RESEARCH ARTICLE

Post-traumatic stress among COVID-19 survivors: A descriptive study of hospitalized first-wave survivors

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Introduction: The coronavirus Severe Acute Respiratory Syndrome Coronavirus Type 1 induces a severe respiratory disease, coronavirus disease 2019 (COVID-19). After Severe Acute Respiratory Syndrome Coronavirus Type 1 and Middle East Respiratory Syndrome infection, increased post-traumatic stress disorder (PTSD) rates were described.

Methods: This single-centred, prospective study aimed to evaluate the rates of PTSD in patients who were hospitalized for COVID-19. Inclusion criteria were COVID-19 patients hospitalized in the intensive care unit (ICU) or in a standard unit with at least 2 L/min oxygen. Six months post-hospitalization, subjects were assessed for PTSD using a validated screening tool, the Post-Traumatic Stress Checklist-5 (PCL-5).

Results: A total of 40 patients were included. No demographic differences between the ICU and non-ICU groups were found. The mean PCL-5 score for the population was 8.85±10. The mean PCL-5 score was 6.7±8 in the ICU group and 10.5±11 in the non-ICU group (P=0.27). We screened one patient with a positive PCL-5 score and one with a possible PCL-5 cluster score. Nine patients had a PCL-5 score of up to 15. Seven patients reported no symptoms. Seven patients accepted a psychological follow-up: one for PTSD, three for possible PTSD and three for other psychological problems.

Discussion: The PCL-5 tool can be used by lung physicians during consultations to identify patients for whom follow-up mental health assessment and treatment for PTSD are warranted.

Conclusion: Lung physicians should be aware of the risk of PTSD in patients hospitalized for COVID-19 and ensure appropriate screening and follow-up care.

Key Words: *COVID-19; crisis intervention; mental health; post-acute COVID-19 syndrome; post-traumatic; stress disorders*

INTRODUCTION

Psychological disorders, anxiety, depression or post-traumatic stress disorder (PTSD) are common after acute stress. Psychological disorders are described in survivors of serious infectious diseases such as Crimean-Congo Haemorrhagic fever [1], Ebola [2], severe acute respiratory syndrome (SARS) or Middle East Respiratory Syndrome (MERS) [3]. In a meta-analysis of SARS Coronavirus Type 1 (SARS-CoV1) and MERS survivors, the patient-reported incidence of anxiety, depression and PTSD were 14.9%, 14.8% and 32.2%, respectively [3].

The coronavirus SARS-CoV2 is a species of beta-coronavirus and causes coronavirus disease 2019 (COVID-19). The first cases of COVID-19 were reported in Wuhan (China) on December 2019, and SARS-CoV2 is responsible for the current pandemic [4]. Once infected, people can be asymptomatic or develop mild to severe symptoms, including fever, cough, fatigue, diarrhoea, loss of smell and so on. Impairment of the lungs and the development of inflammatory storm are life-threatening [5, 6]. In cases of lung involvement, computerized tomography (CT)-scan features consist of local ground glass opacity, bilateral and subpleural ground glass opacity, a crazy paving pattern, diffuse ground glass opacity or diffuse consolidations [7, 8]. Some features seem to be organizing pneumonia [9]. Ground glass opacity and subpleural lines are more prevalent in the early phase of the disease, whereas crazy paving, consolidations and signs of fibrosis are features of the late phase [10]. CT scans frequently described thrombosis during COVID-19 [11].

In efforts to control the pandemic and the overwhelming healthcare systems, most countries implemented strict quarantine measures during the first COVID-19 wave. In France, the French state implemented measures, including reducing hospital activities in favour of mainly unscheduled activities and prohibiting visits to hospital patients. Associated with the implementation of these measures were reports of psychiatric disorders [12–14]. At the beginning of the COVID-19 crisis, 53.8% of the impacted Chinese population suffered from mild to severe psychiatric troubles. Mild to severe depression, anxiety and stress were reported in 16.5%, 28.8% and 8.1% of cases, respectively. Screening for PTSD, with the Post-Traumatic Stress Checklist-5 (PCL-5), revealed a 7% prevalence of PTSD in Hubei Province, China's hardest-hit area [15]. Since the beginning of the pandemic, studies of general populations in China, Spain, Italy, Iran, the United States and Turkey have reported incidences of PTSD ranging from 7% to 53.8% [16].

