Regional

Abdomen and pelvis

Lower limb
  - Lumbar and lumbosacral plexus
  - Femoral block, three-in-one block
  - Sciatic block
  - Ankle block
  - Other lower limb blocks

Spine and thorax
  - Intercostal block
  - Paravertebral block
  - Blood patch

Upper limb
  - Brachial plexus
  - Interscalene
  - Supraclavicular block
  - Axillary
  - Elbow
  - Wrist

Head
  - Complications of retrobulbar and peribulbar eye blocks
  - Eye blocks
  - Ear
  - Nose
  - Trigeminal nerve
  - Other head and neck

Neck
  - Cervical plexus
  - Airway
  - Recipes for regional anaesthesia
Lumbar and lumbosacral plexus

Lumbar plexus
Four roots: ventral rami of L1-4
L1 divides into superior and inferior branches
Superior: ilioinguinal and iliohypogastric nn.
Inferior: joins L2 to form genitofemoral n.
L2-3 give branches to form lateral femoral cutaneous n.
L2-4 give branches to form femoral and obturator nn.

Iliohypogastric nerve
Runs superior to iliac crest between internal oblique and transversus abdominis
Motor to abdominal wall
Sensory branches: lateral (hip) and anterior cutaneous (suprapubic)

Ilioinguinal nerve
Immediately inferior to iliohypogastric
Traverses inguinal canal
Cutaneous branches to upper inner thigh and root of penis or labia majora

Genitofemoral nerve
Genital branch traverses inguinal canal and supplies cremaster and lateral scrotal skin
Femoral branch arises medially and passes under inguinal ligament with external iliac a., passes through saphenous opening and supplies skin over femoral triangle

Lateral femoral cutaneous nerve
Passes under lateral part of inguinal ligament, deep to fascia lata
Supplies skin of lateral thigh from greater trochanter to above knee

Obturator nerve
Runs on the medial and posterior aspect of psoas, through the obturator canal
Supplies adductors, hip and knee joints and skin over medial thigh just above knee

Femoral nerve below

Lumbosacral plexus
Five roots: ventral rami of L4-S3
Collateral branches to gluteal region, pudendal plexus and hip joint
Anterior and posterior terminal branches
Form posterior cutaneous nerve of thigh
Anterior branches form tibial portion of sciatic nerve
Posteror branches form common peroneal portion of sciatic nerve

Psoas compartment block

Anatomy
Lumbar nerve roots run in compartment posterior to psoas muscle

Needle placement
Patient in lateral position, knees to chest, sedation required
15 cm needle inserted 5 cm lateral and 3 cm inferior to L4 spinous process
Strikes L5 transverse process
Redirected slightly superiorly and advanced until loss of resistance at 12±2 cm

Local anaesthetic
20 ml air to dilate space
30 ml of dilute solution

Indications
Analgesia or anaesthesia in region of femoral, obturator and lateral cutaneous n.
Femoral nerve block, three-in-one block

Anatomy
   Femoral nerve arises from L2-4 roots in lumbar plexus
      Runs deep to psoas, comes lateral to psoas tendon at level of inguinal ligament
      Lies lateral to femoral artery below inguinal ligament
      Different fascial plane: deep to fascia lata and fascia iliaca
      Divides into superficial and deep bundles
         Superficial supplies anterior thigh and sartorius
         Deep supplies quadriceps, knee joint, gives rise to saphenous nerve
   Obturator nerve arises from L2-4
   Lateral cutaneous nerve of thigh arises from L2-3

Needle placement
   Patient supine
   Short-bevel needle inserted 1-2 cm below inguinal ligament 1-1.5 cm lateral to femoral artery
   Two “pops” or paraesthesia elicited or nerve stimulator used to determine depth
   Ultrasound shows the nerve just lateral to femoral artery

Local anaesthetic
   Femoral nerve only
      10-20 ml of 0.5% bupivacaine
   Three-in-one
      30 ml of solution (may need to be more dilute than 0.5% to avoid toxic dose)
      Distal pressure over nerve causes solution to flow proximally
      Proximal spread to lumbar plexus anaesthetizes obturator and lateral cutaneous nerve of thigh

Indications
   Three-in-one may be combined with sciatic block for most leg surgery
   Ideal for muscle biopsy in MH testing
   Useful for knee examination and surgery
   Analgesia for femoral fractures

Complications
   Vascular
      Femoral artery or vein injury, haematoma
   Neurological
      Neuropraxia, sympathetic block to leg
   Common to all blocks
      Local anaesthetic toxicity (esp. combined with sciatic block)
      Poor effect
      Infection
Sciatic block

Classic approach of Labat
- Lateral position, upper heel on lower knee
- Line from greater trochanter to PSIS marks upper border of piriformis
- Bisector of this line extended 3 cm inferioirly marks injection site
  or intersection with line from greater trochanter to sacral cornu
  or intersection with line from midpoint of line from PSIS to ischial tuberosity
to greater trochanter

\[ \text{cornua} \quad \overset{\text{gr.}}{\text{troch.}} \]
\[ \text{isch. tub.} \]

