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Recommendations for Return-to-Sport after COVID-19: Expert Consensus

Empfehlungen zum "Return-to-Sport" nach COVID-19: Expertenkonsensus

POSITION STAND

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Summary

- **Introduction:** An infection with SARS-CoV-2 is relevant especially in high-performance sport due to possible organ damage and reduced performance which occurs in individual cases. Various recommendations are found in the literature concerning when safe return to sports is possible and what examinations are suitable to support this decision. The dominance of other virus variants than those at the start of the pandemic makes revision of earlier recommendations necessary.
- **Methods and Analysis:** The recommended actions are based on the currently-available scientific knowledge of the pathogenicity of the virus and on clinical experiences in general and elite athletes. Twenty-one recommended actions were proposed by the Scientific Council of the DGSP, discussed and agreed on in consensus with experts from German-language sports-medical facilities and evaluated by an independent co-author. The resultant position paper was subsequently released by mutual agreement.
- **Results:** The recommendations are oriented to the severity of the course and the symptoms. The required medical diagnostic is deduced therefrom. During persistent symptoms, sports should be paused and training only begun again at low intensity after a three-day symptom-free period. If COVID-19-associated complaints recur, physical exertion should be stopped and a doctor consulted. After moderate and serious course, medical diagnostics are required prior to the start of training.
- **Summary:** To prevent a health risk due to sports and thereby resultant organ damage after a SARS-CoV-2 infection, a procedure adapted to the symptoms and course before return to training and finally to competitive sports is recommended.

KEY WORDS:
Return-to-Play, Inflammation, Myocarditis, Pandemic, Scoping Review

Zusammenfassung

- **Einleitung:** Eine Infektion mit SARS-CoV-2 ist wegen möglicher Organschäden und einer in Einzelfällen auftretenden Leistungsminderung gerade im Leistungssport von Relevanz. In der Literatur gibt es unterschiedliche Empfehlungen, wann ein sicherer Wiedereinstieg in den Sport möglich ist und welche Untersuchungen geeignet sind, bei dieser Entscheidung zu unterstützen. Die Dominanz anderer Virusvarianten als zu Beginn der Pandemie macht eine Überarbeitung früherer Empfehlungen erforderlich.
- **Methoden und Analyse:** Die Handlungsempfehlungen basieren auf den aktuell verfügbaren wissenschaftlichen Erkenntnissen zur Pathogenität des Virus und auf den klinischen Erfahrungen bei Breiten- und Spitzensportlern. Im Wissenschaftsrat der DGSP wurden 21 Handlungsempfehlungen bearbeitet, mit Experten aus deutschsprachigen sportmedizinischen Einrichtungen im Konsensus abgestimmt und von einer unabhängigen Co-Autorin ausgewertet. Abschließend erfolgte die gemeinsame Freigabe des daraus resultierenden Positionspapiers.
- **Ergebnisse:** Die Empfehlungen richten sich nach dem Schweregrad der Verlaufsform sowie der Symptomatik. Hieraus leitet sich die notwendige ärztliche Diagnostik ab. Während anhaltender Symptomatik sollte eine Sportkarenz eingehalten und erst nach dreitägiger Symptomfreiheit in niedriger Intensität wieder mit dem Training begonnen werden. Bei erneutem Auftreten von COVID-19-assoziierten Beschwerden sollte die körperliche Belastung pausiert und ein Arzt konsultiert werden. Nach moderatem und schwerem Verlauf sollte vor Trainingsbeginn eine ärztliche Diagnostik erfolgen.

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Rückkehr zum Spiel, Entzündung, Myokarditis, Pandemie, Scoping Review

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Introduction

COVID-19 brings great challenges for society and for sports, particularly high-performance sports (32). Even though infection with SARS-CoV-2 usually does not result in a serious illness in athletically-active and younger people and very rarely to the need for hospitalization or treatment in an intensive care unit, in individual cases it may lead to organ damage which limits performance capacity in the mid- to long-term (10, 25). Too short a rehabilitation period between infection and the first competition often results in discomfort that can lead to discontinuation of exercise (27). At the same time, controlled physical activity is considered an important component in rehabilitation measures after a SARS-CoV-2 infection (1, 10).

