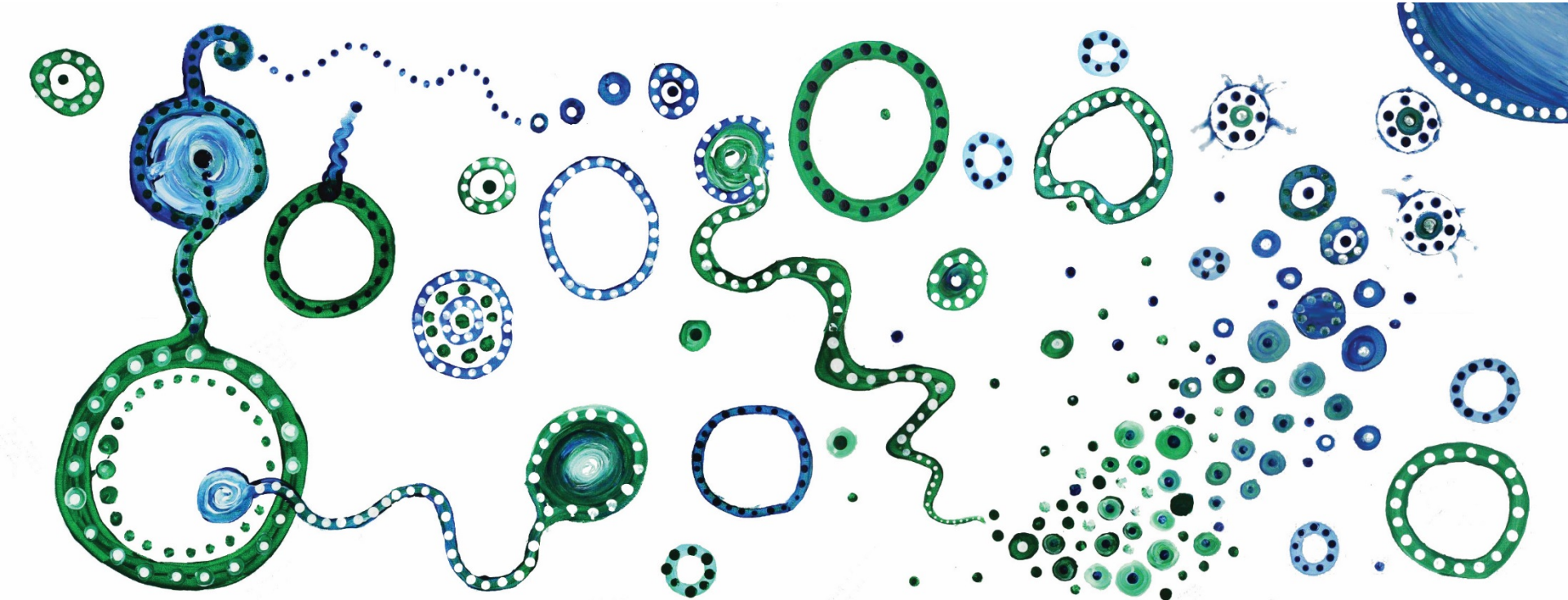
Neurovascular Assessment

A guide to using the NSW electronic observation form

August 2018

Musculoskeletal Network

The ACI acknowledges the traditional owners of the land that we work on − the Cammeraigal People of the Eora Nation. We pay our respects to Elders past and present and extend that respect to other Aboriginal peoples present here today.



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Images

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Neurovascular assessment

- Involves the evaluation of the neurological and vascular integrity of a limb (Judge 2007:39).
- Evaluates sensory and motor function (Blair & Clarke 2013; Turney, Raley Noble, & Kim 2013; Shreiber 2016).
- Detects signs and symptoms of potential complications such as compartment syndrome.

Importance of neurovascular assessment

- To recognise subtle changes that need to be reported promptly to the medical team and senior nursing clinicians (Shreiber 2016).

- To help nursing staff assess neurovascular status and use critical thinking to interpret findings (Shreiber 2016).

Indications for neurovascular assessment

- Limb fractures
- Vascular injuries and procedures
- Trauma or surgery to limbs or joints
- External fixators
- Casts, splints and constrictive dressings to limbs
- Traction
- Burns
- Crush or gunshot injury
- Procedures that may cause limb thrombosis or emboli, e.g. cardiac catheterisation
- Interstitial oedema of limbs or massive intravenous fluid infusion
- Prolonged immobility caused by drugs or alcohol induced coma
- Snake envenomation
- Anticoagulation therapy, e.g. warfarin

Assessment

- Always check the contralateral limb first.
- Assessment needs to be performed in full light.
- Use a separate form for each limb which is being assessed.
- Ensure the correct form is used for the affected limb.

