Conclusions: RA patients without active inflammation of the hands demonstrate a significantly higher mean temperature compared to healthy individuals. These findings provide evidence that baseline thermal data in RA differs significantly from healthy individuals. Thermal imaging may have the potential to become an adjunct assessment method of disease activity in patients with RA.

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FRI0558 FURTHER VALIDATION OF THE US7 SCORE IN A LARGE COHORT OF PATIENTS WITH RHEUMATOID ARTHRITIS WITH DIFFERENT DISEASE STAGES

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Background: Musculoskeletal ultrasound (US) is increasingly used in rheumatology clinical practice and research. Standardisation of US scanning techniques and definitions of pathologies is driven forward by the EULAR and OMERACT (Outcome measures in rheumatology) definitions and guidelines. However, no international consensus on a globally accepted US score system on patient level has been achieved so far. The US7 score, first published in 2009, assesses soft tissue lesions (synovitis, tenosynovitis/paratenonitis) as well as bone erosions of 7 preselected joints in one score.¹

Objectives: The aim of this retrospective analysis was to further validate the US7 score by a detailed analysis of affected joint regions in patients with different RA disease stages.

Methods: The US7 score¹ examines the most commonly affected joints in RA, including the wrist, MCP2,3, PIP2,3 and MTP2,5 joints, for synovitis and tenosynovitis/paratenonitis and bone erosions from dorsal, palmar, ulnar (wrist), radial (only MCP2) and lateral (only MTP5) by greyscale (GS) and power Doppler (PD) US. In this retrospective analysis, our population of 524 patients with RA was divided into 3 subgroups – 69 patients (13.2%) with very early RA (max. 6 months disease duration), 98 patients with early RA (>6 month, ≤2 years of disease duration), and 343 patients (65.5%) with established RA (>2 years disease duration). Patients were examined at baseline, 3, 6 and 12 months after starting or changing therapy (csDMARD/bDMARD).

Results: MCP2 and the wrist (especially from dorsal) were most frequently affected by GS/PDUS synovitis in all groups. PDUS showed a slight tendency towards the dorsal versus the palmar joint side being more often affected in all groups. The group of established RA was more often affected by synovitis, while tenosynovitis/paratenonitis appeared more frequently in very early RA. Significant sensitivity to change within 12 months was detected by GSUS in the group of very early RA in all hand joint regions (for synovitis: $p < 0.001$ MCP2,3 and wrist; $p = 0.046$ PIP2; $p = 0.001$ PIP3) and MTP2 ($p = 0.024$), but not in MTP5 ($p = 0.313$). PDUS demonstrated that the palmar sides of MCP2, PIP2 ($p < 0.001$ for all) as well as the dorsal sides of MCP2 ($p = 0.019$), MCP3 ($p = 0.008$), PIP2 and 3 ($p = 0.029$ both), MTP5 ($p = 0.025$) and all wrist sides ($p < 0.001$, $p = 0.013$, $p = 0.001$, respectively) responded significantly to therapy, while MCP3, PIP3 palmar and MTP 2 dorsal did not show significant response ($p = 0.054$, $p = 0.494$, $p = 0.172$, respectively). In established RA, all joint regions included significantly responded to therapy (PIP2 GS: $p = 0.004$, all others $p < 0.001$) in GS as well as PDUS.

Conclusions: Based on these results, we recommend to include wrist and MCP2 joints in a global US score on the patient level to monitor RA, independent of the disease stage, since they are¹ most commonly affected by synovitis and² most responsive to therapy. Tenosynovitis/paratenonitis is frequent in very early RA and should therefore be implemented in an US score monitoring early disease stages.

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FRI0559 BIOMECHANICAL PROPERTIES OF RADIAL BONE ARE DIFFERENT BETWEEN AUTO-ANTIBODY POSITIVE AND NEGATIVE RHEUMATOID ARTHRITIS

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Background: Functional properties of bone in rheumatoid arthritis (RA) are still not well characterised.

Objectives: This study aimed to define the impact of anti-citrullinated antibodies (ACPA) on biomechanical properties in RA.

