Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Mattar M, Salonen D, Inman RD. Imaging of spondyloarthropathies. *Rheum Dis Clin North Am.* 2013;39(3):645-667.	Review/Other-Dx	N/A	To focus on the pattern of spinal involvement in the axial skeleton, initially speaking about the relevant anatomy of the spine and sacroiliac joints. Then described are the imaging modalities most commonly used today, in addition to the standard imaging protocols for diagnosing and monitoring disease progression	Different types of spondyloarthropathies demonstrate different imaging characteristics that are important to identify to reach the correct diagnosis.	4
2. Dohn UM, Ejbjerg BJ, Court-Payen M, et al. Are bone erosions detected by magnetic resonance imaging and ultrasonography true erosions? A comparison with computed tomography in rheumatoid arthritis metacarpophalangeal joints. *Arthritis Res Ther.* 2006;8(4):R110.	Observational-Dx	17 RA patients and 4 healthy controls	To determine whether bone erosions in RA MCP joints detected with MRI and US, but not with radiography, represent true erosive changes.	The sensitivity, specificity and accuracy, respectively, for detecting bone erosions (with CT as the reference method) were 19%, 100% and 81% for radiography; 68%, 96% and 89% for MRI; and 42%, 91% and 80% for US. When the 16 quadrants with radiographic erosions were excluded from the analysis, similar values for MRI (65%, 96% and 90%) and US (30%, 92% and 80%) were obtained. CT and MRI detected at least 1 erosion in all patients but none in control individuals. US detected at least 1 erosion in 15 patients; however, erosion-like changes were seen on US in all control individuals. 9 patients had no erosions on radiography.	3
3. Aoki T, Fujii M, Yamashita Y, et al. Tomosynthesis of the wrist and hand in patients with rheumatoid arthritis: comparison with radiography and MRI. *AJR Am J Roentgenol.* 2014;202(2):386-390.	Observational-Dx	20 patients with established diagnosis of RA and 5 controls	To compare tomosynthesis with radiography and MRI of the wrist and hand for evaluating bone erosion in patients with RA.	The detection rates of bone erosion for radiography, tomosynthesis, and MRI were 26.5%, 36.1%, and 36.7%, respectively. Significantly more bone erosions were revealed with tomosynthesis and MRI than with radiography ($P<0.01$). When MRI was used as the reference standard, the sensitivity, specificity, and accuracy were 68.1%, 97.5%, and 86.7%, respectively, for radiography and 94.8%, 97.8%, and 96.7%, respectively, for tomosynthesis. Interobserver agreement (kappa value) for bone erosion was good to excellent on tomosynthesis and MRI for all joints (0.65–1.00 and 0.68–1.00, respectively), whereas it was slight to fair on radiography for some carpal bones and bases of metacarpal bones (0.22–0.56).	3

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
4. Wakefield RJ, Gibbon WW, Conaghan PG, et al. The value of sonography in the detection of bone erosions in patients with rheumatoid arthritis: a comparison with conventional radiography. *Arthritis Rheum.* 2000;43(12):2762-2770.	Experimental-Dx	100 RA patients and 20 asymptomatic control subjects	To compare US, a modern imaging technique, with conventional radiography for the detection of erosions in the MCP joints of patients with RA.	US detected 127 definite erosions in 56/100 RA patients, compared with radiographic detection of 32 erosions (26 [81%] of which coincided with US erosions) in 17/100 patients ($P<0.0001$). In early disease, US detected 6.5-fold more erosions than did radiography, in 7.5-fold the number of patients. In late disease, these differences were 3.4-fold and 2.7-fold, respectively. On MRI, all sonographic erosions not visible on radiography (n = 12) corresponded by site to MRI abnormalities. The Cohen-kappa values for intra- and interobserver reliability of sonography were 0.75 and 0.76, respectively.	1
5. Finzel S, Ohrndorf S, Englbrecht M, et al. A detailed comparative study of high-resolution ultrasound and micro-computed tomography for detection of arthritic bone erosions. *Arthritis Rheum.* 2011;63(5):1231-1236.	Experimental-Dx	26 subjects (14 with RA, 6 with PsA , and 6 healthy controls)	To test whether bony lesions appearing on US imaging are cortical breaks detectable by micro-CT.	Overall there was a good correlation between the severity of erosions as assessed by US and by micro-CT (r = 0.463, $P<0.0001$). False-negative results (US negative/micro-CT positive) were obtained in only 9.9% of the joint regions and were mostly due to small erosive lesions at the dorsal sides of the MCP joints. False-positive results (US positive/micro-CT negative) were more frequent (28.6%) and were primarily based on vascular bone channels at the palmar sides of the MCP joints as well pseudo-erosions created by osteophytes.	2
6. Zayat AS, Ellegaard K, Conaghan PG, et al. The specificity of ultrasound-detected bone erosions for rheumatoid arthritis. *Ann Rheum Dis.* 2015;74(5):897-903.	Observational-Dx	250 patients and 60 healthy volunteers	To determine the specificity of US-detected bone erosions (including their size) in the classical “target” joints for RA.	310 subjects were recruited. The inter-reader and intra-reader agreements were good to excellent. US-detected bone erosions were more frequent but not specific for RA (specificity 32.9% and sensitivity 91.4%). The presence of erosions with semiquantitative score ≥2 in four target joints (2nd, 5rd MCP, 5th metatarsophalangeal joints and distal ulna) was highly specific for RA (specificity 97.9% and sensitivity 41.4%). Size of erosion was found to be associated with RA. Erosions of any size in the 5th metatarsophalangeal joint were both specific and sensitive for RA (specificity 85.4% and sensitivity 68.6%).	2

