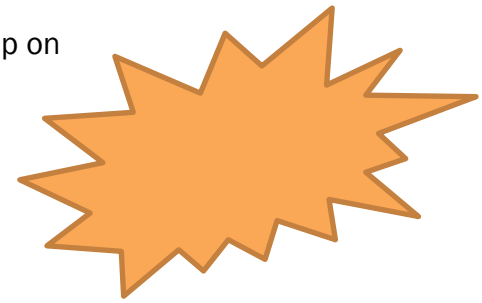
This booklet aims to be guide only to the first couple of weeks in anaesthetics to give a little basis for further teaching/discussions and skill learning

- Orange call out boxes show topics that can be good to read up on in each section
- Feedback for anything you feel needs to be added/removed would be appreciated!



Sections:

1. Starting your day
2. History taking and the anaesthetic chart
3. Basic Principles of anaesthesia
4. Recording intraoperative care
5. Recovery and post operative management
6. Anaesthetic Drugs and Reference Sheet
7. Machine Basics and the Circle System
8. Machine and Ventilation settings – the basics

Starting your day and Pre-Assessment

Finding your list and seeing your patients

Lists for the day:

- Master copies found hanging on the window of the theatre office and you can then make copies
- Surgical Day Unit have a folder with all planned lists – you cannot remove these but are a good reference
- Sometimes the theatre you are in will have an extra list you can take with you.
- CEPOD theatres have a whiteboard outside theatre 12 with the planned list for the day. Handover with night team happens there

Seeing your patients:

- Elective patients are usually in Surgical Day Unit. This is divided into colour zones for different surgeons
- CEPOD patients will be inpatients and the wards usually written on the whiteboard. Worth double-checking on CHARTS as they sometimes get moved overnight.

Preparing your anaesthetic room

- Introduce yourself to the ODP and let them know plans/equipment you'll need
- Machine and equipment checks
- Preparing drugs

Team Brief

WHO team brief in theatre with the whole theatre team. A chance to discuss any concerns and your plan for the anaesthetic.

