

Assessment of Neuromuscular Conditions Using Ultrasound



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KEYWORDS

• Ultrasound • Shoulder • Elbow • Wrist • Nerve • Tendon • Elastography

KEY POINTS

- Pain is commonly reported in persons with spinal cord injury.
- Ultrasound is inexpensive, portable, and accessible.
- Ultrasound has been shown to be a useful imaging modality for nerve, muscle, and tendons in the able-bodied population.
- Ultrasound has been used to assess for changes in the spinal cord–injured population before and after exercise so that early changes can be found and intervention can be preventative.
- Newer measures, including elastography, have the potential to facilitate diagnosis and allow earlier detection of pathology.

INTRODUCTION

No two spinal cord injuries are exactly the same.^{1–29} Not only are there significant differences in those with cervical, thoracic, and lumbar injuries, and complete and incomplete injuries, but there are many individual differences in patients with the same type of injury. Persons with a spinal cord injury (SCI) have reported various musculoskeletal pains that can occur early on or more remotely from the injury. The frequency and risk of certain types of musculoskeletal pain are increased in certain injury levels; up to 73% of persons with an SCI may suffer some form of musculoskeletal pain during their lifetime.³⁰ Most of the musculoskeletal injuries suffered are non-traumatic in origin, and a result of poor posture and overuse.³⁰ Therefore, most of

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these injuries and pain syndromes can be treated medically through rehabilitation, and may even be prevented through education on proper body mechanics, posture, and simple balancing exercises. Here, we outline the scope of the problem, and discuss how, with improvements in technology, ultrasound (US) is changing the way we assess these complaints. We also will address some of the newer data on differences in musculoskeletal structures that can be seen in anatomic structures in the SCI population when compared with the able-bodied population.

NATURE OF THE PROBLEM

After SCI, the upper extremities (UEs) are often called on to become weight-bearing limbs. This is seen in those who now need to use their arms for transfers, positioning, pressure reliefs, and locomotion. The increased use of the UEs in wheelchair propulsion, transfers, and activities of daily living is believed to increase the incidence of injury to the shoulders, elbows, and wrists.³¹ The structures involved include tendons/ligaments, nerves, and joints. Although some of these issues may be acute and short lived, many often progress to chronic problems. In patients with SCI, 69% to 76% report pain in the UEs, most often the shoulders.³² The incidence of pain in the UE has been well characterized and shows the following:

- Shoulder pain ranges between 30% and 73%^{32–36}
- Elbow pain is approximately 32%³⁷
- Wrist and hand pain ranges between 30% and 64%^{33,35,38,39}

This is most likely the result of the inability of the person with SCI to rest the affected structure because he or she is now more dependent on the UEs. Chronic injuries can be a significant source of increased disability in this population. Treatments may require time and even surgery. These chronic injuries can interfere with mobility and transfers. As a result, it is important to address these issues as soon as possible.

POSSIBLE AFFECTED STRUCTURES

Muscles/Tendons and Joints

Overuse of tendons and ligaments is one of the major issues when the UE becomes a weight-bearing structure. The sheer and effects of gravity can affect multiple structures. These in turn can affect the bones and joints. These overuse musculoskeletal injuries carry a significant morbidity in this population. Any structure in the UE has the potential of being injured with the new demands of transfers, wheelchair propulsion, and pressure releases. These structures may be only mildly injured, as in tendinitis or strains, or more seriously damaged, as in a tear. Although many of these injuries may be self-limited in able-bodied persons, this is less likely the case, as it is more difficult to rest the injured area in the SCI population and an acute tendinitis can develop into a chronic tendinosis. A list of the muscles and tendons commonly affected is seen in **Box 1**.

Nerves

Although we see a significant number of musculoskeletal injuries as mentioned previously, neurologic injuries also play a role in contributing to pain in persons with SCI. These injuries may be difficult to diagnose as a result of their symptoms. Many persons with SCI have residual numbness and tingling, which is a common symptom of early peripheral nerve disease and may, therefore, mask the development of peripheral nerve problems. For instance, persons with C6 or C7 tetraplegia may have hand numbness and tingling at the level of injury, which may mask the early symptoms of

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