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Ultrasonographic Assessment of Synovitis and Scoring in Moroccan Rheumatoid Arthritis: Dorsal Versus Volar

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Abstract **Original Research Article**

Background**:* The ultrasonographic assessment of synovitis in rheumatoid arthritis (RA) is important for the establishment of appropriate treatment, development and monitoring of the patient. More useful and with the limited number of ultrasonographer and echograph of the authors are interested in finding reduced assessments of synovitis at hand. ***Aims: To compare ultrasonographic synovitis scores at the palmar and dorsal hands and wrists and these scores with clinical parameters of disease activity. ***Materials and methods:*** Cross-sectional study including 37 patients with RA meeting ACR 1987 collected in consultation. Predetermined questionnaire containing demographic, laboratory and clinical data was completed. Ultrasound examination was performed. For each patient 20 joints were evaluated and the gray-scale ultrasound (GSUS) of synovial hypertrophy was evaluated semi-quantitatively, Power Doppler ultrasound (PDUS) was measured semi quantitatively. Ultrasound score (ES) is determined by the sum of semi -quantitative scores GSUS and PDUs. Volar (VES) and dorsal (DES) ultrasound scores were obtained by adding the semi- quantitative grade of each face in each patient. ***Results:*** 37 patients were included with a mean age of 50 years ± 19.9. Disease duration of RA had a median of 7.5 years [3.2- 19.2]. The mean HAQ was 1.6 ± 0.6 and the mean DAS28 was 1.4 ± 5 with a median of (ES) total = 16 [8.5 to 29], (DES) had a median of 11 [6.5-20] and (VES) was 4 [1, 5-8]. Correlation between (DES) and (VES) was statistically significant p < 0, 001.Statistically significant correlation between CDAI, HAQ and the 3scores (r = 0.3; 0.47) ;(ES) was significantly correlated with DAS 28 (r = 0.04). ***Conclusion:*** In this study the correlation between dorsal and volar assessment of synovitis in RA and ultrasound parameters scores was similar.

Keywords: Ultrasound, RA, synovitis, volar, dorsal.

BACKGROUND

Musculoskeletal Ultrasound is an essential and important tool for the diagnosis and monitoring of rheumatoid arthritis imaging examination. As compared with clinical examination and conventional radiography, improved sensitivity for the detection of joint effusion, synovitis, and bone erosions with the use of US in RA joints has been described [1-6]. Proximal interphalangeal (PIP) and metacarpophalangeal (MCP) finger joints are usually among the first to be affected in RA, and findings in these joints are considered to be markers of overall joint damage in RA patients [7]. Consequently, reliable assessment of these joints is of major importance [8]. The concepts of intra articular fluid and synovial hypertrophy in GSUS are now clearly defined [9] and also the standard position of the patient and transducer for performing US [10]. The development of an US-based global scoring system is one of the tasks of OMERACT group [11]. A number of scoring systems have already been developed [12-16], focusing mainly upon scanning a limited number of joints to reduce the examination time, and upon the sensitivity to change after remissive treatment but there is limited data regarding the value of volar vs. dorsal US examination of the same joint.

The aim of our study was to compare the ultrasonographic synovitis scores at the palmar and dorsal hands and wrists, and to compare these scores with clinical parameters of disease activity.

MATERIALS AND METHODS

A cross-sectional study including patients, with a rheumatoid arthritis meeting the diagnostic criteria of the ACR 1987 was conducted at our Department of

Rheumatology; Patients were recruited in consultation or during hospitalization. A predetermined questionnaire containing demographic, and laboratory data clinical was completed for all patients. Informed consent was obtained from all patients. Patients with major hand deformities were excluded from the study.

Patients and disease characteristics

Socio-demographic data were collected for all patients: age, disease duration (years), diagnosis delay (months). All patients completed Visual Analogic Scale (VAS): (0 -100 mm, 0 = no pain and 100 = severe pain); evaluation for their pain (VASP), for global activity of their disease (VAS global), and HAQ (Health Assessment Questionnaires). VAS MD was recorded as the clinician's opinion regarding global RA activity of the patients. Disease activity was evaluated clinically by the duration of morning stiffness (minutes), night pain (number of awakenings), Clinical examination was performed for all patients by the same physician trained in RA assessments - the examination included all 28 joints from DAS28 [17]. A clinician recorded for each patient the number of tender joints (TJC) and swollen joints (SJC).

CDAI (clinical disease assessment index) was calculated based upon TJC and SJC, VAS global patient and VAS MD; DAS28 and SDAI (Simplified Disease Activity Index) were then calculated based upon lab results for ESR and CRP [18, 19].

ULTRASONOGRAPHY

US examination was realised the same day, by a sonographer trained in Musculoskeletal US. Ultrasound examination was performed by an experimented operator, with a 14 MHz linear probe. The scanning technique and the settings of the machine were the same for all the patients and all examinations were performed in a dark room by the same physician, who was blinded to clinical evaluations.