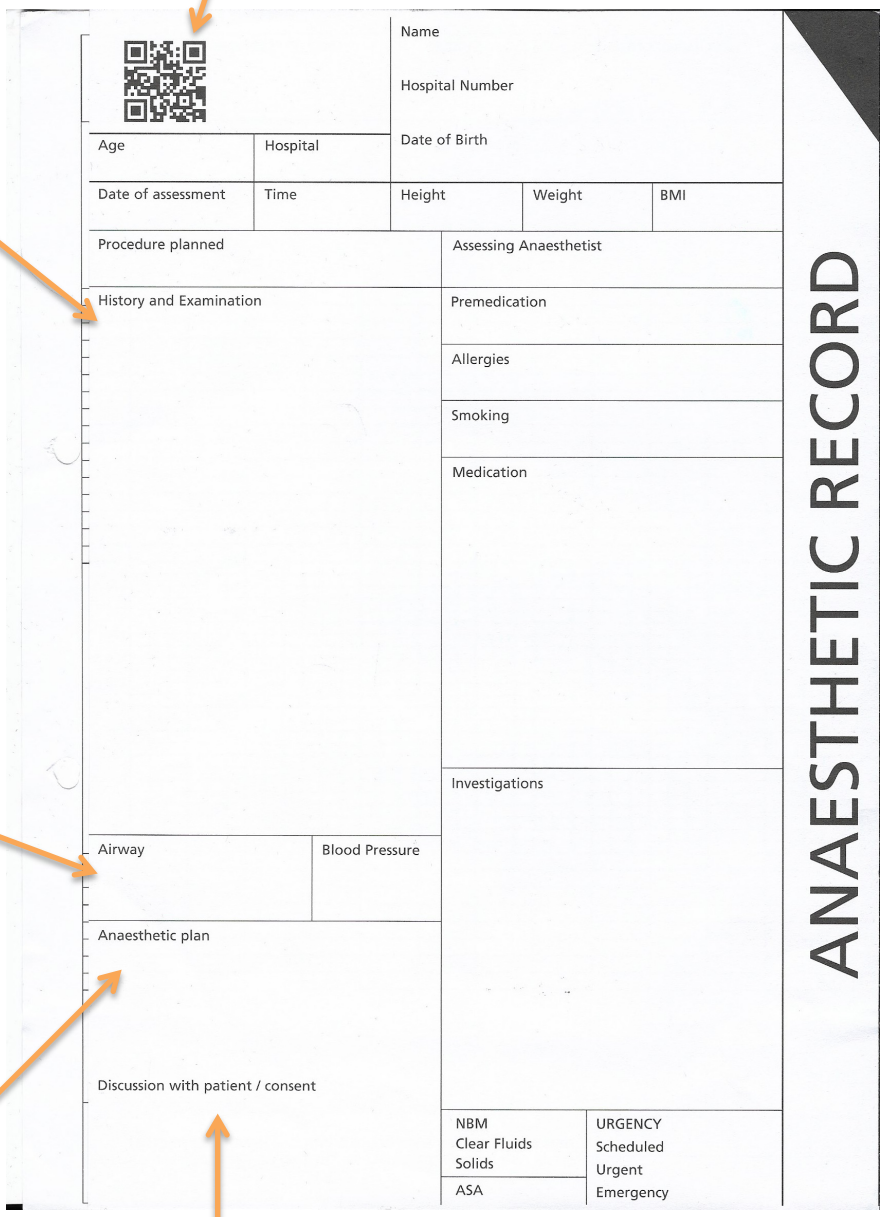
First patient

- Safety checks
- Monitoring
- Begin your anaesthetic!

Ensure you use a chart with QR code as these allow the notes to be scanned. Some old charts on the ward do not have these

For the most part this is similar to most medical history taking you will be used to. Use a system-based approach and explore any co-morbidities in more detail. Specific anaesthetic questions to consider:

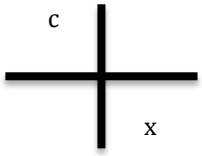
- Previous GA / any problems after
- FHx of problems with GA (Sux apneoa, Malignant hypothermia)
- GORD/aspiration risk
- Exercise Tolerance



Lots of formal ways to assess this (see callout for methods to review) Some things to include:

- Loose teeth /caps /crowns/dentures
- Neck extension
- Mouth opening

You will sometimes see documentation like this denoting the mouth and locations of crowns, broken teeth etc:



*Tip! Use old anaesthetic charts to see intubation grade/any problems

Try and think about each stage for the patient:

- Type of anaesthetic (regional, sedation, GA?)
- Type of airway
- Any regional blocks?
- Invasive monitoring required? (Arterial line, CVC?)
- Plan for intraoperative and post op pain relief? PCA
- Antiemetic plan
- Fluid management, blood products required?

Include consent for any procedures.

Specific anaesthetic consent will vary with patients and procedures. High risk elective patients with multiple co-morbidities are usually seen in clinic and this is discussed at length.
Common things to discuss with all a patients on the day are:

- Dental damage
- Sore throat
- PONV
- Anaphylaxis
- Need for blood products

- ★ Malampatti Scores
- ★ Wilson risk factors
- ★ Intubation Grades
- ★ ASA classification
- ★ Risk factors for PONV

To Tube or not to tube?

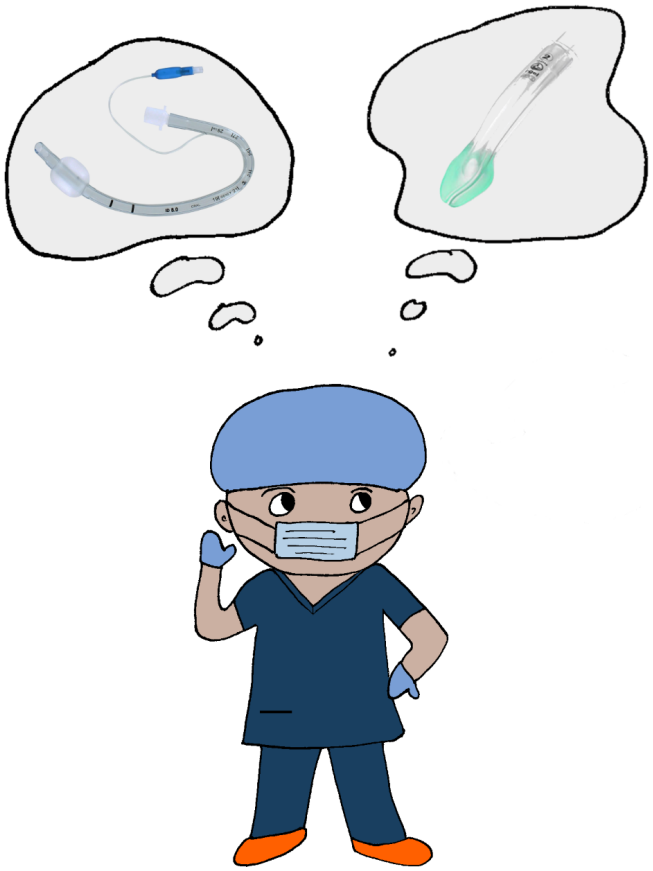
Part of making plans for delivering an anaesthetic is deciding on which patients require intubation and which can be managed on an LMA. With the huge variety of surgical procedures and patient types, these are some factors that can help you decided what may be required:

Patient Factors

- History of reflux
- Pregnancy
- Recent trauma/illness (delayed gastric emptying)

