Neurovascular Assessment for the Orthopaedic Nurse.

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CONFLICT OF INTEREST

I hereby certify that, to the best of my knowledge, no aspect of my current personal or professional situation might reasonably be expected to affect significantly my views on the subject on which I am presenting.

Objectives

At the end of the presentation, the participants:

• List the major peripheral nerves of the upper and lower extremities and the critical sensory and motor changes that indicate actual or potential peripheral nerve damage.
• List 2 nursing interventions to manage the care of patients with actual or potential peripheral nerve damage.
Definition of the Peripheral Nervous System
The peripheral nervous system (PNS) is the part of the nervous system that consists of the nerves and ganglia outside of the brain and spinal cord.

Characteristics of Peripheral Nerves
- There are two types of cells in the peripheral nervous system.
- These cells carry information to (sensory nervous cells) and from (motor nervous cells) the central nervous system (CNS).
- Cells of the sensory nervous system send information to the CNS from internal organs or from external stimuli.

Main Concepts of Peripheral Nerves
- There are both motor and sensory branches of these nerves.
- Each of these functions must be assessed in order to get a complete and accurate picture of the patient's neurovascular function.
Poll question: Do you routinely assess both motor and sensory function of extremities?

- Yes
- No
- Sometimes depending on the patient
- Do not know how to assess these functions

Remember these pictures????

Dermatomes

- A dermatome is an area of skin that is mainly supplied by a single spinal nerve
- There are 8 cervical nerves (C1 being an exception with no dermatome), 12 thoracic nerves, 5 lumbar nerves and 5 sacral nerves
Clinically Important Dermatomes of the Upper Arm

- C6-thumb and wrist extension
- C7-middle finger
- C8-little or 5th finger
- T1-inner forearm
- T2- upper inner arm

Nerves of the Upper Extremity

- Radial
- Median
- Ulnar
Basic Nerve Function and Exam

<table>
<thead>
<tr>
<th>Nerve</th>
<th>Motor</th>
<th>Clinical Exam</th>
<th>Sensory</th>
<th>Clinical Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial</td>
<td>Wrist extensor and thumb abduction</td>
<td>Extension of wrist, fingers and thumb against resistance</td>
<td>Radial aspect of dorsum of hand, thumb and index finger</td>
<td>Sensation at dorsal web space between thumb and index finger</td>
</tr>
<tr>
<td>Median</td>
<td>Muscles involved in the pinch mechanism of fingers</td>
<td>Opposition of the thumb to the 5th finger</td>
<td>Thumb, index, long finger, and radial side of ring finger</td>
<td>Sensation at the volar tip of the index finger</td>
</tr>
<tr>
<td>Ulnar</td>
<td>Muscles involved in grasping of fingers</td>
<td>Abduction of fingers against resistance</td>
<td>Ulnar portion of dorsum of hand, 5th finger &amp; ulnar aspect of ring</td>
<td>Sensation at the volar tip of the 5th finger</td>
</tr>
</tbody>
</table>

Radial Nerve-Anterior and Posterior Sensory Areas – Pink color

Humerus Fracture Causing Injury

Radial Nerve Injury - Location: Humerus - Lewis Fracture
Injury to the nerve at this level will cause the condition of wrist drop as well as weakness of finger extension.
Radial Nerve Injuries/Dysfunction

- Common causes include
  - Humerus fractures
  - Fall on outstretched hand (FOOSH)
  - Direct lacerations
  - Radius fractures
  - Prolonged compression
  - Compartment syndrome

Physical Exam Findings

- Inability to dorsiflex wrist
- Inability to Abduct thumb – hitchhike
- Numbness in thenar space, thumb, and index finger

Sequela of Radial Nerve Injury

- Wrist drop
- Numbness of thumb and index finger
- Atrophy of thenar space
Median Nerve- Anterior and Posterior Sensory Areas – Green color

Thumb opposition

Median Nerve Injuries/Dysfunction

- Common causes include:
  - FOOSH
  - Carpal ligament hypertrophy (carpal tunnel syndrome)
  - Fractures around the elbow
  - Prolonged compression

Physical Exam Findings

- Inability to oppose thumb to rest of fingers
- No contraction of the thenar space
- Numbness in middle and index finger
Sequela of Median Nerve Injury

Ulnar Nerve-Anterior and Posterior Sensory Areas – Blue color

Ulnar Nerve Injuries/Dysfunction

- Common causes include
  - Illness that damages the nerve
  - Direct injury to the nerve
  - Excess pressure on the nerve
  - Nerve pressure due to swelling
  - Elbow fracture or dislocation
Positional/Direct Injury

Physical Exam Findings
- Inability to Abduct 5th finger
- Numbness at volar tip of the 5th finger

Sequela of Ulnar Nerve Injuries
- Claw hand
Radial and Ulnar Arteries

- Only need radial artery to supply hand but always have to check ulnar artery
  - Allen Test-compress the radial & ulnars nerve to test for viability of the artery
  - Especially needed prior to arterial blood gas
  - Always need to grade pulse ie 1+, 2+

What’s a Nurse to Do?

Assess
- Carefully assess the arm, wrist, and hand using the chart
- Questions to ask yourself?
  ➢ Is the patient able to resist any force I apply to the arm, wrist or fingers?
  ➢ Is the patient complaining of “tightness” in the arm?
  ➢ Is the patient complaining of numbness and tingling/pins and needles sensations?
  ➢ Can the patient tell the difference between sharp and dull?
Discrimination of Sensation

- Definition:
  - Tactile discrimination, as the name would imply, is the ability to discriminate between sensations by touch.
  - In other words, tactile discrimination is the ability of the mind to process information gained through the sense of touch.
  - Usually 2 point discrimination is used to assess patients’ ability to identify sharp and dull sensations.

