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Original article

Clinical characteristics and outcome of hospitalized patients with SARS-CoV-2 infection at Toulouse University hospital (France). Results from the Covid-clinic-Toul cohort

Caractéristiques cliniques et évolution des patients hospitalisés pour une infection au SARS-CoV-2 au CHU de Toulouse. Résultats de la cohorte Covid-clinic-Toul

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ABSTRACT

Background. – Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection has spread worldwide from epicenter of Wuhan, China since December 2019. The aim of our study was to describe the clinical characteristics and outcome of hospitalized patients with SARS-CoV-2 pneumonia at the Toulouse university hospital, France.
Patients and methods. – We selected the patients included from March 7, 2020 to April 20, 2020 in the retrolective Covid-clinic-Toul cohort that follows all hospitalized patients with SARS-CoV-2 infection at the Toulouse Hospital. Cases were confirmed by real-time reverse transcriptase polymerase chain reaction. We report demographics, clinical, biological and radiological features, as well as unfavorable outcome at Day 14 after admission (admission in an intensive care unit, mechanical ventilation, death).
Results. – Among 263 hospitalized patients, the median age was 65 years and 155 (58.9%) were males. Two hundred and twenty-seven patients (86.3%) had at least one comorbidity. The median time from first symptom to hospital admission was 7.0 days (interquartile range: 4–10). On day 14 after admission, 111 patients (42.2%) had been transferred to intensive care unit (ICU), including 50 (19.0%) on Day 1; 61 (23.1%) needed mechanical ventilation and 19 patients (7.2%) had died. Patients admitted to ICU at Day 1 of admission ($n = 50$) were more frequently men (66.0% vs 57.3%), smokers (25.0% vs 7.1%), with obesity (42.0% vs 24.7%) and had a higher mean level of C-reactive protein (median: 110.9 mg/L vs 46.2 mg/L).
Conclusion. – This cohort provides epidemiological data on SARS-CoV-2 in hospitalized patients in a University hospital in the South of France.

Mots clés :
COVID-19
SARS-CoV-2
Épidémiologie

RÉSUMÉ

Introduction. – L'infection à SARS-CoV-2 s'est répandue dans le monde entier à partir du foyer de Wuhan depuis décembre 2019. Le but de notre étude était de décrire l'épidémiologie des patients hospitalisés pour une infection à SARS-CoV-2 au CHU de Toulouse.

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Méthodes. – La population était l'ensemble des patients inclus du 7 mars 2020 au 20 avril 2020 dans la cohorte rétrolective Covid-clinic-Toul qui suit l'ensemble des patients hospitalisés pour une infection à SARS-CoV-2 au CHU de Toulouse. Les cas étaient confirmés par *reverse transcriptase polymerase chain reaction* et leurs données démographiques, cliniques, biologiques et radiologiques étaient analysées. La survenue à j14 de l'admission d'un transfert en unité de soins intensifs ou réanimation, le besoin de ventilation mécanique et les décès ont été décrits.
Résultats. – Parmi les 263 patients de l'étude, l'âge médian était de 65 ans, et 155 patients (58,9 %) étaient des hommes. Deux cent vingt-sept patients (86,3 %) avaient au moins une comorbidité. Le délai médian entre le premier symptôme et l'admission était de 7,0 jours (Q1 : 4 ; Q3 : 10). À j14 de l'admission, 111 patients (42,2 %) avaient été transférés en service de soins intensifs ou réanimation, dont 50 (19,0 %) à j1 ; 61 (23,1 %) avaient eu besoin de ventilation mécanique et 19 patients (7,2 %) étaient décédés. Les patients admis en soins intensifs ou réanimation à j1 de l'admission ($n = 50$) étaient plus fréquemment des hommes (66,0 % vs 57,3 %), fumeurs (25,0 % vs 7,1 %), obèses (42,0 % vs 24,7 %) et avec une proteine C-réactive plus élevée (médiane : 110,9 mg/L vs 46,2 mg/L).
Conclusion. – Cette cohorte permet de décrire l'épidémiologie de l'infection à SARS-CoV-2 des patients hospitalisés au sein d'un centre hospitalier universitaire du sud de la France.

