Physical Injury during Anaesthesia

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- **Physical injuries during anaesthesia**. *BJA Education* 2018; 18(10): 310-6
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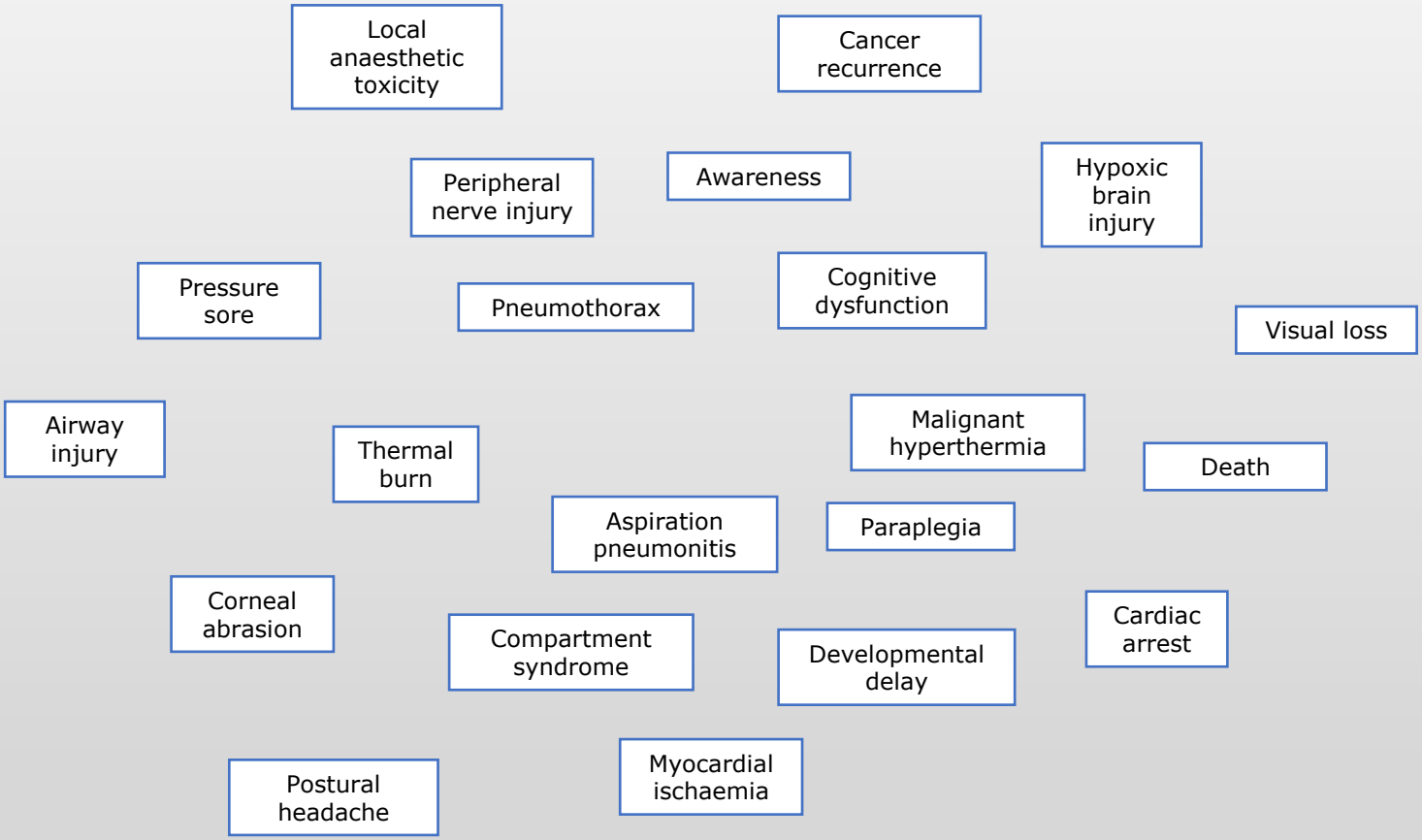
Local anaesthetic toxicity
Cancer recurrence
Peripheral nerve injury
Awareness
Hypoxic brain injury
Pressure sore
Pneumothorax
Cognitive dysfunction
Visual loss
Airway injury
Thermal burn
Malignant hyperthermia
Death
Aspiration pneumonitis
Paraplegia
Corneal abrasion
Compartment syndrome
Cardiac arrest
Developmental delay
Myocardial ischaemia
Postural headache

Peripheral nerve injury

Airway injury

Peripheral nerve injury

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Peripheral nerve injury

- Key references:

