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General principles

Regional Techniques

- LA infiltration
- regional nerve blocks +/- sedation
- sedation agents; propofol, midazolam, ketamine

The Difficult Airway

- may arise from; anatomical deformity from tumour, trauma, infection, previous operation, radiotherapy
- AFOI
- competency in PO, nasal and tracheostomy required
- ETT tied, taped or stitched

Poor Access to Patient

- produces problem with; heat conservation, monitoring, vascular access

Smooth Emergence

- avoid coughing and straining @ end of operation
- propofol and LMA good option

Analgesia

- less painful
- doesn't involve cavity surgery or new #'s
- patient can take oral medications usually post
- much pain is off set by LA infiltration

Long operations

- vascular access
- blood loss
- fluid balance
- Temp
- positioning
- pad pressure areas (including eyes)
- VTE prophylaxis
- ET cuff pressure (measure/fill with saline)
- post op care -> flap observations

Attention to Detail

- high maintenance client

By Surgery

Breast Reduction

Preoperative Management

- often have severe back and neck pain (check neck extension)
- young and fit
- DVT prophylaxis
- requires G+H

Intraoperative Management

- moderately painful
- supine with 30 degrees head up
- GA (ETT/LMA + IPPV)
- lie patient on bluey's to absorb blood
- after positioning check patency of IV's

Post operative Management

- dose of morphine -> simple analgesia
- watch for haematoma formation (early), wound infections, dehiscence & fat necrosis (later)
- with larger reductions (>1kg) may require RBC's - X match

Breast Augmentation

- indications:
 - ▶ reconstruction post mastectomy
 - ▶ correction asymmetry
 - ▶ aesthetic bilateral augmentation

Preoperative Management

- patients usually fit and well
- FBC

Intraoperative Management

- supine, 30 degrees head up, arms out on boards/hand behind buttocks
- GA (ETT/LMA + IPPV)
- minimal blood loss
- can be post mastectomy with TRAM flap (transverse rectus abdominis muscle) or free flap
- pocket formation @ anterior axillary line -> implant insertion

Postoperative Management

- large implants -> more pain
- simple analgesia + NSAIDS
- complications; haematoma (early), infection, capsule formation, rupture (late)

Correction of Prominent Ears

Preoperative Management

- may be unilateral
- day case
- usually children (4-10 years old)
- children may be self conscious and anxious (teased @ schools)

Intraoperative Management

- supine, head up @ 30 degrees
- flexible LMA (SV)
- PONV common ∴ propofol TIVA tolerated well
- NSAIDS
- LA infiltration by surgeon
- 20mL/kg crystalloid

Postoperative Management

- paracetamol, ibuprofen
- dressing tight - takes a while at end of operation
- complication; haematoma formation (early)

Facelift (Rhytidectomy)

= surgical reduction of facial folds and wrinkles to create a more youthful look

Preoperative Management

- 45-65yrs
- normally fit and healthy
- have high expectation and may have had procedure previously
- discontinue NSAIDS 2/52 prior to surgery

Intraoperative Management

- 3-4 hours
- supine, 30 degrees head up
- facial nerve blocks
- GA (LMA/ETT + IPPV) - nasal north rae useful
 - ↳ discuss airway surgeon would prefer
- can use hypotensive technique - SBP 70-80 may ↓ blood loss
- remifentanyl TIVA
- incisions made in concealed areas and skin mobilised and traction applied
- anti-emetics
- warming blanket

Postoperative Management

- no coughing on extubation (LMA and propofol ideal)
- peri-extubation morphine but not sig pain long term
- avoid shivering (pethidine)
- paracetamol + NSAIDS
- lots of pain ≈ haematoma

Free Flap Surgery

Preoperative Management

- long OT
- painful
- key Rx is to minimise warm ischaemic time
- operations:

1. TRAM -> mastectomy
2. Gracilis flap -> lower limb trauma
3. radial forearm flap -> oropharynx

- co-morbid conditions; smoking with oropharyngeal cancers, healthy with lower limb trauma

