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COVID-19 Pandemic in the Maghreb Region: Epidemiological, Clinical, Biological, Radiological and Evolutionary Profile of Patients Hospitalized at Arrazi Hospital, Marrakech University Hospital

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Abstract **Original Research Article**

Introduction: SARS-CoV-2 infection triggers heterogeneous clinical, biological and radiological manifestations, responsible for a global public health crisis and would probably have a different impact on African countries given the demographic structure and the constraints of the health system. ***Aim of the work:*** Analyze the epidemiological, clinical, biological, tomodensitometric and evolutionary characteristics of patients with COVID-19 infection, in order to better understand the Moroccan profile of the patient with Covid-19 and to adapt its care to local contexts. ***Materials and methods***: This is a descriptive and analytical cross-sectional study carried out among patients hospitalized for a SARS-CoV-2 infection confirmed during the period from March 19 to June 30, 2020 at Arrazi hospital, Marrakech CHU. Descriptive statistics were used to summarize demographic, clinical, biological, radiological, therapy, and evolutionary features. Continuous variables were presented as the mean and the standard deviation or the median as appropriate. Categorical variables were presented as a number and a percentage. Results: 102 patients were included, 95.8% of patients were Moroccans, 47 cases had contact with a confirmed case and 48 were indigenous cases. 53.9% were men, with a sex ratio of 1.17, the median age was 43.7 years, the majority of patients were between 33 and 45 years old. The majority of patients were non-smokers in 86.2% of cases, the most observed co-morbidities were arterial hypertension in 10.7%, diabetes in 6.8% and pleuropulmonary tuberculosis in 2.9%. 74.5% of the patients were symptomatic, with an average diagnostic delay of 6 days, the clinical signs were dominated by the triad "asthenia-myalgia-cough" in more than 55% of cases, dyspnea in 35.2%. 17 (16.6%) patients had SaO2 less than 94%, 41% of patients were febrile, 5 patients had hypovolemic shock and 8 were hypertensive, pulmonary auscultation was normal in 88.2% of cases, crackling rales in focus in 10.9% of cases, and an air effusion syndrome in one patient, it was an associated pneumothorax. The confirmatory diagnosis was made by PCR in 96 patients (94.11%) and by clinical and CT criteria in 5.8% of cases. The most frequent laboratory abnormalities were: CRP increased (57.3%), D-dimer increased, lymphopenia (30.7%), leukocytosis (16.6). The most frequent CT lesions were: frosted glass appearance in patches (40%), combination of frosted glass opacities and foci of condensation (36.6%), and nodular frosted glass appearance (3.3%), The most frequent topography was the subpleural region (88%), and the lesions were bilateral in 74% of cases. 95% of patients received the treatment recommended by the Ministry of Health in Morocco based on chloroquine or hydroxychlorochine associated with azithromycin and vitamin therapy. 36, 9% of cases had a negative control PCR on D9 and D10 of treatment, more than 40% of cases required more than 21 days for negativation. The length of hospital stay was on average 17 days (10-40 days). 97% of the patients were declared cured after 2 negative PCRs every day. ***Conclusion:*** Knowledge of the profiles of SARS-COV2 infection will help advance infection control strategies, hence the need to expand these studies.

Key words: Coronavirus, COVID-19, pneumonia, infection, patient profile, North Africa.

INTRODUCTION

In December 2019, an epidemic of pneumonia due to the 2019 novel coronavirus, SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) broke out in Wuhan, Hubei, China [1]. This beta coronavirus causes a sometimes severe respiratory pathology, named COVID-19 by the World Health Organization (WHO). On March 12, 2020, the WHO declared COVID-19 as a pandemic [1-3]. Indeed, after Asia, Europe, the United States and Iran, Africa was initially less affected, but the epidemiological situation changed rapidly and the pandemic spread to almost the entire continent in a very short time, especially in South

Africa, Egypt, Morocco and Algeria [4 The rapid growth of the epidemic in Africa is a major threat to health in the coming months, given the weak public health ecosystem, co-morbidities and the high prevalence of HIV. The experiences gained in Italy, Spain, Iran and China are extremely valuable, nevertheless, the COVID-19 pandemic would have a different impact on African countries, as the demographic structure of the continent and the constraints of the health system are different.

