

Clinical Procedures

Emergency Medicine Fellowship Program

Acknowledgement: Dr A Sandry

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Structured Approach to Clinical Procedures

In clinical practice and the OSCE exam it is important to have a structured approach to procedures.

It is common to divide into 3 phases

- Pre-procedure
- Procedure
- Post-procedure

Below is an example

Pre-procedure

- *Confirm indication*
- *Exclude contraindication*
- *Consent/explanation*
 - *What is the procedure?*
 - *What is the condition needing the procedure?*
 - *How is the procedure informed?*
 - *What are the risks of DOING the procedure?*
 - *What are the risks of NOT doing the procedure?*
 - *What are the alternatives?*
- *Equipment/Drugs*
- *Place*
- *Staff required*
- *Patient optimised?*
- *Rest of department considered*

Procedure

- *Anaesthesia/analgesia*
- *Patient positioning*
- *Preparation*
- *Technique*

Post-procedure

- *Monitoring/Admission or follow up*
- *Explanation*

SAQ Questions

Clinical procedures may be assessed in the SAQ exam. You should be able to answer the following styles of question.

What are the indications for ... ?

What are the contraindications for ...?

What anaesthetic/analgesic options exist for -/ pro's and con's

Describe the steps involved in performing ...?

What are the main aspects of post-procedure care after ...?

Anterior nasal packing

S&J p277

D p 1089

St G trial FEx 2015

<http://care.american-rhinologic.org/epistaxis?print>

Indications	Control of epistaxis after failure of first aid	
Contraindications	Base of skull fracture	
Complications	Pain, discomfort Headache Coughing, spitting as clots pushed into pharynx Failure and necessity for contralateral pack Trauma to nasal mucosa Infection	
Positioning	Sitting upright	Leaning forward Bucket
Local anaesthetic	Cophenylcaine spray Pledgets	
IV sedation	If nasal packing	
Inspect septum	Suction	
	Cautery	Silver nitrate Electrocautery
Packing	Anterior Posterior Bilateral	Antibiotics if packed
Anterior	Ribbon gauze	Lubricated gauze 1 cm width Layers from floor upwards Crocodile or Tilly forceps
	Nasal tampon	6 cm for anterior 8 cm for posterior Sit upright Topicalize Lubricate with chloromycetin ointment Against septum Direct posteriorly Until end flush with nares

		Inject NS until sponge dribbles Tape drawstring Remove at 48 h
Posterior	Brighton balloon	10 ml anterior 30 ml posterior Inflate with NS Not definitive pack
	Rapid Rhino	Soak in sterile water until cover converts to gel Against septum
	Foley catheter	10-14 F – 20-30 ml balloon Pass to nasopharynx Visualize tip in oropharynx or >10cm inserted Fill balloon 7ml NS Seat in nasopharynx Further 7 ml NS Anterior pack about catheter Gentle traction Clamp with umbilical clamp Gauze between clamp and nares
Bilateral	If unilateral unsuccessful	
Disposition	Discharge	Stable Bleeding ceases with simple measures and does not recur after 2 h observation Definitive treatment Adequate supports Follow up Advice
	Admission	Elderly Coagulopathy Posterior packs

Arterial line

S+J p226, my practice

Introduction	Introduce self Confirm patient identity Ask about pain, offer analgesia Brief PMHx, meds, allergies
Indications	Invasive monitoring of blood pressure Repeated blood sampling
Contraindications	Patient refusal Local trauma, infection Ischaemic extremity Severe bleeding disorder Arteriovenous fistula
Benefits	Accurate continuous BP Pattern can provide information about circulation as a whole eg hypovolaemia Avoid cuff going up and down repeatedly Avoid repeated needles
Risks	Haematoma Bleeding if disconnects
	Embolism or thrombosis → ischaemia Accidental drug injections Line sepsis
Alternatives	Non-invasive BP Repeated sticks Large IV cannula
Check equipment	Cleaning swab Drape LA, insulin needle/syringe Gauze squares Arterial line (Seldinger or 20G cannula) Adhesive dressing (Opsite 3000) Primed extension line Saline bag, bluey, tape to position wrist
Procedure steps	Feel arterial pulse Allen's test Assess site skin Position wrist dorsiflexed at 45 degrees Secure in position Gloves on Prepare field and drape

	LA Cannulate Attach extension line Secure with sterile adhesive dressing
Closing	Comment on need to connect to pressure transducer Dispose of equipment, sharps Thank patient

Allen's test

Confirms collateral circulation in hand

Occlude radial + ulnar artery
Pump fist until pale
Release ulnar artery
If pinks up in 5-6 secs then ulnar artery supply is sufficient

Ascitic tap

S+J

NEJM article 2004

Specific extras	Specific Hx of abdominal surgery	
Examination	Ascites Shifting dullness Surgical scars Identify site Overall volume status	Site 2cm below umbilicus in ML L or RLQ 4cm cephalad and medial to ASIS
Indications	Diagnostic	Investigate cause of ascites Diagnose spontaneous bacterial peritonitis
	Therapeutic	Symptomatic relief Pressure Respiratory embarrassment
Contraindications	Patient refusal Infection at insertion site Surgical abdomen Obstruction Coagulopathy + clinical DIC Adhesions Not enough fluid ISOCAN	INR > 2 plt < 40
Benefits	Diagnose cause of ascites Diagnose SBP, identify org Relief of symptoms	
Risks	Haematoma at site Infection Persistent leakage	
	Hypovolaemia leading to shock and renal failure Haemoperitoneum Perforation bowel	
Alternatives		
Check equipment	LA Skin prep/drape Dressing pack 10 ml syringe, 25G+21G needle for LA 20 ml syringe Paracentesis catheter Tubing + Drainage bag Opsites for securing mesentery	

	BC bottles Albumin if required	
Procedure steps	Monitoring + IV line running Positioning supine USS, mark skin Glove, prep, drape LA skin bleb w 25G then deeper w 21G until aspirating fluid If using pigtail straighten by advancing needle to end Attach 20ml syringe Advance using Z-tract technique Not continuous suction Take sample Attach tubing Secure	
	Volume to remove	First or diagnostic 200-500ml Therapeutic 5 – 12 L
	Albumin if > 5L removed	6-8g albumin per L removed Or 50 g 20% if overloaded 5% if hypovolaemic
	Pathology	Cytology Culture Cell count Albumin/protein, LDH Serum albumin/protein, LDH Urine jar for cyto, culture, cell count Serum tube if poss but path can take from jar
	Aftercare	Do not leave in longer than 6 h if cirrhosis Monitor
Closing	Comment on what happens next Dispose of equipment, sharps Thank patient	

Spontaneous bacterial peritonitis

Prevalence in patients with ascites	10 – 30%
Diagnostic criteria	> 250 PNM / ml ³
Common pathogens	Gram negatives esp E. coli most common Also gram positives

Pathogenesis	Translocation of bacteria from gut → lymph nodes
Treatment	Third generation cephalosporins Ceftriaxone To prevent HRS IV albumin 1.5g/kg at Dx 1g/kg 48 hrs later
Complications	Hepatorenal syndrome
Recurrence	70% at one year
Prophylaxis	Norfloxacin 400mg/day PO

Ascitic fluid

WBC > 250 PMNs > 250	SBP	
MNs	TB	
Amylase	Pancreatic	
Malignant cells		
LDH > 225	Exudate	
pH < 7.0	Bacterial infection	
GS/culture	Monomicrobial	SBP
	Polymicrobial	Secondary ?perf viscus

Serum ascites albumin gradient SAAG [=serum albumin – ascitic fluid albumin]

High Gradient (≥ 1.1 g/dL) Transudate	Cirrhosis Alcoholic hepatitis Cardiac ascites Massive liver metastases Fulminant hepatic failure Budd-Chiari syndrome Portal vein thrombosis Venous occlusive disease Fatty liver of pregnancy Myxedema Mixed ascites
Low Gradient (< 1.1 g/dL)	Peritoneal carcinomatosis

Exudate	Tuberculous peritonitis Pancreatic ascites Biliary ascites Nephrotic syndrome Serositis in connective tissue diseases
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More than 11 g/L is almost 96% suggestive of portal hypertension.

Indicates transudative ascites.

If SAAG > 11 g/L and serum total protein < 25 g/L it indicates cirrhosis.

If SAAG > 11 g/L and serum total protein > 25 g/L it indicates heart failure or hepatic venous obstruction.

SAAG < 11 g/L indicates exudative ascites, may be due to malignancy or infection (TB)

Bier block

<http://www.nysora.com/techniques/3071-bier-block.html>

Arch Emerg Med 1990 article

Indications	Short procedures of the extremities	Ganglionectomy Carpal tunnel release # reduction
Contraindications	Superficial infections Sickle cell disease Severe PVD Crush injuries No IV access Compound fractures Allergy to LA AV shunts Hepatic insufficiency Poor cooperation	
Complication	LA toxicity	Short acting LA Correct tourniquet use
	Haematoma at IV	Small IV, dressing
	Extremity engorgement	Atherosclerosis may prevent tourniquet from functioning properly Different site eg lower
	Eccymoses	Padding
Limitations	Tourniquet pain limits to 45 min	
Equipment	LA Rubber tourniquet and IVs Bag of crystalloid Infusion set Double cuffed pneumatic tourniquet Esmarch bandage	
Procedure	Determine SBP of limb Insert IV on other side Insert small IV on block side, as distal as possible Pad upper arm and place double cuff Elevate arm for 2 min to exsanguinate Apply Esmarch bandage in spiral fashion to complete exsanguinations Digitally occlude axillary artery Inflate distal cuff to 100>SBP Inflate proximal cuff	

	Deflate distal cuff	
	Inject LA	
	When patient reports tourniquet pain, inflate distal cuff and deflate proximal cuff	Gives extra 10 mins
Deflation sequence	Deflate only > 20min from injection Quickly reinflate, look for signs of LA toxicity	

Lignocaine	40 ml 0.5% Max 2 mg/kg
Prilocaine	40 ml 0.5% = 3mg/kg for 67kg = 200mg Risk of methaemoglobinaemia – not these doses Greater tissue takeup → slower release → lower levels Partially extracted by pulmonary circulation Amide group → less anaphylaction Max 6mg/kg

Clearing c-spine

Introduction	Introduce self Confirm patient identity Purpose of discussion Ask about pain, offer analgesia
Mechanism	High risk features mandating imaging Low risk features allowing safe assessment of ROM
Injuries suffered	
New neurological symptoms	
Intoxication	
Brief PMHx, meds, allergies	
Consent for exam	
Wash hands	
Neurological exam	
C-spine midline tenderness	
Assess high or low risk	
Test range of movement	45 degrees L and R
Collar off	
Whiplash advice	Paracetamol NSAIDs Graduated return to activity

Nexus	Not ALOC Not intoxicated No distracting injury No neurology No midline tenderness
CCR exclusions	<16, >65 Neurology Previous c-spine disease or surgery

	Physiologically stable
CCR high risk	Fall > 1m or 5 steps Axial load to head MVA > 100 kph Rollover or ejection MVA Motorized recreational vehicle collision Bicycle collision
CCR low risk	Simple rear ender Sitting position in ED Ambulatory at any time Delayed onset of neck pain Absence of midline c-spine tenderness
Not a simple rear ender if...	Pushed into oncoming traffic Hit by bus or truck Rollover Hit by high speed vehicle

CDR factoids

2003 BMJ article compared Nexus and CCR

	CCR	Nexus
Sensitivity	99.4%	91%
Specificity	45%	37%

CVL

Indications	Therapeutic Delivery of	Drugs TPN Temporary pacing wire Dialysis
	Diagnostic	Regular blood samples
	Monitoring	CVP Pulmonary artery catheter
Contraindications	Infection at site Coagulopathy, thrombocytopenia Difficult landmark Uncooperative patient [all relative]	
Complications	Early	Arrhythmias Arterial puncture Neck haematoma Air embolism Wire embolism Pneumothorax Haemothorax Ventricular perforation Cardiac tamponade
	Late	Line sepsis Vein thrombosis
Equipment	LA Sterile field Central venous catheter, flushed Syringe, needle, guidewire Connectors for each lumen Suture Dressing	
IVJ		
Positioning	Supine, 10 degrees head down Right is better Head turned slightly to other side Operator at head	
Landmarks	IJ runs from mastoid to clavicle between heads of SCM Lateral to internal/common carotid Entry site apex of two heads of SCM At level of cricoid	

	<p>Lateral to pulse 30 deg to skin Direct needle to ipsilateral nipple</p>
Subclavian	
Positioning	<p>Supine Rolled towel between scapulae Operator at side at level of shoulders</p>
Landmarks	<p>Subclavian v is extension of axillary vein beyond first rib Runs underneath clavicle ant to subclavian artery Joins IVJ at sternoclavicular joint Entry site at lateral third clavicle Direct needle to suprasternal notch</p>
Femoral	
Positioning	<p>Supine Hips extended in neutral rotation Tilt 5 degrees head up to fill veins Operator at side at level of hips</p>
Landmarks	<p>Femoral vein medial to femoral artery at the inguinal ligament Draw a line from pubic tubercle and anterior superior iliac spine Artery palpated at medial third 2cm caudal Entry point 1cm medial to artery 45 deg to skin Direct needle to umbilicus</p>
Procedure	<p>Position patient Check monitoring – ECG in view Scrub Prep, drape, LA Seldinger technique Find vein by inserting needle and aspirating syringe Hold needle with non-dom hand, detach syringe Insert guidewire to past 10cm mark Withdraw needle until it is out, hold guidewire at skin Small nick in skin (cut away from wire) Pass dilator over wire and remove Keep control of wire at all times Pass catheter over wire Wire will come out distal (brown) port Insert to correct distance Remove wire Aspirate and flush each lumen Connectors on Suture IVL Opsite</p>