Surgery Factors

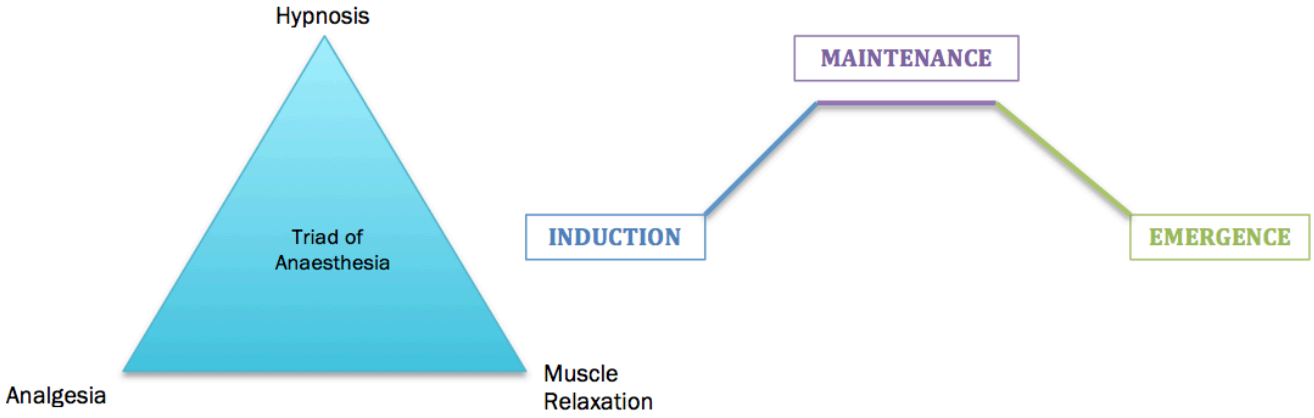
- Muscle relaxation required for surgery
- Surgery with increase intra-abdominal pressure (laparoscopy)
- Bowel manipulation
- Long surgical time
- Shared airway (blood/surgical debris)
- Position of patient (e.g prone)



IF IN DOUBT PUT A TUBE IN

Basic principles of Anaesthesia

There are different decisions that need to be made when conducting an anaesthetic, and as such there are many ways to think about how to divide these various components.
The classical triad of anaesthesia and the three key stages of anaesthesia are shown below:



These can be helpful in categorizing in your mind what you may need for each step and help you plan and prepare.

Type of Induction	Type of Airway	Maintenance Type	Type of Ventilation
Gas	Facemask	Gas	Spontaneous Ventilation (SV)
IV	LMA	IV	Intermittent Positive Pressure Ventilation (IPPV)
RSI	ETT		

General sequence of events for ASA 1/2 patient

WHO safety checks → AAGBI monitoring → Pre-oxygenation

Induction:

- Small dose fentanyl, propofol and muscle relaxant
- Manual Ventilation + sevoflurane on
- Tracheal Intubation confirmed by – equal chest rise, tube misting, capnography (at least 6 breaths!)

Maintenance:

- Oxygen/Air/Sevoflurane
- IPPV
- Analgesia

Emergence:

- Pre-oxygenation
- Turn volatile off
- Reversal of neuromuscular block
- Extubation when SV and awake

