The application of sonography in shoulder pain evaluation and injection treatment after stroke: a systematic review

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Abstract. [Purpose] This review article is designed to expose the application of sonography in shoulder pain after stroke. [Methods] A range of databases was searched to identify articles that address sonography examination, with or without ultrasound guided corticosteroid injection for hemiplegic shoulder pain (HSP). The electronic databases of PubMed, CENTRAL, CINAHL, Cochrane Library, Medline were searched. [Results] According to the articles identified in our databases research, sonographic technique has potential to provide objective measurements in patients with HSP. The main sonography finding of HSP included subacromial subdeltoid (SASD) bursal effusion, tendinosis of the supraspinatus and subscapularis tendon, long head of biceps tendon sheath effusion, and shoulder subluxation. Our analysis also revealed significantly decreased pain score (VAS) and increased passive external rotation degree in the steroid injection group than control group. [Conclusion] The sonography examination is useful for HSP assessment and ultrasound guided technique is recommended for HSP injection treatment.

Key words: Stroke, Shoulder pain, Ultrasound

INTRODUCTION

Hemiplegic shoulder pain (HSP) is one of the most common impairment after stroke1) with prevalence rates varying from 6.9% to 26% for point prevalence and up to 66.7% for lifetime prevalence in the general population2). The most painful and limited shoulder movement is usually lateral (external) rotation, followed by abduction3).

The associated factors of HSP include poor upper extremity function, shoulder motion limitation, shoulder subluxation, increased muscle tone on the shoulder, reflex sympathetic dystrophy, and rotator cuff injuries3-6). The standard imaging for assessing HSP are arthrography and shoulder magnetic resonance imaging7, 8), but these methods are time-consuming and expensive. Shoulder sonography is a convenient and inexpensive imaging tool for evaluating soft tissue injury among hemiplegic stroke patients9-11). Based on shoulder sonography, a high prevalence of periarticular soft-tissue injuries was reported in post stroke patients12, 13).

Corticosteroid injections are widely used for short-term pain relief for patients with shoulder pain14, 15). Ultrasound (US)-guided injections are widely used because of the advances in image quality, decreased cost of use, portability and lack of radiation exposure16). Recently US-guided injections showed greater accuracy than landmark technology for all shoulder pain treatment, with the exception of the target space17-19).

Here, we will review the current use of ultrasound evaluation for HSP and compare the benefit of US-guided steroid injection to placebo for shoulder pain after stroke.

METHODS

A range of databases was searched to identify articles that address sonography examination or ultrasound guided injection for hemiplegic shoulder pain (HSP). The search strategy involved entry of the word stroke with a combination of other words such as shoulder pain and (ultrasound or sonography or sonographic or injection). This is a narrative review and we choose the related high quality evidence based on our knowledge and experience. So, we were confident that we would be able to find the main answers to our question. The electronic databases of PubMed, CENTRAL, CINAHL, Cochrane Library, Medline were searched. This study also included randomized controlled trials (RCTs) comparing the clinical efficacy of steroid injection vs. placebo or other treatment options. Case series and case reports were excluded. Articles focusing on the comparison of therapeutic effect of intra-articular injection (IAI) vs. SSN were also excluded.
RESULTS AND DISCUSSION

The sonography finding of HSP after stroke

Subacromial subdeltoid (SASD) bursal effusion

Lee et al.20) used ultrasound to evaluate adequately the rotator cuff, the long head of the biceps tendon and tendon sheath, rotator cuff interval, subacromial subdeltoid (SASD) bursa, acromioclavicular (AC) joint, and posterior glenohumeral joint in all study patients. They found if fluid accumulation was observed in the SASD bursa, with an increased thickness of > 2 mm and hyperaemia as observed by power Doppler imaging, bursitis was confirmed. In Falsetti’s study the SASD bursal effusion rate was 26.6% in patients after brain injury21). In patients with increasing spasticity, high-grade sonographic findings, such as a rotator cuff tear or bursitis, were expected depicted on sonography20).

