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Epidemiological, clinical and biological profile of COVID-19 in patients hospitalized at the Avicenne Military Hospital in Marrakech

Imane El khannouri [1, 2, *], Kenza El Bazi [1, 2], Mouhcine Miloudi [1, 2], Lamiae Arsalane [1, 2], Said Zouhair [1, 2] and Youssef El Kamouni [1, 2]

[1] *Department of Bacteriology and virology, Avicenna Military Hospital, Marrakech, Morocco.*
[2] *Faculty of medicine and pharmacy of Marrakesh – Cadi Ayyad University, Marrakech, Morocco.*

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Abstract

In late December 2019, a series of cases of viral pneumonia caused by a novel coronavirus emerged in Wuhan, China, and quickly spread to all continents. This coronavirus, identified in respiratory tract samples, was named SARS-CoV-2 for Severe Acute Respiratory Syndrome Coronavirus-2 by the ICTV (International Committee on Taxonomy of Viruses). The disease it causes was designated COVID-19 for Coronavirus Disease 2019 by the Word Health Organization.

Most often, SARS-CoV-2 infection is responsible for a mild or moderate form, with the most typical clinical presentation being that of a febrile respiratory infection with dry cough, dyspnea, fatigue, and myalgia. Approximately 10-15% of cases are severe, and 5% are critical. Cases of reinfection have been described. Treatment for COVID-19 is currently symptomatic, relying on supportive care.

The present study aims to investigate the demographic, clinical, and diagnostic aspects, as well as the study of risk factors associated with SARS-CoV-2 infection among 318 patients admitted to the Avicenne Military Hospital in Marrakech during the first wave of the pandemic.

This is a retrospective descriptive and analytical study involving 318 cases of SARS-CoV-2 infection, diagnosed at the microbiology-virology department, and followed up in various non-intensive care units of the Avicenna Military Hospital in Marrakech, during the period of the first wave of the epidemic in Morocco, schematically between March 22, 2020, and July 19, 2020.

For patients who developed pneumonia, 20% were diabetic and 13.3% were hypertensive. A quarter of patients with pneumonia experienced desaturation upon admission. In the multivariate logistic regression model, risk factors associated with the development of pneumonia and the various disease outcomes included advanced age and absence of a history of contact with a confirmed case.

In the univariate analysis, hyperleukocytosis, neutrophilia, lymphopenia, eosinopenia, anaemia, hyperferritinaemia with elevated aspartate aminotransferase, hyponatraemia and fasting hyperglycaemia were significantly associated with a higher risk of an unfavourable outcome.

Patients who presented with pneumonia on admission had an unfavourable outcome during their hospitalisation compared with patients who did not develop pneumonia. The statistically significant risk factors associated with an unfavourable outcome were advanced age (>60 years) with p <0. 001: OR=1.194; 95%IC= [1.114-1.278], absence of contact with a confirmed case (p <0.001 : OR= 43.138; 95%IC= [8.893-209.263]), presence of comorbidity (P<0.001 :

* Corresponding author: Imane El khannouri

OR=11. 503; 95%CI= [3,306-40,028]), mainly diabetes (P<0.001: OR=16,971; 95%CI= [4,267-67,504]) and arterial hypertension (P<0.001: OR=18,812; 95%CI= [3,977-88,954]).

The study of the epidemiological, clinical and biological characteristics of COVID 19 at the Avicenne military hospital in Marrakech has enabled us to gain a better understanding of the profile of our patients with SARS-CoV-2 infection, and then to detect shortcomings in terms of prophylaxis, diagnosis and management, in order to be able to provide the necessary solutions aimed at further improving the quality of care for this population.

Keywords: Covid-19; Pneumonia; Risk factors; Clinical characteristics; Comorbidity

1. Introduction

By the end of December 2019, a series of cases of viral pneumonia caused by a new coronavirus appeared in Wuhan, China, and quickly spread to all continents. This coronavirus, identified on upper respiratory tract samples, has been named SARS-CoV-2 for Severe Acute Respiratory Syndrome Coronavirus-2 by the ICTV (International Committee on Taxonomy of Viruses). The disease it causes has been named COVID-19 for Coronavirus Disease 2019 by the WHO [1].

Quickly, the infection spread in China. On January 30, the WHO officially declares the infection a public health emergency of international concern. The disease is spreading quickly outside China, and on February 25, for the first time, the number of new diagnostics outside China exceeds the number of diagnoses inside China. The WHO declares a state of pandemic on March 11, 2020 [2].