Typical general symptoms of the disease are fever, headache and limb pain, runny nose, sore throat, dry cough, impaired sense of smell ›

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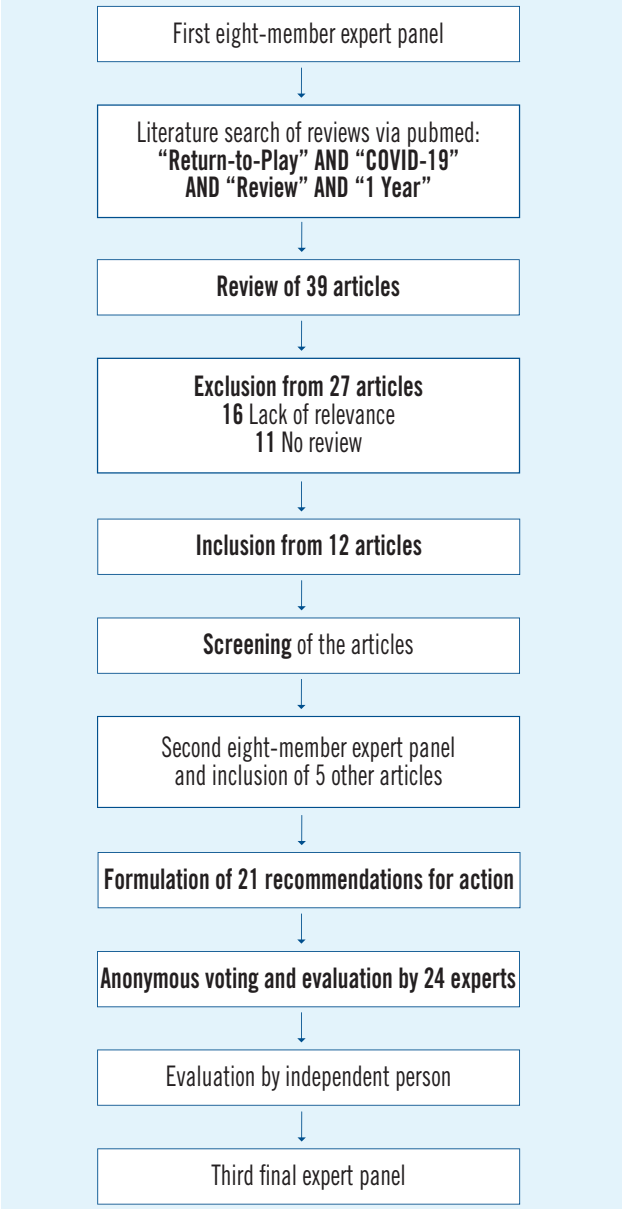

Figure 1

Flowchart for consensus building: scoping review and expert panel.

and taste, conjunctival inflammation, nausea, vomiting and diarrhea, fatigue, languor, as well as shortness of breath at rest or during exercise (6, 27, 30). When a SARS-CoV-2 infection is associated with the above typical symptoms, physical exertion is usually impossible in the acute stage and performance capacity may be clearly reduced (10). Comparable complaints have also been observed after a low-symptom course of the disease, usually about two to three weeks after the primary manifestation as a possibly immunologically-elicited post-COVID Syndrome (PCS), which has not yet been definitively investigated in athletic cohorts (20). Several of the authors are currently involved in a running study COVID-19 and Elite Sports (CoSmo-S), in which 769 athletes have so far been enrolled (28). The PCS may also affect younger persons independent of the severity of the acute course of the infection. Fatigue (prevalence 37.2%) and neurocognitive impairments (prevalence 31.3%) as symptom groups contribute more to a reduced recovery of health and reduced load tolerance (20, 29).

