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Evaluation of contraction motion compensation in gated myocardial perfusion SPECT using intensity- and land-mark based registration techniques

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Background / Aims: Cardiac contraction and respiratory motion have great impact on gated myocardial perfusion SPECT (MPS) image quality degradation, by inducing image blurring and quantification inaccuracies. Therefore, motion compensated temporal processing has a major impact on the quality of gated images.

Methods: 50 patients without knowing heart condition underwent gated MPS. Image compensation was applied using B-spline algorithm along with affine transformation as the general transformation (FFD) and Motion Freezing application of Cedars-Sinai medical software (Cedars-Sinai, California, USA) to warp all image phases to fit the end-diastolic (ED) phase. Myocardial lateral wall thickness, myocardial to blood pool (M/BP) contrast and image CNR were measured in summed images before and after compensation with FFD and MF (BC and FFD-C and MF respectively).

Results: Myocardial wall thickness before compensation was 5.40±3.65 mm and after compensation with FFD-C and MF were 5.39±4.38 mm ($P<0.0001$) and 5.86±1.65 mm ($P<0.0001$), respectively. M/BP contrast in compensated images are greater than the corresponding BC images 46% and 75% respectively ($P<0.05$). CNR has increased 32% and 80%($P<0.0001$) in FFD-C and MF compared to corresponding BC images.

Conclusion: FFD-C is a topology preserving method, transformation fields between frames are physically plausible and it doesn't need contour definition, while MF needs accurate definition of control points. FFD-C can model the non-linear motions in every pixel in myocardium; however, MF only considers motion orthogonal to endocardium and epicardium. Partial volume effect, is not displace by Thin Plate Spline (TPS) motion vectors, while FFD-C, doesn't eliminate partial volume effect, thus MF illustrates better improvement in CNR and contrast. Myocardial wall thickness significant decrease indicates, that motion blurring has been compensated in lateral wall to some extent. Both techniques improved M/BP contrast and CNR while preserving image SNR, which means signal cross contamination between myocardium and blood pool has been effectively reduced.

Disclosure of Interest: None Declared