# Contents

## General principles

- Controlled Hypotension

## Peri-Operative Considerations

- Pre-Op Airway Obstruction
- OSA
- Ventilation Techniques
- Tube Types

## By Surgery

- Myringotomy/Grommets
- Tonsillectomy/Adenoidectomy
- Oesophagoscopy
- Myringoplasty
- Stapedectomy/Typanoplasty
- Nasal Cavity Surgery
- Microlaryngoscopy
- Tracheostomy
- Laryngectomy
- Other Airway Surgery
- Pharyngectomy
- Radical Neck Dissection
- Parotidectomy
- LASER Surgery
- Oesophageal Injury & Repair

## Medical Problems

- Stridor Differential
- Laryngeal Trauma
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, inhalational, 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 Vasoconstrictors**
- 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
  - β blocker
  - clonidine/dex
By A Hollingworth & J Fernando

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 epiglottitis
    - 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 feasible:
  › 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 ventilation:
    - good rescue plan
    - barotrauma real risk as obstruction prevents adequate expiration
By A Hollingworth & J Fernando

Percutaneous tracheostomy - possibly unsuitable as:
- cannot monitor insertion of tracheostomy 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 won't 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

Exubation
- 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:
  - nasal 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
- ind:
  - SV with LA +/- sedation:
- few procedures pt able to tolerate
  - SV with GA:
    - upper airway endoscopy with Storz bronchoscope (usually paed)
  - 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

**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
  - cariofacial 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
- ↑ 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>
<thead>
<tr>
<th>Table 1</th>
<th>Comparison of the LMA and the tracheal tube for tonsillectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LMA</strong></td>
<td><strong>Tracheal tube</strong></td>
</tr>
<tr>
<td>Advantages</td>
<td>Straightforward airway</td>
</tr>
<tr>
<td></td>
<td>No soiling of airway with blood</td>
</tr>
<tr>
<td></td>
<td>Smooth emergence</td>
</tr>
<tr>
<td></td>
<td>Paralysis not required</td>
</tr>
<tr>
<td></td>
<td>Airway protection until awake</td>
</tr>
<tr>
<td></td>
<td>Minimizes trauma to the airway</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Less secure airway</td>
</tr>
<tr>
<td></td>
<td>May impair surgical access</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 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 suction 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 sparing, non effect on bleeding tendency
- disadvantages: rare risk of liver dysfunction

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 sparing, 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 sparing
- 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
- Dosing:
  - 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
  ‣ mediastinitis
  ‣ 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, pyrexia, 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 & β blocker)
      › β 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 inspiratory phase due to high resistance
  - 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 plug 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
- ventilation settings:
  - using normal resp rate (10-20)
  - adjust inspiratory flow/pressure until visible chest expansion
  - accurate flow/pressure measurement not easy ⇒ 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 => 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 >28 days (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 anaesthetise 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 very 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 ⇒ 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 - emission
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

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

### 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
  - Parenteral 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
Anaphylaxis
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