In March 2020, the pulmonology service of the Marrakech CHU received the first cases of Covid 19 patients confirmed at the Marrakech CHU. In this study, we provide an analysis of the data on the epidemiological, clinical, biological, computed tomography and evolutionary characteristics of the patients hospitalized for a confirmed infection with COVID-19 in the University Hospital of Mohammed VI of Marrakech being one of the regions most affected in Morocco, in order to better understand the Moroccan profile of patients with covid-19 disease and to adapt their care to local contexts.

MATERIALS AND METHODS

This is a descriptive cross-sectional study conducted among patients hospitalized for a SARS-CoV-2 infection confirmed during the period from March 19 to May 31, 2020). Epidemiological, clinical, biological, radiological data, type of treatment received, length of hospitalization and progress were collected upon admission of patients and by reviewing medical records.

STATISTICAL ANALYSIS

Descriptive statistics were used to summarize characteristics, baseline demographics, clinical features, laboratory findings on admission, CT lesions, therapies, and developmental aspects. Continuous variables were presented as the mean and standard deviation (SD) or the median as appropriate. Categorical variables were presented as total number and percentage. All analyzes were performed using theEpi Info software.

RESULTS

102 patients who were identified as confirmed infection with COVID-19 were included in this study.

- **Epidemiological data**

95.8% of the patients were of Moroccan nationality, 3% of French and 1 Egyptian patient (Table 1).

Board 1: Distribution of patients according to their nationality.

Table-1

Nationnaly	Frequency	Percent	Cum. Percent
Egyptian	1	1.03%	1.03%
French	3	3.09%	4.12%
Moroccan	93	95.88%	100%

4 patients had the notion of travel to an endemic area, 47 were in contact with a confirmed case and 48 were indigenous cases (Figure 1).

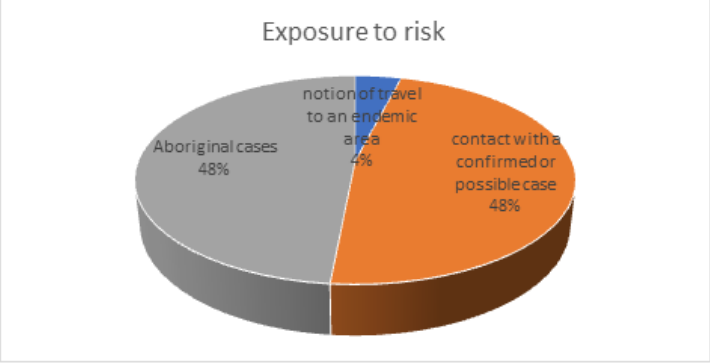

Fig-1: Distribution of patients according to exposure to the risk of contamination

- **Demographics:**
- Among the 102 patients 53.9% were men and 46 were women, with a sex ratio of 1.17 (Table 2).

Board 2: Distribution of patients by sex

Table-2

Sex	Frequency	Percent	Cum. Percent
Women	47	46.07%	46.07%
Men	55	53.92%	100.00%
Total	102	100.00%	100.00%

The 102 patients selected were aged between 10 and 90 years with a median of 43.7 years, the majority of patients were between 33 and 45 years old (Figure 2).

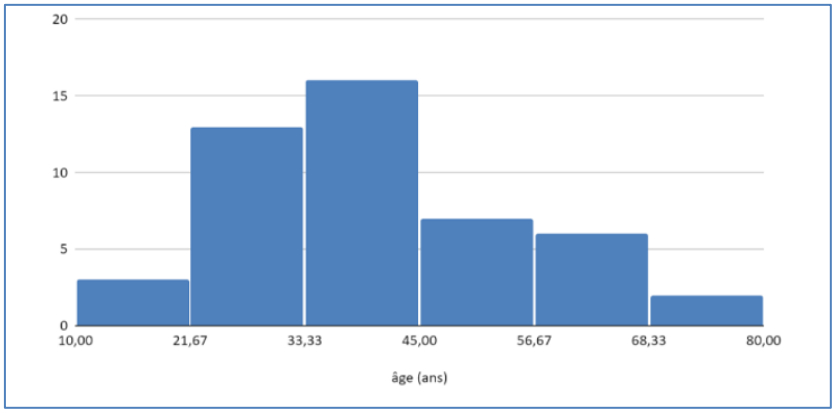

Fig-1: Distribution of patients by age group

- **History and comorbidities**

The majority of patients were 86.2% non-smokers and only 14 were chronic smokers (Table 3).

