Post COVID-19 fitness to dive assessment findings in occupational and recreational divers

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Abstract
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Introduction: It is now known that COVID-19 has long term effects that may not correlate with clinical severity of disease. The known pulmonary and cardiovascular changes as well as thrombotic tendency could predispose to diving accidents. We aimed to investigate COVID-19 related changes that may cause disqualification from diving among divers who recovered from the disease.
Methods: Occupational and recreational divers who applied for fitness to dive (FTD) assessment after COVID-19 infection were included. Routine FTD assessments were performed. Details of COVID-19 history were evaluated. Lung computed tomography (CT) scans were advised if not previously performed or if there were COVID-19 related changes in previous scans. Divers with pathological findings were restrained from diving and followed prospectively.
Results: Forty-three divers were analysed. Thirteen divers were restrained from diving, all due to persistent COVID-19 related changes in lung CT. The prevalence of CT with at least one lung lesion was 68.2% at the time of diagnosis, 73.3% in the first three months after diagnosis and 19.2% later. The most common CT findings were glass ground opacities and fibrotic changes. Demographic characteristics and COVID-19 history of divers deemed 'unfit' were similar to those deemed 'fit'.
Conclusions: Divers who recover from COVID-19 should undergo FTD assessments before resuming diving. A chest CT performed at least three months after diagnosis may be suggested.

Introduction

Severe acute respiratory syndrome caused by the SARS-CoV-2 virus commonly referred as COVID-19, is a multisystem infection although the major insult is to the lungs. The pathophysiology and course are still not fully understood but it is clear that COVID-19 can have persistent effects. These effects do not correlate reliably with the severity of the disease and even asymptomatic patients have been shown to have lingering manifestations.[1,2] The most common persistent effect is pulmonary damage and this can vary from mild radiological changes to severe respiratory dysfunction that would require long term oxygen therapy. Cardiovascular problems, a thrombotic tendency and some neurological problems have also been reported frequently.[3] These sequelae may have physiological and social consequences both on patients and health system.

Diving, either occupational or recreational, can be a challenging activity due to the effects of immersion and pressure change on human physiology and sometimes strenuous exercise. Increased venous return and peripheral vasoconstriction caused by immersion and cold increase both the preload and afterload putting a considerable stress on cardiac function. Respiratory work increases as density of breathing gas and airway resistance increases with the increase in ambient pressure. When additional physical effort is needed during a dive this cardiac and respiratory stress may intensify.[4] Pressure changes may also cause reciprocal volume changes in gas filled spaces in the body, primarily lungs. Pressure equalisation or volume compensation is required for these bodily spaces during a dive. Existence of air trapping lesions or inability to compensate these variations in volume may lead to serious barotrauma.[5] Therefore, an adequate health and physical condition are prerequisite for safe diving.

When there are health risks fitness to dive (FTD) assessment is needed for divers. Indeed, it is obligatory for occupational divers to be medically certified. They undergo periodic examinations and are screened to exclude any conditions that may cause unconsciousness, decrease exercise capacity and predispose to barotrauma, especially in the lungs.[6] Failing to meet health standards may result in job loss for occupational divers. Regular examinations are strongly advised for recreational divers as well, although this advice is frequently not followed.

Given the potential long-term effects of COVID-19, the possible risks of diving for people who recovered from the disease have been a concern to diving community.[7] Several guidelines and position documents about returning to diving after COVID-19 have been published, but they are mainly based on general coronavirus infections knowledge.[8,9] Thus, data describing the post-COVID-19 condition of divers is important for development of more specific guidelines. In this cross-sectional observational study, we aimed to screen the divers who applied for FTD assessments after recovering from COVID-19 for symptoms and sequelae which could interfere with diving. Here we report our preliminary findings which may help physicians involved in FTD assessments and to develop guidelines.

Methods

This study was approved by the Istanbul Faculty of Medicine Clinical Research Ethical Board (approval number 2022/72).

