quantitative Regurgitation Analysis for TAVR procedures
Caas Quick and reproducible quantification of Aortic Regurgitation
A-Valve

Aortic regurgitation (AR) is common after TAVI. Recent studies have shown it is associated with increased mortality proportionate to the degree of regurgitation\(^1\). Prompt detection of leakage after device deployment allows the operator to undertake corrective measures that can reduce the leakage. Conventional methods such as Transesophageal Echocardiography (TEE) and X-Ray are subjected to intra- and inter-observer variability or have the limitation that it has to be performed post-procedural (CT and MRI) outside the catherlab.

New video densitometric method
CAAS A-Valve provides quick and reproducible quantification of AR (qRA and LVOT-AR) after TAVI by using angiography which is already present in the catherlab. The software generates contrast time-density curves (TDC) using a semiautomatic algorithm. On the angiogram the reference and the region of interest (ROI) are drawn to include the contrast-filled aortic root and the LV, and the base of the aortic root is indicated.

**qRA**
Five TDCs are created: for the total ventricle, for the reference area in the aortic root and for the three regions in the LV: base (subaortic segment), mid and apex. The qRA index algorithm is based on comparing the area under the curve (AUC) of the three LV regions versus the AUC (time-density integral) of the reference region (red). RAUC can also be computed for the whole ventricle by comparing the AUC of the entire ventricle (yellow) to that of the reference region. The calculation is made over three cardiac cycles. The qRA index ranges from 0 (no regurgitation) to 4 (severe regurgitation) analogous to the Sellers grades.

**LVOT-AR**
When LVOT-AR is analyzed, the contour of the ROI is modified to include the subaortic LV segment instead of the entire LV. In contrast with the qRA index, in which the algorithm is usable only when the entire LV is interrogated, the LVOT-AR index ranges from 0 to 1. Zero indicates that there is no contrast in the ROI, and 1 indicates that the density of contrast in the ROI is the same as in the reference area.
Validation

1. **CAAS A-valve qRA/LVOT-AR relative to visual grading**
   In the study of Schultz and colleagues they concluded that inter-observer measurement of qRA and LVOT-AR index were highly correlated ($r=0.98$, $p<0.001$) and showed a high level of agreement, which is much improved over visual scoring according to Sellers’ method (kappa between 0.47 and 0.60)$^2$.

2. **CAAS A-valve qRA/LVOT-AR compared with gold standard cardiac MRI**
   Measurement of AR via standardized quantitative aortography (qRA and LVOT-AR) is a novel and promising technique that is strongly correlated ($r$ between 0.85 and 0.91, $p<0.05$) with the gold standard of cardiac MRI$^3$.

3. **CAAS A-valve LVOT-AR relative to clinical end-points**
   In a study by Tateishi et al. AR after TAVI was quantified, using dedicated video densitometry software (qRa compared with the new method LVOT-AR), and inter- and intra-observer reproducibility was investigated. The assessment of LVOT-AR is feasible, reproducible and predictive of one-year mortality$^4$.

**Conclusion**

Visual assessment of AR on contrast aortography via Sellers’ method is challenging in being a subjective measurement with significant inter-observer and intra-observer variability affecting its validity, reproducibility, and accuracy. Measurement of qRA index via standardized quantitative aortography is strongly correlated with gold standard of cardiac MRI. The assessment of the LVOT-AR can judge the severity of valve leakage and predicts long-term all-cause mortality after TAVI.

The use of CAAS A-valve can aid in accurate, reproducible quantification of AR during TAVI procedures on angiography.

---


*This document is provided on an “as is” basis and does not imply any kind of guarantee or warranty, including the warranties of merchantability or fitness for a particular use. Your use of the information in the document or materials linked from the document is at your own risk. Pie Medical Imaging reserves the right to change or update this document at any time.

** When the results provided by CAAS A-Valve are used in a clinical setting to support diagnoses or for assistance during intervention of cardiovascular conditions, the results are explicitly not to be regarded as the sole, irrefutable basis for clinical decision making.”