

Mortality and Associated Risk Factors among In-Patients with Covid-19 in Douala, Cameroon: A Retrospective Cross-Sectional Study

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Abstract

Background: In March 2020, the World Health Organization declared the coronavirus disease 2019 a pandemic, this was caused by the Severe Acute Respiratory Syndrome Coronavirus 2. The overall mortality from this remains high, yet there are limited studies assessing the associated factors in Africa. **Objective:** To identify the factors associated with mortality in hospitalized COVID-19 patients in Douala, Cameroon. **Method:** We conducted a single-centre retrospective cross-sectional study by reviewing records of patients managed for COVID-19 between March and June 2020. Diagnosis was confirmed by real-time RT-PCR. Outcome of interest was mortality during hospitalization. We inputted and analyzed data using SPSS version 25.0, compared mortality between groups using the Chi's squared test and the Fisher's exact test where appropriately investigated for associations using the Logistic regression in a stepwise approach and alpha-value set at $P = 0.05$. **Results:** We analyzed 282 case files, 68% were males (M:F = 2:1) and a mean age of 52 (± 15) years. We had an overall mortality of 31.5% (89/282 patients) and 54% (50/92 patients) admitted in the ICU died. Patients aged 0 - 39 years had a significantly lesser odds of mortality compared to those > 70 years (OR:

0.2 (0.1 - 0.5) $P < 0.001$). Hemodynamic instability at presentation showed association with mortality ($P < 0.001$) ranging as follows; moderate disease OR: 7.3 (2.4 - 21.8) versus Sepsis OR: 317 (58.3 - 1729.3). Mortality was as high as 63% in those with alveolar consolidation on CT scan (OR: 0.3 (0.1 - 0.6)), those with a 75% - 100% involvement of the lung parenchyma had a significantly higher mortality compared with those of <10% involvement (OR: 0.02 (0.01 - 0.06) $P < 0.001$). About 55% of patients placed on supplemental oxygen died (OR: 0.2 (0.1 - 0.3)) and up to 80% (OR: 0.1 (0.01 - 1.0)) of intubated patients died. In the ICU population, placement on non-invasive mechanical ventilation (AOR: 0.5 (0.2 - 1.2)) and intubation (AOR: 0.3 (0.03 - 2.6)) showed no significant differences in terms of mortality. **Conclusion:** The in-hospital mortality in COVID-19 patients is very high and hospitalisation into the ICU is associated with even higher mortality. Advanced age, diffused lung involvement (particularly with alveolar consolidation), hemodynamic instability at presentation and altered level of consciousness favoured hospitalisation in the ICU. Once in the ICU, placement on mechanical ventilation did not reduce death discernibly.

Keywords

COVID-19, Risk Factors, Mortality, Cameroon

1. Background

A coronavirus disease also called coronavirus respiratory syndrome, coronavirus pneumonia, coronavirus flu, or any other variant is a disease caused by members of the coronavirus (CoV) family. These include: severe acute respiratory syndrome (SARS), Middle East Respiratory Syndrome (MERS), and Coronavirus disease 2019 (COVID-19) [1].

In December 2019, Wuhan city, the capital of Hubei province in China, became the centre of an outbreak of pneumonia of unknown cause [2]. By Jan. 7, 2020, Chinese scientists had isolated a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), previously known as 2019-nCoV, later designed as COVID-19 by World Health Organization (WHO) [3]. By January 11, 2020, the first virus-related death of a 61-year-old man in Wuhan was reported [4].

The 2019-20 coronavirus outbreak was declared a pandemic by the WHO on 11th March 2020 [5]. As of June 21st, 2020, a total of 8,708,008 cases had been documented globally and 461,715 deaths. North America was the most affected region with almost 50% of cases and 47% of deaths, while, Africa had recorded 216,999 cases for 4874 deaths [6]. In Cameroon, the first case was reported on March 6th, 2020, and within days it declared a state of emergency that included travel bans, lockdowns, widespread testing, and quarantine [7]. As of May 30th, 2020, the Ministry of Public Health who regularly communicated on figures at a

national level, reported 5659 persons tested positive, 185 deceased and 3441 recovered cases [8].

The clinical spectrum of SARS-CoV-2 infection appears to be wide, encompassing asymptomatic infection, mild upper respiratory tract illness, and severe viral pneumonia with respiratory failure and even death. Pneumonia mostly occurs in the second or third week of symptomatic infection. Prominent signs of viral pneumonia include decreased oxygen saturation, blood gas deviations, changes visible through chest X-rays and other imaging techniques, with ground glass abnormalities, patchy consolidation, alveolar exudates, and interlobular involvement, eventually indicating deterioration. Blood analysis has shown lymphopenia to be common, and inflammatory markers to be elevated [9] [10].