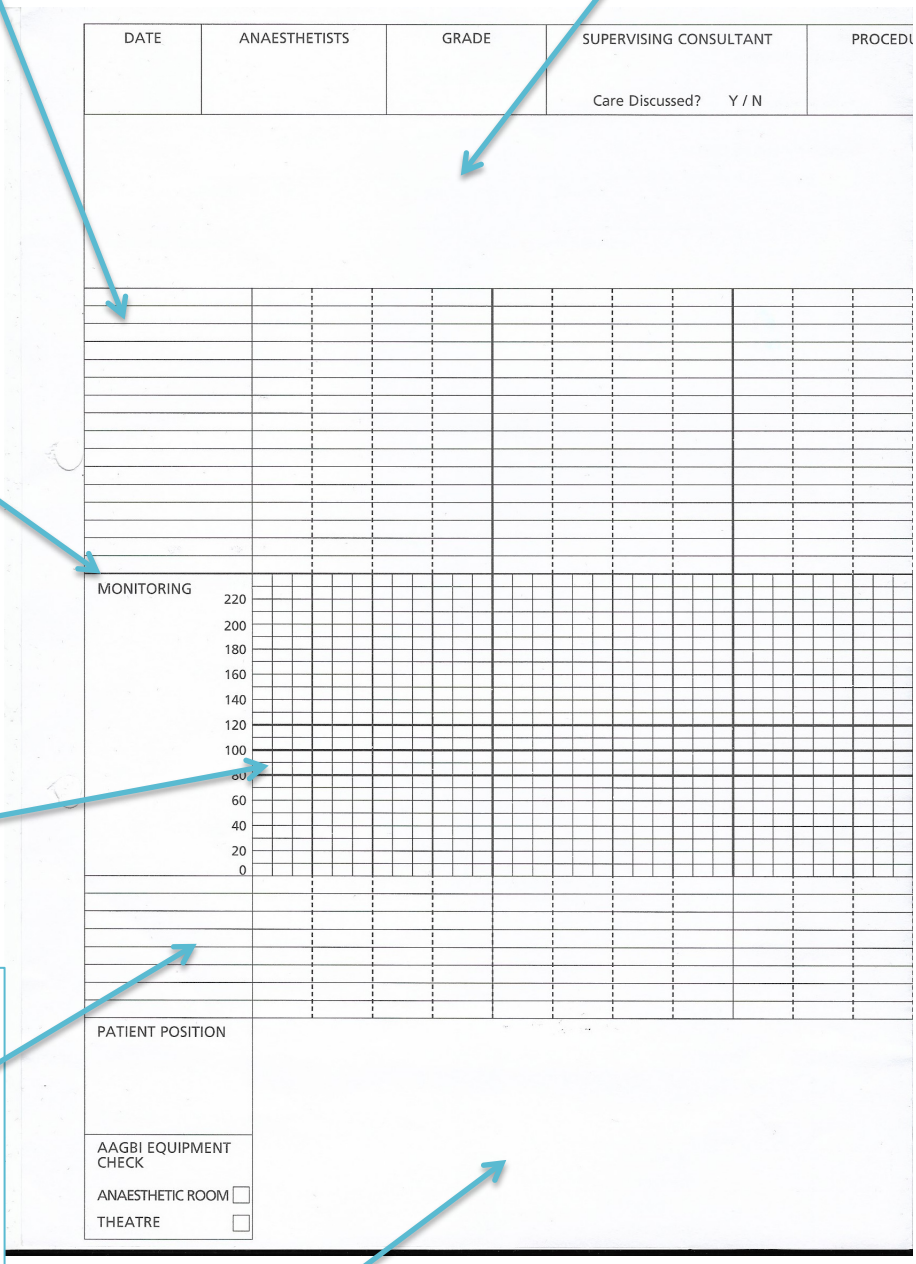
★ Indications for RSI
★ Pros/Cons Gas vs IV induction and situations used
★ Difficult intubation and failed intubation drills
★ Preoxygenation
★ Train of Four

Recording Intra-operative Care

This section documents any medications given during the anaesthetic and the times/dosages administered
REMEMBER: Antibiotics/Paracetamol should also be charted on JAC

Generally this section is used to describe your induction events. On old charts it is a useful source of information for details on airway/intubation difficulties
Good things to include

- Access/lines established
- BVM – easy/difficult/adjuncts used
- Intubation grade - direct/video laryngoscopy/ bougie
- Any blocks performed



AAGBI (Association of Anaesthetists of Great Britain and Ireland) Monitoring refers to the minimum standards of monitoring required:

- Pulse Oximetry
- NIBP
- ECG
- Insp./Exp. (oxygen/carbon dioxide/volatile gas)
- Peripheral nerve stimulator (if muscle relaxant use)

Additional monitoring may include:

- BIS/EEG
- Cardiac Output

Document HR and BP intra-operatively. Each line = 5 minutes

What people record in this section can vary. Parameters generally recorded in this section include:

- FiO_2
- SpO_2
- $ETCO_2$
- ET (volatile agent) /MAC
- Paw (peak airway pressure)
- Temperature
- Urine output

Can be used to document any fluids/blood products given intra-operatively

Recovery and Post-operative management

Following completion of surgery and emergence of anaesthesia your responsibility also lies in safe transfer, handover and review of patients in Recovery.

Before transfer to recovery ensure:

- The patient is physiologically stable and maintain breathing adequately
- Post op analgesia is prescribed (there are post-op pain protocols that can be found on JAC)
- Anti-emetics are prescribed
- All documentation on anaesthetic chart completed
- Doses of antibiotics/paracetamol given intra-operatively are charted and signed for on JAC
- During the surgical time out, plans for VTE, oral intake and antibiotics are discussed. It is important that these are handed over to recovery staff as well as any special instructions

There is space on the back of the anaesthetic chart to allow written handover to recovery staff.
Examples of things to include:

- Oxygen and monitoring requirements
- Acceptable physiological parameters
- Plan for oral intake
- Further IV fluids
- Further doses of antibiotics needed
- Can the patient E+D
- If BMs/blood gas /CXR need doing

Before Leaving Recovery – make sure the nurse is happy and knows where to find you if needed

- ★ PCA
- ★ Regional Blocks
- ★ Post op Oxygen therapy

Anaesthetic Drugs

There are a plethora of drugs used in anaesthetics. As most of them are clear there is a colour coded labeling system in place

