

## Local Guideline



John Hunter  
Children's Hospital  
CHILDREN, YOUNG PEOPLE AND FAMILIES



Health  
Hunter New England  
Local Health District

## Paediatric Orthopaedic Neurovascular Assessment

Sites where Local Guideline applies	John Hunter Children's Hospital
This Local Guideline applies to:	
1. Adults	No
2. Children up to 16 years	Yes
3. Neonates – less than 29 days	Yes
Target audience	Clinicians who perform neurovascular assessments on paediatric patients
Description	A guideline for an orthopaedic neurovascular assessment of babies, children and young people

[Hyperlink to Guideline](#)

Keywords	Limb observations, neurovascular observations, extremity, assessment
Document registration number	JHCH 10.4
Replaces existing document?	No
<b>Related Legislation, Australian Standard, NSW Ministry of Health Policy Directive or Guideline, National Safety and Quality Health Service Standard (NSQHSS) and/or other, HNE Health Document, Professional Guideline, Code of Practice or Ethics:</b> <ul style="list-style-type: none"> <li>NSW Ministry of Health Infection Control Policy PD2007 036</li> <li>NSW Ministry of Health Hand Hygiene Policy PD 2010 058</li> <li><a href="#">NSW Health Policy Directive 2014_036 Clinical Procedure Safety</a></li> </ul>	
Prerequisites (if required)	Nil
Local Guideline note	This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s <b>require mandatory compliance</b> . If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients health record.
Position responsible for the Local Guideline and authorised by	Pat Marks. General Manager / Director of Nursing CYPFS
Contact person	Kim Tomasic, Clinical Nurse Consultant, Paediatric Orthopaedics
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Date authorised	24 <sup>th</sup> May 2016
This document contains advice on therapeutics	No
Issue date	May 2016
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Note: Over time links in this document may cease working. Where this occurs please source the document in the PPG Directory at: <http://ppg.hne.health.nsw.gov.au/>

### 1. CLINICAL RISKS

RISK	WHAT IS THE GOAL FOR THE PATIENT?	WHAT IS THE RECOMMENDED ACTION?	HAS THE INTERVENTION BEEN SUCCESSFUL?
The extremity is swelling or swollen	Maintain neurovascular circulation and reduce or prevent swelling	<ul style="list-style-type: none"> <li>· Elevate the extremity</li> <li>· Encourage movement of distal joint (where appropriate)</li> <li>· Check for and release restrictive materials down to the level of the skin</li> <li>· Instigate a clinical review within 30 minutes</li> <li>· Increase the frequency of neurovascular assessment according to the recommendation in the protocol</li> </ul>	The extremity is elevated and the swelling has been reduced
There is excessive serous ooze coming from the extremity	Maintain skin integrity and investigate the cause of the ooze	<ul style="list-style-type: none"> <li>· Keep skin dry with appropriate dressing materials</li> <li>· Initiate a clinical review</li> <li>· Monitor haemodynamic status and look for signs of infection</li> </ul>	The skin is intact and the cause of the ooze has been identified and corrective intervention has been successful
Fracture blisters have formed	Maintain skin integrity. Broken skin creates an	<ul style="list-style-type: none"> <li>· Avoid breaking blisters</li> <li>· Keep the extremity elevated</li> <li>· Maintain increased level of</li> </ul>	The skin is intact and the blister formation has ceased

