Contents

General principles

Airway

- shared
- manipulated by surgery (bleeding, resection)
- good communication essential
- protection of surrounding structures - unable to access them eg eyes
- via ETT:
  - south RAE good for nasal & much oral surgery
  - nasal tube - optimum oral access
- use sux, miva, inhalationals, propofol or remi TCI
- flexible LMA used more and more:
  - adv:
    - adequate protection against aspiration blood & debris
    - ↓complications of tracheal intubation
  - disadv:
    - but can be displaced intraoperatively
    - ↓surgical access

- SV vs IPPV:
  - NMB often not required
  - many favour SV to ensure bag movement indicative of patent airway
  - alts to sux to avoid myalgia:
    - mivacurium 0.15mg/kg = block for 15mins
    - alfentanil 30mcg/kg
    - remi 3mcg/kg

Airway Mnemonics

- Risk of diff BMV = rarely mnemonics offer much benefit:
  - R adiotherapy
  - M ale
  - O SA
  - M allampati III, IV
  - B eard
- Risk of diff SGA placement:
  - R restricted mouth opening
  - O abstracted airway
  - D disrupted airway
  - S tiff lungs
- Risk of diff surgical airway:
  - S urgery/disrupted airway
  - H aematoma/infection
  - O bese/access problem
  - R adiation
  - T umour

Deep or Light Extubation

- considerations:
  - bleeding in airway - coroners clot
  - laryngospasm - never extubate in-between deep or light
- deep suited for SV
  - continue or deepen volatile
  - preoxygenate, place on side, head down, guedel insitu, check regular respiration, extubate
  - must have skilled PACU staff with anaesthetist immed available if problems
- light suited for IPPV
  - brief period of coughing & restlessness - may worsen bleeding

- reverse, suction, wait until nicely awake and coughing

Throat packs

- remove before extubation
- systems to ensure removal :
  - tie to ETT
  - identification sticker on pts head
  - include pack in scrub count
  - always laryngoscopy prior to extubation
  - reminders all over place including near SpO2

Nasal Vasocontrictors

- cocaine 4-10% (max dose 1.5mg/kg)
- adrenaline (1:100,000 – 1:200,000)
- spray, paste, gel, soaked swabs, infiltration

Remifentanil

- good for many ENT procedures that are intensely stimulating but not too painful afterward:
  - middle ear surgery
  - head & neck surgery - controlled hypotension ⟹ ↓bleeding
  - parotidectomy - IPPV without relaxant
  - laryngoscopy - attenuates HTN response
- IV fluid load
- glycopyrulate if HR drifts down
- give morphine prior to end of OT
- Clonidine can attenuate hypertension postoperatively
- ketamine can attenuate Remi induced hyperalgesia

Controlled Hypotension

- goals: ↓blood loss, ↓transfusion rate, ↓operating time, ↓platelet consumption related coagulopathy post op
- 2 options for target:
  - if ASA 1/2: ↓MAP by ⅓ of their baseline
  - If ASA 3/4 or co-morbidities as below: 20% of baseline MAP
- contraindications:
  - IHD
  - PVD
  - uncontrolled HTN
  - DM
  - severe anaemia
  - haemoglobinopathies
  - stroke
  - hepatic & renal impairment
- Methods to achieve MAP target:
  - regional
  - GTN
  - Remi
  - volatile
  - ß blocker
  - clonidine/dex

Table 1 Drugs used to deliberately induce hypotension

Drug	Administration and dose	Advantages	Disadvantages
Volatile agents	As required	Convenience and familiarity if already being used for anaesthesia	Prolonged recovery PONV
Remifentanil	As required	Convenience and familiarity if already being used for anaesthesia	Need for additional opioids after operation Acute postoperative opioid tolerance
SNP	Infusion Up to 1.5 μg kg min^{-1}	Venous and arteriolar dilatation Potent and reliable hypotension Rapidly titratable (half-life ~2 min)	Reflex tachycardia and tachyphylaxis may limit its effects Rebound hypertension Cyanide toxicity
GTN	Infusion 10–400 μg min^{-1}	No dangerous breakdown products	Venodilator only Less efficacious than SNP Tachyphylaxis
Clonidine	Infusion or bolus 1 μg kg^{-1}	Vasodilatation with heart rate control Analgesic properties Ease of administration Not negatively inotropic	Postoperative sedation Rebound hypertension after stopping infusion
β-blockers	Depends on drug	Vasodilatation with heart rate control Ease of administration	Bronchospasm Negatively inotropic Metabolic effects
Magnesium	Bolus 20–60 mg kg^{-1}	Vasodilatation with heart rate control Analgesic properties Ease of administration No rebound hypertension	Modest decrease in blood pressure Prolonged neuromuscular block