1. Introduction

The Coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has been first reported in Wuhan, China, in December 2019 [1,2]. It has subsequently spread to other provinces of China and then worldwide. The World Health Organization declared COVID-19 outbreak a pandemic on March 11, 2020. SARS-CoV-2 causes viral pneumonia that can lead to severe acute respiratory distress syndrome (ARDS) and even death. Previous studies have reported the clinical, biological and radiological characteristics of the first infected patients in Wuhan area [3–5], and other authors have compared the epidemiological and clinical features of patients with COVID-19 in Wuhan and other regions in China [6–8]. Especially, disease evolution and risk factors of complications, essentially ARDS, have been described in this population [9,10]. Due to a lack of consensual hospitalization criteria, data about hospitalized patients are heterogeneous. To date, clinical characteristics and outcomes of patients outside China have been reported mostly in Asia, Italy and in the Unites States of America, and mostly for patients admitted to intensive care units (ICU) [11–18]. Descriptive data about clinical presentation, comorbidities, treatment, and outcomes of hospitalized patients in France are lacking [19]. Moreover, prognosis factors specific to European hospitalized patients must be identified. Therefore, we developed the Covid-clinic-Toul cohort, recording data about all patients hospitalized for a SARS-CoV-2 infection at the Toulouse University hospital, South of France (2800 beds, unique tertiary hospital covering an area of about 3 million inhabitants).

The aim of this study was to describe demographics, clinical, biological and radiological features, as well as outcome at Day 14 after admission (admission in an intensive care unit, mechanical ventilation, death) in patients included in the Covid-clinic-Toul cohort until April 20, 2020.

2. Methods

2.1. Study design and participants

The Covid-clinic-Toul cohort records data about all patients hospitalized for SARS-CoV-2 at the Toulouse University hospital. First patients (from March 7 to April 1) were included retrospectively and data from subsequent patients hospitalized after April 1 were collected prospectively. All the patients primarily admitted at the Toulouse University hospital (not transferred from another hospital) were included. Exclusion criteria was the opposition to data collection. All patients, or their representatives for those not able to understand the purpose of the study, were informed by a letter given at admission to hospital and/or sent to their place of residency. This cohort has been approved by institutional review board (n° RnIPH 2020-31), in accordance with the French data protection authority (MR004, Commission nationale de l'informatique et des libertés, CNIL).

In the present study, we selected the patients included in the Covid-Clinic-Toul up to April 20, 2020 and with a SARS-CoV-2 infection proven by reverse transcriptase polymerase chain reaction (RT-PCR). All patients enrolled in this cohort were diagnosed according to interim guidance of theWorld Health Organization [20].

2.2. Data collection

We collected demographics, clinical, laboratory, radiological (description of chest computed tomography [CT] scans), and treatment data within the first 24 hours after admission, as well as outcome at Day 14 after admission (see below). Data were extracted from electronic medical records and recorded in an electronic data collection form.

The date of disease onset was defined by the day on which the first symptom was noticed. Duration of symptoms was defined by the time between first symptoms and admission at the hospital. Chest-CT scans were classified as mild, moderate, severe, or critical by the extent of lung lesions, according to the severity score of the French Society of Radiology that assesses the extent of lesions [21].

2.3. Outcome on Day 14 after admission

The primary outcome was composite, including admission to ICU, need of mechanical ventilation and death occurring during the 14 days after admission to the hospital.

2.4. Statistical analysis

We described the characteristics of the whole population, and then by two categories of subgroups: first, the patients admitted to ICU at Day 1 of admission to the hospital versus others; then, among the patients not admitted to ICU at Day 1, those with occurrence of the composite outcome versus others. Continuous variables were expressed as mean and standard deviation (SD) or

median and interquartile range (IQR) depending on their distribution. Categorical variables were presented as numbers of patients and percentages. We described, using Kaplan-Meier curves, the occurrence of the composite outcome and of death within the 14 days after admission in the subgroup of patients not admitted to ICU at Day 1, as well as the occurrence of death within the 14 days after admission in the whole population.

3. Results

3.1. Patient characteristics (whole population)

A total of 263 patients were included in this study. Data are summarized in Table 1. The median age was 65 years (IQR: 54–76), and 155 patients (58.9%) were male. Among these, 227 (86.3%) had one or more chronic medical illness. Overweight (36.1%), obesity (28.3%), hypertension (39.5%), chronic pulmonary disease (21.6%) and diabetes (19.8%) were the most common coexisting medical conditions. Immunosuppression was found in 9.1% of the patients. Only one patient had infection by the human immunodeficiency virus (HIV), with normal lymphocyte count. Thirty-one (11.8%) patients were exposed to angiotensin converting enzyme inhibitors (ACEis), 45 (17.1%) to angiotensin receptor blockers (ARBs), 19 (7.2%) to corticosteroids and 6 (2.3%) to non-steroidal anti-inflammatory drugs (NSAIDs).

The median duration of symptoms at admission was 7.0 days (IQR: 4.0–10.0). On admission, most patients had experienced cough (74.3%) and presented with fine crackles at pulmonary auscultation (62.9%). Less frequent symptoms were diarrhea (35.5%), anosmia (31.0%), dysgeusia (39.8%) and confusion (8.2%).

