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ORIGINAL ARTICLE

Ultrasonographic and clinical study of post-stroke painful hemiplegic shoulder

Rania E. Mohamed [a,*], Mohamed A. Amin [a,1], Ashraf A. Aboelsafa [b,2]

[a] *Radiodiagnosis Department, College of Medicine, Tanta University Hospitals, El-Gharbia governate, Tanta, Egypt*
[b] *Neurology Department, College of Medicine, Tanta University Hospitals, El-Gharbia governate, Tanta, Egypt*

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KEYWORDS

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Abstract *Aim of the work:* To describe the structural abnormalities of the painful hemiplegic shoulder (PHS) by ultrasound (U/S) and their relationship with some clinical variables.
Materials and methods: Eighty consecutive patients with post-stroke PHS were subjected to both clinical assessment and ultrasonographic examination of both shoulders. Ultrasonographic imaging data were classified into five grades.
Results: The biceps tendon sheath effusion (51.25%) and the SA–SD bursitis (43.75%) were the most frequent abnormalities in the affected painful shoulder. No significant relationship ($P = 0.114$) was found between the U/S grades of the painful hemiplegic shoulder and the Brunnstrom motor recovery stages. Ultrasonographic grades of the unaffected shoulder were significantly correlated with the stroke duration ($P < 0.001$), the Brief Pain Inventory score ($P < 0.05$), shoulder pain duration ($P < 0.001$), and degree of spasticity ($P < 0.001$).
Conclusion: Ultrasonography is an essential method in evaluation of post-stroke PHS. However, the U/S grades were not correlated with the stages of motor recovery. Avoiding overuse of the unaffected shoulder will be helpful for prevention of shoulder injuries following hemiplegic stroke.

1. Introduction

Stroke is a medical emergency that can cause permanent neurological damage (1). Pain in the hemiplegic shoulder, which is one of the most common and distressing complications that patients may experience after stroke, has an incidence that ranges widely from 5% to 84% (2). The early onset of the painful hemiplegic shoulder (PHS) may hamper the rehabilitation process because patients avoid painful shoulder movement and withdraw from active rehabilitation, thus reducing the effectiveness of any motor restoration technique (2,3). The exact etiology of post-stroke shoulder pain remains unknown (4) and, most commonly many factors were involved (5).

Abbreviations: PHS, painful hemiplegic shoulder; U/S, ultrasound; SA–SD, subacromial–subdeltoid; BPI, Brief Pain Inventory; ROM, range of motion; RS, recovery stage

* Corresponding author. Tel.: +20 1011756464.
E-mail addresses: Rany1997@Yahoo.Com (R.E. Mohamed), mohamin73rad@yahoo.com (M.A. Amin), draboelsafa@hotmail.com (A.A. Aboelsafa).
[1] Tel.: +20 1005359186.
[2] Tel.: +20 1006622792.

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Epidemiological and radiological studies, previously performed to identify the possible causes of PHS, have described neurological abnormalities including thalamic pain (6), shoulder muscle spasticity or flaccidity (7), and sympathetic dystrophy (8) as well as orthopedic abnormalities including impingement, rotator cuff tears, supraspinatus tendinosis, subacromial–subdeltoid bursal effusion, tendon sheath effusion of biceps long head and adhesive capsulitis (9,10). The PHS may interfere with functional improvement, the patient quality of life, and it may impede the process of rehabilitation (11).

Radiological methods are the most appropriate tools in the evaluation of shoulder pain, particularly when examining bony structures and joint subluxation is suspected. However, these methods cannot be used to examine soft tissue lesions (11). The primary noninvasive methods to diagnose shoulder pain and rotator cuff abnormalities are sonography and magnetic resonance imaging (MRI). However, it is difficult to perform shoulder MRI or MR arthrography in stroke patients with hemiplegia because of limited and intolerable positioning of the patients. Although there are some limitations in the usual dynamic examination of such patients, sonography is a noninvasive, widely available, and inexpensive imaging technique that can be used for the soft-tissue assessment. It combines direct multiplanar structural evaluation with dynamic investigation of movement, thereby providing both anatomic and functional elements to the assessment (12). Furthermore, high frequency ultrasonography established its role in the demonstration of different pathologies of the shoulder girdle complex that is difficult to identify by clinical examination (5).