Peri-Operative Considerations

Pre-Op Airway Obstruction

Assessment

- obstruction may be:
  - supraglottic
  - glottic
    - commonest @ larynx ⟹ stridor
  - subglottic
- causes:
  - adults = (commonest first)
    - tumours
    - haematoma
    - infection
  - children:
    - infection - Hib vaccine nearly eliminated epiglotitis
    - foreign body
- exhaustion or ↓LOC ⟹ immediate intervention
- features of upper airway obstruction:
  - long slow inspirations with pauses in speech
  - recent marked ↓ex tolerance
  - dysphagia, drooling - unable to swallow saliva
  - critical obstruction:
    - stridor @ rest = ↓airway diameter by at least 50%
    - worsening stridor during sleep/supine
- gather info:
  - vitals: ↓SpO2/PaO2 or ↑PaCO2 = late sign
  - lat Cx spine
  - CT/MRI
  - ENT flexi nasoendoscopy:
    - straight forward access to larynx
    - ability to seat LMA
    - friable surfaces where DL/VL would do harm
  - quick look VL with topicalisation

Management

Emergency

- heliox FM (79% helium, 29% O2) can improve flow past obstruction
  ↳ can add additional O2 via Y connector
- problems in intubation:
  - obstruction worsened by:
    - lying flat
    - induction ⟹ loss of pharyngeal tone
    - bleeding or laryngospasm
  - hard to identify laryngeal inlet due to distortion
  - stenosis ⟹ tube passage difficult

Planning Intubation (SupraGlottic Tumours)

- little evidence either way
- IV induction agents & NMBs carry risk of CICO
- indications for sport ventilation:
  - Mediastinal surgery
  - bronchopleural fistula
  - laryngeal trauma
  - FB
- Few options - awake is always safest option
- DL under **deep inhalational** anaesthesia - only if awake intubation or awake trachy feasable:
  - sevo or slow titrated TCI propofol
    ↳ may take time due to ↓MV
  - once deep spray larynx with LA
  - only likely option in children
  - if unable to identify glottic opening try pressing on chest and watch for bubbles
  - contact bleeding:
    - epiglottic tumours very likely to bleed
    - 1st attempt is best attempt
    - use bougie to pass tumour
  - procedure:
    - do not insert of OPA during light anaesthesia ⟹ coughing, spasm ⟹ obstructed airway
    - pre topicalise nose awake with unilateral sniffing of co-phenylcaine
    - scrubbed surgeon & rigid bronchoscope present
    - sevo induction, do not assist ventilation, allow CO2 to rise
    - insert NPA if obstruction
    - only attempt laryngoscopy if pupils convergent & miotic **and** hypotension
    - look with VL: decide by looking if intubation possible
    - reasonable to not attempt any tube passes & ask surgeon to perform unhurried tracheostomy
    - NMBs only after tube in
    - rescue: emergent trachy or single try at rigid bronchoscope
- **tracheostomy** under LA or deep inhalational GA via FM or LMA
  - likely needed if severe stridor, large tumour, fixed hemi larynx, gross anatomical distortion
  - if emergency: cricothyroidotomy is preferable as quicker, more superficial & ↓bleeding
  - therapeutic reasons: laryngeal or subglottic lesions may need trachy to allow surgery
- **AFOI** under LA:
  - should be used rarely (mostly for supraglottic lesions)
  - reasons is poor option:
    - any sedation (or even LA) of pt may lose airway
    - patient is terrified not calm
    - masses prevent adequate topicalisation of LA
    - unusual anatomy means impossible to identify airway
    - risk of dislodging blood & material esp in supraglottic tumours
    - cork in a bottle - scope may block airway completely esp glottic/subglottic tumours
- **other** options:
  - cricothyroidotomy & jet ventillation:
    - good rescue plan
    - barotrauma real risk as obstruction prevents adequate expiration

    - percutaneous trachy - possibly unsuitable as:
        - cannot monitor insertion of trachy with bronchoscope
        - may enter guidewire directly into tumour
- prepare all equipment
- small ETT in ice will be stiffer to aid passing tight stenotic lesions

Planning Intubation (Other Tumours)

- use CT to delineate level of lesion ∴ plan right strategy
- mid tracheal obstruction:
    - tracheostomy below level of tumour/obstruction
    - ∴ inhalational induction poor option cos if obstruction no rescue option
    - if enough clearance above carina for tracheal cuff ⟹ IV induction
    - ease to pass tube depends on thyroid lesion type:
        - benign - soft easy to pass
        - carcinoma - hard & can invade wall ∴ risk of collapse of trachea with NMBs
    - should always have rigid bronchoscope + scrubbed surgeon capable of emergency FONA
- lower tracheal obstruction:
    - tracheostomy not an option - tube wont be long enough to pass obstruction
    - any NMB may precipitate complete obstruction
    - if mass close to carina or invading bronchus ⟹ transfer to cardiothoracic unit in case bypass needed
    - rigid bronchoscopy may be life saving
    - have ECMO/bypass on standby

