Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Heart, Lung and Circulation (2022) **31**, e29–e30
1443-9506/21/$36.00
https://doi.org/10.1016/j.hlc.2021.08.010

LETTER TO THE EDITOR

Relationship of Myocardial Gadolinium Enhancement to Late Clinical Outcomes: Implications for the COVID-19 era

Keywords CMR • LGE • COVID-19

To the Editor,

In April 2021, coronavirus (COVID-19) surpassed 130 million cases and accounted for three million deaths, globally [1]. A recent study established one-third of individuals, 2 months post-recovery from COVID-19 with low normal left ventricular ejection fraction (LVEF), exhibited myocardial late gadolinium enhancement (LGE) on cardiac magnetic resonance (CMR) [2]. To advance understanding regarding implications for prognosis of such findings [2,3], we report late outcomes associated with LGE and preserved LVEF amongst an historical Australian cohort i.e., before the current COVID-19 era.

One-hundred-and-fifty-two (152) patients who undertook CMR between January 2008-December 2018 (1.5 Tesla [T]) were retrospectively assessed for attainment of major adverse cardiovascular events (MACE), comprising; cardiovascular (CV)-associated mortality, heart failure (HF) hospitalisation and/or cardiac arrhythmia (atrial fibrillation and/or ventricular fibrillation/tachycardia). LGE+ was defined by a hyper-enhanced myocardial signal, >2SD above normal myocardium. Exclusion criteria included obstructive coronary artery disease (CAD) (defined as >70% stenosis) or current/later developed definite cardiomyopathy phenotype including arrhythmogenic right ventricular cardiomyopathy (ARVC), hypertrophic cardiomyopathy (HCM), dilated cardiomyopathy (DCM) or cardiac sarcoidosis. An age/gender-matched control cohort (LGE-) was utilised for comparison. Institutional ethical approval was obtained.

Baseline mean study participant age was 51.9±15.3 years (69.7% male). LGE- (n=58) and LGE+ (n=94) groups were well-matched for age (p=0.10) and gender (p=0.35). LGE more frequently occurred with a mid-wall enhancement pattern (n=91) versus transmural (n=4), p<0.0001 (Figure 1A). Note, one patient had both mid-wall and transmural patterns of enhancement. Mean LVEF was lower in the LGE+ group however, remained within normal range (LGE+ vs LGE-; 55.5±14.1% vs 66.9±5.1%, p<0.0001).

The retrospective analysis occurred over an average of 5.0±2.1 years, during which 70 (46.1%) participants experienced MACE. Two (2) patients (1.3%) experienced CV-associated mortality, 59 (38.8%) HF-hospitalisation and 46 (30.3%) cardiac arrhythmia. LGE+ patients had over three-fold greater occurrence of MACE (LGE+ vs LGE-; 62.8% vs 19.0%; p<0.0001).

The LGE+ cohort was further sub-grouped by LVEF status; preserved (EF≥50%; n=66; 70.2%) or reduced (EF<50%, n=28, 29.8%). Upon comparison, no significant difference in MACE occurrence was noted (LGE+/LVEF≥50% [n=37] vs LGE+/LVEF<50% [n=22]; 56.1% vs 78.6%; p=0.06). The Kaplan-Meier analysis indicated progressive and significant attainment of MACE across all cohorts (p<0.0001; Figure 1B).

In conclusion, LGE on CMR is associated with long-term adverse clinical outcomes. These findings are significant as COVID-19-associated myocarditis incidence is likely to substantially increase, where patients will require careful follow-up. Uncertainty remains as to whether access to CMR in Australia can meet this clinical demand as there are currently no provisions made for this category of imaging on the Medicare Benefits Schedule.

Paraskevi Morris, PhD [d*]
Sean Lal, MD, PhD [a,d]
Shisan Bao, MD, PhD [d]
Mark Dennis, MD, PhD [a,d]
Imre Hunyor, MD, PhD [a,d]
John O'Sullivan, MD, PhD [a,d]
Stuart M. Grieve, MD, PhD [b,c,d]
Rajesh Puranik, MD, PhD [a,d]

[a]*Department of Cardiology, Royal Prince Alfred Hospital, Sydney, NSW, Australia*
[b]*Imaging and Phenotyping Laboratory, Charles Perkins Centre, Sydney, NSW, Australia*
[c]*Department of Radiology, Royal Prince Alfred Hospital, Sydney, NSW, Australia*

