

REGIONAL NERVE BLOCKS

Facilitators Guide

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Topic: **Regional Nerve Blocks**

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Duration: **Up to 2 hrs**

Facilitator level -

Learner level **Most useful for NCHDs managing acute fractures and injuries in the Emergency department**

Equipment required: **None**

OUTLINE

- Basics (5mins)
- Main session: (3 x 10 minute) case discussions covering the key points and evidence
- Advanced session (15mins) case discussions covering grey areas, diagnostic dilemmas; advanced management and escalation
- Quiz (5mins)
- Infographic sharing (5 mins); take home learning points.

PRE- READING FOR LEARNERS

Expectations is for the learners to have watched or read the basic local anaesthetic physiology tutorial and reviewed the anatomy of both hand and femur anatomy. Ideally learners are familiar with the use of ultrasound machines, and if not, will have reviewed the basics ultrasound tutorial; alternatively, will have had hands-on practice with a machine in their department.

[Local Anaesthetics](#) quick tutorial on RCEM learning

[Hand Anatomy](#) • [LITFL](#) • [BSCC Clinical Anatomy](#)

[Pediatric Femur Fractures – Core EM](#)

[Physics and basic equipment settings RCEM learning\(for those not familiar with using ultrasound machines\)](#)

[Managing wounds](#)

Also aim to listen to the EM podcast

[Regional Nerve Blocks for Hip Fractures | Journal Jam podcast](#)

BASICS

Regional nerve blocks are a fantastic skill to have in your emergency medicine analgesic tool box to use in the management, treatment or repair of injuries, such as fractures, dislocations, lacerations or removal of foreign bodies.

The management of specific injuries is beyond the scope of this tutorial but an overview of common paediatric fractures can be found on the [DFTB website here](#) and [by following this link](#).. Similarly, a refresher in wound management is beautifully outlined by the DFTB crew for anyone to review [Managing wounds](#).

Selecting the appropriate patient is key; a cooperative patient is essential. As well as a struggling child, there are other contraindications to regional techniques. These include:

- Local anaesthetic sensitivity or allergy
- Circulatory compromise
- Overlying skin infection

Typically 1% lidocaine is an appropriate short acting local anaesthetic agent. Onset of action is 5 to 10 minutes, with a duration of 1 to 1.5 hours. The volume of local anaesthetics varies depending on procedure performed, keeping in mind a max dose 3mg/kg.

Combining lidocaine with a long acting agent, which as Bupivacaine 0.25% is appropriate for femoral nerve or fasical iliac blocks only. Again, onset action is 5 to 10minutes, with duration 2 to 3 hours. Max dose 2.5mg/kg.

CASE 1: DIGITAL NERVE BLOCK

Harry is a 14-year old who injured his right hand while playing football. He explains that, as he fell, he caught his little finger on the ground, bending it awkwardly. On presentation, there is an obvious deformity of the little finger. He has had paracetamol and ibuprofen prior to arriving in the emergency department and is comfortable.

On assessment, Harry has a closed injury of his 5th finger, with no neurovascular compromise. There is an obvious deformity of the proximal phalanx, with reduced movement at the joint. An x-ray reveals a dorsal dislocation of the proximal interphalangeal joint, with no evidence of an associated fracture.

Questions

- 1. What local anesthetic would you choose for a digital nerve block?**
- 2. Outline the nerve supply of a digit?**
- 3. Describe the technique and steps of performing a nerve block?**