Organ complications, especially those of the heart, are particularly important. They may manifest in symptoms like chest pain, angina pectoris, dyspnea, palpitations, rapid heart rate or syncope. After a SARS-CoV-2 infection, laboratory and imaging evidence of damage to and involvement of the cardiac muscle has been observed in both symptomatic and asymptomatic persons (13). This finding occurs also in rare cases after administration of an mRNA vaccine (30, 33). While findings in the early phase of the pandemic gave rise to a fear of marked cardiac involvement, more recent results from larger cohorts indicate a risk which is comparable to that of other viral diseases with respect to incidence (15, 22, 31, 35). In the literature, various recommendations are made about when return to sports can be safely undertaken and what examinations are necessary to determine the timepoint (8, 9, 18, 27, 38).

These recommendations were necessary also because the pattern of disease changed with strict vaccination in most sports areas, and also with the occurrence of other variants of SARS-CoV-2. Complete vaccination protection remains important in sports. A complete vaccination status is helpful in prompt elimination of the virus, in reducing the rate of infection and also for quicker authorization for physical training (26). The recommendations are intended to help in estimating the severity of an infection with SARS-CoV-2, to provide a guideline for the exercise pause and return to sports as well as the required sports-medical examinations. This should keep the acute health risk in sports and the resultant organ damage after a SARS-CoV-2 infection and illness as low as possible or even prevent it.

Methods and Analysis

The recommendation for action published in this article are based on (1) the currently-available scientific knowledge of the pathogenicity of the virus, and (2) on the clinical experiences of the authors in working with general and elite athletes (4, 10, 19, 27).

The recommendations were worked out by the Scientific Council of the Deutsche Gesellschaft für Sportmedizin und Prävention (DGSP; https://www.dgsp.de) then submitted to an Expert Panel consisting of other managing physicians at larger sports-medical facilities in Germany, Austria and Switzerland, as well as the Medical Commission of the German Olympic League. After initial collecting of problems and formulation of the hypothesis, an initial literature search was performed as a scoping review via Pubmed using the keywords "Return-to-Play-"AND "COVID-19" AND "review" AND "1 Year" (Figure 1). Thirty-nine articles were reviewed, of which 27 were rejected due to lack of relevance and non-fulfillment of the criteria of a review. 12 articles could be included which were presented after screening to another expert panel. Then the experts included another 5 articles as relevant (Table 1).

After 21 action recommendations were drafted, consensus was worked out first in the Scientific Council of the DGSP, and then submitted to another 16 experts for evaluation. This was done without knowledge of previous consensus results. The answers were then assessed by an independent co-author. Two statements were again revised and agreed on in a further meeting. The authors rated the degree of consensus with a value between 0 (none) and 9 (complete agreement): the median, mean and confidence interval (Mdn, M und CI) of the assessment are given here.