On admission, patients had moderate lymphopenia (median: 0.9×10^9/L, IQR: 0.7–1.3) and moderate elevation of C-reactive protein (median: 52.4 mg/L, IQR: 27.0–107.6). Platelet count was normal in most patients.

Most patients (96.2%) had a chest CT-scan at admission, with a "moderate" and "severe" score in 139 (54.9%) and 64 (25.3%) patients, respectively.

Thirty-three patients (12.5%) had received hydroxychloroquine, 9 (3.4%) lopinavir/ritonavir and only one patient (1.9%) remdesivir within the first 24 hours after admission. Most patients (62.7%) were given antibiotic treatment, mostly cephalosporins, amoxicillin/clavulanic acid and macrolides.

3.2. Outcome

Of the 263 patients, 111 (42.2%) were admitted to ICU because of the development of organ dysfunction, ARDS or need of oxygen therapy $\geq$ 5 L/minute during the 14 first days of hospitalization. The median time from onset of symptoms to ICU admission was 8.0 days (IQR: 5.0–11.0). Mechanical ventilation was required in 61 patients (23.2%).

Nineteen patients (7.2%) had died within the 14 days after admission, including 7 in ICU. Characteristics of these 19 patients are presented in Table 2. All of them were aged > 65 years and had one or more chronic medical illness, except one patient who was 49 year-old with no other comorbidity than obesity and died of thrombo-embolic complication, sepsis and ARDS. Limitation of life-sustaining treatment was made in 14 patients (73.7%). Causes of death was ARDS for all the patients, plus pulmonary embolism ($n = 3$), acute heart failure ($n = 4$) and sepsis ($n = 3$).

Occurrence over time of death in the whole population, as well as occurrence of death and of the composite outcome in patients not admitted to ICU at Day 1 are presented in Figs. 1–3.

3.3. Patient characteristics in the subgroup of patients admitted to the ICU at Day 1 versus others

On admission, 213 patients (81.0%) were admitted to general wards and 50 patients (19.0%) were admitted to the ICU at Day 1. In the subgroup of those admitted to the ICU, patients were more frequently men (66.0% vs 57.3%) and smokers (25.0% vs 7.1%). Except for obesity (42.0% vs 24.7%), there was no other predominance in comorbidities. They were not more frequently exposed to ACEis, corticosteroids or NSAIDs but were more frequently exposed to ARBs (24.0% vs 15.5%). Clinical features and time from first symptoms to admission were similar. Laboratory results showed higher serum concentrations of ferritin (median: 1570 μg/L vs 863 μg/L), C-reactive protein (median: 110.9 mg/L vs 46.2 mg/L) and higher levels of troponin (51.7% with troponin > 14 ng/L vs 33.3%) in patients hospitalized in the ICU at Day 1. Chest CT-scan results werecorrelated with clinical severity in these patients (49.0% and 10.2% of "severe" and "critical" CT-scans in ICU patients vs 19.6% and 0.5%, respectively). Most of these patients (96.0%) received an antibacterial therapy during the first day of hospitalization and 38.0% received hydroxychloroquine.

3.4. Characteristics in the subgroup of patients not admitted to the ICU at Day 1, according to the outcome at Day 14

On Day 14, among the 213 patients who were initially hospitalized in regular medical wards, 72 patients (33.8%) had an unfavorable outcome, and 15 died. These patients, being compared with those who were still alive without ICU admission on day 14, were more frequently men (68.1% vs 51.8%) with a history of hypertension (51.4% vs 34.0%) or diabetes (26.4% vs 15.6%). They were more frequently exposed to ARBs (20.8% vs 12.8%). Anosmia and dysgeusia were less frequently reported in patients with unfavorable outcome (18.2% and 19.0% vs 35.3% and 50.0% respectively). These patients were given more frequently antibiotic and hydroxychloroquine treatments during the first 24 hours after admission (76.4% and 12.5% vs 44.0% and 3.5%, respectively).

4. Discussion

We report here a case series of 263 hospitalized patients with laboratory-confirmed SARS-CoV-2 infection. One hundred and eleven patients (42.2%) needed ICU and nineteen patients died (7.2%) within 2 weeks after their admission.