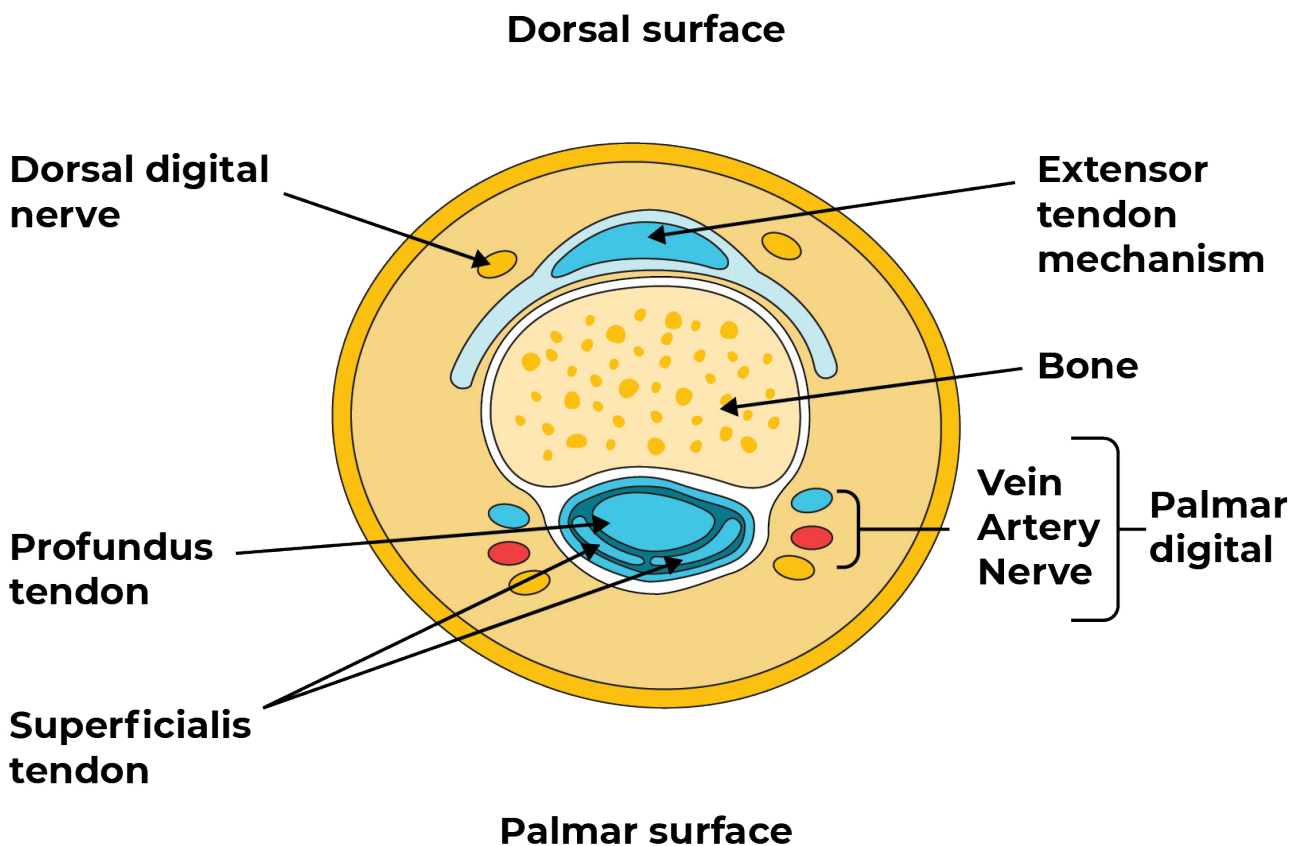
CASE 1: DISCUSSION

When preparing your equipment for Harry's digital nerve block, you find 1% lidocaine with adrenaline. Is this suitable to use when performing a digital nerve block?

A short acting local anaesthetic, such as lidocaine, is suitable for digital nerve blocks.

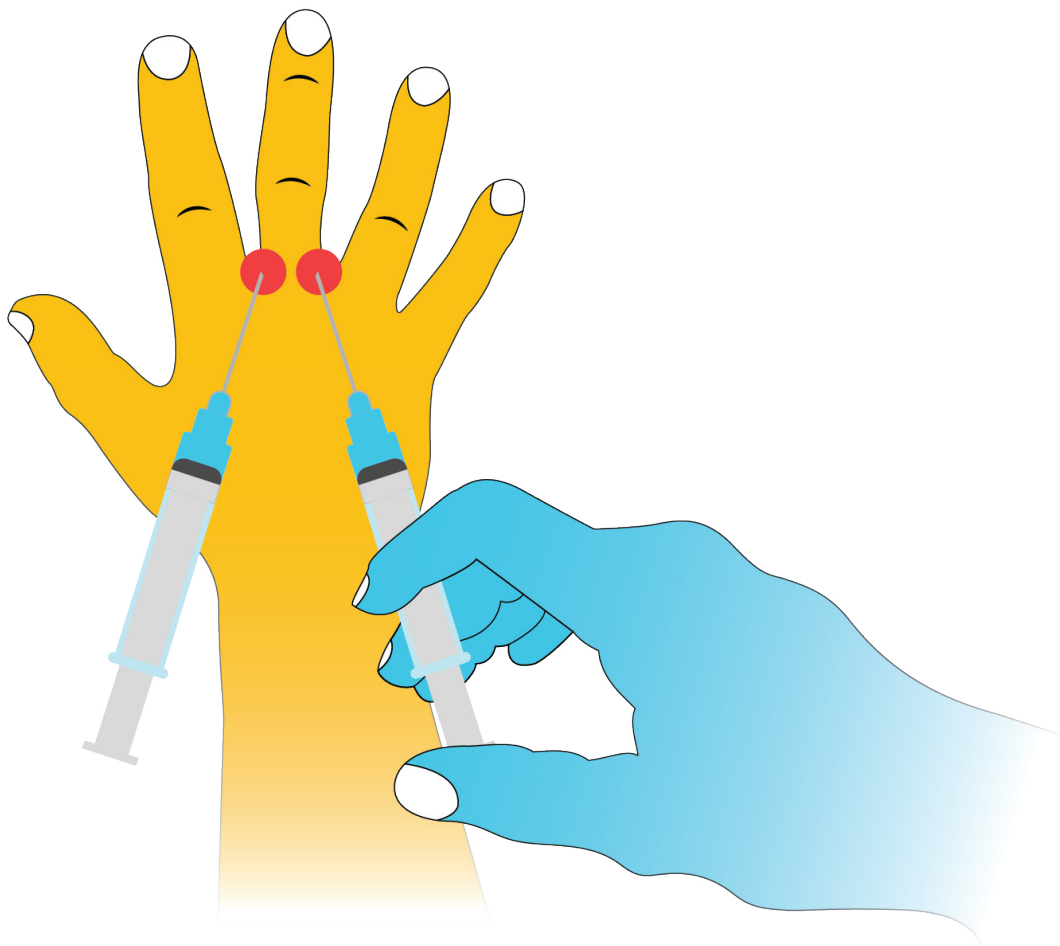
The anatomy of the nerve supply to digits is outlined below

