ORIGINAL ARTICLE

JIACM 2020; 21(3-4): 111-14

A Comparison between Ultrasonogram versus Clinical Parameters to Detect Disease Activity in Rheumatoid Arthritis Patients

Tuhin Subhra Sarkar, Surajit Das**, Umakanta Mahapatra***, Kalimujjaman Molla*, Kripasindhu Gantait *****

Abstract

Objective: Traditionally, disease activity in a rheumatoid arthritis patient is assessed by clinically detected joint tenderness, swelling, CDAI score, SDAI score, DAS28 ESR, DAS28 CRP. USG Power Doppler also detects disease activity by detecting joint synovial thickening, increased vascularity. This study investigated the relationship between traditional methods (CDAI score, SDAI score, DAS28 ESR, DAS28 CRP) and USG Power Doppler to detect disease activity in rheumatoid arthritis patients.

Method: One hundred rheumatoid arthritis patients are recruited consecutively for this study. We assessed disease activity by clinical joint assessment, global assessment, ESR, CRP, X-ray, and USG Power Doppler study.

Result: Active disease was found in 96, 72, 80, 74, 62, 12 per cent of the study subjects according to USG Power Doppler, CDAI score, SDAI score, DAS28 ESR, DAS28 CRP, X-ray respectively. Comparison between USG Power Doppler with CDAI score, SDAI score, DAS28 ESR, DAS28 CRP, X-ray to detect disease activity is found statistically significant p = 0.0015, 0.0269, 0.002. 0.0001, < 0.0001 respectively.

Conclusion: USG Power Doppler study is superior to detect disease activity than CDAI score, SDAI score, DAS28 ESR, DAS28 CRP and X-ray.

Key words: Rheumatoid arthritis, USG power Doppler, disease activity scores.

Introduction

Rheumatoid arthritis is a chronic inflammatory disorder of unknown aetiology. Although there are a variety of systemic manifestations, the characteristic feature of established RA is persistent inflammatory synovitis, usually involves the peripheral joint in symmetric distribution[1]. In the ACR/EULAR 2010 criteria set, classification as "definite RA" is based on the confirmed presence of synovitis in at least 1 joint, absence of an alternative diagnosis that better explains the synovitis, and achievement of a total score of 6 or greater (of a possible 10) from the individual scores in 4 domains: number and site of involved joints (score range 0 - 5), serologic abnormality (score range 0 - 3), elevated acute-phase response (score range 0 - 1), and symptom duration (2 levels; range 0 - 1)[2], with the synovitis not better explained by another disease. Classification criteria for RA (score-based algorithm: add score of categories A-D; a score of 6/10 is needed for classification of a patient as having definite RA. RA is the most common inflammatory joint disease that causes premature mortality, disability, and compromised quality of life, two to three times more common in females than males. RA is widely prevalent throughout the world. The prevalence of RA in the world is 0.8%[3] and in India the prevalence of RA is 0.7%[4].

Traditionally, the disease activity has been evaluated by clinical variables, laboratory measures, and radiographic findings[5-6]. However, clinical evaluation of joint pain and swelling have not been sufficiently reliable, and conventional plain radiography depicts indirect signs of cartilage loss and bony erosions. USG Power Doppler has greatly improved musculoskeletal imaging in rheumatology. Several studies have demonstrated that high frequency US has more efficacy to detect joint effusion and synovitis[7-14]. Doppler ultrasound (US) can detect Synovial thickening (Synovitis), increased vascularity within joints, and changes in the periarticular soft tissues, thus can demonstrate the presence of active inflammation. In this study, we tried to find out the correlation of ultrasonographic findings with clinical disease activity and X-ray in RA patients and its implications for a better clinical utilisation of this imaging technique.

Aims and objectives

The aim of this study is to find out the correlation between ultrasonographic and clinical findings in Rheumatoid Arthritis patients reporting to Rheumatology clinic in a tertiary care hospital in West Bengal. The Objective of this study is to investigate the relationship between traditional methods (CDAI score, SDAI score, DAS28 ESR, DAS28 CRP) and USG Power Doppler to detect disease activity in

Post-Graduate Trainee, ***Assistant Professor, ****Professor, Department of General Medicine, **Assistant Professor, Department of Radiology, Midnapore Medical College and Hospital, Midnapore - 721 101, West Bengal.
Corresponding Author: Dr Kripasindhu Gantait, Post-Graduate Trainee, Department of General Medicine, Midnapore Medical College and Hospital, Midnapore - 721 101, West Bengal. Tel: 9434243054, E-mail: gkripasindhu@yahoo.in.

Rheumatoid arthritis patients.