Ultrasonography was performed on 10 joints at both hands, 8 of them in both volar and dorsal aspect (MCPs 2 to 5, PIPs 2 to 5). radiocarpal and intercarpal joints were only examined from the dorsal side. MCP1 and PIP1 were excluded. For carpal joints, scanning was performed in a longitudinal plane, from dorsal side, over the surface of radius, lunate and capitate bone [20]. MCPs and PIPs, scanning was performed longitudinally, over the joint space, first from dorsal and then from volar side. No compression was applied. For Doppler signal evaluation, standard Doppler settings of the machine were established [15, 21].

GSUS synovial hypertrophy was assessed both by quantitative measurement and semi quantitative scale (0-3 grades); PDUS was recorded on a semi quantitative scale (0-3 grades). The semi quantitative grades for each joint were added and the sum was defined as the Echographic Score (ES) of each patient. Separately, we added the semi quantitative grades for volar and dorsal side, resulting in Volar ES (VES) and Dorsal ES (DES) of each patient. We used both scales of quantification because we only found limited data in literature regarding semi quantitative scale on the volar side. For volar synovitis, we measured the hypoechoic tissue between flexor tendon and cortical bone, perpendicularly to the bone, at the point of its greatest thickness, and we quantified it the same way as the dorsal one. Doppler signal was semi quantitatively quantified, as described in the literature [22-24] on a 0-3 scale (0 = absence, 1 = mild, single vessel signal, 2 = moderate, confluent vessels, 3 = marked vessel signals in more than half of intra particular area).

Statistical analysis

All statistics were calculated using SPSS for windows version 10 (SPSS, Chicago, IL). Chi2-Test was used to determine the prevalence. The Spearman test was use for correlation. p= 0.5 was considered as significant.

RESULT

Patients and disease characteristics

37 patients were included with a mean age of 50 years ± 11. The Disease duration of rheumatoid arthritis had a median of 7.5 years [3.2 to 19.2]; Almost 72.2 % of patients had seronegative form of RA. The mean of global VAS; VAS of physician overall patient were respectively 42.7 ±14.8 and 38 ± 16. The VAS pain of patients had a median of 50[40-70]; The median value of articlar index and synovial index was respectively 8 [3-13] and 4 [1.5-9.5]; the mean of DAS28 was 5 ±1.4. The HAQ had a mean of 1.6 ± 0.6.

Demographic, clinical and laboratory characteristics in our patients are described in Table 1.

Table 1: Patients and disease characteristics

Characteristics	
Age (years)	50 ±11
Disease duration (years)	7.5 [3.2-19.2]
DAS 28	5 ±1.4
VASP (0-100)	50 [40-70]
VAS global (0-100)	42.7±14.8
SJC	4 [1.5-9.5]
TJC	8 [3-13]
VAS MD (0-100)	38 ±16
HAQ	1.1± 0.6
ESR (mm)	39[22- 67.5]
CRP (mg /l)	10[4.2-29.6]
CDAI	18[10.5-30]
SDAI	30,5[19.6-58]

VASP, Visual Analogic Scale for the patient's pain; VAS global, patient's global evaluation of their disease activity; VAS MD, physician's global evaluation regarding patient's disease activity; SJC, the number of swollen joints; TJC, the number of tender joints; HAQ, Health assessment Questionnaire; ESR, erythrocyte

sedimentation reaction, CRP, C reactive protein; CDAI, clinical disease activity index; SDAI, simplified disease activity index

US parameters in our patients

A median of echographic score (ES) for each patient was 16 [8.5 - 29]; the dorsal echographic score (DES) had a median of 11 [6.5- 20] and volar echographic score (VES) was 4 [1.5-8]. The echographic positive joints (EPJ) had a median of 9[5.5-15.5]; Volar echographic positive joints (EPJ volar) had a median of 3[1-5] and the dorsal echographic positive joints (EPJ dorsal) median was 6[3-11.5]

The US parameters in our patients are presented in Table 2

Table 2: US parameters in our patients N = 37

	Median and interquartiles
SCORECO (ES)	16[8,5-29]
VOLAR ES	4[1,5-8]
DORSAL ES	11[6,5-20]
EPJ	9[5.5-15.5]
EPJ VOLAR	3[1-5]
EPJ DORSAL	6[3-11.5]

SCORECO: Echographic Score; EPJ: Echographic positive joints

Correlations between ES score and measures of disease activity

Correlation between dorsal echographic score (DES) and volar score (VES) was statistically significant p < 0, 001 and a median dorsal row > the volar median rank. There was a statistically significant correlation between the patient echographic score (ES) and CDAI (r = 0.343, p = 0.03), between the echographic score dorsal (DES) and CDAI (r = 0.335, p = 0.04) and between the echographic score of the volar surface (VES) and CDAI (r = 0.371, p= 0.02). It was no significant correlation between the SDAI and all echographic scores (ES, DES, VES), correlation between ES and HAQ was statistically significant (r = 0.475, p = 0.003) and with the other two scores; ultrasound score was significantly correlated with the DAS 28 (r = 0.045, p = 0.03), correlation between doctor EVA and the 3 scores was statistically significant but not significant between the 3 scores and VAS pain patient. The Correlations between ES score and measures of disease activity are presented in Table 3.