Advance 6-8 cm until bone is contacted
Geometric grid approach searching for paraesthesia or using nerve stimulator

Anterior approach of Labat
- Supine anatomical position
- Line of inguinal ligament identified
- Medial trisector extended inferiorly
- Intersection with a line parallel to inguinal ligament running through greater
trochanter identified
- Needle advanced slightly laterally strikes lesser trochanter
- Walk medially off femur and identify LOR 4.5-6 cm beyond (or use nerve stimulator)

My anterior approach
- Supine position, external rotation at hip is optional
- Entry point 2-3 cm inferolateral to where femoral artery crosses inguinal crease
  Just lateral to femoral nerve
- Advance 15 cm Stimuplex needle with 3 mA current quickly past femoral nerve
- Walk inferiorly off bone (some medial angulation if necessary)
- Ankle plantar- or dorsi-flexion elicted about 5 cm past bone
- Aim for ≤0.4 mA threshold

Lithotomy approach
- Lithotomy position with full hip flexion
- Line from ischial tuberosity to greater trochanter
- Needle advanced through midpoint perpendicular to skin
- LOR or nerve stimulator or paraesthesia determine depth

Lateral approach
- Supine position
- Needle inserted 3 cm distal to greater trochanter at posterior border of femur
- Advanced immediately behind femur 8-12 cm total depth
- Nerve stimulator or paraesthesia used to determine depth

Prone (Ian McKenzie’s) approach
- Prone position
- Line from ischial tuberosity to head of fibula marks biceps femoris
- Line from midpoint between ischial tuberosity and greater trochanter to middle of
popliteal fossa marks course of sciatic (tibial) nerve
- Needle inserted at intersection of lines
- LOR deep to biceps femoris

Regional 3.H.4 James Mitchell (29 January 2010)
Ankle block

**Saphenous n**
- Blocks postero-medial part of dorsum of foot
- Superficial infiltration around long saphenous vein anterosuperior to medial malleolus

**Tibial n**
- Needle entry medial to Achilles tendon or lateral to posterior tibial artery at upper border of medial malleolus
- Determine depth with paraesthesia, nerve stimulator or 1 cm superficial to tibia
- Alternatively infiltration either side of artery behind medial malleolus
- Blocks sole, plantar surface of digits

**Deep peroneal n**
- Needle entry between extensor hallucis longus and tibialis anterior tendons or lateral to anterior tibial artery
- Blocks first web space and short toe extensors

**Superficial peroneal n**
- Superficial infiltration from lateral border of tibia to upper part of lateral malleolus
- Blocks dorsum of foot and toes except first web space

**Sural n**
- Superficial infiltration from Achilles tendon to lateral malleolus
- Blocks lateral side of foot and fifth digit
Other lower limb blocks

Lateral femoral cutaneous nerve

Anatomy
L2-3 ventral roots
Emerges at lateral border of psoas inferior to ilioinguinal nerve
Runs between obturator internus and iliacus
Emerges inferomedial to ASIS from under inguinal ligament
Crosses origin of sartorius and runs deep to fascia lata, dividing into anterior and posterior branches
Supplies skin over lateral thigh

Needle placement
Patient supine
Short bevel needle inserted 2 cm inferior and 2 cm medial to ASIS
Pop felt on passing through fascia lata

Local anaesthetic
10-15 ml placed deep and superficial to fascia lata
Dilute solution required if multiple blocks are to be performed

Indications
Combined with sciatic, femoral and obturator blocks for leg surgery

Obturator nerve

Anatomy
L2-4 nerve roots
Emerges medial to psoas at pelvic brim
Runs around pelvis behind iliac vessels and ureter
Enters obturator canal superior and anterior to obturator vessels
Divides in canal into anterior and posterior branches
  Anterior branch supplies anterior adductors, hip joint and medial thigh
  Posterior branch supplies deep adductors and knee joint

Needle placement
Patient supine, legs slightly abducted
Point 1.5 cm lateral and 1.5 cm inferior to pubic tubercle identified
Needle inserted AP, contacts superior pubic ramus at 1.5-4 cm depth
Walked laterally into obturator canal and advanced 2-3 cm

Local anaesthetic
10-15 ml of dilute solution while advancing and withdrawing

Complications
Intravascular injection in obturator vessels, haematoma

Tibial and common peroneal nerves in the popliteal fossa

Anatomy
Sciatic nerve divides at apex of popliteal fossa
  Tibial nerve continues lateral to vessels inferiorly between heads of gastrocnemius
  Common peroneal nerve accompanies biceps femoris tendon laterally, passes around head of fibula and divides into superficial and deep branches

Needle placement
Patient prone or lateral
Margins of popliteal fossa identified: semimembranosus, biceps femoris and gastrocnemius
Point identified 1 cm lateral to midline of fossa and 5 cm superior to skin crease
Needle inserted angled 45°-60° anterosuperiorly, paraesthesia or stimulation sought
Ultrasound shows the nerve well
Local anaesthetic
30-40 ml of dilute solution
Indication
   Foot and ankle surgery
   Saphenous nerve territory not covered (femoral origin)
Blood patch

