Abstract: P3376

Software-based automated CT analysis for planning TAVI-Procedures: Systematic validation against expert and novice human interpretation

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Topic(s):
Computed Tomography: Valve Disease

Citation:

Introduction:
Cardiac computed tomography (CT) is an established modality for planning TAVI procedures. We validated CT parameters measured by automated software analysis and by newly trained readers against expert readers.

Methods:
Consecutive patients with symptomatic severe aortic valve stenosis referred for CT assessment of the aortic root prior to TAVI were included in this analysis. Measurements were performed manually by an expert reader, a newly trained reader as well as semi-automatically using a commercially available workstation. Manual measurements were performed as per clinical standard. For semi-automatic analysis, CT data sets were exported to a dedicated workstation with fully automated detection of the aortic annulus plane.

Results:
Out of 159 consecutive patients, 146 patients were included in this analysis (83±10 years). The median annulus area for expert reader, newly trained reader and software measurement was 468 mm², 511 mm² and 513 mm², respectively (p=0.28) whereas the mean annulus diameter showed a mean±SD of 25.6± 2 mm, 25.5±2 mm and 25.6±2 mm, respectively, p=0.47. Agreement between expert and newly trained reader for annulus area was good with Bland-Altman analysis showing a systematic overestimation of the annulus area for the newly trained reader of 16 mm² (95% limits of agreement 42 to -74 mm²) and for automatic software of 20 mm² (95% limits of agreement 60 to -99 mm²). Assuming an annulus area-based recommendation for a balloon-expandable Sapien 3 prosthesis (23, 26 or 29 mm prosthesis), kappa statistics revealed moderate agreement between expert measurement, newly trained reader and software measurement (\( \kappa = 0.60 \) for newly trained reader, \( \kappa = 0.58 \) for software measurement, \( p<0.0001 \) for all). The time needed for annulus adjustment measurement for the newly trained reader compared to software measurement was 2+0.6 minutes vs. 1+0.5 minutes, respectively, \( p<0.0001 \). The software correctly identified the annulus plane without reader correction in 49% of cases and in 51% of cases manual correction of the cusp insertion point or annular tracing had to be performed. Agreement between expert predicted angulation and software predicted angulation was excellent in 55%, good in 29% vs. 31%, moderate in 11% vs. 6% and fair in 5% vs. 8% for LAO/RAO orientation, CAU/CRA orientation, respectively (assuming excellent agreement when difference: <5°, good agreement: 5-10°, moderate agreement: 10-15° and fair agreement: >15°).

Conclusion:
Novice human interpretation manually and with semi-automatic assessment of the aortic root for planning TAVI procedures is feasible with good agreement with expert measurement for annulus dimensions and prediction of implantation angles, however with a trend for systematic overestimation of the annulus area. For semi-automatic
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Conclusion:
Novice human interpretation manually and with semi-automatic assessment of the aortic root for planning TAVI procedures is feasible with good agreement with expert measurement for annulus dimensions and prediction of implantation angles, however with a trend for systematic overestimation of the annulus area. For semi-automatic assessment, reader correction of cusp insertion point and annular dimensions have to corrected for in 50% of cases.