Contents

By Surgery ........................................2

Thyroidectomy .............................2
Parathyroidectomy .........................4
Phaeochromocytoma ......................5
By Surgery

Thyroidectomy

- high variance in complexity from nodule removal to excision of massive retrosternal goitre with tracheal compression
- occasional need for sternal split to excise retrosternal component
- rLN or parathyroid glands may be damaged or removed
- unilat surgery can be done under superficial or deep Cx plexus block

Preoperative

- ensure as near euthyroid as possible
- check for complications assoc with ↑thyroid:
  ▶ AF
  ▶ tachycardia
  ▶ proptosis
- thyrotoxic patients:
  ▶ prepare for surgery jointly with endocrinologist
  ▶ drugs = iodine & steroids -
    ▶ both inhibit T4 ⇔ T3 conversion
    ▶ 7-10d window for surgery
- ask about:
  ▶ duration of goitre - longer ≈ ↑risk of tracheomalacia
  ▶ positional breathlessness
- examine thyroid:
  ▶ consistency = hard ≈ malignant
  ▶ size of goitre - can get below it?
  ▶ signs of SVC obstruction -
    ▶ distended neck veins which dont change with resp cycle
    ▶ Pembertons sign - hold both arms upright so to touch ears for 1min. +ve with cyanosed face & SOB
  ▶ stridor
  ▶ orthoponea?
  ▶ check neck AROM
- Investigations:
  ▶ routine bloods & TFTs, Ca
  ▶ CXR - tracheal deviation
  ▶ CT -
    ▶ tracheal encroachment
    ▶ retrosternal encroachment = ≥ 50% mass below thoracic inlet ≈ ↑risk needs sternotomy
- Referrals:
  ▶ ENT consult for nasendoscopy to document baseline cord function is routine in some places
    ▶ ie rLN function
  ▶ useful in airway planning

Perioperative

Airway Planning

- most airways are easy even with compression or deviation
- reinforced ETT negotiate most obstructions
- tracheal compression will often expand to fit any size ETT as is soft
- standard plan = preoxygenate > IV induction > tube
  ▶ +/- RSI
- warning signs:
  ▶ malignancy:
    ▶ cord palsy likely
    ▶ ↑ing distortion & rigidity of surrounding structures
    ▶ possible intraluminal spread
    ▶ obstruction anywhere from glottic to carina
  ▶ significant resp symptoms

Endocrine - 2
- >50% narrowing on CXR of trachea
- coexisting predictors of DI
- options to manage difficult airways:
  - RSI - standard DL/VL induction
  - inhalational induction:
    - premed antisialoges
    - slow onset (~30mins) due to stridor & ↓MV
    - use LA to cords
  - AFOI:
    - may be very difficult due to complete obstruction of airway with scope
      → cork in a bottle ↓ generally not 1st line
    - useful if marked displacement of larynx or other problems eg Anky Spond
  - LMA - but may be difficult to sit if marked laryngeal displacement
  - Tracheostomy under LA - only an option if thyroid not extending caudad
  - Rigid bronchoscope:
    - backup option if ETT attempts fail
  - Cricothyroid puncture likely not an option!
  - Bypass on standby
- Induction
  - large IV access in case of bleeding
  - eye cares impt - esp if has exophthalmus
  - goitre alone doesn’t predict difficult airway
  - airway:
    - inhalational vs IV
    - difficult intubation
    - fibreoptic intubation
  - should use armoured ETT
  - Superficial Cx plexus block billet
  - full relaxation or LA to cords - likely multiple ETT manipulations
  - if EMG monitoring of rLN intraop - NIM tube:
    - electro pad @ cord
    - no NMBs
    - Touch rLN → cord movement closes onto pad
    - get visual & audible alarm
  - avoid neck ties to ETT
  - consider superficial Cx plexus block for post op analgesia
- Maintenance
  - TIVA remi
  - slight head up
  - dex
  - prior to wound closure check haemostasis: valsalva manoeuvre 10-20s +ve pressure breath hold with head down
- End of case
  - surgeon may ask for ETT to be withdrawn so tip just distal to operating site to check for tracheomalacia
  - extubate sitting up ⇒ ↓venous pressure
  - attempt to avoid coughing:
    - deep extubation
    - LMA switch
    - remi wake-up
  - no place for assessing cords immediately following extubation - better assessed awake & sitting upright in PACU
- Postop
  - PRN opioids
  - nasendoscopy if concern about rLN damage
- Post Op Complications
  - Stridor:
    - haemorrhage ⇒ tense swelling of neck
    - Bfs:
      • HTN peri-op
• diff extubation
  - remove clips from skin & sutures from platysma/strap mms
  - can do at bedside in emergency
  - return to theatre asap: need scrubbed surgeon ready for emerg trachy/FONA
  - any haematoma ⇒ blockage of lymph drainage ⇒ eventual laryngeal & pharyngeal oedema