- Two dorsal digital nerves at the **10 and 2 o'clock** positions of the phalanx.
- Two palmar digital nerves at the **4 and 8 o'clock** positions.
- Each palmar digital nerve is closely associated with a digital artery and vein.
- In this specific example, the digital nerves of the 5th finger are branches of the ulnar nerve, as are those of the ring finger. The thumb, index and middle finger are innervated by digital nerves which arise from the median nerve.



The step by step technique of performing a digital nerve block is outlined below. Some learners may find this [DFTB video](#) a great learning aid.

- Place the hand or foot flat on a sterile surface.
- Clean the skin
- Hold a syringe containing a short-acting anaesthetic, such as 1% lignocaine, perpendicular to the digit and insert the needle into the subcutaneous tissue of the digital web space.
- After aspirating to ensure you're not in a vessel, slowly inject 2 ml of anaesthetic into the subcutaneous tissue and infiltrate, surrounding the nerve, as you withdraw
- Withdraw needle and repeat procedure on the opposite side of the digit.
- Allow 5 to 10 minutes for the local anaesthetic to work before performing the procedure.



CASE 2: AURICULAR NERVE BLOCK

Ciara, a 7-year-old girl, has been brought to the emergency department because her earring is stuck somewhere in her earlobe. Ciara won't let anyone look for it as it's too painful to touch. You sit Ciara on her mom's lap, and with the help of the magical play specialist, you plan to perform an auricular block.

Questions

1. How are you going to position your patient for an auricular block?
2. Can you recall the nerve supply to the ear, the targets of your block?
3. Outline the steps of performing an auricular block?
4. Describe the discharge advice for your patient?

CASE 2: DISCUSSION

Auricular nerve blocks are excellent for the treatment of injuries to the external ear such as lacerations, haematomas requiring drainage, and removal of foreign bodies, such as embedded earrings, while preserving anatomy.

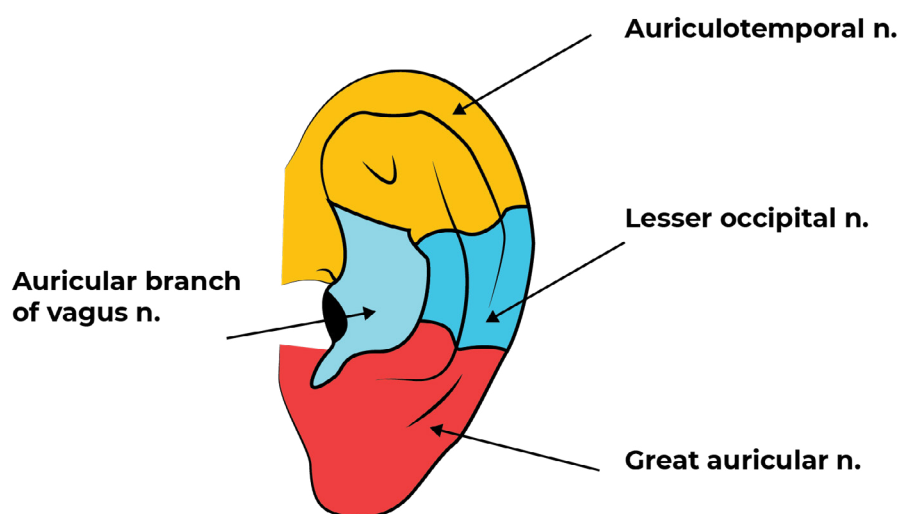
Ensuring children are positioned appropriately, and most importantly securely prior to attempting any procedure is **ESSENTIAL**. For best results ask the parents to be involved as the child will feel more at ease. Some departments have specialist play therapists who can be a very helpful distraction technique.

Place young children on their parents lap, with the affected ear positioned outwards. Parents can wrap one arm around the child's arm/body and the other can be placed gently on their head to limit movement.

Older children may be comfortable lying prone on a bed with the affected ear faced upward.

The innervation of the ear and surrounding skin is outlined below

- The outer portion of the auricle receives its innervation from the **greater** and **lesser auricular nerves**
- The medial portion receives innervation from the **auriculotemporal nerve**



To anaesthetise the greater auricular nerve (for all things earlobe related):

- Clean the skin
- Insert a 25 gauge needle containing a short-acting local anaesthetic such as 1% lignocaine subcutaneously below the earlobe in line with the external auditory meatus.
- Direct the needle behind the ear towards the mastoid process, advance it parallel to the skin, aspirate to ensure you're not in a vessel, then inject 2-3ml as you withdraw the needle
- Withdraw the needle back to the first position.



