The e-Lung Weighted Reticulovascular Score Identifies Patients at Risk of Future Progressive Pulmonary Fibrosis: Results from the REVISE PPF Study.

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Objective

To evaluate whether e-Lung WRVS can identify patients at risk of PPF.

Introduction

- Early identification of PPF is important but remains challenging.[1]
- e-Lung (Brainomix) is an artificial intelligence-powered quantitative CT tool.[2] The weighted reticulovascular score (WRVS) analyzed by e-Lung measures the percentage of the lung periphery that consists of reticulation and honeycomb walls.[2]
- A WRVS threshold of ≥15% has been shown to identify patients with IPF who are at higher risk of FVC decline and mortality.[2,3]

Methods

Patients

- The Retrospective EValuation In the US of e-Lung in PPF (REVISE PPF) study used data from three specialist ILD centers: the University of Alabama, Weill Cornell Medicine and the University of Chicago.
- Patients with PPF and ≥1 CT scan taken prior to the identification of PPF were evaluated. The definition of PPF was determined by local sites based on clinical standard of care and the ATS/ERS/JRS/ALAT guideline.[4]
- Patients from the same institutions who had fibrotic ILDs (other than idiopathic pulmonary fibrosis) that were deemed to be clinically stable (based on local assessment), and who had ≥1 CT scan, were also evaluated.

Analyses

- We compared WRVS distribution at baseline in patients with stable ILD vs patients who later developed PPF using the Wilcoxon rank-sum (Mann–Whitney) test.
- We evaluated the association between WRVS <15% and ≥15% on any CT scan performed prior to identification of PPF and the odds of developing PPF. Odds ratios were calculated using a 2 x 2 contingency table approach.
- We evaluated the association between WRVS at baseline, as a continuous variable and as a categorical variable (<15% and ≥15%), and the risk of death using Cox models. The University of Alabama and Weill Cornell Medicine cohorts were pooled for these analyses due to the small numbers of deaths.