Yellow: Induction agents

Blue: Opioids

Red: Muscle Relaxants

Pale Orange: Antiemetics

Dark Orange: Benzodiazepines

Grey: Local Anaesthetics

Green: Anticholinergic

Purple: Vasopressors

Red and White Stripes: Reversal agents

White: Miscellaneous

Equivalent Drug Dilutions

Ratio	% Weight (w)/ Volume (v)	= Grams/ 100ml	Mg/ml	Micrograms/ml
1:10	10%	10 g/ 100ml	100mg/ml	100,000mcg/ml
1:20	5%	5 g/100ml	50mg/ml	50,000 mcg/ml
1: 50	2%	2 g/ 100ml	20mg/ml	20,000mcg/ml
1:100	1%	1 g/ 100ml	10mg/ml	10,000 mcg/ml
1:200	0.5%	0.5 g/ 100ml	5mg/ml	5,000mcg/ml
1:1000	0.1%	0.1 g/100ml	1mg/ml	1000 mcg/ml
1: 10,000	0.01%	0.01 g/100ml	0.1mg/ml	100 mcg/ml

- ★ Pharmacology of Anaesthetic Drugs
- ★ Neuromuscular junction physiology
- ★ Detrimental effects of Suxamethonium

Anaesthetic Drug Reference Sheet

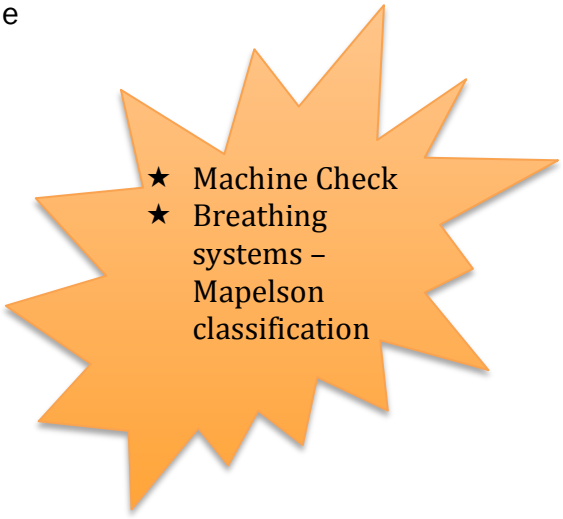
Drug	Dose	Comes as/Preparation
Induction Drugs		
Propofol	Induction dose 1-2mg/kg	1% 10mg/ml (20ml vial) 2% 20mg/ml
Ketamine	IV induction 1-2mg/kg IM induction 5-10mg/kg	10mg/ml 50mg/ml 100mg/ml
Thiopental	Induction dose 3-5mg/kg	Yellow Powder reconstituted to 2.5% solution
Opioids		
Fentanyl	1mcg/kg	50mcg/ml (small = 2 ml vial, large = 10ml vial)
Morphine	*titrate to effect	10mg/ml (1 ml vial) diluted to 10ml saline
Oxycodone	*titrate to effect	10mg/ml (1ml vial) diluted to 10ml saline
Muscle Relaxants		
Atracurium	0.5mg/kg	10mg/ml
Cisatracurium	0.1-0.2mg/kg	2mg/ml 5mg/ml
Rocuronium	0.6mg/kg RSI: 1mg/kg	10mg/ml (5ml vial)
Suxamethonium	1-1.5mg/kg	50mg/ml (2ml vial)
Vecuronium	0.1mg/kg	10mg powder (Reconstituted to 1mg/ml)
Reversal Agents		
Neostigmine/Glycopyrronium	Neo 2.5mg/Glyco 500mcg (1ml vial)	
Suggamadex	Routine reversal: 2-4mg/kg (TOF twitches dependent) Immediate post RSI: 16mg/kg	200mg vial 500mg vial
Local Anaesthetics		
Bupivacaine	Max 2mg/kg	0.25% - 2.5mg/ml 0.5% - 5mg/ml
Levobupivacaine	Max 2mg/kg	0.25% - 2.5mg/ml 0.5% - 5mg/ml 0.75% - 7.5mg/ml
Lidocaine	Max 3mg/kg Max 6mg/kg (with adrenaline)	1% 10mg/ml 2% 20mg/ml
Emergency Drugs		
Atropine	Bradycardia	20mcg/kg	600mcg/ml
Glycopyrronium	Bradycardia	200mcg bolus	200mcg/ml
Ephedrine	Hypotension	3mg bolus	30mg diluted in 10ml saline (pre-formed syringe)
Phenylephrine	Hypotension	bolus	0.1mg/ml 10mg/ml
Metraminol	Hypotension	0.5mg bolus	10mg diluted in 20ml saline
Adrenaline	Anaphylaxis	50-100mcg bolus	0.5-1ml of 1:10,000

Machine Basics and the Circle System

The anaesthetic machine is a complex multicomponent system. The following section aims only to give the general principles of how the machine functions and outlines the principles of the circle system

Broadly, the function of the machine can be divided into

1. Supply
2. Processing and pressure regulation
3. Delivery
4. Disposal



Breathing systems:
The function of any breathing system is to deliver oxygen, anaesthetic gases and to eliminate CO_2.
They can be:

- Non rebreathing systems
- Rebreathing (circle) system *most common*

The key feature of the circle system is that it uses one-way valves to ensure unidirectional flow and a CO_2 absorber (soda lime) to capture CO_2. This allows for low fresh gas flows and anaesthetic gas usage without toxic build up of carbon dioxide.

