Aims: To compare prediction models in rheumatoid arthritis-related interstitial lung disease (RA-ILD) to identify patients with a progressive fibrosis phenotype.

Methods: RAILD patients presenting to the Royal Brompton Hospital, London (n=90) and Edinburgh Royal infirmary, Scotland (n=67) who had undergone volumetric non-contrast CT imaging had CTs scored visually and by CALIPER and pulmonary functional measures evaluated. Outcome prediction was evaluated in RA-ILD patients using three separate techniques: 1. A composite staging system evaluating visual ILD extent on CT and forced vital capacity (FVC) values (first developed in patients with scleroderma); 2. The Fleischer Society idiopathic pulmonary fibrosis (IPF) diagnostic guidelines (definite, probable or inconsistent usual interstitial pneumonia pattern) applied to RAILD patients (with disease distribution and a mosaic attenuation pattern not considered inconsistent features); 3. Automated CT scores of vessel-related structures (VRS) derived using CALIPER analysis. Survival was evaluated using Cox regression analyses, and Kaplan Meier survival curves, with model fit evaluation using Harrells C-index. Outcome was compared to a multicenter population of IPF patients.

Results: On univariable Cox analysis, all three staging systems strongly predicted outcome: scleroderma system: HR=3.78, 95%CI=2.10-6.81, p=9x10^-5; Fleischner system HR=1.98, 95%CI=1.38-2.85, p=2x10^-3; 4.4% VRS threshold HR=3.10, 95%CI=1.81-5.29, p=4x10^-4. On multivariable Cox analysis, the scleroderma and Fleischner systems when evaluated together (C-index=0.71), identified a patient subset (n=36) demonstrating a progressive fibrotic phenotype (Figure 1). After adjustment for patient age and gender, when combined in a single model, the scleroderma (p=0.004), Fleischner (p=0.03) and VRS (p=0.01) systems all independently predicted outcome (C-index=0.75).

Conclusions: Three separate staging systems when evaluated together in RAILD patients all independently predicted outcome. The scleroderma staging system and the Fleischner system when examined together identify a subgroup of RAILD patients with an IPF-like progressive fibrotic phenotype. Computer-derived VRS thresholds can further improve outcome prediction when compared to established staging systems. 67