

COVID-19 and myocardial injury

Bryce Alexander MD, Adrian Baranchuk MD

■ Cite as: *CMAJ* 2020 July 13;192:E812-3. doi: 10.1503/cmaj.201230; early-released June 25, 2020

See related article at www.cmaj.ca/lookup/doi/10.1503/cmaj.200879

Myocardial injury is common in patients admitted to hospital and has been estimated to occur in 8%–28% of patients admitted to hospital for coronavirus disease 2019 (COVID-19).¹ Myocardial injury, which is defined as an elevated troponin level greater than the 99th upper limit of normal (ULN) may be due to ischemic or non-ischemic myocardial processes in COVID-19.² Patients admitted to a critical care setting with COVID-19 have a higher rate of troponin elevation than those admitted to noncritical care settings, with observational studies reporting rates of troponin elevation of as much as 59% among patients who subsequently died.²

In related research, Si and colleagues³ report on the association between peak troponin levels and ventilatory support and mortality outcomes, and burden of arrhythmias in patients with COVID-19 in a population of patients admitted to hospital in Wuhan, China. An increased peak troponin level during admission was found to independently predict the need for invasive ventilatory support and all-cause mortality. Myocardial injury within 72 hours of admission to hospital was significantly associated with a 10-fold increase in mortality. In addition, unlike other coronaviruses affecting humans, COVID-19 was associated with a significant arrhythmia burden including fatal arrhythmias.

Although the finding of myocardial injury predicting poor outcomes in people with COVID-19 is a valuable contribution to the field, it may not be unique to this disease. The relation between elevated troponin level and increased mortality has been described previously in both intensive care unit (ICU) and non-ICU inpatient populations. In a 2015 study involving non-ICU inpatients who presented with elevated troponin levels without acute coronary syndrome suspected as the primary diagnosis, a higher troponin level was independently associated with 1-year all-cause mortality (odds ratio [OR] 3.37, 95% confidence interval [CI] 1.55–7.34).⁴

An elevated troponin level has also been shown to be predictive of mortality in critical care populations. Among other studies, a large retrospective cohort study involving a mixed ICU population of nearly 20 000 patients that used a previous acute coronary syndrome as an exclusion criterion showed that troponin elevation was an independent predictor of 30-day mortality when adjusted for illness severity (OR 1.82, 95% CI 1.62–2.04).⁵ In patients with sepsis, a large meta-analysis of 13 studies involving 1227 patients admitted to ICU identified elevated troponin levels during the first days of admission as an

KEY POINTS

- Myocardial injury is common in patients admitted to hospital who are being treated for coronavirus disease 2019 (COVID-19), and it was shown to be associated with adverse outcomes in a related study.
- Myocardial injury has been shown previously to predict adverse outcomes in other critical care populations and may not be a unique feature of COVID-19.
- The occurrence of arrhythmias appears to be higher in patients with COVID-19 than in people with other coronavirus infections; however, this may be because of the different assessment techniques employed in previous studies.
- Further research is needed to better define the relation between myocardial injury and adverse outcomes in patients with COVID-19.

independent risk factor for death.⁶ It is possible that an elevated troponin level serves as a marker of the severity of illness, which is not exclusive to COVID-19, and may be useful for risk stratification.

Elevated high-sensitivity cardiac troponin is a common laboratory finding in patients presenting to hospital. A 2019 prospective study found the prevalence of a troponin level above the ULN in a population presenting to the emergency department but not suspected to have acute coronary syndrome to be 12.4%.⁷ The frequency of elevation of troponin level among patients admitted to the ICU is even higher. A 2006 systematic review of 20 studies involving 3278 patients showed a prevalence of 43%.⁸ For patients admitted to a critical care setting with a diagnosis of sepsis or septic shock, the prevalence of troponin level elevation increased to 60%.⁸ The finding in the related research³ of an elevated troponin level in only 14.7% of patients may be merely reflective of less severe illness in the group of patients with no elevation of troponin level, which may, in part, explain the dramatic difference in mortality observed.

Si and colleagues noted a concerning high incidence of arrhythmias in their study, which they compared with a previous study of patients with severe acute respiratory syndrome in which no hemodynamically significant arrhythmias were observed.⁹ However, patients in the previous study were not monitored with continuous cardiac monitoring as the patients were in the related study. Instead, rhythm was assessed only through electrocardiography, which was

performed when clinically indicated (i.e., tachycardia, bradycardia, hypotension or other indication). It is plausible that the higher incidence of arrhythmias observed in the related research may result from increased identification through continuous usage of cardiac monitoring. It is concerning that 6 patients had lethal arrhythmias; however, the lack of a comparator population does not allow for attribution of the cause to COVID-19, and lethal arrhythmias may reflect the critically ill nature of the patients observed. Finally, the authors included data on QT prolongation secondary to known usage of QT-prolonging drugs. The formula used to calculate the corrected QT-interval was not described. If the formula used was Bazett (automatic), then at high heart rates (> 100 beats/min), QTc may be overestimated, and correction with other formulas (i.e., Fridericia) is advisable.

Despite the few limitations described above, the authors should be congratulated on identifying an area of interest for further investigation, which may prove clinically useful in the management of COVID-19. Further investigation should be undertaken to explore and refine the relation between myocardial injury and adverse outcomes in patients admitted to hospital with COVID-19.

References

1. Calvillo-Argüelles O, Ross HJ. Cardiac considerations in patients with COVID-19. *CMAJ* 2020;192:E630.
2. Driggin E, Madhavan MV, Bikdeli B, et al. Cardiovascular considerations for patients, health care workers, and health systems during the COVID-19 pandemic. *J Am Coll Cardiol* 2020;75:2352-71.
3. Si D, Du B, Ni L, et al. Death, discharge and arrhythmias among patients with COVID-19 and cardiac injury. *CMAJ* 2020 June 24 [Epub ahead of print]. doi: 10.1503/cmaj.200879.
4. Dhesi S, Shanks M, Tymchak WJ. Troponin rise in hospitalized patients with non-acute coronary syndrome: retrospective assessment of outcomes and predictors. *Can J Cardiol* 2015;31:296-301.
5. Poe S, Vandivier-Pletsch RH, Clay M, et al. Cardiac troponin measurement in the critically ill: potential for guiding clinical management. *J Investig Med* 2015; 63:905-15.
6. Bessière F, Khenifer S, Dubourg J, et al. Prognostic value of troponins in sepsis: a meta-analysis. *Intensive Care Med* 2013;39:1181-9.
7. Lee KK, Noaman A, Vaswani A, et al. Prevalence, determinants, and clinical associations of high-sensitivity cardiac troponin in patients attending emergency departments. *Am J Med* 2019;132:110.e8-21.
8. Lim W, Qushmaq I, Devereaux PJ, et al. Elevated cardiac troponin measurements in critically ill patients. *Arch Intern Med* 2006;166:2446-54.
9. Yu C-M, Wong RS-M, Wu EB, et al. Cardiovascular complications of severe acute respiratory syndrome. *Postgrad Med J* 2006;82:140-4.

Competing interests: None declared.

This article was solicited and has not been peer reviewed.

Affiliation: Division of Cardiology, Queen's University, Kingston, Ont.

Contributors: Both authors contributed to the conception and design of the work, drafted the manuscript, revised it critically for important intellectual content, gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

Correspondence to: Adrian Baranchuk, Adrian.Baranchuk@kingstonhsc.ca