Technique

Timing
- Probably less effective in first 24 hours
- Must wait until block is completely resolved

Volume
- No clear evidence that large volumes are better
- Commonly 10-20 ml

Bed rest
- Two hours is better than 30 min or one hour

Indications
- Moderate to severe PDPH
- Prophylactic on catheter withdrawal after dural tap on insertion (controversial)

Contraindications
- Needle placement
  - Coagulopathy, sepsis, local infection, anatomical abnormality
- Autologous blood injection
  - Sepsis
  - No adverse sequelae in HIV infection
  - Raised ICP: increased further by injection

Complications of PDPH
- Cranial nerve palsies unaltered
- Hearing loss and tinnitus markedly improved
- Seizures uncommon, no evidence of effect
- Intracranial bleed and ↑ ICP: contraindication

Effectiveness
- >90% initial relief
- 60-75% persistent relief after large needle puncture

Mechanism of action
- Pressure effect from injection
  - Brief for crystalloids, minutes to hours for blood
- “Plug” effect from sealing dural tear

Effect on subsequent epidural
- Increased risk of dural puncture and poor block

Prophylactic use
- Saline 40-60 ml reduces need for blood patch
Intercostal block

Anatomy

Intercostal nerve arises from T1-T11 nerve roots, T12 is similar (subcostal)

Branches

Grey *ramus communicans* from sympathetic chain

Posterior cutaneous branch arises beyond vertebral foramen and supplies paravertebral muscles and skin

Lateral cutaneous branch arises anterior to midaxillary line and supplies skin of lateral aspect of chest

Anterior cutaneous branch pierces *pectoralis major or rectus abdominis* and supplies breasts and anterior chest and abdominal wall

T1-3 give branches to axillary plexus and intercostobrachial nerve

T12 gives branches to iliohypogastric and ilioinguinal nerves

Nerve lies deep to internal and external intercostal muscles, superficial to *intercostalis intimis* and pleura

Neurovascular bundle lies immediately inferior to rib and consists of vein, artery and nerve from superior to inferior

Needle placement

- Sitting, lateral or prone positions
- Identify line of lateral margin of paravertebral muscles (6-8 cm lateral to midline)
- Count ribs to identify correct level
- Apply traction superiorly to skin, insert needle over rib
- Allow skin to retract inferiorly and walk needle off inferior edge of rib

- Inserted another 2-5 mm with aspiration

Local anaesthetic

- Long-acting agent with adrenaline
- 2-5 ml of solution per nerve
- Care with total dose as absorption is fairly rapid

Indications

- Anaesthesia
  - Chest drain insertion, gastrostomy insertion
  - Other minor thoracic or abdominal procedures
- Analgesia
  - Fractured ribs
  - Thoracotomy or laparotomy as adjuvant technique

Complications

- Pneumothorax
  - Rare despite risks of entering pleura as the needle used is small
  - Managed conservatively
- Local anaesthetic toxicity
  - Minimize with adrenaline-containing solution

Paravertebral block

Anatomy

Similar to intercostal block but placement 2 cm lateral to midline

Needle placement

- Needle inserted postero-anteriorly onto transverse process
- Walked off top or bottom of process and inserted 1 cm
- “Hanging drop” can be used
- Inject at every level or else rely on spread between levels

Local anaesthetic

- Divide total dose between number of levels

Indications

- Breast surgery, other surgery requiring unilateral block
Brachial plexus

Five nerve roots
- C5-8 branches to *longus colli* and *scaleni*
- C5-7 branch to long thoracic n.
- C5 contributes to phrenic n. and dorsal scapular n.

Three trunks
- Form between *scalenus medius* and *scalenus anterior*
- Superior, middle and inferior
- Superior gives off suprascapular n.
- Inferior gives off first intercostal n.
- Divide into ventral and dorsal divisions at lateral edge of first rib

Six divisions
- Dorsal divisions supply extensors
- Ventral divisions supply flexors
- Form cords on entering the axilla

Three cords
- Lateral, posterior and medial
- Axillary artery lies between
- Posterior gives off five extensor branches
  - Two major: radial and axillary nn.
  - Three minor: thoracodorsal and two subscapular nn.
- Lateral gives off three branches
  - Two major: musculocutaneous n. and half of median n.
  - One minor: lateral pectoral n.
- Medial gives off five branches
  - Two major: ulnar and half of median n.
  - Three minor: medial pectoral and medial cutaneous nn. of arm and forearm
Interscalene block

Anatomy
Trunks of brachial plexus cross first rib behind *scalenus anterior* and subclavian artery at the level of C6

Needle placement
Patient supine with head turned away
Interscalene groove is palpable at the level of cricoid cartilage or Chassaignac’s tubercle
Needle inserted with slight posteroinferior angulation
Walked posteriorly in C6 plane if required to elicit paraesthesia or twitches
Ultrasound shows the plexus well