	increased risk of infection	neurovascular assessment until the swelling has been controlled and the blister formation has been controlled	
Pain is unresponsive to interventions	Prevent compartment syndrome or its complications and control the pain	<ul style="list-style-type: none"> <li>Use paediatric pain protocol</li> <li>Instigate urgent clinical review</li> <li>Keep the patient nil by mouth until review</li> <li>Use Between the Flags criteria</li> </ul>	Pain is controlled effectively and compartment syndrome is avoided or treated appropriately
Pyrexia >38.5	Prevent / treat infection	<ul style="list-style-type: none"> <li>Instigate clinical review according to DETECT protocol (yellow zone)</li> <li>Follow inpatient sepsis pathway</li> </ul>	Inpatient sepsis pathway recommendations followed. The pyrexia is managed appropriately
Cold unilateral extremity	Maintain vascular circulation	<ul style="list-style-type: none"> <li>Check and release restrictive materials down to the level of the skin</li> <li>Check any traction weight does not exceed 10% of the child's body weight</li> <li>Check traction</li> <li>Instigate clinical review within 30 minutes</li> <li>DO NOT place a sock over a unilateral cold extremity – look for the cause</li> <li>Increase frequency of neurovascular assessment according to recommendation in protocol</li> </ul>	The cause of the ischaemia is found and corrective intervention has been successful. The extremity has returned to its natural temperature
Pulseless extremity	Maintain vascular circulation	<ul style="list-style-type: none"> <li>Check and release restrictive materials down to the level of the skin</li> <li>Check the traction does not exceed 10% of the child's body weight</li> <li>Check other pulses on the extremity</li> <li>Get another person to check the pulse</li> <li>Instigate clinical review within 30 minutes</li> <li>Increase frequency of neurovascular assessment according to recommendation in protocol</li> </ul>	The cause of the pulseless extremity has been identified and corrective intervention has been successful. The pulse has returned.
White / pale extremity	Maintain vascular circulation	<ul style="list-style-type: none"> <li>Check and release restrictive materials down to the level of the skin</li> <li>Check the traction weight does not exceed 10% of the child's body weight</li> <li>Look for other causes, eg. low Hb</li> <li>Clinical review within 30 minutes</li> <li>Increase frequency of neurovascular assessment according to recommendation in protocol</li> </ul>	The cause of the ischaemia has been identified and corrective intervention has been successful. The limb colour is natural.
Altered sensation in extremity	Maintain neurological function	<ul style="list-style-type: none"> <li>Check for signs of swelling and pressure, particularly at the knee and elbow.</li> <li>Check and release restrictive materials down to the level of the skin</li> <li>Instigate clinical review within 30 minutes</li> <li>Increase frequency of neurovascular assessment according to recommendation in protocol</li> </ul>	The sensation is within expected limits for the injury or condition
Limited movement in	Maintain neurological	<ul style="list-style-type: none"> <li>Check and release restrictive materials down to the level of the skin</li> </ul>	The movement is within expected limits

hand or foot	function	<ul style="list-style-type: none"> <li>· Check for sensation</li> <li>· Check weight of traction does not exceed 10% of child's weight</li> <li>· Check for signs of compression or swelling</li> <li>· Instigate clinical review within 30 minutes</li> <li>· Increase frequency of neurovascular assessment according to recommendation in protocol</li> </ul>	for the injury or condition
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**Risk Category:** *Clinical Care & Patient Safety*

## GUIDELINE

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

### 1. INTENDED OUTCOMES:

- Clinical staff will be able to interpret clinical findings of a neurovascular assessment and act appropriately
- Neurovascular assessments will be completed and effective
- Babies, children and young people will benefit clinically from thorough neurovascular assessments
- The incidence of neurovascular related complications will be reduced

### 2. BACKGROUND INFORMATION

Surgery, disease and injuries have the potential to cause nerve and vessel damage to children's extremities. To decrease the risk of permanent damage to an extremity, neurovascular assessments must be performed. Identifying and treating an extremity at risk before damage occurs, is essential.

#### Aim

This clinical procedure will provide clinicians with the correct procedure for performing an effective neurovascular assessment. It will provide examples of complications and strategies for managing potential complications. It will enable the clinician to undertake and satisfactorily complete a competent neurovascular assessment.

#### Assessment

This clinical document is suitable for children and young people 0-18 years with the potential to develop neurovascular complications. This document is a clinical procedure. For a more comprehensive understanding of neurovascular assessment, the self-directed learning package should be completed. This is available on the Kaleidoscope website.

The word extremity is used throughout this document and refers to any part of a child's limb, including digits.



#### 4. RECOMMENDED FREQUENCY OF NEUROVASCULAR ASSESSMENT ACCORDING TO RISK

There are three levels of risk.

##### High Risk

**The extremity is obviously compromised or likely to become compromised**

$^{15}/_{60}$  neurovascular assessments are undertaken until the risk has decreased or definitive treatment has commenced.

The risks include:

- Identified or suspected compartment syndrome
- A dislocated joint
- Known or suspected crush injury
- Severe swelling
- Ischaemia
- Vascular stasis
- Absent pulse where one was previously present
- Pain that cannot be controlled with opioid analgesia
- Extensive surgery to repair the extremity (which may involve replantation)
- Extensive soft tissue injury
- MO orders

##### Moderate Risk

**The extremity is at risk of compromise or within 24 Hours of a procedure or injury, or the patient is within 24 hours of admission**

$^{1}/_{24}$  neurovascular assessments are undertaken until the risk has decreased or 24 hours has elapsed.