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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7. McQueen FM, Stewart N, Crabbe J, et al. Magnetic resonance imaging of the wrist in early rheumatoid arthritis reveals a high prevalence of erosions at four months after symptom onset. *Ann Rheum Dis.* 1998;57(6):350-356.	Observational-Dx	42 patients	To evaluate the role of MRI of the wrist in detecting early joint damage in patients with RA.	Interobserver reliability for the overall MRI score was high (r = 0.81) as was intraobserver reliability (r = 0.94 for observer 1 and 0.81 for observer 2). There was more variation in scoring synovitis (interobserver reliability: r = 0.74). Erosions were detected in 45% of scans (19/42), compared with 15% of plain radiographs. The most common site for erosions was the capitate (39%), for synovitis the ulnar aspect of the radiocarpal joint, and for tendonitis, the extensor carpi ulnaris tendon. The total MRI score and MRI synovitis score correlated most significantly with C reactive protein (r = 0.40 and 0.42 respectively, $P<0.01$). The MRI erosion score was highly correlated with MRI bone marrow oedema (r = 0.83) as well as the Ritchie score and disease activity score (r = 0.32, $P<0.05$). HLA-DRB1*04 or *01 (shared epitope +ve) was found in 76% of patients; 84% of those with MRI erosions and 69% of those without (NS, $P=0.3$).	2
8. Tan YK, Ostergaard M, Conaghan PG. Imaging tools in rheumatoid arthritis: ultrasound vs magnetic resonance imaging. *Rheumatology (Oxford).* 2012;51 Suppl 7:vii36-42.	Review/Other-Dx	N/A	To compare the performance of US vs MRI as diagnostic, prognostic and monitoring tools for RA, and to provide insights into which modality can provide the optimal information for a desired outcome in a given clinical trial or practice situation.	Comparing US and MRI is difficult due to differences in joints evaluated and quantification methods. Choice of imaging tool depends on their respective strengths and weaknesses and the desired purpose.	4
9. Baillet A, Gaujoux-Viala C, Mouterde G, et al. Comparison of the efficacy of sonography, magnetic resonance imaging and conventional radiography for the detection of bone erosions in rheumatoid arthritis patients: a systematic review and meta-analysis. *Rheumatology (Oxford).* 2011;50(6):1137-1147.	Meta-analysis	21 studies including 913 patients	To evaluate the reproducibility of US and to compare its efficacy with that of MRI and conventional radiography for the detection of bone erosion in RA patients.	Intraobserver and interobserver reproducibility of US for erosion detection was good. US and MRI efficacies were comparable at both joint (OR = 1.19, $P=0.45$; 7 studies, 869 joints) and patient (OR = 1.76, $P=0.22$; 9 studies, 338 patients) levels. US detected significantly more erosion than conventional radiography at both joint (OR = 0.30, $P<0.00001$; 4,047 joints studied) and patient (OR = 0.31, $P<0.00001$; 592 studied patients) levels. The number of patients to screen in order to detect an additional patient with an erosion in comparison with conventional radiography was 4, 95% CI (2.4, 5.9).	M

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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10. Backhaus M, Kamradt T, Sandrock D, et al. Arthritis of the finger joints: a comprehensive approach comparing conventional radiography, scintigraphy, ultrasound, and contrast-enhanced magnetic resonance imaging. *Arthritis Rheum.* 1999;42(6):1232-1245.	Experimental-Dx	60 patients	To compare conventional radiography, 3-phase bone scintigraphy, US, and MRI with precontrast and dynamic postcontrast examinations in patients with various forms of arthritis including RA, spondyl-arthropathy, and arthritis associated with connective tissue disease.	Clinical evaluation, scintigraphy, MRI, and US were each more sensitive than conventional radiography in detecting inflammatory soft tissue lesions as well as destructive joint processes in arthritis patients in group 1. All differences were statistically significant. We found US to be even more sensitive than MRI in the detection of synovitis. MRI detected erosions in 92 finger joints (20%; 26 patients) in group 1 that had not been detected by conventional radiography.	1
11. Sugimoto H, Takeda A, Hyodoh K. Early-stage rheumatoid arthritis: prospective study of the effectiveness of MR imaging for diagnosis. *Radiology.* 2000;216(2):569-575.	Observational-Dx	50 consecutive patients	To assess the effectiveness of MRI for the diagnosis of early-stage RA.	Final diagnoses were established after a mean follow-up of 776 days: RA in 26 patients and nonrheumatoid disease in 22. Use of the MRI criterion yielded the correct diagnosis in 25 patients with RA and 3 false-positive results in 3 patients without RA. As compared with the traditional format and classification tree criteria of the American Rheumatism Association, the MRI criterion allowed detection of 7 and 6 additional patients with true RA, respectively. The introduction of MRI into the diagnostic criteria for early RA may contribute to more accurate diagnosis in patients suspected of having RA and thus allow an earlier decision to start proper medication.	3