If the procedure also involves the upper half of the ear, rather than just the earlobe, continue with the following steps:

- Direct the needle anterior to the external ear towards the area just anterior to the tragus, aspirate, then inject as you withdraw the needle completely.
- Insert the needle subcutaneously directly above the ear again in line with the external auditory canal
- Repeat the above steps with the needle facing caudally towards the mastoid process and anterior to the tragus

Here's a [quick video from DFTB](#) which demonstrates how to perform an auricular block.

Having successfully removed the foreign body or having repaired a laceration, dressing with steristrips is usually sufficient. Be sure to advise the parents of the signs of infection, including increasing pain, swelling, erythema or if the child became generally unwell. The local anaesthetic will last approximately 1 hour, after which additional analgesia such as paracetamol or ibuprofen may be required if there is any ongoing discomfort.

In this case of an embedded earring, there is no need for antibiotics. As a reminder, the use of antibiotics are reserved for wounds that are heavily contaminated, involving joints or underlying structures or fractures. Always refer to local guidelines and local specialist teams for their preferences.

CASE 3: FASCIA ILIACA BLOCK

Sam is a 15-year-old brought to the emergency department by ambulance following a fall from a tree. The ambulance crew have given paracetamol and ibuprofen en route but Sam is very distressed, complaining of severe pain in his right leg, as he is moved from the trolley to the bed. Following a primary survey, you are satisfied Sam is stable with no airway, c-spine, breathing or circulatory compromise. His right thigh is grossly swollen and tense. You place it in a traction splint, give Sam intranasal fentanyl and organise an urgent x-ray of his right femur, which confirms a proximal femur fracture.

Questions:

- 1. Outline the equipment and monitoring required prior to performing a fascia iliaca block.**
- 2. Describe your rationale of local anesthesia choice.**
- 3. Describe the steps of performing a fascia iliac or femoral nerve block.**

CASE 3: DISCUSSION

Femoral nerve or fascia iliaca blocks are useful for providing analgesia in the context of femur fractures, as well as wounds to the anterior thigh requiring exploration and washout.

Femoral nerve and fascia iliaca blocks should always be performed under **ultrasound guidance**; this a gold-standard of care. Therefore, being familiar with your department's ultrasound machine is essential. Using a linear ultrasound probe is ideal for this procedure, and you should have a sterile ultrasound probe cover, ultrasound gel and a sterile drape and gloves.

A specific nerve block needle is ideal, alternatively a spinal needle with the trocar removed also works well. You will also need **chlorhexidine** to prepare the skin, the local anaesthetic in a 20ml syringe, and finally a **sterile dressing** to cover the site when finished.

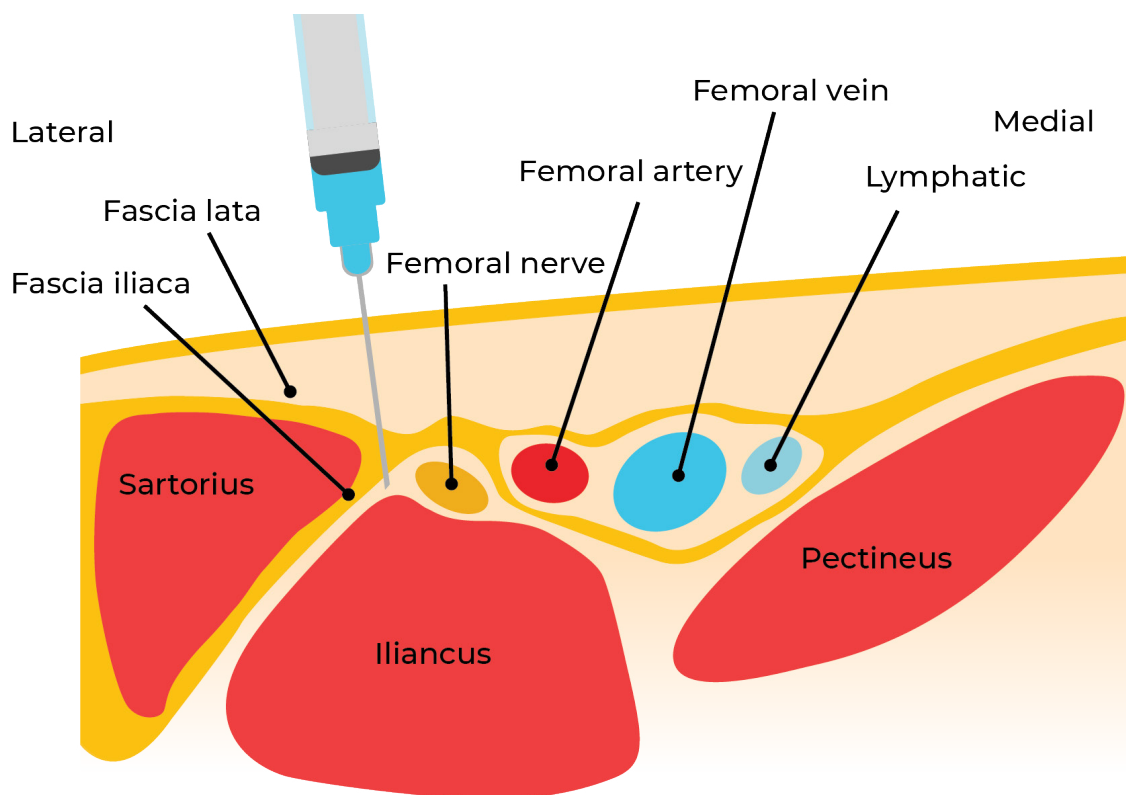
All patients should be connected to **ECG monitoring** and **pulse oximetry** for the duration of the procedure. Pre and post procedure observations should be documented. Consider adjunct analgesic eg: intranasal fentanyl prior to performing the nerve block.