Recent reports suggest that approximately 14% - 29% of hospitalized patients with COVID-19 pneumonia require intensive care, primarily for respiratory support in the setting of hypoxic respiratory failure, with Acute Respiratory Distress Syndrome (ARDS) developing in 33% of hospitalized patients at a median time from symptom onset of 8 days [11] [12]. In these reports, critically ill patients were older, more likely to be male, and to have underlying comorbidities. Evidence shows that the overall mortality rate of COVID-19 is 3.8% - 5.4%, rate ranged from 8% to 21% among those patients admitted with pneumonia, however, it increases up to 41% - 61% among severe or critically ill patients [13] [14].

Given the rapid spread of COVID-19, and in order to reduce the overall mortality, identifying the risk factors related to disease severity and mortality in COVID-19 patients is urgently required. The present article therefore aimed to provide data describing the factors associated with mortality in COVID-19 patients in a sub-Saharan nation.

2. Materials and Method

2.1. Study Design and Period

This study was a hospital-based cross-sectional retrospective study carried out for four months (March to June 2020).

2.2. Study Area

The study was carried out in Douala, the economic capital of Cameroon, which has the busiest international airport in the country thereby more likely to receive imported cases. It is a cosmopolitan city, recording the largest number of confirmed cases in the country as of the end-date of this study. It is a town with an estimated 3.7 million inhabitants in 2021 [15]. All the critically ill patients requiring Intensive Care Unit (ICU) admission in the region were referred to LHD.

The Laquintinie Hospital of Douala (LHD) was the designated focal point for reception, treatment, and isolation of COVID-19 cases in the Littoral region. It is

a tertiary hospital dispensing extensive medical services and a very important health structure in the country due to the affordability of its wide range of services, seniority, and surface area. It also serves as a teaching hospital. Along with the well-equipped 24-hour casualty unit, there exist laboratory, pathology, and radiologic units. The ICU has a 12-bed capacity, with two ventilators and the unit is managed by three anaesthesiologists. Two hospital wards each with 100-bed capacity were set aside for isolation of asymptomatic patients and those with mild to moderate presentations of COVID-19, managed by 40 health personnel among which were infectious disease specialists, cardiologists, pneumologists, and general practitioners.

2.3. Study Population and Sample

Subjects for the study included all COVID-19 patients who were admitted at LHD from 1st March 2020 to 31st June 2020.

Inclusion Criteria: All confirmed cases of COVID-19 admitted and managed at LHD during the study period with complete data in files.

Exclusion Criteria: Cases not treated in the hospital, not having a positive real-time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test.

Sample Size: 282 cases were involved in the study.

2.4. Study Procedures

Authorization to carry out this research was obtained from the director of the Laquintinie Hospital. Ethical clearance was equally sought and gotten from the Institutional Ethics Committee (IEC) of the hospital. This permitted us to use both the electronic and physical files of patients consulted and managed in the hospital during the study period. Anonymity was respected by coding the files and guaranteed that patient's names or identification was not to be disclosed on any study document. We then proceeded to the various wards to have access to the records of patients treated for this condition. We obtained epidemiological, demographic, clinical, laboratory, management, and outcome data from patients' medical records.

Laboratory confirmation of COVID-19 was being done initially by the Centre Pasteur du Cameroun, a reference biological laboratory in the country, then by the hospital's laboratory. Nasopharyngeal swab samples were collected following standard safety procedures. The analysis was done by the RT-PCR for suspected cases following the protocol established by the country which was adapted from WHO guidelines [16].

In emergency situations, cases with a high clinical and radiological suspicion were treated as COVID positive similar to situations in other western countries [17], with PCR confirmation coming afterward. Radiological interpretations of the chest computed tomography (CT) scans were done by radiologists. The cases were classified in clinical syndromes as described by WHO in their interim guidance of March 2020 [16].

The ICU and hospital outcomes of each patient were recorded. The interval from symptom onset to ICU admission, length of ICU stay, rate of intubation, and rate of readmission to ICU were also evaluated. The drug therapy used for all confirmed cases was the same irrespective of severity as was approved by the country's national guidelines.

In cases of incomplete data from the records, we obtained data by direct communication with attending physicians and other healthcare providers. All data were checked by two physicians.

