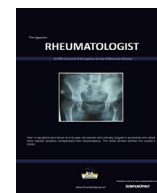




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Original Article

Role of ultrasound disease activity score in assessing inflammatory disease activity in rheumatoid arthritis patients

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ABSTRACT

Aim of the work: To evaluate role of ultrasound disease activity score (DAS) in assessing joint inflammation in rheumatoid arthritis (RA), and its correlation with disease parameters.

Patients and methods: Fifty RA were included. All patients were assessed for DAS-28, health assessment questionnaire disability index (HAQ-DI) and X-ray simple erosion narrowing score (SENS). Power Doppler (PD) and grey-scale (GS) US examination were done for all patients. PDUS score for synovitis in 22 joints and GS score for effusion/hypertrophy in 28 joints were included in US DAS calculation.

Results: The mean age of the patients was 43.9 ± 10.8 years; 46 females and 4 males and the mean disease duration was 8.7 ± 6.1 years. The mean DAS28 was 5.04 ± 1.2 and HAQ-DI was 1.2 ± 0.7 . The mean US DAS was 5.2 ± 1.3 (2.11–7.21). According to the US DAS, patients with high activity had significantly prolonged morning stiffness, higher swollen and tender joint counts, patient and physician global assessment, DAS-28, HAQ-DI, and SENS compared to those with moderate activity or low activity/remission. The mean US erosion count (USEC) was 8.9 ± 6.6 (0–18) and it was higher in patients with high disease activity ($p = 0.04$). A significant correlation was found between USDAS with DAS28 and HAQ-DI. US DAS showed moderate correlation ($r = 0.5$, $p = 0.001$), while USEC showed a strong correlation ($r = 0.8$, $p < 0.001$) with SENS.

Conclusion: US DAS is a feasible scoring system for use in daily rheumatologic practice. US DAS may reflect disease activity and disability. The association between US DAS and USEC with radiologic scoring reflects their ability to detect structural joint damage.

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1. Introduction

Rheumatoid arthritis (RA) is a chronic inflammatory disease which can lead to the destruction of the cartilage, bone and ligaments, causing deformity of the joints [1]. Rheumatoid arthritis has a major impact on the patients' lives and tends to have a profound impact on the health-related quality of life [2]. Genetic background was found to be associated with RA in Egyptian patients and was strongly linked to the increased production of anti-cyclic citrullinated peptide antibodies which contribute to the development, severity and activity of the disease [3].

Clinical scoring and grading methods for the assessment of arthritis used in clinical trials and daily practice are of different sensitivity and reproducibility. The composite 28-joint disease activity score (DAS-28) is most frequently used in the assessment

of RA disease activity [4]. Considerable variations in clinical assessment of synovitis were recorded between different observers, as well as different centers in clinical trials and clinical practice [5]. The joint count is an indirect assessment of inflammation in joints and it can hardly be regarded as an objective measure. Clinical assessment has been confronted with the growing evidence that magnetic resonance imaging (MRI) and high-resolution ultrasound (US) are more sensitive in detecting synovitis [6,7].

A number of studies have tested the validity of grey-scale ultrasonography (GSUS) and Color Doppler US (CDUS) or Power Doppler US (PDUS) techniques for evaluating inflammatory activity in affected joints. In most cases, the GSUS and CDUS or PDUS findings have been compared with clinical, laboratory, histological, radiographic and/or MRI findings [8–10]. GSUS is well suited for synovium visualization. The scoring systems developed for grading the synovial hypertrophy generally used semiquantitative criteria [11–13], being considered to be the standard approach. The Szkudlarek et al. scoring system [13] is the most used for scientific and clinical purpose. In other studies on Egyptian RA patients, US of the hands provided valuable disease activity information more

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than clinical examination [14] and the DAS 28 significantly correlated with synovial thickness and power Doppler US score [15].

The aim of the study was to evaluate the role of US DAS score in assessing joint inflammation in RA patients, and its correlation with disease parameters.

2. Patients and methods

Fifty consecutive patients (46 female, 4 male; F:M 11.5:1) who fulfilled the 1987 ACR classification criteria for RA [16] were included in the present study. All patients were attending the outpatient Rheumatology clinic, Minia University Hospitals. Informed consent was taken from all participants in the study. The study was approved by the ethics committee of the Faculty of Medicine.

The DAS-28 [4] was determined for each patient; the swollen 28-joint count (SJC28) and tender 28-joint count (TJC28) were assessed. Health assessment questionnaire disability index (HAQ-DI) was calculated (ranged 0–3) [17]. Rheumatoid factor (RF), C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were assessed. In all patients conventional radiography of hands, wrists and feet was recorded. simple erosion narrowing score (SENS) was used for X-ray scoring [18].