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
12. Reiche BE, Ohrndorf S, Feist E, Messerschmidt J, Burmester GR, Backhaus M. Usefulness of power Doppler ultrasound for prediction of re-therapy with rituximab in rheumatoid arthritis: a prospective study of longstanding rheumatoid arthritis patients. *Arthritis Care Res (Hoboken).* 2014;66(2):204-216.	Experimental-Dx	20 patients	To assess the value of gray-scale and PDUS in detecting inflammatory/destructive changes and for prediction of necessity of re-therapy with rituximab in patients with RA over 1 year of follow-up.	Significant decreases in clinical and laboratory parameters were observed after 6 and 12 months. US synovitis scores significantly decreased after 6 and 12 months (P<0.05 for each). Regarding patients who received re-therapy between 6 and 9 months after the start of therapy (n = 9), a fair therapy response was still detectable before re-therapy. In these patients, PD-positive synovitis was the only parameter that increased up to the 6-month examination. All patients negative for rheumatoid factor and anti-cyclic citrullinated peptide (n = 4) were in the group of patients receiving a second course of treatment. Seropositive patients showed a better response to treatment with less need for re-therapy.	3
13. Navalho M, Resende C, Rodrigues AM, et al. Bilateral MR imaging of the hand and wrist in early and very early inflammatory arthritis: tenosynovitis is associated with progression to rheumatoid arthritis. *Radiology.* 2012;264(3):823-833.	Experimental-Dx	32 women and 3 men	To identify bilateral hand and wrist findings of synovial inflammation associated with progression to RA in very-early-RA cohort (duration, <3 months) and early-RA cohort (duration, <12 but >3 months), to test tenosynovitis as a MRI additional parameter for improving diagnostic accuracy of the 2010 American College of Rheumatology/European League Against Rheumatism (ACR/EULAR) RA classification criteria, and to evaluate the symmetry of joint and tendon involvement.	Tenosynovitis of the extensor carpi ulnaris (OR, 3.21) and flexor tendons of the second finger (OR, 14.61) in very-early-RA group and synovitis of the radioulnar joint (OR, 8.79) and tenosynovitis of flexor tendons of the second finger (OR, 9.60) in early-RA group were significantly associated with progression to RA (P<.05). Consideration of tenosynovitis improved areas under the receiver operating characteristic curve of ACR/EULAR criteria performance for the diagnosis of RA from 0.942 (P<.0001; sensitivity, 52%; specificity, 100%) to 0.972 (P<.0001; sensitivity, 76%; specificity, 100%), with cutoff score of 6 or greater. Asymmetry was found in 80.0% (62/77) (very-early-RA patients) and 69.3% (106/153) (early-RA patients) of joint or tendon pairs (P<.05).	2
14. McQueen FM. Imaging in early rheumatoid arthritis. *Best Pract Res Clin Rheumatol.* 2013;27(4):499-522.	Review/Other-Dx	N/A	To summarize the latest imaging advances in the field of early RA, including the role played by each modality, firstly in diagnosis and secondly in monitoring disease activity and damage.	No results stated in abstract.	4

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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15. Kubota K, Ito K, Morooka M, et al. FDG PET for rheumatoid arthritis: basic considerations and whole-body PET/CT. *Ann N Y Acad Sci.* 2011;1228:29-38.	Review/Other-Dx	N/A	Review the use of FDG-PET for patients with RA.	FDG-PET/CT enables the detailed evaluation of disease in large joints throughout the whole body, which is a unique advantage of PET/CT. FDG-PET/CT can also be used to detect high-risk disease complications, such as atlanto-axial joint involvement, at an early stage. The possible contribution of FDG-PET to the management of patients with RA remains to be studied in detail.	4
16. Girish G, Glazebrook KN, Jacobson JA. Advanced imaging in gout. *AJR Am J Roentgenol.* 2013;201(3):515-525.	Review/Other-Dx	N/A	To describe the role of advanced imaging using US, CT, and MRI in the assessment and diagnosis of gout.	Dual-energy CT can quantitatively identify monosodium urate crystal deposits with high sensitivity and specificity within joints, tendons, and periarticular soft tissues. There are several characteristic US imaging findings, which include visualization of echogenic monosodium urate crystal deposition, tophus, and adjacent erosions. MRI is sensitive in showing soft-tissue and osseous abnormalities of gout, although the imaging findings are not specific. Gout commonly involves specific joints and anatomic structures, and knowledge of these sites and imaging appearances are clues to the correct diagnosis.	4
17. Choi HK, Burns LC, Shojania K, et al. Dual energy CT in gout: a prospective validation study. *Ann Rheum Dis.* 2012;71(9):1466-1471.	Observational-Dx	80 patients (40 crystal-proven gout patients and 40 controls)	To determine: (1) the specificity and sensitivity of dual energy CT for gout; and (2) the interobserver and intraobserver reproducibility for dual energy CT urate volume measurements.	The mean age of the 40 gout patients was 62 years, the mean gout duration was 13 years and 87% had a history of urate-lowering therapy. The specificity and sensitivity of dual energy CT for gout were 0.93 (95% CI, 0.80 to 0.98) and 0.78 (0.62 to 0.89), respectively. When the authors excluded 3 gout cases with unreadable or incomplete scans, the sensitivity was 0.84 (95% CI, 0.68 to 0.94). The urate volumes of 40 index tophi ranged from 0.06 cm(3) to 18.74 cm(3) with a mean of 2.45 cm(3). Interobserver and intraobserver intraclass correlation coefficients for dual energy CT volume measurements were 1.00 (95% CI, 1.00 to 1.00) and 1.00 (95% CI, 1.00 to 1.00) with corresponding bias estimates (SD) of 0.01 (0.00) cm(3) and 0.01 (0.03) cm(3).	2

