

# Shoulder Ultrasound Abnormalities, Physical Examination Findings, and Pain in Manual Wheelchair Users With Spinal Cord Injury

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**ABSTRACT.** Brose SW, Boninger ML, Fullerton B, McCann T, Collinger JL, Impink BG, Dyson-Hudson TA. Shoulder ultrasound abnormalities, physical examination findings, and pain in manual wheelchair users with spinal cord injury. *Arch Phys Med Rehabil* 2008;89:2086-93.

**Objectives:** To investigate the presence of ultrasound (US) abnormalities in manual wheelchair users with spinal cord injury (SCI) using a quantitative Ultrasound Shoulder Pathology Rating Scale (USPRS). To investigate physical examination (PE) findings using a quantitative Physical Examination of the Shoulder Scale (PESS), and to obtain data about pain and other subject characteristics such as age, years with SCI, and weight.

**Design:** Case series.

**Setting:** National Veterans' Wheelchair Games 2005 and 2006.

**Participants:** Volunteer sample of manual wheelchair users with SCI participating in the National Veterans' Wheelchair Games.

**Interventions:** Not applicable.

**Main Outcome Measures:** Presence of relationships between US findings, PE findings, pain, and subject characteristics.

**Results:** The USPRS correlated with age, duration of SCI, and weight (all  $P < .01$ ), and showed a positive trend with the total Wheelchair User's Shoulder Pain Index (WUSPI) score ( $r = .258$ ,  $P = .073$ ). Several US findings related to presence of PE findings for specific structures. The PESS score correlated with the WUSPI ( $r = .679$ ,  $P < .001$ ) and duration of SCI ( $P < .05$ ). The presence of untreated shoulder pain that curtailed activity was noted in 24.5% of subjects, and this was related to increased WUSPI scores ( $P = .002$ ).

**Conclusions:** PE and US abnormalities are common in manual wheelchair users with SCI. The USPRS and PESS demonstrated evidence for external validity and hold promise as research tools. Untreated shoulder pain is common in manual wheelchair users with SCI, and further investigation of this pain is indicated.

**Key Words:** Rehabilitation; Shoulder; Spinal cord injuries; Ultrasonography; Wheelchairs.

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MANUAL WHEELCHAIR USERS have increased demands placed on the structures of the shoulder. In addition to neuropathic phenomena, many factors contribute to mechanical shoulder stress. Activities such as transferring the wheelchair in and out of vehicles, bathing, and even dressing contribute to stress on the shoulders. The mechanical forces created by increased intra-articular pressure and repetitive motions necessitated by manual wheelchair mobility are believed to contribute to the development of shoulder pain, impingement syndromes, and rotator cuff injuries.<sup>1,2</sup> Weakness in specific muscles can cause an imbalance in the forces placed on the rotator cuff as well as lead to shortening of antagonists to weak muscles.<sup>3,4</sup> Another proposed source of increased demand on the shoulders is overuse of structures that compensate for weakness in other muscle groups.<sup>4</sup> Persons with tetraplegia use alternative muscle groups for the lost contribution of the normative primary movers for a given task; an example of this phenomenon would be a person with C6 tetraplegia performing inferior reach. This leads to compensatory use of rotator cuff muscles to perform the task previously accomplished by prime movers.<sup>5</sup> Established risk factors for shoulder pain in persons with SCI include increased body mass index, duration of injury, and age.<sup>6</sup>

Investigations have been conducted to identify ways of reducing shoulder related complaints in the wheelchair-using population. Examples of this include identifying which wheelchair propulsion techniques may contribute to progression of shoulder pathology<sup>7</sup> and improving wheelchair design. Despite

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## List of Abbreviations

AC	acromioclavicular
MRI	magnetic resonance imaging
PE	physical examination
PESS	physical examination of the shoulder scale
SCI	spinal cord injury
US	ultrasound
USPRS	ultrasound shoulder pathology rating scale
WUSPI	Wheelchair User's Shoulder Pain Index