Maintenance

- TIVA & Remi for maintenance

Extubation

- use of remi allows cough free wake up
- leave Cook exchange catheter in place at extubation
- if debulking has occurred then continue for 24hrs:
    - humidification
    - dexamethasone
- bridging CPAP connected to tracheostomy can be useful

OSA

- (see obesity section)
- adult surgery:
    - nsal operations
    - uvulopalatopharyngoplasty (UPPP) - role is controversial as may render nasal CPAP less effective
- children surgery:
    - adenotonsillectomy
- children OSA features:
    - chronic hypoxaemia eg
        - polycythaemia
        - RV strain = large P waves in II & V1, Large R V1, deep S V6)
        - ECHO
        - PSG studies
    - should perform corrective surgery prior to other surgeries
- Anaesthetic goals:
    - avoid sedative premeds
    - intubation usually not difficult ⇛ x2 ↑ risk of DI
    - avoid long acting opioids if poss - otherwise use 50% dose & titrate slowly
    - use rest of analgesic ladder & LA
    - pulse oximetry monitoring post op
    - nasal surgery - incorporate NPA into nasal packing

Ventilation Techniques

- options depend on surgery & access required to operative site
- incl:
    - SV with LA +/- sedation:

- few procedures pt able to tolerate
- SV with GA:
  - upper airway endoscopy with Storz bronchoscope (usually paeds)
- IPPV:
  - usually with microlaryngoscopy tube
  - adv:
    - allows standard anaesthetic circuit
  - disadv:
    - ↓access to surg site - occlusion of post ⅓ glottis
    - operative field is mobile with respiratory cycle
- Jet ventilation:
  - 3 delivery options:
    - cannula on suspension laryngoscope:
      - Expiration only when not blowing
      - Risk of gas trapping - use prolonged exp phase and waits for full expiration
      - risk of blowing papilloma down airway
    - catheter placed subglottically
      - Hunsackwr catheter
      - petals over nozzle
      - expiration through resp cycle
      - risk of barotrauma if obstructed airway
    - cricothyroid cannula:
      - Highest risk of complications (10%)
      - use anti-kink cannula
      - risk of cub cut emphysema
- low frequency jet vent (LFJV)
  - high pressure gas source via narrow cannula attached to suspension laryngoscope or bronchoscope
  - hand operated jets 10-20/min - rate based on allowing full expiration
  - entraining of air ↑s VT & ↓FiO2
  - adv: = excellent surgical access
  - disadv:
    - risk of barotrauma
    - unable to Ax EtCO2
    - unable to accurately measure VT
    - TIVA required
    - gastric insufflation if jet poorly aligned
- High frequency jet ventilation (HFJV)
  - air still entrained but VT v small
  - RR generally 60-600/min; insp time ~30% of cycle
  - adv =
    - excellent surgical view
    - safety features: monitor pressure
  - disadv:
    - as LFJV
    - unfamiliar equipment
    - airway humidification impt

Tube Types

Laryngectomy Tubes

- J tube
- short distance from cuff to tip - avoids endobronchial tube
- goes through stoma

MicroLaryngoscopy Tube

- small diameter but adult sized cuff
- size 4,5,6
- long - intubate via rigid scope
- connectors out of way of surgeon

By Surgery

Myringotomy/Grommets

= myringotomy and grommet insertion
- needed as:
  - short Eustacian tubes ⟹ reflux secretions into middle ear
  - recurrent UTI ⟹ oedema of Eustacian tube ⟹ ↓drainage
  - enlarged adenoids ⟹ mechanical obstruction

  ↳ create -ve pressure in middle ear encouraging mater build up here
- Grommet = pressure equalising tube

Preoperative

- day procedure
- repeated ear infections
- check URTI

Intraoperative

- face mask
- circle or T-piece
- supine, head tilted, head ring
- gas induction
- guedel
- can get reflex bradycardia from vagal stimulation (IV handy)

Postoperative

- paracetamol
- NSAIDs

Tonsillectomy/Adenoidectomy

= excision of lymphoid tissue from oropharynx (tonsils) or nasopharynx (adenoids)
- indications:
  - obstructive symptoms
  - recurrent infection
- day stay =
  - minimal risk of post op airway compromise
  - responsible adults
  - cars/phones/close to hospital

Preoperative

- common presentations:
  - nasal obstruction
  - OSA - can improve symptoms in 85-95%
  - deafness
  - exclude active infection
- EMLA
- ?consent for PR analgesia
- risks of periop complications:
  - <3yrs
  - carniofacial abnormalities
  - neuromuscular disorders