Aftercare	CXR to check position and exclude pneumothorax Blood gas or transducer for arterial v venous if doubt
Choice of site	
Femoral	Easiest Can't get CVP Not if abdominal, pelvic injury
Subclavian	Not if pneumothorax will cause problem Not if chest injury Not compressible if anticoagulated
IJ	Can be done sitting up with USS

DCCV

R+H p228, 247

Indications	Broad or narrow complex tachycardia + haemodynamic instability Stable patients with failed pharmacological mx VT with a pulse SVT Atrial fibrillation Atrial flutter	Shock Syncope CCF Myocardial ischaemia
Contraindications	No pulse AF + duration > 48h + no anticoagulation Sinus tachycardia Digitalis toxicity	
Complications	Pain Failure VF if not synchronised (R on T) Post-shock tachydysrhythmias or bradycardia Chest wall burns Complications of sedation Shock of a HCW	
Preprocedure check	Full resuscitation facilities IV running Sedation SPEEDBOMB	
Equipment	Defibrillator Monitoring equipment Sedation drugs	
Positioning	Supine	
Landmarks	Electrode pads Right of sternum anteriorly + 5th ICS MAL Or Left of sternum anteriorly + left scapula posteriorly	Avoid pacemaker Remove metal jewellery
Procedure	Sedate patient	
	Mode selection	Synchronised
	Energy selection	Atrial flutter 50J Atrial fibrillation 100J SVT 50J VT 100J

	Charge defibrillator	
	Clear top, middle, bottom	
	Shock	
	Reassess rhythm and patient	

Digital block

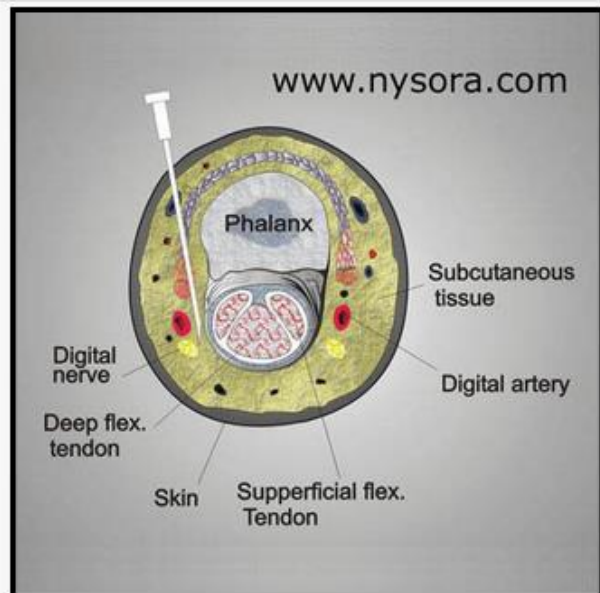
<http://emedicine.medscape.com/article/80887-overview#a4>

<http://www.nysora.com/digital-nerve-block>

<https://lifeinthefastlane.com/tox-library/toxicant/anaesthetics/local-anaesthetic/>

Indications	Any minor surgical procedure of digits Lacerations Nail bed lacerations Ingrown nails Incision of paronychia Trephination of subungual haematoma Dislocations or fractures
Contraindications	Compromised digit circulation Infected injection site Allergy to LA
Alternatives	Systemic analgesia Procedural sedation
Procedure	
<i>Preparation</i>	
Consent	
Staffing	
Equipment	Sterile equipment Syringe, needle, drawing up needle LA
Medications	LA
Positioning	Hand prone
<i>Technique</i>	Insert needle at dorsolateral aspect of base of digit Skin wheal Advance anteriorly towards base of phalanx until contact Withdraw 1 mm Inject 1 ml LA Inject further 1ml as withdrawing Repeat on other side
Pearls	Use insulin syringe Do not draw up an enormous syringe with an enormous drawing up

	needle in front of patient Do not use adrenaline Bleeding may be reduced with a clamped Penrose drain	
Complications	Infection	Sterile technique
	Haematoma	Avoid multiple needle insertions <25G needle Avoid superficial veins
	Vascular puncture	Intermittent aspiration
	Gangrene	Limit volume to 2ml each side CI small vessel disease
	Nerve injury	Avoid intraneuronal injection
	LA toxicity	Calculation of LA dose
	Vasovagal syncope	Have patient recline Gentle technique
Post procedure care	Warn of effects of numbed digit	



LA factoids

LA	Onset	DOA Anaesthesia	DOA Analgesia	Max Plain
Lignocaine	10-20	2-5 h	8 h	3 mg/kg
Bupivacaine	15-30	5-15 h	30 h	2.5 mg/kg
Ropivacaine	15-30	5-15 h	30 h	3 mg/kg

LA toxicity

Na channel blockade

CNS depression	Intubation If ECG changes give NaHCO ₃ first
Ventricular dysrhythmias	NaHCO ₃ 2mmol/kg IV q2min ILE 20% 1.5ml/kg bolus q5min rpt x2 ILE infusion 0.25ml/kg/min
Hypotension	NS bolus 20ml/kg NaHCO ₃ 2mmol/kg Pressors
Seizures	Treat dysrhythmias BZD Lorazepam, midazolam, diazepam 0.1mg/kg IV
Hypoxia	Consider methaemoglobinaemia Methylene blue 1-2mg/kg over 5 min

Escharotomy

Clinical Practice Guidelines

Escharotomy for Burn Patients

NSW Statewide Burn Injury Service

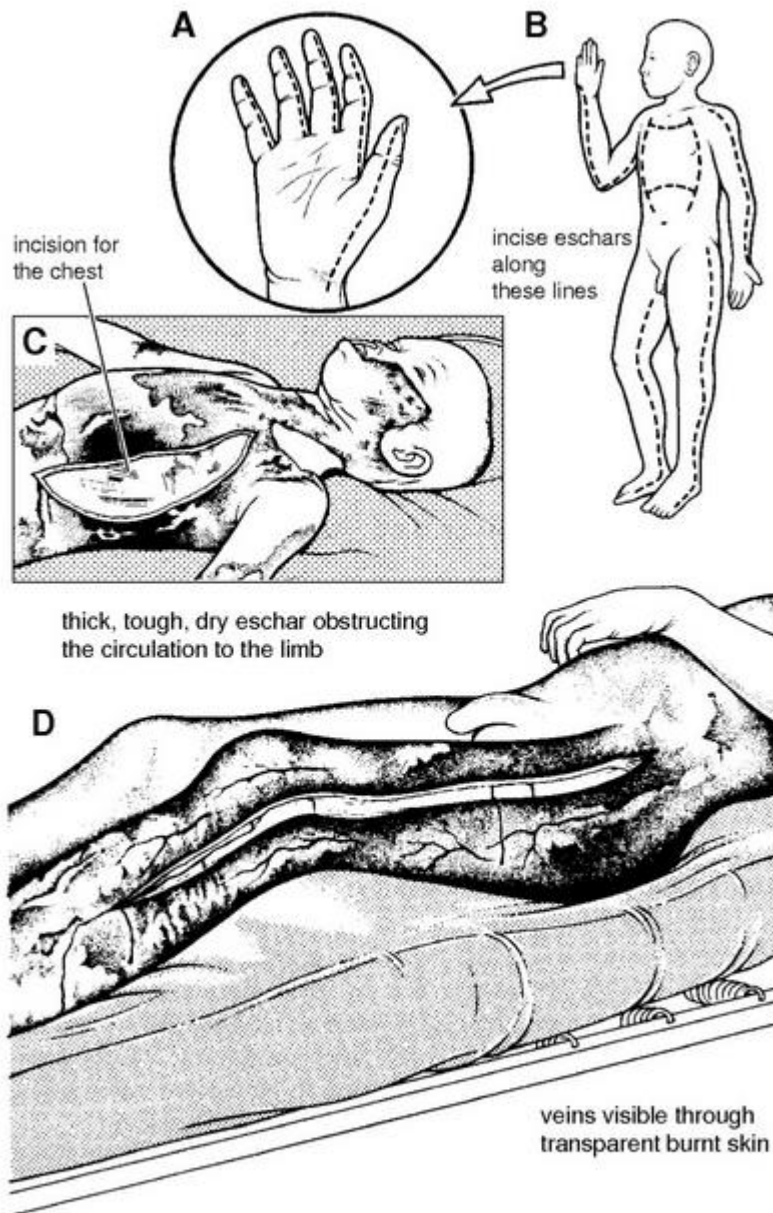
<https://lifeinthefastlane.com/trauma-tribulation-005/>

Indications	<p>Circumferential burns of the chest that increase chest wall rigidity and impair ventilation</p> <ul style="list-style-type: none">• Increased peak airway pressures in the ventilated patient• Children may have predominantly diaphragmatic breathing• Escharotomy may be required even if the burn is limited to the anterior chest <p>Constrictive circumferential neck burns</p> <p>Circumferential burns of the extremities resulting in circulatory embarrassment/ compartment syndrome.</p> <ul style="list-style-type: none">• Evidence of decreased circulation to the extremity, but before pulses are lost
Contraindications	
Alternatives	
Procedure	
<i>Preparation</i>	Resuscitation area Procedural sedation, airway management available
Consent	
Staffing	
Equipment	Diathermy (or scalpel), skin prep, drapes and crepe bandages Dressing Pack (contains Algisite®, Bactigras® and Melonin®) Generally no anaesthetic is required in adults- the patient should be appropriately sedated and given adequate pain relief General anaesthetic should be used for children Can be done in ED/resus/ICU with local anaesthetic Can be done with scalpel but will need diathermy to control bleeding
Medications	As above LA for extension into unburnt skin
Positioning	limb is in anatomical position (forearm supinated NOT pronated)
<i>Technique</i>	Mark incision line

	<p>Skin prep</p> <p>Cut with diathermy or scalpel to see fat (not muscle) at base of wound</p> <p>Observe obvious separation of edge</p> <p>Run finger if unsure</p> <p>Extend to normal skin by 1cm</p>
Trunk	<p>Longitudinal incisions along the anterior axillary lines to the costal margins, or upper abdomen if also burnt</p> <p>These longitudinal incisions are connected by convex upwards transverse incisions below the clavicles across the upper chest, and across the upper abdomen</p>
Limbs	<p>Longitudinal incisions along the mid-axial lines between the extensor and flexoral surface</p> <p>Incisions along the flexural creases of joints are avoided</p>
Lower limb	<p>Medial incision should pass behind the medial malleolus to avoid the long saphenous vein and saphenous nerve</p> <p>Lateral incisions are made in the midlateral line, avoiding the common peroneal nerve at the neck of the fibula</p>
Upper limb	<p>Medial incision should pass anterior to the medial epicondyle to avoid the ulnar nerve at the elbow</p> <p>On the medial aspect of the hand the incision may progress as far as the base of the little finger</p> <p>On the lateral aspect of the hand the incision can progress to the proximal phalanx of the thumb</p> <p>Sometimes an incision along one side of a limb is sufficient to preserve circulation</p>
Neck	<p>Usually performed laterally and posteriorly to decrease risk of damage to the carotid arteries and jugular veins</p>
Penis	<p>midlateral incisions to avoid the dorsal vein</p>
Complications	<p>Escharotomy</p> <ul style="list-style-type: none"> • bleeding • infection • damage to underlying structures <p>Inadequate escharotomy</p> <ul style="list-style-type: none"> • local effects — muscle necrosis, compressive neuropathy, amputation, inadequate ventilation, airway obstruction, abdominal compartment syndrome • systemic effects — rhabdomyolysis (renal impairment, hyperkalemia, metabolic acidosis)
Post procedure care	<p>Monitor for return or preservation of circulation (limb), breathing (chest)</p>

	<p>Dress with Alginate eg Algisite® or Kaltostat® (in escharotomy wound) Vaseline gauze Bactigras® (over rest of burn wound but NOT CIRCUMFERENTIAL) Loose Melolin® & crepe as outer dressing</p> <p>POST ESCHAROTOMY CARE Continue monitoring Circulation (in a limb) Breathing and ventilatory pressure (when chest involved) Elevate limbs Continue burn care</p>
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EMERGENCY ESCHAROTOMY



A and B are guides to the lines of incision when performing an escharotomy (from PrimarySurgery.org)

Fascia iliaca block

S&J p280

<http://www.nysora.com/techniques/3120-ultrasound-guided-femoral-nerve-block.html>
<https://www.bromleyemergency.com/frcem-primary-blog/core-anatomy-fascia-iliaca-compartment/>