Components of neurovascular assessment

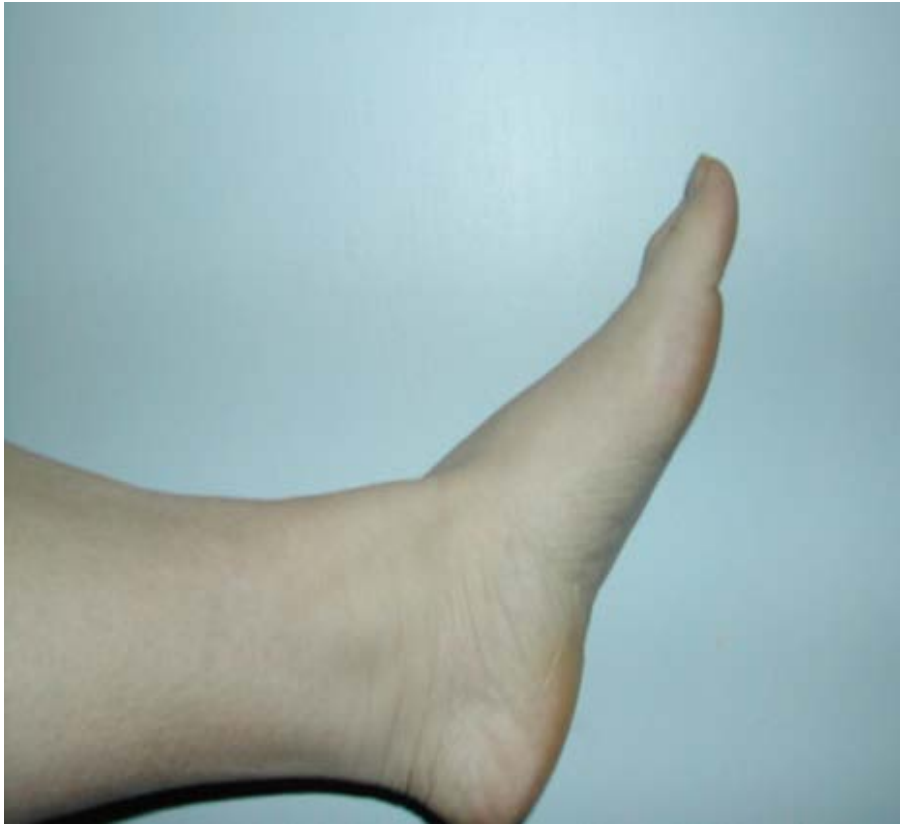
- Pain
- Circulation
- Sensation
- Motor function

Pain

- Pain is assessed by asking the patient to rate pain on a scale from zero to 10.
- Assess the pain score at rest and on passive stretch.
- Assess whether the pain is disproportionate to the injury.
- Any compromise to neurovascular status will result in pain due to sensory nerve damage and diminished blood flow (Shreiber 2016).

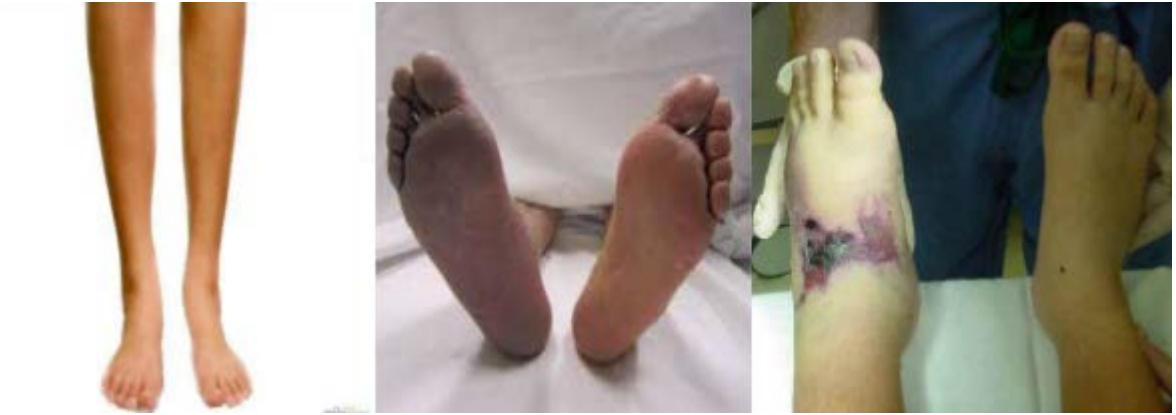
Circulation

- Colour
- Temperature
- Capillary refill
- Pulse



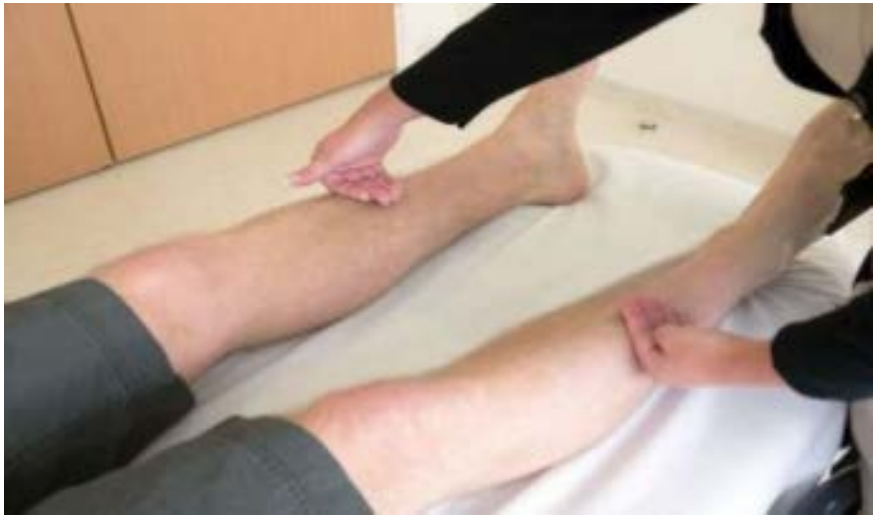
Skin colour

- Natural
- Pale/white – diminished arterial blood flow (Shreiber 2016)
- Flushed/red
- Dusky
- Cyanosed – venous insufficiency (Shreiber 2016)



Temperature

- Warm
- Hot
- Cool – diminished arterial flow (Schreiber 2016)

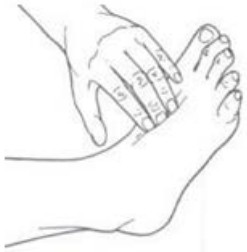


Capillary refill

- Press on the nailbeds or skin (using your thumb and forefinger until blanching occurs) to assess peripheral vascular perfusion (Wiseman and Curtis 2011)
- < 2 seconds – normal
- > 2 seconds – abnormal perfusion (Wiseman and Curtis 2011)

