

## COVID-19 Guidance for Referees

This guidance uses the very limited evidence currently available to minimise risk while avoiding restrictions and medical investigations that would deter divers from declaring issues that require assessment.

A score card has been devised and approved by the UK Diving Medical Committee for divers to assess their own risk and the need for appropriate follow-up. It is endorsed by the British Diving Safety Group. All divers other than those with very low risk are prompted to have a conversation / consultation with a Medical Referee.

### Summary

Likely risk	Score	Recommendation
Very Low	Less than 0	No requirement for review, note unknown risks
Low	0	Advise of unknown risks of asymptomatic COVID-19 lung damage
Moderate	1-7	Delay assessment for 3 months from illness or exposure to infection Complete resolution of COVID-19-related symptoms Assessment as below
High	8-47	Delay assessment for 3 months from illness Complete resolution of COVID-19-related symptoms Assessment as below
Very High	>=48	Delay assessment for one year Diver likely to have had Respiratory Medicine follow-up Obtain medical records and undertake a full risk assessment

### Guidance notes

1. Divers who have no known exposure to SARS-CoV2 and had no symptoms of COVID-19 (score zero on the score card) may still have suffered asymptomatic disease which can be associated with damage to the lungs<sup>1</sup>, heart and other organs which could lead to injury or death whilst diving. This risk however is deemed to be low.<sup>2</sup> Undertaking medicals and / or invasive testing on all divers would be impractical. These low risk individuals can return to diving as they would have done previously, providing they accept this potential risk.

2. Divers may seek reassurance by having an antibody test at their own expense. The test must be CE marked, comply with the MHRA's Target Product Profile for antibody tests<sup>3</sup> and be used in the way that it has been validated and for which the CE mark has been awarded.<sup>4</sup> If a low risk diver phones for advice or requests a medical the potential risks of asymptomatic disease should be explained to them so they can make their own informed decision (based on the best available evidence at the time) as to whether they return to diving. It is worth asking a diver who has not had the case identification symptoms (new

persistent cough, fever, anosmia) about any other illnesses since 1 January 2020 to rule out an atypical presentation.<sup>5</sup>

3. Those with a known contact with SARS-CoV2 but who remained asymptomatic score 1. They should discuss this with a referee. They can choose to have a validated antibody test which would adjust the score to -1 if negative but they must be made aware that a positive result would move them to a higher level of risk with a score of 6.

4. Those with a positive test who have been asymptomatic score 5, so will need more detailed assessment due to the higher risk of lung changes.<sup>6</sup>

5. Those with mild to moderate symptoms but not requiring admission to hospital (scoring between 10 and 47 on the score card) will include some 'false positives' who had one or more of the case identification symptoms without being infected. There is not yet, however, a highly reliable method to rule out past infection – one series (admittedly from a pre-print paper) estimates that up to 8.5% of patients do not have detectable IgG antibodies up to 60 days post infection, and that the rate of seroconversion is lower in those who have had milder symptoms, are younger, have no co-morbidities and lower BMI.<sup>7</sup> As a result, for the time being, it is safest to assume that they had COVID-19 and their risk of lung changes exceeds the 54% found in asymptomatic patients with proven infection. These divers are advised to wait three months from when they have recovered. This is more conservative than some organisations, but has been selected because the time course for resolution of lung changes is not yet known with any accuracy and case series have shown abnormalities persisting for at least 14 days after onset of symptoms in patients who did not have severe respiratory distress or require oxygen at any time.<sup>8</sup> The diver can then be assessed provided they are back to their previous level of aerobic fitness.

6. For the time being, those with severe COVID-19 will not, in general, be assessed for one year. It is likely, however, that these patients will undergo a structured programme of follow up<sup>9</sup> and, if there is objective evidence that lung lesions have resolved, then an earlier return to diving can be considered on a case-by-case basis. Further guidance on decision-making for these individuals will be issued as relevant evidence becomes available.

### **Referee Consultation Guidance**

Assessment of divers scoring 1-47 (Moderate and High Risk): A careful history should be taken. Where the history is highly suggestive of ongoing respiratory symptoms or unresolved issues, the diver is unfit to dive. If the diver has returned to their previous level of fitness, a medical examination should be carried out per existing guidelines with the following additional tests recommended:

- a) Pulse assessment for 15 to 60 seconds<sup>10</sup> and at least long enough to determine if there are frequent ectopic beats. If frequent ectopic beats are detected or if the history indicates concerns such as palpitations, an ECG should be performed. If the ECG shows frequent ventricular ectopic beats or evidence of repolarisation changes (ST segment or T wave changes) or LBBB, the diver should be referred to a cardiologist for further investigation which should include an echocardiogram.