- failure to thrive
- obesity

OSA in children

- features:
  - heavy snoring
  - apnoeas
  - restless sleep
  - extended neck position during sleeping
  - daytime hypersomnolence

  ↳ NB laryngoscopy is not more difficult in obese child
- if left untreated can ⟹ neurocognitive impairment, failure to thrive, heart failure
- ↑ed risk of post op complications 1% vs 16-27%
- Ix incl
  - PSG,
  - overnight SpO2 to monitor for apnoeas,
  - FBC
  - ECG
- Specific management points:
  - do in morning - shown to have less post op apnoeas
  - small doses of fentanyl only - less postop resp depression
  - HDU monitoring postop

Intraoperative

- supine, pad under shoulders
- south facing RAE or LMA placed in split of Boyle-Davis Gag

  ↳ look for obstruction

Table 1 Comparison of the LMA and the tracheal tube for tonsillectomy

	LMA	Tracheal tube
Advantages	Straightforward airway No soiling of airway with blood Smooth emergence Paralysis not required Airway protection until awake Minimizes trauma to the airway	More secure airway Good surgical access
Disadvantages	Less secure airway May impair surgical access	Risk of airway trauma Oesophageal/bronchial intubation Requires paralysis Soiling of airway with blood Problems associated with extubation

- SV or IPPV
- IV or gas induction (sevo):
  - sux often avoided in case undiagnosed mm disease ⟹ hyperkalaemic crisis
- intubate using relaxant or deep inhalational anaesthesia
- +/- throat pack - depending on surgical field requests
- beware of surgeon displacing ETT or obstructing ETT with clamp
- keep bag always visible
- paracetamol, NSAIDS, morphine, dex

  ↳ non specific COX inhibitors ↑risk of bleeding slightly ∴ use COX 2 inhibitor
- careful suction under direct vision (Coroners Clot)
- anti-emetic -
  - incidence up to 70%

    - multimodal approach:
        - minimise starvation
        - avoid N2O
        - IVF hydration
        - prophylactic antiemesis - both or one of: dex or ondansetron
        - rescue cyclizine 0.5-1mg/kg (up to 50mg)
- extubate - both ok if done properly:
    - deep
        - established SV, bloodless field, non-responsive to tube manipulation,
        - position: head down, L lat with Guedel (tonsil position)
    - awake
- LA may be used

Postoperative

- analgesia (see below)
- leave IV incase of bleeding
- continual swallowing in recovery -> bleeding
- can be done as day case - extended observation 5-6hr post op

The Bleeding Tonsil

- classified:
    - primary haemorrhage
        - = first 24hrs (but majority in 1st 6hrs)
        - <1% risk
    - secondary haemorrhage = up to 28days
- overall postop bleed rate 3.5% with overall return to theatre 1%
- factors influencing haemorrhage:
    - age - ↑ed in adult men
    - surgery indication - ↑ed in quincy & recurrent tonsillitis
    - technique - ↑ed in diathermy & disposable equipment
    - coagulopathy - 1st presentation of vWF deficiency

Issues:
1. hypovolaemia
2. risk of aspiration
3. difficult laryngoscopy c/o airway oedema and blood
4. residual anaesthetic effects

- call for help
- blood loss may be concealed
- resuscitate preoperatively (Hb on ABG or Haemacue) & X match
- two large bore suctions available
- 2 induction methods:
    - RSI - risk of difficult laryngoscopy - blood & swelling
    - inhalational induction on L side with head down - unfamiliar technique & takes longer
- unilateral common carotid pressure
- place N/G and suction blood out of stomach
- extubate awake
- may need nasal tampon if from ad's - very uncomfortable

Tonsillectomy in Adults

- more painful
- IPPV with mivacurium common
- peritonsillar abscess:
    - generally conservative Rx with Abx
    - if drainage required - LA & syringe aspiration

Peri-operative Tonsillectomy Analgesia

- painful procedure. Pain may be worse at day 3.

Goals:

1. a multi-modal analgesic approach
2. avoidance or minimisation of opioids use to decrease risk of respiratory depression and airway obstruction

Preoperative

PARACETAMOL
- loading dose 20mg/kg PO
- advantages: cheap, quick onset, well tolerated, minimal side effects, 4-6 hours of duration, opioid sparring, non effect on bleeding tendency
- disadvantages: rare risk of liver dysfunction

Intraoperative

LOCAL ANAESTHESIA (TOPICAL) BY SURGEON
- advantages: can be done by surgeon, adrenaline can be used to decrease bleeding risk, easy, quick, avoidance of injection and thus intravascular injection and glossopharyngeal nerve palsy
- disadvantages: has been shown in some studies to not be very effective

