Intraobserver and interobserver variability of ascending aorta diameter measurements as assessed with ECG-gated MDCT: automatic versus manual measurements

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Purpose: Recently morphometric measurements of the ascending aorta have been done with ECG-gated MDCT to help the development of future endovascular therapies (TCT) [1]. However, the variability of these measurements remains unknown. It will be interesting to know the impact of CAD (computer aided diagnosis) with automated segmentation of the vessel and automatic measurements of diameter on the management of ascending aorta aneurysms.

Methods and Materials: Thirty patients referred for ECG-gated CT thoracic angiography (64-row CT scanner) were evaluated. Measurements of the maximum and minimum ascending aorta diameters were obtained automatically with a commercially available CAD and semi-manually by two observers separately. The CAD algorithms segment the iv-enhanced lumen of the ascending aorta into perpendicular planes along the centreline. The CAD then determines the largest and the smallest diameters. Both observers repeated the automatic measurements and the semi-manual measurements during a different session at least one month after the first measurements. The Bland and Altman method was used to study the inter/intraobserver variability. A Wilcoxon signed-rank test was also used to analyse differences between observers.

Results: Interobserver variability for semi-manual measurements between the first and second observers was between 1.2 to 1.0 mm for maximal and minimal diameter, respectively. Intraobserver variability of each observer ranged from 0.8 to 1.2 mm, the lowest variability being produced by the more experienced observer. CAD variability could be as low as 0.3 mm, showing that it can perform better than human observers. However, when used in non-optimal conditions (streak artefacts from contrast in the superior vena cava or weak lumen enhancement), CAD has a variability that can be as high as 0.9 mm, reaching variability of semi-manual measurements. Furthermore, there were significant differences between both observers for maximal and minimal diameter measurements ($p<0.001$). There was also a significant difference between the first observer and CAD for maximal diameter measurements with the former underestimating the diameter compared to the latter ($p<0.001$). As for minimal diameters, they were higher when measured by the second observer than when measured by CAD ($p<0.001$). Neither the difference of mean minimal diameter between the first observer and CAD nor the difference of mean maximal diameter between the second observer and CAD was significant ($p=0.20$ and 0.06, respectively).

Conclusion: CAD algorithms can lessen the variability of diameter measurements in the follow-up of ascending aorta aneurysms. Nevertheless, in non-optimal conditions, it may be necessary to correct manually the measurements. Improvements of the algorithms will help to avoid such a situation.

Reference

1. T.L. Lu, C.H. Huber, E. Rizzo, J. Dehmeshki, L.K. von Segesser, S.D. Qanadli. "Ascending aorta measurements as assessed by ECG-gated multi-detector computed tomography: a pilot study to establish normative values for transcatheter therapies." *European Radiology* **19(3)**, pp. 664-669, 2009