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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18. McCollough CH, Leng S, Yu L, Fletcher JG. Dual- and Multi-Energy CT: Principles, Technical Approaches, and Clinical Applications. *Radiology.* 2015;276(3):637-653.	Review/Other-Dx	N/A	To review the underlying motivation and physical principles of dual- or multi-energy CT and to describe each the current technical approaches. In addition, current and evolving clinical applications are introduced.	No results stated in abstract.	4
19. Colebatch AN, Edwards CJ, Ostergaard M, et al. EULAR recommendations for the use of imaging of the joints in the clinical management of rheumatoid arthritis. *Ann Rheum Dis.* 2013;72(6):804-814.	Review/Other-Dx	199 studies	To develop evidence-based recommendations on the use of imaging of the joints in the clinical management of RA.	A total of 6,888 references were identified from the search process, from which 199 studies were included in the systematic review. 10 recommendations were produced encompassing the role of imaging in making a diagnosis of RA, detecting inflammation and damage, predicting outcome and response to treatment, monitoring disease activity, progression and remission. The strength of recommendation for each proposition varied according to both the research evidence and expert opinion.	4
20. Tan YK, Ostergaard M, Bird P, Conaghan PG. Ultrasound versus high field magnetic resonance imaging in rheumatoid arthritis. *Clin Exp Rheumatol.* 2014;32(1 Suppl 80):S99-105.	Review/Other-Dx	N/A	To compare the usefulness of US and MRI in RA diagnosis, prognosis and outcome assessment.	No results stated in abstract.	4
21. Ostergaard M, Conaghan PG, O'Connor P, et al. Reducing invasiveness, duration, and cost of magnetic resonance imaging in rheumatoid arthritis by omitting intravenous contrast injection -- Does it change the assessment of inflammatory and destructive joint changes by the OMERACT RAMRIS? *J Rheumatol.* 2009;36(8):1806-1810.	Observational-Dx	86 patients and 5 controls	We explored to what extent RA joint pathologies in wrists and MCP joints can be reliably assessed by unenhanced MRI images compared with Gd-enhanced MRI as the reference method.	Gd contrast injection appeared unimportant to MRI scores of bone erosions and bone edema in RA wrist and MCP joints. However, when post-Gd MRI was considered the standard reference, MRI without Gd provided only moderate to high agreement concerning assessment of synovitis, and omitting the post-Gd acquisitions increased the interreader variation on synovitis scores. Low-field (0.2 T) E-MRI in these exercises provided a lower sensitivity of unenhanced imaging for synovitis than MRI using higher-field strengths.	2