Local anaesthetic
30-40 ml of lignocaine 2% or bupivacaine 0.5%

Indications
Most reliable from C4-C7
Shoulder surgery, reduction of dislocated shoulder
Supplementation required for hand of forearm surgery
More caudal needle placement to cover C8-T1/ulnar distribution

Complications
Phrenic nerve block common
Subarachnoid or epidural injection
Intravascular injection (subclavian or vertebral artery)
Pneumothorax
Supraclavicular block

Anatomy
- Plexus lies inferior to mid-clavicle
- Subclavian artery is anterior and medial to the plexus
- Both pass over the first rib together

Needle placement
- Classical approach
  - Relatively difficult to describe and teach
  - Patient supine, arm at side, head turned away
  - Interscapular roll and inferior displacement of the shoulder can make it easier
  - Interscalene groove identified by palpation posterior to sternocleidomastoid
  - Subclavian artery is often palpable behind clavicle
  - Needle inserted 2 cm behind midpoint of the clavicle or immediately posterior to the artery
    - Lateral end of clavicle is medial to the acromion
    - Directed inferiorly with slight posteromedial angulation
    - Paraesthesia or nerve-stimulator indicates location at the plexus
    - If no paraesthesia is elicited, the superior surface of the first rib is usually contacted
    - Walking anteriorly along the rib surface should result in paraesthesia

  - “Plumb-bob” approach
    - My preferred approach without ultrasound
    - Patient supine, head turned away
    - Lateral margin of insertion of sternocleidomastoid into clavicle identified
    - Needle inserted directly anteroposterior
    - Angled superiorly and then inferiorly until paraesthesia or stimulation elicited

  - Sternocleidomastoid approach
    - 10 cm needle inserted at junction of clavicular and sternal heads of sternocleidomastoid
    - Directed posterolaterally aiming at posterior of midpoint of clavicle
    - Nerve stimulator indicates plexus

Local anaesthetic
- 15-25 ml of lignocaine, bupivacaine or ropivacaine
- Periodic aspiration

Indications
- Most reliable from C5-T1
- Most upper limb surgery
  - Proximal block: compact plexus, above most branches, small volume required
- Shoulder surgery may require supplemental cervical plexus block for overlying skin

Complications
- Pneumothorax
  - 0.5-6.0% in different series
  - Usually small and managed conservatively
- Phrenic nerve block
  - 40-60%, usually asymptomatic
- Stellate ganglion block
  - Increased incidence with volume of anaesthetic
  - Up to 90% with 50 ml of solution
  - Horner’s syndrome
- Vascular injury
- Local anaesthetic toxicity
Axillary

Anatomy
- Brachial plexus has formed terminal branches in the axilla
- Musculocutaneous lies in coracobrachalis
- Median, ulnar and radial nerves lie in close relation to the axillary artery from superficial to deep
- Fascial septa divide the branches of the plexus at this level

Needle placement
- Patient supine with arm abducted to 90°, externally rotated and flexed 90° at the elbow
- Course of the axillary artery determined by palpation
- Skin wheal and needle insertion adjacent to artery
- Paraesthesia or twitching elicited in appropriate nerves
- Alternatively LA deposited in all quadrants around artery
- Infiltration in mass of coracobrachialis to block musculocutaneous n.
- Ultrasound allows identification of all divisions and musculocutaneous n.

Local anaesthetic
- 20-30 ml of lignocaine or bupivacaine with adrenaline
- Hyaluronidase, bicarbonate for more rapid spread (but less duration)

Indications
- Most reliable from C7-T1
- Best for distal limb surgery (hand or forearm)
- Suitable for indwelling catheter placement

Complications
- Intravascular injection (axillary artery or vein)
- Haematoma and plexus compression
Elbow

All these nerves are well-imaged with ultrasound

Median

**Anatomy**

Lies medial to brachial a. where it emerges medial to biceps tendon

**Needle placement**

- Arm supinated and extended at the elbow
- Plane of epicondyles of humerus identified
- Brachial artery palpated
- Needle insertion immediately medial to artery

**Local anaesthetic**

- 3-5 ml of lignocaine 1% or bupivacaine 0.25%

Radial

**Anatomy**

- Pierces lateral intermuscular septum above the elbow
- Lies between brachialis and brachioradialis

**Needle placement**

- Position and level as for median nerve
- Point 2 cm lateral to biceps tendon

**Local anaesthetic**

- Fan-like injection of 4-6 ml

Ulnar

**Anatomy**

- Nerve runs behind medial epicondyle
- In groove between epicondyle and olecranon

**Needle placement**

- Elbow in full flexion
- Epicondyle identified
- Needle inserted 1 cm proximal to epicondyle (not in groove)

**Local anaesthetic**

- 3-5 ml lignocaine 1% or bupivacaine 0.25%

Medial cutaneous nerve of forearm

**Anatomy**

- Continuation of musculocutaneous nerve
- Ramifies superficially over medial forearm

