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Original Research Article

Role of ultrasonography in diagnosing early rheumatoid arthritis and it's remission

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Abstract

Background: Rheumatoid Arthritis is an autoimmune disorder primarily affecting the synovial tissue. Over the past ten years, advancements in ultrasonography quality have made it possible to employ higher ultrasonic frequencies, leading to an improvement in the quality of ultrasound examinations of superficial structures. Ultrasound has improved to the point where it can now be used to evaluate patients for rheumatic conditions. Grey-scale Ultrasound, which may identify morphological abnormalities such as synovial thickening and bone erosion, and Doppler Ultrasound, which can show blood flow in the synovium and surrounding tissue, are the two forms of Ultrasound that are used.

Objectives: 1. To evaluate the efficacy of Ultrasonography in diagnosing early Rheumatoid Arthritis 2. To evaluate the efficacy of Ultrasonography in diagnosing Rheumatoid Arthritis remission. 2. To evaluate the correlation of findings seen on Ultrasonography with clinical parameters in diagnosis of early Rheumatoid Arthritis and it's remission.

Materials and Methods: The study was conducted in Department of Radiodiagnosis, S.N. Medical College, Agra. The study included 72 clinically confirmed cases of Rheumatoid Arthritis. All the cases in the study were followed up for 1.5 years.

Conclusion: The study emphasizes how useful Ultrasonography is for the early diagnosis and treatment of Rheumatoid Arthritis. Clinicians can measure disease progression and therapy response more accurately by combining clinical observations with Ultrasonography.

Keywords: Rheumatoid Arthritis, Ultrasonography, Early diagnosis, Remission.

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1. Introduction

Rheumatoid Arthritis is the most common type of inflammatory arthritis affecting 0.5-1% of population.[1] An autoimmune systemic disease, Rheumatoid Arthritis progresses markedly to chronicity in all instances. The underlying cause of the onset of autoimmunity in Rheumatoid Arthritis remains unknown despite much research. The synovial membrane and pathogenesis are closely related. The connective tissue that lines bursae, tendon sheaths, and synovial joints is known as the synovial membrane. Both small and big joints are affected by the condition, with the wrist and hand joints showing particular sensitivity.[1] Prolonged inflammation of the peri-articular tissue and the joint itself can cause erosions and destruction of the joint, resulting in severe morbidity and substantial impairment. The classic clinical presentation is with pain, swelling and early morning stiffness lasting for at least an hour predominantly in the small joints of hand, wrist and feet. As the disease worsens, big joints become involved along with systemic symptoms and extra-articular signs. Bone marrow edema and synovial inflammation which cause cartilage and underlying bone erosions that ultimately result in joint deformity are the disease's hallmarks.

With the advent of Ultrasonography and MRI, early imaging findings associated with Rheumatoid Arthritis are being made possible. Debatable is the potential contribution of these imaging modalities to the early diagnosis of Rheumatoid Arthritis.[2]

The American College of Rheumatology added radiographic erosions to their list of diagnostic criteria for Rheumatoid Arthritis in 1987. The 2010 criteria were noticeably devoid of radiographic erosions from the scoring

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system, as the 1987 criteria were acknowledged to be relatively insensitive to the identification of early disease.[3]

Now, European Alliance of Associations for Rheumatology/American College of Rheumatology 2010 Clinical criteria is used for the diagnosis of Rheumatoid Arthritis.[4]

Criteria	Score
1.Joint distribution	(0-5)
-large joints	0
-10 large joints	1
-3 small joints	2
-10 small joints	3
->10 joints	5
2.Serology	(0-3)
-Negative RF AND negative ACPA	0
-Low positive RF OR low positive ACPA	2
-High positive RF OR high positive ACPA	3
3.Symptom Duration	(0-1)
-< 6 weeks	0
->/=6 weeks	1
4.Acute Phase Reactants	(0-1)
-Normal CRP AND normal ESR	0
-Abnormal CRP OR abnormal ESR	1

1.1. Patients with a score ≥ 6 are considered to have definite rheumatoid arthritis.[5]

Normal joints, including the small joints in the hands and wrists, have smooth cortical surfaces devoid of abnormal bony excrescences or proliferative changes in the bone. There is also no evidence of joint distention brought on by synovial hypertrophy or increased amounts of synovial-fluid complexes.[6]

The features of Rheumatoid Arthritis like synovitis, synovial hypertrophy, joint effusion, bone erosion and tenosynovitis can be easily identified on Ultrasonography.