  - Cheney, Domino, Caplan, Posner. **Nerve injury associated with anesthesia: a closed claims analysis**. *Anesthesiology* 1999; 90: 1062–9
  - Hewson, Bedforth, Hardman. **Peripheral nerve injury arising in anaesthesia practice**. *Anaesthesia* 2018. 73: 51-60
  - Warner, Warner, Matsumoto, Harper, Schroeder, Maxson. **Ulnar neuropathy in surgical patients**. *Anesthesiology* 1999; 90: 54–9
  - Hewson, Bedforth, McCartney, Hardman. **Dexamethasone and peripheral nerve blocks: back to basic (science)**. *British Journal of Anaesthesia* 2019. 122: 411-412
  - Hewson, Hardman. **Physical injuries during anaesthesia**. *BJA Education* 2018; 18: 310-6

Peripheral nerve injury

- Symptoms
  - Weakness *(e.g. foot drop, grip strength)*
  - Altered sensation *(numbness, tingling)*
  - Pain *(burning, lancinating – CRPS)*
  - Can be disabling *(profession, income, depression)*
- Most frequently caused by:
  - Positioning *(compression/stretch ischaemia)*
  - Needling *(intraneural injection, others)*
  - Others *(surgical injury, tourniquet)*

Peripheral nerve injury

- Position related
  - 1:300 general anaesthetics
  - Ulnar nerve most common
    - Also brachial plexus & common peroneal nerve
  - Positioning *(initial & monitoring)*
  - Prolonged surgery *(position respites)*
  - Risk factors *(slim habitus, diabetes, prior history)*

Ulnar nerve injury

- Usually compression at elbow *(arm vs bed)*
- Increased risk:
  - Ulnar nerve mobility *(escapes cubital tunnel)*
  - Males >50 yr
  - Elbow flexion (>90 degrees) *(↑cubital pressure)*
  - Supine with hands on chest *(vs. arms at sides)*
    - Justified if brief, low-risk pt, need access to IV
- May appear days after surgery
  - Can arise despite appropriate standard of care
- Following injury
  - NCS may show subclinical contralateral defect
  - Good recovery, but sometimes cubital decompression

Brachial plexus injury

- Associated with specific positions / surgery
  - Supine, arm(s) abducted >90°, elbows behind torso
  - Prone, hands by head
  - Steep head-down using shoulder braces
  - Worsened by neck flexion/rotation
  - Median sternotomy
- Practical steps *[document these]*
  - Supine: abduct <90° & keep elbows above torso
  - Maintain neutral neck/head
  - Avoid shoulder braces
  - ‘Uncomfortable’ positions mandate *position respites*

Peripheral nerve blocks

- Injury via:
  - Intraneural injection *(probably predominant)*
  - Swelling / haematoma / inflammation / scarring
  - Minimal risk of injury via LA neurotoxicity or vasoconstrictor
- Temporary neurological symptoms: 1 in 5,000 nerve blocks
  - Gross structural integrity preserved
- Permanent symptoms: 1 in 15,000 nerve blocks
  - Temp vs permanent – not clear even with NCS
  - Improvement might continue for 2 yr
  - Chronic pain not uncommon
- Risk highly variable
  - Operator experience
  - Equipment used
  - Site of block

Peripheral nerve blocks

- Protective strategies are key *(record your use of these)*
  - Use of electrical peripheral nerve stimulation
    - Loss of twitch at low current
  - Competent use of ultrasound
    - Needle-tip & nerve seen when needle advanced or LA injected
  - Use of short bevelled needle
  - Low pressure injection (always ≥10 ml syringe)
  - Response to pain
  - Performance in the conscious patient?

Peripheral nerve blocks

- Pragmatic advice:
  - You must make an effort to reduce risk of nerve injury
  - Competent use of nerve stimulator -or- ultrasound
  - Short-bevelled needle
  - Low pressure injection
  - Do not seek paraesthesia
  - PAIN $\rightarrow$ if injecting, stop $\rightarrow$ withdraw & redirect needle
  - Blocking insensate area acceptable if the above assured

Airway injury

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Airway injury

- Key references:

  - Evans, McGlashan, Norris. **Iatrogenic airway injury**. BJA Education 2015; 15: 184–9
  - Cook, MacDougall-Davis. **Complications and failure of airway management**. Brit J Anaes 2012; 109(S1): i68–i85
  - Sell, Patel. **Airway trauma**. Anaes Int Care Med 2011;12:303-5

Airway injury

- Airway complications most apparent in
  - Failure to secure a patent airway – hypoxaemia
  - Failure to protect the lungs – aspiration
- However, less dramatic (i.e. “minor”) injury is not uncommon