2.5. Data Management and Analysis

Pre-established data collection sheets were used to collect information on identification, socio-demographic and clinical characteristics, follow-up and outcome. SPSS version 25.0 was used to enter and analyse data. Numerical variables were presented as mean (Standard Deviation (SD)) or median (Interquartile Range (IQR)) or categorized based on reference limits. Meanwhile we summarised categorical variables as frequencies (n), proportions (%) and compared differences in proportions (mortality, which was our outcome of interest) using the Chi's squared test and the Fisher's exact test where appropriate. We further compared variables which showed significant associations with mortality using logistic regression models with Odds Ratio (OR) (95% Confidence Interval (CI)) in a stepwise approach. First we exposed crude OR for each of the variables and subsequently made adjustments for being hospitalized into the ICU (Adjusted OR (AOR)). An Alpha value was set at $P = 0.05$.

3. Results

We retrieved 379 files of patients in the hospitalised for COVID-19 within the study period, excluded 97 which did not meet inclusion criteria (either were not admitted or clear reference to positive PCR test was seen) and retained 282 for analysis. 192 (68.1%) were males giving an M: F ratio of 2:1. The mean age was 52 (± 15) years. We identified at least one chronic medical condition in 124 cases (44.0%), with hypertension and diabetes accounting for about 75% of these conditions identified (**Table 1**). The median duration of symptoms before presentation at the hospital was 5 (3 - 10) days. Most cases, 274 (97.2%) reported at least one of the major symptoms investigated with fever, cough, dyspnea, asthenia, and chest pain, contributing to 80.0% of these symptoms. The commonest severe manifestation was severe pneumonia (11.3%), closely followed by sepsis and ARDS (8.5% and 9.2%) respectively. Patients benefited from a first CT scan evaluation averagely on their first day of hospitalization (mean (SD) 0.5 (0.0)), with varying radiological patterns. The most frequent pattern observed was a <10% lung parenchymal involvement (70.6%) with a ground-glass appearance (85.1%) meanwhile a >75% lung involvement occurred in 5.2% of cases. The proportion of cases put on oxygen (via nasal prongs) was 35.5%, often within the first day of hospitalization (Mean (SD): 0.8 (0.0) days). The average duration of

Table 1. Mortality according to the general characteristics of patients.

Sociodemographic Characteristic	Total Number of cases (N = 282)	Mortality n (%)	P-Value
Age Groups			
1 - 39	64	7 (10.9)	<0.001
40 - 49	74	24 (32.4)	
50 - 59	52	15 (28.8)	
60 - 69	62	30 (48.4)	
70+	30	13 (43.3)	
Sex			
Male	192	62 (32.3)	0.7
Female	90	27 (30.0)	
Diabetes			
Absent	236	69 (29.2)	0.057
Present	46	20 (43.5)	
HIV			
Absent	278	88 (31.7)	0.999
Present	4	1 (25)	
Obesity			
Absent	277	87 (31.4)	0.652
Present	5	2 (40)	
Hypertension			
Absent	197	57 (28.9)	0.149
Present	85	32 (37.6)	
Chronic Obstructive Lung Disease			
Absent	277	88 (31.7)	0.999
Present	5	1 (20)	
Asthma			
Absent	274	87 (31.8)	0.999
Present	8	2 (25)	
Chronic Kidney Disease			
Absent	276	86 (31.2)	0.384
Present	6	3 (50)	
Cancer			
Absent	277	86 (31)	0.182
Present	5	3 (60)	
Other Immunodepressions			
Absent	280	87 (31.7)	0.099
Present	2	2 (100)	
Sickle cell disease			
Absent	279	89 (31.9)	0.554
Present	3	0 (0)	

stay on oxygen was 2.5 (± 2) days, delivered at maximum flow rates of 5.7 (± 1.9) L/min. Up to 92 (32.6%) patients were admitted to the ICU. Eighty-one (88%) patients were put on non-invasive mechanical ventilation (NIMV), with the mean duration per patient of 3.2 (± 2.0) days. The mean duration of hospital stay (LOS) was 10 (± 5.2) days; however for patients who died the average LOS was 4.4 days (**Table 2**).

Out of the 282 cases, 89 patients died, giving an overall mortality of 31.5%. The mortality in patients admitted into the ICU was 54.3% (50/92), compared with 20.5% (32/190) when not admitted into ICU. The average age was 48.8 (SD: 14.8) years among the discharged and 56.4 years (SD: 12.9) among the deceased. Furthermore, mortality ranged from 10.9% in patients <40 year old to 48.4% in those 60 - 69 year old (**Table 1**). Overall, patients aged 0 - 39 years had a significantly lesser odd of mortality compared with those >70 years (OR: 0.2 (0.1 - 0.5) $P < 0.001$) and this was the same when we considered only cases admitted into the ICU (**Table 3**). Meanwhile mortality was approximately equal in males and females. Also, those with chronic medical conditions such as diabetes and hypertension experienced higher mortality (**Table 1**).