1. Synovitis is defined as hypoechoic non compressible intra-capsular hypertrophy with or without Power Doppler signal within the synovium[7] regardless of the presence or absence of effusion.
2. Joint effusion is defined as intra-capsular compressible anechoic area.
3. Synovial hyperaemia is defined as flow within the synovium on Power Doppler.
4. Tenosynovitis is defined as anechoic thickening involving the tendon with or without associated Power Doppler signal uptake and adjacent synovial fluid.
5. Bone erosion is defined as intra-articular discontinuity of the bone surface that is visible in two perpendicular planes.[8]

The most studied joint for the detection of tenosynovitis has been the wrist and ankle joints. However, in Rheumatoid Arthritis not all tendons are affected in the same way. At hand and finger level, the most frequently involved tendons are the Extensor carpi ulnaris and the flexor tendons of the second, third, and fourth fingers.[9]

With the introduction of newer therapies remission has become a possible target in majority of the patients. Remission is characterized by the absence of joint injury and impairment as well as no active disease.[4]

Ultrasonography is non-invasive, easily accessible and cost effective as compared to other diagnostic tests. Ultrasonography is generally feasible, valid, dependable, and change-sensitive. Consequently, it may play a part in routine patient monitoring and follow-up to assess response to treatment and to forecast future structural deterioration.[10]

2. Materials and Methods

Prospective and Correlational study was done among clinically confirmed cases aged between 18 to 60 years referred to Department of Radiodiagnosis, S.N. Medical College, Agra from November 2022 to May 2024.

A total of 72 clinically confirmed cased of Rheumatoid Arthritis were selected for the study and followed up.

2.1. Inclusion criteria

1. Clinically diagnosed Rheumatoid Arthritis cases (new + follow up).

2.2. Exclusion criteria

1. Patient not giving consent.
2. History of current primary inflammatory joint disease or primary rheumatological autoimmune disease other than Rheumatoid Arthritis.
3. Patients diagnosed with Juvenile Rheumatoid Arthritis.

2.3. Ethical committee approval

SNMC/IEC/2024/286.

3. Results

The study included 72 clinically verified Rheumatoid Arthritis cases that were referred to the S.N. Medical College, Agra in Department of Radiodiagnosis for assessment from November 2022 to May 2024. All patients enrolled in the study were subjected to Ultrasonography including Colour Doppler study as per the protocol.

The table shows that out of 72 participants, 52 (72.2%) had synovitis, effusion was present in 37 participants (51.4%), erosions were observed in 32 participants (44.4%), bursitis was present in 36 (50.0%) participants. The total number of participants sums up to 100%, providing a comprehensive overview of the prevalence of these clinical findings within the study population.(**Table 1**)

The table shows that out of 72 participants, 29 were classified as Mild on USG (32 on Clinical grading), another 26 as Moderate (28 on Clinical grading) and Severe in 13 (12 on Clinical grading). 4 participants did not show any findings on USG. The total number of participants sums up to 100%, providing a comprehensive overview of the distribution of Clinical and USG grades within the study population.(**Table 2**)

The table shows that out of 72 participants, 22 (30.6%) achieved complete remission, 32 (44.4%) had partial remission, and 18 (25.0%) experienced no remission. The total number of participants sums up to 100%, providing a comprehensive overview of the remission status within the study population.(**Table 3**)

Table 1: Frequency distribution of clinical/Other imaging findings among study subjects

Clinical/Other Imaging findings		Frequency (n)	Percentage (%)
Synovitis	Yes	52	72.2
	No	20	27.8
Effusion	Yes	37	51.4
	No	35	48.6
Erosions	Yes	32	44.4
	No	40	55.6
Bursitis	Yes	36	50.0
	No	36	50.0
Total		72	100

Table 2: Clinical & USG grading

Grading	Mild	Moderate	Severe
Clinical Grading	32	28	12
USG Grading	29	26	13

Table 3: Distribution of study subjects according to the remission

Remission	Frequency (n)	Percentage (%)
Complete Remission	22	30.6
Partial Remission	32	44.4
No Remission	18	25.0
Total	72	100

Table 4: Association of USG findings with parameter of synovitis

Synovitis	USG Findings				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Yes	44	84.6	8	15.4	52	72.2
No	7	35	13	65	20	27.8
Total	51	70.83	21	29.17	72	100

$X^2 = 17.23$, df = 1, p-value = 0.0001

Table 5: Association of USG findings with parameter of effusion

Effusion	USG Findings				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Yes	29	78.4	8	21.6	37	51.4
No	11	31.4	24	68.6	35	48.6
Total	40	55.6	32	44.4	72	100

$X^2 = 15.8$, df = 1, p-value = 0.0001

Table 6: Association of USG findings with parameter of erosion

Erosion	USG Findings				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Yes	5	15.7	27	84.3	32	44.4
No	14	35	26	65	40	55.6
Total	19	26.4	53	73.6	72	100

$X^2 = 3.35$, df = 1, p-value = 0.0672

Table 7: Association of USG findings with parameter of bursitis

Bursitis	USG Findings				Total	
	Positive		Negative			
	No.	%	No.	%	No.	%
Yes	28	77.8	8	22.2	36	50.0
No	15	41.7	21	58.3	36	50.0
Total	43	59.7	29	40.3	72	100