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In previous coronavirus outbreaks, the prevalence of PTSD in survivors was estimated at 38% at 6 months post-discharge [17]. One year after the MERS outbreak, in a cohort of 69 survivors, 42.9% reported symptoms of PTSD [18]. A total of 30 patients (42%) of a cohort of 68 SARS survivors reported symptoms of PTSD during a 4-year follow-up study [19].

The present study aims to describe associations between first-wave COVID-19 hospitalizations and symptoms of PTSD 6 months post-discharge.

METHODS

Study population

A single-centre, prospective descriptive study was conducted at a general hospital centre in France. This hospital is the main hospital for two French counties. During the first wave, 324 patients were admitted with COVID-19. Of these, 66 patients died and 42 were admitted to an intensive care unit (ICU).

Subjects were eligible for inclusion if they were hospitalized in ICU or non-ICU units for COVID-19 during the first wave of the pandemic (between March 12 and April 15, 2020) and received at least 2 L/min oxygen. Patients with a previous history of PTSD were eligible for inclusion. Minors and those unable to provide consent were excluded.

To identify the study subjects, we matched data provided by the medical information department, the ICU and the hospital pharmacy. Potential subjects were informed of the study, through a letter, during a routine follow-up appointment, approximately 6 months post-discharge.

Each patient underwent a physical exam with dyspnoea assessment, a lung function test and a 6-min walking test. A chest x-ray and/or a CT scan were left to the discretion of the patient's physician. The lung physician assessed patients who provided consent for inclusion in the study for PTSD using a paper version of the PCL-5 tool.

PCL-5 and interpretation

The PCL-5, a valid and reliable tool, was used by the lung physician to screen for PTSD. This tool assesses the 20 *DSM-5* symptoms of PTSD. Clinically, it is used to 1) screen individuals for PTSD, 2) make a provisional PTSD diagnosis and 3) monitor symptom change during and after PTSD treatment. A previous study reported the PCL-5 to have specificity and sensitivity of 95% and 83%, respectively [20, 21]. The questionnaire is a 20-item self-report tool that assesses symptoms and the severity of PTSD symptoms in the past month. Patients' symptoms are assessed using a 5-point Likert scale: "not at all=0", "a little bit=1", "moderately=2", "quite a bite=3" and "extremely=4". The questionnaire is divided into four clusters: the first (questions 1 to 5), the second (questions 6 to 7), the third (questions 8 to 14) and the fourth (questions 15 to 20). There are two ways of measuring suspected PTSD:

- A person reports a total score of ≥33/80;
- A person reports 4/4 positive clusters. The first and second clusters are positive when patients answer "2" or more for at least one question. The third and fourth clusters are positive when patients answer "2" or more for at least two questions.

A psychological or psychiatric consultation was offered to patients with a positive PCL-5 screening result (score or clusters). A consultation was also offered if the lung physician had doubts about the outcome of the PCL-5 test. Consultations were arranged if the patient asked for one.

Data collection and analysis

We calculated the number of patients who had to be included according to the SARS-CoV1 incidence of PTSD about 50%. With a risk α at 0.05 and β at 0.2 (statistical power at 0.8), the number of patients required was 64 (calculated using the library "pwr" of the R software, version 4.2.1).

The following demographic and treatment data, recorded during hospitalization for COVID-19, were extracted from the subject's hospital records: age, sex (male/female), medical, trauma or psychological history; COVID-19 severity according to the WHO severity definitions [22]; corticosteroid therapy; and treatment settings (standard or intensive care hospitalization). The variables are presented in mean ± standard deviation.

The normality was tested with the Shapiro-Wilk test. A Student's *t* test or a Mann-Whitney U test was realized to compare the ICU group and the non-ICU group. The qualitative variables were analysed with the χ^2 test or Fischer's exact test. All statistical analyses were conducted using R software (www.therproject.com) linked to BiostatGV (http://biostatgv.sentiweb.fr/).

Ethics approval for the present study was obtained from the French Comité de Protection des Personnes Nord Ouest (*N° ID-RCB:* 2020-A01577-32).