Intraoperative Management

- variable position
- blood loss ++
- GA (ETT + IPPV)
- invasive lines
- regionals/epidurals:
 - ▶ usual benefits eg vasodilation, ↓stress response, ↓DVT, ↓blood loss
 - ▶ ? ↓vasospasm to flap
 - ▶ BUT:
 - as flap denervated is great concern loss of SNS to that area will ⇒ ischaemia due to ↓MAP via steal phenomenon
 - animal model: 10% hypovlaemia ⇒ ↓flap microcirculation flow by 40%
- pressure & VTE cares
- aggressive warming - keep core:periph gradient <2deg
- avoid shivering
- ventilate to norm parameters - norm CO₂, O₂
- aim = to produce a hyperdynamic circulation, high Q, adequate vasodilation, wide pulse pressure
- isoflurane, propofol or remi
 - ↳ some evidence propofol improved microvascular flow by avoiding volatiles effect on rbc
- membrane stiffness
- theoretical targets:
 - ▶ volume load to CVP 12mmHg - although at best only trends valid
 - ▶ U/O 2mL/kg/hr,
 - ▶ widened pulse pressure,
 - ▶ low SVR
- use colloid rather than crystalloid (increased flap oedema risk with crystalloid)
- aim for haematocrit of 30%:
 - ▶ best balance of ↓viscosity & optimal O₂ flux with ↑bleeding
- transfuse Hb <80
- fluid choices:
 - ▶ albumin
 - ▶ D70 dextran (polysaccharide from sucrose)->
 - volume expander 500 ⇒ 750ml plasma expansion
 - decreased platelet aggregation and factor VIII levels
 - ↳ although fallen out of favour - high allergy risk 1:3000, metab'ed to glucose
- prophylactic antibiotics
- avoid β blockers ⇒ vasoC in periph tissues
- vasodilators not required -
 - ▶ anaesthetic agents sufficient
 - ▶ pt warm
 - ▶ volume loaded
 - ▶ pain free
 - ▶ normocarbic
- vasoactives:
 - ▶ phenylephrine:
 - no evidence of decreased blood flow
 - but must ensure normal volume status
 - ▶ dobutamine:
 - ↑CO but may ↓MAP
 - must ensure normovolaemic
 - ▶ adrenaline - may be best agent
 - ▶ noradrenaline - many like to avoid

Extubation

- aim for smooth emergence to avoid spikes bp:
 - ▶ deep extubation
 - ▶ deep LMA switch
 - ▶ lignocaine 0.5mg/kg
 - ▶ careful esmolol boluses

Postoperative Management

- smooth emergence
- hourly flap observations:
 - arterial supply problems = pale & pulseless with sluggish CRT
 - venous outflow = swollen, dusky, blanches easily with brisk CRT
- avoid vasoconstriction (cold, pain, low circulating volume, hypotension, hypocarbia)
- warming blanket
- treat shivering - IV pethidine 25mg, clonidine, chlorpromazine
- regional; epidural for LL, axillary catheter for UL
- can be given nifedipine with premed & then continue post op 10mg tds for 5/7
- Overall free flap survival >95%

Optimising Blood Flow to Flap

Table 3 Factors decreasing blood flow in free flaps

Arterial	Arterial thrombosis Arterial spasm
Venous outflow	Venous thrombosis Venous spasm Mechanical compression (e.g. dressings)
Flap oedema	Excessive use of crystalloids Extreme haemodilution Prolonged ischaemia Histamine release (e.g. anaesthetics, antibiotics) Excessive tissue handling
Generalised vasoconstriction	Hypovolaemia Hypothermia Pain Respiratory alkalosis
Hypotension	Hypovolaemia Cardiac depressant drugs (e.g. anaesthetics, calcium channel blockers) Extensive sympathetic blockade (e.g. epidural) Profound vasodilatation Cardiac failure (e.g. ischaemia, fluid overload)
Prolonged flap ischaemia	

- Goal = optimisation of blood flow to forearm
- Resistance to flow =

$$R = \frac{8 \times \text{viscosity} \times \text{length}}{\pi \times r^4}$$
- Flow =

$$\text{arterial} - \text{venous pressure} / \text{resistance}$$
- Cardiac Output = MAP / SVR
- Q = HR x SV
- SV is determined by preload, afterload and contractility
- Manipulating any of these factors can alter blood flow to the re-implanted forearm

Non-pharmacological

1. Positioning of limb @ the level of the heart to optimise blood flow

2. Keeping limb and body warm
3. Adequate preload – IVF, colloid, blood if required
4. Low normal viscosity of blood (haematocrit 0.3)
5. Adequate Hb concentration
6. Frequent clinical monitoring to detect and manage microvascular thrombosis