After the recognition of long-term sequelae of COVID-19, we informed local divers about the potential effects of the disease on FTD in webinars or with repeated statements shared in social media platforms. We advised all divers who recovered from COVID-19 to take a FTD assessment before resuming diving.

Divers who applied to our department for FTD assessments after COVID-19 infection were evaluated retrospectively. Divers who had a confirmed COVID-19 diagnosis either through a positive polymerase chain reaction (PCR) test or suggestive history and chest computed tomography (CT) findings in the absence of a positive PCR test, who had at least one pulmonary imaging study, were 18 years or older and agreed to share their medical records were included in the study. Demographic data (age, gender, weight, height, previous disease and medication, smoking, alcohol and drug use) and diving history (diving experience, certification, intention) of the divers were recorded. Divers who did not present any radiological or laboratory results to confirm COVID-19 infection were excluded from analysis.

FTD ASSESSMENTS

Routine FTD assessments involved blood testing (fasting glucose, liver and renal function tests, lipids, total blood count) and urinalysis, audiological evaluation, respiratory function testing, electrocardiogram (for divers older than 40) and radiologic imaging of joints, sinus and lungs (when necessary). A thorough physical examination was conducted. We advised low dose chest CT to the divers who had not undergone a CT during or after the COVID-19 diagnosis. Divers were referred to the cardiology department if there was a decrease in effort capacity or any other cardiovascular condition related to COVID-19 was suspected or reported by the diver. Although respiratory function tests are usually mandatory in routine assessments, they could not be performed for most of the divers because of concerns around associated risk of disease transmission.

CT IMAGING AND GROUPS

All lung CT images were evaluated by the same pulmonology specialist with a 30-year experience in the field. The presence of air trapping lesions (pneumatoceles); fibrotic sequelae, reticulations; architectural distortion; honeycombing; traction bronchiectasis; mucus plugging, ground glass opacities, parenchymal lesions and others (crazy paving pattern; nodules; pleural thickening or pleural effusion) were assessed. If a condition considered an absolute contraindication to diving was detected the diver was permanently disqualified irrespective of whether the finding seemed related or unrelated to COVID-19.

Divers were broadly classified according to the availability of CT scans prior to the FTD assessment.

Divers who had one CT scan performed before they applied for FTD assessment were grouped as 'during diagnosis' if the scan was performed in the first week of diagnosis, 'first three months' if the scan was performed anytime between the end of the first week and beginning of the fourth month after the diagnosis, and 'later than three months' if performed after the beginning of the fourth month (regardless of the time of FTD assessment). If no pathological finding related to COVID-19 was detected in their scan the diver was cleared for diving. If a COVID-19 related finding was observed the diver was considered temporarily unfit for diving and a follow-up CT scan at least three months after initial one was advised. Follow-up CT scan results were added to groups 'first three months' and 'later than three months' according to their timing.

Some divers had undergone more than one CT scan before they applied for FTD assessment of their own volition or at the request of another physician. Timing of these scans was again classified as described above. In these cases the most recent CT scan was taken into consideration for FTD assessment. If a COVID-19 related finding was observed, the diver was considered temporarily unfit for diving and a follow-up CT scan was advised.

COVID-19 HISTORY

A detailed COVID-19 history was taken. The time and method (PCR test/CT scan) of diagnosis, symptoms and signs, blood tests (involving acute phase reactants, total blood count, metabolic parameters, liver and renal function tests, sedimentation, coagulation parameters, D-dimer where available), other diagnostic and imaging studies performed during the course of the disease, medication and other treatments (high flow oxygen, positioning, convalescent immune plasma therapy), duration of hospitalisation and days in intensive care unit where applicable were recorded. If

Table 1
Demographic and diving data of the divers included in the analysis. BMI – body mass index

