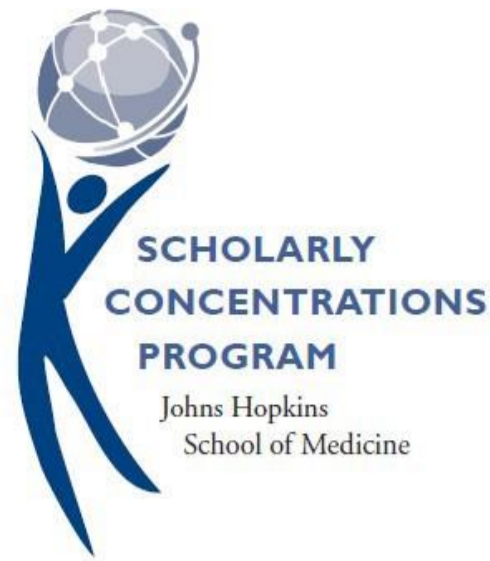


Predictive Capacity of the Heart Failure with Preserved Ejection Fraction (H2FPEF) Score is Limited in Systemic Sclerosis



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BACKGROUND

- Systemic Sclerosis (SSc) patients with Heart Failure with Preserved Ejection Fraction (HFpEF) have poor clinical outcomes
- SSc-HFpEF is pathophysiologically distinct from other forms of HFpEF due to underlying fibrotic disease mechanisms
- Current prediction algorithms for HFpEF, such as the HF2pEF Score are widely used but poor, leading to occult HFpEF in SSc patients

STUDY OBJECTIVE

- Identify unique demographic and clinical findings specific to SSc-HFpEF patients that can be used to compose a better predictive algorithm for SSc-HFpEF

METHODS

- Study Design:**
 - A single center **cross-sectional study** using the Johns Hopkins Scleroderma Registry from 07/2003 to 07/2020
- Population**
 - SSc patients who received prior echocardiogram and Right Heart Catheterization (RHC)
 - Patients were divided based on Framingham Heart Failure criteria, echocardiography EF > 50%, and RHC-confirmed evidence of HFpEF, defined as resting pulmonary capillary wedge pressure (PCWP) \geq 15 mmHg
- Data Collection**
 - Demographic, laboratory studies, auto-antibodies, pulmonary function tests, echocardiography and RHC parameters were collected
- Main Outcomes**
 - ROC** characteristics were used to compare H2FPEF score with SSc-HFpEF variables identified through Machine Learning (ML)