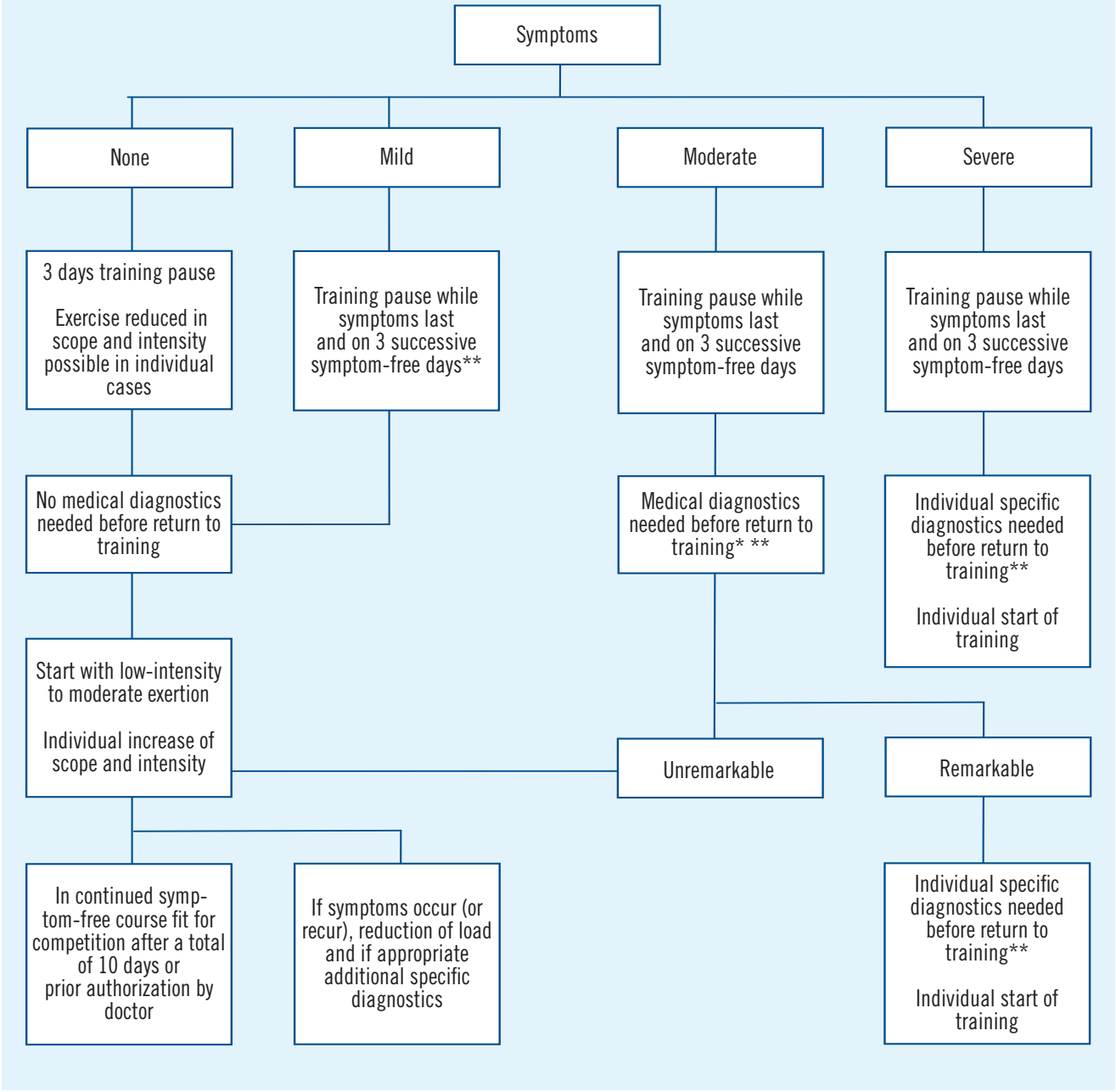

Figure 2

Algorithm Return-to-play after infection of SARS-CoV-2. *=After moderate course or to shorten exercise pause in asymtomatic or mild courses: Anamnesis, physical examination, resting ECG, laboratory (differential blood count, C-reactive protein, transaminase, CK, creatinine, possibly supplemental troponin). **=In cardiac symptoms like palpitations, extra-systoles or rapid HR, an echocardiography and determination of NT-Pro-BNP and troponin is recommended in addition to resting and exercise ECG. Depending on current findings, possibly further diagnostics with cardiac MRT. In pulmonary symptoms (exercise dyspnea) a lung function test and ergometry, if possible spiroergometry with BGA should be performed before and after exercise.

Results

In order to make recommendations, the COVID-19 symptoms must be categorized, which is clinically often not easy. The recommedation is to classify courses according to the WHO suggestion as asymptomatic, mild, moderate or severe. The symptom mild runny nose lasting up to three days is rated by most of the experts as equivalent to "asymptomatic" as long as no other symptoms are present. As an explanation, (mild) runny nose may be vasomotoric or indicate an allergic rhinitis. Even if such a finding prima vista cannot be differentiated from a chance finding with SARS-CoV-2 or other nasopharyngeal viruses, determination can be made retrospectively. The 3-day limit appeared practicable to most of the experts, and likewise a known, typical hay fever should not be rated as a symptom of a SARS-CoV-2 infection. Other experts consider runny nose as a sign of involvement of the upper respiratory tract, similarly dry cough and sore throat, and thus a mild symptom. Two experts include impaired sense of smell and taste among the mild symptoms.