Indications	Analgesia for NOF# Fractured femur Application of traction
Contraindications	Allergy to local anaesthetic Overlying skin infection
Complications	Failure to provide block Local anaesthetic toxicity Haematoma Abscess Intraneural injection and damage
Location	Nil specific
Equipment	Asepsis LA for skin [1% plain lignocaine]+drawing-up needle+22G needle+5mL syringe 2 x 20mL syringes 20mL NS 20mL ropivacaine 0.75% Plexuflux needle [or any blunt 21-23G needle] Skin marking pen
Positioning	Supine
Landmarks	Line from pubic tubercle to anterior superior iliac spine Divide into thirds Injection point 2cm below lateral 1/3 Palpate artery medial to this
Procedure	Prep skin Prepare LA for skin Drape LA to skin Prepare LA for block 2 x 20mL syringes with 10mL NS and 10mL 0.75% ropivacaine To make 0.375% 30mL for <60kg 35mL for >60kg

	Prime Plexuflux needle Hold like a pencil Insert perpendicular to skin First 'pop' after skin is fascia lata Second 'pop' is fascia iliaca Aspirate Inject Be aware of complaints of nerve pain Bandaid
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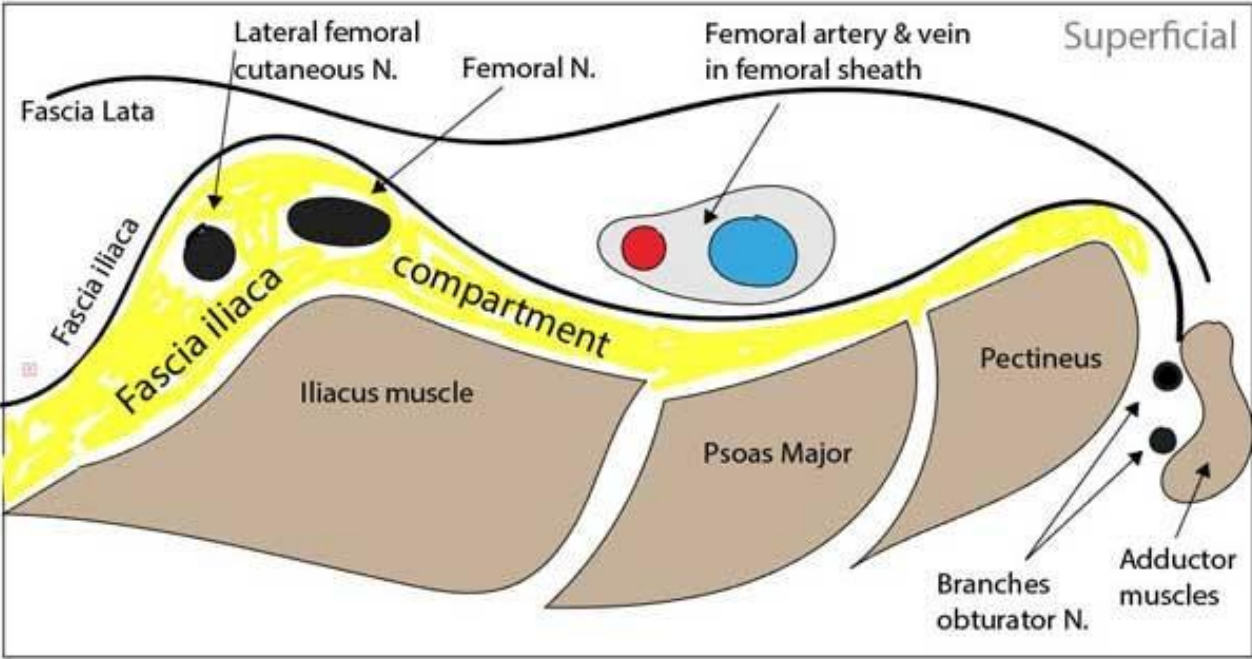
LA

LA	Onset	DOA Anaesthesia	DOA Analgesia	Max Plain
Lignocaine	10-20	2-5 h	8 h	3 mg/kg
Bupivacaine	15-30	5-15 h	30 h	2.5 mg/kg
Ropivacaine	15-30	5-15 h	30 h	3 mg/kg

Nerves

Nerve	Roots	Cover
Femoral	L 2 - 4	Ant, med thigh and knee Femur periosteum Hip joint Knee joint
Lateral femoral cutaneous	L 2 - 3	Lat buttock, thigh Hip joint
Obturator	L 2 - 4	Medial thigh Hip joint Knee joint

Local anatomy



Fracture reduction

Indications	Dislocation
Contraindications	None
Complications	Failure Pain Neurovascular injury Complications of sedation
Alternatives	GA
Informed consent	
Preparation	Xrays
Location	Resuscitation area if procedural sedation
Equipment	Sedation drugs Monitoring Airway equipment Velban POP Crepe Water
Positioning	
Reduction	
Check NV status	
Check stability	
Splint	
Post procedure care	Xray Analgesia Recovery

Ankle reduction

R+H p996

Usually associated with fractures

Posterior dislocations

Fall on plantar flexed foot

Positioning	Supine Knee flexed [to relax Achilles tendon]
Reduction	First assistant countertraction rostrally on leg Grasp heel and dorsal metatarsals Slight plantar flexion Longitudinal distraction Dorsiflex foot Second assistant applies downward [posterior] pressure on distal tibia Move heel anteriorly
Check NV status	
Check stability	NA
Splint	Ankle 90° Short leg backslab Stirrup

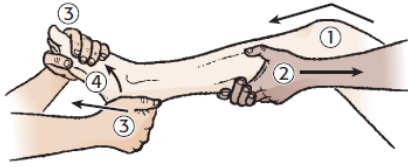
Anterior dislocations

Forced dorsiflexion

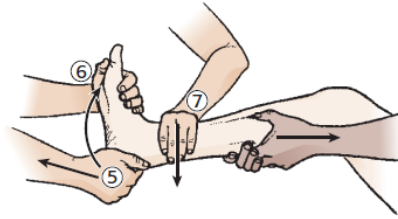
Positioning	Supine Knee flexed [to relax Achilles tendon]
Reduction	First assistant countertraction rostrally on leg Grasp heel and dorsal metatarsals Dorsiflexion to disengage foot Longitudinal distraction Second assistant applies upward [anterior] pressure on distal tibia Move heel posteriorly
Check NV status	
Check stability	NA
Splint	Ankle 90° Short leg backslab Stirrup

ANKLE DISLOCATION REDUCTION

A. Posterior Dislocations

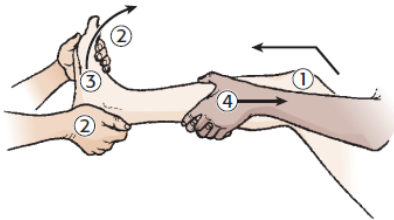


(1) Slightly flex the knee. (2) Instruct an assistant to provide countertraction on the leg. (3) Grasp the heel with one hand and the dorsal metatarsals with the other. (4) Slightly plantarflex the foot and apply straight downward counterpressure on the foot.

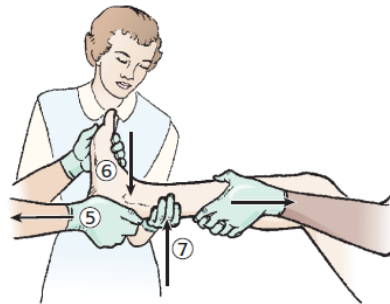


(5) Pull the foot forward with longitudinal traction on the heel. (6) Dorsiflex the foot. (7) Instruct a second assistant to provide counterpressure on the front of the lower part of the leg.

B. Anterior Dislocations



(1) Flex the knee. (2) Grasp the forefoot with one hand and the heel with the other. (3) Dorsiflex the foot to disengage the talus. (4) Instruct an assistant to provide countertraction on the leg.



(5) Apply straight longitudinal traction. (6) Push the foot directly backward. (7) Instruct a second assistant to apply countertraction on the back of the lower part of the leg.

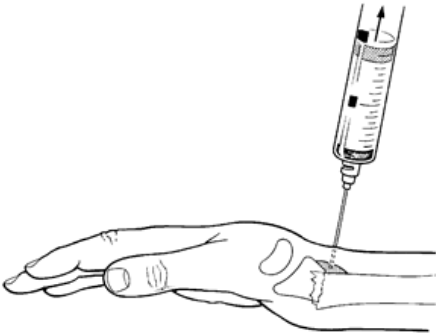
Figure 49-67 Ankle dislocation reduction.

Haematoma block

<http://www.fpnotebook.com/surgery/pharm/HmtmBlck.htm>

<https://blogs.brown.edu/emergency-medicine-residency/orthopedic-review-distal-radius-fracture-reduction/>

<http://www.orthobullets.com/trauma/1027/distal-radius-fractures>

Indications	Clean closed fracture site For closed reduction of Distal radius fracture Phalanx fracture	Similar pain scores to conscious sedation with propofol Shorter ED stay
Contraindications	Open fracture Overlying infection Uncooperative patient Young children	
Complications	Failure LA toxicity Osteomyelitis Abscess	
Equipment	10ml 1% lignocaine 10ml syringe Drawing up needle 21G needle Skin prep	
Procedure	Examine for medial n palsy Identify fracture site by palpating for bony step-off Clean and prep site Insert needle Aspirate blood Inject LA Aspirate blood Reinject with aspirated fluid several times Wait 10 min for effect Reduce Rexamine for median nerve	

Closed reduction of distal radius fracture

Jones method

Elbow flexed 90° and traction on upper arm

Operator controls distal fragment with both thumbs dorsally

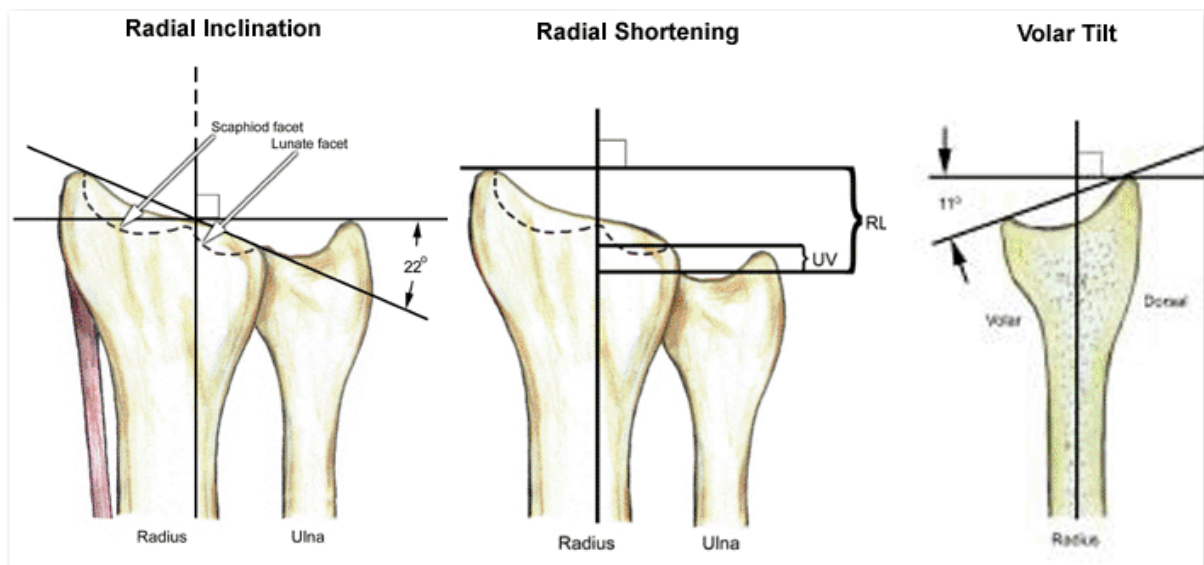
Hyperextend wrist to recreate mechanism

Volar translation of distal fragment

Sugartong splint

Acceptable deformity

	Normal	Acceptable
Radial length	13mm	< 5mm shortening
Articular step-off	None	< 2mm
Radial inclination	23°	< 5° change
Volar tilt	11°	Dorsal angulation < 5°



Positioning	Supine or sitting up 30 degrees Ipsilateral arm abducted
Landmarks	Triangle of safety Lateral edge of latissimus dorsi Lateral edge of pectoralis major Apex axilla 5 th intercostal space
Procedure	Aseptic technique Skin prep LA down to parietal pleura Horizontal incision above and parallel to rib [avoid neurovascular bundle] big enough for finger + drain 3 cm Blunt dissection with forceps Layers skin, SC tissue, IC muscles, parietal pleura Breach pleura – hissing Finger sweep [confirm position, ensure absence of viscera] Load ICC onto curved forceps Insert ICC without trocar Attach to drain Check bubbling Suture in place Suture rest of wound Mesentery with opsite
Aftercare	Check swinging, bubbling Assess patient CXR to confirm position

Blood from a chest drain

Indication to call cardiothoracics	>1000 ml immediately >150 -200 ml/h for 2 hr Repeated transfusions required for stability
------------------------------------	---

Classification and Mx of spontaneous pneumothorax

Type	Primary	No underlying lung Δ
	Secondary	>50yr + smoking Hx or Evidence of underlying lung Δ on CXR
Size	Small	<2cm rim at level of hilum
	Large	>2cm rim at level of hilum

