Cut-off values of non-dimensional aortic valve coefficient (AVC) for functional assessment of aortic stenosis in TAVR patients: a prospective analysis

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Disclosure of Relevant Financial Relationships

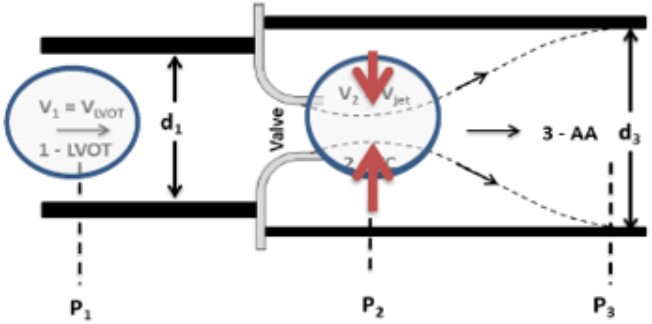
I, Shreyash Manegaonkar DO NOT have any relevant financial relationships to disclose.

I, Rishi Sukhija DO NOT have any relevant financial relationships to disclose.

I, Rupak Banerjee DO NOT have any relevant financial relationships to disclose.

Introduction

- assessment of aortic valve stenosis (AS) is challenging
- this research builds on establishing the *cut-off values* of *aortic valve coefficient (AVC)* w.r.t aortic valve area (AVA)



LVOT – Left Ventricular Outflow Tract; VC – vena contracta

- Diagnosis of AS: *Non-invasive* Doppler echocardiography
  - *aortic valve area (AVA)* = $\frac{\text{Area}_{\text{LVOT}} \times \text{V}_{\text{LVOT}}}{\text{V}_{\text{jet}}}$
  - derived Δp using LVOT and downstream velocitie have inherent *inaccuracies*
- abnormality in AVA leads to *invasive* measurement: *catheterization*
  - directly measured Δp leads to decision making or TAVR procedure

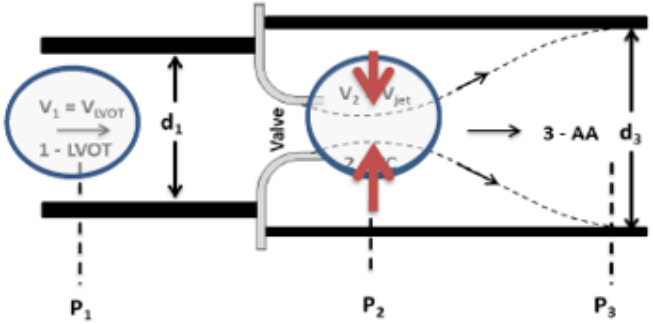
Introduction

- *Aortic valve coefficient (AVC)* - ratio of transvalvular *Δp* to *proximal dynamic pressure* (0.5 × blood density × V_{LVOT}^2)

$$AVC_{cath} = \frac{\Delta p_{total,cath}}{0.5 \times \rho \times V_{LVOT}{}^2}$$

← P_1-P_3 directly measured by catheterization

← Velocity from Doppler



LVOT – Left Ventricular Outflow Tract; VC – vena contracta

- AVC is
  - combines *pressure drop (Δp) - flow* measurements
  - provides wide range: *0 ~ 50*, leads to better delineation of AS severity
  - *non-dimensional* parameter developed from fundamental *fluid dynamic principles*
  - includes both *frictional* (viscous) loss and *inertial* (pressure) loss due to momentum change irrespective of flow status
  - incorporates corrections for *pressure recovery* phenomenon