Characterization of Symptoms

1. To plan return to training and competition the course should be rated according to WHO guidelines as asymptomatic, ›

mild, moderate and severe courses of the SARS-CoV-2 infection. (Degree of consensus: M=8.21; z=9.0; [95% CI: 7.58; 8.84]) (36)

2. Symptoms of a mild course are subfebrile temperature (<38.5°C), mild cough, sore throat, slight feeling of illness and malaise, lack of dyspnea and subjective cardiac complaints like palpitations, rapid pulse or thoracic complaints. Mild runny nose ≤3 days is to be rated as symptom-free; if it lasts longer, it is considered a mild symptom. (Degree of consensus: M=7.13; z=8.0; [95% CI: 4.01; 10.25]) (4)
3. Symptoms of a moderate course are marked feeling of illness (fatigue symptoms), dyspnea at rest, higher fever (fever >38.5°C) as well as headache, muscle, joint, and limb pain, nausea or diarrhea. Persistent cough ≥ 3 days is also considered a moderate symptom. (Degree of consensus: M=7.33; z=8.0; [95% CI: 6.95; 8.31]) (4)
4. A severe course of the SARS-CoV-2 infection is characterized by the necessity of hospitalization due to COVID-19 up to and including intensive medical treatment. (Degree of consensus: M=8.54; z=9.0; [95% CI: 8.11; 8.97]) (4)

In order to evaluate the timepoint for returning to training and later determination of fitness for competition, it is agreed that the specific current symptoms and the course are taken together as a criterium (19). The expert panel cited the following parameters, which can be addressed on a regular basis: subjective load capacity, quality of sleep, fatigue symptoms and feeling of illness. These can be determined, for example, as a numerical value or on a visual analogue scale (scale 0-10). To depict the possibly complex symptoms, the majority of the experts agreed that the questionnaires tested for ME/CFS (Myalgic Encephalitis/Chronic Fatigue Syndrome) can be used in the diagnostics (3).

5. For return to training and competition, the actual, current symptoms and course are relevant (Degree of consensus: M=8.54; z=9.0; [95% CI: 8.11; 8.97])
6. Grading: To better quantify and assess the fitness for training and competition, it may be helpful if the athlete rates his feelings in subjective load tolerance (Scale 0-10, not at all to full), quality of sleep (Scale 0-10, not at all to very good), fatigue symptoms (Scale 0-10, not at all to always) and his feeling of illness (Scale 0-10, not at all to very strong). The doctor can inquire about the symptoms using a checklist, such as the questionnaire by Carruthers et al. (Table 2; see supplemental material online). (Degree of consensus: M=7.75; z=8.0; [95% CI: 7.17; 8.33]) (3)

Consensus was achieved with respect to the training pause after SARS-CoV-2 infection in asymptomatic, mild, moderate and severe courses. Even in symptom-free courses, an unimpaired load tolerance cannot be automatically assumed, so a reduction of training scope and intensity, isolation as infection prophylaxis and especially thorough monitoring in the return to training appears sensible (9, 27, 37). For this reason, there was broad consensus for the suggestion to bind the sport pause and return to sports with freedom from symptoms. In the case of a completely asymptomatic and mild course, times have been defined after which a return to sporting activities is possible if the patient is free of symptoms, and after which load increases for competition are possible. Due to the possibility of cardiac damage, one expert argued for completely refraining from sports during the entire period in which the infection can be proven (positive PCR or positive antigen quick test) and another expert would recommend medical consultation prior to return to sports even after a mild course (11). Two experts recommend a period shorter than 10 days to authorization of return to competitive sports with an eye to possibly upcoming changes in quarantine regulations. While it is true that quarantine regulations provide a legal framework, it was agreed that the duration of the pause in training and competition must be assessed only on the complaint pattern and course of symptoms to protect the athlete.