RESULTS

Population

In total, 324 people were admitted to the hospital because of COVID-19 disease during the first wave of the pandemic. A total of 192 patients were excluded from the present study because their oxygen saturation was less than 2 L/min, and they were transferred to another private or public hospital, or they did not receive follow-up at 6 months post-discharge. Sixty-six persons died. Sixty-six subjects met the inclusion criteria for the study. Twenty-six subjects refused to participate or could not be contacted. Forty subjects were included in the study (n=18 in the ICU group and n=22 in the non-ICU group).

The mean time between COVID-19 hospitalization and the follow-up consultation (PTSD assessment) was 196 days±34. The mean age was 64 years±13. The sex ratio was 1.2 (male, n=22). There was no difference in the use of corticosteroid therapy between groups. Body mass index and smoking exposure were significantly higher in the ICU group. The disease was significantly more extended and diffuse on CT scan in the ICU group (Table 1).

In our cohort, one patient reported using medication to treat a psychiatric disorder at the time of COVID-19 hospitalization, and 14 reported earlier traumas, such as family bereavements, before hospitalization (ICU group, n=7, non-ICU group, n=5; P=0.26). During hospitalization, 24 patients received psychological support (ICU group, n=14, non-ICU group, n=10; P=0.054) (Table 1).

Post-traumatic stress disorder

The mean PCL-5 score was 8.85±10 for the study population. The mean PCL-5 scores were 6.7±8 in the ICU and 10.5±11 in the non-ICU groups. Those means were not significantly different (P=0.27). Figure 1 presents the PCL-5 score and the number of PCL-5 clusters for the 40 subjects. Two subjects had a positive PCL-5 (N°38, PCL-5 score=36, non-ICU group and N°3, PCL-5 with four positive clusters ICU group). Fifteen subjects (37.5%) had a PCL-5 over 10 and 9 subjects (22.5%) over 15. Seven subjects (17.5%) reported none of the PTSD symptoms reported in the PCL-5. Except for questions 16 and 18, five patients reported having at least moderate symptoms for each question (Figure 2).

Psychological follow-up

One subject received psychological treatment and follow-up before the COVID-19 infection and continued the psychological care. Two subjects (n°30: anxiety, n°35: anxiety) received psychological care immediately after hospital discharge for COVID-19. Six subjects accepted a psychological follow-up after enrolment in this study (n°1: agoraphobia, n°2: PTSD, n°3: doubt PTSD, n°10: anxiety, n°22: doubt PTSD, n°38: PTSD). Concerning the use of the psychological follow-up, no statistical difference was found between the ICU and non-ICU groups (P=0.42).

DISCUSSION

Our study was carried out in response to concerns reported by our hospital. During this first wave, we observed many anxious patients. These

TABLE 1
Study population characteristics

	Population	ICU group	Non-ICU group	P
Size (n)	40	18	22	
Age (years) ± SD	64 ± 13	65.7	63.7	0.63
Sex M/F, (n)	22/18	12/6	10/12	0.17
BMI	28+/-4	29.6	26.6	**0.034**
Corticosteroid treatment (n)	18	11	7	0.06
Time between COVID-19 hospitalization and PCL-5 assessment (days)	196+/-34	195.4	195.7	0.97
Medical history				
Tobacco exposure (n)	11	8	3	**0.039**
Diabetes (n)	8	6	2	0.11
Hypertension (n)	20	10	10	0.75
Respiratory disorders (n)	3	2	1	0.57
Cardiovascular disorders (n)	4	3	1	0.3
Kidney disorders (n)	4	1	3	0.61
Liver disorders (n)	0	0	0	1
Haematology/cancer (n)	2	1	1	1
Immunosuppression (n)	0	0	0	1
Inflammatory diseases (n)	2	0	2	0.49
Psychiatric disorder (n)	1	1	0	0.45
Psychological Trauma history (eg, family bereavements) (n)	12	7	5	0.26
Non-ICU group				
WHO COVID-19 scale 5/6 (n)	20/2		20/2	
ICU group				
WHO COVID-19 scale 7/8/9 (n)	3/13/2	3/13/2		
Mean invasive mechanical ventilation Length (days)	15	15		
Post-intensive care neuromyopathy (n)	11	11		
COVID-19 CT-scan involvement at the onset of the disease				
Size (n)	39	18	21	
Surface area				
<30%	14	1	13	**0.008**
30%–60%	12	7	5	0.31
>60%	13	10	3	**0.01**
Distribution				
Peripheral pattern	13	1	12	**0.007**
Diffuse pattern	26	17	9	**0.0006**