Pulse

- Strong
- Weak
- Absent
- Doppler used
- Unable to assess/comment



Dorsalis pedis

Posterior tibialis

Radial

Motor and nerve sensation

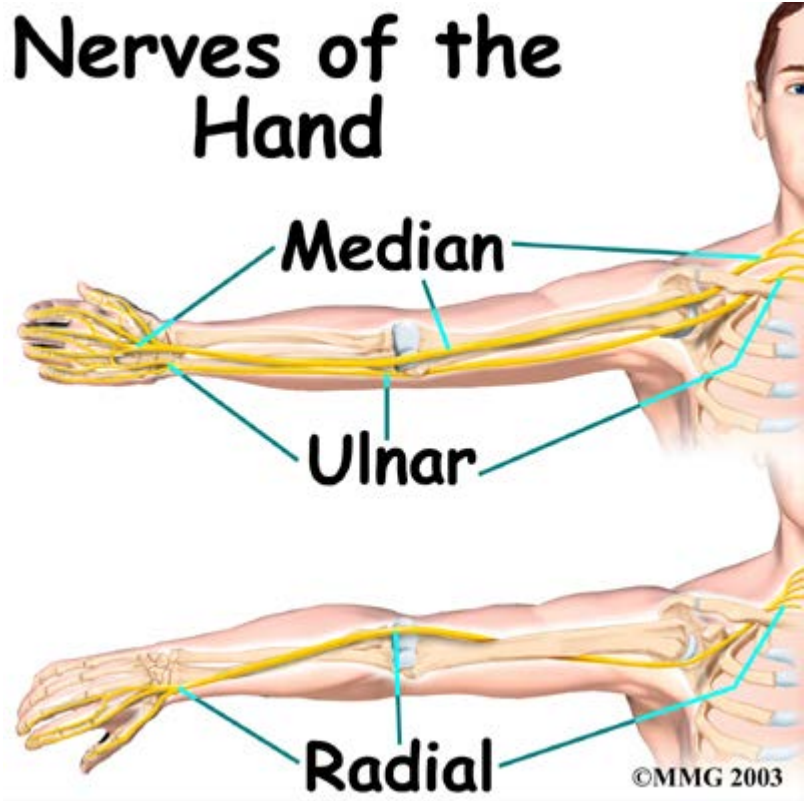
- When testing sensation ask the patient to close their eyes.

- Sensation changes may include:
  - Pins and needles
  - Tingling
  - Numbness

- Changes in sensation need to be reported.

Upper limb

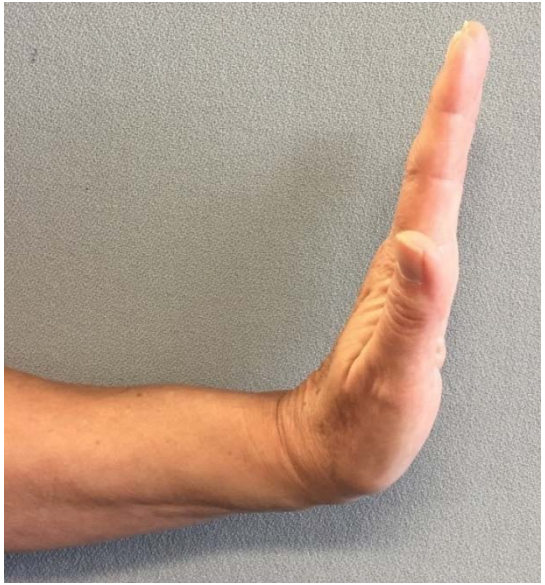
- Radial nerve
- Ulnar nerve
- Median nerve



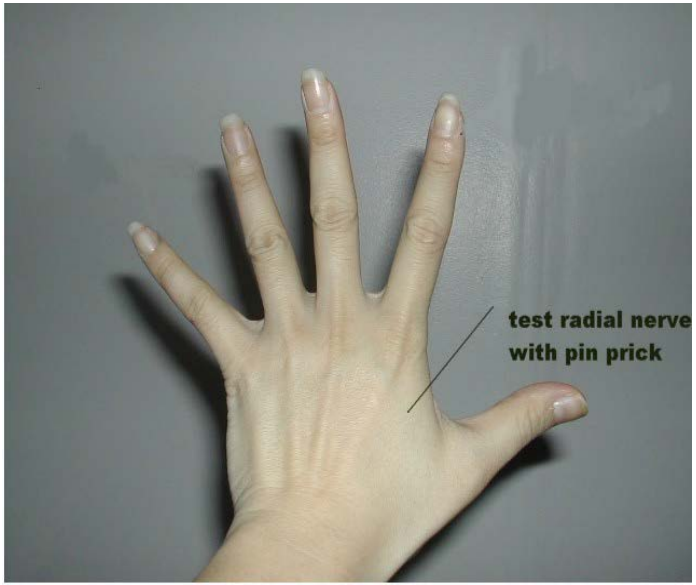
https://ergomomma.com/2012/10/11/thursdays-stretch-radial-nerve-the-third-amigo