And finally, a fellow doctor or nurse as an assistant to help during the procedure is always useful.

When performing a fascia iliaca block, the nerve blockade is achieved as the local anaesthetics bathes the surrounding nerves. For patients whose injury requires a trip to the theatre but who may have to wait some time for their definitive treatment, a **long acting local anaesthetic** is often more appropriate; such as **bupivacaine 0.25%** or a combination of 1% lidocaine and 0.25% bupivacaine.

- Prepare the ultrasound machine: Choose the correct probe, position yourself on the opposite side of the bed, apply gel to the probe and apply a probe cover.
- Prepare a dressing pack with 1-2% lignocaine, appropriate needle, sterile dressing and low-pressure tubing

- Clean the area and drape appropriately.
- Use the 'in-plane' ultrasound probe orientation with the marker pointing to Anterior Superior Iliac Spine
- Observe landmarks (lateral > medial)



- Infiltrate 1-2ml of 1-2% lignocaine superficially lateral to the artery
- Pierce the skin with the block needle through anaesthetised skin
- Advance the needle slowly ensuring tip of the needle is always visible
- When lateral to the nerve and between layers of fascia iliaca, aspirate the needle to ensure it is not within a vessel, and then infiltrate local anaesthetic slowly, aiming to fully encircle the nerve (total 10-20ml in an adolescent)
- Apply a sterile dressing over the injection site; label the block time and date.

[5 Min Sono have a great video](#) that demonstrates nicely the steps involved in performing the block.

ADVANCED CASE 1: ULNAR NERVE BLOCK

An alternative analgesic approach for Harry's 5th phalanx dislocation is an ulnar nerve block.

An ulnar nerve block is an alternative regional block technique, suitable for injuries to the ulnar border of the palm, as well as the 5th finger such as lacerations to or manipulation of metacarpal or interphalangeal fractures.

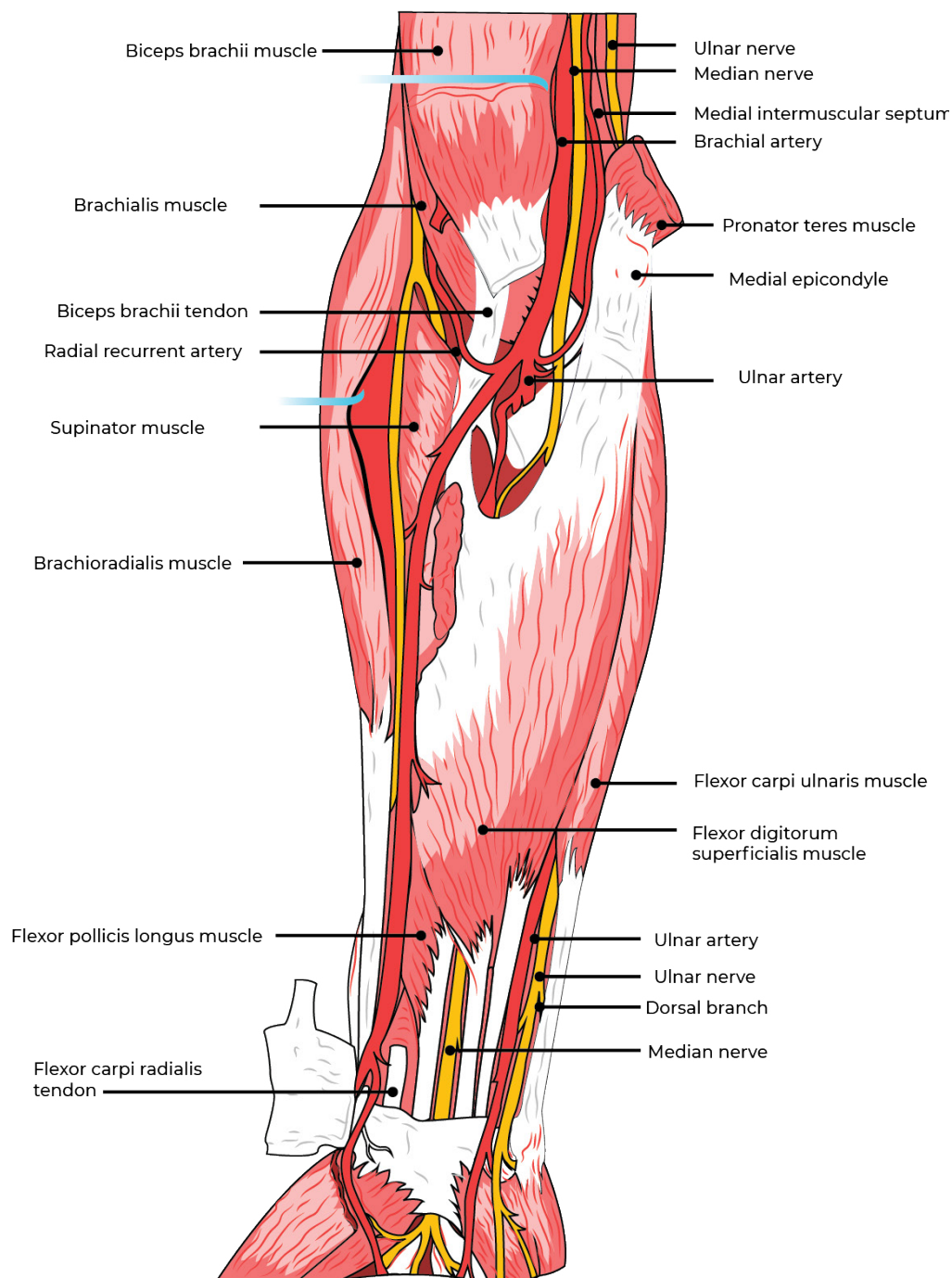
Performing ulnar nerve blocks are made easier with the use of ultrasound guidance so familiarity with your department's ultrasound machine is essential.