BMI body mass index; COVID-19 coronavirus disease 19; CT computerized tomography; ICU intensive care unit; n size of the population; M/F male/female; SD standard deviation; WHO World Health Organization; Bold <0.05.

observations were made within a context where health authorities had decided to isolate the population, to prohibit visits to hospitalized patients and where the number of hospitalizations and deaths because of coronavirus infection in France was being reported daily. During this period, our hospital's medical and surgical units were reorganized, and the staff mobilized to receive the influx of patients infected by the coronavirus. Also, during this period, psychologists at our institution were brought in on request by patients and/or the doctors working within the COVID-19 units.

We investigated the prevalence of PTSD 6 months after COVID-19 admissions during a lung consultation. We reported a low rate of PTSD (n=2, 5%) with no difference between the ICU and non-ICU groups. The mean PCL-5 score was low, but most patients presented mild to moderate symptoms as defined by the PCL-5 assessment tool. We also recorded self-reports of other psychological disorders (n=5) that lead to psychological care.

Psychological symptoms such as anxiety, depression or PTSD are common in survivors of infectious disease epidemics. Earlier studies examining the prevalence of PTSD during follow-up of COVID-19 patients reported values ranging from 6.5% to 31% at 2, 4, 8 and 12 weeks [23–28]. Data are summarized in Table 2. At 6 months, PTSD screening was very low in our cohort.

To explain this low PTSD rate, we formulated several hypotheses. Firstly, as supposed by McNally et al, "the majority of people exposed to trauma will experience stress reactions that remit within 3 months of the traumatic event" [29]. However, PTSD recovery can be longer, with a median time to remit from 36 to 64 months, and one-third have a chronic disorder. Secondly, during the first wave, psychological supports were provided to COVID-19 patients on patients' and physicians' requests. Thirdly, a psychological assessment is mandatory in respiratory rehabilitation departments, and a follow-up is organized if necessary. This strategy, discussed in earlier studies, may contribute to a better recovery [29, 30]. Unfortunately, we cannot prove this theory because data on the number of patients who received support during their hospitalization and rehabilitation were not collected.

Moreover, we did not analyse the PTSD risk factors, such as the severity of stress during hospitalizations [29, 31]. A 6-month delay between COVID-19 and PCL-5 scoring may also explain this low rate, compared with the other references in Table 2. Finally, individual trajectories and resilience are difficult to predict. Regarding a 4-year SARS follow-up study, the PTSD trajectories differed during the follow-up period. In fact, PTSD could persist over time, disappear or reoccur. Some recurrences of PTSD are described [19].

The follow-up served to identify psychological challenges such as PTSD and helped to route patients to psychological supports. PTSD must be screened not only at the onset of the trauma, but also at later time points. This procedure has been termed "triage" [32] or "screen and treat" [33]. Physicians must pay attention to the existence of symptoms of PTSD and their severity when patients are hospitalized for COVID-19. They should also follow symptoms at times after the event and consider screening for PTSD if "symptoms do not fail to subside

FIGURE 1

Individual global Post-Traumatic Stress Checklist (PCL-5) scores PCL-5 scores and PCL-5 cluster scores. Coronavirus disease 19 (COVID-19) survivors with positive or possible SPTD: patients #2 (ICU group) and #38 (non-ICU group). COVID-19 survivors already followed for PTSD: patients #30 and #35 (non-ICU group)