Dyspnoea	Not dyspnoeic
	Dyspnoeic

Observe	Primary < 2cm, no SOB → discharge and review Secondary < 1cm, no SOB → admit, high-flow O2
Aspiration	In all primary > 2cm or SOB In secondary 1- 2cm, no SOB
ICC	Failed aspiration In all secondary > 2cm or SOB

How O2 helps

Hi flow O2 if in hospital

Reduces PP of nitrogen in pleural capillaries

↑ gradient bw pleural caps and pleural space → ↑ absorption of air

This increases absorption x 4

This generally applies to secondary PTs <1cm/apical in asymptomatic pts

Securing ICC

Roman sandal technique no longer recommended as too much movement

Simple suture on one side of ICC

Standard knot leaving ends even

Wrap around and around base of ICC and tie off

Repeat on other side

Simple sutures if required to close incision

Sandwich dressing using 2 tegaderms or opsite

Sleek mesentery to attach ICC to chest



How the drainage system works

<http://emedicine.medscape.com/article/1503275-overview#showall>

Drainage by

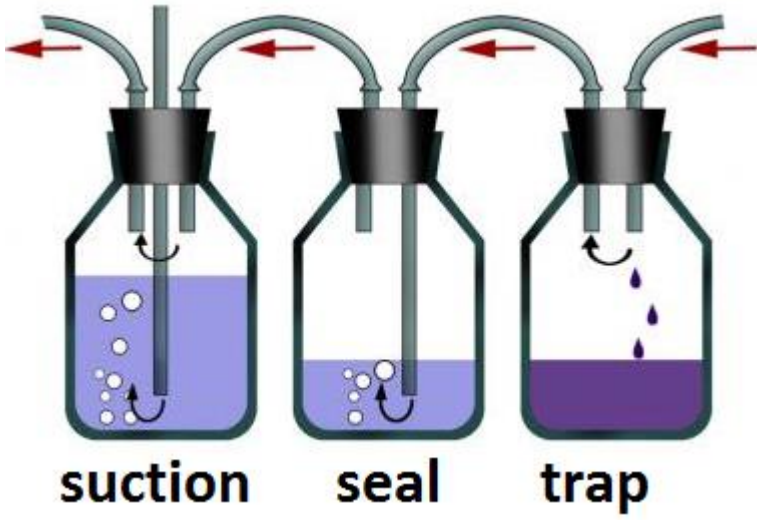
Expiratory positive pressure

Gravity

Suction

3 chambers in drainage system

Underwater seal	One way valve Resistance \propto depth of tube underwater Water column moves with intrapleural pressure Bubbles from ongoing air leak
Reservoir chamber	Between seal and ICC Traps fluid from chest so underwater seal kept at a constant level
Suction regulator	Between seal and suction source Force of suction \propto depth of atmospheric vent underwater Suction at wall is adjusted to give constant bubbling during inspiration and expiration



IO

S&J p267

Installing an intraosseous Infusion System (EZ-IO®)

Arrow® EZ-IO® Insertion Site Identification - Proximal Humerus vid

Indications	Rapid vascular access PIV not readily available	
Contraindications	Fracture in same bone as site Absence of landmarks Previous successful attempt in same bone as site in last 24 h Prev orthopaedic surgery of nearest joint eg TKR Ischaemic extremity Overlying infection	
Complications	Pain from insertion or infusion Superficial insertion → extravasation Displacement → extravasation Extravasation → compartment syndrome Through and through insertion → fracture Cellulitis Osteomyelitis Local neurovascular injury	
Common sites	Prox tibia	Anteromedial surface 2cm distal to tuberosity Up to 1cm medially
	Distal femur 2 nd choice <1y	Midline 1-2 cm above superior border of patella w leg in extension
	Distal tibia 2 nd choice 1-18y	1-2 cm prox to medial malleolus
	Proximal humerus 2 nd choice adults	Greater tubercle Avoid intertubercular groove [biceps tendon] To find Adduct, internally rotate pts arm Operator's medial [wrt pt] hand to axilla Lateral hand in midline of upper arm Thumbs define surgical neck of humerus Greater tubercle is 1-2 cm above
	Superior iliac crest	
Equipment	IO needle	Pink 15 mm 3-39kg Blue 25mm >40 kg

		Yellow 45mm Fat adults or prox humerus
	Power driver EZ-Connect, primed EZ-Stabilizer dressing	
	Lignocaine Flush syringes	
	Skin prep, gloves	
Procedure	Preparation	Position patient PPE Skin prep Consider SC LA if patient awake, time allows
	Insert	Fit needle to driver Stabilize site Remove safety cap Position needle to skin at 90° Push to bone Check a black line still visible Drill smoothly, driver does the work Stop w decreased resistance Remove drill while stabilizing needle
	Fix and dress	Remove stylet by twisting CCW Secure w EZ-Stabilizer Take samples Connect EZ-Connect Lignocaine if pt awake Flush Assess for complications Administer treatment
	Label with time/date	CAN ONLY BE USED FOR 24 H

Samples

Notify lab IO source

Reliable	Glucose, pH, pCO2 Hb, XM HCO3, Na, Cl, Urea, Cr Drugs Cultures
Not reliable	pO2 WC K, Ca, LFTs

--	--

Lignocaine

2% plain = 20 mg/mL

Max 2 mL = 40mg

0.5 mg/kg

Allow to dwell for 1 minute

Checking placement

- Needle stands without support
- Aspiration successful
- Flushes
- Squeeze test if in doubt

Lee BK, Jeung KW, Lee HY et al. Confirmation of intraosseous cannula placement based on pressure measured at the cannula during squeezing the extremity in a piglet model. Resuscitation. 2014 Jan;85(1):143-7

Connect IO to pressure transducer eg TruWave

Squeeze limb firmly with both hands for 10 secs

If P < 80mmHg → placement correct

Joint aspiration

R+H

First Carpometacarpal Joint (Fig. 53-7)

Landmarks	Radial aspect of the proximal end of the first metacarpal Abductor pollicis longus (APL) tendon is located by active extension of the tendon
Position	Oppose the thumb against the little finger so that the proximal end of the first metacarpal is palpable Apply traction to the thumb to widen the joint space
Needle Insertion	22- to 23-gauge needle at a point proximal to the prominence at the base of the first metacarpal on the palmar side of the APL tendon
Comments	Degenerative joint disease commonly affects this joint Arthrocentesis is moderately difficult The anatomic "snuffbox" (located more proximally and on the dorsal side of the APL tendon) should be avoided because it contains the radial artery and superficial radial nerve

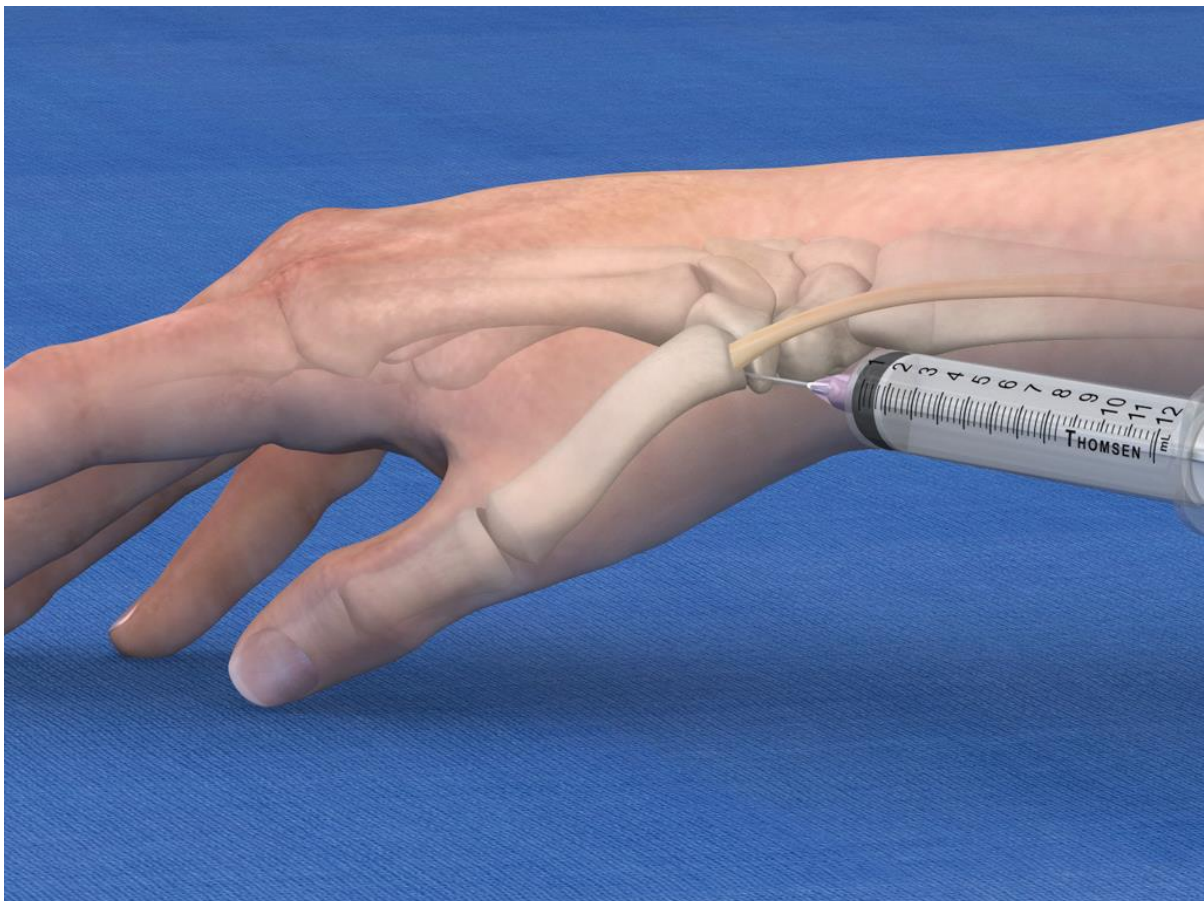


Figure 53-7 Landmarks for arthrocentesis of the first carpometacarpal joint. All small joints pose a difficult aspiration. When aspirating small joints, apply continuous suction to the syringe, and walk the tip of the needle along the bones until the joint is entered or fluid is obtained. Apply longitudinal traction to facilitate entry into a small joint. *MCP*, metacarpophalangeal.

Interphalangeal and Metacarpophalangeal Joints (Fig. 53-8)

Landmarks	on the dorsal surface For the metacarpophalangeal joints, palpate for the prominence at the proximal end of the proximal phalanx For the interphalangeal joints, palpate for the prominence at the proximal end of the middle or distal phalanx. The extensor tendon runs down the midline
Position	Flex the fingers to approximately 15 to 20 degrees and apply traction
Needle Insertion	22- to 25-gauge needle into the joint space dorsally, just medial or lateral to the central slip of the extensor tendon
Comments	Synovitis causes these joints to bulge dorsally Normally, it is unusual to obtain fluid in the absence of a significant pathologic condition

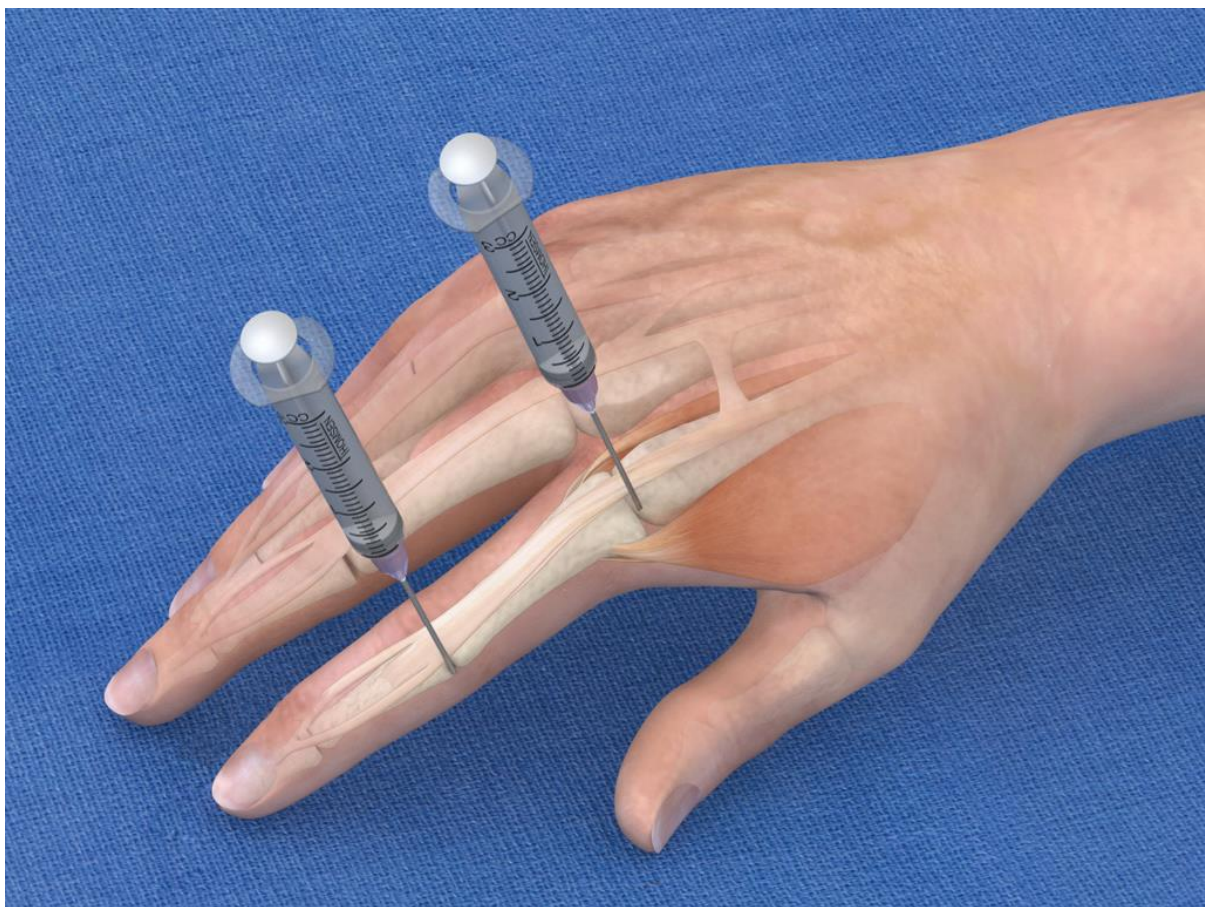


Figure 53-8 Landmarks for arthrocentesis of the interphalangeal (IP) and metacarpophalangeal (MCP) joints.