Radial nerve

- Movement – wrist dorsiflexion

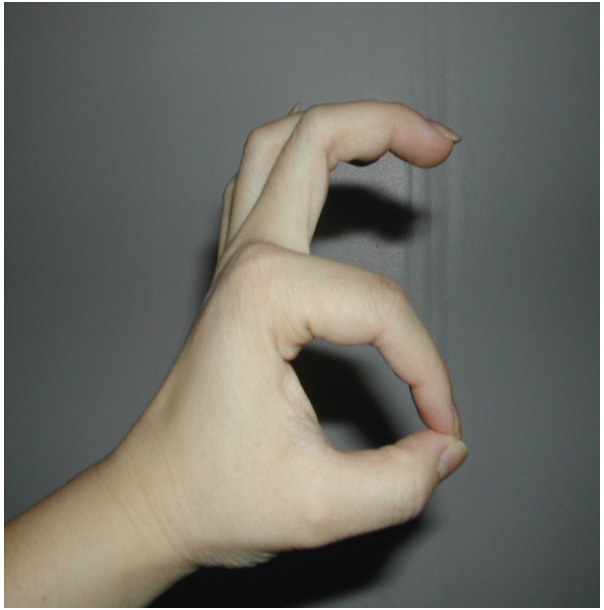


- Sensation

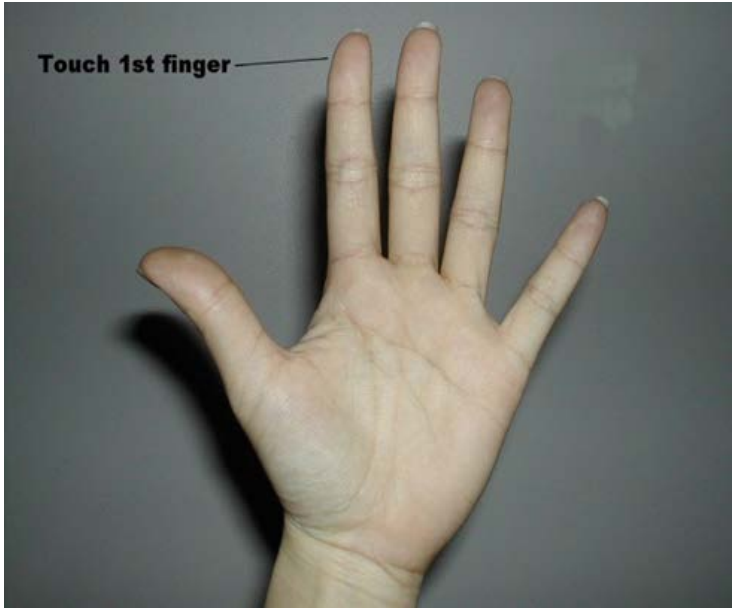


Median nerve

- Movement – thumb opposition

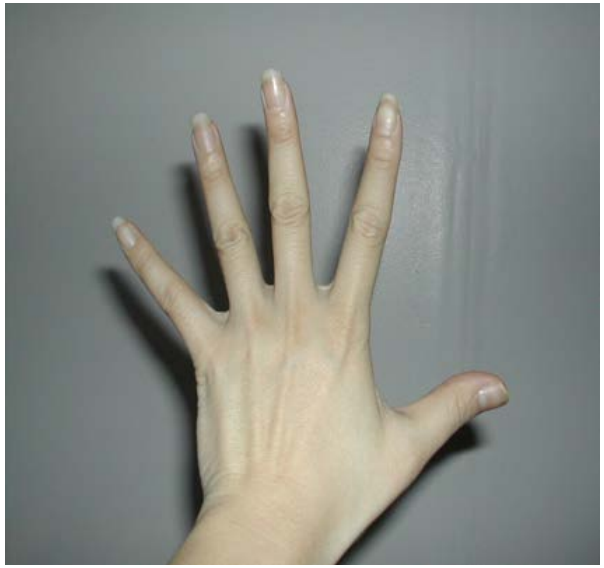


- Sensation

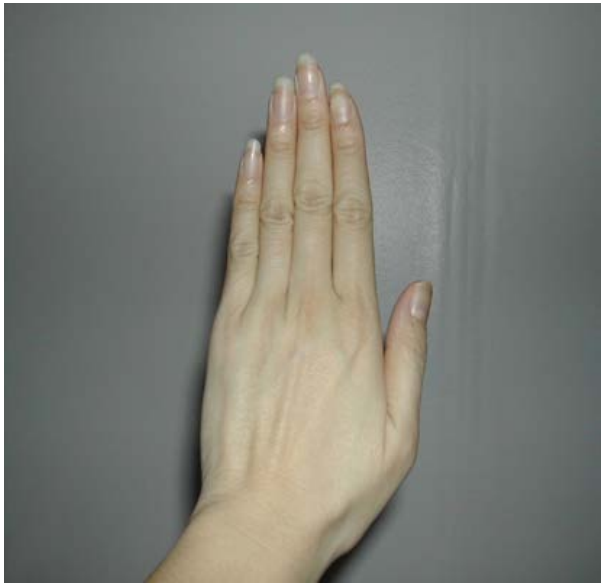


Ulnar nerve movement

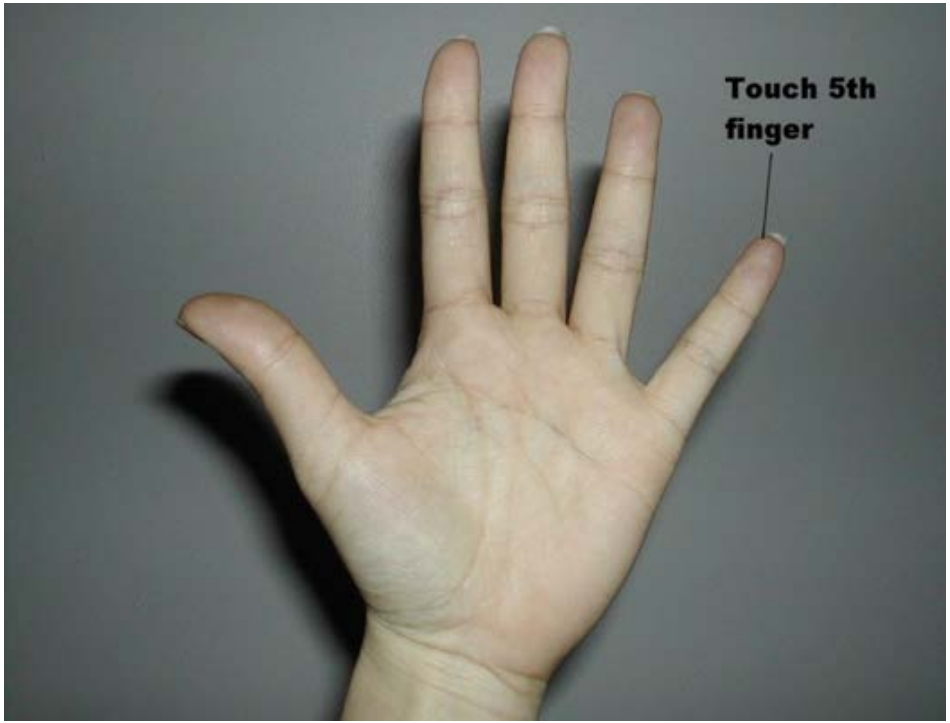
- Abduction



- Adduction