Clinical and para-clinical evaluation revealed that mortality varied significantly according to the hemodynamic states at time of presentation, the clinical syndromes observed, CT scan image patterns and the proportion of lung parenchyma involved. Mortality following hemodynamic disturbances identified at time of presentation was as follows; 51.1% in patients presenting with a respiratory rate >35 breaths/min; up to 87.8% of those with oxygen saturations <75%; 55.5% of those with pulse rates >126 beats per minute and 43.1% in those with temperatures >38.5°C. All patients (6) presenting with a GCS < 13 died. ARDS was observed in 25 patients, 84% of whom died (OR: 133.4 (33.1 - 537.3) $P < 0.001$) (**Table 3**).

In addition, mortality was as high as 63% in those with CT scan image patterns showing alveolar consolidation and 85% when lung involvement was 75% - 100%. In the presence of alveolar consolidation patterns the odds of mortality was 3.3 times higher compared to its absence (**Table 2**). Also a 75% - 100% involvement of the lung parenchyma on CT-scan was associated with odds of mortality which were 50 times that when only <10% of lung parenchyma was involved. In both previous situations, there were no obvious changes in the OR when we considered only patients admitted into the ICU (**Table 3**). Two cases were identified with pulmonary embolism and they both died during hospitalisation, however not significant.

One-third of the patients presented in a state requiring supplemental oxygen therapy, 55% of them died, meanwhile those not placed on oxygen experienced 18.7% mortality. Whereas 44.5% of patients on NIMV survived and only 20% of intubated patients were discharged from the ICU (**Table 2**). Patients presenting a state requiring supplemental oxygen (by mask or prongs) had an odds of mortality which was 5 times that of those not placed on oxygen at any point during

Table 2. Mortality according to clinical, paraclinical and treatment options in patients.

Clinical Characteristics	Total Number of Cases	Mortality n (%)	P-Value
Respiratory Rate (breath/min) N = 250			
<12	0	-	
12 - 24	90	6 (6.7)	<0.001
25 - 34	113	32 (28.3)	
35+	47	24 (51.1)	
Oxygen Saturation (%) N = 279			
0 - 75	49	43 (87.8)	<0.001
76 - 85	44	26 (59.1)	
86 - 93	76	10 (13.2)	
94+	110	7 (6.4)	
Pulse Rate (bpm) N = 278			
<125	260	79 (30.4)	0.017
126+	18	10 (55.6)	
Systolic Blood Pressure (mmHg) N = 278			
0 - 90	4	2 (50)	0.588
90+	274	83 (29.9)	
Diastolic Blood Pressure (mmHg) N = 278			
0 - 60	12	3 (25)	0.999
60+	266	82 (30.8)	
Temperature (°C) N = 275			
0 - 38.5	210	54 (25.1)	0.007
38.6+	65	28 (43.1)	
Glasgow Coma Score N = 282			
3 - 8	0	-	<0.001
9 - 13	6	6 (100)	
14+	276	83 (30.1)	
WHO severity Classification (Clinical Syndromes) N = 282			
Mild disease	132	5 (3.8)	<0.001
Moderate disease	54	12 (22.2)	
Severe Pneumonia	33	21 (63.6)	
ARDS	25	21 (84)	
Sepsis	27	25 (92.6)	
Septic Shock	8	5 (62.5)	
Ground-Glass Patterns N = 282			
Absent	42	10 (23.8)	0.241
Present	240	79 (32.9)	
Reticulonodular Patterns N = 282			
Absent	279	89 (31.9)	0.554
Present	3	0 (0)	

Continued

Alveolar Consolidation N = 282			
Absent	263	77 (29.3)	0.002
Present	19	12 (63.2)	
Parenchymal Involvement N = 282			
<10%	199	28 (14.1)	<0.001
10% - 25%	43	27 (62.8)	
75% - 100%	40	34 (85)	
Pulmonary Emboli N = 282			
Absent	280	87 (31.1)	0.099
Present	2	2 (100)	
Oxygen Therapy N = 282			
No	182	34 (18.7)	<0.001
Yes	100	55 (55)	
Admission into ICU N = 282			
No	190	39 (20.5)	<0.001
Yes	92	50 (54.3)	
Non-invasive Mechanical Ventilation (CPAP, face-masks) N = 282			
No	201	44 (21.9)	<0.001
Yes	81	45 (55.5)	
Invasive Mechanical Ventilation N = 282			
No	277	85 (30.7)	0.036
Yes	5	4 (80)	

hospitalisation. Similarly, placement on NIMV was associated with odds of mortality which were 5 times that of those not placed on it (OR: 0.2 (0.1 - 0.4) $P < 0.001$). However, when we considered just patients admitted into the ICU, odds of mortality following placement on NIMV were only twice that for those who were not, and this was not significant. Finally intubation was associated with odds of mortality which were 10 times that of those who were not intubated, but when considering just cases in the ICU this was only 3.3 times higher and not significant (**Table 3**).

