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Original Article

Sonographic findings of painful hemiplegic shoulder after stroke

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Abstract

Background: Hemiplegic shoulder pain is common in stroke patients and can influence rehabilitation outcome. The underlying pathology can be various: in addition to impaired motor control and altered peripheral and central nervous activity, soft tissue lesions may also play an important role. It remains unclear how these pathologies may interact or correlate with each other.

Methods: This retrospective study collected data from 26 stroke patients who received sonography examination due to shoulder pain. Severity of soft tissue lesion over the shoulder joint was graded on the basis of the sonographic findings. The information regarding cognition, sensory function, spasticity (measured by the Modified Ashworth Scale) and the Brunnstrom stage of motor recovery was collected though medical chart review. This study examined the association between sonographic findings and the clinical findings.

Result: This study showed that sonographic grading of painful hemiplegic shoulder is not statistically associated with impaired cognition and sensory function. (P value = 0.0587 and 0.9776, respectively) In addition, there is no correlation between sonographic grading and motor recovery in patients with hemiplegic shoulder pain. (Spearman's correlation coefficient = −0.0053, P value = 0.9796) Neither is there any statistically significant correlation between sonographic grading and the degree of spasticity. (Spearman's correlation coefficient = −0.0311, P value = 0.8801).

Conclusion: The results of this study suggests that the mechanism through which soft tissue lesions causes hemiplegic shoulder pain may be independent of the mechanisms through which changes of muscle tone and nervous activity causes shoulder pain.

Keywords: Hemiplegia; Shoulder pain; Sonography; Stroke

1. Introduction

Shoulder pain is a common clinical consequence of stroke. Previous studies have reported an incidence of shoulder pain after stroke ranging from 9% to 73%.[1,2] Shoulder pain can occur as early as 2 weeks after stroke, but typically occurs 2–3 months after stroke.[3] The median pain score is most severe at 4 months following stroke.[4] The degree of pain can be moderate to severe, and may intensify at night. It has been reported that shoulder pain is associated with depression, disturbed sleep, and a reduced quality of life.[5,6] Hemiplegic shoulder pain is also associated with prolonged length of hospital stay and poor recovery of arm function during the first 12 weeks of illness.[7]

Due to the various possible underlying pathogeneses involved in the development of hemiplegic shoulder pain, the precise etiology is difficult to assess. Kalichman et al.[5] performed a systematic review regarding associated factors and underlying pathology of hemiplegic shoulder pain. They proposed a systemization for pathologies underlying hemiplegic shoulder pain, which includes impaired motor control (change of muscle tone), altered peripheral and central nervous activity, and soft tissue lesions. These underlying pathologies may

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occur separately or simultaneously. In addition, each pathology may initiate the development of another. It remains unclear how these pathologies may interact or correlate with each other.

Therefore, in order to clarify the associations between the factors that might cause hemiplegic shoulder pain the evaluation of soft tissue lesions is key. The standard imaging modalities for evaluating soft tissue lesions of shoulder region are arthrography and magnetic resonance imaging.[8,9] However, both types of examinations take a long time and cost a large amount of money. In addition, neither of these two imaging modalities is indicated for stroke patients due to limited and intolerable positioning. Sonography on the other hand is a noninvasive method for evaluating soft tissue lesions that is a quick procedure which provides real-time and dynamic evaluation of multi-planar structures and movements.

Therefore, the goal of this study was to examine the sonographic findings of painful hemiplegic shoulder in stroke patients. This study also investigated the association between sonographic findings and clinical findings including cognition, sensory function, spasticity, and motor recovery.

2. Methods

2.1. Study population

This study retrospectively collected data from stroke patients who received sonographic evaluation of their shoulder joint due to shoulder pain between January 2015 and December 2015. Patients with a diagnosis of a new-onset stroke within the previous 6 months were included. Patients were excluded if radiographic examination revealed any humeral fracture or shoulder dislocation.

2.2. Sonographic examination

Shoulder sonographic examinations were performed using a 4.4−13.0 MHz linear transducer (Acuson X300 Ultrasound System, premium edition, Siemens) by three physicians certified by the Taiwan Society of Ultrasound in Medicine. The sonography examination followed a sequence of steps described by previous studies to ensure a complete and thorough evaluation.[10,11] The assessed soft tissues included the long head of the biceps brachii tendon, supraspinatus tendon, subscapularis tendon, infraspinatus tendon, and subacromial-subdeltoid (SA-SD) bursa. Patients underwent the sonography examinations while sitting in their wheelchairs.

The severity of soft tissue lesions over the shoulder joint can be classified by a grading system proposed in previous studies on the basis of the sonographic findings. The grading system is described as follows: grade 1, normal or effusion of the biceps tendon sheath; grade 2, tendinosis of the supraspinatus; grade 3, SA-SD bursitis; grade 4, a partial-thickness tear of the rotator cuff; and grade 5, a full-thickness tear of the rotator cuff. The cases with two or more abnormal sonographic findings were graded on the basis of the most severe finding.[12,13]

2.3. Physical examination

This study collected information regarding clinical findings including cognition and sensation, as well as the spasticity and motor recovery of the affected upper limb. The data were collected through medical chart review. The study variables were measured. Cognitive function was evaluated by assessing judgment, orientation, memory, abstract thinking, and calculating ability. Any impairment of such dimensions of cognition was defined as impaired cognitive function. Sensory function included pinprick sensation, light touch sensation, and proprioception over the hemiplegic side. Any impairment of such dimensions was defined as impaired sensory function. Spasticity was evaluated using the Modified Ashworth Scale, an ordinal scale ranging from 0 to 4, in which 0 refers to no increase in muscle tone; 1 refers to slight increase in muscle tone; 2 and 3 refer to more and considerable increase in muscle tone, and 4 refers to rigid in flexion or extension.[2] Brunnstrom stage was used to evaluate stroke recovery. It consists of seven stages: stage 1, flaccidity with no movement of the affected muscles; stage 2, passive movement and spasticity occur; stage 3, active movement and spasticity occur; stage 4, spasticity decreases and significant motor control emerges; stage 5, spasticity wanes and complex movement develops; stage 6, coordination reappears and spasticity is no longer present; and stage 7, normal function returns and full control of muscle movement is restored.

2.4. Data analysis

This study investigated the correlation between sonographic grading and clinical findings including cognitive function, sensory function, motor recovery (measured by Brunnstrom stage), and spasticity (measured by the Modified Ashworth Scale). The correlations between sonographic grading and cognitive function as well as sensory function were analyzed using the Wilcoxon (Mann−Whitney) rank-sum test. The correlations between sonographic grading and Brunnstrom stage as well as the Modified Ashworth Scale were analyzed using the Spearman's rank correlation test. Statistical significance was defined as $P < 0.05$. Statistical analyses were performed using STATA software (STATA IC 14.2, College Station, TX, USA).

3. Results

A total of 26 patients were included; their mean age was 66.52 years (range: 38.5−90.9 years). Among the patients, 18 were male and 8 were female. Twenty patients had cerebral infarction and 6 had cerebral hemorrhage. Ten patients had right hemiplegia and 16 had left hemiplegia. Shoulder sonography was performed at a mean of 78.15 days after stroke. The characteristics of the study population are shown in Table 1.

All of the 26 patients included in this study presented with at least one abnormal sonographic finding. In addition, more than two-thirds of the patients (N = 18) had more than one