Radiocarpal Joint (Wrist) (Fig. 53-9)

Landmarks	The dorsal radial tubercle (Lister's tubercle) is an elevation found in the center of the dorsal aspect of the distal end of the radius The extensor pollicis longus tendon runs in a groove on the radial side of the tubercle The tendon can be palpated by active extension of the wrist and thumb
Position	Wrist in approximately 20 to 30 degrees of flexion with accompanying ulnar

	deviation Apply traction to the hand
Needle Insertion	22-gauge needle dorsally, just distal to the dorsal tubercle on the ulnar side of the extensor pollicis longus tendon
Comments	The anatomic snuffbox, located more radially, should be avoided to prevent injury to the radial artery or superficial radial nerve

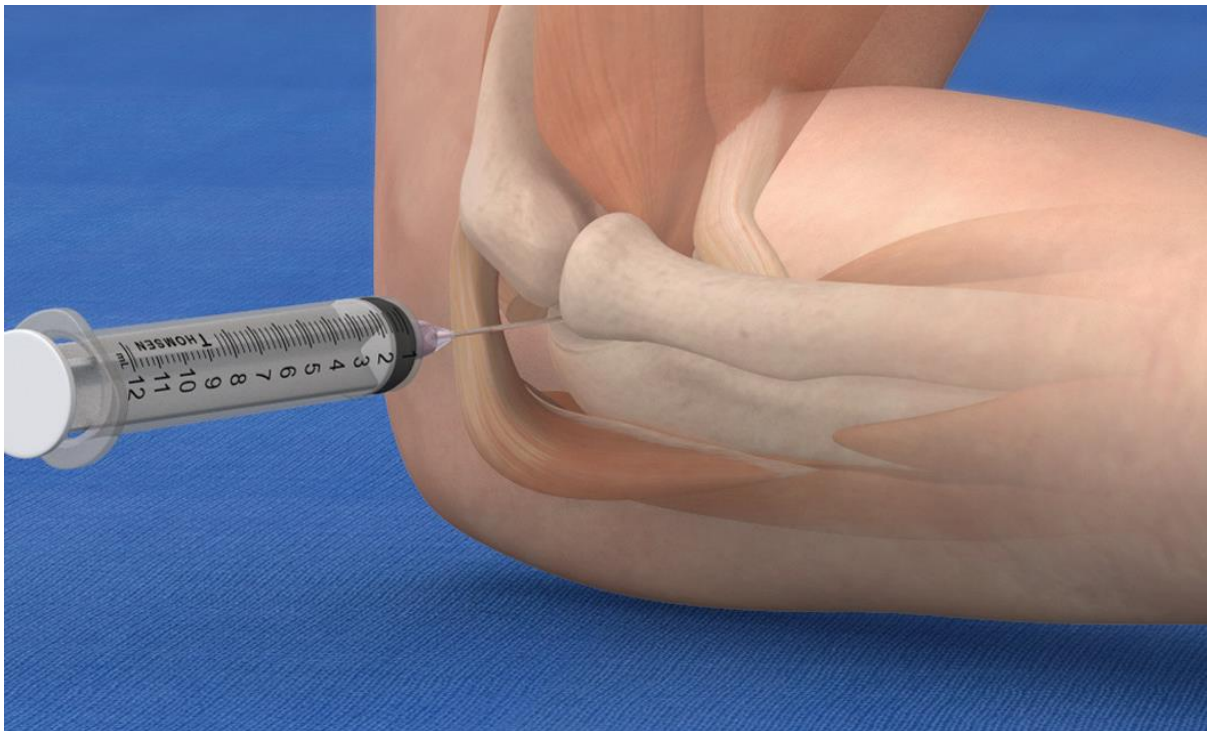


Figure 53-9 Landmarks for arthrocentesis of the radiocarpal (wrist) joint.

Radiohumeral Joint (Elbow) (Fig. 53-10)

Landmarks	The lateral epicondyle of the humerus and the head of the radius With the elbow extended, palpate the depression between the radial head and the lateral epicondyle of the humerus
Position	With the palpating finger still touching the radial head, flex the elbow to 90 degrees Pronate the forearm Place the palm flat on a table
Needle Insertion	20-gauge needle from the lateral aspect just distal to the lateral epicondyle and directed medially
Comments	Elevation of the anterior fat pad or the presence of a posterior fat pad on a lateral soft tissue elbow radiograph signifies blood, pus, or fluid in the elbow joint (see Fig. 53-10B) Effusions in the elbow joint may bulge and be readily palpated (see Fig. 53-10C)

Frequently, the effusion appears inferior to the lateral epicondyle. The bulge can then be aspirated from a posterior approach on the lateral side (see Fig. 53-10D)
A medial approach is not recommended because the ulnar nerve and superior ulnar collateral artery may be damaged
Gout and septic arthritis commonly affect this joint
The most common cause of elbow hemarthrosis after trauma with no obvious fracture is a nondisplaced radial head fracture
A small hemarthrosis need not be aspirated, but removal of blood from a tense elbow joint will significantly hasten recovery and facilitate range of motion in patients with a radial head fracture



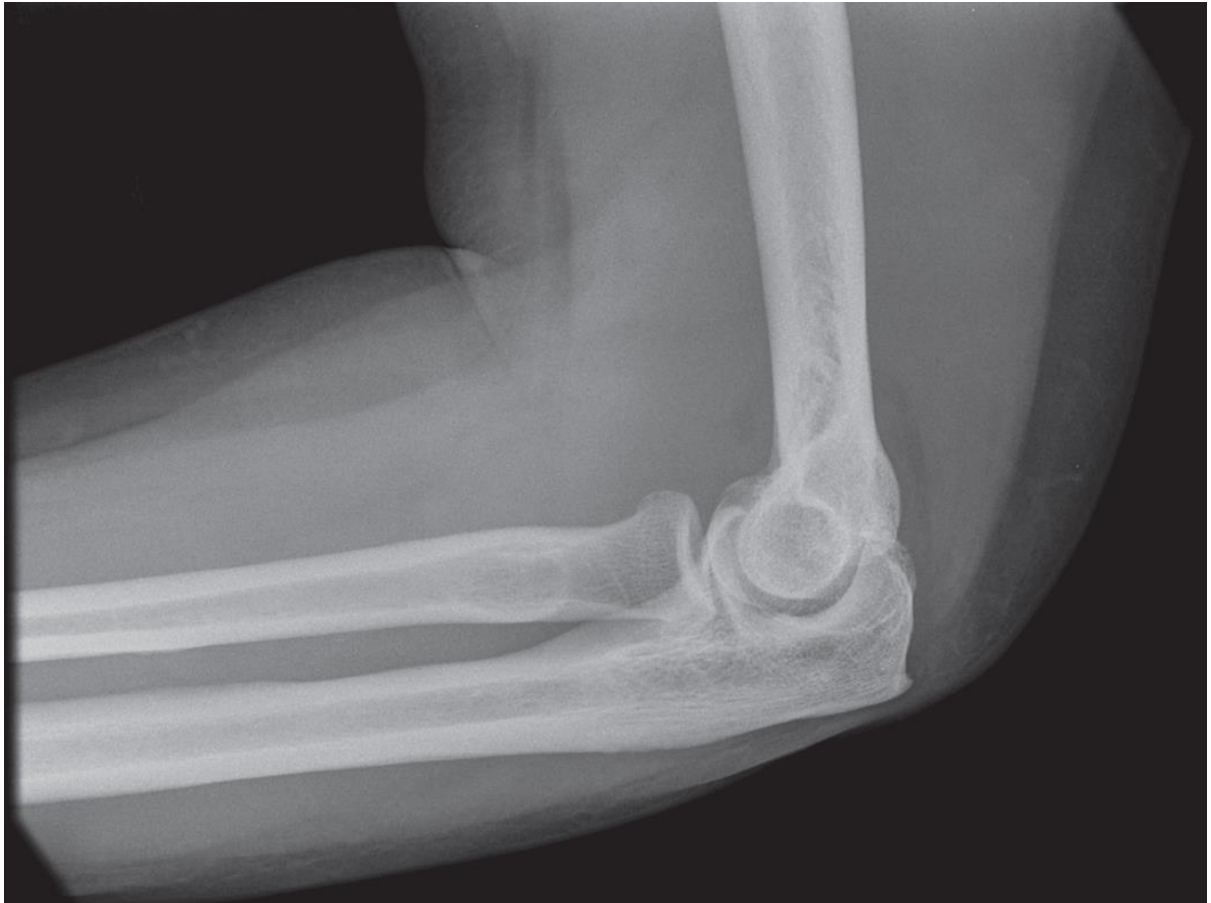




Figure 53-10 **A**, Landmarks for arthrocentesis of the radiohumeral (elbow) joint. **B**, On a lateral elbow radiograph, displacement of the anterior fat pad (*arrows*) or the presence of a posterior fat pad (*arrows*) indicates blood, pus, or fluid in the joint. **C**, An effusion in the elbow joint can usually be readily palpated. A palpating finger is placed over the lateral epicondyle (*asterisk*) and slid posteriorly and inferiorly toward the olecranon (*arrow*). Usually, a depression is felt as the finger leaves the epicondyle, but a bulge is appreciated if a joint effusion is present. **D**, Removal of only a few milliliters of blood will reduce pain and hasten recovery of range of motion. The most common pathology after trauma with a radiograph negative for fracture but positive for hemarthrosis is a nondisplaced radial head fracture.

Glenohumeral Joint (Shoulder), Anterior Approach (Fig. 53-11)

Landmarks	Anteriorly palpate the coracoid process medially and the proximal end of the humerus laterally
Position	The patient should sit upright with the arm at the side and hand in the lap
Needle Insertion	20-gauge needle at a point inferior and lateral to the coracoid process and direct it posteriorly toward the glenoid rim
Comments	Arthrocentesis of this joint is moderately difficult Other approaches have been suggested but are less well accepted

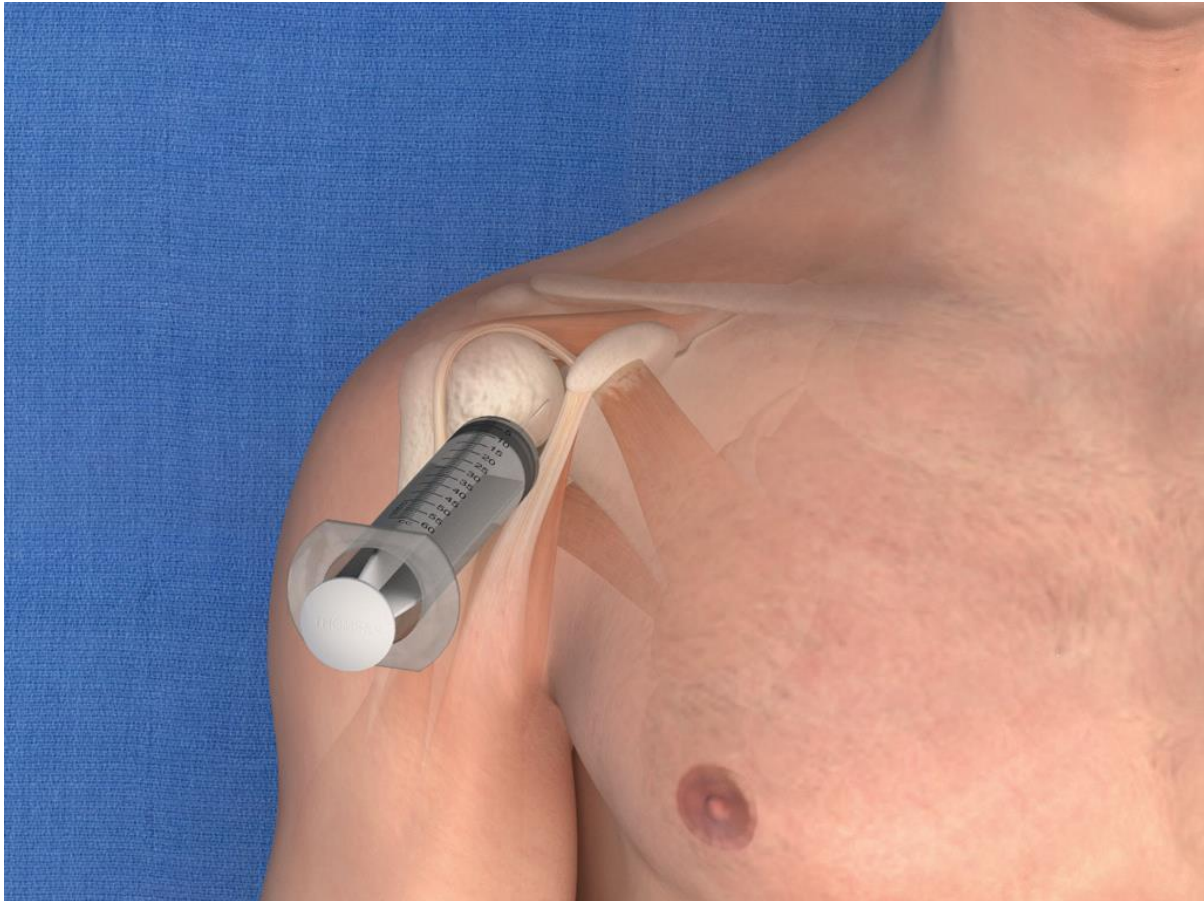


Figure 53-11 Landmarks for arthrocentesis of the glenohumeral (shoulder) joint.