Board 3 : Distribution of patients according to their exposure to active smoking.

Table-3

Smoking	Frequency	Percent	Cum. Percent
Non-smoking patients	88	86.27%	86.27%
Smoking patients	14	13.73%	100.00%
Total	102	100.00%	100.00%

The most observed comorbidities were arterial hypertension in 10.7%, type II diabetes in 6.8% and pleuropulmonary tuberculosis in 2.9%, respectively (Figure 3).

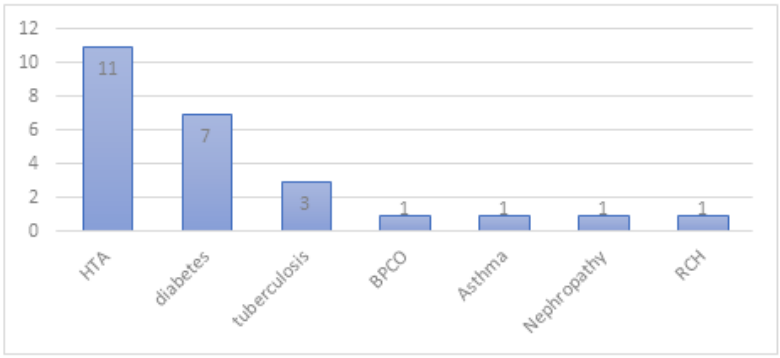

Fig-2: Distribution of patients according to comorbidities

- **Clinical data**:

74.5% of patients were symptomatic, with an average diagnostic delay of 6 days. The clinical signs were dominated by the triad "asthenia-myalgia-cough" in more than 55% of the cases, dyspnea in 35.2%, 25% of the patients were asymptomatic, their diagnoses were made within the framework of the screening in the subjects. contact of a confirmed case (Table 4).

Board 4: Symptoms seen in patients.

Table-4

Symptoms	NOT	Percentage	days
Time to onset of symptoms			6 (2-30)
Dyspnea	36	35.29%	
Dry cough	57	55.88%	
Hemoptysis	8	7.84%	
Chest pain	8	7.84%	
Headache	33	32.35%	
Myalgia	53	51.96%	
Asthenia	58	56.86%	
Chills	27	26.47%	
Anosmia	11	10.78%	
Diarrhea	17	16%	
Epigastralgia:	2	1.96%	
Asymptomatic patients	26	25%	

Admission SaO2 was determined at rest and in room air, the mean was 94% (55-99) and 17 (16.6%) patients had SpO2 less than 94%. 41% of the patients were febrile. The median blood pressure was 130mmgh for systolic and 85mmgh for diastolic, 5 patients had hypovolemic shock and 8 were hypertensive. Pulmonary auscultation was normal in 88.2% of cases, focal crackles in 10.9% of cases, and air effusion syndrome in one patient; it was an associated pneumothorax (Table 5).

Board 5: Data from clinical examination in Covid-19 patients.

Table 5

Settings	NOT		%	Median
T °	<38.3 ° c	60	58.8	6 (2-30)
	≥38.3 ° c	42	41.17	
EN cpm				20 (17-45)
SaO2%	<94 (55-93)	17		83
	≥94	85		
Systolic BP mmHg				130 (80 -160)
Diastolic BP mmHg				70 (50-110)
HR bpm				85 (18-126)
Normal lung auscultation	90		88.23	
Crackling rails	9		10.98	
Fluid effusion syndrome	2		1.96	
Air effusion syndrome	1		0.9	

PCR test: Nasopharyngeal swabs were taken on admission from all patients. The detection of the genomic material of the coronavirus by real-time PCR was objectified in: 96 patients (Figure 4).