4. Discussion

Our study compared the demographic and clinical data, laboratory findings, radiological characteristics, and complications between COVID-19 patients who died or were discharged and evaluated the risk factors for mortality in a single center in Douala, Cameroon. We found that, mortality was very high in hospitalized COVID-19 patients especially in ICU cases, and that old age together with a wide range of clinical and para-clinical features were associated with mortality.

The mortality rate in our study was 31.5% which was similar to values obtained in Burkina Faso but higher than values obtained from China [14] [18]

Table 3. Association between certain patient characteristics and mortality.

Patient Characteristics	Unadjusted values		Adjusted Values (Adjusted for hospitalisation into ICU)	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Age Groups				
1 - 39	0.2 (0.1 - 0.5)	0.001	0.2 (0.1 - 0.5)	0.002
40 - 49	0.6 (0.3 - 1.5)	0.295	0.7 (0.3 - 1.7)	0.399
50 - 59	0.5 (0.2 - 1.4)	0.185	0.6 (0.2 - 1.5)	0.244
60 - 69	1.2 (0.5 - 2.9)	0.649	1.3 (0.5 - 3.4)	0.557
70+	-	-	-	-
Alveolar Consolidation				
Absent	0.3 (0.1 - 0.6)	0.004	0.3 (0.1 - 0.7)	0.01
Present	-	-	-	-
Parenchymal Involvement				
<10%	0.02 (0.01 - 0.06)	<0.001	0.03 (0.01 - 0.1)	<0.001
10% - 25%	0.3 (0.1 - 0.9)	0.026	0.3 (0.1 - 0.96)	0.042
75% - 100%	-	-	-	-
WHO severity Classification (Clinical Syndromes)				
Septic Shock	42.3 (7.8 - 228.8)	<0.001	56.6 (9.1 - 353.6)	<0.001
Sepsis	317 (58.3 - 1729.3)	<0.001	393.7 (66.2 - 2340.4)	<0.001
ARDS	133.4 (33.1 - 537.3)	<0.001	165.6 (37.01 - 740.5)	<0.001
Severe Pneumonia	30.5 (9.9 - 93.9)	<0.001	37.5 (10.9 - 128.9)	<0.001
Moderate disease	7.3 (2.4 - 21.8)	<0.001	8.1 (2.6 - 25.1)	<0.001
Mild disease	-	-	-	-
Oxygen Therapy				
No	0.2 (0.1 - 0.3)	<0.001	0.2 (0.1 - 0.4)	<0.001
Yes	-	-	-	-
Non-invasive MV				
No	0.2 (0.1 - 0.4)	<0.001	0.5 (0.2 - 1.2)	0.126
Yes	-	-	-	-
Invasive MV				
No	0.1 (0.01 - 1.0)	0.051	0.3 (0.03 - 2.6)	0.264
Yes	-	-	-	-

[19] this difference could be explained by the fact that hospital admissions in Africa usually consisted of severe cases compared to China, the late presentation of patients in hospitals and also the higher standard of care in China. This mortality however rose to 54% among the critically ill patients, as reported in other studies [11] [12] [20] the reasons for which may differ, in our context, the absence of ventilators and few beds in the ICU may explain this increase.

Our data showed that patients who died were older similar to what was reported worldwide. Bellani *et al.* [21] [22] explains that old patients mostly men with viral pneumonia easily develop ARDS which could eventually be fatal to

them. This study confirmed that old age was associated with death in patients with COVID-19. For example cases older than 70 year old had a 5-fold odds of mortality compared with those younger than 40 year old. More so, when we considered just cases hospitalised into the ICU, the association between old age and mortality remained unchanged suggesting advanced age strongly favoured transfer into ICU and consequently death.

Although we had more male patients and more deaths in absolute terms in this population, the male and female mortality showed no significant difference, this however contrasts with most studies seen which showed a male sex associated with mortality [14] [20] [23].