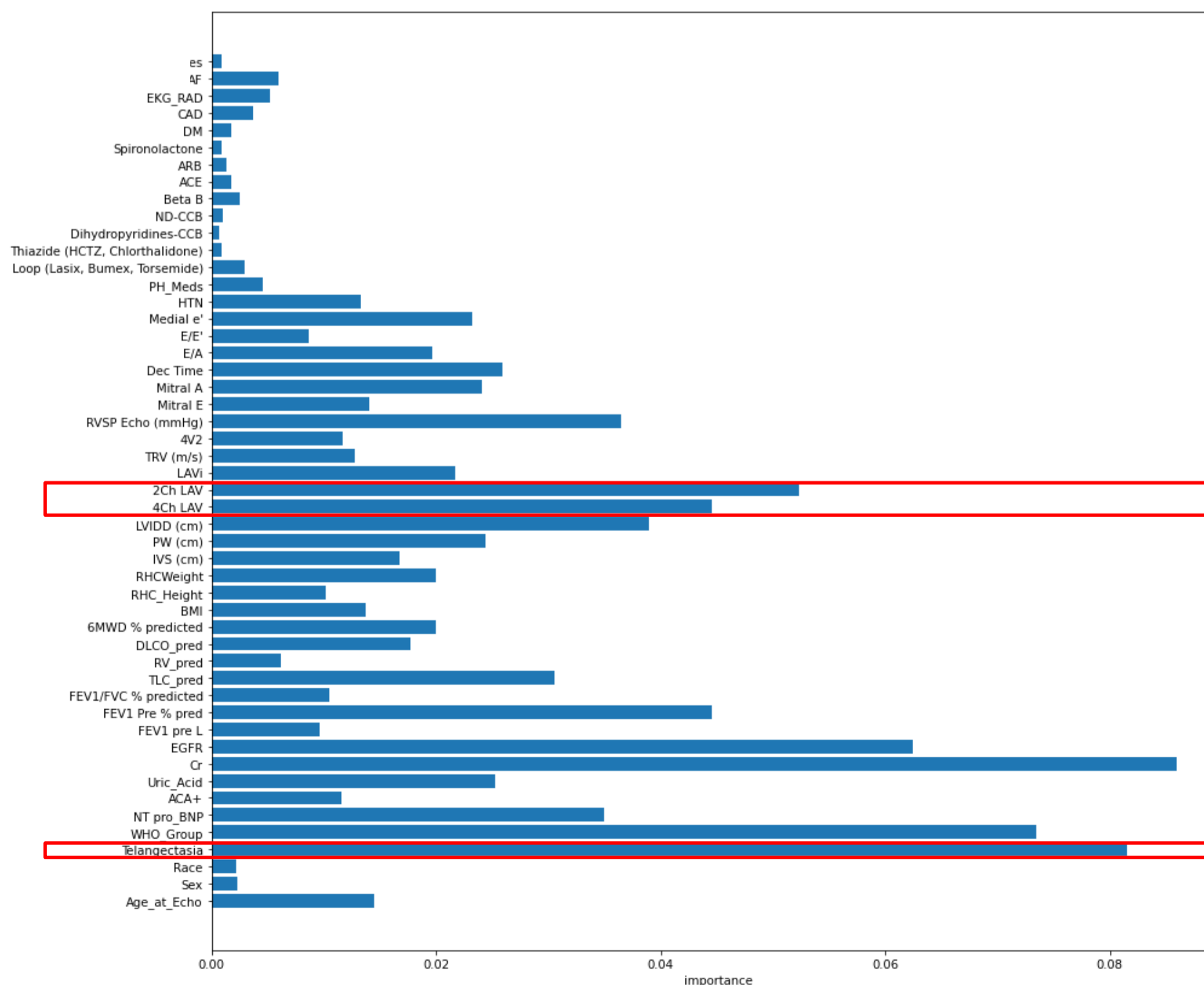
RESULTS

- Final cohort consisted of 421 patients, of which 71 (17%) had RHC-defined HFpEF, and 394 patients with calculable H2FpEF scores
- Out of the H2FPEF criteria, patients with SSc-HFpEF had increased BMI ($p=0.002$) and elevated E/e' ($p=0.008$) compared to SSc only

Table 1. H2FPEF characteristics in SSc patients with and without HFpEF

Covariate	PCWP \geq 15 mmHg (SSc-HFpEF)	PCWP < 15 mmHg	P-Value
Age, yrs	60 \pm 12	60 \pm 14	0.874
BMI, kg/m ²	28 \pm 6	25 \pm 7	0.002
Atrial Fibrillation	23/71 (32%)	78/323 (24%)	0.452
>2 Anti-hypertensives	17/71 (24%)	88/323 (27%)	0.654
Echo RVSP, mmHg	52 \pm 21	54 \pm 24	0.882
E/e'	16 \pm 10	13 \pm 6	0.008

Figure 1. Parameter Weighting by Random Forest Machine Learning



RESULTS CONT.

Figure 2. Principal Component Analysis of SSc-HFpEF vs SSc only

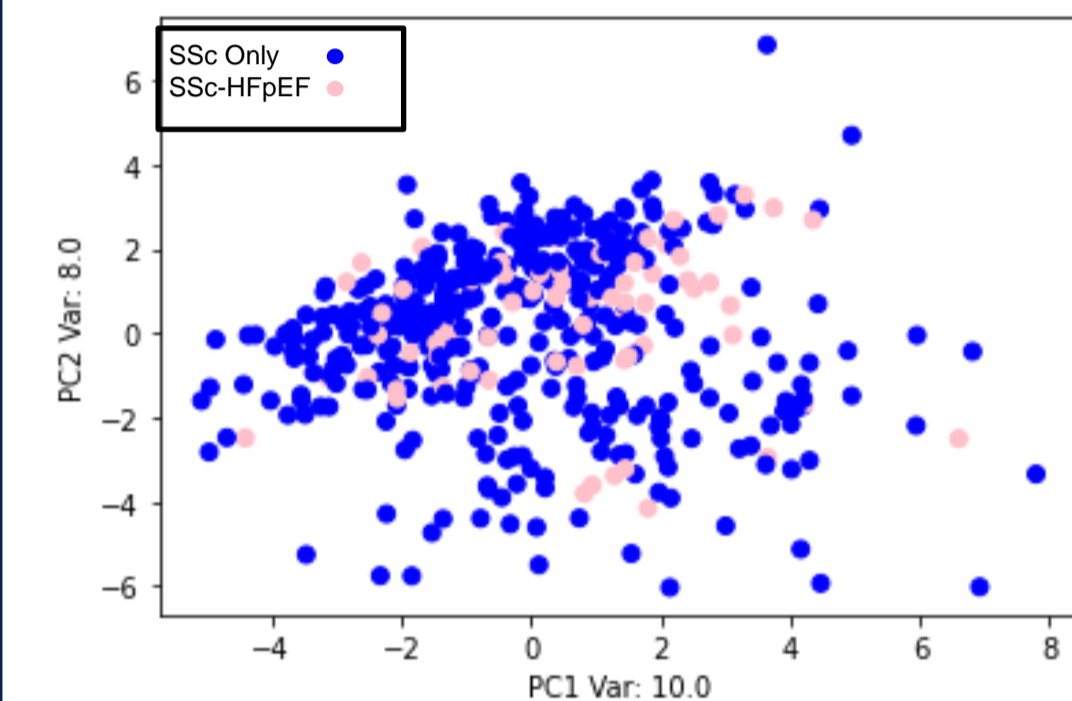


Table 2. Comparison of ROC characteristics of Various Predictive Models

Predictive Model	Accuracy	AUC
Random Forest	.887	0.693
Support Vector Machine	0.730	0.732
H2FPEF	0.629	0.634
HFA-PEFF	0.685	0.639

CONCLUSIONS

- SSc-HFpEF is poorly differentiated from SSc only by linear algorithms
- Linear ML models provide mild improvement in prediction of SSc-HFpEF

LIMITATIONS

- Overfitting of model to the training data limits the ROC characteristics
- Exclusion of exercise RHC data biases SSc-HFpEF study definition by excluding elevated PCWP during exercise

IMPLICATIONS

- ML may provide improvement in predictive models for special patient populations by large dataset analysis