Pharmacological

1. Maintenance of adequate mean arterial pressure and cardiac output – may require: vasopressors (phenylephrine – 0.1-5mcg/kg/min) or inotropes (milrinone 50mcg/kg -> 0.4-0.8mcg/kg/min or dobutamine 1-20mcg/kg/min) – avoid noradrenaline as may result in microvascular vasoconstriction
2. O₂ administration titrated to SpO₂
3. Vasodilation via autonomic blockade (axillary or brachial plexus blockade)
4. Dextran Infusion: decreased platelet aggregation and factor VIII levels -> increased blood flow

Liposuction

= vacuum aspiration of SC fat via small skin incision and specialised blunt-ended cannula

Preoperative Management

- often fit and well

Intraoperative Management

- LA infiltration + IV sedation + SV
- injection of fluid helps breakdown fat
- blood loss proportional to LA infiltration technique
- extensive liposuction = burn injury -> large fluid shifts -> IVF required

Postoperative Management

- pressure dressings applied
- encourage oral fluids
- monitor U/O
- check Hb
- bruising can be considerable
- simple analgesics
- morbidity related to high aspiration volume (>2L) and high lignocaine dosage

Skin Grafting

Preoperative Management

- variety of co-morbidities
- may have major burns

Intraoperative Management

- GA (LMA) + SV OR RA
- blood loss variable
- pain +++ (@ donor site)
- types:

1. FTSG – used where thickness, appearance and texture important (face, hand)
2. SSG – can be meshed

Postoperative Management

- LA to donor site
- simple analgesics

- NSAIDS

Burns

General Considerations

- adults = fire
- children = scalding
- maybe associated with ET-OH, abuse, epilepsy or psychiatric problem
- mortality is related to age (>50yrs), TBSA (40%) burnt and burn depth

Classifications

- Superficial = dry & red, blanches, painful, warm, no immediate blisters
- Partial Superficial: Pale red, blanches, CRT quick, fine blisters, pain +++
- Partial Deep: blotchy & red. No CRT, decr sensation, large blisters
- Full thickness: white, waxy, asensate, no blisters, no CRT

ED Management

A with C-spine control

- may need ETT quickly (use an uncut tube)
- warning signs include = singed nasal hairs, horse voice, productive brassy cough, soot in sputum, stridor, facial burns, breathed fire, voice change
- consider airway injury by location:
 - ▶ Systemic ie HbCO or cyanide from inhalation in enclosed space
 - ▶ Supraglottic burn
 - ▶ Infraglottic burn
 ↳ NB bronchoscope doesn't correlate with outcome ∴ do only if therapeutic need
- maximum wound oedema takes place @ 12-36hrs after injury
- FOB or nasoendoscopy
- Bronchoscopy - soot, charring, mucosal erythema, necrosis, airway oedema
- RSI
- sux ok for 24-48hrs then none for 2 days -> 2 yrs
- may need AFOI or surgical airway

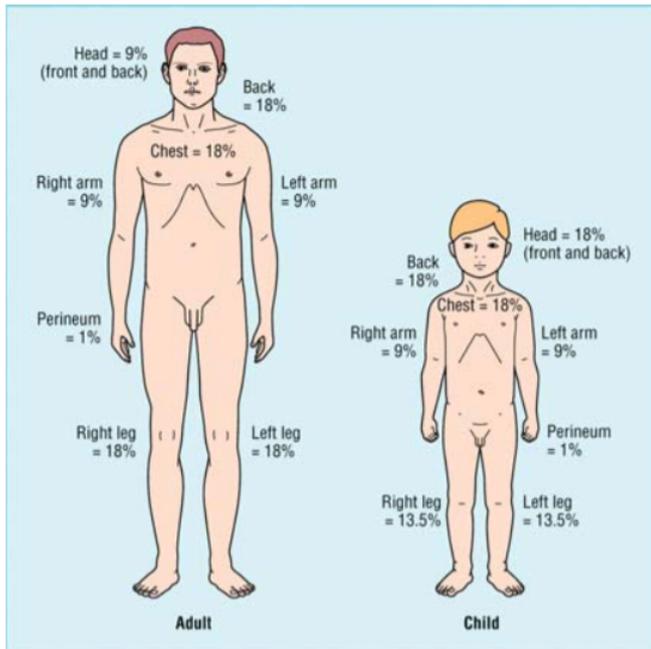
B with O2

- 15L/min + reservoir bag
- may require ETT + IPPV because of other injuries, major resuscitation, sedation, ARDS & analgesia, decreased pulmonary compliance
- area of burn & symptoms:
 - ▶ supraglottic = stridor, hoarseness, swollen uvula
 - ▶ infraglottic = SOB, cough/wheeze, copious secretions
- protective lung injury
- suction