> tracheomalacia:
  - v rare
  - large chronic goitres ⇒ tracheal collapse
  - immediate re-intubation may be needed & tracheostomy needed ⇒ ICU 24hrs vent & assess

> bilat rLN palsies:
  - (unilateral ⇒ hoarseness)
  - resp difficult immed post op or later
  - stridor only when agitated
  - assess with nasendoscopy

> laryngeal oedema:
  - traumatic intubation or complex surgery

- hypocalcaemia:
  - in up to 20% temporarily (very uncommon to be permanent)
  - 2nd to parathyroid removal ⇒ check PTH end of op - if absent then at risk
  - check Ca at 24hr & then daily
  - signs: neuromuscular excitable, tingling around mouth, tetany
  - diagnose:
    - carpopedal spasm (Trousseau sign) - cuff inflation ⇒ flexed wrist & fingers
    - Chvostek sign - tap over facial nerve at parotid ⇒ twitching
    - long QTc
  - Rx Ca immediately:
    - <2 = IV Ca
    - >2 = oral calcium + calcitriol (vit D)

- Thyroid crisis:
  - rare given preop control
  - commonest in Graves
  - can be triggered by infection, surgery, stress
  - often present 6-24hr post surgery
  - diagnosed: ↑ing HR & ↑ing temp, sweating, coma, D&V
  - may look v similar to MH (check CK & PvCO2 = higher in MH)
  - Rx:
    - IVF
    - avoid NSAIDs - these displace thyroid hormones from binding sites
    - ß blockers - to slow HR <100:
      • propanolol - 1mg increments up to 10mg (also blocks peripheral conversion)
      • esmolol
    - IV hydrocortisone 200mg qds - ↓periph conversion
    - Propylthiouracil 1g loading via NGT then 200qds
      • inhibits T3 & T4 release & ↓s periph conversion
    - after PTU give sodium iodide, potassium iodide or Lugols iodine
  - PTx

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**Parathyroidectomy**

= removal of solitary adenoma or four glands for hyperplasia

- are 4 parathyroid glands which release PTH
- PTH ⇒ ↑serum Ca
  - Bone - ↑Ca & PO4 reabsorption
  - Kidney -
    • ↑Ca reabsorption & ↑PO4 excretion
    • ↑vit D formation

- usual indication is for **primary parathyroidism**:
  - often partial removal
› pre-op localisation of simple adenoma may allow removal under LA/sedation
› these pts have 1 co-morbidities:
  - increased risk of CVS disease,
  - HTN,
  - LVH,
  - valvular and myocardial calcifications,
  - arrhythmias,
  - impaired glucose tolerance,
  - dyslipidaemia
- secondary hyperparathyroidism = chronic renal failure patients due to ↓ serum Ca
  › recent dialysis please
  › ↑ risk of bleeding
  › alfalcaldiol usually started preop
  › total resection may be required - as then easier to manage postop
- Tertiary hyperparathyroidism:
  › glands become autonomous post chronic kidney disease
- pre-op identifications:
  › ultrasound & technetium 99m sestamibi scanning - for adenomas
  › methylene blue -
    - parathyroids highly vascular & uptake dye faster than surrounding tissues
    - useful in 4 gland hyperplasia
    - if give too early lose contrast with surrounding tissues
    - 5mg/kg diluted in 500ml 1hr prior to surgery
    - side effects =
      • restlessness, paraesthesia, chest pain, dizziness, headache, confusion
      • ↓ accuracy of SpO2

Preoperative Management
- hypercalcaemia:
  › level <3 = IVF sufficient
  › > 3.0 prior to surgery - needs correcting:
    - IDUC
    - IVF 1 litre over 1 hour then 4hrly bags
    - bisphosphonates - pamidronate 60mg in 500ml over 4hrs
    - Ax for fluid overload, watch electrolytes incl Mg, PO4 & K
  › severe ↑↑ Ca may require emergency surgery -
    - ↑↑ risk arrhythmias
    - antagonisation of NDNMBs

Intraoperative Management
- head up
- ETT with IPPV
- unpredictable length
- may require frozen section
- active heat conservation
- bedside PTH assays are available ➔ allow rapid assessment of success intraoperatively
- extubate cough free

Postoperative Management
- watch Ca2+ - 6hr & 24hr
- start calcitriol
- perform fibre-optic nasoendoscopy if recurrent laryngeal nerve damage suspected
- usually not too painful

Phaeochromocytoma
= removal of 1 or 2 adrenals or extra-adrenal tumour
= tumour of chromaffin cells
= secrete any of (common to uncommon):
noradrenaline or
adrenaline or
dopamine
- 99% in abdo or pelvic (usually adrenals); 10% bilateral
- most benign
- less common in children
- can occur as apart of MEN2A (thyroid Ca) or MEN2B (thyroid Ca with marfanoid features)
  ↓: (chromosome 10 defect)
  ↑: if thyroid disease always consider possibility of phaeo
- also in neurofibromatosis and Von Hippel-Lindau syndrome