Airway injury

- Facemasks
- Jaw thrust
- Supraglottic airway devices
- Guedel airways
- Direct laryngoscopy
- Videolaryngoscopy

Airway injury

- Facemasks
  - Corneal abrasion – correct mask size & placement
  - Neuropraxia – facial & mental nerves

- Jaw thrust
  - Temporomandibular joint injury – subluxation/dislocation
    - Articular disc displacement / ligament injury
    - Pain, clicking, limitation & laxity
    - Forceful TMJ subluxation unnecessary for routine SGA insertion
  - Dental injury – incisor collision

Supraglottic airway devices

- Inappropriate use *(e.g. obesity, head-down, lithotomy)*
  - High pressure –> gastric inflation –> aspiration
- Dental injury
  - Rare on insertion
  - Relatively common during removal
    - Remove in cooperative (non-biting) patient
    - Do not stimulate patient to expedite expulsion
- Cranial nerve injury (rare)
  - Lingual (tube), hypoglossal (cuff)
  - Poor fit, over-inflation, N_2O
- Second generation – better?

Guedel oral airways

- Poor sizing causes problems
  - Correct size – incisors to angle of mandible
- Incorrect insertion
  - Risks airway obstruction – folding epiglottis & bunching tongue
- Hard plastic
  - Risks soft tissue injury against teeth
  - Prolonged use risks soft palate / uvular ischaemia
- Bite block (extubation)
  - Effective, but incisor injury reported
  - Avoid fragile dentition (e.g. incisor veneers)

Direct laryngoscopy

- Dental injury
  - 10% of all claims vs. anaesthetists
  - 70% of dental injury occurs during laryngoscopy
  - Risk factors
    - Dental fragility, difficult laryngoscopy, poor technique
  - Re-implantation, dental surgeon
  - Lost teeth – lung, stomach
- Lacerations
  - Tongue & lips
  - Common and avoidable

Videolaryngoscopy

- Likely safer for teeth
- Risk of soft-tissue injury
  - Focussing on screen during airway insertion
- Potential for airway contusion/bleeding
  - Good view of glottis, cannot pass tube –> collisions with airway
  - Optimal glottic view is not necessarily optimal for intubation
    - Distant view usually better
    - Leading tip of tube usually not seen –> hang-up on right vocal cord / arytenoid

Tracheal intubation

- Laryngeal injury
  - Arytenoid subluxation / vocal cord injury
  - Large tubes, cuff pressure, bougie, force/difficulty, poor paralysis
- Tracheal mucosal injury
  - Ischaemia at around 30 cmH_2O
  - Duration & pressure –> sore throat / ulceration / scarring / stenosis
- Tracheal rupture
  - Rare, potentially catastrophic
  - Correcting deep tube insertion with cuff inflated
  - Tear of membranous posterior trachea
  - Surgical emphysema & haemoptysis

Tracheal intubation

- Nasal intubation
  - Epistaxis in 50% of nasal tubes
    - Can complicate intubation (aspiration/view)
    - Caution in warfarin/antiplatelet
    - Reduced by
      - Soft/warm/small/lubricated tubes
      - Topical vasoconstrictor
      - Jaques catheter
      - Using large, patent nostril (tricky to assess)
  - Turbinate fracture
  - Sinus injury/infection
  - Skull-base fracture

Bougie / exchange catheter

- Laryngopharyngeal perforation
  - Tip contact pressure (penetrating)
  - Repeated attempts, especially blind/difficult
  - Never advance a bougie forcefully (finger-pressure)
- Bronchial injury
  - Deep insertion
  - Seeking hold-up (~40 cm) risks perforation/laceration *(capnography safer)*
- Upper airway oedema
  - Repeated, forceful attempts
  - Risks CICV and/or post-extubation obstruction

Extubation

- Cuff deflation pre-removal
  - Minimal evidence of injury if cuff left inflated
  - Inflated-cuff can clear material from larynx
- Airway swelling –> obstruction
  - Steroids pre-extubation, “ICU” extubation
- Dental injury
  - 20% of dental injury during extubation
  - Awake patient (cooperative, avoiding stimulus-lightening)
  - Biting
    - Bite block/Guedel
    - Forceful extubation during biting –> high risk of dental injury
    - Cuff deflation can also allow ventilation during biting

Summary

Summary

- Exploration of injuries during anaesthesia
- Patients are vulnerable
- Injury can occur despite excellent care
- Simple measures prevent most injuries

- Lots of detail – please email for slides etc.

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