Table 3: Correlations between ESs and measures of disease activity

		TJC	**SJC**	**DAS28**	**CDAI**	**SDAI**	**HAQ**	**ES**	**VES**	**DES**
TJC	r	1	0.6	0.8	0.9	0.7	0.4	0.3	0.3	0.3
	P		0 .00	0.00	0.00	0.00	0.1	0.00	0.02	0.02
SJC	r	0.6	1	0.6	0.8	0.6	0.3	0.2	0.3	0.2
	P	0.00		0.00	0.00	0.00	0.5	0.1	0.05	0.12
DAS2	r	0.8	0.6	1	0.8	0.6	0.4	0.2	0.3	0.2
	P	0.00	0.00		0.00	0.00	0.00	0.1	0.4	0.05
CDAI	r	0.9	0.8	0.8	1	0.6	0.4	0.3	0.3	0.3
	P	0.00	0.00	0.00		0.00	0.05	0.03	0.01	0.07
SDAI	r	0.5	0.5	0.6	0.6	1	0.4	0.2	0.3	0.2
	P	0.00	0.00	0.00	0.00		0.01	0.13	0.05	0.16
HAQ	r	0.4	0.3	0.4	0.4	0.4	1	0.2	0.3	0.2
	P	0.01	0.05	0.007	0.05	0.001		0.09	0.06	0.1
ES	r	0.3	0.2	0.2	0.3	0.2	0.2	1	0.8	0.9
	P	0.00	0.1	0.1	0.03	0.13	0.09		0.00	0.00
VES	r	0.3	0.3	0.3	0.3	0.3	0.3	0.8	1	0.7
	P	0.02	0.05	0.04	0.01	0.05	0.06	0.00		0.00
DES	r	0.3	0.2	0.2	0.3	0.2	0.2	0.9	0.7	1
	P	0.02	0.12	0.2	0.07	0.16	0.1	0.00	0.00	

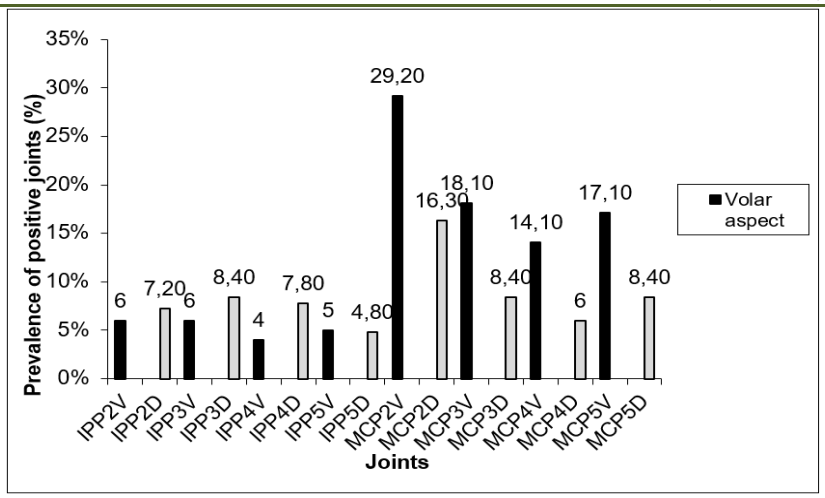

Figure 1: prevalence of echographic positive joints in volar and dorsal sides

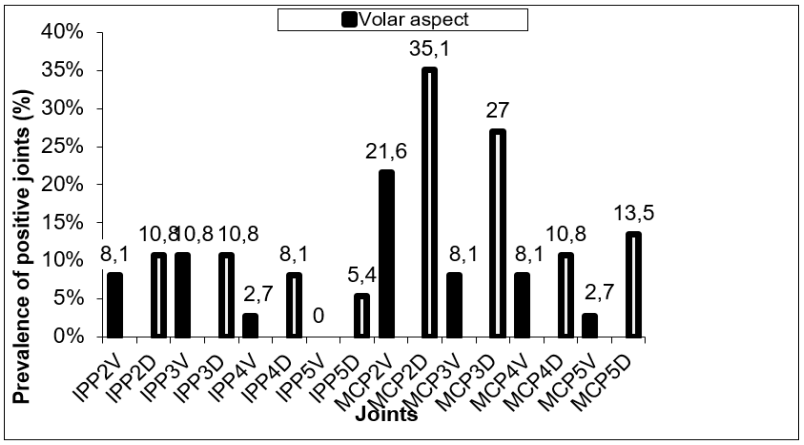

Figure 2: prevalence of echographic positive doppler joints in volar and dorsal sides

