

# USG in Evaluation of Small Joint Disease

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**Abstract:** Musculoskeletal Ultrasonography (USG) is nowadays widely used for clinical grounds and for research purposes in rheumatology. USG of the hand and wrist has recently developed due to the technological improvement and use of new, high resolution transducers. US is currently improving clinical examination of the rheumatic hand and wrist and it is commonly used as daily practice by many rheumatologists. The number of publications addressing this area of US scanning has grown exponentially over the last few years. The aim of this paper is to review the current literature on US of the hand and wrist in rheumatology, including US scanning techniques, as well as normal and pathological findings. **Methodology:** Position - US scanning of the hand was performed with the patient seated on a chair with hands on the USG table. The most appropriate transducer used for that purpose is a high-frequency linear-array probe, with operating frequencies of 12-18 MHz. **Result:** High resolution US qualifies as a first line tool in the detection and quantification of rheumatic pathology in the hand and wrist area. In case of local swelling, US is the first tool for differential diagnosis. The advantages of being a safe, widely available, non invasive, and widely feasible imaging technique makes it particularly suitable for being used at the bedside in clinical practice. The use of high quality equipment has markedly decreased the learning curve for US in rheumatic diseases [22,40]. Efforts are made for accurate standardization of the method, for making it suitable for an outcome measure both in clinical practice and clinical trials.

**Keywords:** Ultrasonography, DIPs and PIPS joints, Rheumatoid arthritis, Osteoarthritis, Psoriatic arthritis

## 1. Introduction

- X-Rays have always been the 1st inv. in the small joint disorders.
- However with the development US machines with high resolution probes there is much more to look for in small jt. disorders.

Normal sonographic findings of the main anatomic structures of wrist and hand

Anatomic structure	Transducer position	Normal US findings
Tendons	Sagittal	Fibrillar pattern with hyperechoic margins
Tendons	Transverse	Oval to round shape with hyperechoic spots
Bone contours	Sagittal	Hyperechoic and sharp
Intraarticular fat pad	Sagittal	Inverted triangular area with homogenous echogenicity
Cartilage	Sagittal	Anechoic band with hyperechoic margins
Median and ulnar nerve	Transverse	Oval to round shape with hyperechoic spots
Median and ulnar nerve	Sagittal	Fascicular pattern

## 2. Methodology

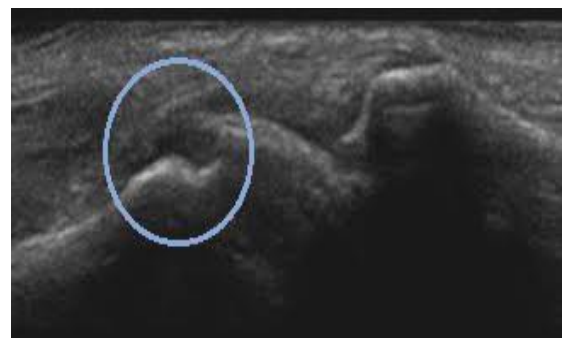
Position - US scanning of the hand was performed with the patient seated on a chair with hands on the USG table. The most appropriate transducer used for that purpose is a high-frequency linear-array probe, with operating frequencies of 12-18 MHz.

- Joints evaluated- PIP, DIP and MCP jts.
- Findings looked for - synovial effusion, synovial thickening, erosions, cartilage changes and osteophytes.

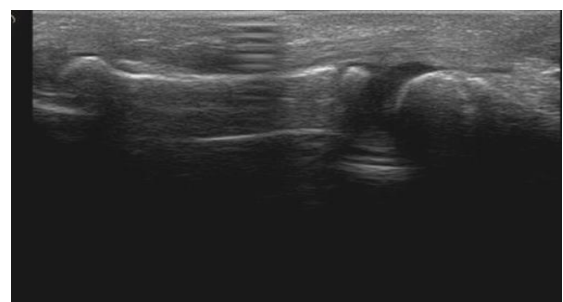
## 3. Discussion: USG features of Joint involvement

### Bone Erosions

- On USG scan, discontinuity of the bone surface visible in two perpendicular planes. Bony erosions appear as an irregular margin and a poorly defined base which mainly affect bare areas of joint. Space formed by bony erosions may / may not be filled with pannus. In case of bony erosions, USG doppler is performed to see for angiogenesis and inflammation
- Erosions in RA are most commonly detected on the heads of the metacarpals and on the bases of the phalanges.



**Synovial effusion:** Synovial effusion is the earliest detectable abnormality on USG in small joint disease. The presence of excess intra-articular fluid suggests synovitis



**Synovial Proliferations:** Synovial Proliferations present as non-compressible thickening of the synovium. Areas of active proliferations show increased flow on Doppler.

**Cartilage Change:** There may be thinning of the cartilage or thickening due to edema. These may not be always seen.

**Doppler Application:** RI is the difference between systolic and diastolic pressure divided by systolic pressure. RI is a good marker of high flow resistance. Under normal circumstances it is 1 and is reduced by angiogenesis induced by synovitis.

