Sex, body size and right atrial volume are the main determinants of tricuspid annulus geometry in healthy volunteers. A 3D echo study using a novel, commercially-available dedicated software package

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Tricuspid annulus (TA) sizing is essential for percutaneous and surgical procedures. Guidelines recommend to assess TA size by 2D echo (2DE) linear dimension; but TA is a complex 3D structure.

Aim: To identify physiological determinants of TA geometry parameters and their reference values using 3D echo (3DE) and a novel, commercially-available software in healthy volunteers.

Methods: 254 healthy volunteers (113 men, mean age 47±11 years) were evaluated by 2D and 3DE. 3DE TA analysis was made in 228 of them (feasibility=90%). TA 3DE area, perimeter, diameters, sphericity index and coaptation (Figure) were assessed at mid-systole using a dedicated software package (4D AutoTVQ, GE Healthcare, Horton, N). 3D right atrial (RA) and ventricular (RV) volumes were measured.

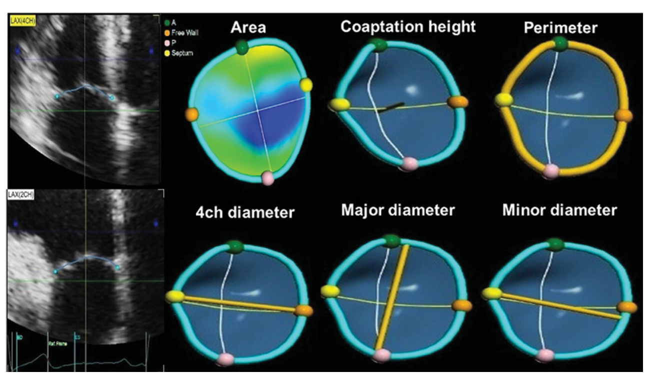
Results: Normal values of 3D TA geometry parameters, RV and RA volumes are presented in table. 3D TA area, perimeter and diameters correlated with BSA (r=0.33 to 0.5, $p<0.001$) and were larger in men, independently of BSA ($p<0.0001$). There were no age-related changes in TA parameters ($r<0.25$, p=0.0001). 2D TA diameters measured in apical 4ch and RV focused views were significantly smaller than 3DE 4ch diameter (16±2 and 16±3 vs 17±3, $p<0.0001$). RA maximal volumes had the strongest correlation with 3D TA area (r=0.65), compared with RV end-diastolic (r=0.55) and end-systolic (r=0.51) volumes ($p<0.0001$). By multivariable linear regression, RA maximal volume, sex and BSA, but not RV volumes, were independent predictors of 3D TA area ($R2=0.46$, $p<0.0001$).

Conclusions: Reference values for TA metrics should be sex-specific and indexed to BSA. 2DE underestimates TA dimensions. Even if both RA and RV volumes correlate significantly with TA area, only RA maximum volume was an independent predictor of its size at mid-systole.

TA, RV and RA metrics measured by 3DE

	Men (n=99)	Women (n=129)
TA area (cm^2/m^2)	5.2±1.1	4.8±0.9
TA perimeter (cm/m^2)	6.1±1.1	5.9±0.8
TA 4ch diameter (mm/m^2)	18±3	17±3
TA major diameter (mm/m^2)	20±3	19±2
TA minor diameter (mm/m^2)	17±3	16±3
TA sphericity index (%)	84±11	83±10
RV end-diastolic volume (ml/m^2)	65±13	52±13
RV end-systolic volume (ml/m^2)	27±7	21±6
RV ejection fraction (%)	57±5	60±5
RA volume (ml/m^2)	32±9	28±7 all $p<0.002$

TA, tricuspid annulus; RV, right ventricle; RA, right atrium.



3D tricuspid annulus parameters