(THV) function, however, preliminary reports indicate potential additive clinical value of multislice computed tomography (MSCT) for the diagnosis of THV thrombosis. We sought to determine the value of MSCT for the diagnosis of THV thrombosis and the frequency of this complication after balloon-expandable TAVR.
**Methods:** In addition to TTE and TEE, MSCT was performed in 140 patients within 1-3 months after TAVR with the Sapien XT THV (Edwards Lifesciences, Irvine, CA) to assess the presence of THV thrombosis (distinct cusp thickening and low attenuation mass) as well as THV stent geometry and positioning.
**Results:** Post-TAVR MSCT identified THV thrombosis in 5 patients (4%), notably 3 (60%) of them had a normal TTE without signs of thrombus formation or flow obstruction. TOE demonstrated restrictive movement of one or more THV cusps in all patients, whereas clearly mobile masses were identified in one patient only. THV thrombus formation was associated with left ventricular ejection fraction $< 35\%$ (60% vs. 13%; p=0.021). Neither atrial fibrillation, balloon underfilling, THV malpositioning nor THV underexpansion were associated with THV thrombosis (p=NS for all). No THVs were noncircular.
**Conclusions:** THV thrombosis after balloon-expandable TAVR appears to be more common than previously anticipated and is commonly occult on transthoracic echocardiography. Patients with low-flow circumstances (e.g. depressed cardiac function) may carry a higher risk of early THV thrombosis. The role of routine post-procedural MSCT for the evaluation of THV thrombosis in patients at a heightened risk of thrombus formation warrants further investigation.

## TCT-666

### Short-roll C-arm computed tomography (C-arm CT) scans to guide transcatheter aortic valve replacements

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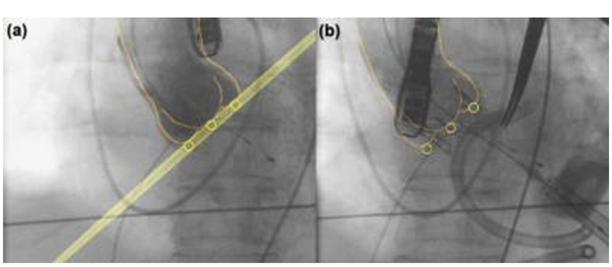
**Background:** A key step in transcatheter aortic valve replacement (TAVR) procedures is finding the optimal x-ray C-arm viewing angle for prosthetic valve deployment. This step is challenging and often requires performing several 2D x-ray aortograms. Another approach using short-roll 160° C-arm computed tomography (C-arm CT) scans was tested on a group of TAVR patients that automatically reconstructed, landmarked and registered 3D aortic root volumes to efficiently determine this angle.
**Methods:** Short 160° roll C-arm CT scans were done and reconstructed across 13 TAVR patients under direct contrast injection and rapid ventricular pacing. The segmented aortic root volume, valve cusp landmarks and optimal viewing angles were automatically determined from these scans using customized image processing software. Optimal angles determined from C-arm CT were compared to angles used during treatment.
**Results:** The mean differences between C-arm CT angles and angles used during deployment were 0.5°(SD=2.6°) and 0.5°(SD=2.4°)for oblique and cranial/caudal C-arm angulation respectively. For transapical patients, the angles were easier to obtain from C-arm CT than unregistered CT due to a rotated patient setup in the cath lab for better access compared to their baseline CT setup. Transapical unregistered CT mean angle differences were 18.8°(SD=14.1°) and 0.1°(SD=5.2°) for oblique and cranial/caudal angulation.




**Conclusions:** Short roll C-arm CT scans provide accurate optimal viewing angle estimates at treatment for TAVR patients, along with easier workflow compared to the aortogram approach and to 180°(plus fan angle) C-arm CT scans.