Tibiotalar Joint (Ankle) (Fig. 53-13)

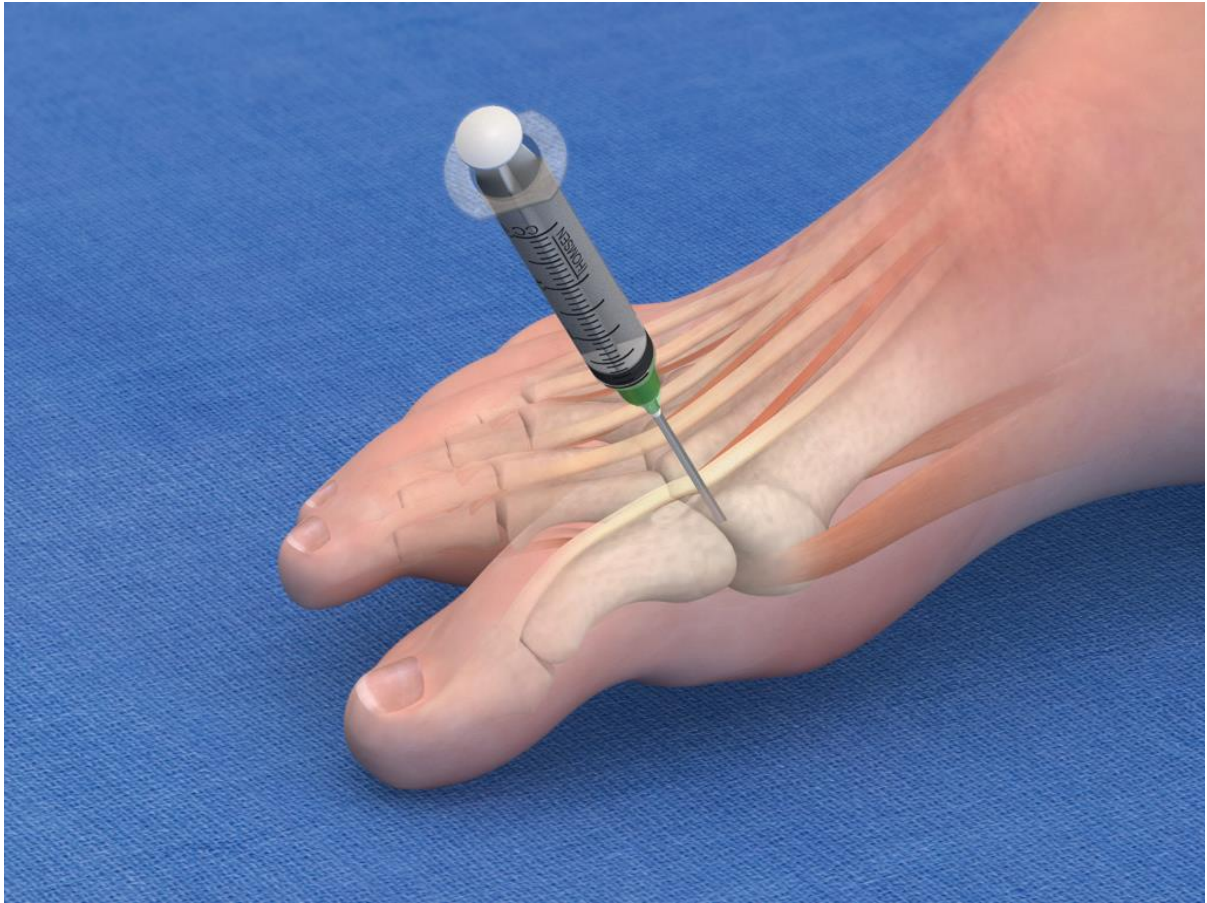
Landmarks	The medial malleolar sulcus is bordered medially by the medial malleolus and laterally by the anterior tibial tendon The tendon can easily be identified with active dorsiflexion of the foot
Position	With the patient lying supine, plantar-flex the foot
Needle Insertion	20- to 22-gauge needle at a point just medial to the anterior tibial tendon and directed into the hollow at the anterior edge of the medial malleolus The needle must be inserted 2 to 3 cm to penetrate the joint space
Comments	If the joint bulges medially, one may use an approach that is more medial than anterior and enter at a point just anterior to the medial malleolus The needle may have to be advanced 2 to 4 cm with this approach



Figure 53-13 A, Landmarks for arthrocentesis of the tibiotalar joint.

Metatarsophalangeal and Interphalangeal Joints (Fig. 53-14)

Landmarks	For the first digit, landmarks are the distal metatarsal head and the proximal base of the first phalanx For the other toes, the landmarks are the prominences at the proximal interphalangeal and distal interphalangeal joints The extensor tendon of the great toe can be located by active extension of the toe
Position	With the patient supine, flex the toes 15 to 20 degrees Then apply traction
Needle Insertion	22-gauge needle on the dorsalsurface at a point just medial or lateral to the central slip of the extensor tendon
Comments	



Knee aspiration

S&J p271

R+H p1075

Indications	Exclude septic arthritis Diagnosis of nature of joint fluid: traumatic, inflammatory, infective Instillation of therapeutic agents Relief of pain of acute haemarthrosis
Contraindications	Cellulitis at site of insertion For prosthetic joint, aspiration should be in OT under sterile conditions Coagulopathy INR > 4.5 [relative] Bacteraemia [relative]
Complications	Pain Introduction of infection Haemarthrosis Damage to articular cartilage Reaccumulation
Location	Nil specific
Equipment	Asepsis LA for skin 18G needle, syringe, haemostat or 3 way stopcock if much fluid expected Island dressing
Positioning	Sitting or supine Quads relaxed Knee flexed 20°
Landmarks	Medial surface of patella, midpoint or superior aspect 1 cm medial to patella edge Needle is advanced between patella and intercondylar femoral notch May elevate patella with other hand Keep needle parallel to the floor
Procedure	Prep skin Prep LA Drape LA to skin and track of aspiration needle Insert aspiration needle and advance while aspirating Remove as much fluid as possible Change syringes with haemostat if required

Required factoids

Samples

EDTA	Cell count
Na heparin	Crystals
Sterile/plain	Gram stain, culture

Disease	Colour	Clarity	WCC	PMN	Crystals	Bacteria
Non-Inflammatory						
OA	Yellow	Clear	700	15%	None	None
Traumatic arthritis	Straw	Cloudy	1000	25%	None	None
Inflammatory						
SLE	Straw	Clear	2000	30%	None	None
RF	Yellow	Slightly Cloudy	14000	50%	None	None
Pseudogout	Yellow	Cloudy if acute	15000	70%	Calcium Pyrophosphate	None
Gout	Yellow to milky	Cloudy	20000	70%	Urate	None
RA	Yellow to green	Cloudy	20000	70%	None	None
Infective						
TB arthritis	Yellow	Cloudy	20000	60%	None	Present
Septic arthritis	Grey or bloody	Turbid	90000	90%	None	Present

	White Cell Count (WCC)	Polymorphonuclear Leukocyte (PMN)
• Non-inflammatory	• <2000	• <25%
• Inflammatory	• 2-50,000	• >50%
• Infectious	• >50,000	• >75%

Lateral canthotomy and cantholysis

<http://lifeinthefastlane.com/ophthalmology-befuddler-033-2/>

R+H p1295

CJEM article

Indications	Orbital compartment syndrome in setting of trauma
	Primary ↓ VA IOP > 40 Proptosis
	Secondary RAPD Cherry red macula Ophthalmoplegia Nerve head pallor Eye pain
Contraindications	Ruptured globe
Alternatives	
Procedure	
<i>Preparation</i>	Examination as above PC to ophthalmologist desirable
Consent	
Staffing	
Equipment	Asepsis LA needle, syringe Haemostat Scissors Dressing Tonometer
Medications	LA Sedation if required
Positioning	Supine
<i>Technique</i>	
Clean area	

LA	1-2 ml lignocaine with adrenaline into lateral canthus
Devascularize	Squeeze with haemostat To lateral orbital rim
Canthotomy	Place scissors across lateral canthus Cut 1-2 cm laterally to lateral orbital rim
Cantholysis	Pull lower eyelid anteriorly Point scissors towards nose Dissect past adipose tissue pocket Eisler's pocket Blades either side of inferior lateral canthal tendon Cut
Check IOP	
If decompression inadequate	Repeat for superior lateral canthal tendon
Dressing	
Complications	Haemorrhage Infection Mechanical injury to globe
Post procedure care	Dressing Analgesia Ophthalmology review

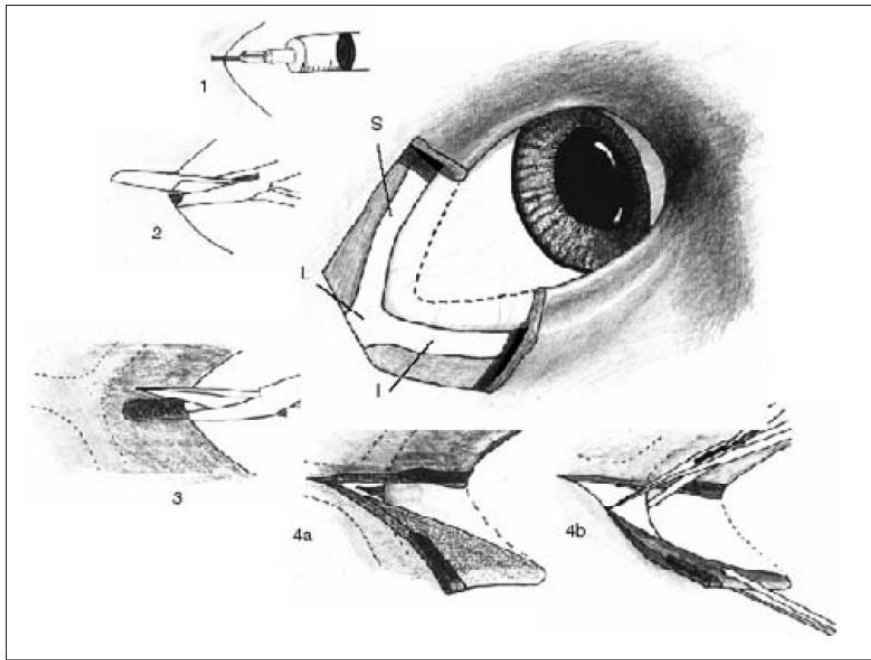
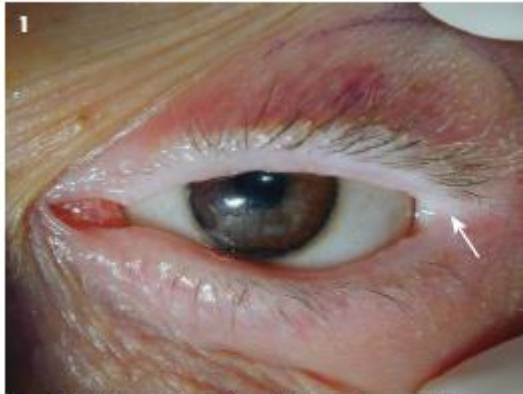
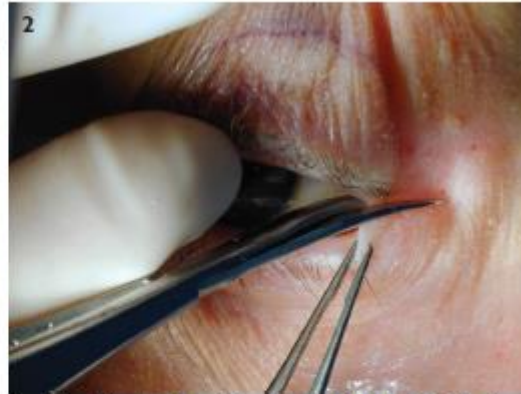


Fig. 3. Anatomy of the lateral canthus. I = inferior canthal tendon. L = lateral canthal tendon. S = superior canthal tendon. Stages of the procedure: 1: Infiltration of the local anaesthetic. 2: Devascularization. 3: Cut through skin and lateral canthus. 4a: Expose the inferiolateral canthal tendon. 4b: Cut inferior canthal tendon.