The median age of this cohort (65 years, IQR 54–76) is higher than in the three largest cohorts from China (median ages between 47 and 56 years). We also observed a higher prevalence of comorbidities [8–10]. Among hospitalized patients with COVID-19 in China, the percentage of patients who required ICU care ranged from 5 to 32% [8], less than in our cohort which included both "critical care unit" and "intensive care unit" patients. Compared to national epidemiological data, median age of the patients included in the Covid-Clinic-Toul cohort was slightly higher (65 years versus 61.5 years). However, characteristics of the ICU-hospitalized patients were consistent with national data with a male predominance and high prevalence of chronic medical illnesses [22]. Mortality rate among hospitalized patients ranged from 0 to 11% in the first reports [4,5,11]. Mortality rate in our study may have been underestimated due to an initially broad hospitalization criteria. Moreover, we censored the follow-up at Day 14 after admission. All patients who died had comorbidities and most of them were aged over 65 years. Causes of death were ARDS for all the patients. We also observed pulmonary embolism in 15.8% of the deceased patients, in accordance with previous reports [23].

Table 1
Characteristics of the 263 patients hospitalized for a SARS-CoV-2 infection proven by RT-PCR included in the Covid-Clinic-Toul cohort until April 20, 2020.

Variables	All patients (*n* = 263)	Patients admitted to the ICU at Day 1 of hospitalization		Among the patients not admitted to the ICU at D1 of hospitalization (*n* = 213)	
		Yes (*n* = 50; 19.0%)	No (*n* = 213; 81.0%)	Admission to ICU, mechanical ventilation or death at Day 14 (*n* = 72; 33.8%)	No admission to ICU, mechanical ventilation or death at Day 14 (*n* = 141; 66.2%)
Age, median (IQR), years	65 (54–76)	67 (56–73)	64 (53–76)	69 (60–79)	63 (50–74)
Men, *n* (%)	155 (58.9)	33 (66.0)	122 (57.3)	49 (68.1)	73 (51.8)
Comorbidities					
≥ 1 comorbidity, *n* (%)	227 (86.3)	42 (84.0)	185 (86.9)	67 (93.1)	118 (83.7)
Overweight (BMI: 25–30 kg/m^2), *n* (%)	88/244 (36.1)	14/50 (28)	74/194 (38.1)	29/68 (42.7)	45/126 (35.7)
Obesity (BMI > 30 kg/m^2), *n* (%)	69/244 (28.3)	21/50 (42.0)	48/194 (24.7)	19/68 (27.9)	29/126 (23.0)
Hypertension, *n* (%)	104 (39.5)	19 (38.0)	85 (39.9)	37 (51.4)	48 (34.0)
Diabetes, *n* (%)	52 (19.8)	11 (22.0)	41 (19.2)	19 (26.4)	22 (15.6)
Cardiovascular disease, *n* (%)	35 (13.3)	6 (12.0)	29 (13.6)	13 (18.1)	16 (11.3)
Cerebrovascular disease, *n* (%)	17 (6.5)	2 (4.0)	15 (7.0)	6 (8.3)	9 (6.4)
Chronic lung disease, *n* (%)	57 (21.6)	11 (22.0)	46 (21.6)	19 (26.4)	27 (19.1)
Chronic kidney disease, *n* (%)	24 (9.1)	3 (6.0)	21 (9.8)	9 (12.5)	12 (8.5)
Chronic liver disease, *n* (%)	2 (0.8)	0 (0)	2 (0.9)	2 (2.7)	0 (0)
Malignancy < 5 years, *n* (%)	27 (10.3)	5 (10.0)	22 (10.3)	10 (13.9)	12 (8.5)
Immunosuppression, *n* (%)	24 (9.1)	4 (8.0)	20 (9.4)	10 (13.9)	10 (7.1)
Current smokers, *n* (%)[a]	11/115 (9.3)	4/16 (25.0)	7/99 (7.1)	3/35 (8.6)	4/64 (6.3)
Exposure to selected drugs					
NSAIDs, *n* (%)	6 (2.3)	1 (2.0)	5 (2.3)	1 (1.4)	4 (2.8)
Corticosteroids, *n* (%)	19 (7.2)	3 (6.0)	16 (7.5)	8 (11.1)	8 (5.7)
ACE inhibitors, *n* (%)	31 (11.8)	4 (8.0)	27 (12.7)	11 (15.3)	16 (11.3)
ARBs, *n* (%)	45 (17.1)	12 (24.0)	33 (15.5)	15 (20.8)	18 (12.8)
Signs and symptoms					
Cough, *n* (%)	179/241 (74.3)	30/41 (73.2)	149/200 (74.5)	45/62 (72.6)	104/138 (75.4)