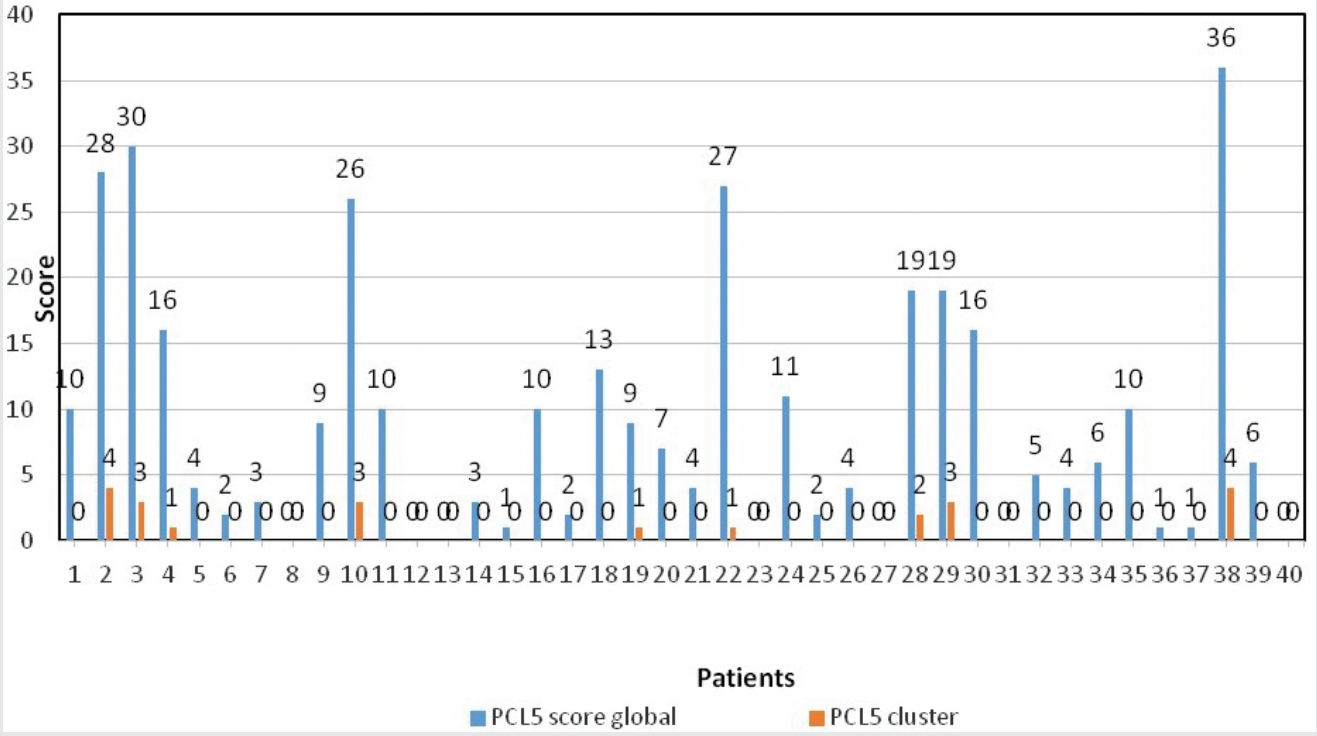


TABLE 2
Summary of studies that investigated post-traumatic stress disorder prevalence in patients post-COVID-19 hospitalizations

References	Subjects (*n*=)	Time of follow-up assessment (post infection) (weeks)	PTSD scale	Prevalence (%)
Cai 2020 (23)	126	2	PTSD-SS	31
De Lorenzo 2020 (24)	185	4	IES-R	22
Mazza 2020 (25)	402	4	PCL-5	15
			IES-R	28
Horn 2020 (26)	138	4	PCL-5	6.5
Park 2020 (27)	10	4	IES-R-K	10
Chang 2020 (28)	64	8	PCL-5	20
Current study	40	24	PCL-5	5

IES-R impact of event scale-revised; IES-R-K impact of event scale-revised Korean version; *n* size of the population; PCL-5 post-traumatic stress disorder checklist; PTSD-SS post-traumatic stress disorder self-rating scale.

naturally by about 4 to 6 weeks post-trauma" [33] and if depression appears [34]. Repeated PTSD screening is recommended because of the delayed onset of chronic PTSD symptoms [35]. The "SARS 4-year follow-up study" supports this recommendation [19]. To help physicians, several instruments, such as PCL-5, exist to screen for psychological disorders [36].

