Purpose: It is aim to test the hypothesis that a dynamic keyhole MRI reconstruction technique using external/internal respiratory surrogate position reduces acquisition time while retaining image quality for real-time tumor monitoring, compared to the conventional keyhole technique.

Methods: 46 thoracic MRI studies with 13 healthy human subjects have been acquired using a 3T GE MRI. Acquired MR images were reconstructed using zero-filling, conventional keyhole and the proposed respiratory motion based dynamic keyhole techniques; resultant images were then compared for image quality. Undersampled k-space rate in the phase encoding direction was determined based on the difference between the original image and the reconstructed image. The position of abdominal muscles and diaphragm were used to determine any excess data that exists in the overlaid temporal data. In addition, the feasibility of the dynamic keyhole method was applied using lung tumor MR images.

Results: The result from dynamic keyhole using respiratory motion demonstrated significant improvement compared with the zero-filling and conventional keyhole methods. Firstly, the dynamic keyhole method using external respiratory motion had an overlaid average of 79.7% (204 lines) of 256 lines from 46 datasets, compared to 63.9% in zero-filling and 74.3% in conventional keyhole. Secondly, dynamic keyhole method using internal diaphragm motion had an overlaid average of 84.5% (216 lines) of 256 lines from all datasets compared to 67.1% and 77.8% or zero-filling and conventional keyhole, respectively. Lastly, dynamic keyhole has been validated with one dataset involving lung tumor MR images. Image blurring artifacts and inferior resolution were not present in the final MR images using dynamic keyhole.

Conclusions: Dynamic keyhole method using respiratory external/internal surrogate motion has been proposed to reconstruct MR images without image artifacts and with superior resolution. This method is applicable to MR images targeting lungs and other organs affected by respiratory motion for real-time tumor motion monitoring.