Crackling, *n* (%)	156/248 (62.9)	33/44 (75.0)	123/204 (60.3)	44/69 (63.8)	79/135 (58.5)
Confusion, *n* (%)	21/255 (8.2)	3/45 (6.7)	18/210 (8.6)	6/70 (8.6)	12/140 (8.6)
Diarrhea, *n* (%)	83/234 (35.5)	14/37 (37.8)	69/197 (35.0)	19/65 (29.2)	50/132 (37.9)
Anosmia, *n* (%)	27/87 (31.0)	5/14 (35.7)	22/73 (30.1)	4/22 (18.2)	18/51 (35.3)
Dysgeusia, *n* (%)	33/83 (39.8)	5/14 (35.7)	28/69 (40.6)	4/21 (19.0)	24/48 (50.0)
Time from first symptoms to admission[a], median (IQR), days	7 (4 –10)	8 (6 –11)	7 (4 –10)	7 (4–8)	7 (4–10)
Vital signs at admission[a]					
Temperature, median (IQR), Celsius degrees	37.8 (37.0–38.5)	37.8 (37.1–38.5)	37.8 (37.0–38.5)	38.0 (37.2–38.8)	37.6 (37.0–38.3)
Heart rate, median (IQR), by minute	90 (77–100)	90 (80–100)	90 (76–101)	90 (81–100)	88 (75–101)
Respiratory rate, median (IQR), by minute	22 (19–17)	25 (20–30)	22 (18–26)	24 (19–28)	22 (18–25)
Systolic arterial pressure, median (IQR), mmHg	130 (120–140)	128 (120–135)	130 (119–140)	130 (119–140)	130 (119–140)
Diastolic arterial pressure, median (IQR), mmHg	76 (67–85)	78 (70–81)	76 (67–86)	74 (62–87)	77 (70–85)
Oxygen saturation ≤ 92% (without oxygen therapy), *n* (%)	58/202 (28.7)	19/22 (86.4)	39/180 (21.6)	22/56 (39.3)	17/124 (13.7)
With oxygen therapy before admission, *n* (%)	59/261 (22.6)	28/49 (57.1)	31/212 (14.6)	15/71 (21.1)	16/140 (11.4)
Laboratory findings at admission[a]					
Lymphocyte count, median (IQR), × 10^9/L	0.9 (0.7–1.3)	0.8 (0.7–1.1)	1.0 (0.7–1.3)	0.8 (0.6–1.1)	1.1 (0.8–1.5)
Platelet count, median (IQR), × 10^9/L	186 (150–233)	184 (140–233)	186 (154–236)	175 (134–211)	192 (160–244)
C-reactive protein level, median (IQR), mg/L	52.4 (27.0–107.6)	110.9 (50.3–220.5)	46.2 (22.0–88.8)	73.7 (30.5–107.9)	39.5 (19.3–74.3)
Creatinine level, median (IQR), µmol/L	80 (66–97)	80.0 (67.0–112.0)	79 (65–95)	86 (73–109)	76 (63–92)
Serum ferritin, median (IQR), µg/L	972 (399–1820)	1570 (792–2484)	863 (305–1622)	1326 (594–1986)	661 (280–1622)
D-dimers, median (IQR), µg/L	780 (555–1300)	1200 (1040–2870)	740 (540–1170)	765 (670–1790)	710 (460–1170)
Troponin > 14 ng/L, *n* (%)	43/113 (38.1)	15/29 (51.7)	28/84 (33.3)	15/31 (48.4)	13/53 (24.5)
Lactate dehydrogenase (UI/L), median (IQR)	332 (258–428)	389 (338–590)	295 (236–351)	308 (252–635)	285 (228–336)
Chest CT scan at admission	253 (96.2)	49 (98.0)	204 (95.8)	71 (98.6)	133 (94.3)
Chest CT scan severity score					
No typical sign of COVID-19, *n* (%)	10 (4.0)	2 (4.1)	8 (3.9)	2 (2.8)	6 (4.5)
Mild, *n* (%)	34 (13.4)	1 (2.0)	33 (16.2)	12 (16.9)	21 (15.8)
Moderate, *n* (%)	139 (54.9)	17 (34.7)	122 (59.8)	29 (40.8)	93 (69.9)
Severe, *n* (%)	64 (25.3)	24 (49.0)	40 (19.6)	27 (38.0)	13 (9.8)
Critical, *n* (%)	6 (2.4)	5 (10.2)	1 (0.5)	1 (1.4)	0 (0)
Treatment administered during the first 24 hours after admission					
Oxygen therapy, *n* (%)	212 (80.6)	50 (100)	162 (76.1)	66 (91.7)	96 (68.1)
Antibiotics, *n* (%)	165 (62.7)	48 (96.0)	117 (54.9)	55 (76.4)	62 (44.0)
Hydroxychloroquine, *n* (%)	33 (12.5)	19 (38.0)	14 (6.6)	9 (12.5)	5 (3.5)
Lopinavir/ritonavir, *n* (%)	9 (3.4)	5 (10.0)	4 (1.9)	4 (5.6)	0 (0)
Remdesivir	1 (1.9)	1 (2.0)	0 (0)	0 (0)	0 (0)
Detailed outcomes at Day 14 after admission					
Admission to ICU, *n* (%)	111 (42.2)	50 (100)	61 (28.6)	61 (84.7)	–
Mechanical ventilation, *n* (%)	61 (23.2)	29 (58.0)	32 (15.0)	32 (45.7)	–
Death, *n* (%)	19 (7.2)	4 (8.0)	15 (7.0)	15 (20.8)	–
Discharged, *n* (%)	173 (65.8)	21 (42.0)	152 (71.4)	32 (44.4)	120 (85.1)

