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Neurological assessment

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Abstract Neurological system assessment is an important skill for the orthopaedic nurse because the nervous system has such an overlap with the musculoskeletal system. Nurses whose scope of practice includes such advanced evaluation, e.g. nurse practitioners, may conduct the examination described here but the information will also be useful for nurses caring for patients who have abnormal neurological assessment findings. Within the context of orthopaedic physical assessment, possible neurological findings are evaluated as they complement the patient's history and the examiner's findings. Specific neurological assessment is integral to diagnosis of some orthopaedic conditions such as carpal tunnel syndrome. In other situations such as crushing injury to the extremities, there is high risk of associated neurological or neurovascular injury. These patients need anticipatory examination and monitoring to prevent complications. This article describes a basic neurological assessment; emphasis is on sensory and motor findings that may overlap with an orthopaedic presentation. The orthopaedic nurse may incorporate all the testing covered here or choose those parts that further elucidate specific diagnostic questions suggested by the patient's history, general evaluation and focused musculoskeletal examination. Abnormal findings help to suggest further testing, consultation with colleagues or referral to a specialist.

Editor comments
This paper is the third in our Assessment Series and provides a really useful overview of neurological assessment related to trauma and orthopaedic nursing practice. It is of the utmost importance that nurses have the knowledge and skill to carry out anticipatory assessment and monitoring to facilitate prompt detection of neurological changes. This might include the onset of confusion or diminished sensation and/or movement following orthopaedic surgery, trauma and following application of casts, external fixators, splints or traction.
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Introduction

Neurological system assessment is an important skill for the orthopaedic nurse because the nervous system has such an overlap with the musculoskeletal system. Nurses whose scope of practice includes such advanced evaluation (e.g. nurse practitioners) may conduct the examination described here. However, the information will also be useful for nurses caring for patients who have abnormal neurological assessment findings. Within the context of orthopaedic physical assessment, possible neurological findings are evaluated as they complement the patient's history and the examiner's findings. Although the patient may complain of a musculoskeletal problem, the challenge is to determine whether the symptoms originate in bone, muscle, tendon or ligament; or whether these symptoms are due in part or completely to a central or peripheral nervous system problem. The context for the examination described below is the patient who presents with a musculoskeletal problem and/or stabilized traumatic injury that warrants neurological evaluation. Multiple trauma patients and those being urgently evaluated in the prehospital setting will require a more targeted assessment protocol; see Parker and Magnusson (2016) and Joyce et al. (2015).

This article describes a basic neurological assessment; emphasis is on sensory and motor findings that may overlap with an orthopaedic presentation. Musculoskeletal problems such as decreased range of motion, or age related changes such as decrease in muscle strength, should be considered in evaluation of findings. Many tests can be modified to accommodate these issues. The orthopaedic nurse may incorporate all the testing covered here or choose those parts that further elucidate specific diagnostic questions suggested by the patient's history, general evaluation and focused musculoskeletal examination. Abnormal findings help to suggest further testing, consultation with colleagues or referral to a specialist.

Whatever your clinical setting or position, you will need to make decisions about abnormal findings; Is this urgent/non-urgent? Should you contact the primary care provider/orthogeriatrician/attending physician immediately? If you are triaging in a clinic or office setting, does the patient need to be seen today? Do they need to go to the Emergency Department now? Should you wait to see if the symptoms change in an hour? A day? What is the relationship of these symptoms/changes to the patient's presenting problem/diagnosis?

Neurological history

An organized approach to obtaining a history is essential and an excellent template is presented in the introductory article of this series (Flynn et al., 2015). Patient responses to questions and description of symptom(s) may suggest neurological as well as musculoskeletal involvement. If so, consider asking additional questions about associated neurological symptoms such as headache, nausea, vomiting, difficulty swallowing or speaking, dizziness, vertigo, numbness, weakness, involuntary movements and visual disturbances (Crimlisk and Grande, 2004; Oommen, 2013). Pain presentation suggesting neurological involvement may include quality descriptors such as tingling and stinging. The patient may describe pain radiation along dermatomes. As a significant percentage of orthopaedic patients are older adults, it is important to consider neurological impairments that increase fall risk. These include disorders of balance, gait, lower extremity weakness or sensory loss (Thurman et al., 2008).

Neurological examination

The basic neurological examination includes evaluation of both the central and peripheral nervous systems. The central nervous system (CNS) consists of the brain and the spinal cord. CNS testing includes complex higher functions such as gait, speech, and mental status (Oommen, 2013) as well as sensory and motor information. The cerebellum coordinates movement and maintains posture by integrating sensory input and sending unconscious feedback along the motor pathways. Sensory pathways of the CNS include the Spinothalamic Tract (pain, temperature, light touch) and the Posterior (Dorsal) Columns (position, vibration, more finely localized touch). Motor pathways include the Corticospinal (Pyramidal) Tract (discrete, purposeful, voluntary movement) and the Extrapyramidal Tracts (maintain muscle tone, control gross automatic movement) (Jarvis, 2016).

The peripheral nervous system includes the 12 cranial nerves and 31 spinal nerves. The cranial nerves enter and exit directly from the brain. Some cranial nerves contain both sensory and motor fibres while others are strictly sensory or motor. The spinal nerves enter and exit from the spinal cord. The spinal nerves contain both sensory (afferent) and motor (efferent) fibres and are named for the region from which they exit (cervical, thoracic, lumbar, sacral, coccygeal). Each spinal nerve forms a discrete loop that can be assessed by testing the reflex arc of the loop.

A dermatome is a delineated skin area mainly supplied from one spinal cord segment through its corresponding spinal nerve although there is significant