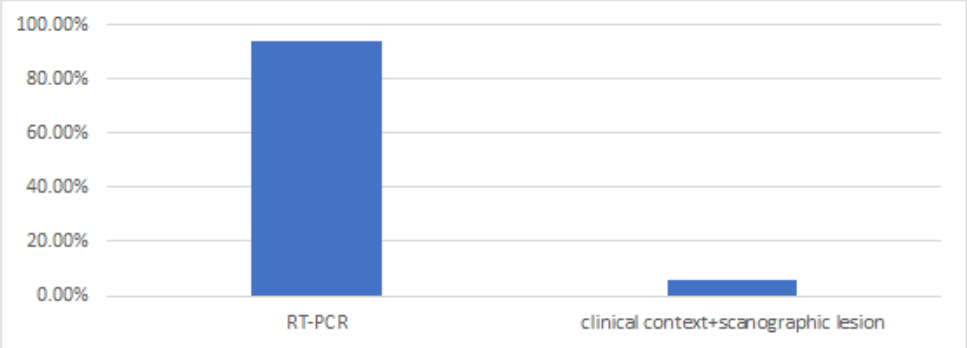

Fig-3: Distribution of patients according to the positive diagnostic method

- **Biological profile**

A blood sample was taken to determine a standard biological assessment comprising the following data: blood count (CBC) [hemoglobin, leukocytes, leukocyte formula, platelets, CRP, renal function (urea (g / l), creatinine blood ionogram, blood level of prothrombin (PT), fibrinogen, D-dimers, troponins and LDH. Analyzes were carried out according to the usual methods of the biology department of Arrazi hospital. The most frequent laboratory abnormalities were as follows: increased CRP (57.3%), D-dimer increased, lymphopenia (30.7%), leukocytosis (16.6). (Board 6 and Table 7).

Board 6: Laboratory parameters of Covid-19 patients

Table-6

Settings	Min	Median	Max
Hg g / dl	7, 5	13	17, 4
Leukocytes elmts / mm3	500	8127	21190
Lymphocytes elmts / mm3	240	2011	6570
PNN elmts / mm3	1420	5483	19060
Platelets elmts / mm3	113000	245000	49000
CRP mg / l	0.3	9	383
Fibrinogen g / l	1.05	3.35	8
D-dimer ng / l	190	395	9000
TP%	46	88.5	100
Ferritin ng / ml	5	307	9204
LDH U / l	98	281	962

Board 7 : Laboratory abnormalities observed.

Table-7

Laboratory abnormalities:	NOT	Percent
Anemia	6	6.98%
Polycythemia	4	4.65%
Hyperleukocytosis	17	16.6%
Lymphopenia	28	30.77%
Thrombocytopenia	10	11.24%
Thrombocytosis	2	2.25%
CRP> 6 mg / l	51	57.30%
CRP> 12 mg / l	41	46.07%
Cytolysis	7	7.53%
Cholestasis	3	3.23%
Cytolysis + cholestasis	4	4.30%
D-dimers> 500 ng / l	18	46.15%

- **Radiological data:**

Thoracic TDM was performed in patients with severe symptomatology, or with a strong suspicion of Covid-19 infection with negative PCR. the four most frequent radiological signs were as follows: appearance of frosted glass in areas (40%), combination of opacities in frosted glass and foci of condensation (36.6%), and appearance in nodular frosted glass (3.3%). The most frequent topography was the subpleural region (88%), and the lesions were bilateral in 74% of cases. Extensive extension was present in 30% of cases and severe in 6.6% of cases (Table 8).

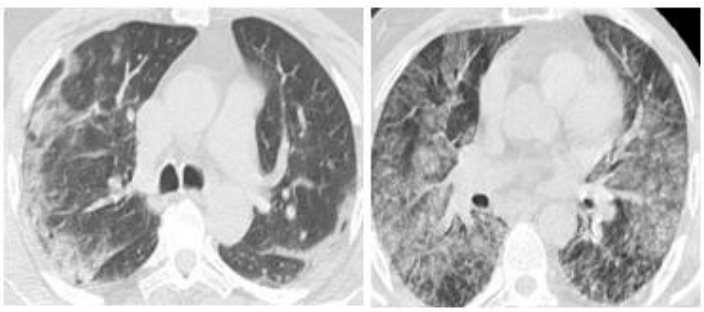

Fig-5: Extensive Impairment 25 To 50% Critical Impairment> 75%

Board 8: Estimation of the extent of CT lesions

Table-8

Estimate	NOT	Percentage
Absent / minimal <10:	10	33.3%
Moderate (10-25%):	8	26.66%
Range (25-50%):	9	30%
Severe (More than 50%):	2	6.66
Critical (Over 75%)	1	3.33

- **Treatments received**

The basic treatment according to the therapeutic protocol recommended by the Ministry of Health in Morocco associated with preventive enoxaparin was prescribed in 95% of patients. Oxygen therapy was prescribed in 16.6% of patients.

- **Evolution and duration of hospitalization**

36.9% of cases had a negative control PCR on D9 and D10 of treatment, more than 40% of cases required more than 21 days for the control PCR to be negative (Figure 6).