Training Pause and Start of Training

7. In asymptomatic course of the SARS-CoV-2 infection, a three-day exercise pause after the time of diagnosis is recommended. Exercise reduced in scope and intensity is possible in individual cases. (Degree of consensus: M=7.74; z=9.0; [95% CI: 6.63; 8.85]) (9, 37)
8. In a mild course an exercise pause during persistent symptoms and on three successive symptom-free days is recommended. (Degree of consensus: M=8.21; z=9.0; [95% CI:7.75; 8.67])
9. Exercise in freedom from symptoms after a mild course: after 3 successive days without specific symptoms, exercise reduced in scope and intensity can be resumed without medical diagnostics. Further increases in exercise are made individually, taking possible symptoms and the individual load reaction into account. (Degree of consensus: M=7.88; z=8.0; [95% CI: 7.26; 8.5]) (25)
10. Should complaints occur on resuming training in exercise or even at rest, exercise should be discontinued, a doctor consulted and if appropriate, specific diagnostics performed. (Degree of consensus: M=8.75; z=9.0; [95% CI: 8.38; 9.12])
11. Competitions (in a mild course): competitions appear possible after a total of 10 successive symptom-free days, unremarkable load increases and subjective good complaint-free load tolerance. An earlier return to competitive activities appears only possible after thorough medical examination. (Degree of consensus: M=8.0; z=8.0; [95% CI:7.48; 8.52]) (14)

With respect to medical diagnostics after SARS-CoV-2 infection with moderate and severe course of the disease and a shortened training pause in asymptomatic and mild course, the opinion pattern is homogeneous among the experts. Differentiated monitoring after the start of training is strongly recommended (see also Statement 6), but the contents differ among those questioned. Some experts do not consider either quality of sleep or continuous determination of body weight necessary, others refer to the loss of muscle mass after long training pauses. It was also argued that monitoring should be extended after serious courses.

It was unanimously agreed that the medical examination should include anamnesis, physical examination, laboratory tests and a resting ECG (10, 27). In this, the expert panel differs from the recommendations of the American College of Cardiology, which requires a resting ECG only in the case of cardiac symptoms (2).

Medical Diagnostics

12. Monitoring after exercise start: After the return to sports, differentiated monitoring is recommended (exercise and resting heart rate, quality of sleep, pulmonary or cardiac complaints, fatigue, body weight). (Degree of consensus: M=7.75; z=8.5; [95% CI: 6.91; 8.59])

Table 1

Articles included from the Scoping Review and the Expert Group.