Parameter	Male (n = 35)	Female (n = 8)	Total (n = 43)
Age (years), mean (SD)	41.7 (10.8)	36.3 (10.7)	40.9 (10.6)
BMI (kg·m^{-2}), mean (SD)	28.1 (4.7)	25.2 (3.8)	26.9 (4.6)
Smoking, n	10	–	10
Professional diver, n (%)	15 (40.6%)	2 (25%)	17 (37.5%)
Total diving years, mean (SD)	13.1 (9.6)	8 (6.4)	12.4 (9.3)
Total dives, mean (SD)	1703 (3301)	2644 (7017)	1882 (4161)
Divers with comorbidity, n	10	2	12
Comorbidities			
Cardiovascular disease	4	1	5
Lung disease	3	–	3
Diabetes	3	–	3
Other	1	1	2

Table 2
Common COVID-19 symptoms among 43 divers and number of divers who reported each symptom

Symptom	Divers n (%)
Fever	29 (67.4)
Fatigue	26 (60.4)
Body and muscle ache	24 (55.8)
Dyspnoea	18 (41.9)
Loss of smell/taste	17 (39.5)
Cough	16 (37.2)
Chilling	11 (25.6)
Headache	8 (18.6)
Sore throat	8 (18.6)
Gastrointestinal symptoms	6 (13.9)
Runny nose	2 (4.7)

any follow up tests were performed before FTD assessment, these were also taken into account.

ANALYSIS

Numerical results from blood and urine tests were presented as in normal range, increased or decreased. Demographic and descriptive data were expressed as mean and standard deviation or numbers and percentages where appropriate. Statistical analysis was performed using the Med-Calc® for Windows (version 11.2.1.0). Data distribution was evaluated using the Kolmogorov-Smirnov test. A Student's t-test was used to compare paired samples and the 'N-1' Chi-square test was used to compare proportions. Significance was accepted at $P < 0.05$.

Results

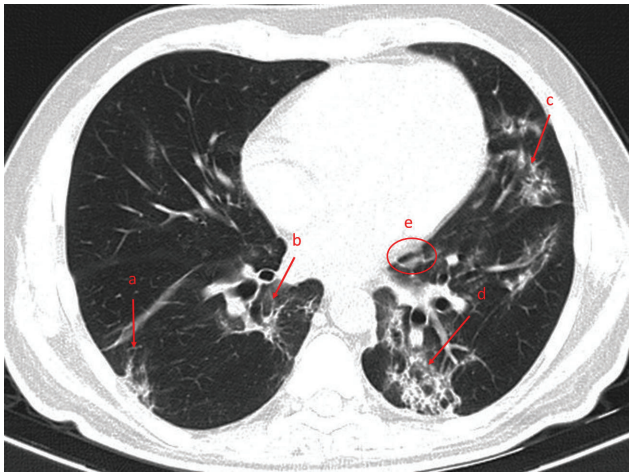
Fifty divers who recovered from COVID-19 presented to our department for FTD assessment over four months until the end of April 2021. Six divers did not have any prior pulmonary imaging (CT or X-ray) or undergo one so were not included in the analysis. One other diver was excluded as he was younger than 18. Forty-three divers (eight female, 35 male) were evaluated. Demographic data and the diving history of the divers are presented in Table 1. Mean time to apply for FTD after COVID-19 was 5.3 months.

Thirty-three divers were non-smokers. Twenty-five (seven female, 18 male) had not smoked at all and eight had quit at least five years ago. Twenty-nine divers (six female, 23 male) had not experienced any serious health problem. Cardiovascular problems were cerebrovascular accident, hypertension and hypercholesterolaemia. Pulmonary problems (other than COVID-19) included mild asthma and previous tuberculosis. One male had Buerger's disease and one female diver had Hashimoto thyroiditis.

