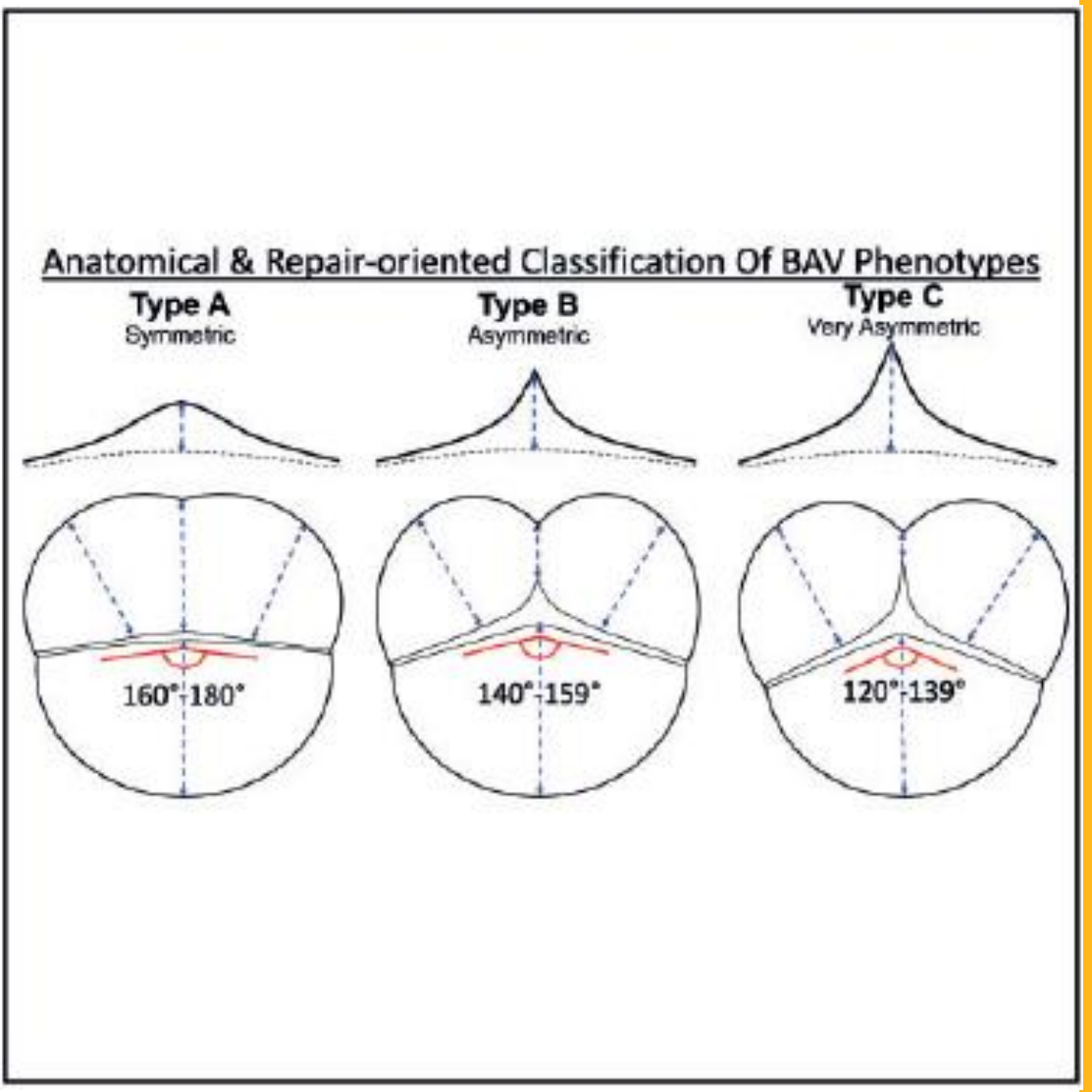
# Comparison of Preoperative Aortic Valve Imaging Techniques for Patients with Aortic Insufficiency Undergoing Aortic Valve Repair Surgery

