

# Diagnostic value of musculoskeletal USG in patients with rheumatoid arthritis of wrist at a tertiary care center

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## Abstract

**Background:** Musculoskeletal ultrasound may be used to assist needle positioning to facilitate invasive rheumatological procedures such as aspiration of fluid, drainage of abscess, tissue biopsy and local injection of therapeutic agents. **Aim:** To evaluate the diagnostic value of musculoskeletal USG in patients with rheumatoid arthritis of wrist at a tertiary care center. **Material and Methods:** A total of 50 patients (40 patients were already diagnosed and on treatment and 10 patients were newly diagnosed) of Rheumatoid arthritis were studied. 25 healthy volunteers were also included as control cases. All patients were subjected to B mode ultrasonography and power Doppler study of wrist joint. **Results:** The most common pathology that we found in our study was bony erosions. We found carpal erosions in 45 patients. Out of these patients with bony erosions, the pannus associated with bony erosions was found in 38 patients. The pannus was hyperaemic in 34 patients. We also found synovial thickening in Radiocarpal joint in 42 patients. **Conclusion:** Ultrasonography of wrist is a real-time, noninvasive, cheap, easily available investigation in patients with rheumatoid arthritis.

**Key Word:** Rheumatoid arthritis, wrist joint, musculoskeletal ultrasonography, bony erosions

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Received Date: 03/12/2018 Revised Date: 30/12/2018 Accepted Date: 16/01/2019

DOI: <https://doi.org/10.26611/1013921>

## Access this article online

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Accessed Date:  
02 February 2019

## INTRODUCTION

Ultrasonography is a rapid, non-invasive, low-cost, easily available examination and acutely ill patients can be examined painlessly without any special preparation. Advances in high-speed digital processing and transducer technology enabled the production of high-quality images of musculoskeletal structures. Visualization of synovitis, tenosynovitis, rheumatoid erosions and demonstration of soft tissue hyperaemia in rheumatic diseases by

ultrasonographic techniques opened up an unexplored and fascinating realm for rheumatologists and musculoskeletal specialists.<sup>1,2</sup> Perhaps the greatest benefit of US in daily clinical practice lies in the guidance for diagnostic and therapeutic interventions. Musculoskeletal ultrasound may be used to assist needle positioning to facilitate invasive rheumatological procedures such as aspiration of fluid, drainage of abscess, tissue biopsy and local injection of therapeutic agents.<sup>3</sup> US provides the best means for dynamic assessment of tendon movement. Differential changes in various structures can readily be appreciated during active, resisted, and passive motion.<sup>4</sup> US has multi-planar imaging capability currently only rivaled by magnetic resonance imaging (MRI), albeit more expensive. Its high repeatability and sensitivity to change offer the potential use in monitoring disease progression and evaluation of therapeutic efficacy of both local and systemic treatment. The present study was conducted to evaluate the diagnostic value of musculoskeletal USG in patients with rheumatoid arthritis of wrist at a tertiary care center.

**How to cite this article:** Sanket Ravikant Shah, Chetan Shashikant Ravi. Diagnostic value of musculoskeletal USG in patients with rheumatoid arthritis of wrist at a tertiary care center. *MedPulse – International Journal of Radiology*. February 2019; 9(2): 36-39. <http://www.medpulse.in/Radio%20Diagnosis/>

**MATERIAL AND METHODS**

A total of 50 patients attending the outpatient Department of Orthopaedics or Medicine clinically diagnosed as Rheumatoid arthritis with painful wrist joint with positive rheumatoid factor (RA) factor. For clinical diagnosis 1987 ACR criteria were used. Out of the 50 patients included, 40 patients were diagnosed as Rheumatoid arthritis previously and were already on treatment. 10 patients were newly diagnosed as Rheumatoid arthritis (i.e. first time diagnosed). 25 healthy volunteers were also included as control cases.

**Instrumentation:** USG machine: SHIMADZU-Diagnostic ultrasound system. Model: SDU 1200 X Plus, Probe: Triple frequency (5.0Mhz/7.5Mhz/10Mhz) electronic linear probe. High resolution linear array transducers are essential. A minimum of 7.5 MHz probe was used. Since structures of wrist joint are superficially located high frequency probes were preferred.

**METHODOLOGY**

In each patient, standard scan planes were taken such as dorsal longitudinal scan along the radio-carpal joint and along the ulnocarpal joint, dorsal transverse scan along the wrist joint, volar longitudinal scan along the radiocarpal joint and along the ulnocarpal joint, volar transverse scan along the wrist joint. In all cases power Doppler sonography was used to evaluate the vascularity of pannus and inflamed synovium. In all patients cross sectional area of median nerve was obtained in carpal tunnel. Dynamic scanning helped to identify the median nerve.