## TCT-667

**Abstract Withdrawn**

## TCT-668

### Aortic Annulus and Root Characteristics In Severe Aortic Stenosis Due To Bicuspid Aortic Valve And Tricuspid Aortic Valves: Implications For Transcatheter Aortic Valve Therapies

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**Background:** Patients with severe aortic stenosis due to BAV are excluded from transcatheter aortic valve replacement (TAVR) due to concern for asymmetric expansion and valve dysfunction. We sought to characterize the aortic root and annulus in bicuspid aortic valve (BAV) and tricuspid aortic valves (TAV).
**Methods:** We identified patients with severe AS who underwent multi-detector computed tomographic (MDCT) imaging prior to surgical aortic valve replacement (SAVR, n=200) for BAV and TAVR (n=200) for TAV from 2010-2013. The presence of a BAV was confirmed on surgical and pathological review. Annulus measurements of the basal ring (short- and long-axis, area-derived diameter), coronary ostia height, sinus area (SA), sino-tubular junction area (STJ), calcification and eccentricity index (EI, 1-short axis/long axis) were made.
**Results:** Patients with TAV were older (78.8 years vs. 57.8 years, p=0.04) than those with BAV. The aortic annulus area (5.21± 2.1 cm2 vs. 4.63 ± 2.0 cm2, p=0.0001), sinus of Valsalva diameter (3.7 ± 0.9 cm vs. 3.1 ± 0.1 cm, p=0.001) and ascending aorta diameter (3.5 ± 0.7 cm vs. 2.97 ± 0.6 cm, p=0.001) were significantly larger with BAV . Bicuspid aortic annuli were significantly less elliptical (EI, 1.24 ± 0.1 vs. 1.29 ± 0.1, p=0.006) and more circular (39% vs. 4%, $p < 0.001$) compared to the TAV annulus. There was more eccentric annular calcification in BAV vs. TAV (68% vs. 32%, $p< 0.001$). The mean distance from the aortic annulus to the left main coronary ostium was less than the right coronary ostium. Less than 10% of the BAV annuli would not fit a currently available valved stents.
**Conclusions:** Bicuspid aortic valves have a larger annulus size, sinus of Valsalva and ascending aorta dimensions. In addition, the BAV aortic annuli appear circular and most will fit currently available commercial valved stents.

## TCT-669

### Very Low Intravenous Contrast Dose (20 cc) Computed Tomographic Angiography Protocol for Pre-Procedural Assessment of the Aortic Annulus Prior to Transcatheter Aortic Valve Replacement: Validation by 3-Dimensional Transesophageal Echocardiography

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**Background:** Transcatheter aortic valve replacement (TAVR) is an approved treatment for patients at high risk for surgical aortic valve replacement. Computed tomography angiography (CTA) is essential for pre-procedural planning but patient with chronic kidney disease (CKD)are at elevated risk for contrast-induced nephropathy (CIN). Minimization of intravenous contrast while obtaining essential imaging is necessary in this at risk patient population. The accuracy of CTA annular measurements using a very low dose contrast protocol is unknown. 3-dimensional transesophageal echocardiography (3D-TEE) annular measurements have been validated in prior studies and have been the default for TAVR screening in patients with CKD.
**Methods:** Patients with severe, symptomatic aortic stenosis and severe CKD (estimated creatinine clearance $< 30$ mL/min) and BMI less than 40 kg/m2 underwent full pre-procedural TAVR CTA assessment utilizing a 320-slice volumetric scanner (Aquilion One, Toshiba Medical Systems) with a 20 cc contrast bolus injection. One experienced reader measured the aortic annulus on CTA and measurements were compared to a standard of 3D-TEE, with the latter being interpreted by one of two experienced readers. CTA and 3D-TEE readers were different, and were blinded to one another's measurements. Measurements were compared using a paired t-test and correlated using Pearson's correlation coefficient (R).
**Results:** 9 patients (average age = 84, BMI = 25 kg/m2, 67% female) who had a 20 cc protocol CTA and 3-D TEE were studied. There was excellent correlation and there were no significant differences in annular measurements between CTA and 3D-TEE (see Table 1).