AATS Aortic Symposium 2024

1. Objective
2. Methods
3. Results
4. Conclusions




# Objective

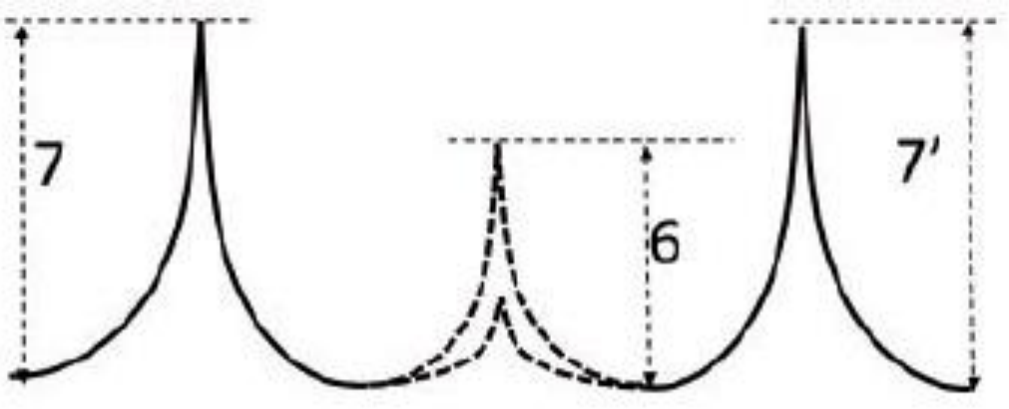
- To report the comparative accuracy of pre-repair imaging techniques for determination of bicuspid aortic valve phenotype, using the de Kerchove repair-oriented classification and measurement of **commissural orientation**, **geometric heights** and **functional commissural heights** using:
  - 4D CTA
  - 3D TEE
  - Surgeon's intraoperative measurements

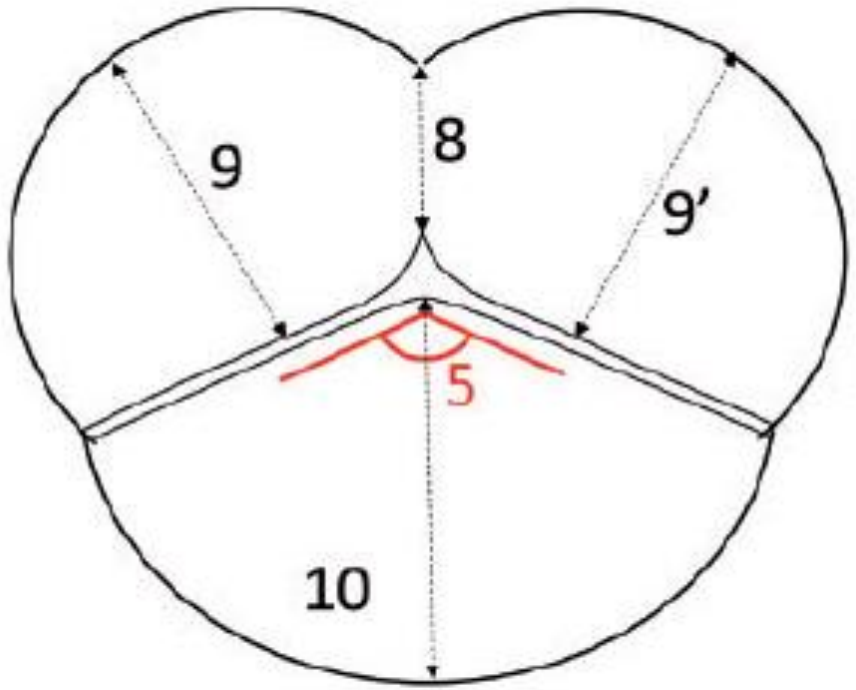


de Kerchove L, Mastrobuoni S, Froede L, et al. Variability of repairable bicuspid aortic valve phenotypes: towards an anatomical and repair-oriented classification. Eur J Cardiothorac Surg. Published online February 20, 2019. doi:10.1093/ejcts/ezz033