C with haemorrhage control

- >25% have SIRS with oedema
- IV access through intact skin where possible
- IVF for >20% in adults & >10% in children
- Hartmans is preferred

Lund Browder Chart:



2yr to 10yr: for each year grows older
remove 1% from head & give to legs

Fluid replacement for first 24hr from Time of Burn

- perform Fluid Resuscitation based on burn size:
 - ▶ adult > 20%,
 - ▶ children >10%
- type fluid:
 - ▶ adults = balanced crystalloid eg plasmalyte or Hartmans
 - ▶ Paeds = as above + 5% dextrose added to maintenance (not resus fluid) component
- Classical parkland formula :
 - ▶ Calculate as starting point:
 - Adults - 4mL/kg/% burn
 - Children - 3-4mL/kg/% + normal maintenance!!!
 - ▶ Then give 1/2 in first 8hrs since injury; other 1/2 in next 16hrs
 - ↳ more modern is 3ml/kg/% for both
- target for ongoing fluid therapy is urine output of >0.5ml/kg (adult) or 1mL/kg (child) and normal cardiovascular parameters
- If deep electrical burn or urine +ve with myoglobinuria then:
 - (1) ↑urine output target: adult 1ml/kg/hr; paed 2mL/kg/hr
 - (3) promote diuresis with 12.5g mannitol to each litre of Hartmans
- if not meeting urine output target:
 - ▶ Avoid fluid bolus
 - ▶ give 150% of fluid plan for next hr & r/v at end of hour
- aim to halve fluid regime @ 48hrs
- must avoid albumin for 1st 24hrs (SAFE study) thereafter:
 - ▶ 0.5ml 5% albumin x kg x %TBSA
-
- x-match units
- may have to stop surgery to catch up
- aim for PCV 0.3

D with assessment of neurological function

CO poisoning ⇒

- ▶ L shift OHDC ⇒ tissue hypoxia
- ▶ 100% O₂ ⇒ ↓elimination half life of CO from 4 to 1hr

- ▶ hyperbaric O₂
 - 3 atm ⇒ half life of 30mins
 - consider if:
 - pregnant
 - coma
 - HbCO >40%
 - failure to respond to norm therapy
- ▶ if HbCO >25% consider intubation & ventilation

ET-OH poisoning

E with temperature control

- remove all clothes
- if stuck to patient, cut around adherent areas
- keep warm
- assess %TBSA
- 1% = patients palm and fingers
- assess burn depth ->
 - ▶ superficial = red and painful
 - ▶ deep = no capillary refill and not painful
- warm theatre (32 C)
- humidify (70-80%)

Other Measures

- cool with running cold water 8-25 deg (20min)
 - ↳ do if burn within last 3hrs
- watch for hypothermia
- cover with clingfilm (limits evaporation, heats loss & pain) or silver impregnated dressing
 - ↳ depend on surgical advice
- IV morphine
- escharotomy - limbs & chest wall
- have lots of blood ready
- NG tube - early feeding prevents bacterial translocation via gut & decompressed stomach
- strict asepsis
- line changes every 7 days

Chemical Burns

- protect self with gloves, apron & face mask
- remove contaminated clothing
- alkaline burn - irrigate for longer
- neutralize or dilute with H₂O (1hr)
- Hydrofluoric acid -
 - ▶ = rare & life threatening glass burn injury
 - ▶ 2% burn can ⇒ life threatening hypocalcaemia
 - ▶ Rx:
 - topical calcium gluconate burn gel
 - Biers block with 10-15mL of 10% calcium gluconate
 - 5000U of heparin in 40mL 5 % dextrose

