Characteristics and pharmacological management of COVID-19 patients admitted at a hospital in Nairobi, Kenya

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COVID-19 is a novel viral disease with little known about its management. The Nairobi Hospital (TNH) has been involved in managing these patients. This study sought to describe the patients admitted in the hospital due to COVID-19, their management and outcomes. This was a retrospective review of COVID-19 patients admitted at TNH between March and October 2020. Demographic and clinical data, pharmacological management and outcomes of these patients was retrieved from the hospital electronic records, and analyzed. Results revealed that there were 326 study participants with a mean age (s.d.) of 47.1 (15.5) years, of whom 221 (67.8%) were male. Those that were critically ill were 55 (16.9%), while 186 (57.1%) had mild/moderate disease. More than half of the participants had at least one co-morbidity, with hypertension and diabetes being predominant. Remdesivir was the commonest investigational drug and was administered to 39 patients. The patients were mainly managed with paracetamol (83.3%), ascorbic acid (79.8%), anticoagulants (64.4%), antihistamines and cough syrups (53.7%). Dexamethasone was the steroid of choice, having been used in 44% of the patients. Antibiotics were administered to 157 (48.4%) of the patients with Levofloxacin being the most prescribed. The mortality rate was 10% and was significantly associated with advanced age, having multiple comorbidities and severe illness. It was thus understood that management of COVID-19 inpatients at TNH was mainly supportive. There’s need to emphasize on prevention measures especially among the elderly and those with multiple comorbidities.

**Key words:** COVID-19, Remdesivir, Investigational therapies.

INTRODUCTION

The first cases of COVID-19, a viral respiratory infection with flu-like symptoms were confirmed in December 2019 in Wuhan, China (Zhu et al., 2020). The infection subsequently spread rapidly across continents and on 30th January, 2020, the World Health Organization declared the disease a public health emergency of international concern. A year later in January 2021, close to 100 million cases have been reported worldwide with 2
million deaths occurring (WHO COVID-19 dashboard, 2021).

In Kenya, COVID-19 was first confirmed on March 12th 2020 and has continuously recorded high morbidity. As of 14th January 2021, 98,555 patients had tested positive for the disease and a total of 1,720 had died (Kenya Ministry of Health, 2021). Considering the limitations in the ability to conduct mass testing and reporting, these figures could be an underestimation of the gravity of the situation.

Majority of the cases have been reported in adults, with close to one-half of patients having comorbid conditions including cardiovascular disease, hypertension and diabetes. In a prospective evaluation of patients hospitalized in New York with confirmed COVID-19, 22% were critically ill. Of these critically ill patients (n=257), median age was 62 years, 67% were men, 82% had 1 or more chronic comorbidities (Cummings et al., 2020). However, there is limited information describing characteristics and management of COVID-19 patients requiring hospitalization in Kenya.

There is currently no universally endorsed treatment protocol for COVID-19 but there are numerous preliminary guidelines employed by healthcare systems that have informed COVID-19 management the world over (NIH COVID-19 Treatment Guidelines Panel, 2021). The Food and Drug Administration (FDA) approved Remdesivir for the management of severe COVID-19, but there is limited information on its usage. An understanding of the pharmacological management and the outcomes of this disease at The Nairobi Hospital (TNH) will add to the global concerted efforts of coming up with a standardized approach of care.

In this study, we sought to describe the characteristics of patients admitted due to COVID-19, their pharmacological management as well as outcomes and associated factors.

METHODS

Research design

The study was a retrospective review of the characteristics, pharmacological management and outcomes of patients admitted due to COVID-19 at The Nairobi Hospital between March and October 2020.

Study area and population

The study was conducted at TNH, a 350-bed private hospital in Nairobi, Kenya with Intensive Care Units, Surgery, Pediatric, and Medicine departments. An average of about 1500 patients are admitted monthly (TNH Records, November 2020). A separate 100-bed unit was constructed and commissioned in November 2020, to specifically handle COVID-19 patients. The hospital has a specific ward where suspected patients are admitted while they await results. Those who test positive for COVID-19 are moved to the COVID isolation wing of the hospital while those who test negative are transferred to the general ward. There is a designated team of medical specialists, medical officers, nurses and pharmacy staff that attend to these patients. The patients can be discharged for self-isolation at home once their condition improves or can be transferred to the non COVID sections of the wards once they test negative.

Sample size, inclusion and exclusion criteria

The sample size was calculated using the Cochran’s formula (Daniel and Cross, 2013). According to WHO, 80% of COVID-19 patients worldwide have mild disease (COVID-19 situation report, March 2020). Taking this as our p, with a confidence interval of 95%, and a degree of precision of 5%, the minimum sample size was 245. However, we sampled 326 patients. Seven hundred and fifty-three patients were admitted due to COVID-19 during the study period. We used systematic sampling whereby these patients were arranged in order of date of admission and every alternate patient was sampled for inclusion. Those that were still admitted at the end of the study period were excluded.

Data collection

A pre-tested data collection form was used to collect information from patients’ electronic records during the study period. The data included patient demographic and clinical information, prescribed medications, duration of hospitalization and outcome. The end point for each study subject was discharge from hospital or death.