**Diagnosis**
- investigations:
  - 24hr Urine:
    - fractionated metanephrines
    - fractionated catecholamines
  - Bloods
    - fractionated metanephrines
  - If normal -> check during a spell
  - Diagnostic criteria
    - 2 fold elevation above upper limit of normal in urine catecholamines
    - Urine metanephrines
    - significant increase in fractionated plasma metanephrines
  - further tests:
    - MRI/CT to look @ adrenals or for paraaortic mass
    - 123I-MIBG if mass > 10cm
  - If gland normal:
    - whole body MRI
    - 123I-MIBG radio-isotope
    - In-III penttreotide scan
    - PET scan
  - once found:
    - genetic testing
    - alpha & beta blockade
    - surgical resection

**Preoperative Management**
- history: palpitations, sweating, headache, HTN, anxiety, N+V, weakness and lethargy, MI, APO, CVA
  ↓: if present peri-operatively mortality can be up to 50%
- examination; mass, HTN
- investigations;
  - ECG
    - 24hr or overnight urinary metanephrines
  - Imaging:
    - CT, MIBG radioisotope scan (taken up by chromaffin tissue), MRI
    - search in abdo first then widen search if not found
  - ECHO - rare but can get catecholamine cardiomyopathy
  - BSL
- assess for degree of α block by Roizen criteria:
  - no HTN
  - postural drop
  - Norm ECG

**Management**
1. refer to tertiary unit
2. Preoperative blockade:
  - advs:
- safe anesthia
- prevents HTN response to induction
- limits surges at tumour handling

3. Drugs:
   - alpha blocker - phenoxybenzamine
     - = non competitive non selective blocker
     - SE's= post hypotension, lethargy, nasal congestion
   - beta-blocker (propanolol/metoprolol) - ONLY following α block
     - some will avoid these peri-operatively
     - must avoid unopposed β blockade - theoretical vasoC crisis
   - Ca2+ channel blockers
     - eg nicardipine
     - inhibits noradrenaline mediated calcium influx into smooth muscle
     - doen't affect NA release from tumour
   - selective α1 blockers eg doxazosin -
     - = competitive blockers
     - do not inhibit presynaptic NA re-uptake . avoid ↑HR seen in non selective blockade
     - good & bad reports of use

- assess sympathetic blockade with 24 hour ambulatory BP monitoring
- aim for BP < 140/90 + HR <100
- should have a marked postural drop (>20mmHg) with compensatory tachycardia

Intraoperative Management

- plan for critical steps:
  - induction
  - Insufflation of abdo
  - venous ligation ⇒ ↓bp, ↓BSL
  - end of op - adequate reversal given Mg given
- premedication
- can be carried out laparoscopically - pneumoperitoneum may ⇒ ↑HTN in these patients
- large bore IV access -
  - Rx any volume depletion
  - ↑bleeding risk on R side due to venous anatomy
- hypothermia cares
- epidural may be appropriate
- invasive monitoring - A line & CVL
- avoid certain agents:
  - histamine releasers (suggest alfentanil, remi, vecuronium or rocuronium)
  - indirect sympathomimetics
  - SNS stimulants - ketamine, desflurane
  - Metoclopramide
  - Sux ⇒ ↑IABP
- hypotension at induction likely ⇒ may need adrenaline
- HTN episodes:
  - phenotolamine 1mg boluses
  - nicardipine
  - Mg - direct vasodilation +/- myocardial protection
    - prophylaxis: 2-4g before induction then 1-2g/hr infusion
    - Rx- bolus 2g as appropriate
  - remi
  - labetalol - if assoc ↑HR
  - SNP - very titratable
- keep HR <100 - esmolol
- once tumour out
  - bp declines over several minutes
  - fluid preload to CVP 10-15
  - ↓MAP may be due to:
    - ↓CO - low dose adrenaline
    - ↓SVR - phenylephrine or if needed vasopressin
normally self resolving prior to end of operation unless other issues

Postoperative Management
- ICU m- vasopressor
- monitor glucose - risk of severe hypoglycaemia
- if both adrenals resected ->
  ‣ hydrocortisone 100mg in theatre
  ‣ fludrocortisone 0.1mg when swallowing
- if single adrenal - suggest 50mg hydrocort

Other issues
Pregnancy
- phenoxybenzamine and metoprolol are safe
- if diagnosed before midtrimester -> resect
- if diagnosed later -> EILCS +/- resection @ same time

Unexpected Phaeochromocytoma
- consider if: unexplained APO, HTN or severe unexpected HTN
- if possible abandon surgery to allow blockade
- Immediate management:
  ‣ if HTN:
    - vasodilate - GTN
    - load with fluid - even if APO as circulating volume often very low
    - phentolamine
    - labetalol
  ‣ if ↓MAP - acute heart failure due to profound vasoconstriction
    - very difficult diagnosis
    - mortality very high
    - attempt to avoid catecholamines & try guarded Rx as for HTN