Tendinosis of the supraspinatus tendon

Supraspinatus tendon pathology was independent predictors of the development of HSP and was associated with HSP at the subacute and chronic stages during the first 6 months after stroke10). The sonographic signs of full-thickness cuff tear were described in detail by Ptasznik et al22). The incidence of tendinosis of the supraspinatus tendon after stroke is 42.2% in Falsetti’s study21). Patients are more prone to have morbidity rotator cuff injuries with increasing age due to greater magnitudes of weaknesses caused by stroke21). Enhanced muscle tone in the upper extremities following stroke may have a protective role against injury of supraspinatus tendon23).

Long head of biceps tendon sheath effusion

Long head of biceps tendon sheath effusion after acute stroke was very common abnormality observed with US examination21). Bicipital tenosynovitis was confirmed when a thickened hypoechoic area, with power Doppler flow, was found around the biceps tendon. Ultrasonography is a potential method in the evaluation of these changes in hemiplegic shoulder21). An anechoic area (> 2 mm) around the long head of the biceps tendon in the transverse and longitudinal views was interpreted as effusion in the biceps tendon sheath21). Collinger et al. investigated ultrasound changes of biceps and supraspinatus tendon appearance after an intense wheelchair propulsion task. The subjects were more likely to have a darker, diffuse tendon appearance with a longer duration of wheelchair use or immediately after the propulsion task20).

Shoulder subluxation

Subluxation of the affected shoulder in post-stroke patients is associated with nerve disorders and muscle fatigue. Kumar et al.20) assessed the intra rater reliability of acromion-greater tuberosity (AGT) distance in different arm positions. They found that ultrasonographic measurements of AGT distance have shown to be reliable and valid in the assessment of glenohumeral subluxation (GHS) in patients with stroke. Pop T27) also found that there was no subluxation of the shoulder on the healthy side, while on the paretic side, subluxation occurred in 25.3% of the patients. Shoulder subluxation in lateral distances is a predictor for supraspinatus tendonitis28). Ultrasonography is a quantitative method for evaluating the laxity and stiffness of the glenohumeral joint13).

Tendinosis of subscapularis tendon

The number of abnormal sonographic findings of the subscapularis tendon during the chronic stage was significantly higher than that during the acute stage28). The abnormal findings of subscapularis tendons for the shoulder sonographies were also found in Huang YC’s29) and Pong’s30) research. Repeated inappropriate stretching and passive range of motion (ROM) exercises often result in injury to these muscles. Shoulder stabilization exercise positively affects pain alleviation and functional recovery in shoulder pain patients31).

Other changes in sonography of HSP

Other changes in sonography of HSP include partial thickness tear of the rotator cuff, full thickness tear of the rotator cuff, and glenohumeral effusion16, 20, 21, 24). Generic painful shoulder is another interesting phenomenon. In Falsetti’s study some patients without subluxation or frozen shoulder, were classified as generic painful shoulder (even if there were no rotator cuff abnormalities). There are also no neurogenic heterotopic ossifications (NHO) could be observed in shoulders21).

The application of ultrasound-guided steroid injection treatment for HSP

We identified 292 articles, of which 3 RCTs19, 32, 33) conducted between 2000 and 2014 were eligible for this Meta analysis. All patients were randomized into one of the two technique groups: with or without ultrasound guided steroid injection group and placebo injection group. Pain score (VAS) of the patients who received steroid injection was significantly decreased than placebo group. The analysis also showed a significant increased passive external rotation degree in the steroid injection group than placebo group (Table 1). The risk of bias within the studies was medium due to bland of participants and personal bias and unknown quality.

Corticosteroid injections have been shown to be effective in the treatment of HSP in most studies19, 33). Recently, steroid injection for HSP through intra-articular, subacromial

Table 1. Main outcome compared steroid with placebo injection in HSP patients

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Measure</th>
<th>ES</th>
<th>95% CI</th>
<th>F²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased pain score (VAS) after injection</td>
<td>MD</td>
<td>0.73</td>
<td>0.15, 1.32</td>
<td>* 32%</td>
</tr>
<tr>
<td>Increased shoulder passive external rotation degree</td>
<td>MD</td>
<td>8.85</td>
<td>3.82, 13.87</td>
<td>* 0%</td>
</tr>
</tbody>
</table>

*p < 0.01
promote ultrasound technology in HSP assessment and ultrasound guided corticosteroid injection treatment.

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