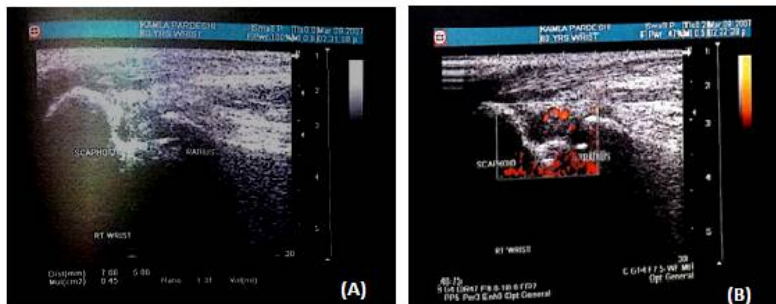
**RESULTS**

Patients from all age groups were included in the study. Most of the patients i.e., 32 (64%) in our study belonged to 31-50 years age group followed by 15 (30%) patients of more than 51 years and only 3 (6%) patients were less than 30 years of age. Female predominance was observed with 38 (76%) female patients and 12 (24%) were male.

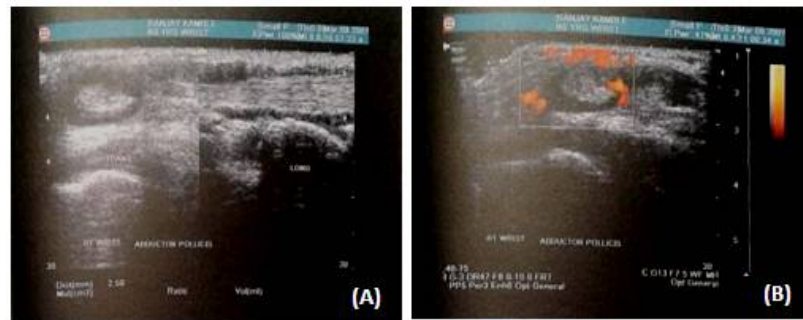
**Table 1: USG findings in study population (N=50 cases)**

Sr. No.	USG findings	No. of cases	Percentage (%)
1	Radiocarpal joint effusion	40	80
2	Radiocarpal joint synovial thickening	42	84
3	Radiocarpal joint synovial hyperaemia	34	68
4	Radiocarpal joint pannus causing bony erosions	38	76
5	Carpal erosions	45	90
6	Tendon tenosynovitis	30	60
7	Tendon rupture	01	02
8	Rheumatoid nodule 02	02	04
9	Carpal tunnel syndrome	00	00

Most of the patients fulfilling the ACR diagnostic criteria showed abnormally thickened synovium with signs of hyperaemia indicating synovitis. In none of the normal volunteers we could find synovial thickening. In our study also cut off for US positivity was defined as synovitis involving a synovial thickness of at least 1mm. We found 42 patients (84%) showing abnormally thickened synovial. Out of 50 patients of RA, thickened synovium was seen in 42 (84%) of patients. Out of these 34 (68%) of patients showed the increased Doppler signals indicating active disease. In none of the normal volunteers we could find synovial thickening. None of the control cases (20) showed pannus formation. We found pannus formation in 38 patients (i.e. 76%), out of these 27 patients showed some form of increased vascularity i.e. semiquantitative Grade I to III Doppler signals indicating disease activity. While remaining 11 patients showed grade 0 or no activity of pannus.



**Figure (A):** Longitudinal sonogram of the radial aspect of the radiocarpal joint in the patient with Rheumatoid arthritis clearly depicts a large crater like bone erosion filled by pannus, measuring 7.6 x 5.0 mm, **Figure (B):** Power Doppler Longitudinal sonogram of the Radial aspect of the Radiocarpal joint in the same patient as above, shows the vascularity of pannus. It was semi-quantitative grade II vascularity that means Doppler signal in < 1/2 area of pannus.



**Figure (A):** Transverse and longitudinal sonogram of the Right wrist joint in a patient with RA clearly depicts a fluid collection along the tendon of Abductor pollicis longus indicating exudative type of tenosynovitis. **Figure (B):** Power Doppler ultrasound image (Transverse scan) of the same patient as in previous patient shows colour spots corresponding to areas of increased synovial perfusion and/or angiogenesis.

## DISCUSSION

The synovium is the primary site of inflammation in the majority of arthritides. There is now increasing evidence in rheumatoid arthritis (RA) that early identification and suppression of synovitis limits the progression of the disease improving the long-term prognosis. Gibbon and Wakefield in their review article states that sonography examination of the hand and wrist in patients with definite or probable early RA shows any swelling of the soft tissues of the fingers corresponds well with underlying synovitis. When comparing the MCP and carpal articulations in patients with RA affecting their hand and wrist there is a significant increase in sonographic synovial abnormalities and erosions compared with normal volunteers.<sup>5</sup> Similar findings were observed in our study. Most of the patients fulfilling the ACR diagnostic criteria showed abnormally thickened synovium with signs of hyperaemia indicating synovitis. In none of the normal volunteers we could find synovial thickening. Ribbens C *et al* in their study reported the mean synovial thickness as of  $0.5\text{mm} \pm 0.2$ . They consider synovial thickness as abnormal when the synovial thickness was equal to or greater than 1mm.<sup>6</sup> In our study also cut off for US positivity was defined as synovitis involving a synovial thickness of at least 1mm. In our study we found 42 patients (84%) showing abnormally thickened synovial. In our study we grade the flow signals semiquantitatively. Kiris A *et al* did not observe flow signals in a significant number of swollen and/or tender joints.<sup>7</sup> Similarly, in our study out of 50 patients of RA, we found thickened synovium in 42 (84%) of patients. Out of these 34 (68%) of patients showed the increased Doppler signals indicating active disease. Hau M *et al* in their study found that healthy joints had no detectable pannus, whereas pannus could be detected in 52 to 82% of active RA and 67% of inactive RA.<sup>8</sup> In our study also none of the control cases showed pannus formation. We found pannus formation in 38 patients (76%), out of these 27 patients showed some