Our findings support the observations of earlier studies [11] [14] [24], which found a high percentage of hospitalized patients of advanced age with pre-existing conditions, hypertension and diabetes being the most common among the deceased.

Our study showed that severe tachypnea and tachycardia were associated with mortality paralleling other observation [25]. Almost half of those with elevated temperature on admission ended up dying. This turned out to be a factor of poor outcome in our population matching findings of different study [13], delay of fever manifestation hinders early identification of patients, fever being an unspecific symptom patients may have attempted to treat as another disease and therefore delays management. Altered level of consciousness was shown by a very few number of cases (2%), but it however showed significant association with mortality. Zhang *et al.* [14] had a similar observation. Altered level of consciousness is a feature of severe pneumonia and may be due to hypoxemia. It also hinders patient from seeking care and leads to loss of protective reflexes and could lead to aspirations further decompensating the situation.

ARDS in our study just like others [26] [27] showed similar mortality. Along with severe sepsis and shock were considered severe presentations and were shown to be associated with mortality similar to other studies [14]. Patients with severe illness may develop dyspnoea and hypoxemia within 1 week after onset of the disease, which may quickly progress to ARDS, end-organ failure and eventually death, giving limited time for response. Furthermore effective therapies may be limited by lack of recognition of ARDS by clinicians [21].

In accordance with most of the recent studies [28] [29], the most common CT features of COVID-19 included bilateral ground-glass opacity and alveolar consolidation. Presence of consolidation patterns was associated with mortality, similar to Zhang *et al.* [19]. Having 75% - 100% of lung parenchyma affected also led to increase mortality as this observation attained statistical significance. This was probably because the damage to the entire lungs, as well as the ensuing fibrosis decreased the available surface area for gas exchange. This prejudice increased risk of death.

Poor oxygen saturation and presence of respiratory distress were main signs which prompted oxygen therapy to be initiated. A third of the population re-

ceived oxygen supplementation as part of their treatment. This however was associated with mortality after univariate analysis. Skrip *et al.* [18] however arrived at a different conclusion. Furthermore when we considered just cases hospitalised into the ICU, the association between placement on oxygen and mortality remained unchanged suggesting presentation with clinical states requiring oxygen, strongly favoured transfer into ICU and consequently death.

There was an association between transfer to the ICU and mortality, this was 2.5 times higher than mortality in the general ward. The findings were similar to those obtained in international studies [21] [23] but differed from results of other studies [11] [26]. The high incidence of critical illnesses among hospitalised patients has acute implications for our hospital systems, specifically the potential need to increase equipment and ICU surge capacity in preparation for large numbers of patients requiring IMV and other forms of organ support.

Overall, being placed on mechanical ventilation at any point, be it invasive or not showed association with mortality. 90% of ICU patients were placed on non-mechanical ventilation similar to other cohorts [20] while only 5% went on to be intubated which was far less than other settings. However, when we limited comparisons just to patients hospitalised into the ICU, we found no significant differences in mortality for those placed on mechanical ventilation (both non-invasive and invasive) compared with those not placed on it. This affirms that hospitalisation into the ICU strongly favoured death and subsequent placement on these treatment modalities did not reduce death significantly. Mechanical ventilation particularly invasive is the main supportive treatment for critically ill patients.

Study Limitations

Laboratory investigations, ECGs and other pertinent information which could have affected mortality were not accessed in this study due to unavailability.

Our study is a single centre study, interpretation of our findings might be limited by the sample size, when compared to the national numbers, therefore limiting generalizability to the entire country.

5. Conclusions

The in-hospital mortality in COVID-19 patients is very high and hospitalisation into the ICU is associated with even higher mortality. Old age, diffused lung involvement (particularly with alveolar consolidation), hemodynamic instability at presentation, altered level of consciousness, ARDS and severe sepsis favoured hospitalisation in the ICU. Once in the ICU, placement on mechanical ventilation did not reduce death discernibly.

What is already known on this topic?

- It is a global pandemic with elevated mortality worldwide.
- It is a highly infectious disease requiring addition preventive measures to reduce risk of infection.

What this study adds:

- The description and analysis of factors affecting mortality in a sub-Saharan population.
- Gives an objective explanation from a scientific angle of the reasons which contributed to the mortality in our community.

Recommendations

More resources should be invested by researchers towards finding solutions to curb mortality especially among the critical ill patient, in aspects such as prevention with vaccines, also multicentre studies with larger sample size to make results more generalizable.

Close follow up of patients' parameters by health personnel might aid in early identification of disease severity and subsequently reduce mortality, also early initiation on oxygen therapy and intubations accordingly.