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EVIDENCE TABLE

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22. Stomp W, Krabben A, van der Heijde D, et al. Aiming for a simpler early arthritis MRI protocol: can Gd contrast administration be eliminated? *Eur Radiol.* 2015;25(5):1520-1527.	Observational-Dx	93 patients	To evaluate whether intravenous Gd contrast administration can be eliminated when evaluating synovitis and tenosynovitis in early arthritis patients, thereby decreasing imaging time, cost, and invasiveness.	At the individual joint/tendon level, sensitivity to detect synovitis without Gd contrast was 91% and 72% for the 2 readers, respectively, with a specificity of 51% and 81%. For tenosynovitis, the sensitivity was 67% and 54%, respectively, with a specificity of 87% and 91%. Pooled data analysis revealed an overall sensitivity of 81% and specificity of 50% for evaluation of synovitis. Variations in tenosynovitis scoring systems hindered pooled analyses.	3
23. Freeston JE, Wakefield RJ, Conaghan PG, Hensor EM, Stewart SP, Emery P. A diagnostic algorithm for persistence of very early inflammatory arthritis: the utility of power Doppler ultrasound when added to conventional assessment tools. *Ann Rheum Dis.* 2010;69(2):417-419.	Observational-Dx	50 patients	To assess the value of PDUS in combination with routine management in a cohort of patients with very early inflammatory arthritis.	All patients positive for rheumatoid factor and/or cyclic citrullinated peptide developed persistent inflammatory arthritis, so the added value of PDUS was assessed in the seronegative (rheumatoid factor and citrullinated peptide negative) group. The probability of inflammatory arthritis in a seronegative patient was 6%. The addition of clinical and radiographic features raised the probability of inflammatory arthritis to 30% and, with certain US features, this rose to 94%.	3
24. Witt M, Mueller F, Nigg A, et al. Relevance of grade 1 gray-scale ultrasound findings in wrists and small joints to the assessment of subclinical synovitis in rheumatoid arthritis. *Arthritis Rheum.* 2013;65(7):1694-1701.	Observational-Dx	100 patients with early or established RA and 30 healthy controls	To investigate the clinical relevance of grade 1 findings on gray-scale US of the joints in patients with RA.	Grade 1 results represented the majority of all gray-scale US findings in patients with RA and were also frequently recorded in healthy controls. Grade 1 gray-scale US findings were not associated with tenderness, swelling, or positive results on PDUS. In comparison to joints with grade 2 and grade 3 findings on gray-scale US, joints with grade 1 findings were less likely to respond to treatment.	3

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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25. Witt MN, Mueller F, Weinert P, et al. Ultrasound of synovitis in rheumatoid arthritis: advantages of the dorsal over the palmar approach to finger joints. *J Rheumatol.* 2014;41(3):422-428.	Observational-Dx	70 patients	To compare the dorsal and palmar US examination of finger joints in early RA with regard to the concurrence of gray-scale US and PDUS positivity, and to correlate both approaches with clinical variables.	With 44.6% vs 32.2% positive findings, palmar gray-scale US identified significantly more joints with synovitis than did dorsal gray-scale US. With 22.1% vs 8.9%, PDUS abnormalities were detected significantly more often from the dorsal side. With 71.2% vs 21.8% for the MCP and 57.5% vs 17.4% for the proximal interphalangeal joints, significantly more gray-scale US and PDUS double-positive joints were found with the dorsal as opposed to the palmar approach. These differences remained significant at month 6. Both palmar and dorsal gray-scale US and PDUS correlated with comparable strength with clinical variables such as the Disease Activity Score 28, Clinical Disease Activity Index, and Simple Disease Activity Index.	2
26. Backhaus M, Ohrndorf S, Kellner H, et al. Evaluation of a novel 7-joint ultrasound score in daily rheumatologic practice: a pilot project. *Arthritis Rheum.* 2009;61(9):1194-1201.	Observational-Dx	120 patients	To introduce a new standardized US score based on 7 joints of the clinically dominant hand and foot (German US7 score) implemented in daily rheumatologic practice.	120 patients (76% women) with RA (91%) and PsA (9%) were enrolled. In 52 cases (43%), erosions were seen in radiography at baseline. Patients received DMARDs (41%), DMARDs plus TNFalpha inhibitors (41%), or TNFalpha inhibitor monotherapy (18%). At baseline, the mean DAS28 was 5.0 and the synovitis scores were 8.1 in greyscale US and 3.3 in PDUS. After 6 months of therapy, the DAS28 significantly decreased to 3.6 (Delta = 1.4), and the GS and PDUS scores significantly decreased to 5.5 (-32%) and 2.0 (-39%), respectively.	2

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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27. Ohrndorf S, Halbauer B, Martus P, et al. Detailed Joint Region Analysis of the 7-Joint Ultrasound Score: Evaluation of an Arthritis Patient Cohort over One Year. *Int J Rheumatol.* 2013;2013:493848.	Observational-Dx	45 patients	The main objective of this study was to evaluate the 7-joint US score by detailed joint region analysis of an arthritis patient cohort.	The joint region analysis performed at baseline disclosed synovitis in 95.6% of affected wrists in the dorsal aspect by greyscale US where Grade 2 (moderate) was most often (48.9%) detected. Palmar wrist regions presented Grade 1 (minor) capsule elevation in 40% and Grade 2 (moderate synovitis) in 37.8%. Tenosynovitis of the extensor carpi ulnaris tendon was found in 40%, with PD activity in 6.6%. Most of the erosions in MCP II were detected in the radial (68.9%), followed by the dorsal (48.9%) and palmar (44.4%) aspects. In MTP V, erosions were seen in 75.6% from lateral.	3
28. Rosa J, Ruta S, Saucedo C, et al. Does a Simplified 6-Joint Ultrasound Index Correlate Well Enough With the 28-Joint Disease Activity Score to Be Used in Clinical Practice? *J Clin Rheumatol.* 2016;22(4):179-183.	Observational-Dx	60 patients	We compared 3 US indices (with different numbers of joints) with disease activity measured by the 28-Joint Disease Activity Score (DAS28) in order to find the most parsimonious index still useful in clinical practice.	All 3 US indices were significantly higher in patients with active disease vs inactive disease ($P<0.05$ for all 3). US index C showed the best correlation with DAS28 (rho = 0.5020, $P<0.0001$) and a very good discriminative value for moderate to high disease activity (DAS28 >3.2) and for absence of remission (DAS28 >2.6) (areas under receiver operating characteristic curve = 0.75 and 0.80, respectively). A cutoff value of 3 in US index C showed sensitivity of 88.89% and specificity of 66.67% for absence of remission. Correlation between the 3 US indices was excellent.	1