3. US assessment

Musculoskeletal ultrasonography of wrist, hands and forefoot was performed with a 10–18 MHz linear scanner and middle class to high-end US machine. Conventional GSUS (B-mode) and PDUS examinations were carried out to calculate the USDAS; PDUS examination of 22 joints and GSUS examination for effusion/hypertrophy (E/H) of 28 joints were performed. GSUS E/H was qualitatively graded as absent or present in the following joints: MCPs, PIP, wrists, elbows, shoulders and knees (range 0–28). PDUS was semi-quantitatively graded based on method of Szkudlarek et al. [13]. Power Doppler semi-quantitative score was graded in the following 22 joints: wrists, MCPs and MTP joints (range 0–66). PDUS score for synovitis in 22 joints (PD22) and GSUS score for E/H in 28 joints (E/H28) were included in the US DAS calculation. US DAS was designed by replacing the number of tender joints in DAS-28 with PD semiquantitative score of the 22 joints and by replacing the number of swollen joints with GSUS E/H28 score. The formula for US DAS is as follows: $US\ DAS = 0.56\sqrt{(PD22)} + 0.28\sqrt{(E/H28)} + 0.7$ in (ESR) + 0.014 (GH). General Health (GH) is a measurement of a patient's response on a visual analogue scale (VAS) of disease activity. Interpretation: remission <3, low disease activity 3.3 – 3.7, moderate disease activity 3.7–5, and high disease activity >5.

Structural damage was assessed by recording US erosion count (USEC); the number of joints with erosions among the selected joints: wrists, MCP joints, PIP joints and MTP joints. In addition to USEC, US erosion rate (USER) was calculated by dividing the number of selected joints (where erosions were detected), with disease duration (in months).

3.1. Statistical analysis

The statistical analysis was performed using SPSS 16.0. Descriptive statistics were done by number and percent as well as mean and SD. ANOVA test was used to compare the difference between more than two group means in interval and ordinal variables. Correlations were calculated using Pearson's correlation coefficient. The level of statistical significance was set at a $p < 0.05$.

4. Results

Fifty RA patients were included in the present study, their mean age was 43.9 ± 10.8 years, and their mean disease duration was 8.7 ± 6.1 years. Table 1 shows demographic, clinical, and laboratory data. According to cut off values of DAS-28, 5 patients were in remission, 3 of low activity, 11 of moderate activity and 31 of high activity. Treatment included non-steroidal anti-inflammatory drugs in 48 (96%) patients, corticosteroids in 16 (32%), methotrexate in 49 (98%), antimalarials in 50 (100%), leflunomide in 10 (20%) and sulfasalazine in 2 (4%) patients.

According to the US DAS, 3 (6%) patients were in remission and 5 (10%) had low activity; they were merged as one group of 8 (16%) patients for statistical analysis; 11 (22%) patients had moderate activity and 31 (62%) had high activity. Patients with US DAS-defined high active disease had longer duration of morning stiffness, tender and swollen joint counts, patient and physician global assessments, DAS28, higher ESR 1st, RF positivity and HAQ-DI. Moreover, they had higher SENS and USEC compared to patients with remission/low activity or with moderate activity (Table 2). No differences between groups according to the medications received.

Table 3 shows the correlation of the US DAS, USEC and USER with the disease duration, morning stiffness, disease activity, disability and radiological score. US DAS significantly correlated with DAS28 as shown in Fig. 1. GSUS and PDUS of the wrist joint are shown in Figs. 2 and 3.

5. Discussion

The DAS-28 is still considered one of the best clinical tools for the assessment of individual disease activity. However, DAS-28 has been criticized for subjectivity of clinical assessment, the omitting of foot joints and an insufficient ability to define remission of the disease [19,20]. The quality of ultrasound results certainly depends on the expertise of the examiner and the power of the ultrasound machine; however, a high reproducibility of sonographic findings was recurrently demonstrated even for less experienced sonographers [21,22]. DAS measurements are more heterogeneous than US scorings. Therefore, US could be more reli-

Table 1
Characteristics of rheumatoid arthritis patients.

Parameter mean \pm SD (range)/n(%)	RA patients (n = 50)
Age (years)	43.9 \pm 10.8 (24–72)
Sex F:M	46/4 11.5:1
DD (years)	8.7 \pm 6.11 (1–37)
MS (min.)	58.6 \pm 51.2 (0–180)
TJC	19.3 \pm 7.7 (4–28)
SJC	9.6 \pm 5.2 (0–22)
PGA	5.3 \pm 1.9 (1–8)
PhGA	5.2 \pm 1.9 (1–8)
DAS 28	5.04 \pm 1.2 (2.2–6.8)
HAQ-DI	1.2 \pm 0.7 (0–2.7)
ESR (mm/1st h)	45.8 \pm 22.3 (7–115)
CRP +ve	39 (78)
RF +ve	34 (68)
SENS	25.7 \pm 16.1 (3–68)
US DAS	5.2 \pm 1.3 (2.1–7.2)
USEC	8.9 \pm 6.6 (0–18)
USER	0.18 \pm 0.09 (0–0.39)

DD: disease duration, MS: Morning stiffness, TJC: Tender joint count, SJC: Swollen joint count, PGA: Patient global assessment, PhGA: Physician global assessment, DAS28 = Disease activity score 28, HAQ-DI = health assessment questionnaire-disability index, ESR = Erythrocyte sedimentation rate, CRP = C-reactive protein, RF = Rheumatoid factor, US DAS = Ultrasound Disease Activity Score, USEC = Ultrasound Erosion Count, USER = Ultrasound Erosion Rate.

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