Neurovascular Assessment

Neurovascular assessment is performed when there is a suspicion of compromised blood flow or nerve damage, to detect early signs and symptoms of acute ischemia or compartment syndrome. Examples of injuries or procedures that place patients at risk for neurovascular compromise include limb fractures, crush injuries, casts/splints/external fixators, vascular injuries and procedures, and circumferential burns. Components of the focused neurovascular assessment, potential risks, and implications of neurovascular complications are presented here.

Components of the Neurovascular Assessment

The neurovascular assessment of the extremities is performed to evaluate sensory and motor function (neuro) and peripheral circulation (vascular). The components of the neurovascular assessment include pulses, capillary refill, skin color, temperature, sensation, and motor function. Pain and edema are also assessed during this examination.

Comparison of assessment findings bilaterally is extremely important. Even subtle changes can have significant implications. Remember to include neurovascular assessment findings of all extremities in your documentation and to notify the appropriate health care provider of any changes.

Pulses

- Assess upper extremity peripheral pulses (brachial, radial, and ulnar) and lower extremity peripheral pulses (femoral, popliteal, posterior tibialis, and dorsalis pedis) bilaterally. Be sure to assess for the presence of pulses distal to any injury.
- Use a 0 to 4 point scale (0=absent and 4=strong/bounding), noting also if the pulse is weak, diminished or absent.
- Use a marker to indicate a pulse palpation site that is difficult to locate; this can help others with their assessment and provide consistency.
- A manual Doppler scan should be utilized if a pulse palpation site is challenging to find or if the pulse is weak.
- If palpable pulses are not assessable due to casting, assess all other parameters.
- Document if a change in the pulse is detected and notify the appropriate health care provider.

Capillary refill time (McGuire et al., 2023)

- Capillary refill time is used to evaluate peripheral perfusion.
- Assess capillary refill by pressing on the nailbeds until blanching occurs.
- Note how long it takes for the distal capillary bed to regain its color.
- The upper limit of normal time to reperfusion is less than 3 seconds.
- Capillary refill time can be affected by age, temperature, ambient light, skin pigmentation, the presence of nail polish or artificial nails, and intra- and inter-observer reliability.

Skin color

- Compare the color of the skin bilaterally.
- Consider the patient's usual skin tone and any skin conditions when performing this assessment; cyanosis can present differently in different skin tones.

- Pallor or cyanosis may indicate inadequate arterial supply; dusky, cyanotic, mottled, or purple black coloration may indicate inadequate venous return.
- Shiny and pale skin, suggesting pressure in the affected area, may be a sign of compartment syndrome, which requires immediate intervention to prevent vascular compromise that can result in muscle and nerve ischemia.

Temperature

- Use the back of your hands to assess skin temperature bilaterally.
- Skin should be warm to touch. Cool skin may indicate inadequate arterial supply; excessive warmth may indicate inadequate venous return or infection.

Sensation

- Ask the patient about changes in sensation, such as tingling, numbness (paresthesia), pressure, or burning.
- A pressure sensory exam often consists of assessing light touch with a cotton swab and assessing temperature discrimination with warm and cold stimuli; pinprick sensation can be tested using the sharp end of a disposable safety pin.
- If indicated, consider using the 2-point discrimination test.
- Complaints of numbness or tingling in an extremity should be investigated immediately, with the assessment proximal and distal to the site of injury or surgery (if not precluded by a cast or splint).
- Nerve involvement compromised blood flow, or the use of ice can alter a patient's sensory function.

Motor function

- Assess range of motion and strength of the extremities.
- Loss of motor function is often a late sign of neurovascular compromise; thus, frequent assessment and careful attention is required to detect these subtle changes in the patient.

Pain

- Complications can be prevented when pain is identified and treated early.
- Pain out of proportion to the apparent injury is an early and common hallmark symptom of neurovascular compromise.
- Pain can be caused by sensory nerve damage and/or diminished blood flow.
- Use a pain assessment tool to assess severity of pain.
- Note the location, severity, and areas of radiating pain.
- In sedated patients or those who can’t verbalize information, be aware of non-verbal pain cues including grimacing, guarding, tachycardia, and hypotension.

Edema

- Edema can result from musculoskeletal injury, contribute to vascular compromise, and cause damage to muscle and nerve tissue.
- Preexisting disease processes (e.g., heart failure, cirrhosis, or kidney disease) can place a patient at increased risk for edema-related complications.
- Elevating the limb, no higher than heart level, can help decrease edema.

Frequency of Assessments

The frequency of performing a neurovascular assessment can vary within health care organizations and across units, providers, diagnosis, or procedure. On average, if there is no change to a patient's condition, neurovascular assessments typically default to every 4 hours. For at risk patients, it is a best practice recommendation for nurses to perform a neurovascular assessment together during handoff or a change in shift.

Risk Factors

Risk factors for increased neurovascular compromise may include:

- Musculoskeletal, nerve, or vascular injury
- Extremity infections, circumferential burns, or gunshot injuries
- Tissue edema
- Fracture or surgery in limbs and joints
- Procedures that may cause limb thrombosis or emboli such as cardiac catheterization.
- Crush injury
- Prolonged immobility due to drug or alcohol induced coma
- Coagulation abnormalities
- History of peripheral vascular disease

Acute Compartment Syndrome

The identification of subtle changes in the neurovascular assessment is critical to the early diagnosis of acute compartment syndrome (ACS). ACS is a devastating complication of musculoskeletal trauma that often presents silently and can result in severe and permanent dysfunction or even limb loss. ACS is defined as increased tissue pressure in a muscle compartment bound by fascia with the potential to cause critical ischemia to the muscle and/or nerve tissue within the compartment. Fractures account for about 75% of cases of ACS, especially long bone fractures such as the tibia (Hammerberg, 2023).

Signs and symptoms of ACS: The 5 Ps

- Pain
- Pallor and delayed capillary refill
- Pulses (may be normal, decreased or absent in distal extremity: loss of pulse is late finding)
- Paresthesia (loss of sensation or tingling)
- Paralysis (late finding)

If pressure within the muscle compartment is not relieved, irreversible damage to the tissues and nerves may result. Immediate management includes removal of restrictive clothing and devices, placing the limb at heart level, and administration of analgesics and supplemental oxygen as prescribed. Fasciotomy may be necessary to fully decompress the compartment(s).

Patient Education

- Explain the importance of neurovascular assessment and why it must be performed.
- Prepare the patient for frequent assessments, if necessary.
- Unless contraindicated, tell patients to move their digits regularly and notify the nurse of any pain or changes to their extremities.

References:

Hammerberg, E. (2025, April 9). Acute compartment syndrome of the extremities. *UpToDate.* https://www.uptodate.com/contents/acute-compartment-syndrome-of-the-extremities

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