

### Post-COVID-19 peri- and myocardial manifestations are less common in athletes than in healthy non-athletes: findings from a systematic review

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**Funding Acknowledgement:** Type of funding sources: Other. Main funding source(s): Dutch Olympic Committee\*Dutch Sports Federation (NOC\*NSF)Amsterdam Movement Sciences (AMS)

**Background/Introduction:** The prognosis of peri- and myocarditis can be negatively influenced by intensive exercise and sports. Therefore sustained cardiac involvement after recovery from COVID-19 in athletes is of particular relevance for the prevention of sudden cardiac arrest/sudden cardiac death (SCA/SCD). To date, only small sample-size studies are available, or studies predominantly focusing on hospitalized and severely ill patients. We aimed to address this knowledge gap in a comprehensive, systematic review of peri-/myocardial involvement after SARS-CoV-2 infection in athletes versus healthy non-athletes.

**Purpose:** Quantification of peri-/myocardial involvement and risks of SCA/SCD after SARS-CoV-2 infection in athletes as compared with healthy non-athletes.

**Methods:** We performed a systematic search with a combination of key terms in Medline (Ovid), Embase (Ovid) and Scopus (through March 8th 2021). To capture potential non-peer-reviewed COVID-19 SCA/SCD reports we performed monthly scoping internet searches. Inclusion criteria: athletes/non-athletes, with cardiovascular magnetic resonance (CMR) or echocardiography after recovery from SARS-CoV-2 infection, including arrhythmia outcomes. Exclusion criteria: study population  $\geq 1$  individual comorbidity and mean age  $<18/>64$  years.

**Results:** We included 16 manuscripts (933 papers reviewed) comprising 1129 athletes (284 college/student-, 807 professional- and 38 elite athletes) and 382 healthy non-athletes. Athletes vs non-athletes reported myocarditis on echocardiography and/or CMR in 0–15% vs 45–60%, LGE in 0–46% vs 0–74% (Figure 1), and pericardial effusion in 8–58% vs 0–47% (Figure 2). Weighted means of diagnosed myocarditis were 3% in athletes (3.5% college/student-, and 0% elite athletes) and 56.6% in non-athletes. No important arrhythmias were reported. Systematic internet query identified 2 collapsed post-COVID-19 athletes during exercise, 1 lethal. Ten studies (n=1301) reporting post-recovery troponin T/I found no clear relationship with cardiac abnormalities.

**Summary/Conclusions:** Rates of peri-/myocardial abnormalities in athletes/healthy non-athletes after SARS-CoV-2 infection are variable, ranging from 0–74%, and predominantly seen on CMR. Athletes have a lower risk of peri-/myocardial involvement, and myocarditis (0–3.5% vs 56.5%) than non-athletes after SARS-CoV-2 infection. Risks of SCA/SCD appear low, but data are lacking. Troponin screenings seems unreliable to identify athletes at risk for myocardial involvement. Prospective studies, with pre-COVID-19 imaging (CMR), in athletes, including follow-up and arrhythmia monitoring, are urgently needed.

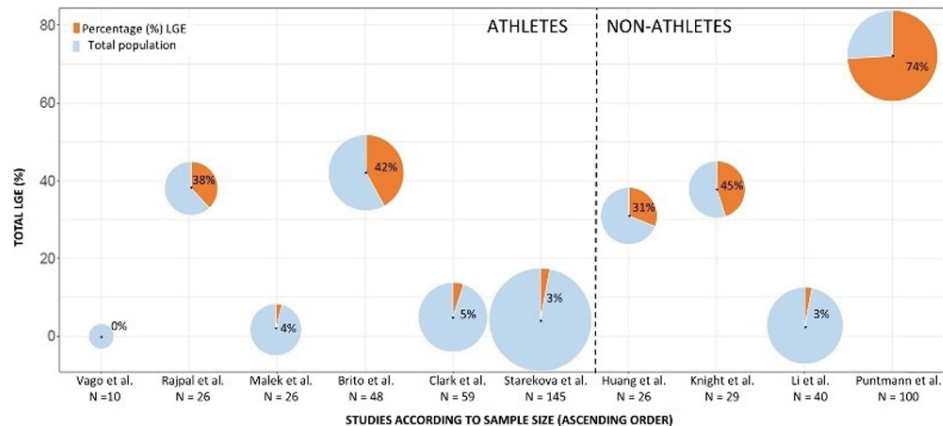


Figure 1. Total peri-/myocardial LGE (%)

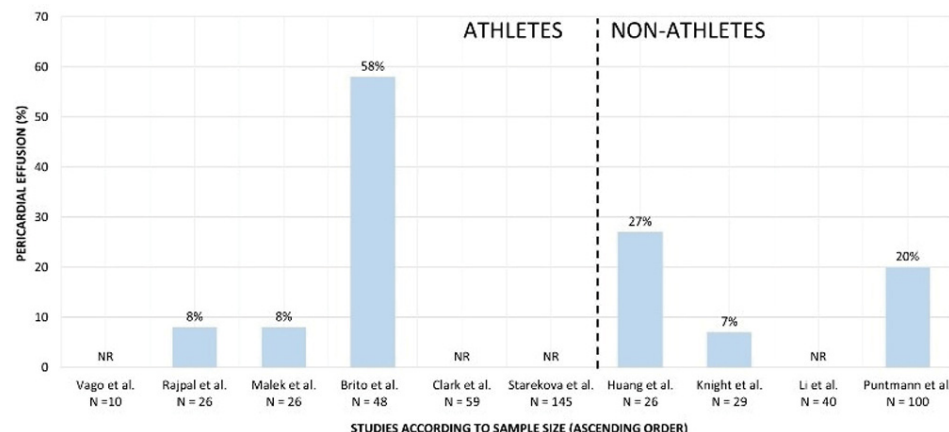


Figure 2. Total pericardial effusion (%)