Specific objective

a. To find out correlation between ultrasonographic findings and CDAI score.
b. To find out correlation between ultrasonographic findings and SDAI score.
c. To find out correlation between ultrasonographic findings and DAS28ESR score.
d. To find out correlation between ultrasonographic findings and DAS28CRP score.
e. To compare the findings between X-ray and ultrasonography of hands.

Methodology

This study has been conducted in the Rheumatology Clinic of a tertiary care hospital in West Bengal. This study was conducted for a period of one year. One hundred consecutive patients were selected for this study who met the ACR/ EULAR 2010 criteria for rheumatoid arthritis and were more than sixteen years of age and willing to participate in this study. We excluded the patients who has septic and traumatic arthritis and history of hand surgery in the last 12 months. The criteria for inclusion of cases from clinical history, biochemical evidence of Rheumatoid arthritis (based on ACR/EULAR2010). Clinical history of rheumatoid arthritis is early morning stiffness lasting more than one hour and easing with activity of affected peripheral joint. The commonly affected joints are symmetrical wrist, proximal interphalangeal, metacarpophalangeal joints. We assessed patients disease activity by tender joint count, swollen joint count, Global assessment of patient health. We performed blood investigations – complete blood count, ESR, CRP, creatinine, SGPT/SGOT, rheumatoid factor, anti-CCP antibody and radiological investigation (X-ray) and USG Power Doppler study. We then assessed disease activity by calculating their CDAI, SDAI, DAS28 ESR, DAS28 CRP score.

Statistical analysis

Data were entered in Microsoft excel spreadsheet and then analysed by SPSS 24.0 and Graphpadprism version 5. Data has been summarised as mean and standard deviation for numerical variables and percentage for categorical variables. McNemar Test was done to see statistical sensitivity difference the two tests.

Result

We conducted this study in the rheumatology clinic in our hospital. One hundred consecutive patients were selected for this study. The background characteristics of the patients are depicted in Table I and disease activity status whether active disease or in remission calculated by different method like CDAI score, SDAI score, DAS28 ESR, DAS28 CRP, X-ray and USG Power Doppler study shown in Table II. We found that most of the study population 40% is from 36 - 50 years of age followed by 16 - 35 yrs age 32% and 28% of study population above the age 50 years of age. The mean age of study population is 43 ± 12.7 years and mean duration of disease is 6.8 ± 6 years. The mean ESR and CRP is 42.8 ± 21.9 and 7.7 ± 12.7 respectively. Male is 26% and female is 74 % of study population. Most of the study population (34%) had studied below class X followed by 28% illiterate, 26% Class X, and only 12% were graduates and above.

Table I: Distribution of study population according to basic information (age, sex and educational status, ESR, CRP, disease duration) (N = 100).

Age group	(16 - 35) Yrs	(36 - 50) Yrs	> 50 Yrs	
	32 (32%)	40 (40%)	28(28%)	
Sex	Male		Female	
	26(26%)	74(74%)		
Education	Illiterate	Below class X	Class X	Graduate and above
	28 (28%)	34 (34%)	26 (26%)	12 (12%)
The mean age of study population in years (Mean ± SD):			43 ± 12.7	
The mean duration of disease of study population in years (Mean ± SD):			6.8 ± 6	
The mean ESR of study population in mm/hour (Mean ± SD):			42.8±21.9	
The mean CRP of study population in mg/dl (Mean ± SD):			7.7±12.7	

Table II: Distribution of study population according to disease activity status by various methods. (N = 100).

Remission	Active disease				
	Remission	Mild	Moderate	Severe	Total active
CDAI score	28 (28%)	20 (20%)	40 (40%)	12 (12%)	72 (72%)
SDAI score	20 (20%)	20 (20%)	36 (36%)	24 (24%)	80 (80%)
DAS28 ESR	26 (26%)	10 (10%)	40 (40%)	24 (24%)	74 (74%)
DAS28 CRP	38 (38%)	10 (10%)	44 (44%)	8 (8%)	62 (62%)
X-ray*	88 (88%)	-	-	-	12 (12%)
USG (Synovitis)**	4 (4%)	-	-	-	96 (96%)
USG (Hyperaemia)***	60 (60%)	-	-	-	40 (40%)

**In X-ray we looked for joint erosion which is suggestive of active disease.*

***In USG Doppler study we looked for synovial thickening.*

****In USG Doppler study we also looked for increased vascularity.*

We found that according to CDAI score 28 (28%) had

remission, 20 (20%) had low, 40 (40%) had moderate, 12 (12%) had high disease activity. According to SDAI score 20 (20%) had remission, 20 (20%) had low, 36 (36%) had moderate, 24 (24%) had high disease activity. According to DAS28 ESR score 26 (26%) had remission, 10 (10%) had low, 40 (40%) had moderate, 24 (24%) had high disease activity. According to DAS28CRP score 38 (38%) had remission, 10 (10%) had low, 44 (44%) had moderate, 8 (8%) had high disease activity.