How to Test for Discrimination

Poll Question: Do you know how to test for 2 point discrimination?

- Yes
- No
- I don’t know
Nursing Interventions

- Check for tightness of bandages, splints and loosen if possible
- Reposition the arm and reassess in 15 minutes to see if the sensation/motor function has improved
- Place the arm at the level of the heart—may have to remove pillows to obtain
- Contact physician/NP/PA and inform of the neurovascular findings
- Continually assess and if at change of shift, bring oncoming nurse in to do the same assessment—hopefully, the finding will be the same!

Compartment Syndrome of Upper Extremity

- Classic 6 P’s of compartment syndrome—
  - Pain out of proportion to injury
  - Pressure—skin feels too small for arm
  - Parasthesias—numbness & tingling
  - Paralysis
  - Pallor
  - Pulselessness

Treatment

- Surgical fasciotomy is only definitive treatment to relieve elevated pressures that are causing compression of the nerves
 Clinically important dermatomes
Lower Extremity

- L3 - Knee
- L4 - Medial malleolus
- L5 - Dorsum of foot
- L5 - Toes 1-3;*** first web space
- S1 - Toes 4 and 5; lateral malleolus

Main Nerves of the Lower Extremity

- Tibial
- Peroneal
  - Common
  - Deep
- Sural**
- Saphenous

**Used as sensory marker
Peroneal Nerve Injury/Dysfunction

- **Common causes**
  - Trauma or injury to the knee
  - Fracture of the fibula (a bone of the lower leg)
  - Use of a tight plaster cast (or other long-term constriction) of the lower leg
  - Crossing the legs regularly
  - Regularly wearing high boots
  - Pressure to the knee from positions during deep sleep or coma
  - Injury during knee surgery or from being placed in an awkward position during anesthesia

**Physical Exam Findings**

- Inability to point toes toward the body (dorsiflexion)
- Pain
- Weakness, especially of extensor hallucis longus - large tendon on top of foot
- Numbness (on the shin or top of the foot) or of the first web space of the foot
- Loss of function of foot
- High-stepping walk (called steppage gait or foot drop gait)
Compression Injury

Sequela of Peroneal Nerve Injury

Tibial Nerve

- The tibial nerve is responsible for foot plantar flexion
- Ask the patient to “put their foot on the gas” then assess the amount of resistance the patient exerts against your hand
Tibial Nerve Injury/Dysfunction

- Direct trauma
- Pressure on the nerve for a long period of time
- Pressure on the nerve from nearby body structures
- Nerve diseases such as Charcot Marie tooth

Entrapment Syndrome

Physical Exam Findings

- Numbness on bottom of foot
- Inability to plantar flex foot
- Inability to tip toe
Sequela of Tibial Nerve Injury

- Inability to curl the toes, push the foot down, or twist the ankle inward
- Weakness
- In severe cases, the foot muscles may become very weak and the foot may be deformed.

Posterior Tibial-Anterior Tibial Artery

- Anterior tibial artery is the pedal pulse
  - It is NOT the primary blood supply to the foot
  - Patients are often born without a palpable pulse and is normal for them
- Posterior tibial artery IS the main blood supply to the foot and MUST be assessed with every neurovascular exam
  - Palpated behind the medial malleolus
- These also get graded as 1+, 2+ etc

What’s a Nurse to Do?
Nursing Interventions

- Check for tightness of bandages, splints and loosen if possible
- Reposition the leg and reassess in 15 minutes to see if the sensation/motor function has improved
- Place the leg at the level of the heart - may have to remove pillows to obtain
- Contact physician/NP/PA and inform of the neurovascular findings
- Continually assess and if at change of shift, bring oncoming nurse in to do the same assessment – hopefully, the finding will be the same!

Compartment Syndrome of the Lower Extremity

- Classic 6 P’s of compartment syndrome -
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  ➢ Paralysis
  ➢ Pallor
  ➢ Pulselessness

Treatment

- Surgical fasciotomy is only definitive treatment to relieve elevated pressures that are causing compression of the nerves
Take Away Messages

• Technically, there should be 15 separate boxes on your documentation sheet to document both sensory and motor function as well as strength of the following nerves/arteries
  ➢ Radial
  ➢ Medial
  ➢ Ulnar
  ➢ Common/deep peroneal
  ➢ Tibial
  ➢ Radial/Ulnar pulses
  ➢ Posterior and anterior tibial pulses

Poll question: Does your organization’s EHR have blocks to document separate motor and sensory function?

• Yes
• No
• I don’t know

Take Away Messages continued

• Test muscle strength or amount of resistance patient exerts
  ➢ Any decrease indicates impending nerve damage
• Consistently document neurovascular function
• Have oncoming and off going nurses assess patient together to make sure exam findings are the same
  ➢ Called inter-rater reliability
• If compartment syndrome suspected, bring extremity to level of heart. NO ELEVATION!!
Finally............

• Advocate for your patients!!!
  ➢ Don’t be afraid of the doctor yelling at you!!!
  ➢ The worst thing that can happen is that you get yelled at!!
• Make sure your report to the MD/NP/PA is concise, accurate, and timely
• If you do not get help, do not hesitate to contact house supervisor or the administrator on call
• Only YOU, as the bedside nurse, can make sure that your patient receives the care required to prevent horrible complication including loss of limb!

Thanks!!!!!!!

• Any questions????
• Please feel free to contact me for any questions you may think of
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References

References


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