Validation of free software for automated vessel delineation and MRI flow analysis

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INTRODUCTION

Accurate flow quantification requires well validated tools. The purpose of this study was to validate a freely available software for cardiac image analysis (http://segment.heiberg.se).

METHODS

Flow measurements were performed both *in vitro* and *in vivo* on a on a 1.5 T Philips Intera CV system using a non-segmented gradient echo pulse sequence.

In vitro measurements were performed using gravity driven flow through a silicon gel with two holes with a diameter of 26 mm. Flow rate was measured by timer and beaker.

For the *in vivo* experiments, one experienced observer outlined the ascending and descending aorta in 12 volunteers and 20 patients. In total 64 vessel region of interests were analyzed both manually and using automated vessel delineation.

The manually outlined vessel contour from the first time frame was taken as input to the automated algorithm. First, the vessel was tracked throughout the heart cycle using an optical flow based method. Thereafter, a deformable model approach was used to refine the vessel contour.

RESULTS

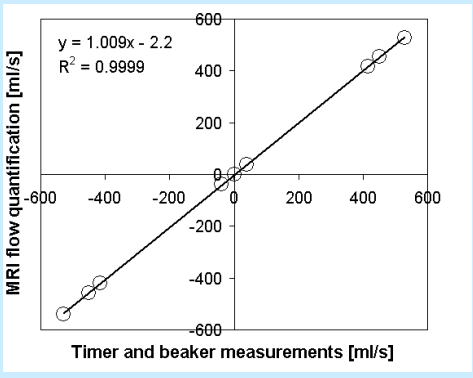

Figure 1. Correlation plot between time and beaker flow measurements versus velocity encoded MR flow quantification.

RESULTS CONT.

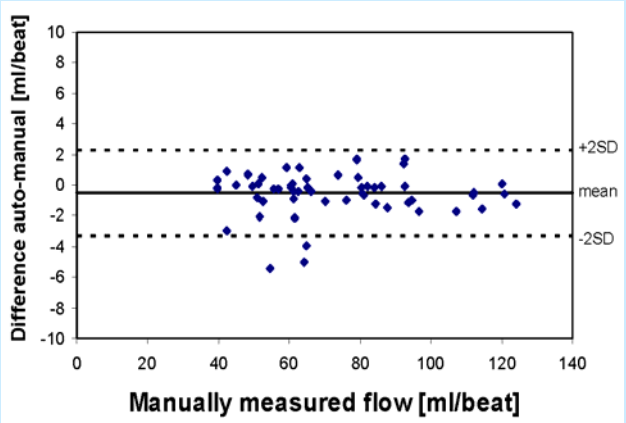

Figure 2. Difference in total net flow comparing automated and manual vessel delineation in patients and volunteers.

Bias and variability between total net flow for the manual vessel delineation and automated vessel delineation were -0.5 ± 1.4 ml/beat.

In 4 of the 64 vessels (6%) the automated vessel tracking failed due to poor image contrast and imaging artifacts. This resulted in a difference larger than 10ml and visually large overestimation in vessel area. These vessels where excluded from further analysis.

CONCLUSIONS

- There was an excellent correlation between timer and beaker measurements and MR flow measurements.
- The suggested method for semi-automated flow quantification showed a low bias and variability compared to manual delineation.