DICLOFENAC
- dose 1mg/kg PR
- advantages: good analgesia, opioid sparring, well tolerated, increased risk of bleeding but not increased risk of re-operation rate
- disadvantages: consent from parents required, will require consultation with ENT surgeon about their thoughts
  ↳ may be assoc with ↑bleeding risk ⇛ use praecoxib 0.5-12mg/kg

DEXAMETHASONE
- dose 0.1-0.5mg/kg IV
- advantages: powerful analgesia, anti-emetics, increases appetite, euphoria
- disadvantages: increases BSL's, immunosuppression

CLONIDINE
- dose 1mcg/kg IV
- advantages: opioid sparing, hypotension may decreased bleeding tendency, patient wake slowly and aren't distressed in recovery
- disadvantages: hypotension, **decreased level of consciousness** -> airway obstruction

TRAMADOL
- loading dose: 1-3mg/kg IV
- advantages: used for moderate to severe pain, no respiratory depression, opioid sparring
- disadvantages: not licensed for use in < 12 year olds however, has been used routinely in paediatric hospitals without a problem (need to inform parents), risk of serotonin syndrome, seizures

MORPHINE
- Doseing:
  - 0.2mg/kg iV may with N saline up to 10mls. Then give 1-2 ml increments
  - 0.05mg/kg 3-4hrly IV
  - 0.2mg/kg oral
- advantages: cheap, long acting, well tolerated, allows for a slow wake up, good for moderate to severe pain, no effect on platelet function and bleeding
- disadvantages: increased PONV, increased risk of respiratory depression, constipation
  ↳ consider half dose if other concerns

Postoperative

- paracetamol 15mg/kg Q 4-6 hourly PO (max 90mg/kg/day)
- ibuprofen 10mg/kg 4-6 hourly PO
- tramadol oral drops 0.5-1mg PO qds or IV
- oxycodone 0.05-0.1mg/kg PO

- morphine 0.15mg-0.3mg/kg PRN PO

Oesophagoscopy

- rigid oesophagoscopy done for removal of FB
- commonest impaction site of FB is at cricopharyngeus mm
- if concern then should scope otherwise risk of:
    - perforation
    - mediastinits
    - fistula formation

Induction

- RSI
- ETT secured to L side of mouth

Maintenance

- adequate depth of anaesthesia
- adequate mm relaxation

Extubation

- if perforation suspected:
    - NBM & IV Abx
    - observe for features of mediastinitis: chest pain, pyrxia, s/c emphysema

Myringoplasty

= reconstruction of a perforated tympanic membrane with an autograft (usually temporalis fascia)

- similar Anaesthetic considerations for
    - Tympanoplasty
    - Mastoidectomy

Preoperative

- usually for recurrent infection or congenital defect
- patients usually young and fit
- communication with patient may be difficult c/o decreased hearing
- look for associated syndrome and medical problems
- high risk of PONV

Intraoperative

- supine, head up
- LMA or ETT (south facing RAE)
- SV or IPPV
- LA to larynx
- stimulating procedure intraoperatively but minimal pain post operatively (remifentanil good agent 0.1-0.5mcg/kg/min)
- avoid N2O c/o diffusion into middle ear and lifting off of graft (discuss with surgeon)
- facial nerve testing may be required so well timed use of NDNMBD and use of PNS important
- PONV prophylaxis (dexamethasone 0.1mg/kg, high FiO2, opioid sparing, hydration, minimise exposure to N2O, ondansetron 0.15mg/kg prior to waking up)
- minimal blood loss:
    - head up 10-15deg
    - TIVA
    - adrenaline LA
    - relative hypotension
    - avoidance of ↑HR
- avoid intraoperative coughing
- extubate without coughing to decrease tension on fine sutures

Postoperative
- PONV cares
- simple analgesia (paracetamol, NSAIDS, tramadol)

Stapedectomy/Typanoplasty
= excision +/- reconstruction of damaged middle ear structures

Preoperative
- check for co-morbid conditions that may limit degree of hypotension patient may tolerate
- premedication options; benzo's, beta-blockers and clonidine

Intraoperative
- supine, head up, head tilted to side, head ring
- south facing RAE or LMA
- IPPV
- art line
- PNS (ensure no coughing or movement)
- avoid N2O (although less imp than myringoplasty)
    ↳ discuss with surgeon
- surgeon would prefer bloodless field:
    - TIVA
    - potent opioid
    - ensure no coughing at intubation or throughout surgery
    - head up ⟹ ↓venous pressure
    - induced hypotension (MAP 50-60mmHg) & HR < 60/min
        ↳ options incl
            - remifentanil
            - labetalol (α & ß blocker)
            - ß blocker + vasodilator eg metoprolol 1mg IV & hydralazine 5mg IV increments
- anti-emetics - at least one