# Methods

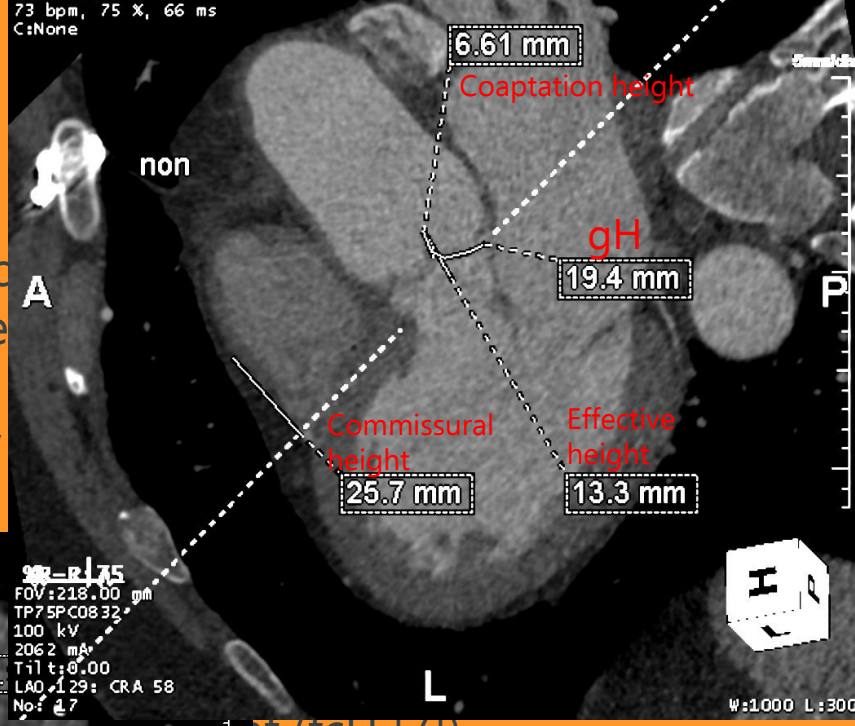
- Prospective, non-randomized, observational design
- Patients undergoing aortic valve repair surgery for predominant aortic insufficiency and/or aortic root aneurysm
- 22 patients accrued over 12 month study period, followed for 3 years postoperatively
- Preoperative 4D CTA and 3D TEE obtained, read by dedicated imaging cardiologists
- Intraoperative measurements from surgeon on the arrested heart pre-repair
- Excluded if aortic valve replacement performed or imaging incomplete

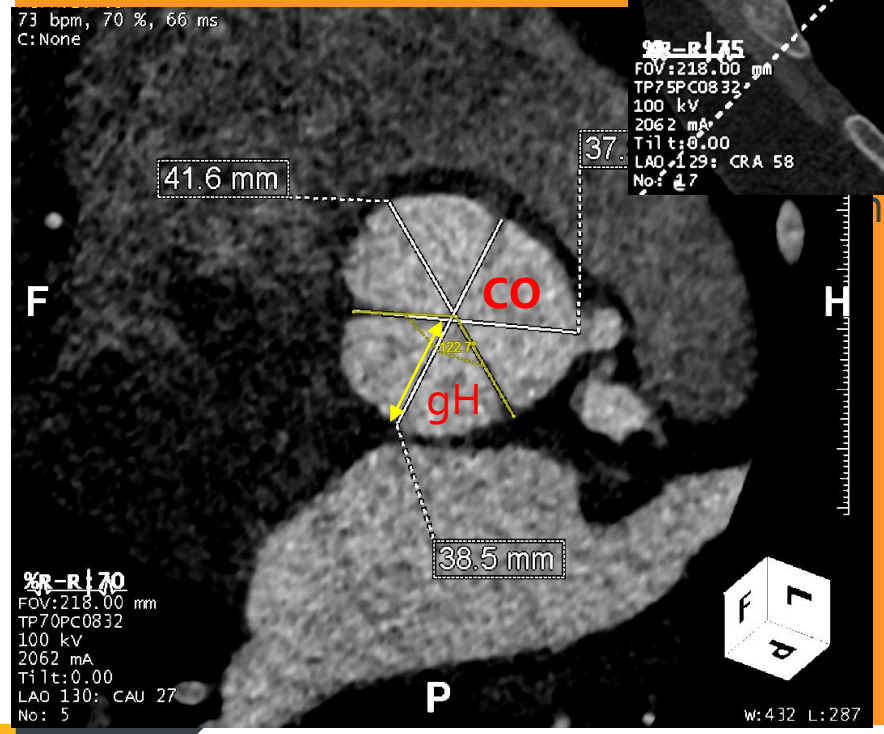



# Methods

- Gold standard tec
  following variable
- AV phenotype by
  (CO [5])




t (fcH [7])



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# Methods

- Cohen's kappa ($\kappa$), Spearman's rank ($r_s$) and Pearson ($r$) correlation coefficients were used to describe agreement of phenotype and measurements between gold standard and other measurement techniques