The Anaesthetic Machine

1. Supply

Gas supply can come from:

- Pipelines
  - Vacuum Insulated Evaporator
  - Cylinder Manifold
- Cylinders

2. Processing and Pressure Regulation

- Both pipeline and cylinder gas enter the system at very high pressure so to prevent damage to the machine; pressure regulation valves reduce this to a suitable supply pressure.

Pipeline supply is used preferentially

- Within the system there is a low oxygen pressure alarm with oxygen reservoir. This kicks in if pressure <200kPa. There is a N_2O shut off valve to prevent hypoxic mixture in absence of low oxygen.

- Gas Flow then enters the rotameters that further reduce the pressure to just above atmospheric (100Kpa). Rotameters also have a hypoxic guard mechanism to prevent hypoxic gas mixtures when using N_2O

- Gas flow then pass through vapourisers, which can be mechanically, or electronically controlled. Each is calibrated for a particular vapour.

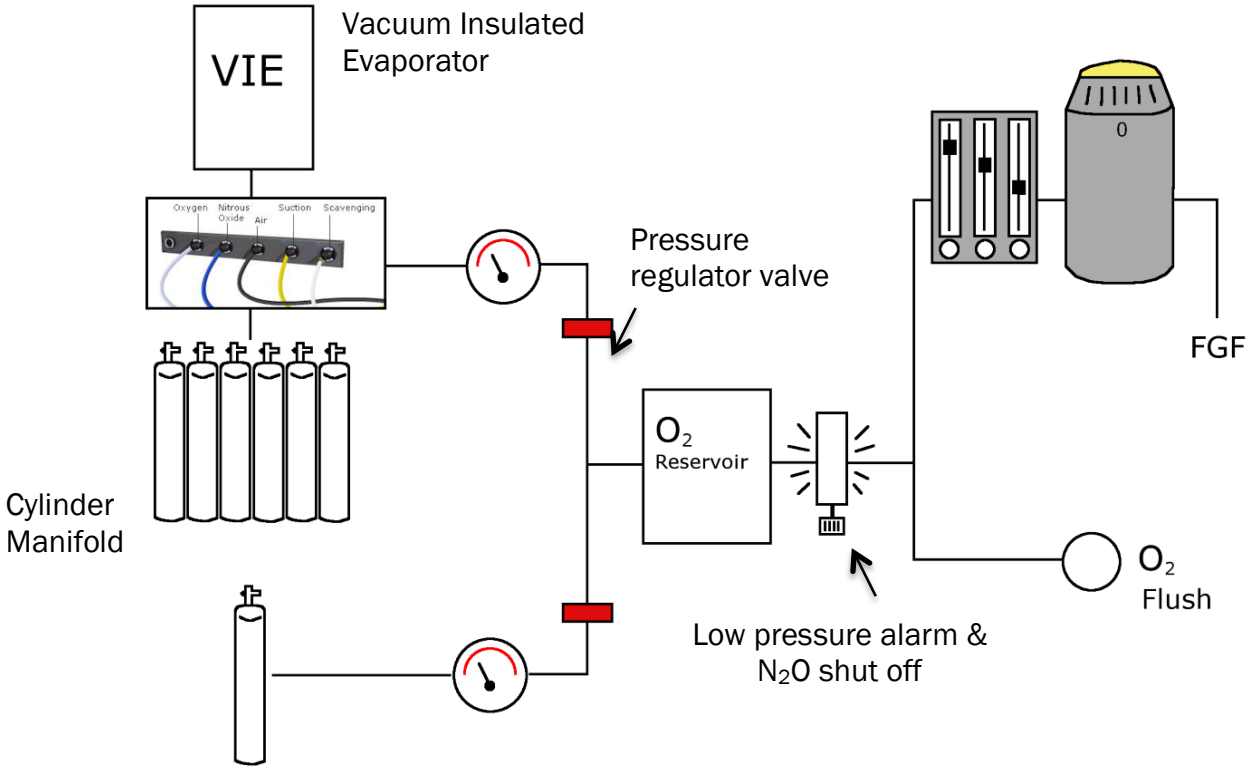
3. Delivery

*Note the Oxygen Flush is outside of the flow meter pressure reduction – therefore using this give high-pressure oxygen into the system – Should therefore not be used routinely.