Data analysis

The data was coded and entered into SPSS statistics version 26 for analysis. Continuous variables were summarized as the mean and standard deviation of the mean. Categorical variables were summarized as frequencies and proportions. Chi-square tests were adopted to determine the association between the variables. P-values of 0.05 or less were considered statistically significant.

Ethical considerations

Ethical approval was obtained from TNH Ethics and Research Committee (TNH-ERC/DMSR/PR/040/20) before commencement of the study. Confidentiality was maintained by using study serial numbers instead of participants’ names.

RESULTS

Characteristics of the study participants

The study participants were mainly male and had a mean age (s.d.) of 47.1 (15.5) years. Those aged between 40 - 49 years were the majority, constituting 45.1% of the participants. Majority were admitted for less than two weeks while more than half had at least one co morbidity (Table 1).

Month of hospitalization

The hospital recorded the highest number of COVID-19 admission in July when we had 113 in-patients. There
Table 1. Characteristics of the study participants.

| Variable                        | n (%)            |
|---------------------------------|------------------|
| Gender                          |                  |
| Male                            | 221 (67.8)       |
| Female                          | 105 (32.2)       |
| Age (mean (s.d.), years)        | 47.1 (15.5)      |
| ≤ 19                            | 11 (3.4)         |
| 20-39                           | 98 (30.1)        |
| Age group (years)               |                  |
| 40-59                           | 147 (45.1)       |
| 60-79                           | 65 (19.9)        |
| ≥80                             | 5 (1.5)          |
| Severity of disease             |                  |
| Mild/Moderate                   | 186 (57.1)       |
| Severe                          | 85 (26.0)        |
| Critical                        | 55 (16.9)        |
| (Median, Days [Range])          |                  |
| 1-7                             | 134 (41.5)       |
| Length of admission (days)      |                  |
| 8-14                            | 118 (36.2)       |
| 15-21                           | 55 (16.9)        |
| >21                             | 19 (5.8)         |
| None                            | 161 (49.4)       |
| Number of co morbidities        |                  |
| One                             | 112 (34.4)       |
| Two                             | 43 (13.2)        |
| ≥Three                          | 10 (3.1)         |

was equally a second peak, though smaller in October (Figure 1).

Prevalent comorbidities

Hypertension was the most prevalent comorbidity with 95 of the study participants reported to have been diagnosed. Sixty-five of the patients had diabetes mellitus while 36 had both hypertension and diabetes. A few patients reported having chronic respiratory conditions (Figure 2).

Suggested COVID-19 therapies received

Majority, that is, 273 (83.4%) of the patients did not receive any drugs associated with the treatment of COVID-19. Of the investigational therapies, Remdesivir was the most commonly used. It was administered in 39 (12%) of the patients. Chloroquine and Hydroxychloroquine were administered to a few patients. Only three patients received Tocilizumab (Figure 3).

Other drugs used in the management of COVID-19 patients

Paracetamol was administered to 271 patients while 260 received Ascorbic acid. Dexamethasone was the preferred anti-inflammatory agent while very few patients received zinc (77) and bronchodilators - 72 (Figure 4).

Antibiotic usage among COVID-19 inpatients

Those that received at least one antibiotic during their stay were 157 (48.2%). Levofloxacin was the most commonly prescribed antibiotic followed by Amoxicillin/ clavulanate and the macrolides. The aminoglycosides were not frequently prescribed (Table 2).

Outcome of therapy

Two hundred and eighty-three (87%) of the patients were discharged home after recovering, 32 (10%) died, while 11 (3%) were moved to other hospitals.
Factors associated with outcomes of COVID-19 patients

Mortality was significantly more likely among the elderly, those with multiple comorbidities and those that had severe illness requiring ICU admission. Gender did not influence outcome. Neither the use of Remdesivir nor antibiotics improved the outcomes of the patients (Table 3).

Factors associated with ICU admission of Covid 19 patients

Being male, elderly and having many comorbidities
significantly increased one’s likelihood of being admitted at the ICU (Table 4).

DISCUSSION
Patients admitted due to COVID-19 in our hospital were predominantly male, as has been the pattern worldwide. The higher expression of angiotensin-converting enzyme-2 in males than females, sex-based immunological differences driven by sex hormone and X chromosome are factors that have been hypothesized to contribute to this pattern (Bwire, 2020). We also found that majority of
the patients were aged between 30 and 60 years. The risk of severe disease and therefore hospitalization increases with age. This is the age when most comorbidities such as cardiovascular disorders and type 2 diabetes set in and these have been associated with severe COVID-19 disease. However, in Europe and America, majority of patients were slightly older than those reported in our study. Among 5,700 patients hospitalized with COVID-19 in the New York City area, the median age was 63 years with an interquartile range of 52 – 75 years (Richardson et al., 2020). Similarly, 33% of patients in a UK study were aged over 80 years (Brill et al., 2020). This is most likely due to the difference in age stratifications between Kenya and these countries. Life expectancy in most African countries is lower than in western nations, meaning that the age group susceptible to moderate or severe COVID-19 infection will be relatively younger than in countries with a higher life expectancy.