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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29. Weiner SM, Jurenz S, Uhl M, et al. Ultrasonography in the assessment of peripheral joint involvement in psoriatic arthritis : a comparison with radiography, MRI and scintigraphy. *Clin Rheumatol.* 2008;27(8):983-989.	Observational-Dx	13 consecutive patients	To investigate the role of musculoskeletal US in the assessment of hand and foot small joints in PsA.	US, MRI and scintigraphy had a higher sensitivity in the detection of overall joint pathology than radiography in painful and/or swollen joints (71%, 72%, 82% vs 32%) and clinically unaffected joints (17%, 21%, 9% vs 2%). US and radiography detected more erosions and osteoproliferations than MRI, with low agreement between the methods in the detection of erosions. Radiography was superior to US in the visualization of osteoproliferations. Joint effusions and/or synovitis were more frequently detected by MRI than US. Agreement between both imaging methods was better in carpal joints, carpometacarpal joint I, MCP/metatarsophalangeal joint I, II and V than in MCP/metatarsophalangeal III, IV, proximal interphalangeal and DIP joints. Compared with MRI, radiography and scintigraphy, the specificity of US ranges between 0.84 and 0.94, depending on the joint pathology. The diagnostic sensitivity of US in the detection of PsA-related synovitis of hands and feet is lower than MRI and depends on the joint region. However, the low cost and the acceptable specificity suggest that US is a useful imaging method in addition to radiography in PsA of hands and feet.	2
30. Poggenborg RP, Ostergaard M, Terslev L. Imaging in Psoriatic Arthritis. *Rheum Dis Clin North Am.* 2015;41(4):593-613.	Review/Other-Dx	N/A	To provide an overview of the status, virtues, and limitations of imaging modalities in PsA, focusing on radiography, US, and MRI.	No results stated in abstract.	4
31. Taniguchi Y, Kumon Y, Takata T, et al. Imaging assessment of enthesitis in spondyloarthritis. *Ann Nucl Med.* 2013;27(2):105-111.	Review/Other-Dx	N/A	To review imaging of enthesitis in spondyloarthritis.	New imaging techniques including MRI, US, and PET/CT using FDG capable of detecting morphological and metabolic abnormalities and monitoring disease activity have improved the assessment and management of enthesitis of spondyloarthritis.	4

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

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32. Sandobal C, Carbo E, Iribas J, Roverano S, Paira S. Ultrasound nail imaging on patients with psoriasis and psoriatic arthritis compared with rheumatoid arthritis and control subjects. *J Clin Rheumatol.* 2014;20(1):21-24.	Observational-Dx	35 patients with PsA, 20 with cutaneous psoriasis, and control groups (28 control subjects and 27 patients with RA)	To show findings at finger nails level revealed by high-frequency gray-scale US and power Doppler in patients with PsA, and cutaneous psoriasis compared with RA and control subjects.	All patients and control subjects presented abnormalities in the US imaging. Those with PsA and cutaneous psoriasis showed a higher number of compromised nails. When classifying those abnormalities using the typology of Wortsman et al, patients with PsA showed loosening of the borders of the ventral plate (type II), whereas patients with cutaneous psoriasis showed focal hyperechoic involvement of the ventral plate without involvement of the dorsal plate (type I). Patients of the control group could not be classified, although 31 of 55 showed thinning of the ventral plate without hyperechoic deposits. 19/35 patients with PsA, and 10/20 patients with cutaneous psoriasis did not show any nail clinical alterations. Nevertheless, the US detected type II alterations in the first group and type I in the second group. Patients with psoriatic arthropathy had power Doppler increases in distal interphalangeal joints and nail beds in a statistically significant form (P=0.0001).When measuring the distance between the ventral plate and the bone margin of the distal phalanx, there was homogeneity among samples in patients and control subjects. A receiver operating characteristic curve analysis determined that a cut point of 2 mm clearly defined these 2 groups. There was a significant difference (P<0.0001) between the mean distance ventral plate-osseous margin of the distal phalanx in PsA patients (P=0.001) and patients with cutaneous psoriasis (P=0.005) vs RA patients (P=0.548).	3
33. Spira D, Kotter I, Henes J, et al. MRI findings in psoriatic arthritis of the hands. *AJR Am J Roentgenol.* 2010;195(5):1187-1193.	Review/Other-Dx	N/A	To provide a practical review of the spectrum of morphologic and functional MRI findings in PsA of the hand joints.	The MRI findings of PsA include enthesitis, bone marrow edema, and periostitis accompanying articular or flexor tendon sheath synovitis in the early stage accompanied by destructive and proliferative bony changes, subluxation, and ankylosis in the late stage.	4