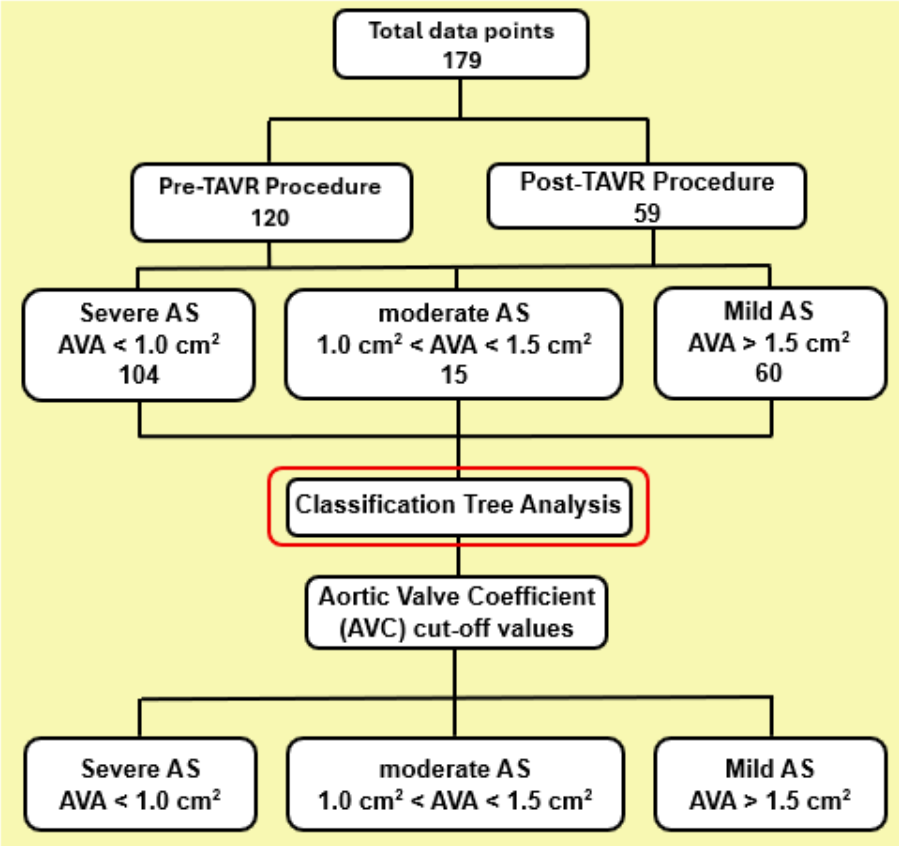
Hypothesis

AVC, a *dimensionless* index, will be a better for accessing AS severity as it incorporates both *square* of V_{LVOT} and Δp in its formulation

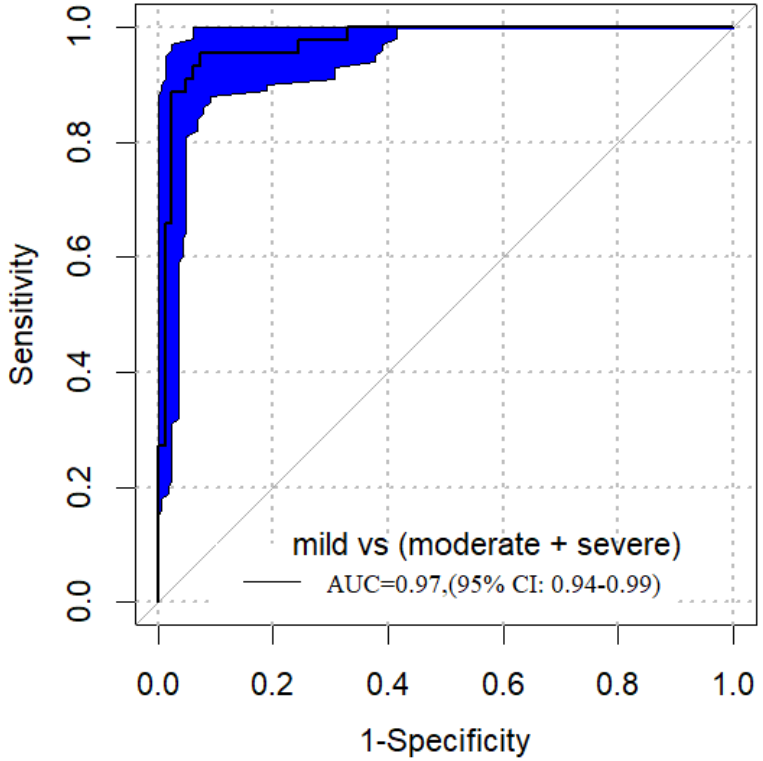
Methods

- AVC is derived from mean transvalvular Δp and Doppler V_{LVOT} measurements
- *120* patients undergoing TAVR were consented
- *179* data points from *pre*- and *post*-TAVR measurements
- Statistical analysis
  - receiver operating curve (ROC) analysis
  - classification tree analysis
  - p-value <0.05 is considered statistically significant
  - ‘R-markdown’ software was used