**Needle placement**

- Infiltration in a band across medial forearm one third of the way from elbow to wrist

**Indications**

- Supplementation of brachial plexus block with inadequate cover
- Not commonly used alone
Wrist

Median
Anatomy
Lies deep to and between FCR and palmaris longus tendons
Inside carpal tunnel
Needle placement
Line from ulnar styloid to distal tip of radius identified
Needle inserted on this line between FCR and palmaris longus
Flexor retinaculum penetrated
Local anaesthetic
3-5 ml, plain solution probably advisable

Radial
Anatomy
Already divided into terminal branches at the wrist
Spread over radial and dorsal aspect of the wrist
Needle placement
Infiltration over anatomical snuff-box and further medially
Superficial to EPL
Local anaesthetic
5-6 ml

Ulnar
Anatomy
Lies lateral to FCU and medial to ulnar a.
Has already given off palmar cutaneous and dorsal branches
Divides into deep motor and superficial sensory branches at the level of pisiform
Needle placement
Approach from anterior or medial aspect just proximal to pisiform
Medial approach allows infiltration to all branches from one puncture
Local anaesthetic
3-5 ml plus infiltration

Indications
Supplementation of brachial plexus block with inadequate cover
Not commonly used alone
Complications of retrobulbar and peribulbar eye blocks

Complications of any block
- **Needle**
  - Local pain
- **Drug**
  - Systemic local anaesthetic toxicity
  - Allergy, anaphylaxis
- **Technique**
  - Failure of aseptic technique: cellulitis, ophthalmitis, meningitis
  - Failure of block: pain intraoperatively or postoperatively

Complications of eye blocks
- **Vessels**
  - Retrobulbar haemorrhage, retinal vascular occlusion, optic nerve trauma, late optic atrophy
    - Variable presentation: arterial vs venous haemorrhage
    - More common with large needle insertion in vascular areas e.g. superonasal
    - Microvascular disease increases risk of ischaemia e.g. diabetes
    - Manage with local pressure, IOP measurement, IOP reduction measures, surgical decompression if necessary
    - Haemorrhage within the optic nerve sheath results in rapid ocular venous congestion
- **Intravascular injection**
  - Retrograde flow with rapid injection
  - Injection of antibiotics or steroids by the surgeon can also be intravascular, causing embolism
- **Nerve**
  - Optic nerve injection
    - Injury to III, IV or VI uncommon
  - Other cranial nerve block related to facial nerve block at stylomastoid foramen
    - Vagus, glossopharyngeal block
    - Swallowing difficulty, respiratory obstruction
- **Brainstem anaesthesia**
  - Associated with long, sharp needles
  - Onset over 2 to 20 minutes, lasts up to three hours
  - Symptoms highly variable: unconsciousness to isolated nerves or nuclei blocked
  - Contralateral eye signs one of the earliest markers
- **Atonic pupil**
  - One case related to ciliary ganglion needle damage
  - More commonly direct trauma
  - Test with pilocarpine

**Muscle**
- Extraocular muscle dysfunction
  - Block duration up to 48 h with bupivacaine or ropivacaine
  - Longer duration suggests nerve or muscle damage
  - Most commonly intramuscular injection which resolves over weeks
- **Persistent ptosis**
  - Common in cataract patients regardless of surgery
  - May be intramuscular injection or bridle suture damage
  - Extraocular muscle injection may cause muscle rupture and diplopia
Globe

Ocular penetration and perforation
More common in long eyes
High myopes for retinal surgery or radial keratotomy

Prevention
Known axial length, open eye during needle placement, avoiding
displacement of the globe into the path of the needle
Commonly accompanied by pain, retinal detachment, haemorrhage

Corneal injury
Careful attention to padding and taping the anaesthetic eye

Ischaemia related to Honan's balloon or other compression device

Suprachoroidal haemorrhage
Related to hypertension
May be secondary to coughing or full bladder

Sympathetic ophthalmia

Reflex
Oculocardiac reflex
Bradycardia after injection
May persist longer than during surgery
Most common in children and young adults
Treat with atropine or glycopyrrolate

Regional

3.H.17
James Mitchell (29 January 2010)
Eye blocks

Peribulbar

Anatomy
- Globe is typically spherical and 20-25 mm diameter
- Sensory supply to conjunctiva is V1
  - Topical anaesthesia with 0.4% oxybuprocaine
- Sensory supply to globe is V1 via long and short nasociliary nerves
- Motor supply is III, IV and VI
  - Anaesthesia requires local anaesthetic placement posterior to the globe

Needle placement
- Least vascular sites for needle insertion are medial and inferotemporal
  - Medial
    - Short needle 12 mm, 26 ga
    - Anteroposterior insertion thorough the caruncle or just medial to it
    - Full length of needle inserted
    - 2-3 ml of local
  - Inferotemporal
    - Long needle 30 mm, 27 ga
    - Insertion point just superior to orbital margin
    - Anteroposterior insertion below equator of globe
    - Then angled towards axis of vision if anatomy allows
    - Depth of insertion is needle hub at limbus
    - Needle tip is usually outside the extraocular muscles
    - 3-4 ml of local

