

# Index of Suspicion: Predictors of Tricuspid Regurgitation Progression and Follow-up Echo Imaging in An Artificial-intelligence Enhanced Study

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# Background

- ▶ Tricuspid regurgitation (TR) is associated with negative outcomes.
- ▶ There are few data on factors influencing TR progression and patient follow-up after TR is discovered.

# Methods

- ▶ A retrospective cohort study of patients with less than severe TR was conducted from August 2018 to December 2021 to identify predictors of
  - 1) disease progression to severe TR, and
  - 2) presence of follow up echo.
- ▶ Patients were followed up from their first (index) echo with TR up until June 2023. Data were collected using Tempus Next (Tempus Labs Inc, Chicago, IL).
- ▶ Demographic and Echo indices were parsed from the Echo report using natural language processing.
- ▶ Multivariate Cox proportional-hazards model examined the association between predictors and disease progression. Logistic regression examined predictors of undergoing a follow-up echo. Both analyses controlled for index disease severity.

# Results

- ▶ 33,108 patients with TR (27,107 mild, 2,517 mild-moderate, 2,851 moderate, 633 moderate-severe) were included in the study (min / max / average observation times: 521 / 1,769 / 1,060 days).
- ▶ 10,696 (32%) had a follow up echo that allowed us to assess disease progression (average time to follow up 570 days; range: 31-1,743 days).
- ▶ 306 (2.9% of 10,696) eventually progressed to severe TR.

# Predictors of Disease Progression

Disease Progression: 306/10696 patients			N	Hazard ratio	p
<b>TR Severity at index</b>	mild	3915	■	Reference	
	mild-moderate	739	■	2.32 (1.48, 3.64)	<0.001
	moderate	983	■	4.95 (3.43, 7.15)	<0.001
	moderate-severe	211	■	11.83 (7.59, 18.43)	<0.001
<b>Gender</b>	Male	3010	■	Reference	
	Female	2838	■	1.59 (1.21, 2.09)	<0.001
<b>Patient Admission Status</b>	Outpatient	3057	■	Reference	
	Inpatient	2791	■	1.22 (0.93, 1.61)	0.152
<b>Age (years)</b>		5848	■	1.02 (1.01, 1.03)	0.004
<b>&gt;= Moderate MR</b>		5848	■	1.08 (0.82, 1.41)	0.596
<b>≥ Moderate AS</b>		5848	■	1.18 (0.86, 1.63)	0.309
<b>RVSP ≥ 35 mmHg</b>		5848	■	1.57 (1.05, 2.34)	0.026
<b>RAP (mmHg)</b>	RAP < 8 mmHg	3938	■	Reference	
	RAP 8-15 mmHg	1691	■	1.81 (1.36, 2.40)	<0.001
	RAP ≥ 15 mmHg	219	■	1.87 (1.16, 3.02)	0.010
<b>LVEF ≤ 35</b>		5848	■	0.97 (0.69, 1.36)	0.841

- ▶ Progression to severe TR was dependent on the index TR severity (0.3% mild; 1.9% mild-moderate; 4.2% moderate; 10% moderate-severe).
- ▶ However, when controlling for index TR severity, RVSP, RAP, and age, females had a 1.6x (95% CI HR 1.21-2.09) higher risk of progressing to severe TR.

# Predictors of Follow-up Echo

Has fup Echo: 10696/33108 patients		N	Odds ratio	p
<b>TR Severity at index</b>	mild	12870	Reference	
	mild-moderate	1838	1.06 (0.95, 1.18)	0.33
	moderate	2196	1.10 (0.99, 1.23)	0.07
	moderate-severe	481	1.03 (0.84, 1.26)	0.78
<b>Gender</b>	Male	8456	Reference	
	Female	8929	0.83 (0.78, 0.89)	<0.001
<b>Patient Admission Status</b>	Outpatient	10038	Reference	
	Inpatient	7347	0.94 (0.88, 1.02)	0.12
<b>Age (years)</b>		17385	1.02 (1.01, 1.02)	<0.001
<b>&gt;= Moderate MR</b>		17385	1.30 (1.20, 1.41)	<0.001
<b>≥ Moderate AS</b>		17385	2.55 (2.32, 2.82)	<0.001
<b>RVSP ≥ 35 mmHg</b>		17385	1.38 (1.27, 1.50)	<0.001
<b>RAP (mmHg)</b>	RAP < 8 mmHg	12522	Reference	
	RAP 8-15 mmHg	4309	1.01 (0.94, 1.10)	0.75
	RAP ≥ 15 mmHg	554	0.84 (0.69, 1.02)	0.07
<b>LVEF ≤ 35</b>		17385	1.39 (1.24, 1.54)	<0.001

- ▶ When controlling for other variables, an **increased severity at index did not result in higher odds of a follow-up echo** (moderate-severe vs mild TR, OR=1.03, p=0.78)
- ▶ Females were 20% less likely to receive a follow up echo (95% CI OR 0.78-0.89).
- ▶ LVEF ≤ 35% (95% CI OR 1.24-1.54), ≥ moderate MR (95% CI OR 1.20-1.54), and ≥ moderate AS (95% CI 2.32-2.52) resulted in higher odds of receiving a follow-up echo.

# Conclusions

- ▶ These findings highlight the importance of comprehensive risk assessment.
- ▶ These findings raise concerns about under-recognition of the importance of TR follow-up and potential sex disparities in TR management and follow-up.