ACE: angiotensin converting enzyme; ARBs: angiotensin receptor blockers; BMI: body mass index; CT: computed tomography; ICU: intensive care unit; IQR: interquartile range; NSAIDs: non-steroidal anti-inflammatory drugs; RT-PCR: reverse transcriptase polymerase chain reaction.

[a] Missing values: current smoker, *n* = 148; time from first symptoms to admission, *n* = 2; temperature, *n* = 7; heart rate, *n* = 7; respiratory rate, *n* = 12; arterial pressure, systolic/diastolic, *n* = 6; oxygen saturation, *n* = 2; lymphocyte count, *n* = 35; platelet count, *n* = 10; C-reactive protein, *n* = 9; creatinine level, *n* = 6; serum ferritin, *n* = 200; D-dimers, *n* = 227; troponin, *n* = 150, lactate dehydrogenase, *n* = 213.

Table 2
Characteristics of the patients included in the Covid-Clinic-Toul cohort until April 20, 2020 who died within the first 14 days of hospitalization.

Patient	Age	Sex	Comorbidities	Time from first symptom to hospital admission	At hospital admission			Limitation of life-sustaining treatments	ICU	Mechanical ventilation	Time from hospital admission to death	Cause of death
					Respiratory parameters	Biological findings[a]	Chest CT-scan severity score					
#1	81	Male	Arterial hypertension, coronary disease, cerebrovascular disease, diabetes, immunosuppression (giant cell arteritis treated by corticosteroids)	4	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Severe	Yes	No	No	5	ARDS
#2	90	Male	Arterial hypertension, heart failure, coronary disease, current smoker	7	Need for oxygen, respiratory rate ≥ 22/min	Thrombocytopenia, C-reactive protein ≥ 50 mg/L	Severe	Yes	No	No	6	ARDS
#3	77	Male	Glioblastoma, immunosuppression (chemotherapy, corticosteroids)	4	–	Lymphopenia	Moderate	Yes	No	No	8	ARDS
#4	85	Female	Obesity, arterial hypertension, chronic lung disease (dermatomyositis, pulmonary fibrosis), cancer < 5 years, immunosuppression (corticosteroids)	7	Need for oxygen	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Severe	Yes	No	No	3	ARDS
#5	87	Male	Arterial hypertension, cerebrovascular disease	3	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	Lymphopenia, C-reactive protein ≥ 50 mg/L	Severe	Yes	Yes	No	3	ARDS
#6	49	Male	Obesity	8	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Moderate	No	Yes	Yes	9	ARDS, pulmonary embolism, sepsis
#7	79	Female	Overweight, arterial hypertension, multiple myeloma, immunosuppression (chemotherapy)	3	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Moderate	No	Yes	Yes	8	ARDS
#8	89	Male	Arterial hypertension, COPD, chronic kidney disease	3	Respiratory rate ≥ 22/min	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Moderate	Yes	No	No	9	ARDS, acute heart failure
#9	83	Female	Obesity, arterial hypertension, heart failure, coronary disease, sleep apnea, chronic kidney disease, diabetes, giant cell arteritis, immunosuppression (corticosteroids)	4	Need for oxygen	Lymphopenia, C-reactive protein ≥ 50 mg/L	Moderate	Yes	Yes	No	3	ARDS, sepsis

Table 2 (*Continued*)