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Author Contribution

FAB, MC, EA, DM, HL, JZM and MNN designed the study. FAB, CN, MT, MSN, MLE and DM collected data at LHD. MC, EEN, DA and CE conducted the data simulation. FAB and MC conducted the data analysis. FAB, MC, EA and JZM wrote the first draft of the manuscript. All authors contributed intellectually and made contributions to the manuscript text.

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Competing Interest

The authors declare that they have no competing of interests.

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APPENDICES

Data Collection Form

COHORTE OBSERVATIONNELLE COVID-19

Centre: _____

Investigateur: _____

Nom patient: I__I (première lettre) Prénom patient: I__I (première lettre)

Date de naissance: |_|_| / |_|_| / |_|_|_|_| (jour/mois/année)

Sexe: masculin féminin

Taille: I__I__I__I cm Poids corporel: I__I__I__I kg

Admission

- Date d'entrée dans l'hôpital: |_|_| / |_|_| / |_|_|_|_| (jour/mois/année)

Antécédents médicaux

Tabagisme (actif ou sevré):	<input type="checkbox"/> Non-Fumeur	<input type="checkbox"/> Ancien	<input type="checkbox"/> Actif	<input type="checkbox"/> ND
Si actif, préciser le nombre de paquets-années: _ _ _ _	ou <input type="checkbox"/> ND			
Pathologie respiratoire chronique:			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Si oui: BPCO (BronchoPneumonie Chronique Obstructive)			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Asthme			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Insuffisance cardiaque systolique (fraction d'éjection < 45%)			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Autre insuffisance cardiaque chronique			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Insuffisance rénale chronique			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Si oui: Epuration extra-rénale chronique			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Cirrhose			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Cancer ou hémopathie			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Autre Immunodépression			<input type="checkbox"/> Oui	<input type="checkbox"/> Non
Drépanocytose			<input type="checkbox"/> Oui	<input type="checkbox"/> Non

ECHELLE DE FRAGILITE HABITUELLE (avant la maladie actuelle)

- | | | |
|--|---|--|
| <input type="checkbox"/> Très en forme | <input type="checkbox"/> En forme | <input type="checkbox"/> Se débrouille bien |
| <input type="checkbox"/> Vulnérables | <input type="checkbox"/> Légèrement fragile | <input type="checkbox"/> Modérément fragiles |
| <input type="checkbox"/> Sévèrement fragiles | <input type="checkbox"/> Très sévèrement fragiles | <input type="checkbox"/> En phase terminale |

INFECTION COVID-19

- Date des premiers symptômes: |_|_| / |_|_| / |_|_|_|_| (jour/mois/année)

Symptômes:

<input type="checkbox"/> Fièvre (T > 38.2°C)	<input type="checkbox"/> Toux	<input type="checkbox"/> Dyspnée
<input type="checkbox"/> Douleur thoracique	<input type="checkbox"/> Malaise	<input type="checkbox"/> Rhinorrhée
<input type="checkbox"/> Arthralgie	<input type="checkbox"/> Céphalée	<input type="checkbox"/> Diarrhée
<input type="checkbox"/> Vomissement	<input type="checkbox"/> Myalgie	

- Diagnostic confirmé par PCR: Oui Non
- Si oui, date: |_|_| / |_|_| / |_|_|_|_|_|
(jour/mois/année)
- Diagnostic scanographique Oui Non
- Si oui:
 - Date: |_|_| / |_|_| / |_|_|_|_|_|
(jour/mois/année)
 - Pattern:
 - Verre dépoli Syndrome réticulo-nodulaire Syndrome de condensation alvéolaire
 - Prédominance inférieure: Oui Non
 - Nombre de lobes touchés: |_|
 - Pourcentage de parenchyme atteint:
 - <10% 10% - 25% 25% - 50% 50% - 75% >75%
 - Embolie pulmonaire: Oui Non scanner non injecté

DONNEES CLINIQUES A L'ADMISSION

Données recueillies au cours des 24 h suivant l'admission (pires valeurs):

- Fréquence respiratoire (cycles /min) |_|_|
- SpO₂ (%) |_|_|_|
- Fréquence cardiaque (bpm) |_|_|_|
- Pression artérielle systolique (mm Hg) |_|_|_|
- Pression artérielle diastolique (mm Hg) |_|_|_|
- Température (°C) |_|_|
- Score de Glasgow |_|_|

DONNEES BIOLOGIQUES A L'ADMISSION

Données recueillies au cours des 24 h suivant l'admission (pires valeurs):

