Predicting Right Ventricular Function and Strain Using Indices of Right Heart Size and Hemodynamics in Functional Tricuspid Regurgitation

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Background/Purpose

Right ventricular (RV) systolic function is evaluated using TAPSE, FAC and RV strain among other parameters. RV strain is a more sensitive predictor of RV dysfunction in functional tricuspid regurgitation (FTR). Based on this, FTR patients can be divided into those in whom with all three parameters are normal (NNN), those in whom all three parameters are abnormal (LLL) and those in whom only RV strain is reduced (NNL). We examined the ability to predict these groups using indices of RV and RA size and hemodynamics.

Methods

- We analyzed echo data from 302 patients with severe FTR (115 male, mean age 72±14 years). This data was collected through *syngo* imaging software (Figure 1).
- Patients were categorized into three sub-groups:
  - NNN = normal FAC, TAPSE and RV strain
  - LLL = all three abnormal
  - NNL = abnormal RV strain only (Figure 2a-c)
- Normal values of TAPSE, FAC and RV strain were ≥1.6 cm, ≥ 35% and ≥ 24%, respectively.
- We used a random decision forest model with resampling to predict group classification using 13 variables including LVEF.
- The area under the ROC curves (AUC) were calculated using a multiclass method, and variable importance was estimated.

Results

- 257 (85%) of the 302 patients with severe FTR had abnormal RV strain compared to 157 (52%) with abnormal TAPSE, and 160 (53%) with abnormal RV FAC (Figure 2d).
- The average AUC was 0.87 with the lowest for NNL-classification (0.78) compared to NNN (0.92) and LLL (0.91).
- RV end-systolic area and S' were the most important predictors followed by LVEF and RV end-diastolic area (Figure 3).

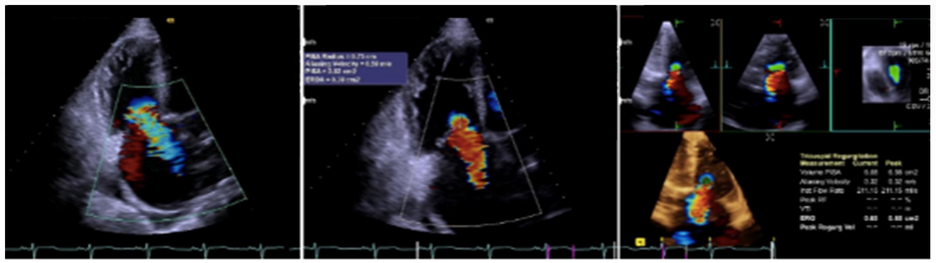

Figure 1. Severe FTR by 2D and 3D Echo

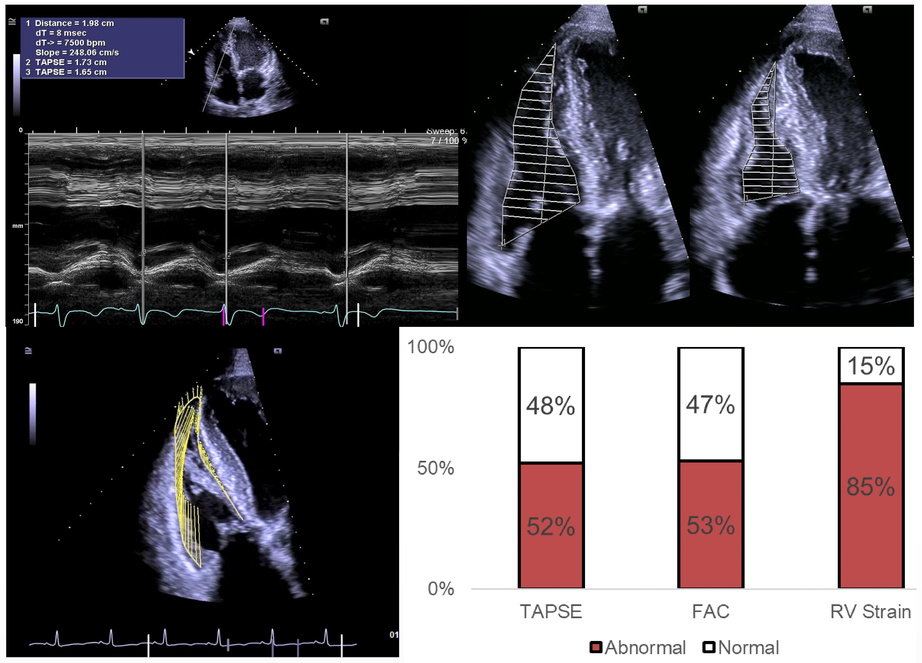

Figure 2 A, B, C, and D. An Example of NNL subgroup (TAPSE 1.7 cm, FAC 55%, and RV Strain 17%). Figure 2D is the Proportion of RV dysfunction based on TAPSE, FAC, and RV Strain measurements

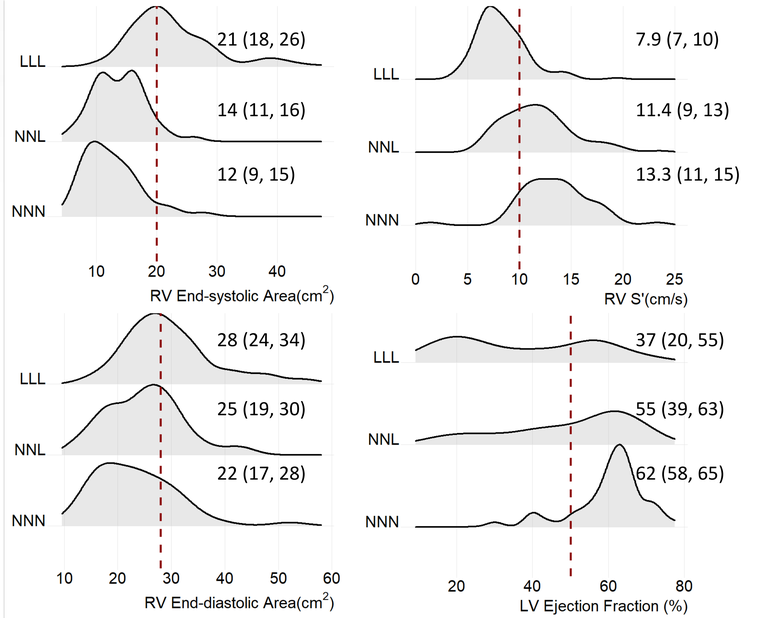

Figure 3. Distribution of the most important predictors of RV function per sub-group: RV end-systolic area and RV S' followed by LVEF and RV end-diastolic area; Median (95% confidence interval); Vertical dashed-line indicates respective abnormal cut-off values. RV ESA (perhaps the most sensitive indicator of volume overload among conventional indices) was not different between the NNN and NNL groups. Other conventional 2D and Doppler parameters (shown here and the others not shown here), all tended to be different between the NNN and NNL groups.

Conclusions

In FTR conventional indices of RV and RA size or right heart hemodynamics do not predict subclinical RV dysfunction defined as normal TAPSE and FAC with abnormal RV strain, **(NNL)**. Thus, measurement of RV strain is necessary to unmask occult RV dysfunction when FAC and TAPSE are normal in FTR. However, the NNN and LLL groups can be reliably predicted by conventional indices of right heart size and hemodynamics.

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Arati Gurung: Employee and Shareholder of Siemens Heathineers
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