Limitations

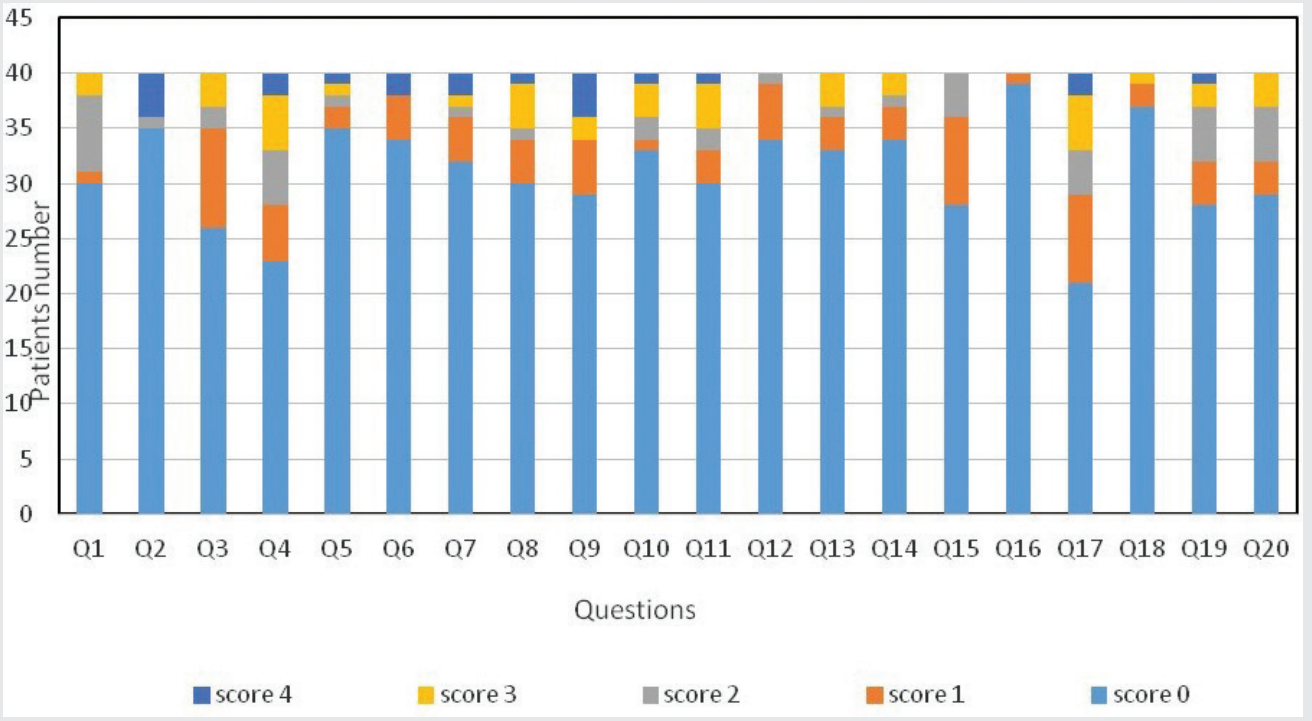
Our study has several limitations: 1) Our sample population is small, so the study lacks statistical power. 2) The study is single-centred, which may affect generalizability [37]. COVID-19-related human resource challenges prevented us from recruiting patients from other institutions. 3) There is a risk of selection bias linked to our patient selection protocol, which could underestimate the number of patients hospitalized and having benefited from at least a 2-L/min oxygen therapy. 4) Patients were not screened for acute stress during their hospitalization for COVID-19.

CONCLUSION

Screening for PTSD should be considered in the aftermath of acute stress. Our study found a low prevalence of PTSD, measured at 6 months post-discharge. However, because of the study's limitations, these findings should be interpreted with caution. Hospitalized COVID-19 patients may be at risk for acute stress and PTSD. The PCL-5 questionnaire can be used to screen for this disorder.

FIGURE 2

Scores distribution for each Post-Traumatic Stress Checklist-5 question. "not at all= score 0", "a little bit= score 1", "moderately= score 2", "quite a bite= score 3" and "extremely= score 4"



DISCLOSURES

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Competing interests
The authors have no conflicts of interest to declare.

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Contributors
GR takes responsibility for the content of the manuscript, including the data and analysis. GB contributed substantially to the study design, data analysis and interpretation, and the writing of the manuscript. SC, CD, PB, LL, CR, AD, JS, MJ, VP and HC contributed to the inclusion of the patients and the reading of the manuscript. SB contributed to the care of the patients. MB contributed to the reading of the manuscript.

Ethical statement
Every patient gave his/her written consent. The study was authorized by French Comité de Protection des Personnes (N° ID-RCB: **2020-A01577-32**).

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