**Table 1. Comparison of CTA and 3D-TEE Measurements**

| | CTA | 3D-TEE | Mean difference | P-value | R* |
|---|---|---|---|---|---|
| Perimeter (mm) | 78.9 ± 8.2 | 78.0 ± 7.0 | 0.9 ± 1.6 | 0.14 | 0.99 |
| Area ($mm^2$) | 476 ± 100 | 470 ± 88 | 6 ± 19 | 0.39 | 0.99 |
| Maximum diameter (mm) | 27.4 ± 3.1 | 26.8 ± 2.9 | 0.6 ± 1.7 | 0.28 | 0.85 |
| Minimum diameter (mm) | 21.7 ± 2.7 | 22.4 ± 2.4 | 0.8 ± 1.4 | 0.13 | 0.86 |
| *All p-values for correlation are significant | | | | | |

**Conclusions:** Annular measurements from a 20 cc CTA protocol were statistically equivalent to a validated standard of 3D-TEE measurements. A very low dose protocol may play a very important role in pre-TAVR assessment for patients at high risk of CIN.

## TCT-670

### Volume and distribution of aortic valve calcium and implications for aortic regurgitation after transcatheter aortic valve implantation

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**Background:** The purpose of this study was to measure volume and distribution of aortic valve calcium using multislice computed tomography (MSCT) and to define whether they predict paravalvular regurgitation (PAR) after transcatheter aortic valve replacement (TAVR).
**Methods:** A total of 263 patients underwent TAVR between August 2008 and September 2013. The MSCT scans were analyzed for the volume and distribution of calcium. Leaflet calcium volume and asymmetry index ((maximum leaflet calcium volume – minimum leaflet calcium volume)/sum of maximum and minimum leaflet calcium volume) were scored. Correlation between aortic valve calcium volume and asymmetry index with post-procedural PAR on discharge transthoracic echocardiography was investigated.
**Results:** Fourty-six percent of patients had no or trivial PAR (grade less than 1), 46% had mild PAR and 8% moderate to severe. The volume of annular calcium was higher in patients with mild or moderate to severe PAR compared to patients with PAR grade less than 1 (2023.1±916.4 µl, 2270.8±1558.3 µl and 1700,9±976.9 µl respectively, p=0.024). No association was found between aortic valve calcium asymmetry and PAR severity. Multivariate analysis, including aortic valve calcium volume, asymmetry index of calcium distribution, and other factors that might be associated with PAR (among others aortic annulus area and valve prosthesis type) showed aortic valve calcium volume as the only independent predictor of PAR severity (B=0.00034, p=0.019).
**Conclusions:** Increasing volume of aortic valve calcium predicts the severity of PAR after TAVR. Asymmetrical distribution of calcium in the aortic valve apparatus is not correlated with the severity of PAR after TAVR.

## TCT-671

### Assessment of the Geometric Interaction Between the Lotus Transcatheter Aortic Valve Prosthesis and the Native Aortoventricular Interface by 320-Slice Multidetector Computed Tomography

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**Background:** The LOTUS (Boston Scientific, MA, USA) device is a mechanically expanded, re-sheathable and repositionable transcatheter aortic valve prosthesis. Post-implantation imaging studies of first generation TAVR devices have demonstrated variable geometric interactions with the native annulus. We sought to assess the geometric interaction between the novel LOTUS device and the native aortoventricular interface by multi-detector CT (MDCT) imaging.
**Methods:** 14 patients (28.6% male, mean age 83.8±5.0yrs) who received a LOTUS device underwent MDCT imaging prior to and 12 months post implantation. Baseline measurements were made at the level of the LVOT, basal plane (BP), SOV and ascending aorta. Prosthesis dimensions (height, minimum and maximum diameters, perimeter and area) were measured on post implantation scans at three levels. The eccentricity index (EI=1-(Dmin/Dmax)) and expansion ((measured area/expected area) x 100) of each prosthesis was calculated.
**Results:** The mean eccentricity was 0.05±0.04 in the inflow segment, 0.04±0.04 in the mid segment and 0.03±0.02 in the outflow segment. 3 devices were non-circular (EI>0.10). There was no statistically significant difference in baseline eccentricity to account for non-circular deployment (BP EI=0.25±0.05 vs 0.23±0.04, p=0.60; LVOT EI=0.41±0.07 vs 0.32±0.10, p=0.15). The mean expansion in the inflow, mid and outflow segments were 101.8±8.9%, 95.9±11.2% and 101.9±11.2%. 1 prosthesis was under-expanded in the mid segment, percent expansion 83%. This prosthesis was significantly more oversized than the other devices (perimeter oversizing 18.1% vs 1.8±5.9%, p=0.02; area oversizing 51.6% vs 10.5±12.9%, p=0.01). The average implantation depth was 3.5±0.6mm. In 9 cases (64.3%) the frame extended above the ostium of the LMCA. In these cases there was significant residual sinus area surrounding the frame area (288.7±92.0mm2) and distance between the frame and origin of the coronary artery (5.2±1.6mm).
**Conclusions:** The LOTUS TAVR device, with its unique mechanism of deployment, results in high rates of circularity and near full expansion. Significant prosthesis oversizing may result in modest under-expansion that has not been shown to impact on valve function.