Patient	Age	Sex	Comorbidities	Time from first symptom to hospital admission	At hospital admission			Limitation of life-sustaining treatments	ICU	Mechanical ventilation	Time from hospital admission to death	Cause of death
					Respiratory parameters	Biological findings[a]	Chest CT-scan severity score					
#10	93	Male	Obesity, arterial hypertension, heart failure, sleep apnea, chronic respiratory disease	1	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	–	Moderate	Yes	No	No	7	ARDS, acute heart failure
#11	85	Male	Overweight, arterial hypertension, coronary disease	8	–	Lymphopenia, C-reactive protein ≥ 50 mg/L	Mild	No	Yes	Yes	8	ARDS
#12	67	Male	Arterial hypertension	2	Need for oxygen	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	No typical sign	No	Yes	Yes	5	ARDS
#13	92	Female	Cerebrovascular disease	2	–	Lymphopenia	No typical sign	Yes	No	No	11	ARDS, sepsis, acute heart failure
#14	92	Female	Overweight, heart failure, cerebrovascular disease, pulmonary arterial hypertension, chronic kidney disease	7	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	Thrombocytopenia, C-reactive protein ≥ 50 mg/L	Severe	Yes	No	No	4	ARDS
#15	78	Female	Overweight, arterial hypertension, asthma, pulmonary arterial hypertension	2	$SaO_2 \leq 92\%$, respiratory rate ≥ 22/min	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Moderate	Yes	No	No	4	ARDS, pulmonary embolism
#16	79	Female	Obesity, arterial hypertension, chronic kidney disease, diabetes	1	Need for oxygen	Lymphopenia, thrombocytopenia	–	No	Yes	Yes	9	ARDS
#17	68	Female	Obesity, arterial hypertension, breast cancer, immunosuppression (chemotherapy)	7	Need for oxygen, respiratory rate ≥ 22/min	Lymphopenia, C-reactive protein ≥ 50 mg/L	Moderate	Yes	No	No	5	ARDS, pulmonary embolism, acute heart failure
#18	61	Female	Obesity, arterial hypertension, COPD, sarcoidosis, diabetes, immunosuppression (immunosuppressants)	4	Respiratory rate ≥ 22/min	Lymphopenia	Mild	Yes	No	No	12	ARDS
#19	86	Female	Overweight, arterial hypertension	NA	Respiratory rate ≥ 22/min	Lymphopenia, thrombocytopenia, C-reactive protein ≥ 50 mg/L	Severe	Yes	No	No	8	ARDS

ARDS: acute respiratory distress syndrome; COPD: chronic obstructive pulmonary disease; ICU: intensive care unit; NA: not available.

[a] Lymphopenia was defined by lymphocyte count < 1.5 G/L; thrombocytopenia was defined by platelet count $< 150 \times 10^9$/L.

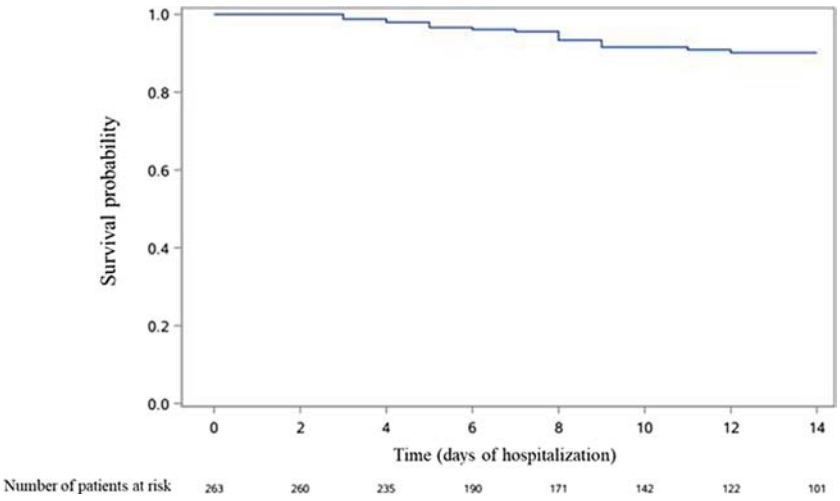

Fig. 1. Occurrence over time of death in the whole population of patients admitted to hospital for COVID-19 ($n = 263$).

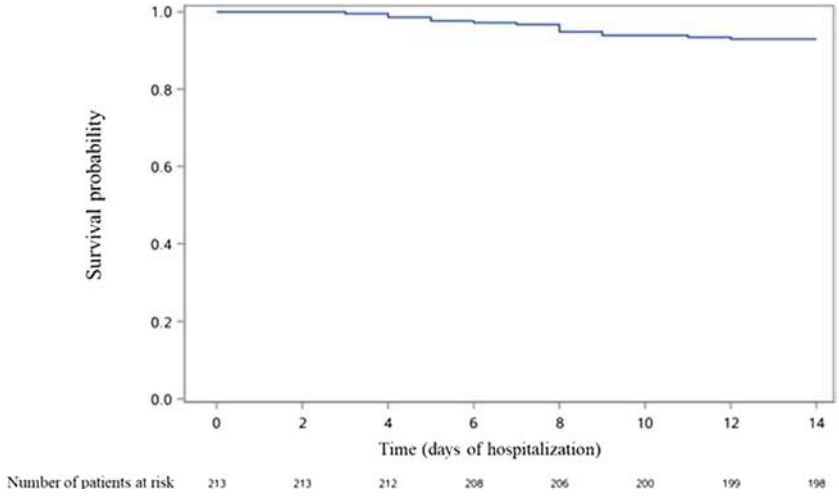

Fig. 2. Occurrence of death in patients not admitted to ICU at Day 1 of admission ($n = 213$).

