Automatic measurement of myocardial reperfusion following percutaneous coronary intervention (PCI)

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Abstract. Following primary PCI, some patients may not achieve optimal microvascular perfusion. This has been associated with increased mortality and morbidity. The ability to readily assess tissue-level reperfusion during PCI is therefore important for the risk stratification of patients.

Myocardial blush grade (MBG) is a semi-quantitative contrast-based index that is often applied to measure contrast medium penetration of the myocardium. Although, MBG has been widely used and validated in clinical use, it is extremely subjective. In this work, we developed an image processing technique that aims to automate the measurement of myocardial blushing.

Our algorithm is based on a frame-by-frame analysis of angiogram data using the following stages. Segmentation of the main coronary arteries based on standard image filtering techniques. Development of a mask, based on the detected arteries, that facilitates encompassing surrounding prominent vessels not initially detected. Augmentation of each frame based on this mask to identify regions surrounding but excluding the main arteries. Calculating an index which is based on the ratio of grey intensity of the detected blushing versus that of the entire frame. The highest index across a set of frames for a recording is taken as the corresponding blushing rate after contrast injection.

We have conducted initial evaluation of our algorithm on angiographic data from 9 patients undergoing PCI at the Royal Victoria Hospital in Belfast. A human observer(cardiologist) reviewed the data and labelled each case into one of three categories: no blushing, blushing and extensive blushing.

Our analysis provided a measure of blushing between 0 and 0.2 for the 9 subjects which was 75% in agreement with labels provided by the cardiologist, with lower values corresponding to no blushing category.

In conclusion, we believe that using live image processing algorithms can help to automatically calculate the myocardial perfusion, which may inform tailored therapy during PCI.