

Comparison of the Work Effort and Accuracy of Post-Processing cardiac MR among Attendings, Fellows, and Third-Party Vendor



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Introduction

Postprocessing cardiac MRI (CMR) images to measure ventricular function is time-consuming for the imaging physician. Outsourcing is one possible way to decrease this time commitment, but the accuracy and relative cost of using outsourced services has not been fully described. We compared the time and accuracy of postprocessing performed by an outsourced third-party to postprocessing by attending physician alone, or in conjunction with the radiology fellow.

Purpose

Outsourced post-processing services may be an attractive alternative to the more traditional in-house workflows because turnaround time and personnel scalability may be more favorable. Advances in data transfer and software systems have made outsourced postprocessing easier to implement. However, the accuracy of outsourced postprocessing for cardiac MRI has not been described. This study addresses the primary concern of third-party post-processing accuracy which directly impacts quality of care, and quantifies how much physician time and effort may be saved using outsourced processing against a variety of traditional in-house workflows.

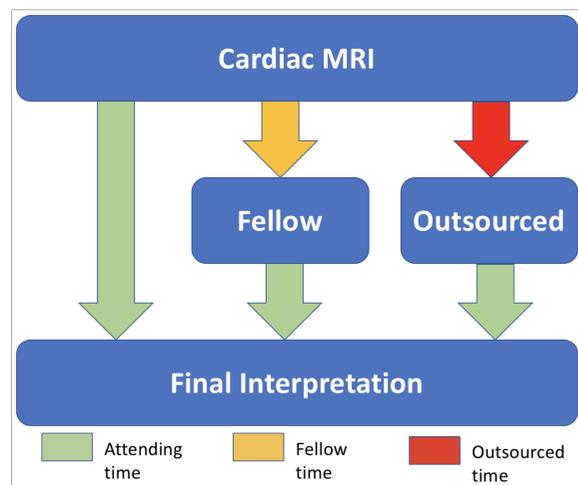


Figure 1: Illustration showing scheme of study. Time values for postprocessing were compared across all groups. The final ventricular function values were compared to the reference standard which was achieved through a group consensus.

Methods

Thirty CMR cases from an academic referral center were randomly selected and anonymized. Left and right ventricular end-diastolic and end-systolic volumes (LV EDV and RV EDV) and LV mass were post-processed by 5 groups: A) a cardiothoracic radiology fellow alone, B) a fellow subsequently modified by attending, C) a third-party vendor (outsourced) alone, D) outsourced modified by attending, and E) an attending alone using the same commercial software. Reference standard values were defined as the consensus of three attending CMR physicians. Processing time was recorded to quantify physician effort. Two fellows, three attendings, and two third-party analysts were observers in the study.

Results

Attendings performing primary analysis of cases alone spent 19.9 ± 9.0 min per case. Fellows spent an average 27.4 ± 11.5 min to process a case, and attendings spent 9.1 ± 6.6 min reviewing and finalizing the Fellow contours, resulting in an average combined physician time of 36.0 ± 13.1 min per case. There was no significant difference in the time attendings spend reviewing images post processed by a fellow vs. the outsource entity ($p = 0.76$).