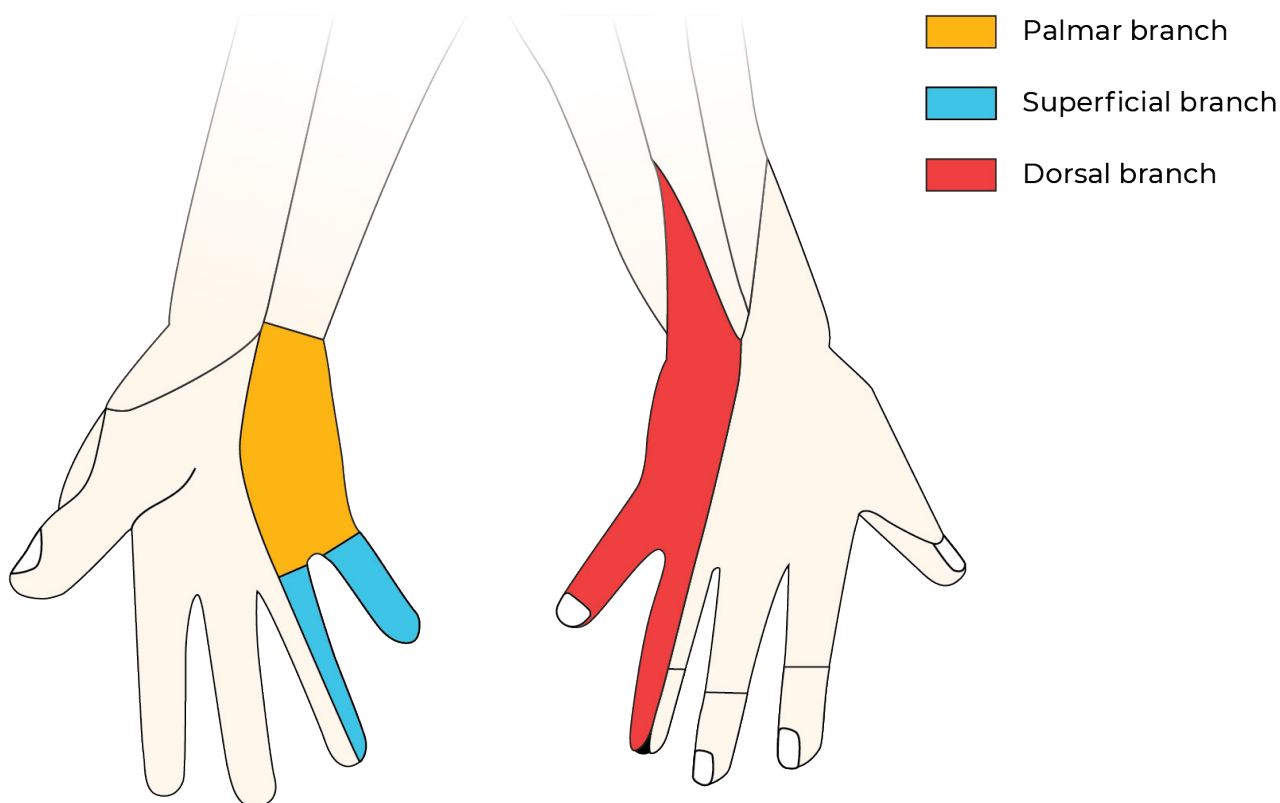
Describe the landmarks of the ulnar nerve.

Outline the steps of performing an ulnar nerve block.

ADVANCED CASE 1: DISCUSSION

Anatomy Review





- The ulnar nerve passes between the ulnar artery and tendon of the flexor carpi ulnaris (FCU). The ulnar nerve is deep to the tendon flexor carpi ulnaris, and medial to the ulnar artery.
- The palmar branch of the ulnar nerve supplies the medial aspect of the palm, and the dorsal and superficial branches supply the dorsal surfaces of the ring and little finger (and associated dorsal hand area) and the palmar surface of the ring and little fingers respectively.