We found that 22 (22%) had non tender - non swollen, 56 (56%) had tender only, 22 (22%) had tender + swollen joint. We found that 12 (12%) had joint erosion, 88 (88%) had no joint erosion on X-ray. 96(96%) had synovial thickening, 4 (4%) had no synovial thickening on USG. 40 (40%) had hyperaemia, 60 (60%) had no hyperaemia on USG.

We found that the comparison between CDAI score and USG Power Doppler study to detect disease activity is statistically significant (P = 0.0015). USG Power Doppler study is superior to detect disease activity than CDAI score. In comparison between SDAI score and USG Power Doppler study to detect disease activity found statistically significant (P = 0.0269). USG Power Doppler study is superior to detect disease activity than SDAI score. In case comparison between DAS28 ESR score and USG Power Doppler study to detect disease activity is statistically significant (P = 0.002). USG is superior to detect disease activity than DAS28 ESR score. In comparison between DAS28 CRP score and USG Power Doppler study to detect disease activity is statistically significant (P = 0.0001). USG is superior to detect disease activity than DAS28 ESR score. Comparison between X-ray and USG to detect disease activity is found statistically significant (P = < 0.0001). Here USG is superior than X-ray to detect disease activity.

Discussion

With the development of high-frequency ultrasound technology, USG Power Doppler study plays an important role to detect disease activity in rheumatoid arthritis patient. USG Power Doppler study detects disease activity by detecting synovial thickening (Synovitis) and increased vascularity (hyperaemia).

In our study, we found that most of the study population (40%) is from 36 - 50 years of age, followed by 16 - 35 yrs age (32%), and 28% of the study population is above the age of 50 years. The mean age of study population is 43 ± 12.7 years and mean duration of disease is 6.8 ± 6 years. The mean ESR and CRP is 42.8 ± 21.9 and 7.7 ± 12.7 respectively. The ratio of male to female is 1:3 approx. Most of the study population (34%) had studied below class X, followed by 28% illiterate, 26% class X and only 12% were graduates and above.

We calculated CDAI score, SDAI score, DAS28 ESR, DAS28 CRP and performed X-ray to look for any joint erosions, and also USG Power Doppler study was done to see for signs of synovitis or increased vascularity. Remission (inactive disease) was found in 28%, 20%, 26%, 38%, 88% and 4% of study population according to CDAI score, SDAI score, DAS28 ESR, DAS28 CRP, X-ray and USG Power Doppler study respectively. Active disease was found in 72%, 80%, 74%, 62%, 12% and 96% of study population according to CDAI score, SDAI score, DAS28 ESR, DAS28 CRP, X-ray and USG Power Doppler study respectively.

We performed statistical analysis to see if sensitivity to detect active disease by different methods is statistically significant or not. We found USG Power Doppler study is superior to detect disease activity than traditional methods like CDAI score (p = 0.0015), SDAI score (p = 0.0269), DAS28 ESR (p = 0.002) and DAS28 CRP (p = 0.0001); all are statistically significant. USG Power Doppler study is also superior to detect disease activity than X-ray (p = < 0.0001) (statistically significant).

Naredo *et al* have found that USG diagnosed more joints with effusion and synovitis than clinical examination and US findings correlated better with CRP and ESR than clinical measures[11]. Hyper-vascularisation and angiogenesis of the synovial membrane are considered to be primary pathogenic mechanisms responsible for joint destruction. Ninety-four (94) consecutive patients who fulfilled the criteria of 1987 American Rheumatic Association for RA were included in this study. Patients who had had traumatic, septic, or microcrystalline arthritis, previous joint surgery, or isotopic synovectomy within the past 12 months (before the study) were excluded from the study.

Mondal *et al* have done a similar type of study in India. They found that Power Doppler ultrasonography of synovium of small joints of hands and feet is a very useful tool in assessing both inflammatory and destructive changes and help the clinician to start the appropriate medication at the earliest stage of the disease[14].

The relationship of MSUS parameters with synovial tissue features is clearly a field open to research, which may add new pathogenic information and help to clarify MSUS usefulness in RA management. Correlation of MSUS was done with physical examination, inflammatory markers and patient-reported outcomes. For many years, rheumatologists have been using the disease activity score of 28 joints (DAS28) and other composite scores as a gold standard for assessment of RA activity; these tools have clearly brought great progress in treatment monitoring. Even though they are the most extensively validated methods for measuring disease activity to date[15], the precise way of objectively defining inflammation is still lacking.

MSUS is more sensitive than physical examination for detection of arthritis according to a number of studies[16-20].