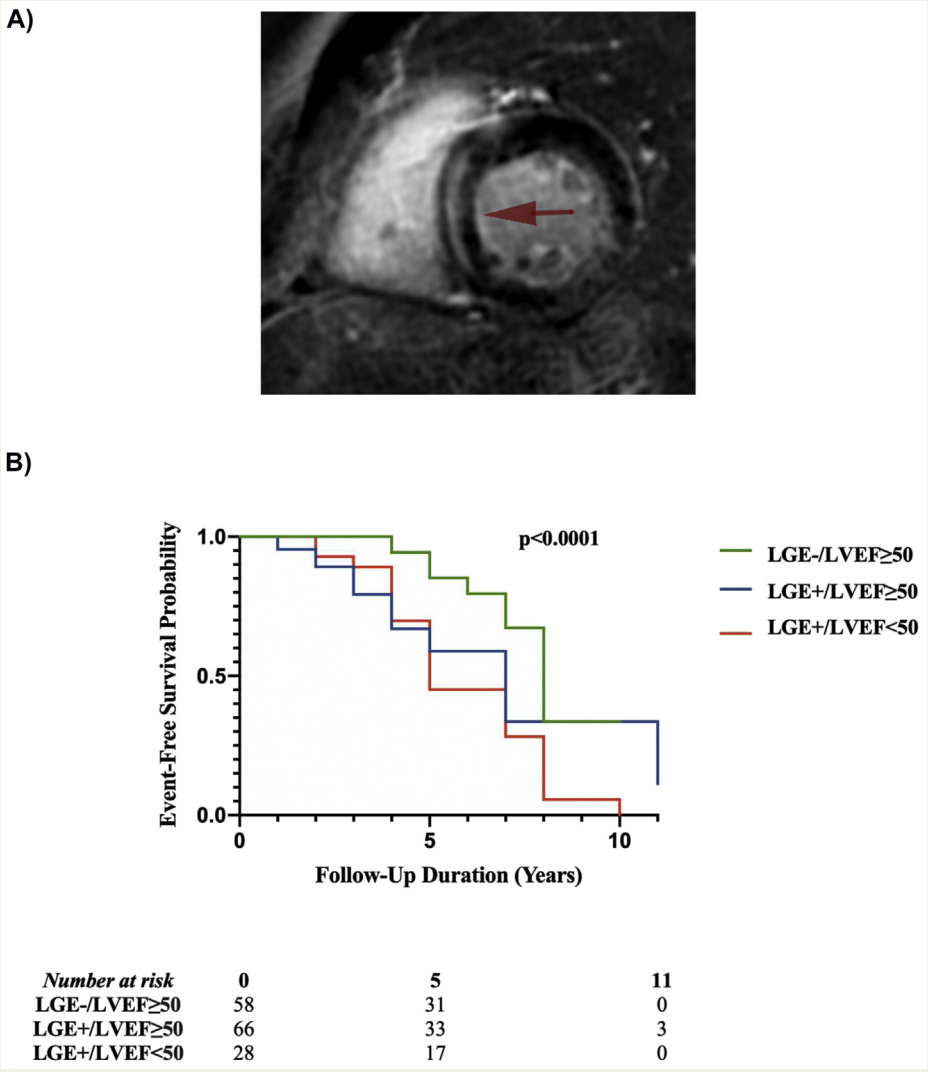

Figure 1 (A) LGE-CMR image demonstrating mid-wall septal enhancement (arrow). (B) Kaplan-Meier survival curve indicating the probability of MACE-free survival amongst patients who were: (i) LGE-/LVEF≥50%, (ii) LGE+/LVEF≥50% or (iii) LGE+/LVEF<50%. p<0.0001 for LGE-/LVEF≥50% vs LGE+/LVEF≥50% and LGE-/LVEF≥50% vs LGE+/LVEF<50%.
Abbreviations: MACE, major adverse cardiac event; LGE, late gadolinium enhancement; CMR, cardiac magnetic resonance; LVEF, left ventricular ejection fraction.

[d]*Sydney Medical School Faculty of Medicine and Health The University of Sydney, Sydney, NSW, Australia*
*Corresponding author at: Department of Cardiology, Royal Prince Alfred Hospital, Missenden Rd, Camperdown, NSW 2050, Australia
Email: raj.puranik@cmrs.org.au

Received 7 April 2021; received in revised form 28 July 2021; accepted 5 August 2021; online published-ahead-of-print 1 November 2021

References

[1] World Health Organization (WHO). WHO Coronavirus Disease (COVID-19) Dashboard. Geneva: WHO. Available from: https://covid19.who.int/. [accessed 28.3.21].
[2] Puntmann VO, Carerj ML, Wieters I, Fahim M, Arendt C, Hoffmann J, et al. Outcomes of cardiovascular magnetic resonance imaging in patients recently recovered from Coronavirus disease 2019 (COVID-19). JAMA Cardiology. 2020;5(11):1265–73.
[3] Greulich S, Seitz A, Müller KAL, Grün S, Ong P, Ebadi N, et al. Predictors of mortality in patients with biopsy-proven viral myocarditis: 10-year outcome data. J Am Heart Assoc. 2020;9(16):e015351.