Technique

- Insert needle deep to the FCU, proximal to its attachment at the styloid process of the ulna
- advance the needle 5-10mm further beyond the tendon on the FCU, injecting 3-5ml of local anaesthetic
- If blood is visible on aspiration, redirect the needle superficially and medially to avoid the ulnar artery

Have a look at this [fabulous video](#) from Mike Stone for some in-action ulnar nerve blockade.

ADVANCED CASE 2: ANAESTHETIC CHOICE

When preparing your equipment for Harry's digital nerve block, you find 1% lidocaine with adrenaline.

Is this suitable to use when performing a digital nerve block?

ADVANCED CASE 2: DISCUSSION

Use of lidocaine + adrenaline

It is thought that the combined use of lignocaine and adrenaline (1:100,000) can increase the risk of digital ischaemia and is best avoided. Actually the evidence isn't that clear cut. Adrenaline is added to a local anaesthetic to prolong its effect. The concern it will constrict end arteries, leading to localized ischaemia, has led to the recommendation to avoid adrenaline in fingers and toes. Cochrane published a review in 2015 which concluded, "from the limited data available, the evidence is insufficient to recommend use or avoidance of adrenaline in digital nerve blocks." So there we are, still on the fence.

There's a bit of a Catch-22 when it comes to injecting local anaesthetic.

It hurts, because it's an acid, and causing pain can lose the trust and rapport you just spent the last 15 minutes building with a child. Even worse, adding adrenaline makes it even more acidic and therefore even more painful to inject.

There are two things we can do to make lignocaine less painful to inject:

- Buffer it to bring the pH up to a more physiological pH. Mix 10ml of 1% lignocaine (or 1% with 1:100,000 adrenaline) with 1ml of 8.4% bicarbonate (using a ratio of 8.4% bicarbonate : 1% lignocaine of 1:10)
- Warm it to room temperature. An EMJ review in 2007 suggested that warming local anaesthetic solution can significantly reduce the pain of infiltration.

ADVANCED CASE 3: ANAESTHETIC TOXICITY

You have completed the nerve block and are tidying up your equipment when Sam complains of a funny sensation around his lips and says he feels sick. As you turn towards Sam you notice his heart is racing and he looks really unwell.

What differentials can you think of as to why Sam is suddenly unwell?
Outline the emergency steps in managing this condition.

ADVANCED CASE 3: DISCUSSION

If a patient becomes unwell during a nerve block, some of the differentials we need to consider are:


- Pain/discomfort
- Anaphylaxis/allergic reaction to:
 - local anaesthetic
 - chlorhexidine (an often forgotten source of anaphylaxis)
- Local anaesthetics toxicity.

Local anaesthetic systemic toxicity (LAST) is a severe and life-threatening condition which can occur when local anaesthetic reaches significantly high levels in the circulation. The causes are often iatrogenic; accidental injection into a vein or artery or excessive doses of anaesthetic used.

Signs and symptoms of LAST are:

Local Anaesthetic Systemic Toxicity

Neurological	parasthesia, restlessness, confusion, seizures, coma
Respiratory	methaemoglobinaemia
Cardiovascular	transient hypertension, hypotension, tachycardia, arrhythmias
GI	nausea and vomiting



Management

STOP the infusion of local anaesthetic, **MOVE** the patients to the resus area if not already there and **CALL** for **HELP**.