Most often, SARS-Cov-2 infection is responsible for a mild or moderate form, the most typical clinical presentation of which is that of a febrile respiratory infection with dry cough, dyspnea, fatigue and myalgia. About 10-15% of cases are severe and 5% are critical. Cases of reinfection have been described. The treatment of COVID has so far been symptomatic, based on supportive care.

The purpose of this work is to study the demographic, clinical and diagnostic aspects, as well as the study of the risk factors associated with infection by SARS-CoV-2 in 318 patients admitted to the Avicenne military hospital in Marrakech. during the first wave of the pandemic.

2. Materials and methods

2.1. Patients and duration of the study

This is a descriptive and analytical retrospective study of 318 cases of SARS-COV-2 infection, diagnosed in the microbiology-virology department and followed up in the various off intensive care unit departments of the Avicenne Military Hospital in Marrakech, during the period of the first wave of the epidemic in Morocco, schematically between March 22, 2020, and July 19, 2020.

2.2. Confirmation of the diagnosis of COVID-19

The diagnosis was confirmed by the detection of the SARS-COV-2 viral genome in the upper respiratory tract (nasopharynx or oropharynx) by the RT-PCR technique, performed at the microbiology-virology department of the Avicenne Military Hospital in Marrakesh.

2.3. Data collection

The data was collected using clinical observations, the results of paraclinical explorations and the tracking are noted on the medical file.

2.4. Statistical analysis

Statistical analysis was performed using the software IBM SPSS statistics version (version 25.0). This analysis was of two types: a univariate analysis and a multivariate analysis, using binary logistic regression, which used the Chi-square test and Fisher's exact test for the comparison of frequencies within the subgroups. The significance level was set at 5% ($p<0.05$).

3. Results

3.1. Descriptive analysis

Out of a total of 318 patients, the median age was 40 years (IQR, 33-45 years), and 292 (91.8%) patients were male. The median consultation time was 4 days. Nasal discharge, sore throat, asthenia, and headache were the most frequent signs. 30 patients (9.4%) developed pneumonia, 11 (3.5%) had an adverse progression during their hospitalization, and among these patients, 5 (1.6%) were admitted in intensive care unit, and 3 (0.9%) died.

Concerning the biological assessment of the patients during their hospitalization, the LDH was performed in 108 patients and was elevated in 66.7% of cases (72/108). Eosinopenia was found in 25.2% (36/144) of patients. Elevated CRP was also reported in 30.8% (44/143) of cases.

Monitoring of treatment efficiency was based on the negativity of the control RT-PCR.

3.2. Statistical analysis

For the patients who developed pneumonia, 20% were diabetic and 13.3% were hypertensive. One quarter of the patients who developed pneumonia had desaturation on admission. In the multivariate logistic regression model, the risk factors associated with the development of pneumonia and the different modes of disease progression included advanced age and the absence of contact with a confirmed case.

The risk factors associated with an unfavorable outcome (mechanical ventilation, transfer to intensive care) and which were statistically significant were advanced age (>60 years) with a risk multiplied by 60.308, absence of contact with a confirmed case, presence of a comorbidity mainly diabetes and arterial hypertension. However, we note that male sex and smoking are negatively associated with a worse outcome (Table I)

Table 1 Demographic risk factors associated with adverse outcomes

	Univariate analysis			**Multivariate analysis**		
	OR	**IC**	**p**	**OR**	**IC**	**P**
Age						
<60 years	1 (ref)	-	-	1 (ref)	-	-
>60 years	60.308	14.31- 254.154	<0.001	18.812	3.977-88.954	<0.001
Sexe						
Masculin	1 (ref)	-	-	1 (ref)	-	-
Feminine	2.62	0.536-12.822	0.234	82.484	17.475- 389.336	<0.001
Presence of contact						
Yes:	1 (ref)	-	-	1 (ref)	-	-
No:	43.138	8.893- 209.263	<0.001	0.363	0.055-2.404	0.294
Smoking						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	0.668	0.083-5.355	0.704	30.28	5.788-158.4	<0.001
Comorbidities						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	11.503	3.306-40.028	<0.001	0.534	0.062-4.563	0.566
Diabetes						
No	1 (ref)	-	-	1 (ref)	-	-

Yes	16.971	4.267-67.504	<0.001	5.006	1.217- 20.595	0.026
HTA						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	18.812	3.977-88.954	<0.001	8.31	1.228-56.252	0.03

