Adds oxygen
4. Allows positive pressure ventilation

Plenum = above surrounding pressure. Opposite to a vacuum.
4 key functions:

1. Deliver volatile agent – *in very carefully controlled and exact “doses”*

2. Prevent re-breathing CO2

3. Add oxygen – “*fiO2 > 30%*” v “*spO2 >95%*”

4. Provide IPPV if needed – *and ensure spontaneous ventilation is easy*
1. Deliver volatile agent

- Accurate
- Low resistance
- Calibrated to agent
- Temperature compensation
- Directional

A draw over vaporizer
2. Avoid re-breathing CO₂

- **Non-rebreather valve**
- ‘Patient valve’
- **Ambu E1 or Mark III**
  - 2 inter-acting leaflets
  - Minimal resistance
  - DANGEROUS with continuous flow
  - Arrows to guide correct direction
- Other NRBVs work
  - Laerdal / Ruben / “E”

X3 ports
1. Inlet
2. Outlet
3. Patient
3. Add oxygen

- **ANY** source
- $\text{fiO}_2$ depends on:
  - flow rate
  - volume of open ended reservoir
  - minute volume
- Room air? – system *still works*
4. Allow for IPPV

- “Self” inflating
  - **Not** flow-inflating**
- Must have upstream one-way valve
- The OIB doubles as a spontaneous ventilation respiratory rate monitor
- Self-inflating bag or bellows
Completed system
The bad news ....

- No monitors
- No suction
- Does not make coffee
- No mechanical ventilator
- No flashing lights
- Not good for impressing people
The good news ....

- Robust, simple, small
- Reliable, accurate
- Does not need pressurized gas
- Will work on room air
- No flashing lights
- Works after coffee spilt on it
- Not good for impressing people
Words

• To draw
Words

• Plenum “full”
  – opposite of vacuum
  – Above surrounding air pressure

• Continuous Flow
Take a minute break??

Intermittent flow is superior
WHY?
Key Technical Differences
Key Technical Differences

• Boyle’s machines *cannot* work without pressurized gas

• Draw-over systems *do not need* pressurized gas

• Oxygen can come from *any* source:
  • Pipeline
  • Tank
  • Concentrator
  • Room Air
Key Technical Differences

• Boyle’s machines are “on” and supplying gases +/- volatile agent, whenever the flow meters are turned on.

• Draw over systems have intermittent flow, determined by the patient or the anesthesia provider.
  – If there is no SV or IPPV, there is no flow
Key Technical Differences

Boyle’s machines with circle:

Vaporizer setting ≠ delivered concentration

Draw over systems:

Vaporizer setting = delivered concentration
Key Clinical differences

Let’s think about the anesthesia systems we usually use...
Quick Quiz

- How do you know the size of your patient’s tidal volume during GA?
Quick Quiz

• How do you know the size of your patient’s tidal volume during GA?
• How do you know your patient’s fiO2?
Quick Quiz

• How do you know the size of your patient’s tidal volume during GA?
• How do you know your patient’s fiO2?
• How do you know what concentration of volatile agent your patient is inspiring?

fiAA  ?
Quick Quiz

• How do you know the size of your patient’s tidal volume during GA?
• How do you know your patient’s fiO2?
• How do you know what concentration of volatile agent your patient is inspiring?
• How do you compensate for a poor seal when performing a gas induction on a fighting child?
Key Clinical Differences

• How do you know the size of your patient’s tidal volume during GA? (plenum)
Key Clinical Differences

• How do you know the size of your patient's tidal volume during GA? (plenum)
  – Read the screen
  – Ventilator settings / movement
  – Chest movement
Key Clinical Differences

• How do you know the size of your patient’s tidal volume during GA? *(drawover)*
  – Read the screen
  – Ventilator settings / movement
  – Chest / abdomen movement
Key Clinical Differences

• How do you know your patient’s fiO2? (plenum)
Key Clinical Differences

• How do you know your patient’s fiO2? (plenum)
  • Read the screen
  • Flow meter(s) if in steady state
Key Clinical Differences

• How do you know your patient’s fiO2? (drawover)

  • Read the screen
  • Flow meters if in steady state

• You estimate by oxygen flow
Key Clinical Differences

• How do you know what concentration of volatile agent your patient is inspiring? (plenum)
Key Clinical Differences

- How do you know what concentration of volatile agent your patient is inspiring? (plenum)
  - Gas analyzer
  - ??? Vaporizer setting ????
Key Clinical Differences

• How do you know what concentration of volatile agent your patient is inspiring? (drawover)

  – Gas analyzer

  – Vaporizer setting
Key Clinical Differences

• How do you compensate for a poor seal when performing a gas induction on a fighting child? (plenum)
Key Clinical Differences

- How do you compensate for a poor seal when performing a gas induction on a fighting child? (plenum)
  - Forget the perfect seal
  - Turn up the flows **REALLY** high
  - Turn up the volatile fraction **really** high
Key Clinical Differences

• How do you compensate for a poor seal when performing a gas induction on a fighting child? (drawover)
  – Forget the perfect seal
  – Turn up the flows REALLY high
  – Turn up the volatile fraction really high
  – **Give them ketamine** IV or IM, and sort out the seal in 2 minutes time!
HYBRID SYSTEMS - Continuous Flow / Draw Over

- O2 flow from concentrator
- Air inlet
- O2 reservoir
- Vaporizer
- 1-way check valve
- Self inflating bag
- 1-way valve
Essential Equipment