Risks include:

- A new device on the extremity, such as a cast or splint
- Where a dislocated joint has been relocated
- A change to complex dressings and bandages (such as negative pressure)
- Mild or moderate swelling
- Post-surgery
- A child who cannot communicate effectively
- Change of traction
- Change of traction weight

##### Low Risk

**The Extremity is at Lower Risk of Neurovascular Compromise**

$^{2}/_{24}$  assessments until discharge from hospital or there is a change in the condition of the extremity.











Assessment of swelling to an extremity

Compare the swollen extremity to the non-swollen extremity if possible.

Measure the circumference of the limb with a tape measure and record it – mark the area measured, for consistency.

Extra attention must be given to an extremity at risk of swelling that is covered in bandages or medical therapy devices.

Patients returning from theatre after fracture reduction surgery who have a full Plaster of Paris cast are at high risk of neurovascular complications.

Ensure a limb at risk of swelling, or that is swollen is elevated above the level of the patient's heart. Ensure the method of elevation is effective and safe.

BINDING MARGIN - DO NOT WRITE

HUNTER NEW ENGLAND AREA HEALTH SERVICE Facility: John Hunter Children's Hospital  
Name of Hospital, Facility or Community Health Centre

PLEASE USE GUMMED LABEL IF AVAILABLE UNIT NUMBER  
 SURNAME Doe 2002020  
 OTHER NAMES Jane  
 ADDRESS 123 Smith St, Newcastle, 2300  
 DATE OF BIRTH 01/01/2010 M.O. Tewari

INJURED EXTREMITY OR EXTREMITIES: Right Femur

TYPE OF IMMOBILISATION: Hamilton-Russell Traction

HOSPITAL / WARD: J1

Frequency	<u>1/24</u>		Date	<u>01/05</u>	
	Time	<u>0800</u>			
VASCULAR OBSERVATIONS	COLOUR	Normal	<u>X</u>		
		Pale			
		Blue			
	TEMP	Hot			
		Warm	<u>X</u>		
		Cool/Clammy			
	CAPILLARY FILLING	Over 3 Seconds	<u>X</u>		
		Under 3 Seconds			
	PULSES	Dorsalis pedis	<u>S</u>		
	SWELLING	<u>Thigh</u>	<u>Yes</u>		
NEUROLOGICAL OBSERVATIONS	SENSATION	(Action by Nurse)			
	MOTOR FUNCTION	(Action by Patient)			
		(Except Post Tendon Surgery)			
	SIGNS OF COMPARTMENT SYNDROME	Pain on Passive Motion Increased Pain Unrelieved by Analgesia			
NURSE'S SIGNATURE:					

**HNEAHS NEUROVASCULAR ASSESSMENT CHART**

Assessment of sensation

Nerve conduction is assessed by the presence of sensation by lightly touching the extremity. A number of nerves supply sensation to an extremity; relevant areas should be assessed referring to the *Neurovascular Assessment Chart*.

Abnormal nerve function is indicated by an alteration in sensation around the injured area. This should be compared to the same unaffected area on another extremity where possible.

The clinician should touch the area of the skin lightly both proximally and distally to the affected area. The patient should be asked (where developmentally appropriate) to communicate any changes to parents and clinical staff. Age appropriate techniques should be implemented. Using methods such as feathers, ice or playing a game may be helpful in achieving a meaningful response.

It is not possible to assess sensation for a child who cannot communicate effectively or is not co-operative. This should be recorded appropriately.

Alterations in sensation can include:

- o Numbness
- o Tingling
- o Pins & needles
- o Burning
- o Allodynia (pain response is triggered by a stimulus that does not normally produce pain)

Documentation should include where the patient describes the alteration of sensation and which nerve is affected.

Children with a nerve block or an epidural have an intentional alteration in sensation to block noxious sensations. Neurovascular assessment must be attended in conjunction with these medical interventions, without ignoring the risk of neurovascular compromise. It is the professional responsibility of staff to have adequate knowledge and competency to care for children treated with nerve blocks and epidurals.