Patients with an unfavorable outcome had fever (25.114-fold increase in risk), asthenia, myalgias, cough, nasal discharge, polypnea, desaturation, and diarrhea. As well as the presence of respiratory distress being a risk factor for adverse outcome in the multivariate analysis (Table II)

Table 2 Clinical risk factors associated with an unfavorable outcome

	Univariate analysis			**Multivariate analysis**		
	OR	**IC**	**p**	**OR**	**IC**	**p**
Fever						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	25.114	6.829-92.366	<0.00	51.978	2.935-920.625	0.007
Asthenia						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	10.538	2.716-40.886	<0.001	0.466	0.047-4.612	0.514
Myalgia						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	9.748	2.598-36.573	<0.001	126.04	6.204-2560.784	0.002
Headaches						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	3.361	0.993-11.377	0.051	0.565	0.064-5.002	0.608
Sore throat						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	1.202	0.311-4.649	0.79	0.24	0.013-4.322	0.333
Cough						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	8.495	2.472-29.193	0.001	2.173	0.239-19.744	0.491
Nasal discharge						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	6.853	1.776-26.436	0.005	0.174	0.012-2.464	0.196
Respiratory distress						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	6.04	0.645-56.597	0.115	234.855	3.615-15256.231	0.01
Polypnea						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	5.107	1.261-20.688	0.022	30.543	1.394-669.307	0.03

Desaturation						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	43.286	8.956-209.206	<0.001	109.552	0.603-19889.308	0.077
Diarrhea						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	63.125	13.489-295.407	<0.001	26.992	0.293-2482.45	0.153
Anosmia						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	0.959	0.118-7.757	0.968	0.052	0.001-2.006	0.112
Ageusia						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	0.649	0.081-5.202	0.684	0.131	0.004-4.687	0.265

Hyperleukocytosis, neutrophilia, eosinopenia, elevated C-reactive protein, markers of organ damage such as elevated lactate dehydrogenase, aspartate aminotransferase, with increased D-dimer, as well as hyperglycemia figures, were associated with the occurrence of pneumonia in the univariate analysis.

In univariate analysis, hyperleukocytosis, neutrophilia, lymphopenia, eosinopenia, anemia, hyperserotonemia, with elevated aspartate aminotransferase, hyponatremia, fasting hyperglycemia, were significantly associated with higher risks of adverse outcome. In addition, no statistically significant relationship was found between elevated urea and creatinine and unfavorable patient outcomes. On the other hand, in the multivariate analysis, the presence of eosinopenia increased the risk by a factor of 20,708 for an unfavorable outcome, as well as anemia (12,106-fold increase), hyperglycemia (11,546-fold increase) and elevated AST (25,467-fold increase) (Table III)

Table 3 Biological risk factors associated with an unfavorable outcome

	Univariate analysis			**Multivariate analysis**		
	OR	**IC**	**p**	**OR**	**IC**	**p**
Hyperleukocytosis (>11x10^3/mL)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	21.5	4.299- 107.515	<0.001	-	-	-
Neutrophilia (>7.7x103/ml)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes:	131	12.805- 1340.197	<0.001	-	-	-
Lymphopenia (<100/l)						
No:	1 (ref)	-	-	1 (ref)	-	-
Yes:	11.091	2.777- 44.291	0.001	2.477	0.305-20.089	0.396
Eosinopenia (<20/l)						
Non	1 (ref)	-	-	1 (ref)	-	-
Yes	8.368	2.035- 34.403	0.003	20.708	1.151-372.692	0.04
Anemia						
No	1 (ref)	-	-	1 (ref)	-	-

Yes	9.143	1.423- 58.736	0.02	12.106	1.039-141.061	0.047
LDH (>225 U/L)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	3.769	0.446- 31.883	0.223	-	-	-
Ferritin (>400 mg/ml)						
No :	1 (ref)	-	-	1 (ref)	-	-
Yes	9.6	2.049- 44.974	0.004	-	-	-
Urea (>7.5mmol/l)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	-	-	-	-	-	-
Creatinine: (>90 mmol/l)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	-	-	-	-	-	-
Procalcitonin: (>0.5 mg/ml)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	3.667	0.354- 38.029	0.276	0.333	0.017-6.654	0.472
ASAT (>50U/L)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	10.75	1.566- 73.799	0.016	25.467	1.767-367	0.017
Fasting blood glucose (>6.1 mmol/l)						
No	1 (ref)	-	-	1 (ref)	-	-
Yes	30.833	5.92- 160.603	<0.001	11.546	1.39-95.895	0.024