- b) An exercise test (such as the Chester step test) with oxygen saturation monitoring. Do not proceed if the resting saturation is lower than 96%.<sup>11</sup> Comparison with previous exercise test results is useful (if available). A drop in O<sub>2</sub> saturation of more than 3% on exercise or an unexpected deterioration in exercise capacity (estimated VO<sub>2</sub> max) compared to previous values would preclude certification of fitness to dive. The test should be conducted and terminated as normal, but the result can only be accepted if the diver reaches and can maintain at least 7 METS (VO<sub>2</sub> 24.5 ml/kg/min) for 2 minutes before reaching any criteria for termination. Using the Chester Step Test this would require completion of Stage V with a 15 cm step or Stage III with a 30 cm step.<sup>12</sup>

Very high risk: Those who required admission to hospital with COVID-19 (scoring more than 48 on the score card) are at very high risk of lung changes and, in general, should wait 12 months from recovery before seeking assessment for fitness to dive. The diver will need to have returned to their previous level of fitness. There is, of course, no information specific to long-term pulmonary outcome in COVID-19 but, if the lesions behave similarly to those seen in SARS and MERS, of those patients who had abnormal chest x-rays at discharge some 35% will still have abnormalities 12 weeks later and 30% at 6 months<sup>13</sup> with some changes persisting for at least 230 days.<sup>14</sup> In addition to the testing mentioned above, they will require more comprehensive chest imaging and possibly laboratory-based lung function testing, including assessment of residual volume. This is expensive and currently not available due to capacity issues within the NHS. It is however possible that these patients will have such tests undertaken as part of their post COVID-19 follow up from their hospital team.

### **Referee Notes**

It is anticipated that a Referee's clinical judgement and shared decision making with the diver will form a large part of the fitness to dive assessment, especially with regard to the known and unknown potential risks of diving post COVID-19. The rate and persistence of lung changes in both symptomatic and asymptomatic individuals is not yet well understood. The relationship of such lung changes to pulmonary barotrauma and consequent decompression illness is not known. The role and interpretation of extended investigations in assessing fitness to dive is currently uncertain.

Where a diver has been found unfit to dive, it is expected that appropriate explanation is given and follow up advised through the diver's primary or secondary care teams as appropriate. It is unlikely that a Referee would be best placed to arrange further investigations themselves as interpretation and follow up of results along with the current logistical issues of arranging such tests is complex.

Divers in both very low to high risk groups may seek additional reassurance of dive fitness through chest imaging or pulmonary function testing. It is important to note that while this may be feasible and a normal result reassuring, there are likely to be a proportion where abnormalities are found. Translating such abnormalities into barotrauma risk or knowing if further investigation is then appropriate (especially if large radiation doses or significant

cost is involved) is very complex and this should be discussed with the diver in advance. The sensitivity and specificity of identifying those at risk of pulmonary barotrauma or other complications such as immersion pulmonary oedema using investigations such as desktop spirometry, peak flow measurements, chest plain films or CT imaging is currently unknown but these tests may be considered based on clinical judgement.

The Association for Respiratory Technology and Physiology (ARTP) anticipates that spirometry will be useful for routine clinical follow up.<sup>15</sup> Simple desktop spirometry will, however, be difficult to interpret in the absence of results prior to exposure to, or infection with, SARS-CoV2. In one series FVC, FEV1, FEV1/FVC and mid-expiratory flows were in the expected range in the large majority of 110 patients at discharge. The only spirometry measurement that reached statistical significance in this series was FEF<sub>75%</sub> in the 19 patients who had severe pneumonia, of whom 5 had values lower than 65% of predicted.<sup>16</sup> Spirometry is, however, simple, widely available and non-invasive so, although the information above suggests that an abnormal result is unlikely to be due to COVID-19, it would be a prompt for further assessment in any diver regardless of the underlying abnormality. It might also be useful as a baseline for follow-up of a candidate who has not yet fully recovered since objective evidence of further deterioration, instead of an improvement, would be a valuable prompt for the diver to seek advice from their general practitioner. When considering spirometry, ARTP guidance or other appropriate procedures for infection control should be taken into account.

According to the British Thoracic Society Guidance, follow-up chest x-rays are likely to be offered routinely to all patients who had abnormalities on imaging whether they were admitted to hospital or were assessed in hospital but then cared for in the community. Some of these patients will be discharged with a normal chest x-ray and others will proceed to more detailed investigation which will be useful when eventually reviewing fitness to dive. There will be some divers who lack objective evidence of resolution, such as those who are discharged from secondary care with “minor insignificant changes”, others who had symptoms but no imaging and asymptomatic divers with evidence of past infection. Although the radiation risk associated with a chest x-ray is low, there is currently no evidence regarding the significance of some of the lung abnormalities seen in COVID-19 on which to base clear advice for or against further imaging and its optimal timing, especially if abnormalities persist and repeat imaging needs to be considered. It is also worth bearing in mind that a chest x-ray might miss lesions related to COVID-19 that would have been identified by a CT scan.<sup>17</sup> Where guidance already exists for an abnormality, such as pneumothorax, this should be followed. In other circumstances, the medical referee will either need to seek specialist advice or to make a decision on the requirement for further imaging based on an overall assessment of risk, taking into account factors such as the likelihood of infection with SARS-CoV2, the nature and severity of symptoms and the type, distribution and number of lesions last shown on imaging.

