Kommission Forschungstauchen Deutschland
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KFT - Recommendation 2: The use of scientific divers in the context of a SARS-CoV-2 infection or COVID-19 disease

Version No 2 / 14.Nov. 2020

Preamble

This update of the KFT Recommendation for Action supplements the previous Recommendation for Action 2, Version 1 with current findings. The aim of this update is to summarise these findings in the current COVID-19 research and practice for the use of scientific divers and to provide a basis for action on how to proceed in the event of infection with symptoms of illness in connection with the activity of scientific diving. As in the previous version, this version was also prepared in cooperation with several German scientific institutions where scientific diving is used as a methodology, in close cooperation with the medical expert of the examination commission for research diving (Dr. U. van Laak). It is aimed at scientific divers, diving mission leaders, persons responsible for scientific diving at institutes and scientific facilities, as well as company and occupational physicians when issuing the G 31.2. The overarching aim of the recommended procedures by KFT is to protect employees who, in the course of their work activity "scientific diving", are exposed to health hazards due to an infection with the SARS-CoV-2 virus.

In the meantime, there is medical scientific evidence that COVID-19 disease can cause pathological (pathophysiological) changes in the body, even if the course of the disease is clinically unremarkable. These changes can cause, among other things, significant structural lung damage even with mild symptoms of the disease, resulting in an increased health risk for people who dive. This particular health risk has become much more pronounced in the past COVID-19 months, with the characteristics of COVID-19 disease ranging from near symptomlessness to flu-like symptoms to organ failure. The exact pathological processes are still not always clear in individual cases. However, the virus can directly or indirectly damage almost all organ systems. Severe courses of the disease also occur in younger persons without previous illness. Organs affected by COVID-19 are the lungs, the cardiovascular system and the central nervous system. This results in possible acute dangers for diving persons in their daily work. The recommended procedures, therefore, show a) possible behaviours that should help to minimise the risk of infection when conducting scientific dives and b) recommended measures after a manifested COVID-19 disease about regaining diving fitness, if necessary after an appropriately long waiting period.

Procedures and rules of conduct for scientific diving to minimizing the risk of infection with SARS-CoV-2 during a diving mission.

1) In principle, the current COVID-19 rules of conduct of the federal and state governments apply, supplemented by internal instructions if necessary.
2) In the context of scientific dives, the applicable distance rules cannot usually be observed. This applies in particular to the equipment and the obligatory safety check of the diver immediately before the dive, when bringing the diver back on board and removing the dive equipment immediately after the dive as well as in case of an emergency in which an injured diver has to be treated. To reduce this considerably increased risk of infection of all members of a dive group, the following measures are necessary:

    a. All members of a dive group fill out a self-declaration for a known COVID-19 disease (see the template in the appendix). This self-declaration shall be submitted together with the service logbook before the assignment and shall provide legally binding evidence of the known status.

    b. The wearing of mouth-and-nose protection when loading and unloading vehicles and boats, inside vehicles and at the diving site shall be implemented in accordance with the current federal and state COVID-19 Code of Conduct.

    c. PPE is always used exclusively in a personalised manner and is cleaned with a virucidal disinfectant after use in accordance with the manufacturer's instructions. When applied, release by the manufacturer of the PPE and proper handling in accordance with the hazardous substance datasheet of the agent used must be ensured. If this information is not available for the PPE used, the use of disinfection procedures, e.g. for rebreather immersion devices, can also be checked.

    d. In the case of an emergency where an injured diver needs to be treated, the following points must be met.

        i. All assistants wear a "mouth and nose protection" as well as protective gloves.
        ii. Respiratory control shall be carried out by extending the neck with the chin raised and observing any chest movements. The first aider should not approach the victim's face to hear any breathing sounds or feel a draft. If no chest movements can be detected, it can be assumed that the person concerned is not breathing and has no circulation (GRC recommendation, April 2020).
        iii. No mouth-to-mouth or mouth-to-nose breathing is performed. CPR procedures with respiratory donation are only performed using a ventilator bag. The appropriate emergency equipment must be available.

    e. There shall be at least two separate breathing sources for the administration of scuba oxygen at the dive site so that in the event of an emergency, both

the casualty diver and the backup diver can be supplied with normobaric oxygen at a sufficient distance.

f. Comment on possible further measures in scientific diving operations and their problems:
Since the course of the disease can be completely symptom-free with COVID-19, additional protective measures may have to be taken. Especially when working in confined spaces (e.g. on longer ship or shore missions) there is an increased risk of infection. According to the current situation, this must be reacted to internally in consultation with the respective occupational physicians and responsible persons. The range of measures extends from extended hygiene regulations with strict mouth-/nose protection (e.g. during operations lasting one or more days) to the strict up to 14-day quarantine of the entire expedition crew before the start of the expedition with sequential testing procedures and exclusion of contact with non-expedition participants during the entire expedition. The proportionality of extended measures has to be discussed in each case and has to be adapted to the current situation within the company.

Measures and rules of conduct for the implementation of occupational medical precautions according to G31.2

The following measures apply to COVID-19 disease courses in which COVID-19 symptoms have manifested themselves. A previous positive PCR test without any COVID-19 disease symptoms is not relevant from a diving medical point of view.

1. If a COVID - 19 illness is detected, the fitness for diving (G31.2) expires immediately, regardless of the severity of the condition.