Patients who presented with pneumonia on admission had an unfavorable progression during their hospitalization compared to patients who did not develop pneumonia, whose risk factors associated with an unfavorable progression, and which were statistically significant were advanced age (>60 years) with p <0. 001: OR=1.194; 95%IC= [1.114-1.278], absence of contact with a confirmed case (p <0.001: OR= 43.138; 95%IC= [8.893-209.263]), presence of a comorbidity (P<0.001: OR=11. 503; 95%IC= [3,306-40,028]), mainly diabetes with P<0.001: OR=16,971; 95%IC= [4,267-67,504] and hypertension (P<0.001: OR=18,812; 95%IC= [3,977-88,954]).

4. Discussion

In this retrospective cohort study, we reported the clinical characteristics and identified risk factors associated with clinical outcomes among patients infected with SARS-CoV-2 who developed pneumonia as well as those who had an adverse outcome.

In our series, univariate analysis shows that an advanced age of patients (>60 years) is a statistically significant risk factor associated with the development of pneumonia, as well as with an unfavorable progression of patients during their hospitalizations, and with death. This is confirmed by multivariate analysis. This finding is fully consistent with the literature. In the study by Wu and al [3]**,** it was found that advanced age (>65 years) was a statistically significant risk factor for the development of a severe form of the disease (severe respiratory distress syndrome) with p<0.001: OR=3.26; 95%IC= [2.08-5.11], as well as for an unfavorable progression of patients towards death p<0.001: OR=6.17: 95%IC= [3.26-11.67]. Another study reported by Kaeuffer and al [4] shows that advanced age is a risk factor associated with severe forms (OR= 1.1 per ten years; 95%CI= [1.0-1.2]).

Indeed, the elderly are particularly exposed to the risk of comorbidity, making them vulnerable and particularly prone to developing severe forms of the disease

In our study, we did not find a statistically significant relationship between gender and the development of pneumonia or the adverse progression of patients. Male sex is often identified as a risk factor for the development of severe pneumonia and adverse progression. In the study by Kaeuffer et al [4]**,** male sex was a risk factor for severe disease (OR = 2.1; 95% CI [1.5-2.8]). This is in contrast to the study by Wu and al [3] which found that male sex is not a factor in the development of severe forms of the disease with p=0.11: OR=1.47; 95%IC= [0.92-2.36]. This finding is explained by the nature of the population included in our study and the military context.

In our study, no statistically significant relationship was found between smoking and the unfavorable progression towards death of the patients. This result is fully consistent with the study by Lippi and Henry [5] which concluded that smoking does not contribute to the development of severe COVID-19. While in the meta-analysis by Reddy and al [6] comprising 47 studies with a total of 32849 patients hospitalized with COVID-19, it is confirmed that active smokers have an increased risk of severe form (OR: 1.80; 95% CI: 1.14-2.85; p = 0.012). A history of smoking is associated with an increased risk of severe disease (OR: 1.31; CI: 1.12-1.54; p = 0.001), disease progression (OR: 2.18; CI: 1.06-4.49; p = 0.035), need for mechanical ventilation (OR: 1.20; CI: 1.01-1.42; p = 0.043), and in-hospital mortality (OR: 1.26; CI: 1.20-1.32; p 7. 5 Comorbidities: < 0.0001).

In our study series, interestingly, the univariate analysis shows that the absence of contact with a confirmed case was statistically significant in terms of development, and of an adverse progression. This was confirmed in the multivariate analysis. These results are fully consistent with the study by Sun and al [7]: which highlights that the key to reducing mortality is early and strong intervention to prevent disease progression. These data demonstrate the value of early detection of infection and therefore early management to improve patient progression and prognosis.

In our series of studies, univariate analysis shows that the presence of comorbidity (mainly diabetes and hypertension) is a risk factor associated with the development of pneumonia with an unfavorable progression of the patients. However, the presence of chronic lung disease and heart disease are risk factors for the development of severe forms.