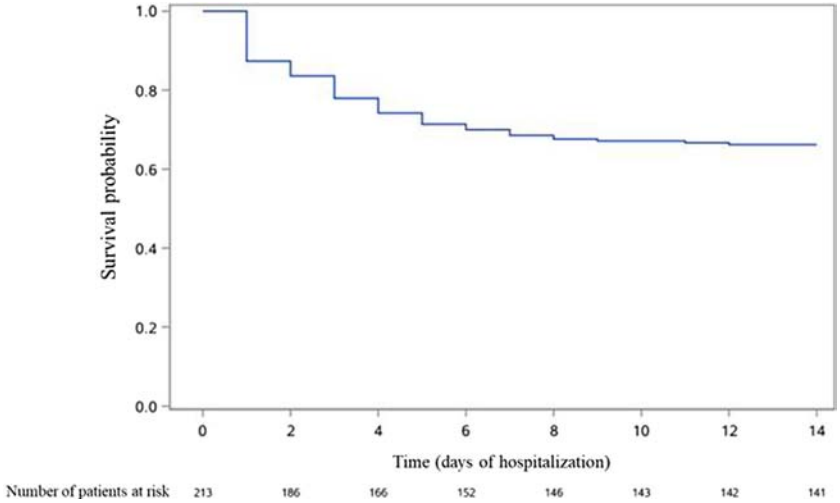

Fig. 3. Occurrence of admission to ICU, need for mechanical ventilation or death in patients not admitted to ICU at Day 1 of admission ($n = 213$).

We observed more smokers and overweight patients among those admitted to the ICU at Day 1, which is concordant with previous studies [24–26]. In our cohort, we observed a predominance of male gender, hypertension, and diabetes in patients with poor outcome within the 14 days after their admission. Grasseli et al. also reported a high prevalence of men and patients with chronic hypertension in their cohort of ICU patients [12]. Zhou et al. and Whu et al. also identified hypertension as a risk factor of ARDS [9,10]. This may

explain the higher proportion of patients exposed to ARBs among those with unfavorable outcome [27,28]. However, we found no difference in proportion of older and other chronic medical illnesses between ICU patients and non-ICU patients. Severe patients had also higher biological inflammatory parameters and troponin levels at admission. Myocardial injury has been described and associated with severity [5,10,24,29].

We did not observe a more frequent outcome occurrence in patients who had taken NSAIDs or corticosteroids before admission, but few patients were exposed. This may be explained by public information before the onset of the epidemic in France.

Anosmia and dysgeusia were less frequently reported in critically ill patients, which is consistent with previous studies reporting these symptoms as associated with mild cases [30]. However, this finding must be taken with caution due to missing data regarding these symptoms.

This study has several limitations. First, only patients with laboratory-confirmed COVID-19 were included; suspected but undiagnosed cases were ruled out, especially those with typical clinical and radiological presentation but with negative RT-PCR (10% of the COVID-19 patients admitted to the emergency department at the Toulouse University hospital; unpublished data). However, chest-CT has higher sensitivity than RT-PCR assay [31,32]. The characteristics of patients with compatible CT-scan and negative RT-PCR need to be further described. Second, some data were missing. In particular, smoking status, anosmia and dysgeusia were not systematically searched in the beginning of the pandemics. Third, the first patients were retrospectively included. Fourth, criteria for admission to ICU may have varied over time during the study period with improved knowledge of the disease by physicians. Lastly, we presented patient characteristics at admission and outcome at Day 14. This is useful for predictive models, but we did not assess in detail what happened between Day 1 and Day 14 (including treatments administered after the first 24 hours following admission [32–41]).

5. Conclusion

This cohort provides data on patients hospitalized for COVID-19 in a University hospital in the south of France, the Toulouse University hospital, and confirms some epidemiological findings: a high frequency of comorbidities in hospitalized patients, a high frequency of male gender and obesity for initial severity; and important rates of admission to ICU, mechanical ventilation, and death.

Collaborators: Covid-Clinic-Toul investigators

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Credit authors statement

A.J., M.L., G.M.B, G.M. and A.S. designed the study. A.J. and M.L. performed data analysis. A.J., M.L., and G.M. wrote the manuscript. All the authors contributed to data acquisition and gave final approval for submission.

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Disclosure of interest

The authors declare that they have no competing interest.

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