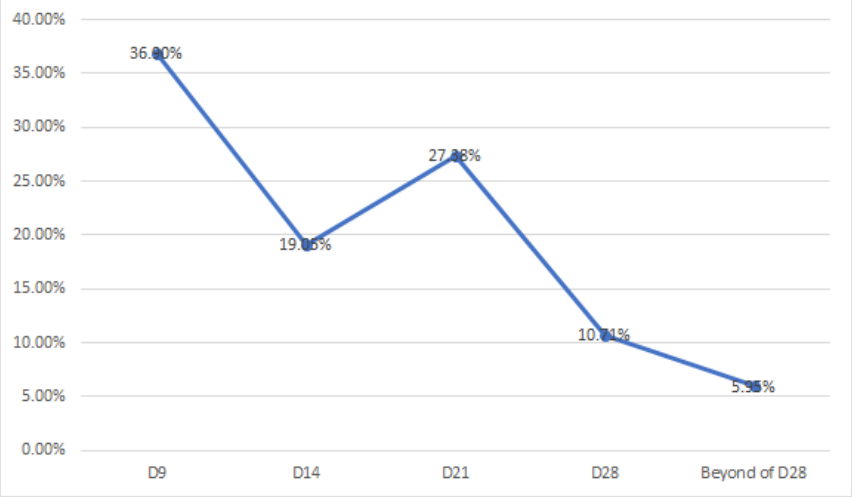

Fig-6: Evolution of the negative kinetics of PCR under treatment

The length of hospitalization was on average 17 days (10-40 days). 97% of patients were declared cured after 2 negative PCRs at one day interval, 2 cases had required transfer to an intensive care unit and one death was noted.

DISCUSSION

Mode of transmission of SARS-CoV-2: Human-to-human transmission of the SARS-CoV-2 virus was demonstrated in February 2020 after intra-family contamination was reported [5]. Van Doremalen's study showed that this virus could remain viable for 3 hours in aerosols and 72 hours on inert surfaces, suggesting air and contact type contamination [6].

Frequency of asymptomatic forms: The study of 3,711 passengers or crew member of the cruise ship "Diamond Princess", who remained in quarantine at the port of Yokohama (Japan), represents a quasi-experimental model of infection by SARS-CoV-2. Among 634 confirmed cases of SARS-CoV-2 infection, 17.9% were asymptomatic [7]. Asymptomatic forms seem to be more frequent in children: estimated at around 30% of cases [8], in our study 25% of patients were asymptomatic.

Characteristics of the SARS-CoV-2 infected population hospitalized: The criteria for hospitalization are not consensual in the world; Morocco has put in place several measures early to deal with the Covid-1 pandemic, in particular with the early detection of cases, their hospitalizations and the adoption of a standard therapeutic protocol, also rigorous follow-up of contacts [9]. There is heterogeneity of demographic data in the patient populations reported in the literature (Table 9).

Board-9: Co-morbidities associated with symptomatic SARS-CoV-2 infection.

Table-9

Comorbidities	Guan (n = 1099) [10]	Wu (n = 201) [11]	Zhou (n = 191) Kefti *et al.* [12] [13]
Age (median)	47 [35–58]	51 [43–60]	56 [46–67] 53 [20-84]
Sex-ratio (M / F)	1.4	1.8	1.7 1.7
Prior exhibition	43.9%	49.3%[vs]	38% 41%
Comorbidity ≥ 1	23.7%	38.2%	48%
Active smoking	12.6%	ND	6% 15%
HTA	15.00%	19.4%	30% 31.4%
Diabetes	7.4%	10.9%	19% 15.1%
Coronary artery disease	2.5%	<4%	8% ND
COPD	1.1%	<2.5%	3% ND
Cancer	0.9%	0.5%	1% ND
IRC	0.7%	1%	1% ND

In the 4 studies selected for their large numbers, and compared to Algeria being a country in the Maghreb region. the median age of hospitalized patients was between 47 and 56 years with narrow interquartile ranges (43 to 60 in the study by Wu *et al*., 35 to 58 in the study by Guan *et al*., 46 to 67 in the study by Zhou *et al*, 20 to 84 in the study by Kefti (Table 9).

The young age of the African population can be considered a protective factor, as the median age of the 1.3 billion inhabitants is 19.7 years, which would limit the elderly population exposed to severe and potentially fatal forms. .