form of increased vascularity i.e., semiquantitative Grade I to III Doppler signals indicating disease activity. While remaining 11 patients showed grade 0 or no activity of pannus. The proof correlation between the power Doppler ultrasound findings and histological findings of synovitis is given by Walther M *et al* in their study.<sup>9</sup> Furthermore, contrast enhanced colour Doppler ultrasound may help in the evaluation of intraarticular vascularization of finger joints in patients with rheumatoid arthritis. In our study, out of 10 newly diagnosed cases of RA, four were put on oral steroids. During follow up of these patients after 6 weeks, 3 out of 4 showed significant improvement clinically. Similarly, on ultrasound we found decrease in synovial thickness and reduced synovial perfusion. Similar results are also obtained in a study by Joel *et al*.<sup>10</sup> Bony erosions are the hallmark of rheumatoid arthritis (RA) with their presence at presentation indicating a poor prognosis. Conventional radiography is the traditional method of investigation, but recent reports suggest that ultrasound is a more sensitive method of detecting early erosions. Ultrasound's main benefit is its ability to visualize the joint in different planes. In our study we included both longitudinal and transverse scan planes to definitely define the bone erosions. We found bony erosions in majority of the patients but none of the control cases showed bony erosions. Also in early disease process bony erosion more often involved the ulnar styloid process than along the radial aspect. In our study we found four cases showing only involvement of ulnar styloid process. Backhaus M *et al* done a study for comparing conventional radiography, scintigraphy, ultrasound and contrast enhanced MRI in arthritis of finger joints and they concluded that ultrasound, scintigraphy and MRI are more sensitive than conventional radiography in detecting bony erosions. Ultrasound is more sensitive than MRI for synovitis and tenosynovitis.<sup>11</sup> Although our study does not include the comparison, out of forty already diagnosed cases of RA who were already on treatment for whom conventional

radiographs had been obtained, when compared with ultrasound we found ultrasound was more sensitive for detecting synovitis and tenosynovitis. Also we found that ultrasound could detect more bony erosions than conventional radiographs. Benedicte Daenen *et al* in their review article states that patients with rheumatoid arthritis present with tendon involvement in 40-80% of cases. Extensor tendon involvement is found in 30-40% of cases.<sup>12</sup> Similarly, in our study we found tenosynovitis in 60% of cases. In our study out of 30 patients showing sonographic evidence of tenosynovitis, 22 patients (i.e. 44%) showed increased signal on power Doppler sonograms indicating active disease. Loss of normal fibrillar echotexture on sonograms is the second most common sign with appearances ranging from a diffuse blurring of the tendon texture to focal defects. In severe cases, tendon tears are observed. In rheumatoid arthritis, tenosynovitis of the extensor carpi ulnaris tendon is particularly common, occurring in up to 50% of involved wrists. In our study, out of 10 newly diagnosed patients of rheumatoid arthritis, 4 patients showed involvements of extensor carpi ulnaris alone or it is more affected than the muscles of radial side. In our study out of 50 patients, one patient (2%) showed tendon rupture. The cause of rupture may be conflict between the tendon and the bone (especially in the case of a dorsally subluxated ulna or Lister's tubercle), tendon invasion by the pannus or tendon compression by the pannus. In rheumatoid arthritis the most common rupture in the wrist involve the extensor pollicis longus tendon and extensor tendon is associated with most functional loss. The propensity toward rupture is correlated not with the extent of tenosynovitis, but with the aggressiveness of the disease (as evidence by a high rheumatoid factor level). This may be the reason why we got somewhat larger percentage of patients showing tendon rupture because in our study we included only rheumatoid factor positive patients.

## CONCLUSION

As compared to conventional radiographs which are the mainstay of diagnosis of rheumatoid arthritis till now, USG has following advantages, USG detects the presence of effusions, bulging, synovial thickening, synovial pannus, Actual vascularity of the synovium, synovial cyst, joint cartilage erosion, damaged tendons and

sheaths, bony erosions, carpal tunnel syndrome and rheumatoid nodules directly.

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Source of Support: None Declared  
Conflict of Interest: None Declared