## TCT-672

### Relationship between atheroma of the thoracic aorta and risk of stroke in patients undergoing transcatheter aortic valve implantation

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**Background:** Clinically relevant stroke is a severe complication after transcatheter aortic valve implantation (TAVI) and occurs in up to 10% of cases. The objective of this study was to assess the relationship between severity of calcification of the thoracic aorta and the aortic valve and stroke after TAVI.
**Methods:** Multislice computed tomography (MSCT) of the thoracic aorta was performed In 140 patients undergoing TAVI in order to quantify calcification of the aortic valve and ascending aorta, arch and descending aorta measuring the Agatston score (AgSc) and plaque size. Physical examination and cerebral imaging assessed patients with new onset of neurological deficits.
**Results:** Stroke occurred in 9 (6.4%) patients. Patients with stroke had higher values of AgSc in the arch (9309±6048 vs. 3911±3335; p=0.01) and larger plaque size in the arch (4.8±1.7 mm vs. 3.4±1.2 mm; P=0.006). AgSc of the descending aorta (6333±4834 vs. 3172±2910; P=0.06) was numerically higher in patients suffering a stroke. There was no difference in calcification of the aortic valve (2868±2177 vs. 2272±1518; (P=ns) and ascending aorta (1569±1486 vs. 1673±2492; P=ns) in both groups. Multiple regression analysis identified AgSc and maximum plaque size of the arch, reduced left ventricular ejection fraction and fluoroscopy time as independent risk factors for stroke.
**Conclusions:** Calcification of the aortic arch but not of the native valve is an independent predictor of stroke after TAVI. Precise preoperative screening may lead to optimized outcome in these patients.

## TCT-673

### Transcatheter Aortic Valve Oversizing: A Comparison of Leaflet Stress and Strain Distribution

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**Background:** Transcatheter aortic-valve replacement (TAVR) is the recommended treatment option for patients with severe aortic stenosis who are not suitable candidates for surgery. The current guidelines for TAVR are to upsize the valve relative to the native annulus to secure the device and minimize paravalvular leakage. However, incomplete TAV expansion due to oversizing negatively impacts valvular hemodynamics and distorts leaflet coaptation. The aim of this study was to determine the impact of valve oversizing on leaflet stress and strain distribution.
**Methods:** 3D leaflet geometry of a 23mm TAV expanded to diameters ranging from 18 to 23mm was obtained in 1mm increments. The TAV design was based on Edwards SAPIEN XT valve design. A large deformation analysis was performed using ABAQUS. Leaflets were only modeled and stent was considered to be rigid. A polynomial strain-energy function was fitted to biaxial data of each individual leaflet. An ensemble averaged transvalvular pressure waveform measured from in-vitro tests was applied to the leaflets.
**Results:** In a fully-expanded configuration, both high stress and large deformation were observed primarily in the commissure and basal attachment regions. The maximum principal stress value in the fully closed position was 1.8MPa (Fig 1A). Valve oversizing induced localized high stress regions within the belly of the leaflets reaching up to 5.4MPa (Fig 1B).