All gas mixtures (Fresh Gas Flow FGF) then pass into the common gas outlet and enter the breathing system. Below – the circle system is discussed.

4. Disposal

Anaesthetic Gas Scavenging (AGSS) actively pipes waste anaesthetic gases and vents into atmosphere



The Circle System

- FGF enters the Inspiratory limb via the one-way valve to the patient.
- Exhaled gases travel in the expiratory limb. This also has a one-way valve to prevent back flow of expired gases to the patient
- During SV – both expiratory tubing and the reservoir bag contains expired gases. When the pressure limit is reached, these escape via the adjustable pressure limiting valve (APL) and are scavenged by AGSS (prevents bag explosions!)
- The APL should be open at minimal pressure during SV (otherwise imagine trying to breath out through narrow straws)
  This can feature can be utilised however if required to give some PEEP
- Expired gas that does not escape via the APL travels in the expiratory tubing to the CO_2 absorber (soda lime) where chemical change occurs allowing return of gases (now CO_2 free!) to return to the inspiratory limb and into the patient

- The patient then breaths in again using gases contained in the reservoir bag (which has passed through the soda lime) in addition to any FGF from the machine

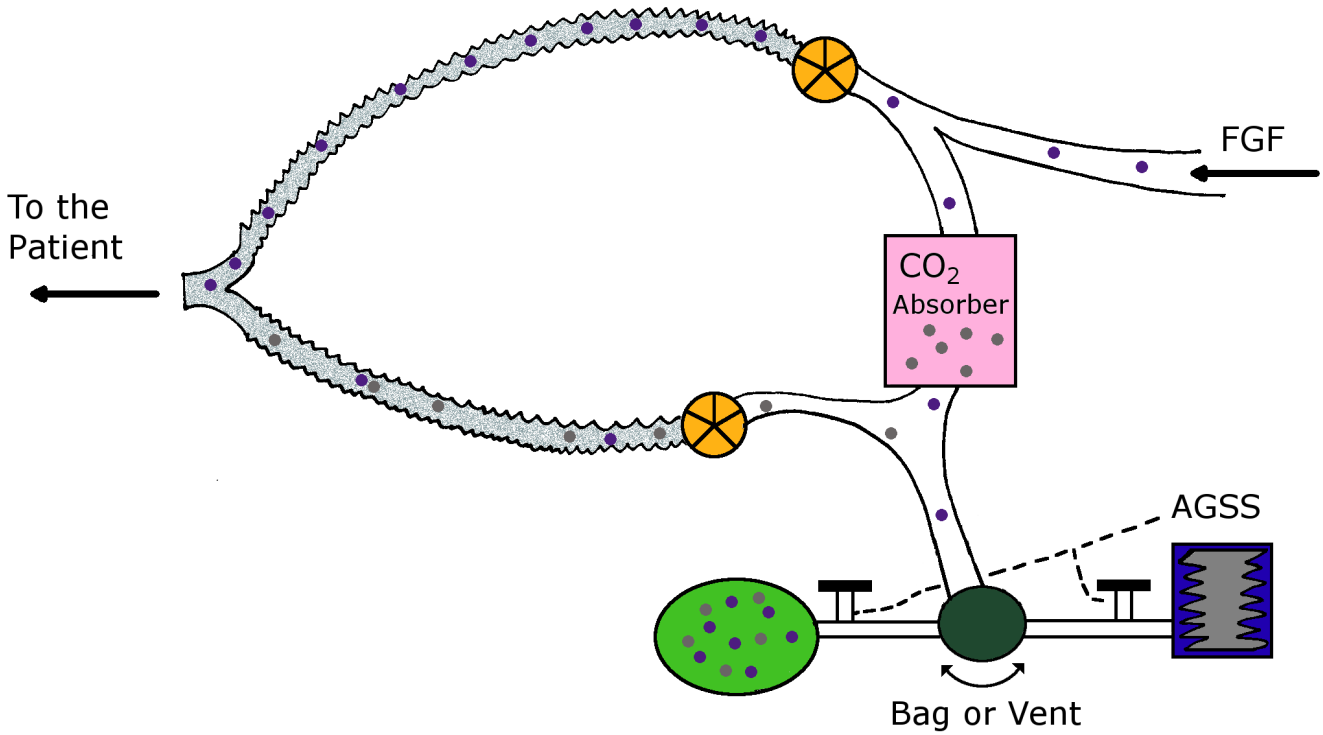
POSITIVE PRESSURE VENTAILATION

- When the patient no longer drives inspiration through negative pressure, ventilation can be maintained either through manual positive pressure ventilation by squeezing reservoir bag or through the ventilator driving bellows

- When squeezing the reservoir bag to deliver gases – if the APL if set to minimum, it would let the gas mixture escape. Therefore to ventilate the patient, the APL valve needs to be set to open only at maximal pressure. This is problematic however as you could only manual ventilate a few breaths before the reservoir bag expands and pressure in the system would increase.