- Gaz du sang: Oui Non
- Si oui, condition de réalisation: Air ambiant Oxygène: |_|_|L/min
- pH |_|_| CO₂t |_|_|, |_| mmol/L Lactates |_|_|, |_| mmol/L
- PaO₂ |_|_|_| mm Hg PaCO₂ |_|_| mm Hg SaO₂ |_|_|%
- Urée |_|_|, |_| mmol/L NA
- Créatinine |_|_|_| μmol/L NA
- CPK |_|_|_|_| UI/L NA
- LDH |_|_| UI/L NA
- ASAT |_|_|_| UI/L NA
- ALAT |_|_|_| UI/L NA
- PAL |_|_|_| UI/L NA
- γGT |_|_|_| UI/L NA
- Bilirubine totale |_|_|_| mmol/L NA
- Bilirubine conjuguée |_|_|_| mmol/L NA
- Leucocytes |_|_|, |_| G/L NA
- Lymphocytes |_|_|, |_| G/L NA
- PNN |_|_|, |_| G/L NA
- Plaquettes |_|_|_| G/L NA

- Hb |_|_|,|_| g/dL NA
- CRP |_|_|_| mg/L NA
- PCT |_|_| ng/mL NA
- D-dimères |_|_|_|_| µg/L NA
- Troponine |_|_|_|_| ng/L NA

MODALITES DE LA PRISE EN CHARGE RESPIRATOIRE

- **Mise sous oxygène:** Oui Non

Si oui,

Date de début: |_|_|/|_|_|/|_|_|_|_|

Date de fin: |_|_|/|_|_|/|_|_|_|_|

(jour/mois/année)

Débit maximal O₂: |_|_|L/min

Cause arrêt: Sevrage (amélioration) Passage à CPAP/VNI Intubation Décès

- **Mise sous CPAP:** Oui Non

Date de début: |_|_|/|_|_|/|_|_|_|_|

Date de fin: |_|_|/|_|_|/|_|_|_|_|

(jour/mois/année)

Débit maximal O₂: |_|_|L/min

Cause arrêt: Sevrage (amélioration) Intubation Décès

- **Mise sous Ventilation Non Invasive:** Oui Non

Date de début: |_|_|/|_|_|/|_|_|_|_|

Date de fin: |_|_|/|_|_|/|_|_|_|_|

(jour/mois/année)

Valeur maximale FiO₂: |_|_|_|%

Cause arrêt: Sevrage (amélioration) Intubation Décès

- **Intubation ventilation mécanique:** Oui Non

Date de début: |_|_|/|_|_|/|_|_|_|_|

Date de fin: |_|_|/|_|_|/|_|_|_|_|

(jour/mois/année)

Valeur maximale FiO₂: |_|_|_|%

Rapport PaO₂/FiO₂ le plus bas dans les 24 h suivant l'intubation: |_|_|_|

Le patient a-t-il été extubé? oui non

o Si oui, date d'extubation sans ré-intubation dans les 72 heures: |_|_|/|_|_|/|_|_|_|_|

TRAITEMENT SPECIFIQUE DURANT L'HOSPITALISATION

- Lopinavir/ritonavir oui non
- Chloroquine/Hydroxychloroquine oui non
- Corticothérapie oui non
- Tocilizumab oui non
- Antibiotique oui non

Si oui, préciser: _____

SUIVI A J 28

Le patient est-il toujours à l'hôpital? oui non

- Si sortie d'hôpital: date: |_|_|/|_|_|/|_|_|_|_|

Le patient a-t-il été admis en réanimation? oui non

• Si admission en réanimation:

○ Date d'admission: |_|_| / |_|_| / |_|_|_|_|_|

○ Le patient est-il toujours en réanimation? oui non

○ Si non, Date de sortie de réanimation: |_|_| / |_|_| / |_|_|_|_|_|

Le patient a-t-il nécessité une perfusion de catécholamines ? oui non

• Si perfusion de catécholamines:

○ Type de catécholamine:

dopamine dobutamine noradrenaline adrenaline

○ Date de début catecholamines: |_|_| / |_|_| / |_|_|_|_|_|

○ Date de fin catecholamines: |_|_| / |_|_| / |_|_|_|_|_|

Le patient a-t-il nécessité une épuration extrarénale? oui non

• Si épuration extra-rénale:

○ Date de début épuration: |_|_| / |_|_| / |_|_|_|_|_|

○ Date de fin épuration: |_|_| / |_|_| / |_|_|_|_|_|

Le patient est-il décédé? oui non

Si décès: date: |_|_| / |_|_| / |_|_|_|_|_|