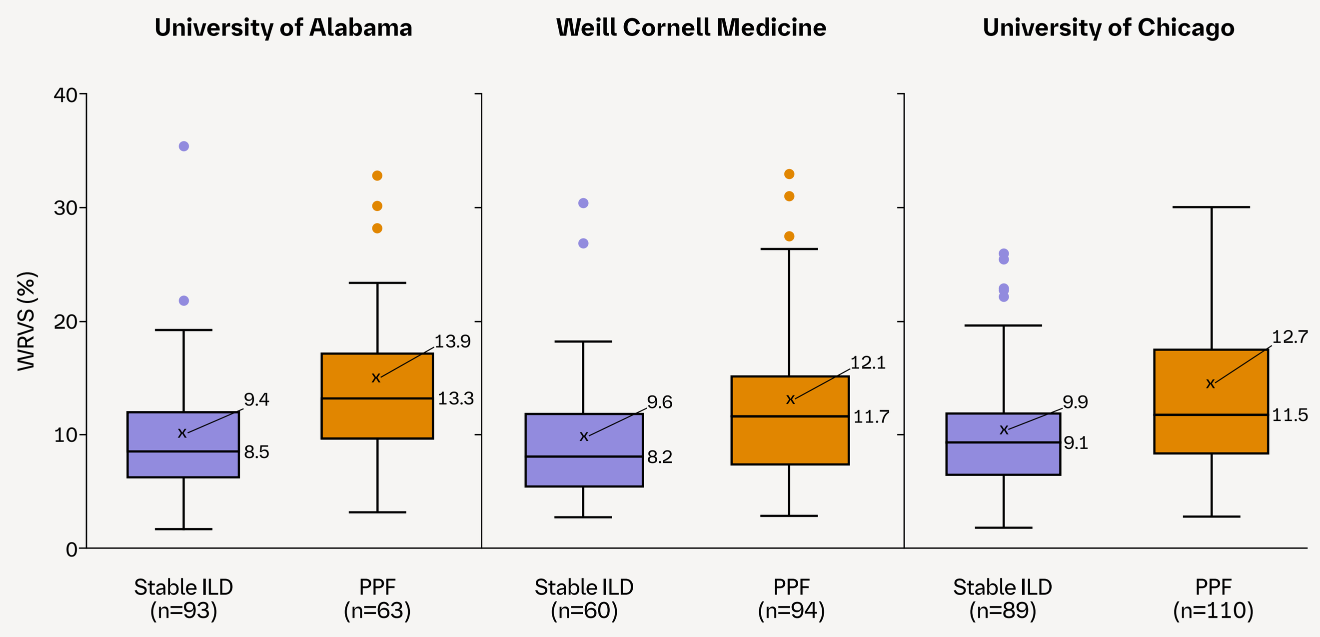
Results

Cohort characteristics at baseline CT scan

	University of Alabama (n=156)	Weill Cornell Medicine (n=154)	University of Chicago (n=199)
Age, years	69 (60, 74)	69 (64, 76)	63 (55, 70)
Female	96 (62%)	100 (65%)	124 (62%)
Current or former smoker	58 (37%)	57 (37%)	94 (47%)
Antifibrotic therapy	61 (39%)	53 (34%)	9 (4.5%)
Diagnosis			
Autoimmune ILD or IPAF	99 (63%)	74 (48%)	126 (63%)
Hypersensitivity pneumonitis	27 (17%)	44 (29%)	43 (21%)
Unclassifiable or other ILD	30 (19%)	35 (23%)	30 (15%)
FVC % predicted	61 (18)	76 (20)	66 (19)
DLco % predicted (uncorrected for hemoglobin)	49 (18)	59 (20)	56 (23)

Data are median (Q1, Q3), mean (SD) or n (%) of patients with available data.