Methods

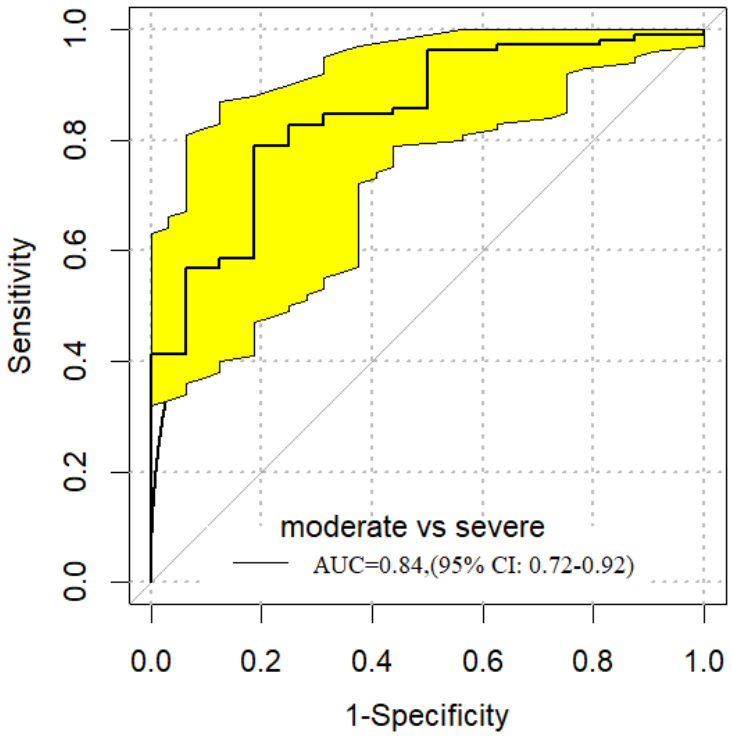

Total data points
179
Pre-TAVR Procedure
120
Post-TAVR Procedure
59
Severe AS
AVA < 1.0 cm²
104
moderate AS
1.0 cm² < AVA < 1.5 cm²
15
Mild AS
AVA > 1.5 cm²
60
Classification Tree Analysis
Aortic Valve Coefficient
(AVC) cut-off values
Severe AS
AVA < 1.0 cm²
moderate AS
1.0 cm² < AVA < 1.5 cm²
Mild AS
AVA > 1.5 cm²

Results



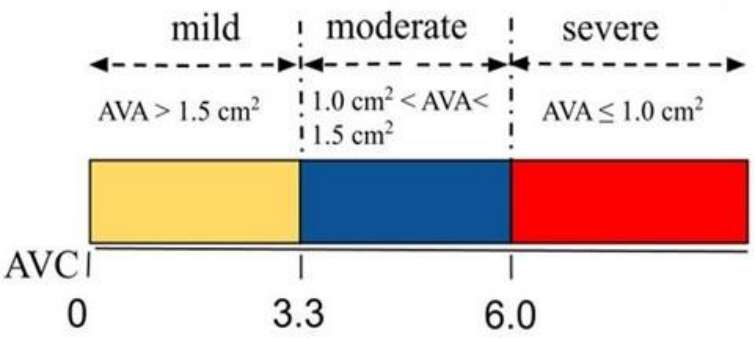
- Mild vs (Moderate + Severe) cases
  - *cut-off value* of AVC to predict mild-AS (AVA ≥ 1.5 cm^2) was ≤ *3.3*
  - the *accuracy* of AVC to predict mild-AS was *97.2%* ($p < 0.001$)
  - *significant* AUC of 0.99 (95% CI: 0.94 to 0.99, $p < 0.001$)

Results



- Moderate vs Severe cases
  - *cut-off value* of AVC to delineate moderate-AS (1.0 cm^2< AVA < 1.5 cm^2) and severe-AS (1.0 cm^2 ≤ AVA) was *6.0*
  - the *accuracy* of AVC to predict severe-AS was *93.3%* (p < 0.001)
  - *significant* AUC of 0.84 (95% CI: 0.72 to 0.92, p < 0.001)

Results



- *cut-off* analysis of *AVC* for
  - mild-AS (AVA ≥ 1.5 cm^2) : 0 < AVC ≤ 3.3
  - moderate-AS (1.0 cm^2 < AVA < 1.5 cm^2) : 3.3 < AVC < 6.0 and,
  - severe-AS (AVA ≤ 1.0 cm^2) : AVC ≥ 6.0
- AVC has a *wider range* to delineate the severity of AS
- figure *highlights* advantage of *AVC* over AVA due to V_{LVOT}^2 in denominator

Conclusion

- AVC, a novel dimensionless index, has potential to improve diagnosis of AS severity and aid in clinical decision making

- Future direction
  - *randomized trial* with *larger sample* size for cut-off and outcome analysis
  - open for *collaboration* and *funding* opportunities

THANK YOU

- Current Fundings:
  - American Society of Mechanical Engineers (part)
  - Research Initiation Fund (part), college of engineering, UC
  - College of Medicine's Research Innovation/Pilot Grant Program

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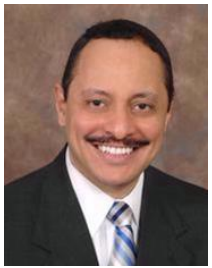

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