



Original Research—CME

Inter-rater Reliability of Real-Time Ultrasound to Measure Acromiohumeral Distance

Tanya Anne Mackenzie, MSc, Alya H. Bdaiwi, MSc, Lee Herrington, PhD, Ann Cools, PhD

Abstract

Background: Real-time ultrasound (RTUS) has been suggested as a reliable measure of acromiohumeral distance. However, to date, no vigorous assessment and reporting of inter-rater reliability of this method has been performed with the shoulder in a neutral position or with active and passive arm abduction.

Objective: To assess intrasession inter-rater reliability of using RTUS to measure acromiohumeral distance with the shoulder in a neutral position and with 60° active and passive abduction.

Study Design: Inter-rater intrasession reliability of repeated measures.

Setting: Human performance laboratory.

Participants: Twenty persons (12 male and 8 female) with an average age of 29.86 years (standard deviation, 7.8).

Method: In an inter-rater, intrasession study, RTUS was used to measure the acromiohumeral distance with the shoulder in a neutral position and with 60° of both active and passive abduction.

Main Outcome Measure: Acromiohumeral distance.

Results: Intraclass correlation coefficient (ICC)_{2,1} scores ranged between 0.65-0.88 (standard error of the mean = 0.81-1.2 mm and minimal detectable differences with 95% confidence = 2.2-2.3 mm) for inter-rater intrasession reliability.

Conclusion: RTUS was found to have fair to good inter-rater reliability as a tool to measure acromiohumeral distance with the shoulder in a neutral position and with 60° of both active and passive arm abduction.

Introduction

In 1972, Neer [1] coined the term *subacromial impingement* and proposed a pathomechanical process in which mechanical compression of the soft tissues in the subacromial space occurred as a result of narrowing of the subacromial space. Because contact occurs between the upper surface of the supraspinatus tendon and the coracoacromial ligament during arm elevation, Neer proposed that any reduction of the subacromial space would lead to subacromial impingement syndrome (SAIS). It has been shown via radiograph that, at rest, the distance between the acromion and the humerus is on average 11 mm, and at 90° abduction, this distance is reduced to 5.7 mm on average [2]. Real-time ultrasound (RTUS) has also been used to quantify a reduction in acromiohumeral interval during arm abduction [3,4]. Using radiographs, an acromiohumeral distance (AHD) of

less than 6 mm was found to correlate with large rotator cuff tears [5]. Reduced AHD has been associated with subacromial impingement syndrome in participants compared with healthy control subjects in studies using RTUS, magnetic resonance imaging, and radiographs [6-9], and it has been proposed as a predictive marker [10]. Some authors have proposed that a measurement of the subacromial space may be a useful method of quantifying objectively the influence of inferior glenohumeral joint instability on AHD [11]. Performing an intervention to increase the AHD both surgically and with rehabilitation is common clinical practice. It is therefore important to evaluate this proposed pathogenic component of SAIS, and a portable, inexpensive, and clinically applicable method is warranted. RTUS has been proposed as an appropriate tool for this purpose.

In a systematic review of the literature reporting on reliable and clinically applicable methods to assess AHD,

McCreesh et al [12] concluded that strong evidence existed for the reliability of RTUS in measuring the AHD when compared with other radiologic methods. Despite this conclusion, research protocols reported in the literature to establish the reliability of using RTUS to measure AHD lack rigor and thorough reporting of statistical results. We found 9 articles [3,8,11,13-18] in which the authors examined intrarater reliability, and authors of only 2 of these articles [4,8] evaluated intertester reliability, namely Desmeules et al [4] and Piljs et al [8], both of whom reported their methods and statistical analysis incompletely. Although Piljs et al [8] report good inter-rater reliability of 0.70 (with a neutral shoulder position) and 0.64 (with a 60° abducted arm position) when measuring AHD, the authors do not report whether the abducted arm position was executed passively or actively. Desmeules et al [4] report intertester reliability of between $r = 0.86$ (with a neutral shoulder position) and 0.92 (with active 60° abduction) but only used 13 shoulders for the intertester reliability, resulting in an underpowered study with incomplete statistical validity. The small number of participants recruited means that the study lacks the ability to detect a clinically important effect and prevents reporting of the intraclass correlation coefficient (ICC) values with confidence [4]. Neither of the articles report standard error of the mean (SEM) values. A large SEM would indicate an imprecise estimate, and a small SEM would indicate a precise estimate [13]. The absence of SEM values prevents any estimation of how much samples would vary within a population. Minimal detectable change (MDC) is an important measurement, because it is the smallest difference that is clinically important for the measurement to be considered credible [13]—that is, the value above which differences are likely not to be due to measurement error. Furthermore, reporting the 95% confidence interval (CI) range is important to reporting the interval estimate for the population parameter [4], because it gives “the range of values used to estimate the true value of a population parameter” [14].