These data were confirmed in the multivariate analysis, where the presence of a comorbidity was significantly associated with an unfavorable progression for patients, mainly diabetes (p=0.026: OR=5.006; 95%IC= [1.217- 20.595]) and hypertension. Our results are fully consistent with the literature. The study by Wu and al [3] showed that the presence of diabetes (p=0.002: OR=2.34; 95%IC= [1.35-4.05]) and hypertension (p=0.01: OR=1.82; 95% IC= [1.13-2.95]) are significantly associated with the development of severe forms of the disease. In the nationwide study conducted in China by Guan and al [8], among 1,590 patients with confirmed COVID-19, the OR was 1.79 (1.16-2.77) for patients with at least one comorbidity and 2.59 (1.61-4.17) for patients with at least two comorbidities.

In our study, multivariate analysis showed that the presence of fever was statistically significant for an unfavorable progression. These results are consistent with the data reported by Wu and Al [3] where the presence of fever is associated with the development of ARDS (acute respiratory distress syndrome) (p=0.02: OR=1.77 ; 95%IC= [1.11-2.84]) and negatively associated with death (p=0.01: OR=0.41; 95%IC= [0.21-0.82]). Furthermore, in the univariate analysis, the presence of polypnea (p=0.03: OR=30.543; 95%IC= [1.394-669.307]) and respiratory distress (p=0.01: OR=234.855; 95%IC= [3.615-15256. 231]) are risk factors for an unfavorable progression of the patients, desaturation is significantly associated with an unfavorable progression and transfer to the intensive care unit, this is perfectly in line with the prospective and observational study of Kaeuffer and Al [4] where dyspnea (OR = 2.5; 95%CI [1.8-3.4]) is significantly associated with the development of severe forms.

Eosinopenia was significantly associated with an unfavorable progression of the patients and thus associated with severe forms of the disease, which is consistent with the study by QIN and Al [8] where eosinopenia was associated with the development of severe forms of the disease.

the presence of anemia was significantly associated with an unfavorable progression of patient, which is consistent with the study by Anai and Al [9] where a decrease in hemoglobin levels is associated with progression of pneumonia to severe respiratory failure requiring mechanical ventilation.

In univariate analysis, lymphopenia is a risk factor associated with adverse outcome and mortality, which is consistent with the study by Yu and Al [10] who reported that lymphopenia (p=0.002: OR=1.67; 95%IC= [1.20-2.33]) is associated with the risk of death from COVID. In various studies [11,3], an increase in neutrophils is associated with the occurrence

of severe disease and mortality; this result is close to our study where neutrophil hyperleukocytosis was significantly associated with the occurrence of pneumonia and an adverse progression of patients.

In addition, the presence of hepatic cytolysis and hyperglycemia figures have a statistically significant relationship in terms of unfavorable progression of patients, which is fully consistent with the literature, the study by Wu and Al [3] found that the presence of hepatic cytolysis (p<0. 001: OR=1.02; 95%IC= [1.01-1.03]) and hyperglycemia (p<0.001: OR=1.13; 95%IC= [1.08-1.19]) are risk factors associated with the occurrence of severe ARDS and not with mortality. According to this study, elevated urea (p<0.001: OR=1.13; 95%IC= [1.09-1.18]) and creatinine (p=0.02: OR=1.05; 95%IC= [1.01- 1. 10]) are risk factors associated with the development of severe forms of the disease, this is discordant with our study where elevated urea and creatinine are negatively associated with an unfavorable progression, this is explained by the absence of renal insufficiency in the patients' history as well as the predominance of the benign form.

In the univariate analysis of the data of our study, hyponatremia is a risk factor associated with an unfavorable progression of the patients, this is in perfect agreement with the study reported by Letellier and Al [12] who objective that hyponatremia is associated with an adverse progression (transfer in intensive care unit and mechanical ventilation).

5. Conclusion

The study of the epidemiological, clinical and biological characteristics of COVID 19 at the Avicenne military hospital in Marrakech allowed us to better understand the profile of our patients with SARS-CoV-2 infection, then to detect the failures in prophylaxis, diagnosis, and management, in order to be able to provide necessary solutions, aiming to further improve the quality of care of this population.

Our study also suggests that the absence of contact with a confirmed case was a risk factor for an unfavorable progression of the patients (transfer to intensive care unit, death). This, objectify the interest of an early detection of patients and thus a quick management to obtain a cure without sequels.

The fight against this pandemic must be done by repeated awareness of the importance of preventive measures, thus encouraging vaccination.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest

Statement of ethical approval

All the data has been collected anonymously following patient confidentiality

Statement of informed consent

Informed consent was obtained from all individual participants included in the study. .

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