Local anaesthetic
- 2% lignocaine required for quick onset
- Bupivacaine or ropivacaine added for duration
- Hyaluronidase improves block success
- Usual mix
  - 2 ml of 10% lignocaine, 8 ml of 0.5% bupivacaine with Hyalase 30 U/ml

Indications
- All globe surgery except penetrating injury
- Increased risk of globe injury with long eye (>25 mm)
- Not great for squint, buckle or enucleation

Sub-Tenon’s

Anatomy
- Tenon’s fascia invests the globe and is continuous with conjunctiva anteriorly

Needle placement
- Conjunctiva anaesthetized with 0.4% oxybuprocaine
- Speculum inserted
- Patient asked to direct gaze superolaterally
- Conjunctiva lifted in inferonasal quadrant using non-toothed forceps
- Incised with spring scissors
- Space opened by spreading with scissors
- Sub-Tenon’s cannula passed along sclera past equator of globe
  - May require hydrodissection or redirection

Local anaesthetic
- 4-6 ml of same solution as for peribulbar

Indications
- All globe surgery except
- Not feasible if buckle is in place
- Raises IOP in glaucoma
Ear

Anatomy

Cervical plexus branches greater auricular and lesser occipital supply posterior surface of auricle and lower third of anterior surface
Greater auricular also supplies posterior part of external canal
Auriculotemporal branch of mandibular division of trigeminal nerve supplies superior two thirds of anterior surface
Auriculotemporal also supplies superior part of external canal
Auricular branch of vagus supplies inferior part of external canal
Tympanic branch of glossopharyngeal and facial nerve supplies drum

Needle placement

Superficial cervical plexus block or infiltrate over mastoid for cervical plexus branches
Infiltrate at posterior aspect of zygoma for auriculotemporal block
Canal supply from exterior blocked by infiltration at junction of bony and cartilaginous parts
Drum anaesthetized with topical lignocaine spray 4-10%
Nose

Anatomy
Trigeminal nerve, ophthalmic division (V₁), nasociliary nerve, anterior ethmoidal and external nasal branches to bridge and tip and superior and anterior parts of septum and lateral wall
Trigeminal nerve, maxillary division (V₂), infraorbital nerve, nasal branches to remainder of external nose
V₂ pterygopalatine ganglion, nasopalatine branch to posterior and inferior septum
V₂ anterior superior alveolar branch to anterior and inferior lateral wall
V₂ pterygopalatine ganglion, posterior and inferior nasal branches to posterior and superior lateral wall
V₂ pterygopalatine ganglion, greater palatine nerve to posterior and inferior lateral wall

Needle placement
External nose: supraorbital notch & medially, infraorbital foramen, junction of nasal bone and cartilage all infiltrated
Cavity
Topical or soaked cotton bud applied to anterior ethmoidal by inserting along the line of the external nose until it reaches a superior limit
Same applied to sphenopalatine ganglion by insertion at 20°-30° to horizontal
Floor anaesthetized with topical local
Trigeminal nerve

Ganglion

Anatomy
Ganglion is intracranial in Meckel’s cave, a reflection of dura
Closely related to superior orbital fissure, foramen rotundum, and foramen ovale through which branches leave the skull
Foramen ovale is in the horizontal plane of zygoma, vertical plane of mandibular notch, dorsolateral to pterygoid process

Needle placement
Skin wheal at anterior border of masseter, 3 cm lateral to corner of mouth, opposite second upper molar
10 cm needle advanced in plane of the pupil, superiorly, medially and posteriorly
Contact with inferior surface of greater wing of sphenoid at 4.5-6 cm
Walked posteriorly along sphenoid until enters foramen ovale, 1-1.5 cm beyond first bony contact

Local anaesthetic
1-3 ml of any solution injected in small aliquots with aspiration

Indications
Facial neuralgias
Major facial surgery in patient unable to receive GA

Complications
Technically difficult
Subarachnoid injection of LA
- Unconsciousness reported with 0.25 ml of 1% lignocaine
Local pain, haematoma formation

Maxillary nerve

Anatomy
Leaves the cranium though the foramen rotundum, deep to the pterygoid plate
Passes through the pterygopalatine fossa
Enters the floor of the orbit through the inferior orbital fissure
Emerges through the infraorbital foramen

Needle placement
Skin wheal over mandibular notch
8 cm needle inserted superomedially through mandibular notch
Strikes lateral pterygoid plate at 5 cm depth
Walked off anterior margin of lateral pterygoid plate into pterygopalatine fossa
Inserted 1 cm into pterygopalatine fossa

Local anaesthetic
5 ml of any solution

Indications
Facial neuralgia

Complications
Vascular region of insertion → haematoma formation
Close proximity to infraorbital fissure
- Disturbance of eye movement or vision
- “Black eye” from haematoma formation