- **Osteoarthritis** Osteoarthritis is seen in 50+ age group with equal incidence in Male and Female patients. Changes of osteoarthritis involve Osteophytes involving articular margins of joints forming bones. There is minimal to marked Decrease in joint space noted with thinning of articular cartilage. Changes of osteoarthritis are predominantly noted in DIPs, PIPs and 1<sup>st</sup> Carpometacarpal joint.
- **Rheumatoid arthritis** : Peak age of Rheumatoid arthritis is 40-50 yr with female predominance. Changes of Rheumatoid arthritis on USG scan include Synovial effusion with Synovitis and Synovial proliferation. Involved bones show changes of bone erosions with pannus formation. Changes of Rheumatoid arthritis are typically seen in Metacarpophalangeal joints and PIPs with sparing of DIPs.
- **Psoriatic Arthritis** : Peak age of onset of disease is between 30-50 yr age group with equal distribution among male and female patients. Changes of Psoriatic arthritis on USG scan include Synovial effusion with Synovitis and Synovial proliferation. Involved bones show changes of bone erosions with pannus formation. USG is important for follow up after initiation of treatment. Psoriatic arthritis can affect small and large joints, However it shows preponderance for DIP joint.
- **Gout:** Intratendinous urate deposits appear as circumscribed areas of inhomogenous echoic material covered with hyperechoic spots inside the tendon, which may generate acoustic shadow.

#### 4. Summary

Ultrasound is easy, simple, cheap, dynamic study. Doppler assessment possible for vascularity and inflammation. Clinical correlation possible. Ultrasound detects synovitis that is silent to even clinical examination. Early detection of bone erosions, synovitis are important in clinical decision making. In diagnosed cases, serial USG examination can be used for assessing *Treatment Response and Follow Up*. Protocols and grading criteria are being developed for bone erosions, synovial proliferations. Can be useful for follow-up

#### 5. Conclusion

X-rays and US are not exclusive investigations. Both have their advantages and disadvantages. However US holds a definite edge in early diagnosis, grading and for follow up of small joint pathologies.

**Advantages of US:** Assessment of normal fat pads, tendons, entheses, articular cartilages, effusion, synovial thickening can only be done on USG and not on X-ray.

**Advantages of X-rays:** Assessment of bone density (osteopenia /sclerosis) and deformity is better seen on X-ray c/t to US.

#### References

- [1] Tan AL, Tanner SF, Conaghan PG, et al. Role of metacarpophalangeal joint anatomic factors in the distribution of synovitis and bone erosion in early rheumatoid arthritis. *Arthritis Rheum* 2003; 48: 1214–1222.
- [2] Hau M, Schultz H, Tony H-P, et al. Evaluation of pannus and vascularization of the metacarpophalangeal and proximal interphalangeal joints in rheumatoid arthritis by high-resolution ultrasound (multidimensional linear array). *Arthritis Rheum* 1999; 42:2303–2308.
- [3] Filippucci E, Iagnocco A, Meenagh G, et al. Ultrasound imaging for the rheumatologist II. Ultrasonography of the hand and wrist. *Clin Exp Rheumatol* 2006; 24: 118–122.
- [4] Jacob D, Cohen M, Bianchi S. Ultrasound imaging of nontraumatic lesions of wrist and hand tendons. *Eur Radiol* 2007; 17: 2237-2247.
- [5] Grassi W, Filippucci E, Farina A, Cervini C. Sonographic imaging of tendons. *Arthritis Rheum* 2000; 43: 969-976.
- [6] Grassi W, Lamanna G, Farina A, Cervini C. Sonographic imaging of normal and osteoarthritic cartilage. *Semin Arthritis Rheum* 1999; 28: 398-403.
- [7] Weidekamm C, Koller M, Weber M, Kainberger F. Diagnostic value of high resolution B mode and Doppler sonography for imaging of hand and finger joints in rheumatoid arthritis. *Arthritis Rheum* 2003; 48: 325-333.
- [8] Iagnocco A, Filippucci E, Perella C, et al. Clinical and ultrasonographic monitoring of response to adalimumab treatment in rheumatoid arthritis. *J Rheumatol* 2008; 35: 35-40.
- [9] Iagnocco A, Perella C, Naredo E, et al. Etanercept in the treatment of rheumatoid arthritis: clinical follow-up over one year by ultrasonography. *Clin Rheumatol* 2008; 27: 491-496.
- [10] Dougados M, Jousse-Jolin S, Mistretta F, et al. Evaluation of several ultrasonography scoring systems for synovitis and comparison to clinical examination: results from a prospective multicenter study of rheumatoid arthritis. *Ann Rheum Dis* 2010; 69: 828-833.

- [11] Koski JM, Saarakkala S, Helle M, Hakulinen U, Heikkinen JO, Hermunen H. Power Doppler ultrasonography and synovitis. Correlating ultrasound imaging with histopathological findings and evaluating the performance of ultrasound equipments. *Ann Rheum Dis* 2006; 65: 1590–1595.
- [12] Klauser A, Frauscher F, Schirmer M, et al. The value of contrastenhanced color Doppler ultrasound in the detection of vascularization of finger joints in patients with rheumatoid arthritis. *Arthritis Rheum* 2002; 46: 647–653.