The COVID-19 history was heterogeneous among divers. Six male divers were asymptomatic and were detected via contact tracing. All other divers had symptomatic COVID-19 of variable severity. The most common symptoms were fever, fatigue and body and muscle aches. Reported symptoms and prevalence are given in Table 2. Eleven divers (eight male) were hospitalised. One of the three hospitalised female divers was admitted because she was giving birth. Intensive care admission was required for only one diver who had respiratory failure and a thromboembolic event.

Antivirals (n = 33), hydroxychloroquine (n = 8) and anticoagulants and/or antiplatelet drugs (n = 19) were commonly used for treatment. Favipiravir was the mostly prescribed antiviral and only one diver was given oseltamivir. Four divers received convalescent immune plasma therapy

Figure 1
An example of a pulmonary CT image of a diver who was deemed unfit for diving due to residual COVID-19-related findings; a – fibrotic changes affecting the pleura; b and c – fibrotic changes with bronchiectasis; d – fibrotic cystic changes; e – air cysts



and one diver received Interleukin 6 antibody. Inhaled corticosteroids were required for two divers. Two divers took colchicine during the course of their treatment. Five divers, one female who was giving birth, and four males, did not take any medication for COVID-19.

All divers but one who was pregnant at the time of diagnosis underwent at least one CT scan; the exception presented with an X-ray performed one month after diagnosis and no COVID-19 related finding was detected. Twenty-two divers had CT scans at the time of diagnosis. There was a total of 15 and 26 divers who underwent CT imaging in the first three months and later than three months respectively. Prevalence of CT imaging with COVID-19 related pathological findings and common findings in each group are summarised in Table 3. The most common COVID-19 related findings in all CT scans were ground glass opacities (GGO), fibrotic changes, alveolar consolidation and emphysematous change. An example of a pulmonary CT image with residual COVID-19 related findings is presented in Figure 1. Of the fifteen divers with a COVID-19 related finding in CT scanning at diagnosis, seven underwent a follow up CT in the first three months while eight divers underwent CT later. Four divers underwent two follow-up CT scans (CT scans at all three time points).

Two male divers one of whom was professional were found to have tuberculosis related changes. They were not included in the COVID-19 related findings table. Two divers who had normal CT scans at diagnosis had COVID-19 related changes in their scans performed in the first three months. Both resolved after a further three months.

Laboratory testing also varied greatly. Sixteen divers had blood test results from the time of diagnosis. Complete blood count and C-reactive protein (CRP) were studied in all. Lymphopenia was detected only in two divers and CRP elevation, mostly mild, was found in four divers. D-dimer was above the normal range in five of the 14 divers who were tested. Lactate dehydrogenase (LDH) and liver function tests (LFT) were elevated in six and five divers respectively whereas renal function tests and urinalysis were invariably normal. Six divers did not have any abnormal results. Complete blood count, coagulation tests and inflammatory markers were normal at the time of FTD assessments for all divers. No abnormality was detected in liver and renal function tests and urine analysis during FTD assessments.

No thromboembolic or cardiac sequelae were found during FTD assessments. Physical examination did not reveal any significant findings in any of the divers. Fifteen divers (one female, 14 male) were found unfit to dive all due to pathological findings in chest CTs. Of these, two male divers, one of whom was professional, were found to have tuberculosis related changes, and thirteen divers, seven professional and six recreational, had persistent COVID-19 related changes. Details of demographic data, COVID-19 history, treatment and CT imaging of the 13 divers who were deemed unfit due to COVID-19-related findings are presented in Table 4.

One professional diver had an air trapping lesion in the CT performed in the third month following COVID-19 diagnosis and was permanently disqualified. A re-assessment at least three months later was scheduled for the other twelve divers regardless of their initial time of assessment in our department.