Postoperative
- regular antiemetics
- simple analgesia -> morphine

Nasal Cavity Surgery
= submucous resection of septum, septoplasty, turbinectomy, polypectomy, antral washout

Preoperative
- obstructive airways disease associated with nasal polyps

Intraoperative
- use OPA to overcome blocked nose
- supine, head up, head ring
- south facing RAE or LMA
- SV or IPPV
- throat pack cares
- vasoconstrictor and LA applied
- if polypectomy: leave eyes untapped so can assess eyes and monitor optic nerve
- suck out Coroners Clot

- extubate on side with head down + Guedel

Postoperative
- simple analgesia
- requires nasal packing (if nasopharyngeal airway required can be incorporated into pack)
- sit up once awake to reduce bleeding
- can bleed post op
- leave IV in overnight

Microlaryngoscopy
= examination of larynx using operating microscope (+/- excision or biopsy)

Preoperative
- usually elderly, smokers -> thorough assessment of CVS and RESP systems
- careful assessment of airway (history of obstruction, stridor, CT, nasal endoscopy)
- have backup plans to secure airway (have ENT surgeon scrubbed and ready)

Intraoperative
- supine, pad under shoulders, head extended
- microlaryngoscopy tube
  - 5.0 with high volume, low pressure cuff
  - allows IPPV but obscures surgeons view
  - use slow insp phase due to high resstance
  - measured inflation pressure will be higher than patients airway pressure
  - cannot be used for laser surgery - tube ignition
- TIVA with jet ventilation
  - 3 options for injector system:
    - tracheal catheter -
      - semi rigid catheter with tip placed midway along trachea
      - special laser suitable tubes available with port for gas sampling
    - injector needle on operating scope:
      - only an option if good view of larynx
      - various needle sizes available or can pug straight onto ventilating laryngoscope
      - manujet or other pressure device needed
    - cricothyroidotomy needle/cannula:
      - aim towards carina
    - cannula can be placed prior to induction in case of failed intubation
    - be aware of barotrauma and surgical emphysema
- ventilation settings:
  - using normal resp rate (10-20)
  - adjust insp flow/pressure until visible chest expansion
  - accurate flow/pressure measurement not easy $\Longrightarrow$ barotrauma risk
  - pause ventilation during surgical work
- LA to cords
- induce and place microlaryngoscopy tube, once ready change to a jet ventilator
- short acting opioid for stimulating parts
- use sux or miv
- good communication essential
- at end of case continue jet ventilation until SV re-established or discontinue and ventilate with FM
- head down, on side

Postoperative
- simple analgesia
- dexamethasone can be used to decrease airway swelling

Tracheostomy

= insertion of tracheal tube via neck incision

Preoperative

- indications; prolonged ventilation wean or airway obstruction
- before induction ensure all equipment prepared (including cricothyroidotomy kit and ENT surgeon scrubbed)

Intraoperative

- supine, pad under shoulders, head ring, head up
- ETT with IPPV or LMA or under LA
- TIVA if from ICU and difficult to ventilate
- secure ETT with tape for ease of removal
- drape so that can access airway
- FiO2 1.0
- withdraw ETT so cuff just below cords
- deflate cuff before surgeon incises trachea
- once tracheostomy insitu connect circuit via sterile catheter mount
- use fiberoptic scope to check position
- if problem occurs take trachy out and advance ETT down trachea

Postoperative

- examine with scope and suction secretions
- protracted coughing is sometime seen - morphine, benzo's or low dose propofol
- humidify gases
- analgesia
- if extubates ->
    - intubate orally and then re-insert electively
    - retraction sutures may be helpful to identify & open stoma

Tracheostomy Tubes

- specific features:
    - fenestration: allows speech by occluding lumen with finger $\Longrightarrow$ exhale through hole in wall of tube
    - inner tube: permits removal for cleaning
    - adjustable flange: modify length for short trachea or deep stoma
    - channel in obturator for guide wire
- tube changes:
    - tube must be inserted with obturator in place to prevent stomal damage
    - use guidewire as can be difficult to find trachea
    - always pre-prepare for orotracheal intubation if problems
    - cannot be left in place >28days (classified as an implant)

Laryngectomy

= excision of larynx with creation of an end-stomal tracheostomy

Preoperative

- thorough airway assessment
- usually smokers with associated co-morbid conditions
- prepare for life with tracheostomy - SALT's will help

Intraoperative

- supine, pad under shoulders, head ring, head up
- ETT changed to tracheostomy tube during surgery:

    - long tracheostomy tube useful for surgical access & suturing of stoma
    - change to standard tracheostomy tube at end
- invasive monitoring
- long operation - if need CVP then femoral or subclav most useful
- fine bore N/G for feeding (suture to nasal septum)
- hypothermia cares
- remi great
- beware of air emboli