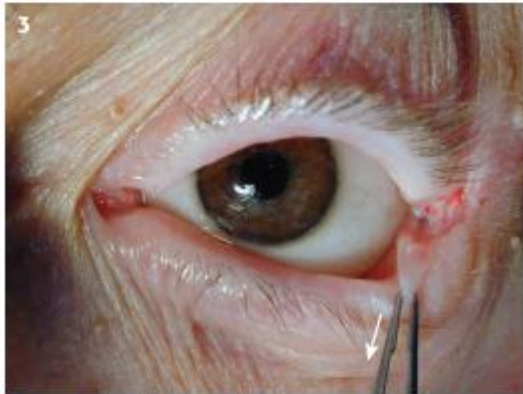
LATERAL CANTHOTOMY AND CANTHOLYSIS



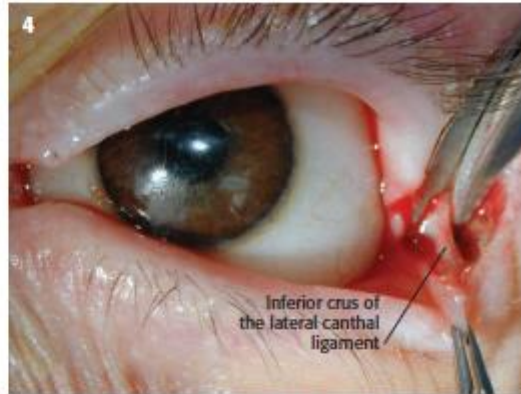
1 Identify the lateral canthus (arrow). Cleanse the area with antiseptic and anesthetize with 1% lidocaine with epinephrine. (The left eye is depicted in this image sequence.)



2 Crush the lateral canthus with a hemostat for 1 to 2 minutes to reduce incisional bleeding (not shown). Then, cut through the crushed tissue with iris scissors (as depicted above) to perform the canthotomy.



3 Pull the lower eyelid away from the globe with toothed forceps (arrow).



4 "Strum" the tissue under the canthotomy with the scissors to identify the inferior crus of the lateral canthal ligament. Cut through this ligament with scissors to perform the inferior cantholysis. Note that the scissors are directed inferiorly during this step, perpendicular to the canthotomy incision.



5 The eye after canthotomy and cantholysis. This procedure relieves increased intraocular pressure by allowing the globe and orbital contents to move forward.

NOTE:

If intraocular pressure remains elevated after inferior cantholysis, the superior crus of the lateral canthal ligament may be released in a similar fashion.

Figure 62-33 Lateral canthotomy and cantholysis. (From Eisele OW, Smith RV, eds. *Complications in Head and Neck Surgery*. 2nd ed. St. Louis: Mosby; 2008.)

LP Adults

S&J p273

<https://lifeinthefastlane.com/procedures/lumbar-puncture/>

<https://www.aci.health.nsw.gov.au/networks/eci/clinical/clinical-resources/procedures/diagnostic-lumbar-puncture-in-the-ed>

Indications	Obtain CSF for examination Diagnosis of bacterial meningitis, SAH, carcinomatosis, MS, GBS Measure CSF opening pressure Removal of CSF in IIH
Contraindications	Cellulitis at site of insertion Trauma to lumbar vertebrae INR > 1.5 Thrombocytopenia < 50 UFH or LMWH in past 24h Known coagulopathy ALOC Suspected raised intracranial pressure
Indications for CT prior	>60 years Immunocompromised ALOC or focal neurology Evidence of ↑ICP [eg papilloedema] Hx of CNS lesion Seizures in past week
Complications	Post procedure headache, nausea, vomiting Brain stem compression due to coning Introduction of infection, meningitis Back pain Epidural abscess or haematoma Damage to spinal cord or spinal nerves Intraspinal epidermoid tumours [no stylet]
Location	Pulse oximeter, SaO2 if using sedation
Additional prep	IV running Assistant
Equipment	Asepsis LA, syringe, drawing-up needle, 22G needle Spinal needle Manometer Pathology tubes Bandaid

Positioning	<p><i>In lateral position</i></p> <ul style="list-style-type: none"> Shoulders vertical Neck flexion uncomfortable and unnecessary Hips, knees flexed Arching back <p><i>Sitting position</i></p> <ul style="list-style-type: none"> Feet on stool facilitates hip flexion Easier to find midline Opening pressure unreliable
Landmarks	<ul style="list-style-type: none"> Spinal cord terminates at L2 L3-4 at level of iliac crests Midline Ask patient if it feels like needle is dead center
Steps	<ul style="list-style-type: none"> Prep skin Draw up LA Drape Infiltrate LA 5mL lignocaine 1% with adrenaline Arrange equipment Insert introducer in interspace toward umbilicus When firmly in interspinous ligament Insert spinal needle until 'pop' Withdraw stylet to see CSF Stabilise needle with left hand, attach manometer with right, note opening pressure Remove manometer Collect 4 x 1ml sample tubes Withdraw introducer and spinal needle together Apply a bandaid
Aftercare	<ul style="list-style-type: none"> Check patient comfort

Headache

Supine position post LP makes no difference

Risk increased with

- Large bore needle
- Multiple attempts
- XS CSF removal

Reduce risk with

- Pencil-point needle [Whiteacre] rather than cutting [Quincke]
- Orient bevel to long axis of spine

CSF

	Normal	Bacterial	Viral	Fungal/TB
Pressure (cmH2O)	5-20	> 30	Normal or mildly increased	
Appearance	Normal	Turbid	Clear	Fibrin web
Protein (g/L)	0.18-0.45	> 1	< 1	0.1-0.5
Glucose (mmol/L)	2.5-3.5	<2.2	Normal	1.6-2.5
Gram stain	Normal	60-90% Positive	Normal	
Glucose - CSF:Serum Ratio	0.6	< 0.4	> 0.6	< 0.4
WCC	< 3	> 500	< 1000	100-500
Other		90% PMN	Monocytes 10% have >90% PMN 30% have >50% PMN	Monocytes

SAH

Normal CSF has < 6 RBCs

Most reliable is presence of bilirubin at 12 hours post onset of headache by spectrophotometry

Hb in CSF → haemolysis in vivo and vitro within 2-4 hours → oxyhaemoglobin

Oxyhaemoglobin → bilirubin in vivo only over 9-15 hours

LP Infants

S+J p 273

http://www.rch.org.au/clinicalguide/guideline_index/Lumbar_puncture/

Indications	Suspected meningitis or encephalitis Suspected SAH with normal CT
Contraindications	As per adults Child so sick that she will get Abs for meningitis anyway even if CSF is normal Give dexamethasone and antibiotics immediately and delay LP for 24h if <ul style="list-style-type: none"> • ALOC • Signs of ↑ICP [bulging fontanelle alone is not] • HD unstable • Focal neurology • Seizures • Febrile + purpura + suspected meningococcal infection
Indication for CT prior	Focal neurology
Complications	As per adults Respiratory compromise from positioning
Positioning	Banana position Reliable experienced person to hold – not parent Do not cover the entire child with drape
Specific anatomy	Conus medullaris at L3 at birth Spinous processes more horizontal Big head → risk of respiratory compromise
Specific analgesia	AnGEL cream if not urgent Lignocaine Sucrose if < 3 months Consider N2O if > 6 months
Specific equipment	22G or 25G bevelled needles w stylet Evidence for pencil point needles reducing PPH not convincing in children No introducer
Specific collection	Manometry not routinely done 6-10 drops per tube

CSF

	White cell count	Biochemistry
--	-------------------------	---------------------

	Neutrophils (x 10 ⁶ /L)	Lymphocytes (x 10 ⁶ /L)	Protein (g/L)	Glucose (CSF:blood ratio)
Normal (>1 month of age)	0	≤ 5	< 0.4	≥ 0.6 (or ≥ 2.5 mmol/L)
Normal term neonate	0*	< 20	< 1.0	≥ 0.6 (or ≥ 2.5 mmol/L)
Bacterial meningitis	100-10,000 (but may be normal)	Usually < 100	> 1.0 (but may be normal)	< 0.4 (but may be normal)
Viral meningitis	Usually <100	10-1000 (but may be normal)	0.4-1 (but may be normal)	Usually normal
TB meningitis	Usually <100	50-1000 (but may be normal)	1-5 (but may be normal)	< 0.3 (but may be normal)

- PCR is routinely available for *Neisseria meningitidis*, Herpes Simplex and Enterovirus.
- As results are not immediately available, they will only help with decisions concerning discontinuing treatment.
- Enterovirus PCR should be requested on CSF from patients with clinical and/or CSF features of viral meningitis.
- HSV PCR should be requested for patients with clinical features of encephalitis.
- Meningococcal PCR is particularly useful in patients with a clinical picture consistent with meningococcal meningitis, but who have received prior antibiotics.

Lumbar puncture USS

Position probe in transverse plane at level of iliac crests



Spinous processes centered



Mark midline

Move one space

Repeat

Rotate probe into sagittal plane

Marker to head

Between skin marks



Identify interspinous space

Center on screen



Mark skin at center of probe on both sides

Join marks



Minnesota tube

EMCrit

<http://lifeinthefastlane.com/cc/senkstaken-blakemore-and-minnesota-tubes/>

<http://www.derangedphysiology.com/main/required-reading/equipment-and-procedures/Chapter%203.1.3/senkstaken-blakemore-minnesota-and-linton-nachlas-tubes>

Indications	Tamponade of gastro-oesophageal bleeding unresponsive to medical, endoscopic treatment	
Contraindications	Unintubated patient Ruptured oesophagus Oesophageal stricture Uncertainty regarding source of bleeding Well-controlled variceal bleeding	
Complications	Haemorrhage	Check pos Correct inflation Coagulopathy
	Pain	Check pos Analgesia
	Aspiration	Head up Intubate
	Pressure necrosis	< 36 h Deflate and reinflate after 12 hours
	Oesophageal perforation	Deflation prior to insertion Avoid inflating oesoph balloon Check position
	Upper airway obstruction Due to balloon migration	Intubated pts only If unintubated remove
	Dysrhythmias	Check position Correct electrolytes Cardioversion
Location	Resuscitation area These patients are very unwell and are usually intubated	
Equipment	Minnesota tube 2 x 3-way taps and manometer 60ml syringe	

	<p>Lubricant Laryngoscope, Magill forceps 1L bag of saline, crepe, IV pole for traction</p>
Position	Head up 45°
Procedure	<p>Test compliance of balloons noting pressures for each 100mL inflation And test for leaks Lubricate the tube Insert the tube via the orogastric route preferably under direct vision To depth 50cm Inflate balloon to 50mL CXR Inflate in 100mL increments and check compliance [\uparrow by $>15\text{mmHg}$ \rightarrow in oesophagus] to 250mL Clamp Withdraw to resistance Attach traction 0.5-1.0kg Suction gastric aspiration port Suction oesophageal aspiration port If blood in oesophagus inflate oesophageal balloon to 30mmHg Can go to 45mmHg</p>

NIV

NTAMS protocols

<https://lifeinthefastlane.com/still-owning-oxylog/>

Indications	COPD	Respiratory acidosis pH 7.25-7.35
	Type 2 failure	Due to chest wall problems
	ACPO	Unresponsive to CPAP
	More controversial	Asthma Delayed sequence intubation ARF in immunocompromised pts
Contraindications Absolute	Face injuries Vomiting Upper airway obstruction Pneumothorax	
Contraindications Relative	Recent upper GIT surgery ALOC Bowel obstruction	
Complications	Failure of treatment Haemodynamic compromise Pneumothorax Aspiration	
Examination	Chest	
Monitoring	NIBP, PR SaO ₂ Mask aim >88%	
Check equipment	NIV, filter, tubing, mask	
Preprocedure check	ABG CXR to exclude pneumothorax	
Positioning	Sitting	
Procedure steps	Size mask Filter to machine, then circuit Start NIV Hold mask to acclimatise Titrate FiO ₂ for SaO ₂ 88-92% Strap mask Check for leaks Increase settings to target by 2	Start low 10/4 Target EPAP 0.1cmH ₂ O/kg, IPAP + 5 Not > 25 Principle same as lung protective strategy on vent IPAP for TV of 6-8ml/kg EPAP/FiO ₂ for SaO ₂ 88-92%

	cmH2O q5m	
Aftercare	ABG in 1 hour Discuss escalation if failure Arrange admission	
Closing	Ensure patient comfort Comment on what happens next Dispose of equipment, sharps Thank patient	

NIV factoids

Cochrane review for COPD

NNT to improve mortality is 10

NNT to avoid intubation is 4

Cochrane review for ACPO

NNT to improve mortality is 13

NNT to avoid intubation is 8



NIH NHLBI ARDS Clinical Network
Mechanical Ventilation Protocol Summary

OXYGENATION GOAL: PaO₂ 55-80 mmHg or SpO₂ 88-95%
Use a minimum PEEP of 5 cm H₂O. Consider use of incremental FiO₂/PEEP combinations such as shown below (not required) to achieve goal.