Methods: Based on on high-resolution peripheral quantitative computed tomography (HR-pQCT) data from the distal radius of ACPA-positive RA (RA+), ACPA-negative RA (RA-) and healthy controls (HC) micro-finite element analysis (μFEA) was carried out to measure failure load and stiffness of bone. (¹ Comparisons of μFEA parameters between groups was calculated and multivariate models were used to determine the role of demographic, disease-specific and structural data of bone strength.

Results: A total of 276 subjects (96 RA+, 84 RA- and 96 HC) were analysed. Age and sex distributions were not significantly different between the three groups. In RA +but not in RA- failure load and stiffness were significantly decreased compared to HC (both $p < 0.001$). Lower bone strength affected both female and male RA +patients and was related to longer disease duration. Impaired bone strength was correlated with altered bone density and microstructural parameters, which were all decreased in RA+. Multivariate models showed that ACPA status ($p = 0.007$) and sex ($p < 0.001$) were independently associated with reduced biomechanical properties of bone in RA.

Conclusions: In summary, μFEA showed that bone strength is significantly decreased in RA +but not in RA- disease.

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FRI0560 QUANTITATIVE CT INDEXES IN THE EVALUATION OF INTERSTITIAL LUNG DISEASE RELATED TO RHEUMATOID ARTHRITIS

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Background: In rheumatoid arthritis (RA), interstitial lung disease (ILD) is the most common pulmonary complication and it is associated with poor prognosis.

The gold standard to detect ILD is the chest Computed Tomography (CT). CT semiquantitative scoring and quantitative methods are used to estimate the extension of ILD; however the first ones are time consuming and they have a considerable inter/intra-observer variability. Quantitative scores are based on the detection of the parameters of distribution of lung attenuation (also called quantitative CT indexes – QCTi).

Previously a good correlation between QCTi calculated through an open-source program (OsiriX) and semi-quantitative score performed by experienced radiologists was demonstrated in a cohort of systemic sclerosis (SSc) patients. Furthermore, the QCTi were demonstrated to be able to discriminate between SSc subjects with different mortality risk based on ILD extent (<20% vs >20%) or lung functional values.

Objectives: Main aim is to investigate if in RA-ILD there is a correlation between QCTi and semiquantitative scores. Secondary aims are: a) to verify if there is a difference of QCTi distribution in RA-ILD patients with severe vs mild ILD extent; b) to evaluate the discriminative ability of QCTi in identifying patients with severe ILD.

Methods: Two experienced radiologists assessed the ILD on chest CT of 45 patients with RA according to the semiquantitative score proposed by Goh et al. ILD extent <and >20% were considered mild and severe, respectively.

All CTs were blindly processed by a rheumatologist using OsiriX to obtain the QCTi (kurtosis, skewness, mean lung attenuation). The semiquantitative scores and the QCTi were correlated through the Spearman rank test. QCTi distribution and discriminative ability were, respectively, verified using Mann-Whitney test and ROC curves.

Results: The majority of QCTi showed a statistically significant correlation of moderate degree ($0.40 < r < 0.59$) with the semiquantitative assessment (p -value < 0.01).

Patients with severe and mild ILD had dissimilar QCTi values ($p < 0.001$). Among QCTi, kurtosis (tKurt) had the best discriminative ability (AUC=0.80, 95% CI 0.65 to 0.91, $p < 0.0001$). The best tKurt cut-off value that identifies patients with severe pulmonary involvement was 3.67.

Conclusions: In RA-ILD, QCTi correlate with the CT semiquantitative scores. Our preliminary findings suggest that RA-ILD severity is related to QCTi. Moreover a QCTi (tKurt) has a cut-off that can discriminate patients with severe ILD. So, QCTi may become simple tools to help the rheumatologist to quickly evaluate the severity of ILD in RA patients and estimate the prognosis.

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FRI0561 MACROPHAGE PET IMAGING FOR PREDICTING TREATMENT OUTCOME OF DE NOVO RHEMATOID ARTHRITIS

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Background: Treatment of rheumatoid arthritis (RA) should be initiated as early as possible to prevent further damage and functional disability.¹ However, clinical assessment of treatment response usually takes 12 weeks or longer. Tools that detect earlier response can improve timely treatment decision. Previously, positron emission tomography (PET) using the macrophage tracer [11C]-(R)-PK11195 has shown promise for both early diagnosis and monitoring response to therapy in RA patients.^{2,3}

Objectives: To determine the value of [11C]-(R)-PK11195 PET to identify RA responders and non-responders to COBRA-light therapy after 2 weeks of treatment.

