

EDITORIAL

COVID-19, the heart and returning to physical exercise

During the COVID-19 pandemic, employers and occupational health (OH) practitioners have worked together to manage the risk of employees developing COVID-19 illness as part of return-to-work considerations [1,2]. The focus of activity for many OH practitioners has centred on the complex issue of assessing the risk of employees developing severe COVID-19 illness through judging their likely clinical vulnerability, aided by COVID-19 clinical risk assessment tools, such as that proposed by Coggon and co-workers [3]. Employers must consider other factors as part of the wider risk assessment for acquiring SARS-CoV-2 virus, such as workplace infection control policies, personal protective equipment and employees' travel arrangements to and from work. In addition to concerns over acquiring the virus, there is a continuing need for employers and OH practitioners to consider the specific requirements of the job as part of the overall OH risk assessment. A specific concern is the return-to-work assessment for employees who have had COVID-19 illness, particularly if symptoms prove recurring or persistent and if the duties of the job require strenuous physical tasks.

The SARS-CoV-2 coronavirus may cause asymptomatic or mild infection, with prompt recovery. In a proportion of cases acute and persistent complications occur. For survivors, recovery can be protracted, and some patients have a prolonged and debilitating illness [4]. The complication rate cannot readily be defined, given the lack of comparative research data and variable (community and hospital) populations for which data are available. What is clear is that severe COVID-19 is known to be a multisystem disorder, potentially giving rise to a wide range of clinical sequelae involving several body systems, including the heart and vascular system. An accurate diagnosis will require appropriate medical investigation. For example, a complaint of persisting shortness of breath may have a primary respiratory cause, such as pulmonary fibrosis or embolism, rather than a cardiac injury.

COVID-19 infection may be complicated by cardiac arrhythmias, myocarditis and other cardiovascular complications, with potentially fatal outcomes [5]. Early reports from China suggested that 12–30% of patients admitted to hospital with SARS-CoV-2 had a raised troponin above the 99th percentile. The pathophysiological mechanisms

of cardiac injury are not yet fully understood, but may include augmented metabolic demand, hypoxaemia, right ventricular pressure overload, T-cell- and cytokine-mediated hyperinflammatory reaction or direct myocardial cell infection [6]. Cardiac involvement is likely to be potentiated by a high level of expression of angiotensin-converting enzyme 2 (ACE2). Cardiac involvement should be considered in patients presenting with a history of new-onset chest pain/pressure, palpitations, breathlessness, or exercise-induced dizziness or syncope—even in the absence of fever and other respiratory symptoms. There is concern that even 'recovered' patients may be at risk of adverse cardiac events. Evidence is limited to date, but Pavon *et al.* reported a case of severe myocarditis in a 64-year-old man 6 weeks after an initial, almost asymptomatic, SARS-CoV-2 infection [7].

Fitness for work advice for the recovering patient will often be determined by residual symptoms and persisting effects such as fatigue, musculoskeletal discomfort, anxiety, etc. However, apparently fully recovered cases may have underlying, low-grade cardiac injury that could prove a health risk in the event of a premature return to vigorous physical exercise, whether through sport or work activity. The cardiac status of the recovering COVID-19 patient therefore merits specific consideration.

Current evidence is limited, but a precautionary approach would suggest the need to actively monitor recovery for at least the more severe COVID-19 cases. A group of international experts has published recommendations for exercise in athletes based on symptoms and recovery from COVID-19, which are endorsed by the section of Sports Cardiology and Exercise of the European Association of Preventive Cardiology (EAPC) [8]. Similar recommendations have been published by three German specialists on behalf of the European Society of Cardiology (ESC) [9] and by teams in the USA. The Defence Medical Rehabilitation Centre at Stanford Hall has issued a consensus statement for multidisciplinary, post-COVID rehabilitation, aimed at a target population of active individuals, including athletes and military personnel, including cardiac rehabilitation and return to exercise guidelines [10].

For athletes with a history of mild COVID-19 illness, the EAPC recommends refraining from exercise until symptom-free for 7 days and resuming training in a

graduated way. Cardiovascular investigation is recommended in an appropriate, COVID-secure environment for selected, at-risk cases. The criteria for further investigation are: if the person has been hospitalized during the COVID-19 illness; if symptoms of myocarditis occurred during the acute infection; if the illness was debilitating (confined to bed for several days) or prolonged (lasting >7 days), even if the person is apparently 'recovered'; and a complaint of persisting exercise intolerance. The EAPC recommends a 12-lead ECG and an echocardiogram for all such cases prior to consideration of exercise tolerance testing. Additionally, EAPC advises a full blood count, blood troponin and C-reactive protein (CRP) levels and cardiac MRI for individuals with abnormal preliminary investigations and those who are experiencing persisting symptoms suggestive of myocarditis. Minor elevations of blood markers may not be significant but marked elevations have prognostic significance. For those who have had myocarditis, a cardiology opinion is recommended in advance of a return to strenuous physical exercise, with an advised duration of restriction of 3–6 months [11].

Whilst concerns have been highlighted by authoritative groups in the context of athletes, the extent to which such recommendations should apply to working populations and at what level of physical demand are unclear. Most occupations do not involve the level of aerobic physical fitness of athletes, but some will involve unpredictable and strenuous physical demands to varying degrees, e.g. combat military and specialist police roles, firefighters and jobs requiring the manual handling of heavy loads. Working populations are more likely to have additional factors increasing cardiovascular risk—older age, obesity, smoking, etc. Employees with underlying medical conditions may have had less frequent clinical oversight during the lockdown, raising concern over the stability of their conditions and many will have become physically deconditioned.

The implications for OH services will vary considerably depending upon the employment sector, job risk assessment and arrangements for provision of OH services to customer organizations. For employees in strenuous physical jobs, liaison with general practitioners will be required, with reference to specialist cardiology expertise in some cases. Criteria for clinical investigation and rehabilitation of occupational groups may emerge from professional consensus and, in time, an evidence base. In the meantime, OH services should be vigilant to the risk of cardiovascular and other complications due to COVID-19 and ensure specific enquiry for symptoms of COVID-19 and myocarditis during return-to-work assessments of fitness.

Consideration should be given to the following actions for employees in strenuous physical jobs who have had COVID-19 illness: raising employer and employee awareness of the risk of cardiovascular and other

complications due to COVID-19; symptom enquiry for COVID-19 and myocarditis during return-to-work assessments of fitness; advising employees with a history of mild–moderate or short-lived COVID-19 symptoms to avoid strenuous physical exercise until they have been symptom-free for at least 7 days and to resume physical exercise in a graded way; risk assessment for mild–moderate cases of COVID-19 who have a pre-existing underlying heart condition; considering cardiac investigation for employees whose work involves strenuous physical exercise and whose COVID-19 illness involved hospitalization, myocarditis symptoms, debilitating illness or prolonged symptoms; referring to the EAPC and ESC guidance and Stanford Hall consensus statement for more detailed guidance on cardiac assessment of COVID-19 cases and guidance on rehabilitation protocols; considering what further work is needed to better understand the implications for specific occupational groups, in consultation with employers and professional OH organizations; and highlighting to employers the increased demands made on OH services from increasingly complex return-to-work assessments due to COVID-19, with the need to take account of rapidly changing medical evidence.

In conclusion, the possibility of persisting low-grade cardiac injury should be considered when assessing protracted COVID-19 illness and providing fitness for work advice, particularly in the context of jobs involving strenuous physical exercise. Inter-specialty collaboration involving OH practitioners, primary care practitioners, cardiologists and other specialists should help ensure the best possible management of cases.

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