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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
 - Pemberton's sign - hold both arms upright so to touch ears for 1min. +ve with cyanosed face & SOB
 - ▶ stridor
 - ▶ orthopnea?
 - ▶ 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

- ▶ >50% narrowing on CXR of trachea
- ▶ coexisting predictors of DI
- options to manage difficult airways:
 - ▶ RSI - standard DL/VL induction
 - ▶ inhalational induction:
 - premed antisialogues
 - 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
 - ▶ fiberoptic 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:
 - caropedal 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
 - β blockers - to slow HR <100:
 - propranolol - 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

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 ↑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
 - ▶ alfacalcidol 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 part 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 pentetreotide 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 anaesthesia
- prevents HTN response to induction
- limits surges at tumour handling

3. Drugs:

- ▶ alpha blocker - phenoxibenzamine
 - = non competitive non selective blocker
 - SE's= post hypotension, lethargy, nasal congestion
- ▶ beta-blocker (propranolol/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
 - doesn't affect NA release from tumour
- ▶ selective α_1 blockers eg doxazosin -
 - = competitive blockers
 - do not inhibit presynaptic NA re-uptake \therefore avoid \uparrow 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 \Rightarrow \downarrow bp, \downarrow BSL
 - ▶ end of op - adequate reversal given Mg given
- premedication
- can be carried out laparoscopically - pneumoperitoneum may \Rightarrow \uparrow HTN in these patients
- large bore IV access -
 - ▶ Rx any volume depletion
 - ▶ \uparrow 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 \Rightarrow \uparrow IABP
- hypotension at induction likely \Rightarrow may need adrenaline
- HTN episodes:
 - ▶ phentolamine 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 \uparrow HR
 - ▶ SNP - very titratable
- keep HR < 100 - esmolol
- once tumour out
 - ▶ bp declines over several minutes
 - ▶ fluid preload to CVP 10-15
 - ▶ \downarrow MAP may be due to:
 - \downarrow CO - low dose adrenaline
 - \downarrow 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 -> EILSCS +/- 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