Methods: Twenty RA patients (female 10/20, age 54±10 years) with clinically active *de novo* RA based on ACR/EULAR criteria⁴ and at least two clinically active joints were included. All patients were given COBRA-light therapy (methotrexate and prednisolone). They received standard clinical care and (clinical) evaluations were performed at 0, 2, 4 and 12 weeks of treatment. Whole body [11C]-(R)-PK11195 PET-CT scans were acquired at baseline and after 2 weeks of treatment. An experienced reader blinded to clinical data scored the 44 joints of the Disease Activity Score (DAS44) visually from 0 to 3. PET response was pre-defined as either positive if there was a decrease in whole body PET score of $\geq 10\%$ after two weeks, or as negative if the score increased or remained unchanged. PET outcome was compared with EULAR clinical response at 12 weeks.⁵

Results: After 12 weeks of COBRA-light treatment, 16 out of the 20 patients were classified as EULAR responders (13 'good' and 3 'moderate') and 4 patients as non-responders. At baseline, a total of 134 PET positive lesions were observed in the joints of 20 patients, ranging from 1 to 21 lesions per patient. Most frequently, lesions were located in hands and feet: 19% in the wrists (e.g. figure 1A), 37% in the small hand joints and 39% in the small feet joints. After 2 weeks of COBRA light treatment, the number of PET positive lesions decreased to 122 (e.g. figure 1B).

A positive whole body PET response was observed in 13 patients. Table 1 shows a side by side comparison between PET response after 2 weeks and EULAR response after 12 weeks. In 15 of the cases (75%), there was an agreement between the PET response and EULAR response.

PET response at 2 weeks	EULAR response at 12 weeks	
	Positive	Negative
Positive	12	1
Negative	4	3

Abstract FRI0561 – Table 1. Correspondence between early PET response and clinical EULAR response.

Abstract FRI0561 – Figure 1

Conclusions: This is the first study to explore the potential of macrophage PET for monitoring therapy in early RA. Preliminary visual assessment demonstrates its ability to monitor arthritis activity changes within 2 weeks of treatment. This offers a window of opportunity for development of precision medicine in the early phase of treatment. Future analyses are in progress to assess whether performance can be further improved by quantification of tracer uptake.

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FRI0562 ASSOCIATION BETWEEN JOINT REGIONS WITH ULTRASOUND-DETERMINED SYNOVITIS AND SYSTEMIC INFLAMMATORY MARKERS

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Background: It is unknown which joint arthritis the inflammatory markers such as CRP or MMP-3 reflect.

Objectives: We analysed the association between joint regions with ultrasound-determined synovitis and systemic inflammatory markers.

Methods: We enrolled 152 patients with untreated arthritis and performed musculoskeletal ultrasound on 40 joints and determined a semiquantitative grade for power Doppler (PD) signals. We analysed the associations between PD scores in 8 joint regions and CRP/MMP-3 levels using multiple linear regression models with forced entry method.

Results: Mean age was 55 years and 112 patients were female. Median CRP and MMP-3 were 0.36 mg/dl and 65.7 ng/ml. Median total PD score was 2. Standard regression coefficients for 8 joint regions were –0.009 for MCPs, 0.05 for PIPs, 0.372 for wrists, 0.183 for elbows, 0.628 for shoulders, 0.377 for knees, 0.261 for ankles, and –0.0131 for MTPs in a regression model to explain CRP using PD scores as dependent variables. Standard regression coefficients for the same joint regions were –5.134, –4.449, 24.061, 27.839, 22.508, 64.108, 36.501, and 2.539 to explain MMP-3.

Conclusions: Systemic inflammatory markers such as CRP and MMP-3 do not accurately reflect the inflammation in small joints. Conversely, it is necessary to weight the large joints for the global ultrasound synovitis score to represent the severity of systemic inflammation.

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