Time and Cost

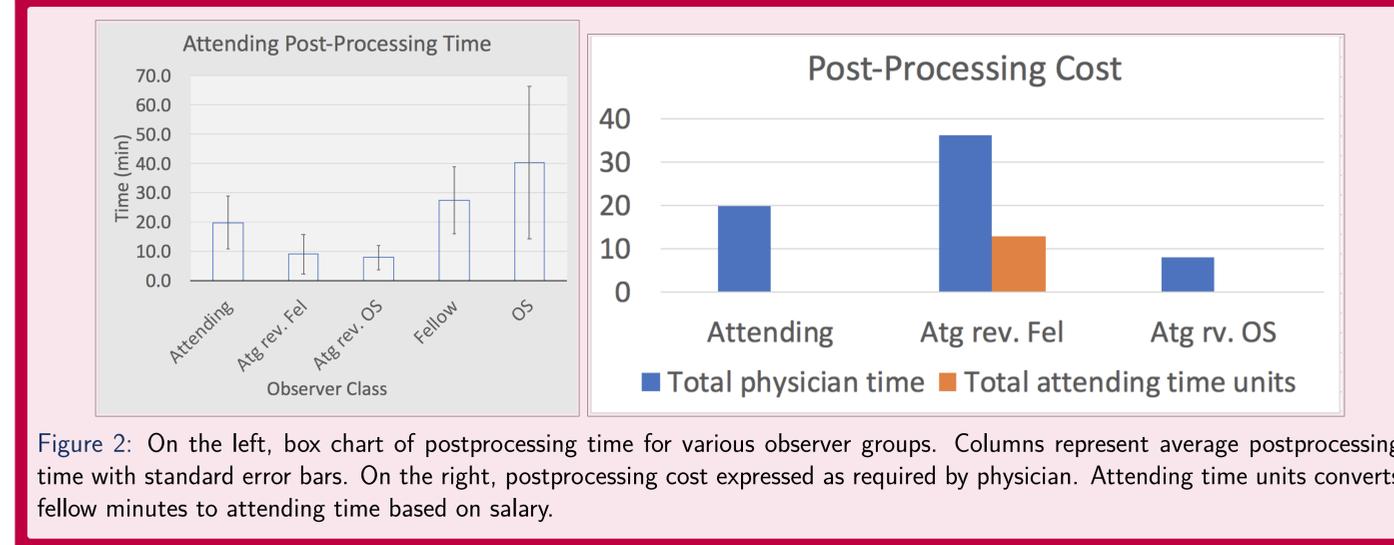


Figure 2: On the left, box chart of postprocessing time for various observer groups. Columns represent average postprocessing time with standard error bars. On the right, postprocessing cost expressed as required by physician. Attending time units converts fellow minutes to attending time based on salary.

Compared to the reference standard values, attending reviews of the outsourced results took 8.0 ± 4.2 min per case. The average combined percent errors for volumetric measurements was $4.1 \pm 8.3\%$ for attending-reviewed fellows, $4.0 \pm 9.7\%$ for attending-reviewed outsourced and $5.5 \pm 9.4\%$ for attendings alone. The correlation value was > 0.98 between the consensus volumetric values and values determined by the observer groups

Discussion

Postprocessing is a time-consuming task that many consider inefficient use of the physician's time. However, as all images need to undergo final review by the attending physician, it has until now been unclear that post processing by an outsourced third-party vendor would result in any efficiency gain while maintaining the same quality.

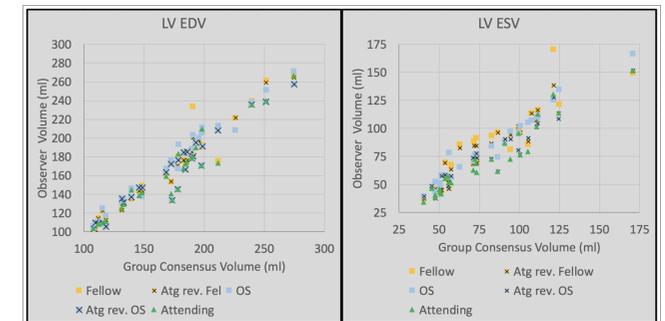


Figure 3: Correlation of diastolic (left) and systolic (right) volumes between observer groups and the reference standard. There is decreased correlation between all groups in the reference standard on systolic volumes. Atg = attending; Fel = Fellow; OS = outsourced

This study shows that ventricular measurements are not significantly different when the processing is performed by attending alone, fellow followed by attending, or an outsourced third-party followed by an attending. This suggests that an outsourced third-party can be used without significant concern for quality of functional measurements.

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