## **Review of Guidelines**

This guidance is based on current understanding at the time of writing, but all Medical Referees should continue to remain up to date with latest data on COVID-19.

The attached references have been used in the development of these guidelines and may form a useful adjunct for clinical decision making and discussions with divers.

The committee will review this document at least every 3 months or earlier if important new evidence becomes available. If you find any new information that you think is relevant, please let the committee know via <http://www.ukdmc.org/contact-us/>.

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<sup>1</sup> Inui S, Fujikawa A, Jitsu M, Kunishima N, Watanabe S, Suzuki Y, Umeda S, Uwabe Y. Chest CT Findings in Cases from the Cruise Ship “Diamond Princess” with Coronavirus Disease 2019 (COVID-19). *Radiology Cardiothoracic Imaging* 2020 Mar 17. doi: 10.1148/ryct.2020200110

<sup>2</sup><https://www.gov.uk/government/publications/national-COVID-19-surveillance-reports/sero-surveillance-of-COVID-19>

<sup>3</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/883897/Target\\_Product\\_Profile\\_antibody\\_tests\\_to\\_help\\_determine\\_if\\_people\\_have\\_immunity\\_to\\_SARS-CoV-2\\_Version\\_2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/883897/Target_Product_Profile_antibody_tests_to_help_determine_if_people_have_immunity_to_SARS-CoV-2_Version_2.pdf)

<sup>4</sup><https://www.gov.uk/drug-device-alerts/results-from-laboratory-based-tests-for-COVID-19-antibodies-using-capillary-blood-sample-collection-kits-may-not-be-reliable-mda-2020-015>

<sup>5</sup><https://www.cebm.net/COVID-19/in-patients-of-COVID-19-what-are-the-symptoms-and-clinical-features-of-mild-and-moderate-case/>

<sup>6</sup>Hu, Z., Song, C., Xu, C. et al. Clinical characteristics of 24 asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China. *Sci. China Life Sci.* 63, 706–711 (2020).

<https://doi.org/10.1007/s11427-020-1661-4>

<sup>7</sup> Staines HM, Daniela E Kirwan DE, David J Clark DJ et al Dynamics of IgG seroconversion and pathophysiology of COVID-19 infections. *medRxiv* 2020.06.07.20124636; doi: <https://doi.org/10.1101/2020.06.07.20124636>

<sup>8</sup>Pan F, Ye T, Sun P, et al. Time Course of Lung Changes at Chest CT during Recovery from Coronavirus Disease 2019 (COVID-19). *Radiology.* 2020;295(3):715-721. doi:10.1148/radiol.2020200370

<sup>9</sup>British Thoracic Society Guidance on Respiratory Follow Up of Patients with a Clinico-Radiological Diagnosis of COVID-19 Pneumonia. <https://www.brit-thoracic.org.uk/document-library/quality-improvement/COVID-19/resp-follow-up-guidance-post-COVID-19-pneumonia/> (accessed 27 June 2020)

<sup>10</sup> Oxford Handbook of Clinical Examination and Practical Skills (2 ed.) Editors Thomas J and Monaghan T. Oxford University Press. Jul 2014 DOI: 10.1093/med/9780199593972.001.0001

<sup>11</sup><https://www.cebm.net/COVID-19/what-is-the-efficacy-and-safety-of-rapid-exercise-tests-for-exertional-desaturation-in-COVID-19/>

<sup>12</sup>Buckley JP, Sim J, Eston RG, Hession R, Fox R. Reliability and validity of measures taken during the Chester step test to predict aerobic power and to prescribe aerobic exercise. *Br J Sports Med* 2004;38:197–205. doi: 10.1136/bjism.2003.005389

<sup>13</sup>Hui DS, Joynt GM, Wong KT, et al. Impact of severe acute respiratory syndrome (SARS) on pulmonary function, functional capacity and quality of life in a cohort of survivors. *Thorax.* 2005;60(5):401-409.

<sup>14</sup>2. Das KM, Lee EY, Singh R, et al. Follow-up chest radiographic findings in patients with MERS-CoV after recovery. *Indian J Radiol Imaging.* 2017;27(3):342-349.

<sup>15</sup>COVID 19 Information <https://www.artp.org.uk/COVID19> (accessed 28 June 2020)

<sup>16</sup> Mo X, Jian W, Su Z, et al. Abnormal pulmonary function in COVID-19 patients at time of hospital discharge. *Eur Respir J* 2020; 55: 2001217 [<https://doi.org/10.1183/13993003.01217-2020>].

<sup>17</sup>Wong HYF, Lam HYS, Fong AH, et al. Frequency and Distribution of Chest Radiographic Findings in COVID-19 Positive Patients. *Radiology.* 2019 Mar;201160. DOI: 10.1148/radiol.2020201160.