AUTHOR	TITLE	JOURNAL	YEAR
DiFiori et al.	Return to sport for North American professional sport leagues in the context of COVID-19.	Br J Sports Med.	2021
Fabre et al.	Managing the combined consequences of COVID-19 infection and lock-down policies on athletes: narrative review and guidelines proposal for a safe return to sport.	BMJ Open Sport Exerc Med.	2020
Gentil et al.	Resistance Training Safety during and after the SARS-Cov-2 Outbreak: Practical Recommendations.	Biomed Res Int.	2020
Gluckman et al.	ACC Expert Consensus Decision Pathway on Cardiovascular Sequelae of COVID-19 in Adults	JACC	2022
Halle et al.	Exercise and sports after COVID-19-Guidance from a clinical perspective.	Transl Sports Med.	2021
Hughes et al.	The Australian Institute of Sport framework for rebooting sport in a COVID-19 environment.	J Sci Med Sport	2020
Kim et al.	Coronavirus Disease 2019 and the Athletic Heart: Emerging Perspectives on Pathology, Risks, and Return to Play.	JAMA Cardiol.	2021
Lodi et al.	Return to sport after the COVID-19 pandemic. How to behave?	G Ital Cardiol (Rome)	2020
Löllgen et al.	Recommendations for return to sport during the SARS-CoV-2 pandemic.	BMJ Open Sport Exerc Med.	2020
Martinez et al.	Prevalence of Inflammatory Heart Disease Among Professional Athletes With Prior COVID-19 Infection Who Received Systematic Return-to-Play Cardiac Screening	JAMA Cardiol.	2021
Moulson et al.	Outcomes Registry for Cardiac Conditions in Athletes Investigators. SARS-CoV-2 Cardiac Involvement in Young Competitive Athletes.	Circulation.	2021
Mulcahey et al.	Sports Medicine Considerations During the COVID-19 Pandemic.	Am J Sports Med.	2021
Niess et al.	Position stand: return to sport in the current Coronavirus pandemic (SARSCoV-2 / COVID-19)	Dtsch Z Sportmed	2020
Phelan et al.	Screening of Potential Cardiac Involvement in Competitive Athletes Recovering From COVID-19: An Expert Consensus Statement.	JACC Cardiovasc Imaging	2020
Steinacker et al.	Fact Sheet: Health Situation for Athletes in the Current Coronavirus Pandemic (SARS-CoV-2 / COVID-19)	Dtsch Z Sportmed.	2020
Wilson et al.	Cardiorespiratory considerations for return-to-play in elite athletes after COVID-19 infection: a practical guide for sport and exercise medicine physicians.	Br J Sports Med.	2020
Yao et al.	Viral Diseases and Youth Sports: How to Handle Common Infections that Sideline Athletes.	Pediatr Ann.	2021

13. In moderate or serious course of disease: After symptoms have abated, medical diagnostics and doctor's decision are recommended before returning to training and especially prior to resuming competitive activities. (Degree of consensus: M=8.54; z=9.0; [95% CI: 8.04; 9.04]) (25, 37)
14. Medical diagnostics after a moderate course or to shorten the exercise pause after asymptomatic or mild courses comprise a specific anamnesis, physical examination, laboratory tests and a resting ECG. Individual specific diagnostics are necessary after serious courses. (Degree of consensus: M=8.42; z=9.0; [95% CI: 8.06; 8.78]) (10)

The laboratory tests of the basic examination should address inflammation states, muscle damage and/or involvement of kidneys or the liver (6). The differential blood count can reveal leukocytosis/leukopenia as evidence of an infection. CRP can reveal possible inflammatory activity. Cardiac and peripheral muscle damage is determined from creatine kinase (CK). Creatinine as a renal retention parameter and transaminase as a parameter for liver damage correspond to basic laboratory practice. There is no evidence for routine determination of cardiac markers, especially troponin, which should only be determined symptom-oriented and in cardiac complaint symptoms (37). Some of the experts would additionally include ferritin as an acute-phase protein (21). In mild or serious courses, the laboratory tests must be appropriately supplemented, whereby thus far primarily data for the prospective role of laboratory values of hospitalized patients but as yet insufficient data for the outpatient situation are available (39).

15. The most important laboratory analyses in the basic examination are: Differential blood count, C-reactive protein, transaminase, CK, creatinine. Routine determination of troponin does not appear primarily necessary, but must be individually added in conspicuous laboratory values and depending on the complaint symptoms (see also 16). (Degree of consensus: M=8.7; z=9.0; [95% CI: 8.45; 8.95]) (6)

Those questioned all agreed on the necessity of additional organ-specific diagnostics prior to authorizing a return to sports if specific complaints in the form of cardiac or pulmonary symptoms are present. Basic cardiac examinations are resting and exercise ECG, Holter ECG on palpitations or arrhythmias in the exercise ECG and an echocardiography to rule out myocarditis or pericarditis (pericardial effusion, left-ventricular regional impaired wall mobility) as well as determination of the left and right-ventricular global function (ejection fraction according to Simpson, if possible global longitudinal strain (GLS)) as a sensitive early parameter for limited systolic function and a tricuspid annular plane systolic excursion (TAPSE) as evidence of limited right-ventricular function) (33). A cardio-MRT should be performed if there is founded suspicion of myocarditis (10). Using T2-weighted sequences and T1-mapping enables success- ›

ful visualization of an existing myocardial edema and not only the fibrosis but also the myocardial inflammation of myocarditis can be classically depicted via proof of a late gadolinium enhancement (LGE) (37). In large series, only about 0.5-3.0% of the athletes have remarkable findings in the cardio-MRT after the infection, so the pretest probability is not very high and the indication for cardio-MRT should be supported by other findings (9, 14, 23, 24).