2. Regaining G31.2 should only be done in conjunction with a specialist medical evaluation (see below). The following differentiated procedure is recommended:

   a. PCR confirmed but an asymptomatic or mild course of the disease (treatment with outpatient therapy or inpatient therapy without oxygen requirement)

      i. Early occupational medical check-up in compliance with G31.2 diving at work, not earlier than one month of being completely free of symptoms.
      ii. Additional examinations to be performed are:

         (1) Bodyplethysmography (large lung function),
         (2) spiroergometry,
         (3) Echocardiography,
         (4) Laboratory profile supplemented by CRP, LDH, CK, CK MB.

      iii. In individual cases, the company or occupational physician providing the assessment shall decide on further examinations such as HR-CT of the lungs in conjunction with a specialist consultation.

b. Severe course of disease with respiratory insufficiency (COVID-19 pneumonia, respiratory therapy, marked changes in thoracic imaging), heart failure or CNS manifestation.

i. Early occupational medical check-up according to G31.2 diving at work, at the earliest after six months of being completely free of symptoms (due to the not yet fully known pathophysiology of the severe forms of the disease).
ii. All control diagnostics recommended in the hospital discharge report must be completed before the follow-up examination.
iii. In principle, a neurological consultation must be arranged and the findings must be presented at the interim examination.
iv. Additional examinations to be performed are:

(1) body plethysmography (large lung function),
(2) spiroergometry,
(3) Echocardiography,
(4) Laboratory profile supplemented by CRP, LDH, CK, CK MB.
(5) Special attention should be paid to post-infectious scars, especially pleural adhesions, pulmonary cavities after tissue destruction and/or fibrotic changes. If there are indications of these changes, e.g. preliminary findings of inpatient treatment, a supplementary HR-CT of the lungs is necessary for further evaluation.

v. Any further examinations that may be required shall be determined by a company or occupational physician in conjunction with a specialist consultation.

c. Disease course not confirmed by PCR

For scientific divers who have shown clear suspicious symptoms of COVID-19 disease in the past, but have not yet been tested for infection by PCR, or where the PCR test has been negative in the past despite clear suspicious symptoms, an antibody test must be arranged.

Clear suspicious symptoms of COVID-19 disease in the sense of this recommendation for action are

- **acute respiratory diseases,**
- **fever, (> 38°C body temperature)**
- **strong feeling of illness,**
- **clearly limited physical capacity,**
- **Disturbances of the sense of taste or smell,**
- **more rarely also additional**
- **states of confusion,**
- **neurological abnormalities,**
- **diarrhoea.**

A further criterion to be considered is sufficient evidence of contact ((cumulative) > 15 minutes face-to-face) with a SARS-CoV-2 infection up to a maximum of 14 days before the start of the disease. For this group of people, it is recommended to arrange for an antibody test. IgG antibodies are detectable from the 15th day after infection at the earliest, and sooner later. Tests available on the market have a sensitivity of around 96% and a specificity of between 92 and 94%. Antibody testing should be carried out by an accredited laboratory. If this test is positive for IgG antibodies, a new early occupational medical check-up according to G31.2 Diving work is recommended, but not before one month of complete freedom from symptoms.

Antibody testing is currently not used in the diagnosis of acute infections. PCR testing is still the method of choice here. If the antibody test and a PCR test are negative and the symptoms of the disease have subsided, the existing occupational medical check-up in accordance with G31.2 Diving work is valid.

The diving medical rationale for the above recommendations (Dr. U. van Laak, Institute of Naval Medicine, Navy)

COVID-19 patients with pulmonary symptoms show bronchial hyperreactivity as well as infiltrates and consolidation areas during the healing phase, even when being subjectively free of symptoms over a longer period.

- Scientific divers have an increased risk of lung over-expansion due to a disturbed ventilation situation of the lungs.

Venous inert gas bubbles also develop during non-decompression dives. In the capillary network of a healthy lung, these are filtered out highly effectively. In COVID-19 patients, right-left shunts of the lung can develop in consolidation areas, which impairs the filter function for inert gas bubbles.

- Scientific divers have an increased risk of decompression sickness from lung shunts.

COVID-19 patients frequently suffer from myocardial diseases, partly as a (subclinical) secondary diagnosis, but also in the absence of pulmonary symptoms. It is not yet clear whether this is caused by the virus itself or by an inflammatory reaction.

- Scientific divers are at vital risk, especially in combination with the immersion effects, of (undiagnosed) heart muscle disease.

An infection with SARS-CoV-2 is often accompanied by neurological symptoms such as dizziness, headaches, taste or smell disorders, epileptic seizures, strokes and focal points of inflammation in the brain. In a series of cases published in the British Medical Journal (BMJ), one in five of the deceased infected persons showed an encephalopathy caused by oxygen deficiency, although the cause of the neurological symptoms remains unclear in the absence of direct detection of the virus in the brain.

- Scientific divers are at risk by (" silent ") neurological impairments especially in combination with the effects of nitrogen narcosis or oxygen intoxication.

Written by the Executive Board of the German Commission for Scientific Diving (KFT) in cooperation with Dr. U. van Laak (Member of the Examination Commission for Scientific Divers in Germany)

This recommendation for action is a living document that is updated in parallel with the development of scientific knowledge. The most current version and further sources of information on COVID-19 can be found on the KFT homepage at www.forschungstauchen-deutschland.de.