Postoperative
- HDU
- humidification
- drugs for protracted coughing - morphine, benzo, propofol
- to anaesthesise these patients @ later date diff options:
    - use an upside down paediatric face mask over stoma
    - LMA applied to neck
    - intubate after spraying LA on stoma

Other Airway Surgery

Direct Laryngoscopy
- holistic pre-op workup to quantify airway risk vital

IntraOp Options
- LA for fibreoptic exam - commonly nasendoscope
- Intermittent apnoea without intubation:
    - disadv: poor airway protection & poor control depth of anaesthesia
    - adv: unobstructed view
- GA with MLT
- Jet vent techniques

Complications
- Intraop:
    - risk of severe SNS stress response
        ↳ up to 5% show post op signs of CVS ischaemia
- Post op:
    - airway obstruction
    - bleeding
    - laryngospasm
    - laryngeal incompetence

Fibre-Optic Bronchoscopy
- often in resp clinic by resp physicians
- usually no need for Anaesthetist
- use sedation, LA, anticholinergics
- if for GA:
    - pass scope through LMA or ETT
    - small leaks in system but fine for gas analysis
    - usually leave pt SV with TIVA or volatile

Rigid Bronchoscopy
- indication:
    - diagnosis of lesion in trachea
    - therapeutics:
        - dilation tracheal stenosis
        - resection upper airway tumour
        - FB removal
- must ensure atlanto-axial stability (head is fully extended)
- LA used

- LFJV common

FB Removal

- inhalational induction followed by SV until FB recovered
- risk of gas trapping if IPPV applied

Tracheostomy

- indication:
  - critical upper airway obstruction
  - threatened airway obstruction when intubation predicted v difficult
- perform semi sitting up
- complications:
  - cuff perforation
  - loss airway control
  - airway fire - avoid cutting diathermy

Airway Trauma

- avoid any positive pressure ventilation
- techniques:
  - trachy under LA
  - inhalational anaesthesia with SV

Pharyngectomy

= excision of pharynx (glossectomy and radical tonsillectomy), may involve a mandibular split for access and tissue transfer

Preoperative

- discuss with surgeon what they need access to (free flaps from forearm)
- careful airway assessment
- often smokers with co-morbidities
- organise ICU bed

Intraoperative

- supine, pad under shoulders, head ring, head up
- ETT -> tracheostomy
- invasive monitoring
- ensure well filled $\Longrightarrow$ minimise use of vasopressors
- fine bore N/G (secure)
- remi good

Postoperative

- ICU
- WWWE
- flap observations
- humidification
- analgesia

Radical Neck Dissection

= excision of sternomastoid, IJ and EJ veins and associated lymph nodes

Preoperative

- careful airway assessment
- smokers with associated co-morbidities

Intraoperative
- hypothermia cares
- have blood ready
- invasive monitoring - MUST avoid neck (femoral for CVL)
- remi
- restrictive fluid regime
- be-aware of air embolism and manipulation of carotid sinus
- dexamethasone for swelling

Postoperative
- risk of head & neck oedema for several days due to ↓VR:
  - head up
  - limit IVF
- need to avoid rebound HTN post extubation which may ⟹ wound haematoma:
  - cont low dose remi
  - adequate morphine prior to end of case
  - Rx any HTN early & aggressively
- generally need surprisingly little analgesia
- clonidine (keep BP down)

Parotidectomy
= excision of parotid gland (preservation of facial nerve)

Preoperative
- careful airway assessment
- check suitability for SV ie (not elderly, obese, resp disease)
- check mouth opening

Intraoperative
- supine, head ring, head tilt and extended
- ETT (south facing RAE) or LMA (reinforced)
- IPPV or SV
- no NMB during dissection
- PNS to declare when nerve action recovered
- remi great
- suppress respiratory drive (remi, hyperventilation, propofol)
- LA to cords to prevent coughing
- can bleeding (good IV access)

Postoperative
- analgesia
- watch for rebound HTN & Rx as neck dissection
- clonidine in recovery

LASER Surgery
General

L - light
A - amplification
S - stimulated
E - emmission
R - radiation

= intense beam of photons with energy capable of vaporising tissues.
- creation of laser requires:
  - energy source
  - lasing medium
  - optical resonater/outlet coupler
- process of laser creation:
  - light hits lasing medium molecules and excites them
  - proton is released and then reflected back into medium
  - protons hit molecules of medium ⟹ release of further protons in a chain reaction
  - these protons make up light emissions which is then managed into laser tube in certain way:
    - collimated = parallel output beam results in little energy loss
    - coherent = waves are all in phase resulting in little energy loss
    - monochromatic = all of same wave length
- effects of laser depends on the following effects:
  - photothermal - predominant clinical effect