16. In cardiac symptoms like palpitations, extra-systoles or rapid heart rate, an exercise-ECG, an echocardiography, a Holter ECG and determination of the NT-Pro-BNP and troponin are recommended in addition to the resting ECG. (Degree of consensus: M=8.33; z=9.0; [95% CI: 7.48; 9.18]) (10, 37).
17. A cardio-MRT is not necessary on a regular basis, but should be performed after corresponding pathological findings and if appropriate supplemented with further cardiological diagnostics. (Degree of consensus: M=8.54; z=9.0; [95% CI: 7.91; 9.17]) (37)

Symptoms of bronchoconstriction may be shortness of breath at rest and in exercise up to a pronounced pattern with thoracic retractions, chest tightness and auscultatory end-expiratory ronchi. In such cases, extensive lung function examination with body-plethysmography and possibly additional determination of the diffusion capacity as well as performance of a blood-gas analysis may be necessary. In asymptomatic athletes, examination of lung function offers little diagnostic information (10). Loss of performance is a frequent problem after COVID-19 and the degree of limitation and the function of the cardiopulmonary system can best be determined by spiroergometry (10, 37). Ergometry supplemented with measurement of O2-saturation or blood gases before and after exercise can reveal impaired diffusion. In addition, spiroergometry enables a differentiated consideration of the cardiovascular, pulmonary and peripheral muscle system at rest and in physical exercise (7, 28). However it must be viewed as a supplementary examination.

18. A lung function test (body-plethysmography) should only be performed in specific clinical findings like symptoms of bronchoconstriction or dyspnea at rest and in exercise. (Degree of consensus: M=7.92; z=8.5; [95% CI: 7.33; 8.51]) (16, 37)
19. In case of exercise dyspnea an ergometry, if possible spiroergometry with BGA, should be performed before and after exercise. (Degree of consensus: M=7.79; z=9.0; [95% CI: 6.93; 8.65]) (10)

All authors emphasize the importance of an examination by and consultation with a doctor if complaints persist and in case of conspicuous findings.

Final Assessment

20. In persistent complaints, among them persistent fatigue and load intolerance, a more extensive medical clarification prior to authorization to return to sports is recommended. (Degree of consensus: M=8.96; z=9.0; [95% CI: 8.87; 9.05]) (37)
21. Authorization with medical findings requires assessment and evaluation by a doctor to prevent overload and damage as far as possible (Figure 2). (Degree of consensus: M=8.87; z=9.0; [95% CI: 8.72; 9.02]) (10, 25).

Conclusion

Infection with SARS-CoV-2 rarely leads to serious illness in athletically-active and younger people, but organ damage may result in individual cases which limits performance capacity in mid- and long-term and endangers health. Various recommendations are made in the literature concerning when a return to sports can be safely made. In the Scientific Council of the DGSP, 21 action recommendations in the sense of an Expert Consensus were formulated and agreed on for the current situation with the Omikron variant and SARS-CoV-2 vaccination and are intended to help in controlling training pauses and return to physical exertion and, if needed, in initiating medical diagnostics. The duration of the break from training and competition is dependent on the symptoms present and the course of the SARS-CoV-2 infection: it serves primarily to protect those active in sports. The risk to health in physical exertion and the resultant organ damage after a SARS-CoV-2 infection should be prevented. For this reason, a procedure adapted to the symptoms and the course is recommended from the return to training up to competition. Particularly cardiac symptoms and their complications should be detected promptly and the appropriate examinations initiated.

Conflict of Interest

The authors have no conflict of interest.

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