- $\kappa \leq 0$ indicates no agreement
- 0.01–0.20 indicates none to slight agreement
- 0.21–0.40 indicates fair
- 0.41– 0.60 indicates moderate
- 0.61–0.80 indicates substantial
- 0.81–1.00 indicates almost perfect agreement

- $r$ or $r_s$ 0 – 0.30 indicates negligible correlation
- 0.30 – 0.50 indicates low positive
- 0.50 – 0.70 indicates moderate positive
- 0.70 – 0.90 indicates high positive
- 0.90 – 1.00 indicates very high positive correlation

| AV Phenotype | | CTA (n) | | | |
|---|---|---|---|---|---|
| | | BAV-A | BAV-B | BAV-C | TAV |
| Intra-op (n) | BAV-A | 3 | 1 | 1 | 0 |
| | BAV-B | 0 | 0 | 4 | 0 |
| | BAV-C | 0 | 0 | 2 | 0 |
| | TAV | 0 | 0 | 0 | 9 |
| | $\kappa$ (95% CI, $p$) | 0.729 (0.541-0.916, $p$<0.01) | | | |

| AV Phenotype | | CTA (n) | | | |
|---|---|---|---|---|---|
| | | BAV-A | BAV-B | BAV-C | TAV |
| TEE (n) | BAV-A | 3 | 0 | 1 | 0 |
| | BAV-B | 0 | 1 | 0 | 0 |
| | BAV-C | 0 | 0 | 5 | 0 |
| | TAV | 0 | 0 | 0 | 7 |
| | $\kappa$ (95% CI, $p$) | 0.902 (0.719 - 1, $p$ < 0.01) | | | |

| CO (degrees) | | | |
|---|---|---|---|
| | CTA | Intra-op | TEE |
| Median (IQR) | 120 (116.75, 129.25) | 120 (120-150) | 109.5 (60.0, 151.0) |
| $r_s$ (95% CI, $p$) | | 0.58 (0.10-0.87, $p$ = 0.01 ) | 0.79 (0.46-0.98, p <0.01) |

# Results

- TEE ($\kappa$=0.902, $p$<0.01) was more likely to agree with CTA for AV phenotype than intraoperative assessment ($\kappa$=0.729, $p$<0.01), however both were likely to agree with CTA
- TEE was thus more accurate than intraoperative measurement at predicting CO ($r_s$=0.79, $p$<0.01 vs $r_s$=0.58, $p$=0.01)

| gH (mm) | | | | | |
|---|---|---|---|---|---|
| | Intra-op | CTA | TEE | CTA | TEE |
| Median (IQR) | 22 (21-25) | 19 (17.25-21) | 21 (19.25-23.95) | 19 (17.25-21) | 21 (19.25-23.95) |
| $r_s$ (95% CI, $p$) | | 0.31 (-0.3-0.72, $p$=0.22) | 0.22 (-0.21-0.58, $p$=0.36) | | 0.40 (-0.14-0.72, $p$=0.11) |

| fcH - LN (mm) | | |
|---|---|---|
| | Intra-op | CTA |
| Median (IQR) | 30 (26.75-30) | 21.7 (19.2-24.43) |
| $r_s$ (95% CI, $p$) | | 0.02 (-0.34-0.46, $p$=0.93) |

| fcH - LR (mm) | | |
|---|---|---|
| | Intra-op | CTA |
| Mean ± SD | 27.4 ± 2.41 | 23.03 ± 4.83 |
| $r$ (95% CI, $p$) | | 0.27 (-0.54-0.82, $p$=0.52) |

| fcH - RN (mm) | | |
|---|---|---|
| | Intra-op | CTA |
| Median (IQR) | 30 (28.5, 30) | 25.7 (21.7, 28.68) |
| $r_s$ (95% CI, $p$) | | 0.06 (-0.44-0.65, $p$=0.83) |

# Results

- Both CTA and TEE were unlikely to predict, and measured shorter than, intraoperative gH measurement
- There was a low positive agreement of gH within CTA and TEE; neither tended to over or underestimate the other
- Measurements of fcH by CTA did not agree with, and were shorter than, intraoperative measurement at all commissures (LN, LR, RN)

# Conclusions

- TEE appears more accurate than intraoperative assessment in predicting AV phenotype by measurement of CO compared to the gold standard of CTA (CTA>TEE>intraoperative measurement)

8

- CTA and TEE did not agree with and predicted shorter gH and fcH than intraoperative measurement  (Intraoperative measurement>CTA+TEE)