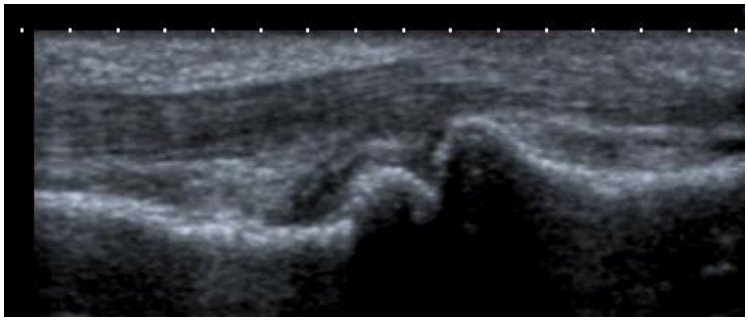

Figure 3: Dorsal synovitis - IPP3 joint

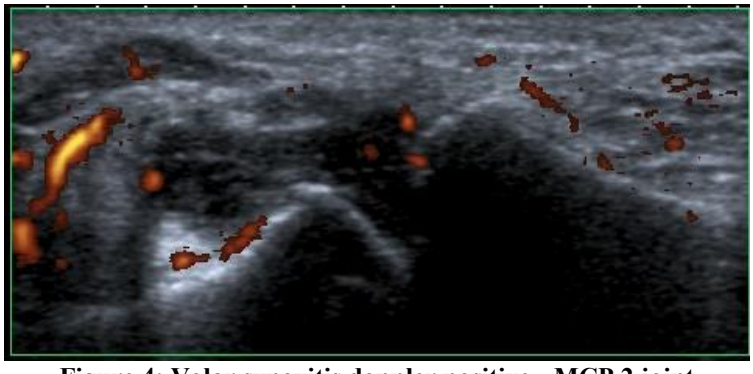

Figure 4: Volar synovitis doppler positive - MCP 2 joint

DISCUSSION

In our study, we found that the dorsal echographic score (DES) was higher than the volar ultrasound score (VES). The same result was found by Vlad *et al.,* [25].

The prevalence of positive joints in MCP at the volar side was higher, but the dorsal side detected more positive joints in IPP. These results are controversies according to literature; indeed Vlad *et al.,* [25] found a variable prevalence of positive synovitis from the highest (88.1%) in MCP2 volar side to the lowest (35.7%) in PIP5 volar side. While several studies have addressed volar synovitis so far [14, 26, 13]. Hoving et al stated that in hand joints small amount of fluid is best visualized from volar side with fingers in gentle flexion [26]. In a recent scoring system, Backhaus found volar synovitis present in 86% of affected joints, whilst dorsal synovitis alone in only 14% [14]. Ostergaard and Szudlarek found only 33% of patients having synovitis on both volar and dorsal side; in the majority of their cases synovitis was limited to volar- 43% or dorsal side - 27% [27]. According to literature, volar synovitis is always found on the proximal area of MCP and PIP joints [13].

SCHEEL ET AL found that synovitis could be detected in the palmar and proximal sites of the finger joints in 86% of all fingers affected by synovitis. In 14% of affected joints, synovitis was visible at the dorsal side, while there was no palmar synovitis. They therefore recommend that a single US evaluation at the palmar side be considered sufficient for analysis of finger joint synovitis in, for instance, the setting of randomized clinical trials [13].

Vlad and al [25] give a personal observation and agree with the conclusion of Hoving [26], that volar synovitis is more easily depicted and quantified in small hand joints than the dorsal one, probably due to the flexor tendon position towards the joint- more distant from the joint comparative with extensor tendon, due to the presence of volar plate.

In our study the echographic score of patients (ES) was significantly correlated with DAS28, SDAI, CDAI, HAQ, Tender joints, VES, DES.

Correlation was significant between volar echographic score (VES) and SDAI, CDAI, HAQ, Tender joints, ES, DES. We found DES (dorsal echographic score significantly correlated with SDAI, CDAI, HAQ, Tender joints, ES, VES. Vlad and al. found all ESs significantly correlated with standard measures of disease activity (DAS28, CDAI, SDAI, SJC, TJC, HAQ) [25]. This would demonstrate that ultrasound musculoskeletal involved in assessment of the activity of rheumatoid arthritis.

CONCLUSION

In our study the dorsal side detected more synovitis than volar side even if it detected more synovitis in at MCP joints.

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