The male predominance observed in our study is intermediate with those reported in the literature, the sex ratio (male / female) varied from 1.4 [10], 1.7 [13] to 1.8 [11].

Only 13.7% of our patients were active smokers. This rate is very close in the Algerian population of 15% [13] and confirms the data in the literature, in a meta-analysis including 11,590 patients, 6.3% were smokers [15].

Clinical profile: The diagnostic delay noted in this study was 6 days on average, earlier than those reported in the literature. In fact, the majority of patients developed symptoms in the 10 in Algeria [13], 11.5 [15] and 12.5 [16] days preceding the hospitalization, probably explained by the adoption of the health ministry's policy of screening contacts of a confirmed case.

In the three studies by Wu *et al.*, Guan *et al*. and Zhou *et al*., the main signs of COVID-19 were associated with fever above 37.5 ° C, cough, sputum and dyspnea, occurring in the first days of infection [10-13].

In addition, myalgia was common (14.9–32.3%) and digestive signs which may be inaugural were also reported, such as diarrhea (3.8–5%) and nausea / vomiting (4–5%) [10, 11].

Some patients present with neurological damage, which had already been reported during the epidemic caused by SARS-CoV-1[17]. In the study by Mao *et al*., 36.4% of the 214 patients included presented neurological signs [18]. In our series, no patient presented with neurological impairment. A phase of worsening respiratory symptoms is possible and approximately 3.4% of patients would develop ARDS within a median of 8 days[19], the mortality associated with ARDS is high, around 50%[11].

Biological signs: Symptomatic forms of SARS-CoV-2 infection are accompanied by biological changes: elevation of polynuclear neutrophils and lymphopenia, [11]; increased CRP (60.7–85.6%), up to 150 mg / L, hypoalbuminemia (median 32–32.3 g / L), hyperferritinemia (78.5–80%)[11],[12], elevation of ALT / AST in approximately 25% of cases and hyperbilirubinaemia (5.1–10.5%)[1O],[11], elevation of LDH for about 40% of patients (13–98% depending on the cutoff chosen in the studies) associated with a decrease in PT (up to 94% of patients) and an increase in D-dimer (23.3–46.4%), stigmata of a coagulopathy associated with serious and predictive forms of mortality[11, 12]. In our series, these anomalies were less frequent and are close to the results of Kefti's study in Algeria [13].

Radiologic signs of SARS-CoV-2 infection: The study by Li *et al*. reports the radiographic presentation of 90 patients whose diagnosis of SARS-CoV-2 infection was based on the combination of an epidemic context, a positive RT-PCR on a nasopharyngeal sample, and having performed a chest CT scan [20]. The picture was that of often bilateral pneumopathy (95.2%) with posterior and subpleural distribution anomalies, associating frosted glass images, foci of alveolar condensation, linear opacities, but also thickening of the bronchial walls and more rarely pleurisy. and pericardial effusion [20]. Our results agree with those of the literature.

Treatments received and length of hospitalization: the chloroquine-azithromycin combination was prescribed in 52% of cases,

hydroxychlorochine-azithromycin in 43% of cases, excluded pregnant women and children according to the therapeutic protocol adopted by the Ministry of Health in Morocco. This therapeutic protocol has been adopted by many countries [21], in the kefti study the chloroquine azithromycin combination was prescribed in 62% of cases [13]. The evaluation of the results is in progress. Oxygen therapy was prescribed in 16.6% of patients. This frequency is clearly lower than that reported in the literature (48.7 [11], 21% [12]). The average length of hospital stay in this study was 17 days, which is higher than that reported in the literature, it is 6 days in Kefti's study [13]; explained by the hospitalization of patients initially until the PCR is negative.

Methodological limitations: Our study presents some methodological limitations. The first concerns the limited duration of the study, which makes it impossible to see the evolution of the pathology in the medium and long term. This limit was imposed by the epidemic context of the current pandemic. The second limitation concerns missing data that was acquired under crisis conditions where the variables were dynamic overnight, hence the completeness of data collection, especially at the time of hospital admission, n was not optimal. However, several attempts to complete the data collection as much as possible (requests from the nursing teams taking care of the patients, telephone calls from contacts or the entourage were tried). These situations make it difficult to compare studies and especially to generalize these results to all Moroccan patients. These limits were imposed by the context of the study in a crisis situation with the necessity of its realization in the emergency situation.

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