WRVS at baseline in patients with stable ILD vs those who later developed PPF

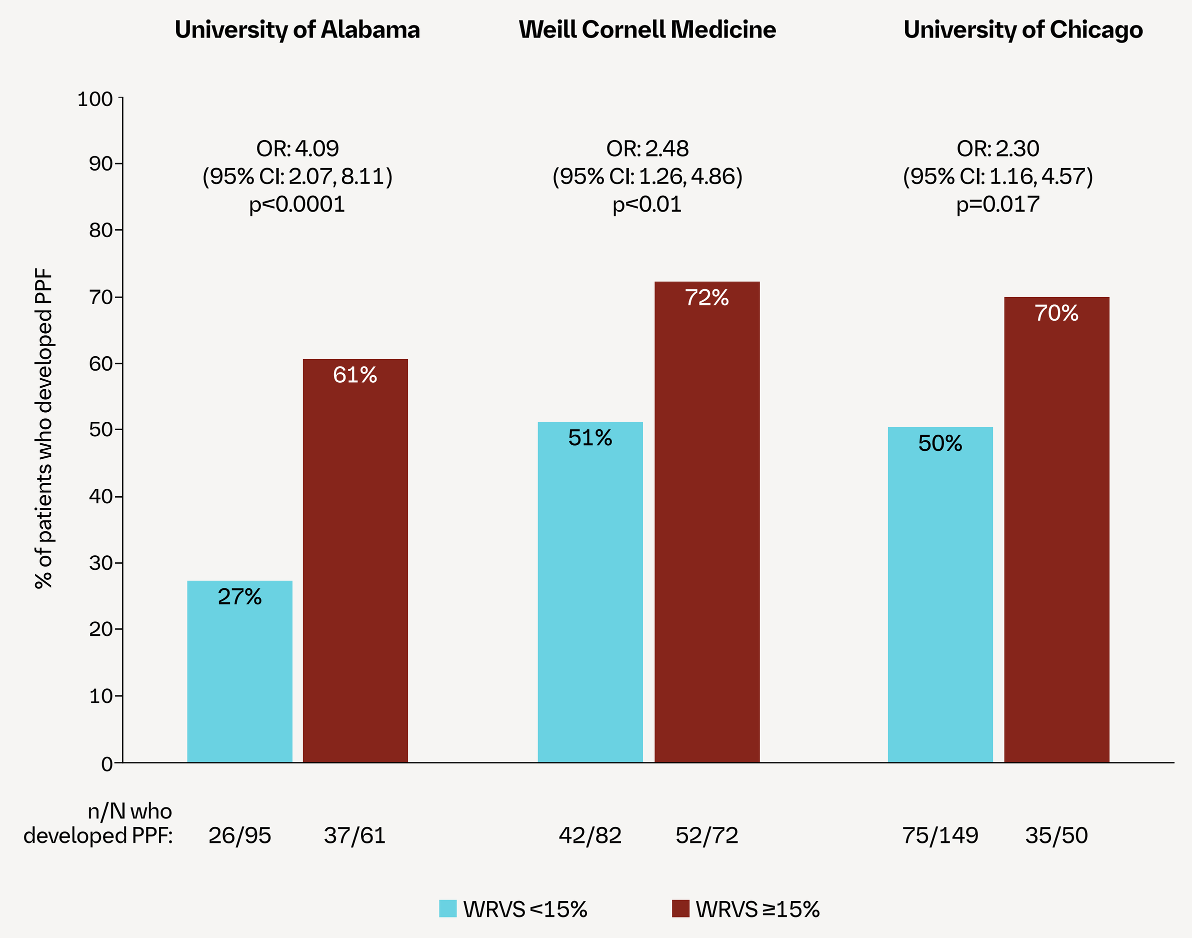


In each cohort, p<0.01 for difference in WRVS distribution between patients with stable ILD vs patients who later developed PPF.
Crosses in the boxes denote means, mid-lines of the boxes medians, boundaries of the boxes 25th and 75th percentiles, whiskers values 1.5 x interquartile range above 75th percentile or below 25th percentile, and circles values outside the range of the whiskers.