A: Maintain airway, if necessary prepare for intubation

B: Ventilate with 100% oxygen

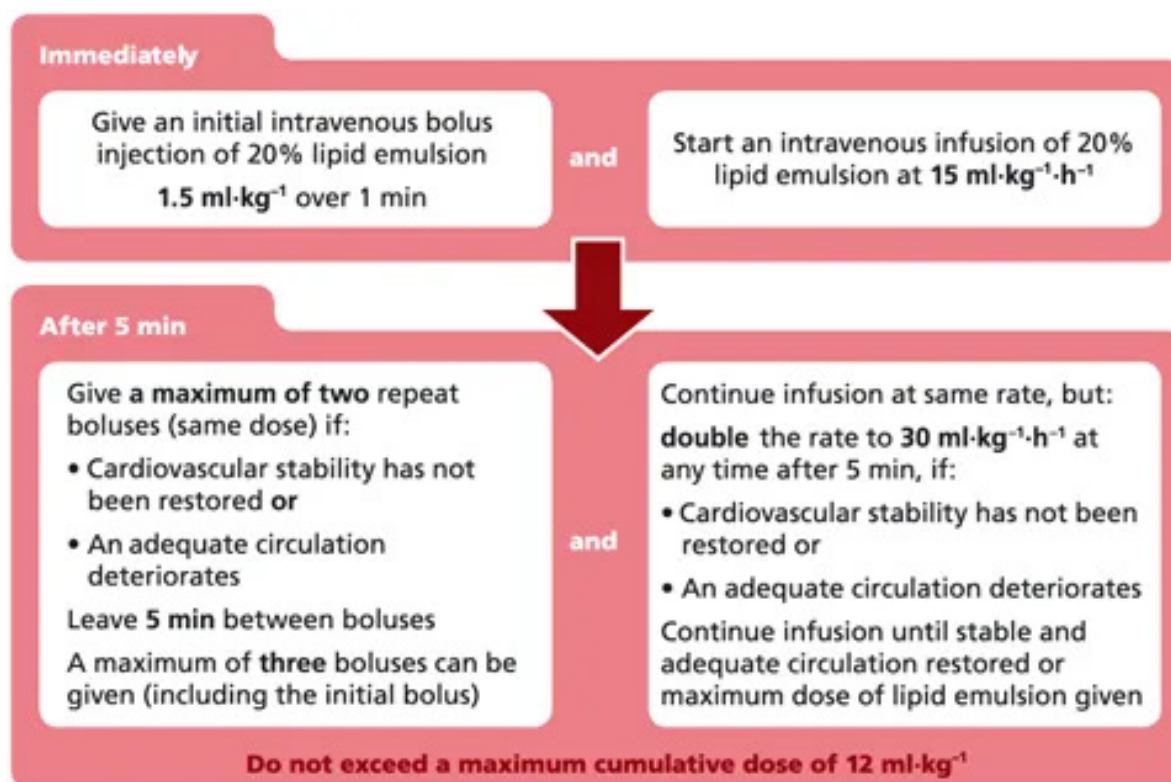
C: Confirm or establish IV access

D: Treat seizures with benzodiazepines. Check glucose.

E: Perform ECG, looking for treatable arrhythmias

Give lipid emulsion therapy, as per your local hospital guideline. Lonnqvist (2012) designed a user-friendly guideline for management of paediatric local anaesthetic toxicity.

Senior/consultant EM doctors should be involved as early as possible, with assistance from your anaesthetics team, as these patients will require PICU for close observation



For anyone who hypothesised that anaphylaxis was the cause of Sam's acute deterioration; excellent work. Anaphylaxis must ALWAYS be considered when there is an acute change following the administration of medication.

The features and management of anaphylaxis is excellently summarised by the [DFTB team in this post](#).

QUIZ QUESTIONS

Question 1.

When performing digit nerve blocks, which of the following agents is the most suitable?

A: 1% lidocaine with adrenaline

B: 0.5% lidocaine

C: 1% or 2% lidocaine

D: 0.25% bupivacaine

Short acting local anaesthetic either 1% or 2% lidocaine is appropriate for digital nerve blocks. *It is thought that the combined use of lignocaine and adrenaline (1:100,000) can increase the risk of digital ischaemia and is best avoided. Actually the evidence isn't that clear cut. Adrenaline is added to a local anaesthetic to prolong its effect. The concern it will constrict end arteries, leading to localized ischaemia, has led to the recommendation to avoid adrenaline in fingers and toes. Cochrane published a review in 2015 which concluded, "from the limited data available, the evidence is insufficient to recommend use or avoidance of adrenaline in digital nerve blocks." So there we are, still on the fence.

Question 2.

What is the maximum dose in mg/kg for lidocaine and bupivacaine?

- A: Lidocaine 3mg/kg and Bupivacaine 2mg/kg**
- B: Lidocaine 2mg/kg and Bupivacaine 3mg/kg
- C: Lidocaine 1.5mg/kg and Bupivacaine 1mg/kg
- D: Lidocaine 4mg/kg and Bupivacaine 3mg/kg

Question 3.

When performing a femoral block, you inject the local anaesthetic only:

- A: Underneath the lata fascia
- B: Underneath the iliac fascia**
- C: Lateral to the femoral artery
- D: Between psoas muscle and fascia lata

Question 4.

In addition to supportive measures, what is the specific antidote required when managing local anaesthetic toxicity?

- A: Methylene blue
- B: Digibind
- C: Intralipid**
- D: Flumazenil

An initial IV bolus of 20% lipid emulsion given over 1 minute, 1.5ml/kg and an infusion of 20% lipid emulsion 15ml/kg/hr. A comprehensive review of the use of Intralipid can be found in this article.

Methylene blue is used in the treatment of methemoglobin. Digibind is used in the treatment of digoxin toxicity and flumazenil is an antagonist and antidote to benzodiazepines.

Take-home messages

- 1 Consider regional nerve blocks as an adjunct to oral analgesic for MSK injuries
- 2 A cooperative and correctly positioned patient keyc
- 3 Ensure you are familiar with maximum doses of local anaesthetic
- 4 Always ensure appropriate monitoring is applied prior to performing a femoral nerve block
- 5 STOP injection of LA and CALL FOR HELP if you have concerns for local anaesthetic toxicity

REFERENCES

[Local Anaesthetics](#) quick tutorial on RCEM learning

[Hand Anatomy • LITFL • BSCC Clinical Anatomy](#)

[Pediatric Femur Fractures – Core EM](#)

[Physics and basic equipment settings RCEM learning\(for those not familiar with using ultrasound machines\)](#)

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[Regional Nerve Blocks for Hip Fractures | Journal Jam podcast](#)

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