The aim of this work was to describe the structural abnormalities of both the painful hemiplegic shoulder and the contralateral unaffected shoulder by ultrasound (U/S), in post-stroke patients. Additionally, we aimed to study the relationship of the U/S imaging grades of the painful hemiplegic shoulder with some clinical variables and the Brunnstrom motor recovery stages.

2. Patients and methods

This study was performed in the period between January, 2013 and October, 2013 on both shoulders (the painful hemiplegic shoulder and the contralateral unaffected shoulder) of 80 consecutive patients with hemiplegic shoulder pain; their ages ranged from 35–75 years (mean 62.29 ± 8.93 years), referred from the Neurology department of our institution. The study included patients with first flare of shoulder pain within 1 year after 1st attack of stroke which resulted in hemiplegia and who had not experienced shoulder pain in both shoulders in the 6 months before the stroke. Exclusion criteria included history of previous shoulder injuries or surgery, history of previous steroid injection in the affected shoulder, neuromuscular disorders associated with shoulder weakness and/or pain (e.g., cervical disk disease), markedly limited range of motion so far as to hinder ultrasonographic evaluation, and severe cognitive impairment that impeded communication. The diagnosis of stroke had been made in all patients on the basis of patient history and clinical examination that was confirmed by the data of either CT or MRI. All patients were subjected to both clinical assessment and ultrasonographic examination of both shoulders. A written consent was obtained from all the patients or their caregivers. The local institutional ethics board approval for this study was also obtained.

2.1. I-clinical assessment

Different clinical variables in eligible patients were evaluated. These variables included age, sex, handedness, type of stroke, duration of stroke, severity of hemiplegic shoulder pain, duration of shoulder pain, range of motion in the shoulder joints, degree of spasticity in the hemiplegic upper limb, composite muscle power score, and the level of functional activity (motor recovery after stroke).

The severity of pain in the PHS was quantified with the Brief Pain Inventory (BPI). The patients were asked to rate their shoulder pain in the last 7 days on a numeric ratio scale from 0 to 10 points, where "0" indicates no pain and "10" indicates pain as worse as the patient can tolerate (13,14). Range of motion (ROM) in both shoulders was examined in abduction, forward flexion, external rotation, internal rotation, adduction and extension. Limited ROM was present when the patient was not able to perform full ROM in either one of these directions. Spasticity was evaluated by using the 5-point Ashworth scale. The presence of shoulder spasticity was defined as an Ashworth scale score of $\geqslant 1$ (15). The composite muscle power scoring was done according to the Medical Research Council (MRC) scoring system. This system grades the patient effort on muscle power examination on a scale of 0–5; where "0" indicates no movement observed and "5" indicates that the muscle contracts normally against full resistance (16).

The level of functional activity and motor recovery of the affected hemiplegic upper limb was assessed by the Brunnstrom staging. The lowest stage; flaccid stage with no voluntary movement (flaccid limb) is stage 1, and the highest stage; isolated joint movement and no longer spasticity, allowing near-normal movement and coordination, is stage 6 (17,18). We abbreviated the 6 Brunnstrom stages into 3 stages by combining two adjacent stages (stages 1–2, 3–4, and 5–6) according to the similarity of the effect of hemiplegic shoulder movement, so the patients were classified into 3 groups: the first, second and third recovery stages (RS1, RS2 and RS3, respectively).

2.2. II-ultrasonography

Ultrasonographic examination was done by radiologist who has an experience in musculoskeletal sonography and unaware of the clinical details of the patients. Both shoulders in all patients were examined (the affected painful hemiplegic shoulder and the contralateral unaffected shoulder). Ultrasonographic examination was performed, using a linear array transducer of 12 MHz frequency connected to a real-time ultrasound machine (Biomedical P-K, Denmark) with optimized settings, for the assessment of the long head of biceps tendon, the rotator cuffs, and subacromial-subdeltoid bursa (SA–SD bursa) of both shoulders. Most of patients underwent shoulder sonography while seated on a wheelchair, using the usual scanning techniques as previously reported by Moosikasuwan et al. and Teefey et al. (19,20). However the usual techniques were difficult for hemiplegic patients because of limits in movements, so we examined the shoulder in position