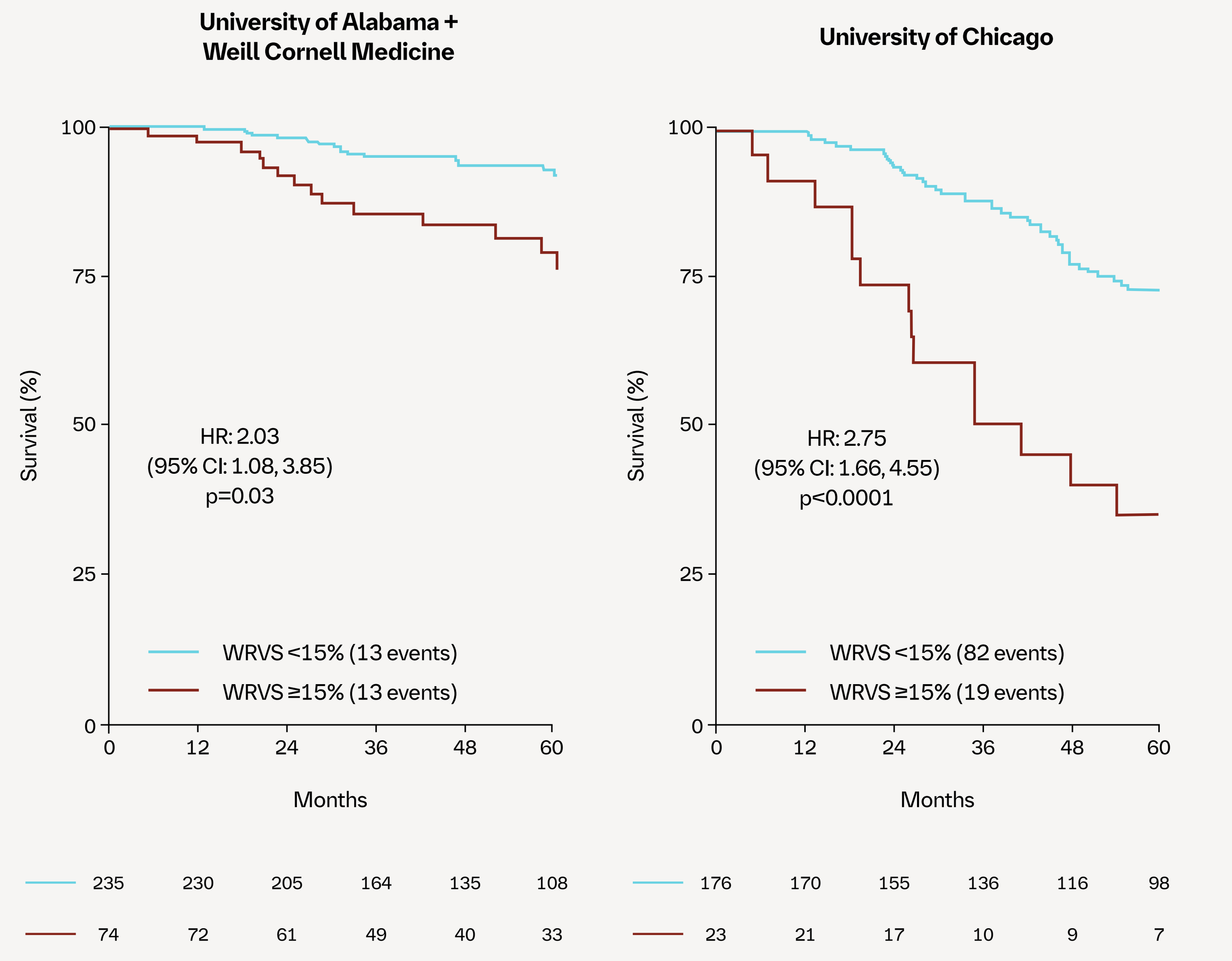
Association between WRVS at baseline and risk of death

	University of Alabama (n=155)	Weill Cornell Medicine (n=154)	University of Chicago (n=199)
Median (Q1, Q3) follow-up, years	3.7 (2.2, 6.2)	5.2 (3.3, 7.1)	5.1 (2.8, 8.5)
n (%) who died	24 (15%)	17 (11%)	93 (47%)
Median (Q1, Q3) time to death, years	2.5 (2.0, 4.5)	5.3 (2.7, 7.0)	4.2 (2.5, 7.3)
Association between WRVS at baseline (continuous) and risk of death	HR: 1.10 (95% CI: 1.05, 1.16) p<0.001		HR: 1.11 (95% CI: 1.07, 1.16) p<0.001
Association between WRVS at baseline <15% vs ≥15% and risk of death	HR: 2.03 (95% CI: 1.08, 3.85) p=0.03		HR: 2.75 (95% CI: 1.66, 4.55) p<0.0001

Association between WRVS <15% and ≥15% on any CT scan performed prior to identification of PPF and odds of developing PPF



Survival over 5 years by WRVS at baseline <15% vs ≥15%



Conclusions

- In a real-world, multi-center setting, e-Lung WRVS identified patients at risk of developing PPF:
  - Baseline WRVS was significantly higher in patients who later developed PPF than in patients with stable ILD.
  - Patients with baseline WRVS ≥15% had a higher risk of developing PPF and a higher risk of death than patients with baseline WRVS <15%.

Abbreviations

CT, computed tomography. DLco, diffusing capacity of the lungs for carbon monoxide. FVC, forced vital capacity. HR, hazard ratio. ILD, interstitial lung disease. IPAF, idiopathic interstitial pneumonia with autoimmune features. OR, odds ratio. PPF, progressive pulmonary fibrosis. Q1, first quartile. Q3, third quartile. WRVS, weighted reticulovascular score.

References

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