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TYPE OF IMMOBILISATION: Hamilton-Russell Traction

HOSPITAL / WARD: J1

Frequency	Date		01/05	
<u>1/24</u>	Time	0800		
VASCULAR OBSERVATIONS	COLOUR	Normal	X	
		Pale		
		Blue		
	TEMP	Hot		
		Warm	X	
		Cool/Clammy		
	CAPILLARY FILLING	Over 3 Seconds	X	
		Under 3 Seconds		
	PULSES	Dorsalis pedis	S	
	SWELLING	Thigh	Yes	
SENSATION	Foot	PN		
	(Action by Nurse) Removed bandage	Y		
NEUROLOGICAL OBSERVATIONS				
MONITOR FUNCTION				
(Action by Patient)				
SIGNS OF COMPARTMENT SYNDROME	Pain on Passive Motion			
	Increased Pain			
	Ulna/wrist Ankle/heel			
NURSE'S SIGNATURE:				

Name the body part you are assessing and whether the sensation is normal, abnormal, ie, pins and needles or absent. If it is abnormal - record your action.

HNEAHS NEUROVASCULAR ASSESSMENT CHART



Assessment of pain

Pain is one of the earliest and most significant symptoms of an extremity with neurovascular compromise. It is an indication of soft tissue compression and/or injury.

Effective relief of pain is a requirement for the psychological welfare of children. Crying is not the only sign of pain in a child. Extreme pain will lead to abnormal physiological mechanisms such as:

- o Increased respiratory rate
- o Increased pulse rate
- o Sweating
- o Grimacing

**Look and listen. Look at the child. Listen to the parents.**

[Follow the Paediatric Pain Management Guideline and use a Paediatric Pain Assessment Tool.](#)

**6. COMPARTMENT SYNDROME**

Muscle groups are enclosed within a thin film of tissue called fascia, which forms its own segment or compartment. It is non-elastic and will constrict oversized contents (swollen muscles).

If muscle tissue begins to swell, the compartment becomes confined and the muscle cells become poorly perfused and hypoxic, leading to ischaemia. Dying cells produce toxins that cause pain. Movement becomes extremely painful and strong analgesia may be ineffective. Pain on passive movement will be intolerable.

Pain from a developing compartment syndrome will present as:

- o Non-localised
- o Persistent
- o Progressive
- o Unrelieved by strong opioid analgesia
- o Exacerbated by muscle stretching on passive movement

