

Wideband myocardial T2 mapping: A preliminary evaluation in an implantable cardiac device taped on healthy volunteers at 1.5T

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BACKGROUND

- Myocardial T2 mapping enables non-invasive characterization of myocardial inflammation and edema [1].
- Conventional T2 mapping in patients with implantable cardioverter defibrillators (ICDs) results in:
 - Image artifacts due to resonance frequency offset
 - Inaccurate T2 values
- Wideband T2 preparation was introduced for black-blood late gadolinium enhancement imaging to suppress ICD artifacts in the myocardium [2].

Objective

- A wideband T2 preparation module was integrated into a myocardial T2 mapping sequence for ICD patients at 1.5T

METHODS

Wideband T2 preparation [3]

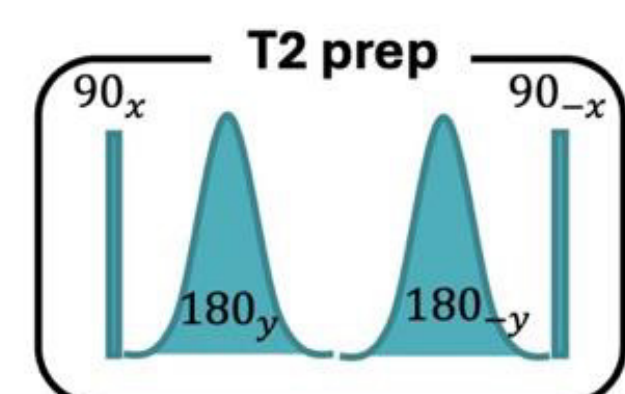
- Rectangular tip down RF pulse
- Two adiabatic hyperbolic secant refocusing pulses
 - Conventional bandwidth: 1.6 kHz
 - Wideband bandwidth: 5.0 kHz
- Rectangular tip up RF pulse

T2 mapping

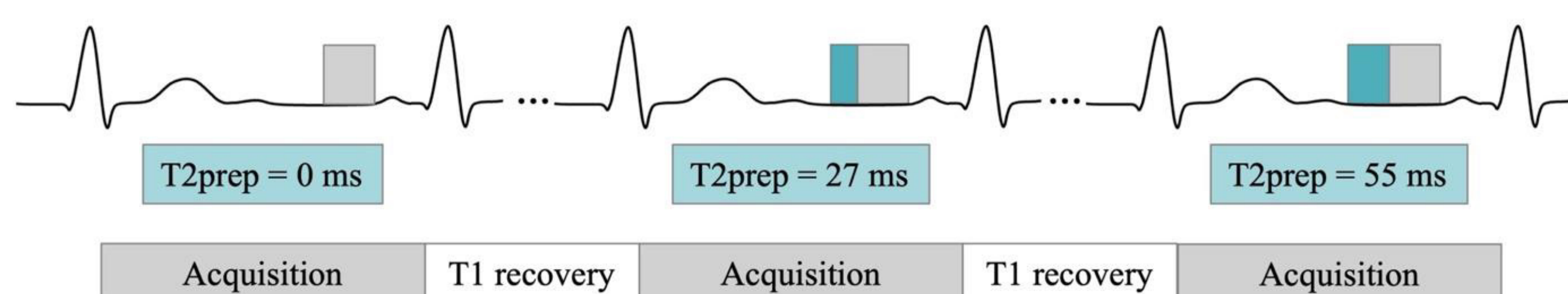
- Three wideband T2-prepared single-shot images are acquired sequentially (T2 preparation duration = 0, 27, and 55 ms) [4].
- A two-parameter exponential fitting model generated the T2 maps.

Parameters

- FOV = 360mm x 287mm, resolution = 1.4mm x 1.4mm, slice thickness = 8mm, TE/TR = 2.09/3.95ms, flip angle = 15°, readout bandwidth = 1221Hz/pixel, 8 signal averages, GRAPPA x2, partial Fourier phase 6/8.