$X^2 = 9.758$, df = 1, p-value = 0.0018

The table indicates that out of 52 participants clinically diagnosed with synovitis, 44 (84.6%) had positive USG findings, while 8 (15.4%) had negative USG findings. Among the 20 participants without clinical synovitis, 7 (35.0%) had positive USG findings, and 13 (65.0%) had negative USG findings. The total number of participants sums up to 100%, with 51 (70.83%) showing positive USG findings and 21 (29.7%) showing negative USG findings. The chi-square value (X^2) is 17.23, with 1 degree of freedom (df), and the p-value is 0.0001, indicating statistically significant association between USG findings and the clinical parameter of synovitis within the study population.(**Table 4**)

The table indicates that out of 37 participants clinically diagnosed with effusion, 29 (78.4%) had positive USG findings, while 8 (21.6%) had negative USG findings. Among the 35 participants without clinical effusion, 11 (31.4%) had positive USG findings, and 24 (68.6%) had negative USG findings. The total number of participants sums up to 100%, with 40 (55.6%) showing positive USG findings and 32 (44.4%) showing negative USG findings. The chi-square value (X^2) is 15.8, with 1 degree of freedom (df), and the p-value is 0.0001, indicating statistically significant association between USG findings and the clinical parameter of effusion within the study population.(**Table 5**)

The table indicates that out of 32 participants clinically diagnosed with erosion, 5 (15.7%) had positive USG findings, while 27 (15.7%) had negative USG findings. Among the 40 participants without clinical erosion, 14 (35%) had positive USG findings, and 26 (65%) had negative USG findings. The total number of participants sums up to 100%, with 19 (26.4%) showing positive USG findings and 53 (73.6%) showing negative USG findings. The chi-square value (X^2) is 3.35, with 1 degree of freedom (df), and the p-value is 0.0672, indicating a statistically no significant association between USG findings and the clinical parameter of erosion within the study population.(**Table 6**)

The table indicates that out of 36 participants clinically diagnosed with bursitis, 28 (77.8%) had positive USG findings, while 8 (22.2%) had negative USG findings. Among the 36 participants without clinical bursitis, the same distribution was observed, with 15 (41.7%) showing positive USG findings and 21 (58.3%) showing negative USG findings. The total number of participants sums up to 100%, with an equal distribution of USG findings among those with and without bursitis. The chi-square value (X^2) is 9.758, with 1 degree of freedom (df), and the p-value is 0.0018, indicating statistically significant association between USG findings and the clinical parameter of bursitis within the study population.(**Table 7**)

4. Discussion

There is significant association between clinical features and Ultrasonography findings**.** Ultrasonography is helpful to detect features of Rheumatoid Arthritis like synovitis, joint effusion and bursitis. R Fakhfakh, N. Elamri, Khadija Baccouche, et al. in a study detected synovial hypertrophy in 94.6% of patients.[11] Bony erosions are not well detected on Ultrasonography in this study. There is significant Ultrasonography correlation with clinical grade in the study. When evaluating synovitis, 11 distinct US scoring systems were evaluated for dependability, including variations in joint counts there were no discernible variations in the dependability of these scoring methods.[12] Ultrasonography offers a high degree of sensitivity in identifying cases of Rheumatoid Arthritis according to Maria Boylan et al.[13]

According to our research, Ultrasonography can be a useful diagnostic technique for identifying early signs of Rheumatoid Arthritis and its remission. According to research by David F. Ten Cate et al. Power Doppler Ultrasonography is beneficial in addition to clinical evaluation for enhancing the early detection of Rheumatoid Arthritis and determining a true remission of the disease.[14] Musculoskeletal ultrasonography evaluation has been shown

by G. Filippieou et al. to be a useful tool for monitoring and assisting in decision-making in patients with Rheumatoid Arthritis who are in clinical remission.[15]

5. Conclusion

Ultrasonography is being used in to measure the activity and progression of the Rheumatoid Arthritis. This imaging data, correlated with clinical assessments, offers valuable insights into the early stages of Rheumatoid Arthritis, facilitating timely therapeutic interventions aimed at halting disease progression and achieving remission. This study emphasizes the importance of early diagnosis and the effective use of Ultrasonography in managing Rheumatoid Arthritis. By integrating clinical findings with Ultrasonography, the study enhances understanding of the disease process, supports the timely initiation of treatment, and improves overall patient outcomes. Through detailed analysis and correlation of Ultrasonography findings with clinical data, the study contributes significantly to the field of rheumatology, emphasizing the critical role of targeted treatment strategies in managing Rheumatoid Arthritis.

6. Source of Funding

None.

7. Conflict of Interest

None.

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