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
34. American College of Radiology. ACR Appropriateness Criteria®: Chronic Back Pain: Suspected Sacroiliitis/Spondyloarthropathy. Available at: URL (TBD).	Review/Other-Dx	N/A	Evidence-based guidelines to assist referring physicians and other providers in making the most appropriate imaging or treatment decision regarding chronic back pain: suspected sacroiliitis/spondyloarthropathy.	N/A	4
35. Ogdie A, Taylor WJ, Weatherall M, et al. Imaging modalities for the classification of gout: systematic literature review and meta-analysis. *Ann Rheum Dis.* 2014.	Meta-analysis	11 studies (9 manuscripts and 2 meeting abstracts)	To examine the usefulness of imaging modalities in the classification of gout when compared to monosodium urate crystal confirmation as the gold standard, in order to inform development of new gout classification criteria.	All studies were set in secondary care, with mean gout disease duration of at least 7 years. 3 features were examined in more than 1 study: the double contour sign on US, tophus on US, and monosodium urate crystal deposition on dual-energy CT. The pooled (95% CI) sensitivity and specificity of US double contour sign were 0.83 (0.72 to 0.91) and 0.76 (0.68 to 0.83), respectively; of US tophus, were 0.65 (0.34 to 0.87) and 0.80 (0.38 to 0.96), respectively; and of dual-energy CT, were 0.87 (0.79 to 0.93) and 0.84 (0.75 to 0.90), respectively.	M
36. Sivera F, Andres M, Falzon L, van der Heijde DM, Carmona L. Diagnostic value of clinical, laboratory, and imaging findings in patients with a clinical suspicion of gout: a systematic literature review. *J Rheumatol Suppl.* 2014;92:3-8.	Review/Other-Dx	19 studies	To analyze the diagnostic utility of clinical, laboratory, and imaging items for gout.	19 studies were included in the review; 4 used the identification of monosodium urate crystals as the reference standard (RS) and the rest used expert opinion or the ACR preliminary criteria. Most features were evaluated in a single study. Evidence for diagnostic utility, using monosodium urate crystals as reference standard, of over 50 individual clinical, laboratory, and radiographic features was retrieved. Most items showed a positive likelihood ratio+ <3, except for the following: response of arthritis to colchicine (likelihood ratio+ 4.3); presence of tophi on physical examination (likelihood ratio+ 15.6-30.9); identification of the double-contour sign in US (likelihood ratio+ 13.6); and detection of urate deposits by dual-energy CT (likelihood ratio+ 9.5).	4

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
37. Chowalloor PV, Keen HI. A systematic review of ultrasonography in gout and asymptomatic hyperuricaemia. *Ann Rheum Dis.* 2013;72(5):638-645.	Review/Other-Dx	N/A	To undertake a systematic review evaluating US as an outcome tool in gout and asymptomatic hyperuricaemia.	US was less sensitive than MRI to cortical erosions in gout, but better than conventional radiography. Interobserver reliability when assessed ranged from fair to substantial agreement for soft tissue changes and was very good for assessing tophi, double contour and erosions. US is a promising tool which could be used in the diagnosis and management of gout. More studies are needed to assess responsiveness, reliability and feasibility.	4
38. Gentili A. Advanced imaging of gout. *Semin Musculoskelet Radiol.* 2003;7(3):165-174.	Review/Other-Dx	N/A	To describe the characteristics of gout.	No results stated in abstract.	4
39. McQueen FM, Doyle A, Reeves Q, et al. Bone erosions in patients with chronic gouty arthropathy are associated with tophi but not bone oedema or synovitis: new insights from a 3 T MRI study. *Rheumatology (Oxford).* 2014;53(1):95-103.	Experimental-Dx	40 gout patients	To use MRI scans to explore associations between bone erosion, bone oedema, synovitis and tophi in gout with a view to clarifying the processes underlying bone erosion and joint damage.	Inter-reader reliability was high for erosions and tophi [intraclass correlation coefficients 0.77 (95% CI, 0.71, 0.87) and 0.71 (95% CI, 0.52, 0.83)] and moderate for bone oedema [intraclass correlation coefficients = 0.60 (95% CI, 0.36, 0.77)]. Compared with dual-energy CT, MRI had a specificity of 0.98 (95% CI, 0.93, 0.99) and sensitivity of 0.63 (95% CI, 0.48, 0.76) for tophi. Erosions were detected in 63% of patients and were strongly associated with tophi [OR = 13.0 (95% CI, 1.5, 113)]. In contrast, no association was found between erosions and bone oedema. Using concordant data, bone oedema was scored at 6/548 (1%) sites in 5/40 patients (12.5%) and was very mild (median carpal score = 1, maximum = 45). In logistic regression analysis across all joints nested within individuals, tophus, but not synovitis, was independently associated with erosion [OR = 156.5 (21.2, >999.9), $P<0.0001$].	1
40. Miksanek J, Rosenthal AK. Imaging of calcium pyrophosphate deposition disease. *Curr Rheumatol Rep.* 2015;17(3):20.	Review/Other-Dx	N/A	To critically review the recent literature on imaging in calcium pyrophosphate deposition disease.	Advances in imaging in calcium pyrophosphate deposition disease will increase diagnostic accuracy and eventually result in better management of this common form of arthritis.	4

