





# Paediatric Orthopaedic Neurovascular Assessment

Sites where Local Guideline applies This Local Guideline applies to:

1. Adults

Description

2. Children up to 16 years

3. Neonates – less than 29 days Target audience

John Hunter Children's Hospital

No

Yes Yes

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Clinicians who perform neurovascular assessments on

paediatric patients 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
Related Legislation, Australian Standard	d, NSW Ministry of Health Policy Directive or Guideline, National
Safety and Quality Health Service Stand	ard (NSQHSS) and/or other, HNE Health Document,

Professional Guideline, Code of Practice or Ethics:

- NSW Ministry of Health Infection Control Policy PD2007 036
- NSW Ministry of Health Hand Hygiene Policy PD 2010 058
- NSW Health Policy Directive 2014\_036 Clinical Procedure Safety

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.
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This document contains advice on therapeutics	No
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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: <u>http://ppg.hne.health.nsw.gov.au/</u>

# 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> <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> <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	Avoid breaking blisters     Keep the extremity elevated     Maintain increased level of	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> <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> <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> <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> <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> <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> <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	Check and release restrictive materials     down to the level of the skin	The movement is within expected limits

hand or foot	function	<ul> <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	
Risk Category:	Clinical Care & Patien	t 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.

# 3. PRIOR TO THE ASSESSMENT

Inform the patient and parent what you are going to do, why you are going to do it and gain consent.

#### **Staff Preparation**

To complete a neurovascular assessment, the clinician will require a *HNELHD Neurovascular Assessment Chart* 77420 – *Mar03.* Prior to touching the patient, it is mandatory for staff follow relevant: "Five moments of hand hygiene", infection control and documentation practices.

Place patient sticker on chart and indicate on the SPOC chart that the neurovascular chart is in use. Fill out details such as hospital, the extremity to be assessed and the type of immobilisation. This could include:

- · Hamilton-Russell traction
- Gallows traction
- · Back-slab
- · Plaster cast
- · Splint
- Collar & cuff

Put in the frequency of assessment based on the recommendations according to risk in this guideline in the next section.



# 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

<sup>15</sup>/<sub>60</sub> neurovascular assessments are undertaken until the risk has decreased or definitive treatment has commenced.

The risks include:

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

- o 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
- o Post-surgery
- A child who cannot communicate effectively
- o Change of traction
- Change of traction weight

# Low Risk

# The Extremity is at Lower Risk of Neurovascular Compromise

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

# 5. CLINICAL ASSESSMENT OF THE EXTREMITY USING DEFINED PARAMETERS

The patient's neurovascular status must be monitored and reassessed regularly to show a pattern of deterioration or improvement. Acceptable parameters are defined to avoid inconsistency and confusion in clinical care. All clinically significant abnormal clinical findings must be documented on the Neurovascular Assessment Chart and a clinical review must be instigated and completed.

#### **Clinical Assessment**

# Assessing the colour of the extremity

The colour of extremity should be compared to the non-affected extremity where possible. An extremity with vascular impairment may be:

- o Pale
- o Mottled
- o Dusky
- o Red (inflammation)

Be aware of other conditions that can cause abnormal colouration of the skin, examples include:

- o Shock
- o Low haemoglobin
- o Bruising
- o Jaundice
- o Birthmarks
- o Medication (steroids)
- Endocrine disorders
- Pigment disorders
- o Pain disorders

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o Haematologic disorders

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#### Assessing the temperature of the extremity

Good circulation and perfusion of blood into an extremity is indicated by warm tissue. Skin should feel warm to touch without feeling hot or cold; compare to the unaffected extremity where possible.

A cold extremity may be an indication of poor blood flow to the extremity, or that the child is cold. Keep an open mind about other possible causes, such as shock. Extremities should be the same temperature. A <u>unilateral</u> cold limb should be investigated as a matter of urgency.

A hot extremity or an extremity with hot areas may be an indication of poor venous return, venous congestion, inflammation or infection.

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# Assessing Capillary Refill

Capillary refill is the time taken for blood to return to a part of an extremity such as a finger or toe after it has been pressed to cause blanching. Press the soft pad of the finger or toe until it turns white and count the time needed for the colour to return.

Satisfactory circulation and perfusion of an extremity is indicated by a capillary refill time of less than 3 seconds. A sluggish or absent refill time could indicate a blood supply issue. A fast refill time could indicate a venous return issue.

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#### Assessing the presence of a pulse

A pulse should be assessed distally to the injured part of the extremity or cast; with the purpose of assessing arterial flow.

Write on the chart the name of the pulse that is being assessed.

Adequate arterial circulation is indicated by the presence of a pulse. The pulse is assessed as weak, strong or absent.

If there is uncertainty about whether a pulse is present, ask a senior staff member or the Team Leader to check the pulse.

When a pulse is absent due to neurovascular impairment, an urgent clinical review must be instigated and completed within 30 minutes.



#### 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.



#### 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
- 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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#### Assessment of movement and range of motion

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Movement and range of motion can be assessed by asking the child to move their extremity (distal to the injury). This can be encouraged by tickling or playing games.

A lack of movement can be an indication of swelling, injury, pain or nerve damage.

Range of motion can be assessed by moving the patient's extremity passively.

Range of motion should be compared in both extremities where practicable. Do not force a joint to move, or repeat this part of the assessment if it causes pain.

Some pain on movement is typical after surgery or injury, and should be treated. Pain at rest must be investigated, especially if analgesia has been administered or traction is in place.





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# 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
- 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.

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#### BINDING MARGIN - DO NOT WRITE



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# 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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# 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.

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# 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



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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.	<ul> <li>The aim is to ensure:</li> <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						
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Reference: Electronic audit tool - National Institute for Health and Clinical Excellence (NICE): www.nice.org.uk/nicemedia/live/10996/56372/56372.xls