Clinical Application for Free Breathing 3D Delayed Enhancement

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Quick Star: Cardiac free breathing 3D Delayed Enhancement

Quick Star sequence incorporates radially samples k-space data from the center in-plane direction and orthogonally in slice direction. This technique delivers high-resolution 3D T1-weighted images that are less influenced by uncontrollable motion in regions of the Heart and Abdomen during free breathing state. This radial sampling technique is an important tool that can be used in the clinical settings for patients who have difficulty in holding their breath. As shown in Figure 1, Quick Star is less susceptible to movements because it repeatedly acquire data near the center of the k-space.

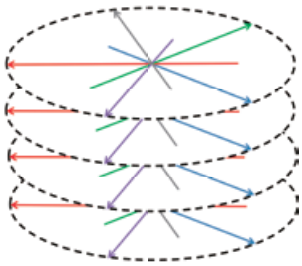
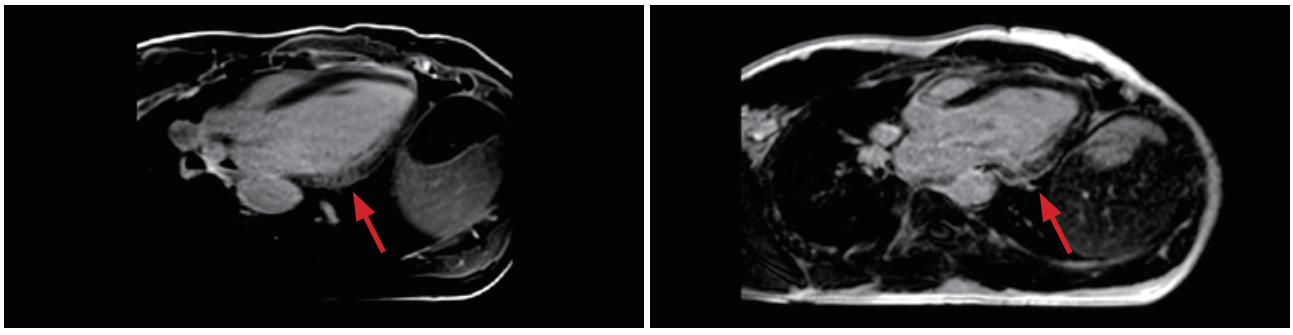


Figure 1: Quick Star: Filling the k-space --- Less susceptible to movements due to repeated acquisition of data near the center of the k-space.

Figure 2 demonstrates Delayed Enhancement sequences (Segmented IR FFE 3D Quick Star and FFE 2D T1-weighted Delayed Enhancement Image), taken as part of routine MR Cardiac Viability on a 23 year old male patient complaining of heart palpitations and shortness of breath. While both Delayed enhancement sequences demonstrate the patchy enhancement of the lateral wall of the myocardium associated with myocarditis, Quick Star (Figure 2-1) utilizes higher spatial resolution for better clarity, while utilizing a free breathing technique which better suited this patient's condition for beneficial diagnosis. Even though, the 3ch FFE Segmented IR



2-1 2-2

Figure 2: 2-1) Ax FE3D 3ch Recon. T1 Fat Sat Quick Star LGE, 2 mm × 1.9 × 1.9, Non-Selective IR Pulse 240 ms, Scan time: 5:00
2-2) Short Axis FFE 2D LGE, 8 mm × 2.7 × 2.0, Non-Selective IR Pulse 240ms, Scan time: 12 seconds

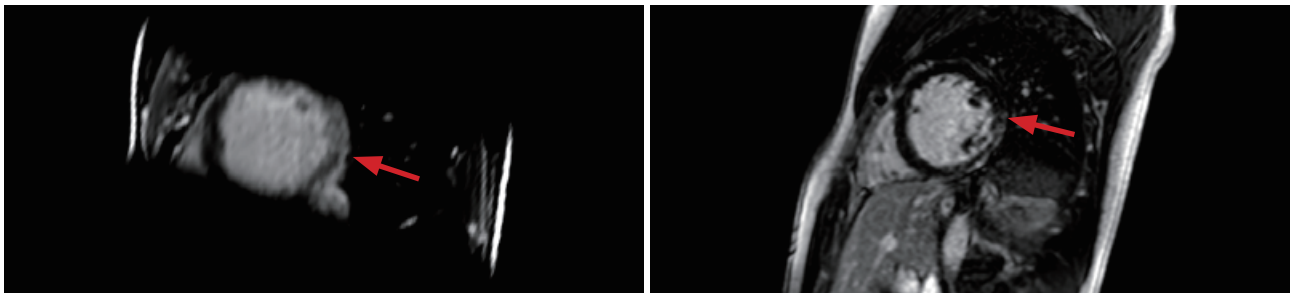
Delayed Enhancement sequence (Figure 2-2) was a 12 second breath hold, the patient's condition proved difficult to acquire consistent image quality. Therefore, multiple repeated scans were required to acquire diagnostic image quality.

Figure 3 demonstrates Delayed Enhancement sequences comparing sequences (Segmented IR FFE 3D Quick Star and FFE 2D T1-weighted Delayed Enhancement Image) displayed in the short axis plane. Quick Star (Figure 3-1) is a reformatted reconstruction of the short axis from acquired 2.0 × 1.9 × 1.9 mm Axial Images. The reformatted short axis image clearly demonstrates the enhancement in the lateral ventricle wall associated with myocarditis. Short Axis FFE Segmented IR Delayed Enhancement sequence (Figure 3-2) correlates the finding of the enhancement on the reformatted Short Axis Quick Star images.

Figure 4 demonstrates Delayed Enhancement sequences comparing sequences (Segmented IR FFE 3D Quick Star and FFE 2D T1-weighted Delayed Enhancement Image) displayed in the 4ch axis. Quick Star (Figure 4-1) is a reformatted reconstruction of the 4ch axis from acquired 2.0 × 1.9 × 1.9 mm Axial Images. The reformatted 4ch axis image clearly demonstrates the enhancement in the lateral ventricle wall associated with myocarditis. 4ch FFE Segmented IR Delayed Enhancement sequence (Figure 4-2) does not clearly the enhancement due to difficulty holding breath and cardiac arrhythmia.

Conclusion

Quick Star delivers high resolution 3D T1-weighted delayed enhancement images of the Heart while in a free breathing state. This free breathing technique overall makes it easier for patients to complete the examination while maintaining high image quality that can reconstructed in any plane without the loss detailed information.



3-1 3-2

Figure 3: 3-1) Ax FE3D Short Axis T1 Fat Sat Quick Star LGE, 2 mm × 1.9 × 1.9, Non-Selective IR Pulse 240 ms, Scan time 5:00
3-2) Short Axis FFE 2D LGE, 8 mm × 2.7 × 2.0, Non-Selective IR Pulse 240 ms, Scan time: 12 seconds

4-1 4-2

Figure 4: 4-1) Ax FE3D 4ch Recon. T1 Fat Sat Quick Star LGE, 2 mm × 1.9 × 1.9, Non-Selective IR Pulse 240 ms, Scan time: 5:00
4-2) 4ch FFE 2D LGE, 8 mm × 2.7 × 2.0, Non-Selective IR Pulse 240 ms, Scan time: 12 seconds

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