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
41. McQueen FM, Doyle A, Dalbeth N. Imaging in the crystal arthropathies. *Rheum Dis Clin North Am.* 2014;40(2):231-249.	Review/Other-Dx	N/A	To review the use of imaging techniques in the crystal arthropathies, with an emphasis on recent advances in this field and evolving clinical applications.	No results stated in abstract.	4
42. Beltran J, Marty-Delfaut E, Bencardino J, et al. Chondrocalcinosis of the hyaline cartilage of the knee: MRI manifestations. *Skeletal Radiol.* 1998;27(7):369-374.	Observational-Dx	72 articular surfaces were evaluated	To determine the ability of MRI to detect the presence of crystals of calcium pyrophosphate in the articular cartilage of the knee.	MRI revealed multiple hypointense foci within the articular cartilage in 34 articular surfaces, better shown on 2D and 3D GRE sequences. Radiographs showed 12 articular surfaces with chondrocalcinosis. In three cases with arthroscopic or surgical correlation, MRI demonstrated more diffuse involvement of the articular cartilage than did the radiographs. The 3D Fat Sat GRE sequences were the best for demonstrating articular calcification in vitro. In no case was meniscal calcification identified with MRI. Hyperintense halos around some of the calcifications were seen on the MRIs.	4
43. Gutierrez M, Di Geso L, Salaffi F, et al. Ultrasound detection of cartilage calcification at knee level in calcium pyrophosphate deposition disease. *Arthritis Care Res (Hoboken).* 2014;66(1):69-73.	Observational-Dx	74 calcium pyrophosphate deposition disease patients and 83 controls	To determine the sensitivity, specificity, and accuracy of US in the detection of cartilage calcification at knee level in patients with calcium pyrophosphate deposition disease and to assess the interobserver reliability.	A total of 314 knees in 157 patients (74 with calcium pyrophosphate deposition disease, 19 with RA, 17 with spondyloarthritis, 32 with osteoarthritis, and 15 with gout) were assessed. In the 74 patients with calcium pyrophosphate deposition disease, hyaline cartilage spots were detected by US in at least 1 knee in 44 patients (59.5%), whereas radiography detected hyaline cartilage spots in 34 patients (45.9%) ($P<0.001$). Meniscal fibrocartilage calcifications were detected by US in 67 of the 74 calcium pyrophosphate deposition disease patients (90.5%), whereas conventional radiography detected calcifications in 62 patients (83.7%) ($P=0.011$). The criterion validity expressed as percentage of sensitivity, specificity, and accuracy of US in the detection of articular cartilage calcification was high. Both kappa values and overall agreement percentages showed moderate to excellent agreement.	2
44. Greenspan A. Erosive osteoarthritis. *Semin Musculoskelet Radiol.* 2003;7(2):155-159.	Review/Other-Dx	N/A	To describe the features of erosive osteoarthritis and the utility of imaging studies to assess the disease.	No results stated in abstract.	4

Chronic Extremity Joint Pain-Suspected Inflammatory Arthritis
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
45. Wittoek R, Jans L, Lambrecht V, Carron P, Verstraete K, Verbruggen G. Reliability and construct validity of ultrasonography of soft tissue and destructive changes in erosive osteoarthritis of the interphalangeal finger joints: a comparison with MRI. *Ann Rheum Dis.* 2011;70(2):278-283.	Experimental-Dx	252 joints	To study the reliability and construct validity of US in interphalangeal finger joints affected by erosive osteoarthritis and non-erosive osteoarthritis with MRI as the reference method.	US and MRI were found to be more sensitive in detecting erosions than conventional radiography in erosive osteoarthritis. A high agreement between US and MRI in the assessment of bone erosions (77.7%), osteophytes (75.9%) and synovitis (86.5%) was present. A high percentage of inflammatory changes was found in erosive osteoarthritis and in smaller amount in non-erosive osteoarthritis, both confirmed by MRI. Good interobserver reliability of US was obtained for all variables (all median kappa >0.8).	1

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  c) the study is an expert opinion or consensus document.
- M = Meta-analysis

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

CI = Confidence interval

CT = Computed tomography

FDG-PET = Fluorine-18-2-fluoro-2-deoxy-D-glucose-positron emission tomography

Gd = Gadolinium

MCP = Metacarpophalangeal

MRI = Magnetic resonance imaging

OR = Odds ratio

PDUS = Power Doppler ultrasound

PsA = Psoriatic arthritis

RA = Rheumatoid arthritis

US = Ultrasound