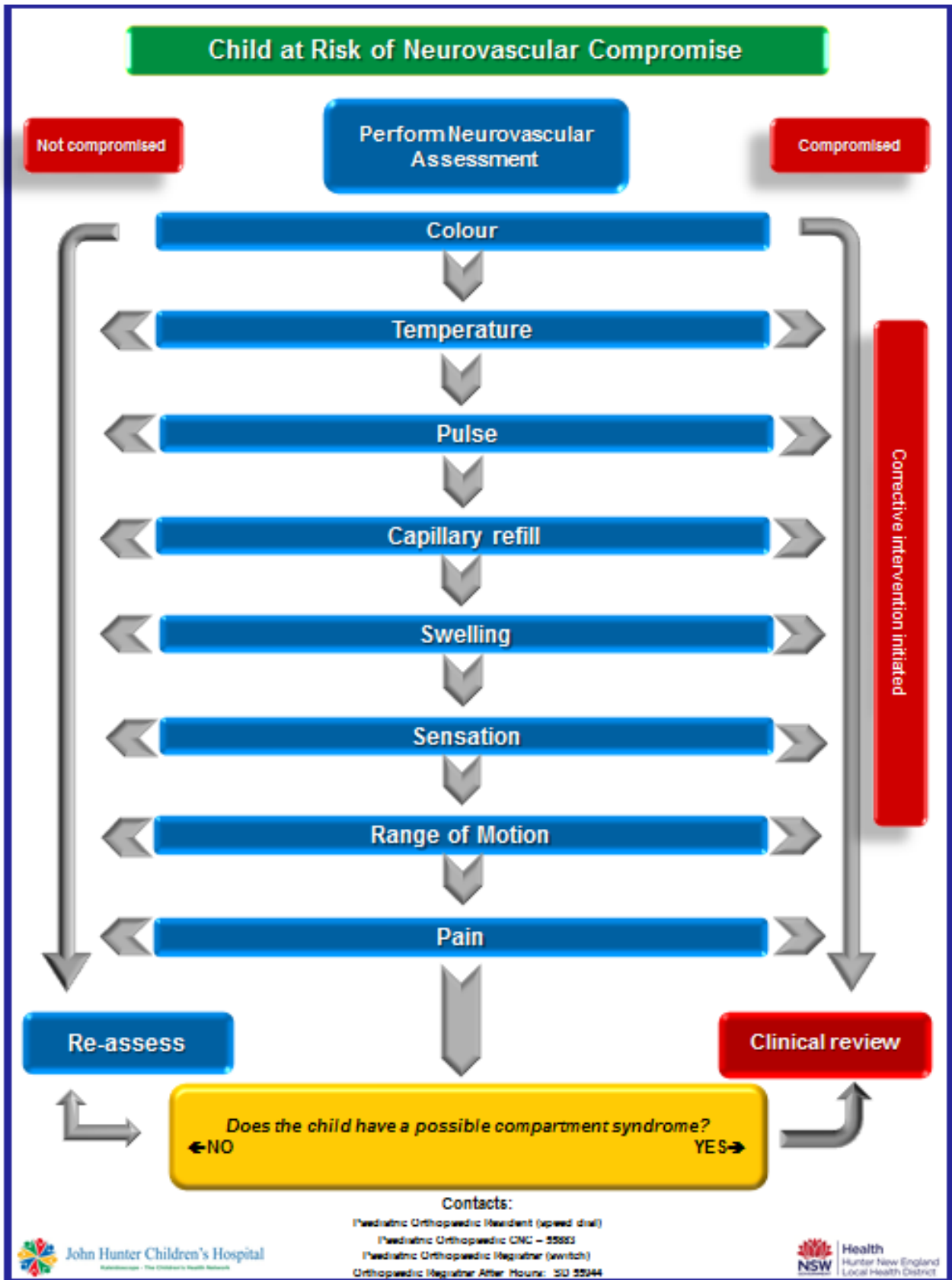
This pain is often mistaken for poorly controlled pre-operative or post-operative pain (a complication in its own right). Attention must focus on the location and characteristics of pain. Any doubt about the cause of uncontrolled pain must be clinically reviewed within 30 minutes, as per DETECT protocol. If pain is not relieved after clinical review and intervention by a junior medical officer, a senior medical officer, such as a registrar, fellow, staff specialist or consultant should be consulted.

Guidelines for the general management of paediatric pain are available on the Kaleidoscope website.

A child's extremity with a compartment syndrome must be treated within 4 hours to avoid permanent damage.



7. FLOWCHART





## 8. IMPLEMENTATION AND MONITORING COMPLIANCE

The owners/developers of the document must:

1. The guideline will be placed on the HNE guideline website.
2. A copy of the guideline will be sent to all the relevant stakeholders
3. The nursing staff on the wards will be given an in-service regarding the updated guideline, including the changes within a month of ratification
4. The nursing educators will be directed toward the updated guideline and the learning package
5. A basic draft clinical audit tool is available at Appendix One
6. Compliance will be monitored with annual audits and an associated action plan, where required, and will be sent to the JHCH Clinical Quality and Patient Care Committee

## 9. APPENDICES

*HNELHD Neurovascular Assessment Chart 77420 – Mar03.*

## 10. REFERENCES

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Satryb, S, Wilson, T & Patterson, M (2011) Casting All Wrapped Up *Orthopaedic Nursing* 30(1):37-41.

Wright, E. (2009) Neurovascular impairment and compartment syndrome *Paediatric Nursing* (21)3:26-29.

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## 11. FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.

## **12. CONSULTATION**

JHCH Nursing Education Department – Elizabeth Newham, Margaret Allwood

Dr Sandeep Tewari Paediatric Orthopaedic Surgeon

JHCH Nurse Unit Managers – Sandra Stone

JHCH Physiotherapy Department – Carolyn Matthews

## **13. APPROVAL**

CPGAG - 15<sup>th</sup> February 2016

JHCH Clinical Quality and Patient Care Committee – 24<sup>th</sup> May 2016.