Divers who were deemed unfit for diving because of COVID-19 effects (n = 13) were not different from the rest with respect to age (P = 0.124), body mass index (P = 0.531), rate of comorbidity (P = 0.887) and smoking (P = 0.519). Severity of disease among unfit divers varied from asymptomatic to ICU requirement and their hospitalisation rate (6/13 divers, 46.2%) was higher than fit divers (5/28 divers, 10.7%). Also, all divers who were found to have elevated D-dimer and lymphopenia were among the unfit divers. Seven of the 28 divers who were found fit to dive had pathological CT findings in their previous imaging studies performed either at diagnosis or in the first three months after diagnosis but normal CT at the time of FTD assessment. Details of demographic data, COVID-19 history, treatment and CT imaging of these seven divers are also presented in Table 4.

Discussion

Our experience suggests that divers who apply for FTD assessments after COVID-19 may have persistent changes on CT scanning involving GGO's, consolidations, reticulations and air trapping regardless of the severity of the disease. General characteristics and prevalence of the lesions in our cohort are similar to data previously reported.[1,3] In many of the follow up studies, mosaic attenuation pattern marked

Table 3
Number of first and follow-up CT scans performed at diagnosis, in the first three months after diagnosis and after the first three months, and number of CT scans that were found to have at least one COVID-19 related finding, with numbers of common findings

Parameter	At diagnosis	First 3 months	Later than 3 months
CT imaging performed (*n*, first time/follow up)	22/NA	7/8	12/14
CT imaging with COVID-19 -related finding (*n*, %)	15 (68.2%)	11 (73.3%)	5 (19.2%)
Common findings *(n)*			
GGO	10	5	0
Consolidation	5	2	0
Fibrotic changes	3	4	5
Emphysema-air trapping	3	2	1
Parenchymal infiltration	2	2	0
Nodule	1	0	0

with hypo- and hyper-inflated zones, bronchiectasis and reticulations which are all associated with pulmonary fibrosis and attributed to small airway disease and air trapping have been reported.[10–13] These residual lesions of COVID-19 may predispose pulmonary barotrauma (PBt) in divers.

It is well known that air trapping may cause overdistention of the lung tissue during ascent when intrapulmonary gas expands as ambient pressure decreases resulting in alveolar rupture.[5] There are a number of reports that present divers who experienced PBt without a provocative incident such as breath holding or rapid ascent and were found to have air trapping lesions.[14–16] Moreover, PBt occurrence either non-invasive or invasive ventilation-associated is found to be higher in COVID-19 compared to other acute respiratory distress syndrome conditions and it is possible COVID-19 may have a unique mechanism that increases the risk.[17,18] It can be speculated that there may also be an increased risk of diving-related PBt in these patients. While this remains to be verified, the possibility that lung damage occurring in COVID-19 can predispose to diving-related PBt should be kept in mind.

Radiologic abnormalities after COVID-19 are shown to regress and change characteristics in time. Many studies report decrease in prevalence of lung lesions during follow-up.[10,11] Also, as GGO's and consolidations are the most common findings in earlier chest CT images, fibrotic like changes are observed to be more prevalent in later radiologic workups.[12,13] That said, an optimum time for radiologic follow-up after COVID-19 has not been defined yet but based on the clinical observations and previous reports, 12 weeks has been suggested. This period is thought to be optimal as most of the radiological abnormalities would resolve and persistent ones that could pose a risk for impairment would be identified as early as possible.[19] In our study, total abnormal radiological findings were reduced in the repeat scans performed later than three months after recovery. Also, some of the divers who were assessed in the first three months and shown to have COVID-19-related lung lesions completely recovered after three months. In this regard, three months or more after recovery seems to be an appropriate time for FTD assessments based on available data.