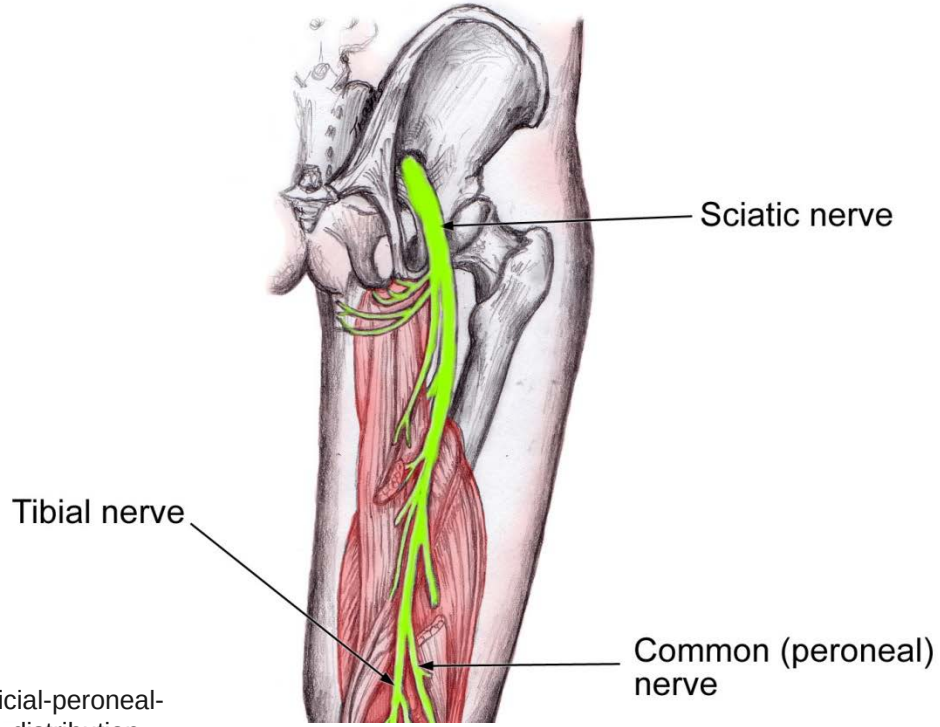


Ulnar nerve sensation



Lower limb

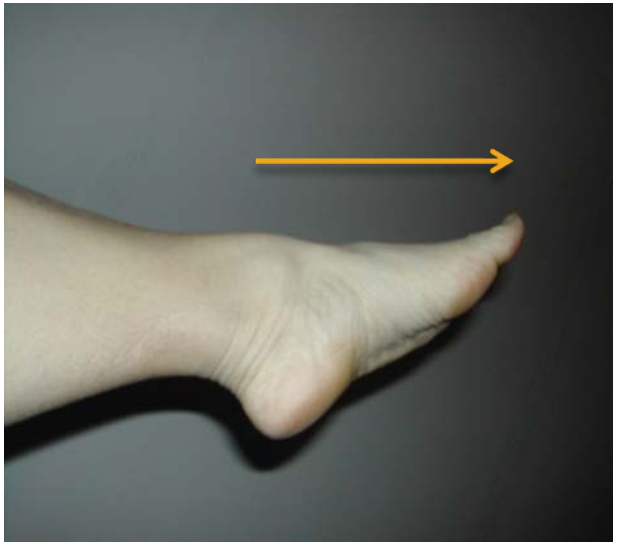
- Common (peroneal) nerve
- Tibial nerve



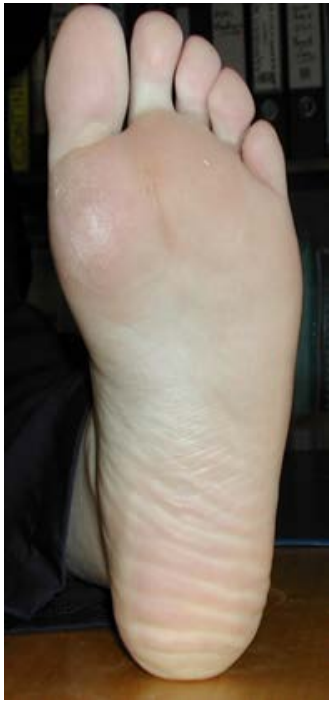
https://anatomyclass01.us/superficial-peroneal-nerves/superficial-peroneal-nerves-peroneal-nerve-innervation-superficial-peroneal-nerve-distribution

Tibial nerve

- Movement – plantarflexion (point toes)

