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Clinical experience with online motion-corrected stress and rest first pass myocardial perfusion images

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Introduction

Myocardial first pass perfusion is useful in patients with known or suspected coronary arterial disease. However, the time to manually trace and correct myocardial regions of interest (ROIs) is a significant barrier to clinical workflow. This study tested time to analyze perfusion using an online (i.e. scanner acquired), fully automated, non-rigid, image registration perfusion method.

Purpose

1. To determine the time needed to analyze online, motion-corrected (MOCO) perfusion images versus raw non-motion corrected images.

2. To qualitatively review whether motion corrected images distort the appearance of abnormal perfusion images.

Methods

20 patients were studied on a 1.5 T Siemens Avanto using a first pass perfusion method that automatically aligns perfusion images on the console using a non-rigid image registration method. All patients were studied during dipyridamole stress and at rest. Half the patients were intentionally instructed not to hold their breath during the acquisition. The study endpoint was time to create and manually correct epicardial and endocardial regions of interest needed to create time intensity curves.

Results

Qualitatively, MOCO perfusion images were essentially equivalent in image quality to the raw perfusion images. Figures 1 and 2 show an example of abnormal MOCO and raw stress perfusion images in a patient with an anteroseptal perfusion defect.

In the 20 stress perfusion studies, MOCO reduced overall analysis time by 28% (20:03 ± 07:33 to 14:24 ± 5:44, raw vs MOCO, $p = 0.001$) which was almost entirely due to less time needed to manually adjust ROIs (15:57 ± 7:36 to 10:28 ± 5:33, $p = 0.001$). MOCO reduced overall analysis time and manual adjustment time by a similar amount for the 20 rest perfusion studies ($p < 0.001$).

To determine how well MOCO handled respiratory motion, we quantified analysis time in patients who were instructed not to hold their breath during the perfusion imaging. For non-breathhold stress perfusion imaging, overall analysis time was reduced from 18:35 ± 5:12 to 11:42 ± 3:11 (raw vs MOCO, $p = 0.007$) which was largely due to the a reduction in the time used to make manual

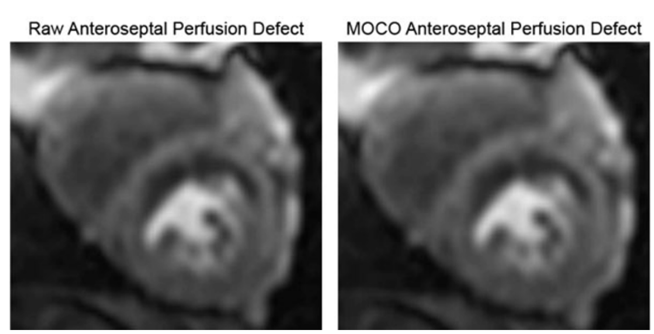

Figure 1

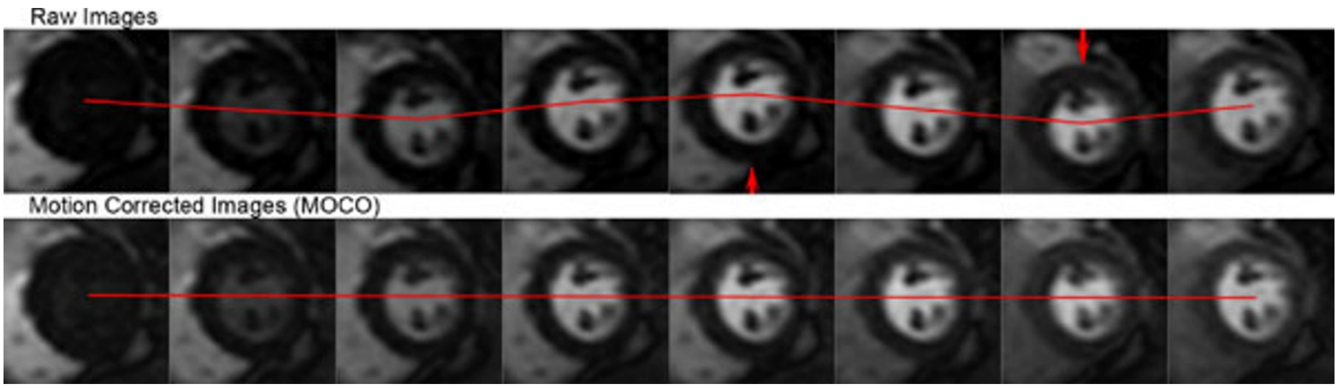

Figure 2

corrections to the ROIs (14:41 ± 5:13 to 7:55 ± 2:46, raw vs MOCO, p = 0.006).

Conclusion

Motion corrected images significantly decreased the length of time to analyze perfusion and improved the feasibility of quantifying perfusion without compromising image quality even in patients with perfusion defects - a major advance in the feasibility of automatic perfusion analysis.