The optimum method to follow these long-term radiological changes is also a controversial subject. Although chest X-rays are the widely accepted imaging method mostly due to lower radiation exposure compared to CT, their usefulness in follow-up is limited. Fibrosis or fibrotic-like changes in the post-COVID setting have been shown to develop in up to 60% of patients especially in the first three months.[11,12,20] Subtle changes may be clinically irrelevant however sensitivity of X-rays to detect these persistent lung lesions, regardless of severity has been shown to be low.[21,22] In addition, it is now well known that clinical severity of COVID-19 is not a reliable predictor for pulmonary changes in CT.[1,21] It has been an ongoing discussion whether CT scans would be more useful compared to X-rays in FTD assessments but they are generally deemed unnecessary as the rate of diving related pulmonary events in the wider diving population is very low and CT scans may cause overdiagnosis.[23] In contrast, in divers recovering from COVID-19 the potential associated risks and unpredictability of pulmonary lesions that could predispose to PBt may justify CT scanning.

Hypercoagulability along with cardiac damage and stroke are also common after COVID-19 and can even be seen in mild infections.[24] These late effects are specifically relevant for diver assessments after COVID-19 since they can directly interfere with diving safety. Physiological effects of diving and its physical challenges require an adequate exercise capacity. Failing to meet this demand may result in diving accidents. Indeed, cardiac problems are an important cause of diving-related deaths.[25] COVID-19-related cardiac injury which is mostly associated with systemic

Table 4

Details of demographic data, COVID-19 history, hospitalisation and treatments, and COVID related findings in the CT imaging performed at diagnosis, in the first three months, and later than three months for the 13 divers who were deemed unfit for diving, and seven divers who had COVID related findings previously but later were cleared for diving (cleared divers); A.bio – antibiotics; A.coag – anticoagulant drugs; A.plat – antiplatelet drugs; ALV.cons – alveolar consolidation; ATL –air trapping lesion; CPl – convalescent plasma; DM – diabetes mellitus; EC – emphysematous change; F – female; FC – fibrotic change; FPV – favipiravir; GGO – ground glass opacities; HQ –hydroxychloroquine; HT– hypertension; I –inhaled; IGT– impaired glucose tolerance; IL-6 AB – interleukin 6 antibody; M – male; O – oral; P – professional diver; PI –parenchymal infiltrations ; py – pack years; R – recreational diver; vit – vitamin C

	Age/ Sex	BMI	P/R	Smoking	Comorbidity	Symptoms	Hospital admission	Treatment	CT at diagnosis	CT < 3 months	CT > 3 months
Unfit to dive											
1	58/F	25	P	Ex	↑ cholesterol	Fever, fatigue, chills, dyspnoea, cough, muscle/body ache	–	FPV, Vit	–	FC	–
2	34/M	25	P	10 py	–	Fever, dyspnoea, cough, muscle/body ache, taste/ smell loss	–	FPV, HQ	ATL	ATL, FC	
3	50/M	25	R	None	HT, IGT, asthma	Fever, chills	–	FPV, A.plat, A.coag	PI, FC	–	FC
4	52/M	25	R	None	–	Fever, fatigue dyspnoea, cough, taste/smell loss	37 days (23 in ICU)	FPV, A.coag, steroids(I), IL-6 AB	GGO (diffuse)	FC, Al. Cons.,	GGO, FC
5	41/M	23	R	None	–	Fatigue, chills, taste/ smell loss	–	FPV	–	–	FC
6	53/M	28	R	None	Mild asthma	Dyspnoea, cough, muscle/ body ache	6 days	FPV, A.plat, A.coag, CPl,	GGO (diffuse)	GGO, PI	–
7	38/M	39	P	None	–	Fever, fatigue muscle/ body ache	–	FPV, A.plat, vit	GGO	–	–
8	35/M	33	P	None	–	Chilling, fatigue dyspnoea, cough	5 days	FPV, A.coag, A.bio	GGO, FC	GGO (diffuse)	–
9	52/M	28	P	None	Splenectomy	Fever. dyspnoea, cough, muscle/body ache	8 days	FPV, HQ, Steroids(I)	GGO, FC	GGO	

Table 4 continued.