**SUGGESTED GUIDELINES FOR A NURSING NEUROVASCULAR ASSESSMENT**

Begin assessment by evaluation of uninjured limb first for normal patient base line

PULSES	NERVES	SENSATION	MOTOR
AUXILLARY	AUXILLARY:	regimental badge on upper arm	Shoulder abduction
BRACHIAL	RADIAL:	Web space between thumb and index finger	Hyperextended thumb or wrist
ULNAR	MEDIAN:	Pad of index finger	Thumb opposition - flex wrist
RADIAL	ULNAR:	Pad of little finger	Abduction of fingers
FEMORAL	FEMORAL:	Anterior of thigh	Straight leg raise
POPLITEAL	SCIATIC:	Lateral aspect of calf and foot	Hip extension
ANTERIOR TIBIALIS	PERONEAL DEEP:	Web space between 1st and 2nd toes	Dorsiflexion of foot
POSTERIOR TIBIALIS	TIBIAL:	Heel of foot	Plantar flexion of foot
DORSALIS PEDIS	SUP PERONEAL:	Dorsum of foot	Foot eversion

HNEAHS NEUROVASCULAR ASSESSMENT CHART

**SENSATION**  
 GN = Good and Normal  
 PN = Pins and Needles  
 NS = No Sensation



- Superficial Peroneal
- Deep Peroneal
- Medial Plantar
- Lateral Plantar
- Tibial
- Saphenous
- Sural

**MOVEMENT**

- A- = Active movement without pain
- A+ = Active movement with pain
- P- = Passive movement without pain
- P+ = Passive movement with pain

Plantar Flexion

Dorsiflexion



Dorsalis pedis pulse

Posterior tibialis pulse

**SENSATION**  
 GN = Good and Normal  
 PN = Pins and Needles  
 NS = No Sensation



- Median
- Ulnar
- Radial

**MOVEMENT**

- A- = Active movement without pain
- A+ = Active movement with pain
- P- = Passive movement without pain
- P+ = Passive movement with pain



Radial Nerve

Median Nerve

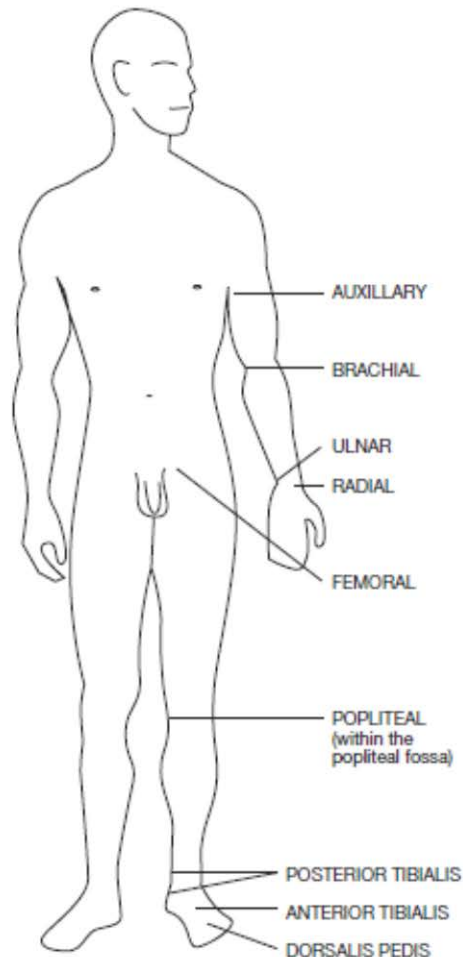
Ulnar Nerve

**PULSE RECORDING**

- A = Absent
- W = Weak
- S = Strong

COMPARTMENT SYNDROME RECORDING - YES or NO

PULSE POINTS



ENDING MARGIN - DO NOT WRITE

**Clinical Audit Tool** –(National Standard 1: 1.7.2 The use of agreed clinical guidelines by the clinical workforce is monitored)

Criterion no.	Criterion	Exceptions	Definition of terms and/or general guidance	Data source	Frequency	Position Responsible
1	Inpatients undergoing neurovascular observations for orthopaedic problems will be audited every 90 days on the wards	None.	The aim is to ensure: <ul style="list-style-type: none"> <li>- Staff adhered to the guideline</li> <li>- The therapy was initiated and managed appropriately and safely</li> <li>- Children and their families were satisfied with the therapy process</li> </ul>	Patient health record.	90 days	Paediatric Orthopaedic CNC
2						
3						
4						
5						

**Reference:** *Electronic audit tool - National Institute for Health and Clinical Excellence (NICE): [www.nice.org.uk/nicemedia/live/10996/56372/56372.xls](http://www.nice.org.uk/nicemedia/live/10996/56372/56372.xls)*