Mandibular nerve

Anatomy
Leaves the cranium through the foramen ovale, posterior to lateral pterygoid plate
Divides into anterior and posterior divisions
Anterior division is motor supply to muscles of mastication, sensory to buccal branch
Posterior division is motor to *** sensory: auriculotemporal, lingual and inferior alveolar nerves

Needle placement
Skin wheal over mandibular notch
8 cm needle inserted superomedially through mandibular notch
Strikes lateral pterygoid plate at 5 cm depth
Walked posteriorly off lateral pterygoid plate
Advanced only 0.5 cm to avoid superior constrictor, pharynx

Local anaesthetic
5 ml of any solution

Indications
Facial neuralgia
Dental work (usually transmucosal approach)

Complications
Haematoma
Injury to the superior constrictor, entering the pharynx
Other head and neck

Greater occipital nerve

Anatomy
   Greater occipital n. is the dorsal ramus of C2
   Emerges over atlas, deep to cervical musculature
   Becomes subcutaneous near superior nuchal line
   Immediately medial to occipital a.
   Supplies sensation to posterior scalp to vertex

Needle placement
   Patient sitting with neck flexed
   Superior nuchal line from occipital protuberance to mastoid
   Nerve lies approximately at medial 1/3 point, near artery
   Infiltration of 3-5 ml around artery

Indications
   Occipital tension headache, diagnostic aid

Complications
   Low risk block
Cervical plexus

Anatomy
- Formed by ventral rami of C1-4
- Direct motor branches to prevertebral muscles
- Cutaneous branches form “superficial” plexus
  - Lesser occipital, greater auricular, transverse cervical and supraclavicular nerves
  - Emerge from behind the midpoint of sternocleidomastoid
- Ansa cervicalis innervates infrahyoid and geniohyoid muscles
- Phrenic nerve (C3-5) is central sensory and sole motor supply to diaphragm
  - Emerges lateral to scalenus anterior and enters the thorax medial to it
- Contribution to CN XI motor supply to sternocleidomastoid and trapezius

Needle placement
- Deep
  - Patient in supine position with head turned away
  - Line drawn 1 cm posterior to line from mastoid to Chassaignac’s tubercle (transverse process of C6)
  - C2 transverse process palpable 1.5 cm inferior to mastoid
  - C3 and C4 transverse processes identified relative to C2 and C6
  - Needles placed on transverse processes of C2-4
    - Withdrawn 1-2 mm off bone
    - Caudad angulation to reduce chance of entering foramina
    - Aspiration to check for vertebral artery puncture
- Superficial
  - Short bevelled needle inserted posterior to midpoint of sternocleidomastoid
  - Injection immediately deep to superficial cervical fascia
  - Infiltration along posterior border of sternocleidomastoid superiorly and inferiorly

Local anaesthetic
- Deep
  - 15-20 ml of lignocaine 1.5% or ropivacaine 0.75%
- Superficial
  - 15 ml of lignocaine 1.5% or ropivacaine 0.75%

Indications
- Carotid endarterectomy, lymph node biopsy, plastic surgery to neck

Complications
- Deep
  - Phrenic nerve block, hypoventilation
  - Vertebral artery injection, convulsions
  - Dural sheath injection, total spinal
- Superficial
  - External or internal jugular vein injection

Stellate ganglion

Anatomy
- Cervical sympathetic trunk is a continuation of the thoracic sympathetics
- Lies anterior to cervical transverse processes
- Composed of three ganglia
  - Superior cervical ganglion opposite C1
  - Middle cervical ganglion opposite C6
  - Stellate ganglion opposite C7-T1
    - Commonly closely related to subclavian and vertebral arteries

Needle placement
- Patient supine with neck extended
Chassaignac’s tubercle identified (at level of cricoid cartilage)
Firm palpation medial to carotid artery either side of C6 transverse process
Short needle inserted onto transverse process of C6 directly A-P
Withdrawal 1-2 mm before injection

Local anaesthetic
5-10 ml of 0.25% bupivacaine with adrenaline
Frequent aspiration

Indications
Complex regional pain syndrome of upper limb
Poor perfusion of upper limb

Complications
Vertebral artery injection, convulsions
Blockade of recurrent laryngeal or phrenic nerves
Airway

Principles

Trigeminal
- Nasopharynx down to soft palate
- Maxillary division

Glossopharyngeal
- Soft palate to epiglottis
- Pharyngeal nerves to pharyngeal mucosa
- Tonsillar nerves to tonsils and soft palate
- Posterior third of tongue

Vagus
- Below epiglottis
- Superior laryngeal nerve arises from inferior ganglion of vagus
  - Crosses cornu of hyoid and divides into internal and external laryngeal branches
  - Internal branch penetrated thyrohyoid membrane and innervates mucosa from epiglottis to cords
  - External branch supplies cricothyroid m.
- Vagus gives off recurrent laryngeal nerve below aorta (L) or subclavian a. (R)
  - Penetrates cricothyroid membrane laterally and innervates the mucosa below the cords and muscles of the larynx