10	55/M	31	P	15 py	HT, insulin resistance	Fever, dyspnoea, cough, muscle/body ache	–	FPV, A.coag, steroids (O), A.bio, colchicine	GGO (diffuse)		
11	56/M	26	R	Ex	–	Fever, fatigue, muscle/ body ache, taste/smell loss	3 days	HQ, A.bio		FC, Cysts?	
12	38/M	27	R	None	None but job with chemicals	Fever, fatigue, dyspnoea	4 days	FPV, A.plat, A.coag, Steroids (I)	GGO, FC, EC		GGO
13	28/M	24	P	5 py	–	None	–	FPV, A.plat, Colchicine	GGO (diffuse)		
Divers cleared to dive											
1	61/M	36	P	None	–	Muscle ache, head ache	–	FPV, HQ	GGO (diffuse) PI	GGO	Normal
2	45/F	25	P	None	–	Fever, fatigue, Sore throat, taste/smell loss	–	FPV, A.coag	GGO, FC	GGO	Normal
3	50/M	29	P	None	None	Fever, chills, muscle ache	–	FPV	Alv.cons, FC	–	Normal
4	44/M	37	P	6 py	TIA, myelitis, HT	None	–	FPV, A.plat	Alv.cons., FC, ATL	–	Normal
5	44/F	36	R	–	Ototiroiditis	Fatigue, dyspnoea, cough	4 days	FPV, A.coag, A.bio	FC	–	Normal
6	53/M	28	P	20 py	Type 2 DM	Fever, fatigue, muscle/body ache	–	FPV, vit	Alv.cons., nodule	–	Normal
7	44/M	29	R	None	–	Sore throat, fatigue, dyspnoea, muscle ache	5 days	FPV, A.plat, A.coag, CPl	–	PI, GGO, septal thickening	Normal

inflammation, hypercoagulability or systemic hypoxia arising from respiratory problems may add to cardiac risk in diving.[26] Decompression sickness, a major diving injury, has a complex pathophysiology in which the coagulation system and inflammatory mechanisms are thought to be involved. Thus, increased risk of decompression sickness due to a hypercoagulable state and hyperinflammation after COVID-19 is another concern for these divers. In addition, acute thromboembolic incidents may complicate differential diagnosis in diving accidents as well as increasing the risks. Fortunately, none of these late effects were encountered in our diver group although minor changes in laboratory findings were observed in a few divers, but these changes were not clinically relevant. Divers taking FTD assessments after COVID-19 need to be scrutinised with respect to cardiac and thrombotic effects.

There are several limitations to our study. The major one is the heterogeneity of the study group, FTD assessment times and evaluated parameters. This was inevitable due to the design of the study and variations in presentation and management of the disease. We tried to minimise this limitation by providing individualised and detailed data as much as possible. Another limitation may be the absence of pulmonary function tests. Spirometric studies do not provide data on structural abnormalities but could have presented a more comprehensive evaluation of pulmonary changes in divers. However, these tests were temporarily ceased in most of the centres due to contamination risks and could not be performed. Finally, we don't have any data about previous diseases or baseline pulmonary problems so some identified abnormalities could have been present before COVID-19. On the other hand, almost half of the divers (n = 7) who had persistent lesions in their chest CT either in first three months or later were occupational divers. Since FTD assessments and certification are an obligation for occupational divers, these divers should have been in perfect health previously. For recreational divers on the other hand there is no obligation for medical screening but since they were actively involved in diving these divers can also be expected to be healthy. Yet, presence of radiological abnormalities before COVID-19 cannot be ignored.

Conclusions

Divers may present with COVID-19-related pulmonary changes that may pose a serious health risk in diving and also cause job loss. Thus, FTD assessment after COVID-19 is of critical importance. Meticulous and timely evaluation with appropriate methods and scheduling re-evaluations to follow possible resolution of residual effects if needed may help optimise FTD assessments.

To our knowledge this is the first report that presents late effects of COVID-19 in occupational and recreational divers. We think our results, even though preliminary, may contribute to the development of guidelines for FTD assessment after COVID-19.

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