- You would need to continually flip between maximal pressure when delivering a breath and minimal pressure during expiration. When manually ventilating a patient you therefore compromise with “middle” APL setting

- The ventilator mechanically controls its own ventilator APL valve and so it able to manually switch these pressure more efficiently. When the ventilator is in use, the manual APL valve and reservoir bag are disconnected from the system

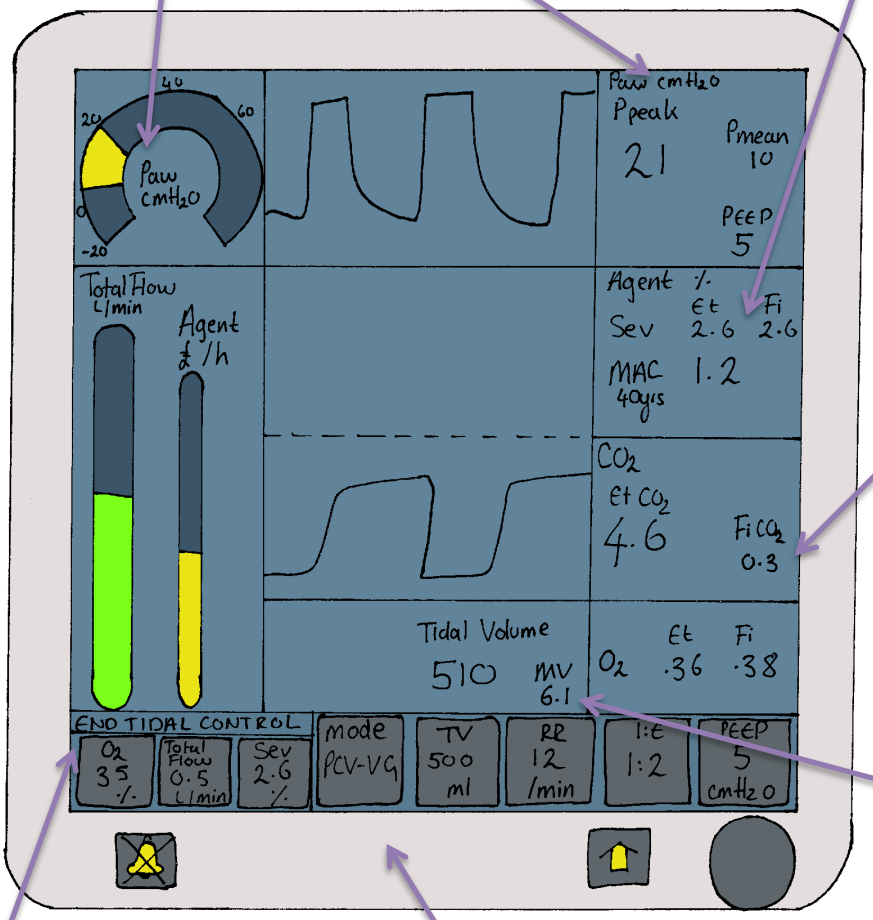


Machine and Ventilation Settings – THE BASICS

Peak airway Pressure (Paw) = Relates to the resistive airway pressure
Should be kept <30cmH_2O to prevent barotrauma.
Causes of high peak airway pressure can be thought of as:

- Machine causes: kinked tubing, waterlogged HME
- Patient Causes: Bronchospasm, Tube biting, Mucus plug

- Minimum alveolar concentration (MAC) of an inhaled anaesthetic = the alveolar concentration at which 50% of patients show no motor response to a standard midline surgical incision
- MAC changes with age and so is often adjusted
- Is one method of gauging depth of anaesthesia



In addition to ensuring $ETCO_2$ is maintained at an appropriate level, the capnography trace itself can be a useful determinant of ventilation
Increased Inspired $FiCO_2$ can indicate problems – e.g exhausted soda lime

Tidal Volume (aim 7-9 ml/kg)

MV = TV x RR

End Tidal Control: set the ETO_2, flow rate, ET volatile .The machine then adjusts the levels of FGF to meet this requirement

Manual gas control: Controlled and adjusted manually by the anaesthetist

Ventilator modes commonly used:

- Pressure control ventilation (PCV): Set the pressure and TV delivered varies on lung compliance
- Volume control ventilation (VCV): set the TV – peak airway pressure varies depending on patient lung compliance
- Pressure controlled Volume Guaranteed (PCV-VG): Newer ventilation method where you set the TV and the ventilator adjusts inspiratory pressure breath by breath to deliver the volume set