Glossopharyngeal nerve

Anatomy
- Exits the skull through the jugular foramen lateral to X, ICA and IJV, anterior to XII and XI
- Descends in the carotid sheath, passes between ICA and ECA before branching
- Branches lie submucosally posterior to tonsil, deep to posterior tonsillar pillar

Needle placement
- Intraoral route
  - Mouth opened with laryngoscope, topical anaesthesia to tongue and tonsil
  - 9 cm curved needle inserted submucosally in caudal part of posterior tonsillar pillar
  - Careful aspiration for blood (ICA is adjacent)
- Peristyloid route
  - Patient supine, head in neutral position
  - Line from mastoid to angle of jaw identified
  - Skin wheal at midpoint of line, styloid may be palpable
  - Short needle inserted medially to contact styloid
  - Walked off posterior aspect of styloid
  - Careful aspiration of blood (IJV and ICA)

Local anaesthetic
- 5-7 ml of lignocaine 0.5%

Indications
- Awake intubation

Complications
- Intravascular injection, convulsions

Superior laryngeal nerve (internal br.)

Anatomy
- Leaves the vagal trunk above the hyoid
- Crosses the cornu of the hyoid
- Penetrates the thyrohyoid membrane inferior to the hyoid
  - Accompanied by superior laryngeal artery and vein
Needle placement
  Patient supine with neck extended
  Hyoid displaced toward side of block
  Skin wheal over greater cornu
  Needle inserted medially to make contact with greater cornu
  Walked inferi-orly off cornu and advanced 2-3 mm
  Should lie between thyrohyoid membrane and laryngeal mucosa

Local anaesthetic
  3-4 ml of lignocaine 0.5%

Indications
  Awake intubation

Complications
  Entering the larynx, coughing with injection
  Intravascular injection is uncommon

Translaryngeal block
  Needle placement
    Needle or IV cannula inserted in midline through cricothyroid membrane until air is aspirated

Local anaesthetic
  3-4 ml of lignocaine 4% topical solution rapidly injected and needle withdrawn before coughing
Recipes for regional anaesthesia

Eye block (Royal Victorian Eye and Ear Hospital)
- lignocaine 10% 2 ml
- bupivacaine 0.5% or ropivacaine 1.0% 7 ml
- hyalase 150 U in 1 ml bupivacaine 0.5% or ropivacaine 1.0%
- oxybuprocaine topical to conjunctiva
  - 30g 12 mm medial canthus 2-3 ml
  - 27g 32 mm inferotemporal 3-4 ml

Bier’s
- prilocaine 0.6% 40 ml
- prilocaine 0.5% 0.5 ml/kg (2.5-3.0 mg/kg)
- lignocaine 2-3 mg/kg

Interscalene
- 15-20 ml

Supraclavicular to Axillary
- 30-40 ml

Cervical
- lignocaine 1.5% with adrenaline
  ± ropivacaine
  superficial 15 ml
  deep 5-7 ml x 3

Caudal (Royal Children’s Hospital)
- bupivacaine 0.25% 0.5-1 ml/kg
- bupivacaine 0.5% 0.5 ml/kg up to 20 ml
- add clonidine 2 µg/kg

Spinal
- LUSCS (Mercy Hospital for Women)
  - bupivacaine 0.5% heavy 2.2 ml (2-2.5)
  - fentanyl 15 µg or morphine 100 µg
- Manual removal (MHW)
  - bupivacaine 0.5% plain 1.2 ml (1.2-2)
  - fentanyl 15 µg
- Neonatal for hernia repair (RCH)
  - bupivacaine 0.5% plain 0.2 ml/kg, min 0.4 ml
- THJR
  - bupivacaine 0.5% plain 3-4 ml
  - D Williams: bupivacaine 0.5% plain 2 ml, midazolam 2 mg, morphine 250 µg
- Knee scope, ESWL, other short procedures
  - procaine 2% 5 ml

CSE
- Labour (MHW)
  - bupivacaine 0.5% plain 0.5 ml
  - fentanyl 25 µg

Epidural
- Labour (MHW)
  - bupivacaine 0.25% 6-10 ml
  - fentanyl 100 µg
  - plus infusion 0.1% bupivacaine, 2 µg/ml fentanyl 10 ml/h
- Labour PCEA (MHW)
  - bupivacaine 0.125%, fentanyl 5 µg/ml 15 ml + 5 ml if inadequate at 15 min
  - bupivacaine 0.625%, fentanyl 2 µg/ml 5 ml bolus, 10 min lockout
- LUSCS (MHW)
  - lignocaine 2% up to 20 ml
  - fentanyl 100 µg or pethidine 50 mg or morphine 3-4 mg

Paediatric (RCH)
bupivacaine 0.125% ≈0.25 ml/kg/h
± fentanyl or clonidine 2 µg/ml