Conclusion

USG Power Doppler study is a very important tool to assess the disease activity in rheumatoid arthritis patients. It is superior in sensitivity to assess and to detect disease activity than traditional method like CDAI score, SDAI score, DAS28 ESR and DAS28 CRP. Synovitis (Synovial thickening) is commonly detected than hyperaemia in ultrasonography. Power Doppler ultrasonography is also more sensitive than X-ray to detect disease activity.

References

1. Harrison's Principle of Internal Medicine, 19th edition, p. 2083.
2. Arthritis and Rheumatism 2010; 62 (9): 2569-81. DOI 10.1002/art.27584 © 2010, American College of Rheumatology.
3. Gabriel SE. The Epidemiology of Rheumatoid Arthritis. *Rheum Dis Clin North Am* 2001; 27: 269-81.
4. Malaviya AN *et al*. *Rheumatol Int* 1993; 13 (4): 131-4.
5. Van der Heijde DMFM, van't Hof MA, van Riel PLCM *et al*. Development of a disease activity score based on judgment in clinical practice by rheumatologists. *J Rheumatol* 1993; 20: 579-81.
6. Felson DT, Anderson JJ, Boers M *et al*. The American College of Rheumatology preliminary core set of disease activitymeasures for rheumatoid arthritis clinical trials. *Arthritis Rheum* 1993; 36: 729-40.
7. Proceedings from the Conference on Outcome Measures in Rheumatoid Arthritis Clinical Trials (OMERACT). *J Rheumatol* 1993; 20: 526-91.
8. Eberhardt K, Fex E, Johnsson K *et al*. Hip involvement in early rheumatoid arthritis. *Ann Rheum Dis* 1995; 54: 45-8.
9. Hauzeur EP, Mathy L, De Maertelaer V. Comparison between clinical evaluation and ultrasonography in detecting hydrathrosis of the knee. *J Rheumatol* 1999; 26: 2681-3.
10. Kane D, Balint PV, Sturrock RD. Ultrasonography is superior to clinical examination in the detection and localisation of knee joint effusion in arthritis. *J Rheumatol* 2003; 30: 966-71.
11. Naredo E, Bonilla G, Gamero F *et al*. Assesment of inflammatory activity in Rheumatoid Arthritis: a comparative study of clinical evaluation with grey scale and power Doppler ultrasonography. *Ann Rheum Dis* 2005; 64: 375-38.
12. Qvistgaard E, Rogind H, Torp-Pedersen S *et al*. Quantitative ultrasonography in rheumatoid arthritis: evaluation of inflammation by Doppler technique. *Ann Rheum Dis* 2001; 60: 690-3.
13. Rees JD, Pilcher J, Heron C *et al*. A comparison of clinical vs ultrasound determined sinovitis in Rheumatoid Arthritis utilizing grey scale, power doppler and intravenous contrast agent Sono Vue. *Rheumatology* 2007; 46 (3): 454-9.
14. Mondal G, Ghosh B, Ghosh M *et al*. Comparative Study of Radiological Changes in Hands and Feet in Patients Suffering from Early Rheumatoid Arthritis by Power Doppler Ultrasound and Direct Digital Radiography. *Open J Rheumatolo Autoimmune Dis* 2014; 4: 39-4.
15. Van der Heijde D, van 't Hof M, van Riel P *et al*. Judging disease activity in clinical practice in rheumatoid arthritis: first step in the development of a disease activity score. *Ann Rheum Dis* 1990; 49: 916-20.
16. Vlad V, Berghea F, Libianu S *et al*. Ultrasound in rheumatoid arthritis: volar versus dorsal synovitis evaluation and scoring. *BMC Musculoskelet Disord* 2011; 12: 124.
17. Szkudlarek M, Narvestad E, Klarlund M *et al*. Ultrasonography of the metatarsophalangeal joints in rheumatoid arthritis: comparison with magnetic resonance imaging, conventional radiography, and clinical examination. *Arthritis Rheum* 2004; 50: 2103-12.
18. Salaffi F, Filippucci E, Carotti M *et al*. Interobserver agreement of standard joint counts in early rheumatoid arthritis: a comparison with grey scale ultrasonography - a preliminary study. *Rheumatology (Oxford)* 2008; 47: 54-8.
19. Ogishima H, Tsuboi H, Umeda N *et al*. Analysis of subclinical synovitis detected by ultrasonography and low-field magnetic resonance imaging in patients with rheumatoid arthritis. *Mod Rheumatol* 2014; 24: 60-8.
20. Mendonca J, Yazbek M, Laurindo I *et al*. Wrist ultrasound analysis of patients with early rheumatoid arthritis. *Braz J Med Biol Res* 2011; 44: 11-5.