Lower PEEP/higher FiO₂

FiO₂	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7
PEEP	5	5	8	8	10	10	10	12

FiO₂	0.7	0.8	0.9	0.9	0.9	1.0
PEEP	14	14	14	16	18	18-24

Resuscitative hysterotomy

LVSA 2010

JEM 2016

Indications	Cardiorespiratory arrest in gravid female >24/40 Or gravid uterus past umbilicus No ROSC at 4 min despite ACLS and LUD
Contraindications	Any other circumstances
Alternatives	None
Benefit for mother	Improve VR by relieving aortocaval pressure Increase cardiac output by 80% Improve diaphragm + lung compliance Remove O2 burden of placenta + baby
Benefit for baby	Early delivery Reduce neurological sequelae
Timing	Survival of mother to 15min Survival of baby to 30min 4 minute rule not absolute Sooner rather than later If wound unsurvivable then immediate
Procedure	
<i>Preparation</i>	
Consent	
Staffing	Ideally 3 teams <ul style="list-style-type: none"> • Resuscitation • Hysterotomy • Neonatal Minimum <ul style="list-style-type: none"> • CPR • Arrest leader • Operator • Assistant • Baby person
Equipment	
Perimortem CS pack	No 10 scalpel

	Scissors Retractors Packing Sutures Suction Baby supplies
Or utilise from the following	
Thoracotomy tray	Scissors Retractors
ICC tray	Clamps
No 10 or 22 scalpel	Broad blade
Scissors	Large and blunt
Baby	Resusitaire BVM Suction Towels
Positioning	Supine
<i>Technique</i>	
Incision	Vertical incision from umbilicus to symphysis pubis Skin SC fat Fascia/rectus sheath Peritoneum Retract laterally Retract bladder inferiorly
Hysterotomy	Small vertical incision in lower uterine segment Finger sweep Extend rostrally to fundus with dressing scissors
Deliver baby	Find head May need to disengage from pelvis Fundal pressure Clamp cord Cut cord and hand baby off
Deliver placenta	Manually separate from the wall of the uterus Massage uterus
Close	Pack with sterile towels <ul style="list-style-type: none"> • In uterus • Around uterus

	A few stitches to skin Cover
Pearls	
Complications	Maternal death Fetal death Distraction from ACLS Haemorrhage Infection Neurological sequelae
Post procedure care	Continue CPR IV Abx If ROSC Post ROSC care Analgesia OT/ICU

Resuscitative thoracotomy

BMJ 2004

SJNA 2007

Injury 2006

LITFL

EMCrit

Indications		
Penetrating thoracic injury	Accepted	Signs of life in ED prior to arrest Previously witnessed cardiac activity [hospital or prehospital] Unresponsive hypotension despite vigorous resus
	Relative	Arrest without previously witnessed cardiac activity
Blunt thoracic injury	Accepted	Signs of life in ED prior to arrest Rapid exsanguination from ICC [1.5L immediately] Unresponsive hypotension despite vigorous resus
	Relative	Arrest with previously witnessed cardiac activity [hospital or prehospital]
Other		Penetrating non-thoracic injury [abdominal, peripheral] with traumatic arrest with previously witnessed cardiac activity [hospital or prehospital]
Contraindications		Prehospital CPR performed for >15 minutes after penetrating chest injury without response Prehospital CPR performed for >10 minutes after blunt chest injury without response The presence of coexistent injuries that are unsurvivable, eg Severe head trauma (An exception maybe the patient who is a potential organ donor) Asystole is the presenting rhythm, and there is no pericardial tamponade
Signs of life		Presence of a pulse or spontaneous movements GCS>3 Presence of pupillary reflexes, corneal reflexes or gag reflexes Evidence of cardiac electrical activity on ECG, or contractile activity on bedside ultrasound
Alternatives		
Procedure		
<i>Preparation</i>		
Consent		

Staffing	Arrest team Thoracotomy team 2 operators , 1 each side
Equipment	PPE Gowns, gloves ICCs Gigli saw Retractors, scissors, forceps, scalpels Needle holder, curved artery forceps Vascular clamps, curved artery forceps, Crawford clamps Internal defibrillation paddles Skin stapler, sutures, surgical ties
Medications	Post ROSC anaesthesia
Positioning and landmarks	Cruciform 5LICS MAL
<i>Technique</i>	
Arrest team	Intubate and ventilate Large bore PIV x 2 MTP Resuscitate with blood products
Exposure	Skin prep Finger thoracostomies bilaterally If this results in ROSC, insert ICCs and stop Connect by incising skin, SC tissue along 5ICS Divide muscle, parietal pleura with scissors, blunt dissection using fingers to hold lung away Cut thru sternum w Gigli saw Insert rib spreaders with handle rostrally Expose pericardium
Pericardium	Identify phrenic nerve Tent pericardium w forceps Longitudinal midline incision Evacuate blood,clot Inspect heart for site of bleeding Close wounds w finger, foley catheter, sutures [1/0 1cm bites avoiding coronary arteries]
Response	Note response of heart to relief of tamponade Beating Beating a bit <ul style="list-style-type: none"> • Massage • Inotropes Not beating

	<ul style="list-style-type: none">• Flick• Massage• Defibrillation
Other	May need to Clamp aorta if torrential abdominal, lower extremity haemorrhage Clamp hilum if significant lung laceration or air embolism from bronchovascular communication
Post ROSC	Clamp bleeders w artery forceps Especially internal mammary arteries Anaesthetise w ketamine, paralysis Call cardiothoracic surgeons

Suprapubic aspiration

R+H p1142

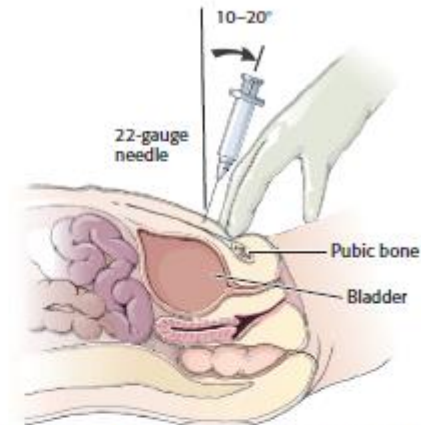
Indications	Obtaining urine for analysis Sensitivity approaches 100% Especially useful in Boys w phimosis Girls w labial adhesions Confirming infection caused by organisms that may be contaminants
Contraindications	Infection overlying site of puncture
Complications	Discomfort Microscopic haematuria expected Bowel perforation – does not usually require treatment
Positioning	Frog leg position
Landmarks	Point of entry 1cm above symphysis pubis Needle angled 10°-20° cephalad in children Needle angled 10°-20° caudal in adults
Steps	Prepare for clean catch in case child spontaneously voids Identify bladder Prep and drape skin Skin wheal LA Needle 22G, 3.75 – 8.75 cm in length Aspirate as advancing Withdraw needle Bandaid

SUPRAPUBIC ASPIRATION

A. Pediatric

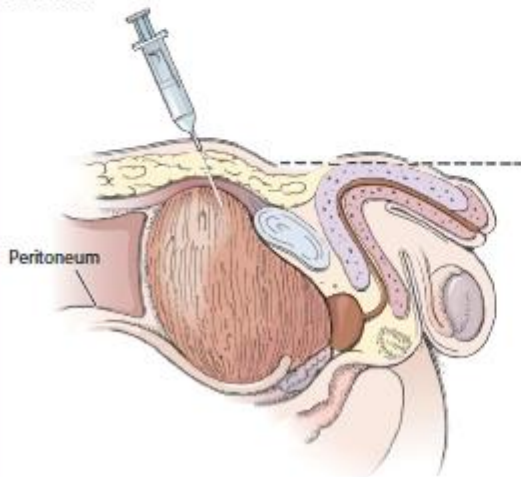


1. Restrain the infant and place her in a frog-leg position. Prepare and drape the skin, and raise a skin wheal with local anesthetic to reduce discomfort. Despite the safety of this procedure, it may be disconcerting for worried parents, and they may wish to leave the room during the aspiration.



2. Puncture the abdominal wall with a 22-gauge needle in the midline approximately 1 to 2 cm cephalad to the superior border of the pubic bone. Keep the syringe perpendicular to the plane of the abdominal wall (usually 10° to 20° from the true vertical). The bladder is an abdominal organ in infants, and placing the needle too close to the pubic bone or angling toward the feet might cause the needle to miss the bladder. Localizing the bladder with bedside ultrasound facilitates this procedure.

B. Adult



In adults, the peritoneum is pushed cephalad by the filled bladder during suprapubic aspiration. Direct the needle slightly caudad.

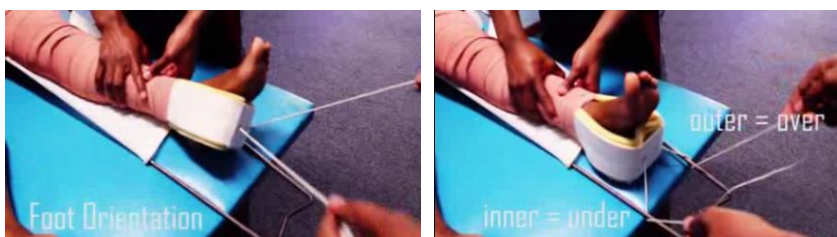
Figure 55-27 Suprapubic aspiration.

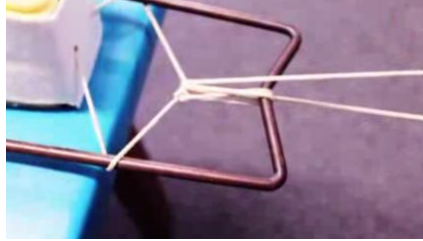
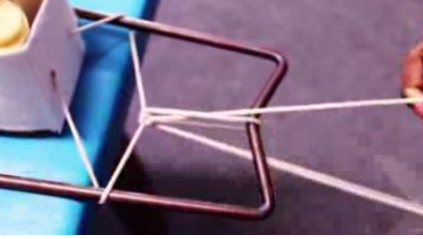
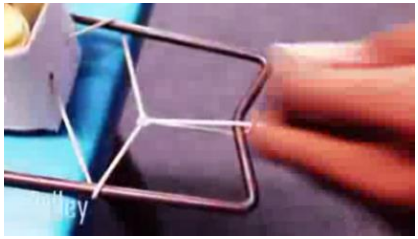
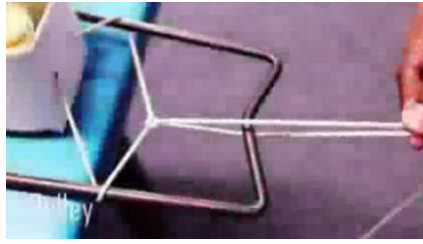
Thomas splint

S+J p323

Indications	Fracture of femoral shaft Traction Reduces fracture Limits space for blood loss Immobilization Analgesia
Contraindications	Pelvic # Foot and ankle #
Complications	Pressure areas Skin pinching Pain while applying

Assemble splint	Attach frame to hip ring Put on slings
Apply skin traction	Traction strapping to leg Double padded region covers malleoli Allow 10cm below heel Secure strapping with crepe starting above malleoli
Put splint on leg	Lift leg Slide splint underneath
Attach traction cords to splint	To reduce external rotation of leg Inner string under Outer string over Tie with a reef knot Make a pulley
Elevate leg	





Transcutaneous pacing

<https://lifeinthefastlane.com/cc/transcutaneous-pacing/>

https://www.openanesthesia.org/transcutaneous_pacing/

<https://www.aclsmedicaltraining.com/blog/transcutaneous-pacing-tcp-without-capture/>

<http://emedicine.medscape.com/article/98939-periprocedure#b4>

Indications	Bradycardia unresponsive to drug therapy Third degree heart block Mobitz 2 block if haemodynamically unstable Overdrive pacing Asystole
Contraindications	Unwitnessed cardiorespiratory arrest Hypothermia
Complications	Failure to capture Discomfort <ul style="list-style-type: none">• Most patients unable to tolerate >50 mA without sedation Oversensing <ul style="list-style-type: none">• Inhibition of pacemaker due to detection of extraneous signal eg muscle artifact
Procedure	Pads in AP position <ul style="list-style-type: none">• Black anterior chest• Red posterior chest ECG leads Pacemaker to demand Pacing rate to >30 above native rate Current to 70 mA Start pacing, increase current until pacing rate captured on monitor Check pulses for mechanical capture Resite pads if no capture at 130 mA Set current at 5-10 mA above threshold once captured
Failure to capture	Obesity Ischaemia Pneumothorax Poor electrode contact Metabolic derangement
Pearls	Fentanyl for discomfort Skeletal muscle contraction may make feeling a pulse difficult <ul style="list-style-type: none">• Use pulse oximetry, IABP, US Patients have been externally paced for up to 5 days Pads should be changed every 4-5 hours to prevent burns

Demand vs fixed

Demand mode – pacemaker senses intrinsic impulses, delivers current only if necessary

Fixed mode – delivers current regardless

Demand is preferable

If capture not obtained try fixed mode – see oversensing above

Typical pacing waveform