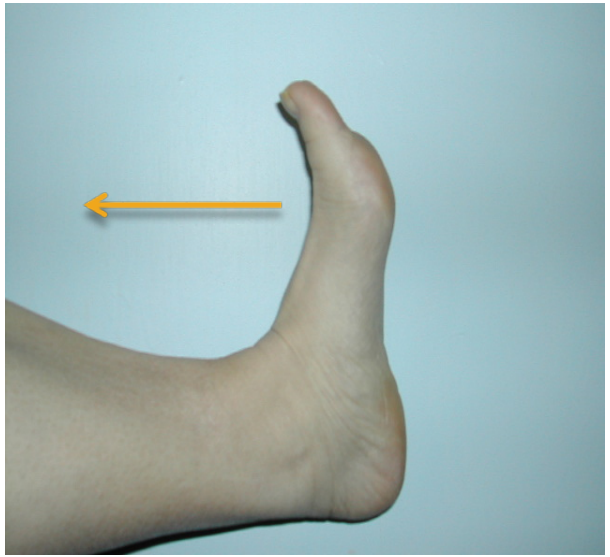


- Sensation

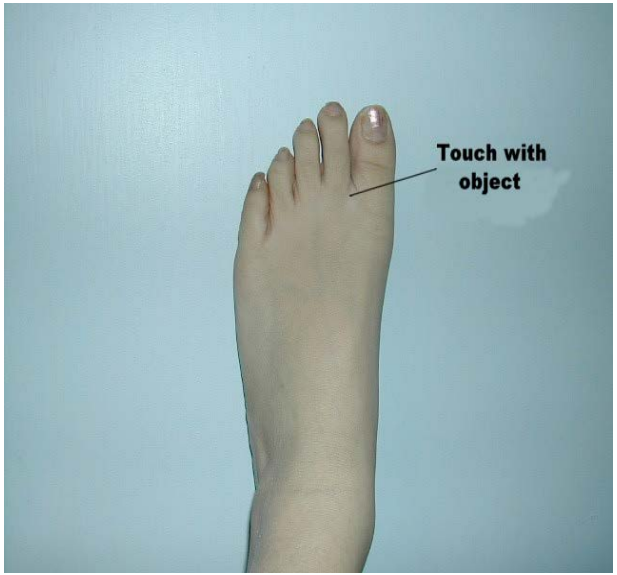


Common (peroneal) nerve

- Movement – dorsiflexion

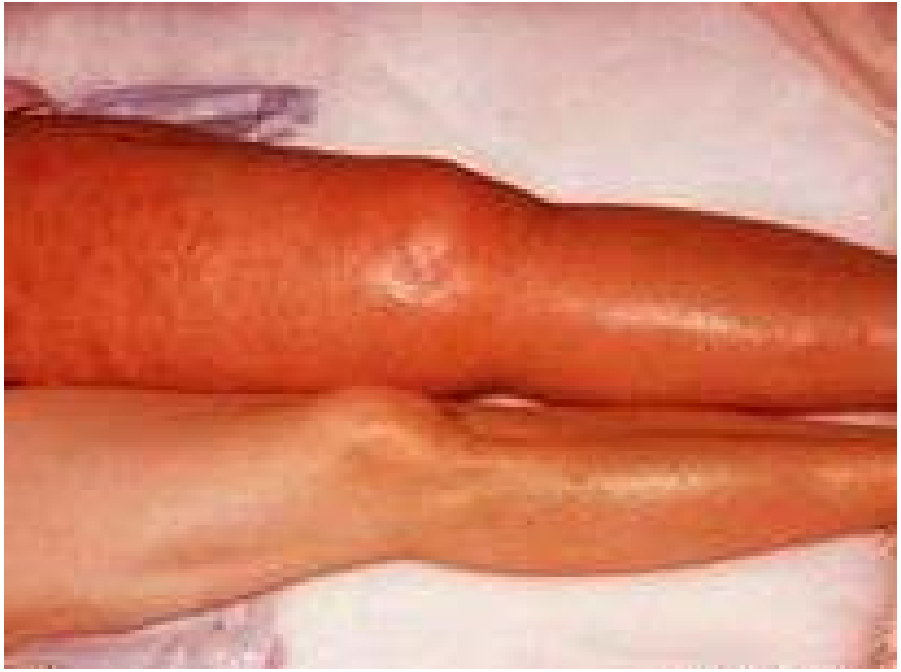


- Sensation



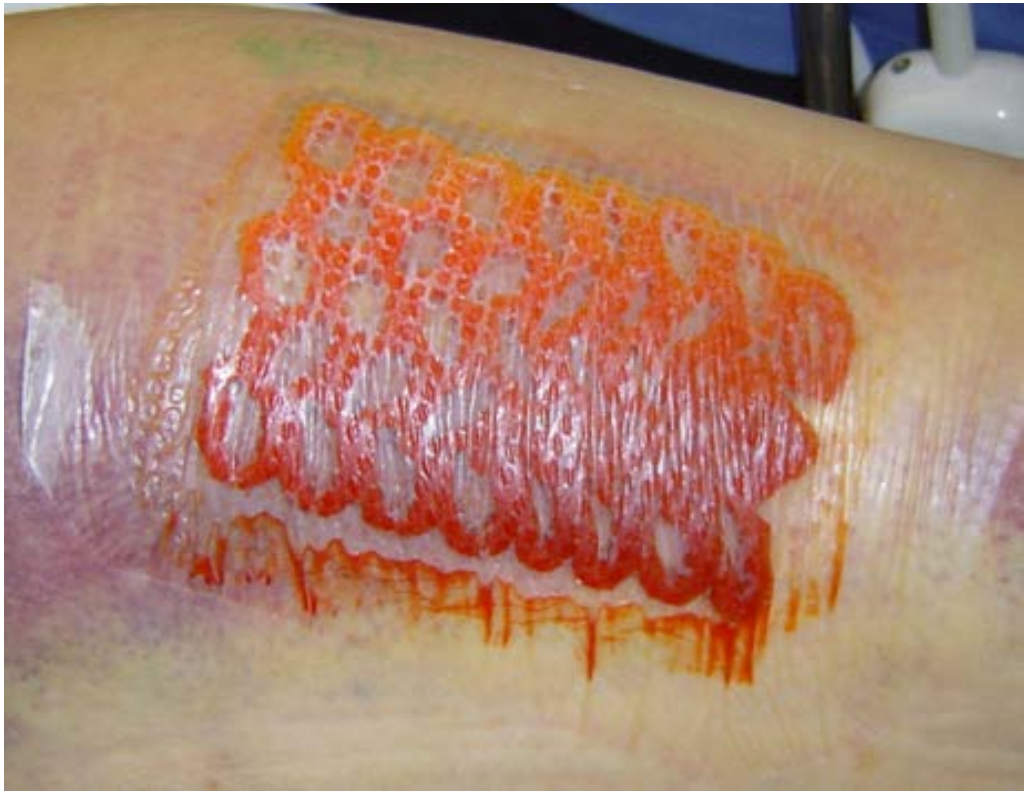
Swelling

- Nil
- Mild
- Moderate
- Large



Blood loss

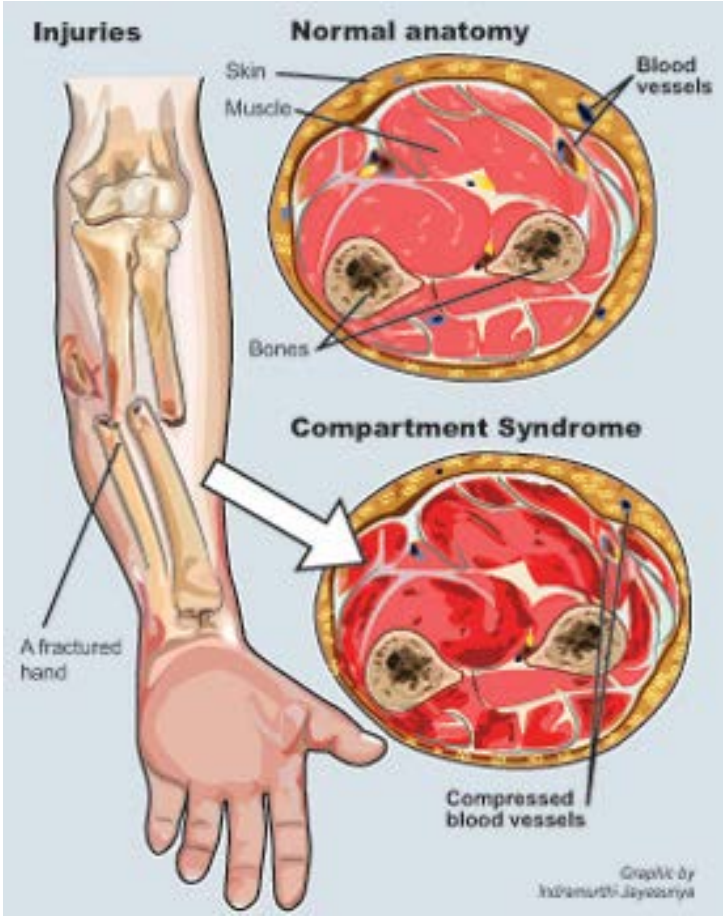
- Nil
- Small
- Moderate
- Large



Compartment Syndrome

- May occur in an extremity from fractures, injuries and/or procedures on a limb (Benche 2010).
- Can be described as increased pressure within a muscle compartment from swelling and/or bleeding (compressing nerves and blood vessels) (Duckworth and McQueen 2011).
- Leads to compromised tissue perfusion and ischaemia (Duckworth and McQueen 2011).