Wideband: 1.6 → 5.0 kHz



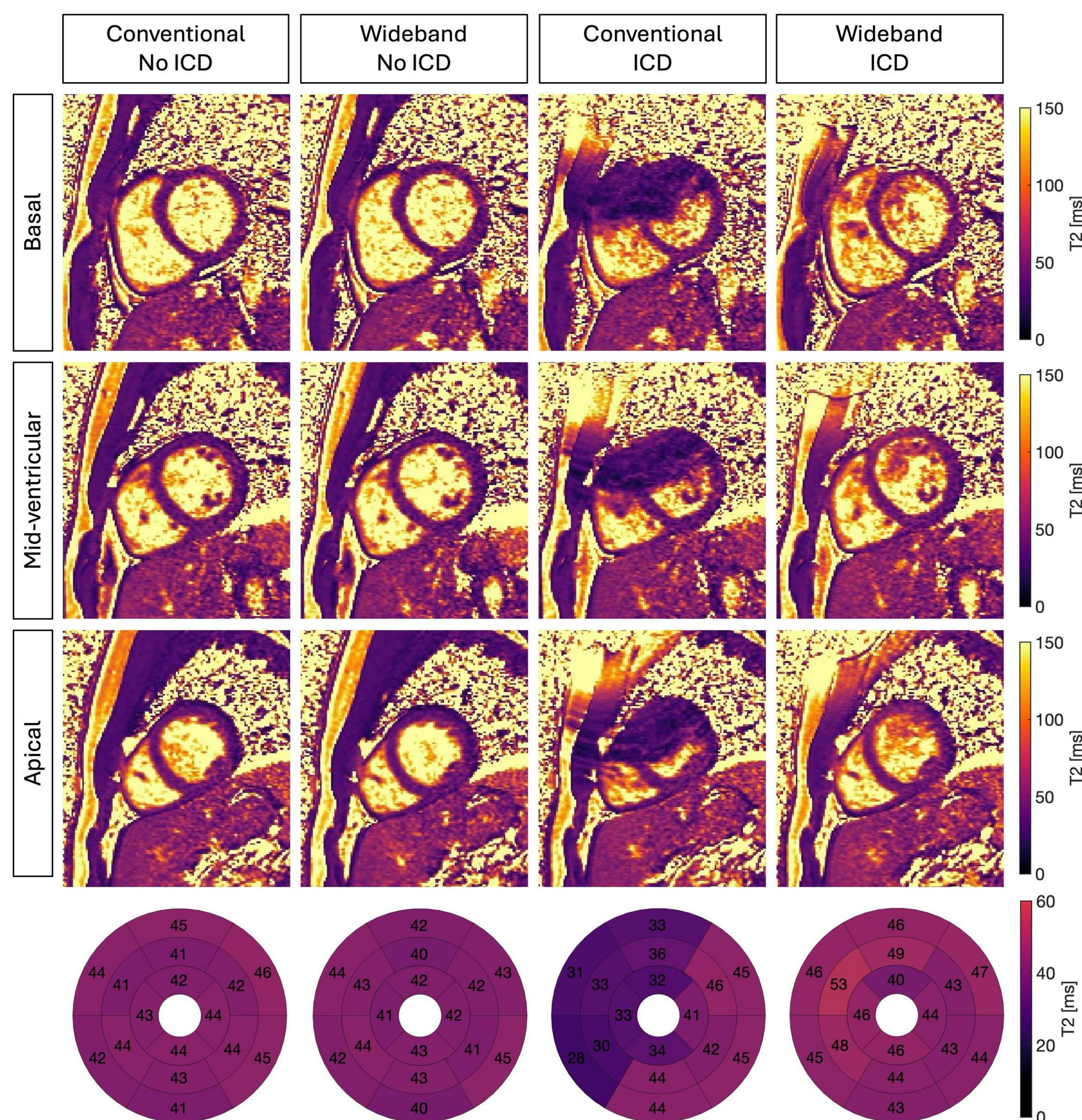
RESULTS

In the absence of an ICD

- T2 values were similar between conventional (median: 42.90, IQR: 42.02,44.40) and wideband technology (median: 42.48, IQR: 41.74, 44.32, P=0.654).

In the presence of an ICD

- T2 values were drastically decreased with the conventional sequence (median: 37.57, IQR: 32.32, 40.87) (P<0.01)
- Using a wideband T2 preparation, ICD-related artifacts affecting the myocardium were suppressed allowing for accurate T2 values (median: 43.54, IQR: 42.52, 45.33), consistent with conventional T2 values (P=1.000) and with wideband T2 values observed in the absence of an ICD (P=0.260).



CONCLUSION

Conventional myocardial T2 mapping is significantly affected by ICD-related artifacts, leading to inaccurate T2 values. In contrast, wideband T2 mapping mitigates these artifacts, providing accurate myocardial T2 measurements even when an ICD is present.

REFERENCES

[1] O'Brien, A. et al., T2 mapping in myocardial disease: a comprehensive review. *Journal of Cardiovascular Magnetic Resonance* vol., 2022. [2] Gut, P. et al., Wideband black-blood late gadolinium enhancement imaging for improved myocardial scar assessment in patients with cardiac implantable electronic devices. *Magn Reson Med*, 2024. [3] Nezafat, R. et al., Spectrally selective B1-insensitive T2 magnetization preparation sequence. *Magn Reson Med*, 2009. [4] Giri, S. et al., T2 quantification for improved detection of myocardial edema. *Journal of Cardiovascular Magnetic Resonance*, 2009.