Phosphorus - copper sulphate solution

Bitumen - cool with H₂O, remove with vegetable or parafil oil

Electrical Burn

- low voltage (<1000V) -> local contact burn
- high voltage (>1000V) -> entrance & exit wound -> may require fasciotomy
 - ↳ Rx as major burn ie use Parkland formula even though no skin burn
- side flash = nearby lightning strike -> superficial burns, entry & exit burns +/- respiratory arrest

- direct lightning strike -> often fatal

Anaesthesia

- ↑ing trend to early excision & wound coverage ⇒ remove full thickness burns
- balance of risk of ↑ing severity of surgery vs physiological status

Type of Surgeries

- escharotomies =
 - ▶ full thickness circumferential burns
 - ▶ need decompression if compartment pressures >40mmHg
- wound debridement & grafting =
 - ▶ monitoring problems:
 - ECG
 - bp cuff on arms - use A line
 - ECG monitoring - use s/c needles on crocodile clips
 - ▶ blood loss - can be large ⇒ 100ml blood loss/% area excised
 - ▶ Can use tumescent infiltration - 1 litre plasmalyte + lignocaine + high dose adrenaline ⇒ ↓↓blood loss
 - ▶ coagulopathy inc ↓platelets
 - ▶ multiple operations
 - ▶ pain - use multimodal incl ketamine

Preop

- ?TBSA & planned surgery
- airway assessment
- G&H & coag screen
- good vasc access +/- CVL
- cont feeding if NJ; stop NG feeding 6hrs
- ?RSI

Intra-OP

- ↓thermoregulation:
 - ▶ hot theatre - >32deg
 - ▶ fluid warmer
 - ▶ aim heat loss <1
- often need high PEEP
- NMBs:
 - ▶ avoid sux >48hrs post burn - risk of hyperkalaemic crisis due to ↑nAChr
 - ▶ resistant to NDNMBs

Post Op

- regional blocks & multimodal analgesia
- psychology involvement

Complications

- Acute lung injury -
 - ▶ mucus plugging
 - ▶ ALI/ARDS
 - ▶ ↑brinchiial blood flow

Table 3 Complications of burns

Complications from over-resuscitation ⁴	Infective complications
Excessive burn oedema	Eyes (secondary infection of corneal burns)
Abdominal compartment syndrome	Pneumonia
Need for fasciotomies on unburned limbs	Burn wound
Pulmonary oedema	Urinary tract infection (common with urinary catheters and burns to perineum)
Prolongation of mechanical ventilation	Sinuses and middle ear (complication of nasogastric feeding)
Excessive burn oedema	Infective endocarditis
Early complications	Later complications
Deep vein thrombosis (thrombo-prophylaxis)	Pulmonary fibrosis
Stress ulcers (early enteral feeding/proton pump inhibitor)	Chronic pain
Adult respiratory distress syndrome	Post-traumatic stress disorder
Renal failure (from inadequate resuscitation, significant muscle breakdown, haemolysis, or sepsis)	Psychological (effects of severe illness, disfigurement and loss of independence)
Hypothermia	Depression
	Sleep disorder

ICU Management

- some secure mandibular/maxillary screw to secure ETT
- 1st 24-48hrs see hormonal & inflam response:
 - ▶ hypermetabolism
 - ▶ immunosuppression
 - ▶ SIRS
- fluid resus - aim UO >0.5ml/kg/hr (adjust Parkland)
- monitor electrolyte problems:
 - ▶ ↓K, ↓PO₃, ↓Ca, ↓Mg
- empirical steroids have no role
- ventilate if required
- temp:
 - ▶ pts reset baseline temp to 38.5 ∴ if 37 = hypothermic
 - ▶ aggressively keep warm
- early feeding (high protein & CHO) & gastric ulcer prophylaxis @ 24hrs ⇒ NJ tube best
- Rx metabolic complications:
 - ▶ anabolic steroids - oxandrolone
 - ▶ Propanolol
- watch for infection - can be difficult to distinguish from SIRS ∴ altered burns criteria:
 - ▶ temp >39
 - ▶ HR >110
 - ▶ ↑ing RR >25
 - ▶ BSL >12

Major Burns Centre Referral Criteria

SPAM

S ize	P erson	A rea	M echanism
>10% adult	PMH	Face/hands/perineum	Chemical/Electrical
>5% child	Pregnancy	Circumferential	Major Trauma
>5% full thickness	Extremes of age	Inhalational	NAI