Compartment Syndrome

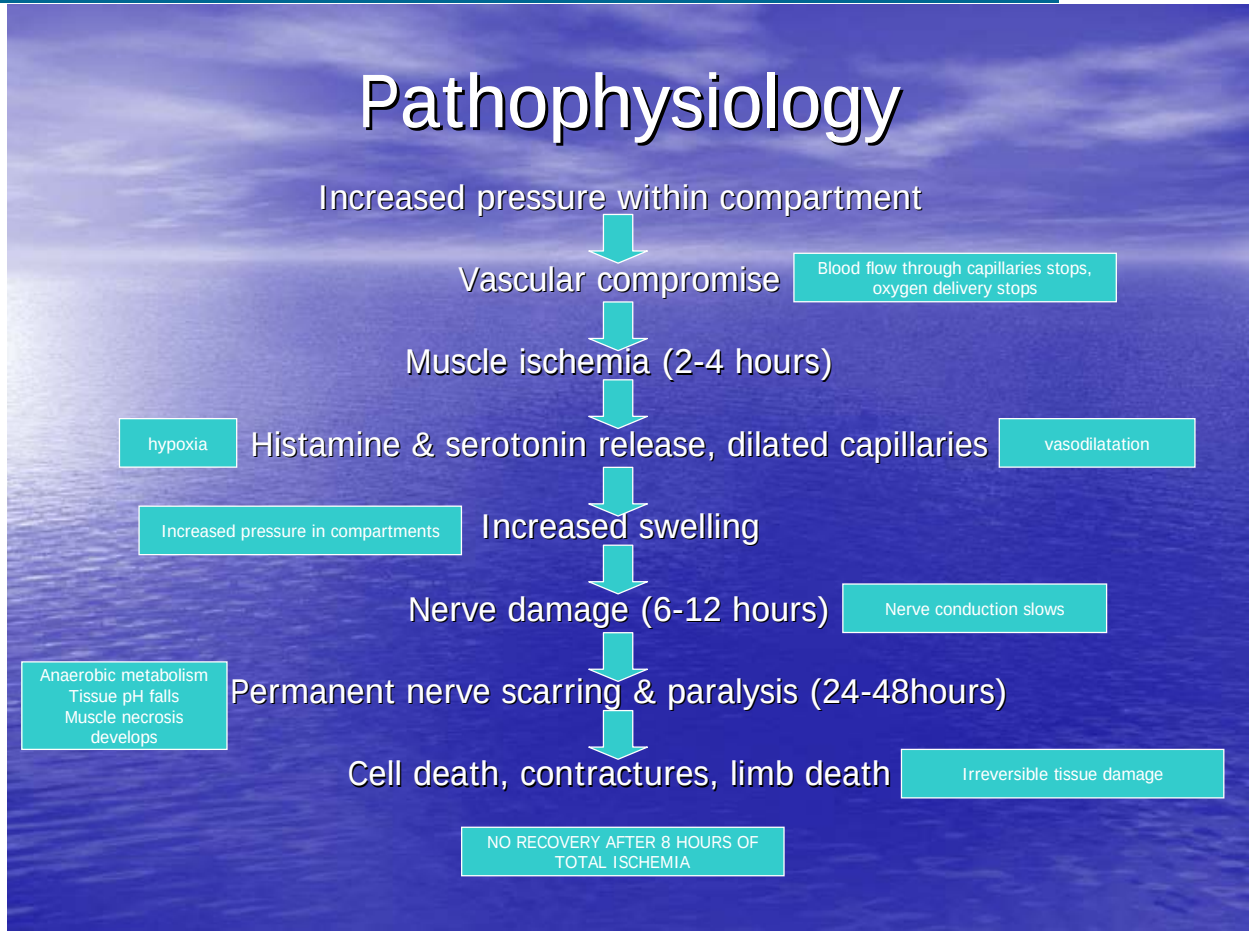


http://www.sundaytimes.lk/130203/news/i-will-train-my-right-hand-says-left-handed-achala-31527.html

Compartment Syndrome

- If left untreated, irreversible damage to the muscles and nerves can begin after six hours.
- In 24-48 hours, ischaemia of the muscle will occur leading to death of the muscle and in extreme cases, the patient will require an amputation.
- Acute Compartment Syndrome is a medical emergency.

Pathophysiology



Signs and symptoms of acute Compartment Syndrome

- Pain – out of proportion to the injury.
- Pallor – skin colour change.
- Paralysis – decreased or loss of movement (motor).
- Paraesthesia – altered sensation.
- Pulselessness – late sign.

Suspected Compartment Syndrome

- Elevate the affected limb to heart level (Altizer 2004; Judge 2007).
- Loosen any restrictive bandages or dressings.
- Notify the orthopaedic/specialty registrar immediately without hesitation.
- Place the patient nil by mouth until review.
- Increase frequency of neurovascular assessment – every 15 minutes until review.
- Make the patient comfortable and reassure them.
- Ensure analgesia is administered.

Acute Limb Ischaemia

May be caused by:

- Emboli (cardiac and non-cardiac)
- Iatrogenic and non-iatrogenic injury to blood vessels and joints
- Chronic peripheral arterial occlusive disease
- Occlusion of a bypass graft conduit
- Hypercoagulable state
- Outflow venous occlusion

Source: Fahey and Schindler 2004; Ouriel 2000

Signs of Acute Limb Ischaemia

The Six Classic P's:

- Pain – sudden and severe
- Pallor – commonly mottled
- Pulselessness – loss of peripheral pulses
- Paraesthesia – decrease in sensation or loss of sensation
- Paralysis – failure of dorsiflexion
- Poikilothermia – coolness of the affected limb

Source: Fahey and Schindler 2004; Ouriel 2000

If suspected Acute Limb Ischaemia

- Elevate the affected limb to heart level (Altizer 2004; Judge 2007).
- Loosen any restrictive bandages or dressings.
- Notify the specialty registrar immediately without hesitation.
- Place the patient nil by mouth until review.
- Increase frequency of neurovascular assessment – every 15 minutes until review.
- Make your patient comfortable and reassure them.
- Ensure analgesia is administered.

Document and communicate

- Timely communication is **vital**. Small or subtle changes need to be escalated and correctly documented.
- Detailed documentation of your assessment and actions needs to be correctly recorded in the patient's medical record.
- Assessment and actions need to be handed over between all shifts. When handing over a patient or receiving a patient from theatre, neurovascular assessment should be completed by both clinicians.

References

- Altizer L. Orthopaedic Essentials: Compartment syndrome. Orthopaedic nursing. 2004;23(6):391-396
- Benche K. Avoid the pressure of compartment syndrome. OR Nurse. 2010;4(1):42-47
- Blair V, Clarke S. Neurovascular assessment post femoral nerve block: nursing implications on all fall prevention. International Journal of Orthopaedic and Trauma Nursing. 2013;17: 99-105
- Duckworth AD, McQueen MM. Focus on: Diagnosis of acute compartment syndrome. The Journal of Bone and Joint Surgery. 2011.
- Fahey VA, Schindler N. *Arterial reconstruction of the lower extremity in vascular nursing,* 4th Ed, Fahey V (Ed). Missouri: Saunders; 2004.
- Hettiarachchi K. I will train my right hand says left-handed Achala [Internet]. Sri Lanka: The Sunday Times; 2013 [cited 10 May, 2018]. Available from: http://www.sundaytimes.lk/130203/news/i-will-train-my-right-hand-says-left-handed-achala-31527.html
- Johnston-Walker E, Hardcastle J. Neurovascular assessment in the critically ill patient. Journal in Critical Care. 2011;16(4):170-177.
- Judge NL. Neurovascular assessment. Nursing Standard. 2007;21(45):39-44.
- McEvoy L. Pathophysiology of compartment syndrome. Orthopaedic Education. Sydney: Liverpool Hospital; 2004.
- Ouriel K. *Acute limb ischemia in vascular surgery*, 5th Ed, Rutherford RB (Ed). Pennsylvania: Saunders; 2000.
- Schreiber ML. Neurovascular assessment: An essential nursing focus. MedSurg Nursing. 2016;25(1):55-57.
- Turney J, Noble DR, Kim SC. Orthopaedic nurses' knowledge and interrater reliability of neurovascular assessments with 2-point discrimination test. Orthopaedic Nursing. 2013;32(3):167-172.
- Wiseman T, Curtis K. Gunshot wounds to the leg causing neurovascular compromise - a case study. Australasian Emergency Nursing Journal. 2011;14:264-269.

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Thank you.

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