The rationale of using the 60° abducted arm position while evaluating AHD is worthy of debate. Peak rotator cuff activity is reported to occur between 30°-60° of abduction [15], because in this range the deltoid produces significant upward force on the humerus, which could narrow the AHD. Contact between the supraspinatus tendon and the biceps tendon with the coracoacromial ligament has been confirmed in cadaveric studies to occur between 45° and 60° of abduction [16]. Converging evidence from radiographs and MRI determined that the distal supraspinatus tendon was engaged between the greater tuberosity and the acromion as early as 30° of flexion and abduction [17]. Clinically, patients with impingement syndrome present with an arc of pain commencing at 60° arm abduction, and thus if this method is to be used to evaluate the scapular

position in symptomatic patients, it is likely that patients will not be able to hold the arm in more than 60° of abduction during measurement collection. The range of arm elevation in which reliable ultrasound (US) measure of AHD is possible is limited to 60° of elevation because of acoustic shadows in higher ranges of arm elevation. As a result, previous authors have suggested caution when interpreting measures taken of AHD with US in higher ranges of arm elevation [18]. It must be borne in mind that the extent to which the measurement of AHD in 60° of abduction can be extrapolated to influence the subacromial space in higher ranges of arm elevation is unclear.

Because RTUS is used in research to quantify AHD to evaluate AHD for the impact of surgical and rehabilitation interventions, it is important that its intertester reliability be ascertained, along with the potential real level of measurement error. The main aim of the present study was to establish the inter-rater reliability of using RTUS to measure AHD with the shoulder in a neutral position and in 60° of both active and passive abduction.

Methods

Estimated sample size was based on guidance by Walter et al [19], who suggest that with 2 raters, a significance level of .05, and a power of 80%, 19 samples are required to determine an ICC score of 0.7 (to interpret reliability indicative of a true p_0 versus an alternative ICC score of 0.9, indicating a p_1). In the present study, 10 voluntary participants were recruited (6 male and 4 female) with an average age of 29.86 (standard deviation [SD] 7.8) years, providing 20 shoulders to test. Participants were excluded from the study if they had cervical, shoulder, or elbow pain within 6 months before testing; previous fracture, surgery, or dislocation of the upper limb; scoliosis; a rheumatologic condition; or were pregnant. The difference between sides in measurements taken of the AHD with RTUS within this group were analyzed with paired t -tests. No significant side to side differences were found, with all P values exceeding .05, thus enabling data collected on a total of 20 shoulders to be used in reliability analysis. The Salford University Research Ethics Panel approved the study protocol. All participants provided written informed consent for testing.

A portable dynamic RTUS scanner MicroMaxx system with a 13-6 MHz linear transducer (HFL38/13-6 MHz, Fujifilm Sonosite Limited, Hitchin, United Kingdom) was used for US image capture. Preset parameters were used for musculoskeletal shoulder settings.

All participants were measured by 2 examiners. Both examiners had 2 years of experience with US in research collecting data on the shoulder to quantify the AHD. The participants' position was standardized, with participants seated on a customized armless chair with a short

Download English Version:

<https://daneshyari.com/en/article/2714852>

Download Persian Version:

<https://daneshyari.com/article/2714852>

[Daneshyari.com](https://daneshyari.com)