Types

Laser	Wavelength (nm)	Pulse length	Uses	Colour
Carbon dioxide	10,600	continuous	tissue cutting	IR
Neodymium-YAG	1064	continuous	coagulation	IR
Neodymium-YAG	1064	10 ns	posterior capsulotomy	Red
Ruby	694	100 mss	tattoo removal	Red
Argon	488-514	continuous	coagulation	Blue/Green
Excimer	308	10 ns	photorefractive keratotomy	Blue/Red

Safety Aspects
- lasers are classified according to amount of damage they can cause:
  - class 1 = generally safe
  - class 2 = safe within the time of the blink reflex
  - class 3 = cause blindness after short exposure from mirrored surfaces
  - class 4 = unsafe even with reflection from non-mirrored surfaces
- all medical lasers = class 4
- ∴ pt & operator should wear goggles

Laser Safety Standards

ENVIRONMENT
- illuminated light displayed outside of theatre when laser on

PERSONNEL
- laser safety officer
- all aware of laser safety protocols
- special face masks ⟹ prevent contamination from aerosolised infectious material (papillomata)

EQUIPMENT
- medical instruments should have a matt finish (decreased risk of reflection)
  ↳ laser resistant ETT - silicon or rubber inner or coiled metal outer
- safety glasses with side shields
- effective smoke evacuation

PATIENT
- cover skin with absorbable non combustible drapes
- tape eyes closed & cover with moist swabs or matt metallic eye covers

- non-flammable skin preparation fluids

Anaesthetic Issues

- if being used in airway surgery -> use laser resistant tube or intermittent jet ventilation via bronchoscope (requires IV anaesthesia)
- fill ETT tube cuff with saline +/- methylene blue
- pack with saline soaked gauze
- low flow O2 or air
- airway fire management -> see viva notes

Risks

- to pt:
  - excessive burning
  - airway fire - ensure 50m syringe of saline pre-filled
  - scar formation
  - visceral perforation
- to operator:
  - accident skin exposure
  - corneal or retinal burns
- anaesthetic risk:
  - burns/eye inj
  - upper airway laser ⟹ ETT ignite ⟹ airway fire
- to ↓risk:
  - damp swabs next to adjacent tissues
  - non combustable gases
  - goggles

Specific Examples

Pulsed Dye Laser

- wavelength targets rbcs within blood vessels
- energy dissipated within dermis ⟹ minimal epidermal scarring
- Rx port wine stains
- children often have multiple Rxs under GA
- post op can be v painful

CO2 laser

- long wavelength
- preferentially absorbed by water
- target cells are heated to vaporisation by beam
- very shallow penetration ∴ can observe tissue damage
- Used facial surgery for wrinkles, vocal cord or airway lesions

Nd-YAG Laser

- transmitted through clear fluids & absorbed by dark matter
- penetrate to depth 1cm
- used in airway neoplasms, vasc malformations & ophthalmic surgery

Oesophageal Injury & Repair

Management Options

- Temporising medical management:
  - NBM
  - Abx coverage
  - PPI
  - Parentral nutrition
  - close observation
- Stenting:

    - ↓ed complication & improving success rates
    - temporary stent placed with removal 6-12 weeks later
    - need to observe for stent migration
- Primary repair:
    - approach depends on rupture level:
        - neck - local incision
        - mid Tx - thorascopic or open approach
        - Low Tx - midline abdo incision, larpascopic approach
    - closure may be made over draining T tube
        ↳ promotes healing without contamination as oesophagus-cutaneous fistula

Preoperative

- standard incl full r/v of radiological investigations

Perioperative

Induction

- DLT or BB - to allow lung isolation for surgical access
- RSI as
    - ↑ed risk of aspiration
    - avoid coughing/straining risking further rupture
- place NG tube into upper oesophagus (above lesion)
    ↳ surgeon likely to manipulate later
- Invasive monitoring
- if critically ill - consider Cardiac output monitoring & goal directed fluid therapy
- analgesia
    - neuraxial
    - PVBs
    - remi intraop > morphine end of procedure

Postop

- early enteral feeding via NJ tube
- monitor for signs of leak:
    - acute - CT or ultrasound
    - 2-3wks post repair = gastrografin swallow

Medical Problems

Stridor Differential

Infection (croup, bacterial tracheitis, epiglottitis, peri-tonsillar abscess)
Trauma
FB
Burns
External compression - tumour
Anaphylaxsis
Angioedema
Laryngospasm

Laryngeal Trauma

- prehosp mortality up to 80%
- signs: stridor, odynophonia, odynophagia, wheeze, ↑WOB

Examination

- loss of anatomy
- haemoptysis
- crepitus
- emphysema
- wounds

Management

- CT if possible to quantify injury to trachea
- ENT surgeon to perform tracheostomy under local
- inhalational with no airway