According to WHO, approximately 80% of COVID-19 patients experience mild disease, 14% severe disease while 5% become critically ill (COVID-19 situation report, March 2020). The proportion of patients with critical illness in our study is higher because the sample was comprised of hospitalized patients only. Majority of those with mild disease were definitely not hospitalized and not included in the computation. Our patients were admitted for a median of 9 days. This is relatively longer than the findings in one systematic review where the median duration of admission was 5 days, for studies outside China (Rees et al., 2020). These were mainly in Europe and America and it is therefore possible that more patients with mild disease were admitted in these studies, thus requiring shorter admission durations.

It is now clear that particular underlying medical conditions, notably cardiovascular and respiratory conditions increased the likelihood of one developing severe COVID-19 once they contract the disease. Also, disease progression among these patients is rapid and at times leading to death (Sanyaolu, 2020). More than half of our admitted patients had at least one comorbidity. An analysis of more than 1.3 million cases in the United States revealed a six-fold increase in the risk for hospitalization (45.4% vs. 7.6%) in those with underlying medical conditions than in those without (NIH COVID-19 Treatment Guidelines Panel, 2021). The pattern observed in our study is a replica of a few other studies where hypertension is the predominant comorbidity, while a significant proportion of patients also have diabetes and respiratory conditions (Brill et al., 2020; Richardson et al., 2020). Currently, it is still unclear the pathophysiology behind this increased risk. It can however be understood why patients with moderate to severe asthma would have severe COVID-19 if infected. This is because this virus affects their respiratory tracts, leading to increased asthmatic attacks, pneumonia, and acute respiratory distress (Sanyaolu, 2020).

There was a peak in the number of patients hospitalized with COVID-19 during the month of July 2020. This corresponds with what was observed nationally. After the first case reported in March 2020, there was only a small rise in cases in April and May
Table 3. Factors associated with outcomes of COVID-19 patients.

| Variable         | Deceased | Recovered | P value |
|------------------|----------|-----------|---------|
| Gender           |          |           |         |
| Female           | 7        | 98        | 0.235   |
| Male             | 25       | 196       |         |
| ≤ 30             | 0        | 40        |         |
| Age (Years)      |          |           |         |
| 31-60            | 17       | 210       | <0.0001 |
| >60              | 15       | 44        |         |
| Severity of disease |        |           |         |
| General Ward    | 1        | 270       | <0.0001 |
| ICU admission    | 31       | 24        |         |
| Use of Remdesivir|          |           |         |
| Not administered | 17       | 270       | <0.0001 |
| Administered     | 15       | 29        |         |
| Use of antibiotics |       |           |         |
| No antibiotics   | 3        | 166       | <0.0001 |
| Antibiotics given| 29       | 128       |         |
| Comorbidities    |          |           |         |
| Absent           | 8        | 153       | 0.005   |
| Present          | 24       | 141       |         |
| No. of comorbidities |     |           |         |
| None             | 8        | 153       | 0.021   |
| 1                | 13       | 99        |         |
| 2 or more        | 11       | 42        |         |

Table 4. Factors associated with ICU admission of Covid 19 patients.

| Variable         | ICU admission | P value |
|------------------|---------------|---------|
| Gender           |               |         |
| Female           | 92            | 13      | 0.006   |
| Male             | 179           | 42      |         |
| ≤ 30             | 40            | 0       |         |
| Age (Years)      |               |         |
| 31-60            | 193           | 34      | <0.0001 |
| >60              | 38            | 21      |         |
| Comorbidities    |               |         |
| Absent           | 143           | 18      | 0.003   |
| Present          | 128           | 37      |         |
| None             | 143           | 18      |         |
| No. of Comorbidities |      |           |         |
| 1                | 91            | 21      | 0.006   |
| 2 or more        | 37            | 16      |         |

(Kenya: Cumulative coronavirus cases 2020 - 2021). Epidemiologically, this is the period of local transmission, where even contacts of confirmed cases can be traced, tested and quarantined if need be. After the epidemic reached the community stage in July 2020, the rate of transmission soared leading to high numbers of admissions. There was another surge of infections in October that led to a second peak (Kenya: Cumulative coronavirus cases 2020 - 2021).

COVID-19 infection is managed by a combination of public health interventions and supportive care for those affected.

Several therapies that have shown potential to improve outcomes among cases are being tested in clinical trials the world over (Xu et al., 2020). Remdesivir was found to be the most frequently used investigational drug due to the fact that it is currently the only drug approved by the Food and Drug Administration (FDA) for the management of severe COVID-19. Early during the course of the infection, there is replication of severe acute respiratory
syndrome coronavirus 2 (SARS-CoV-2). It is therefore hypothesized that anti-SARS-CoV-2 therapies may be beneficial at this stage (NIH COVID-19 Treatment Guidelines Panel, 2021). It has also been suggested that Remdesivir appears to shorten recovery times for hospitalized patients (Stasi et al., 2020).

In the later stages of the COVID-19 infection, an exaggerated immune/inflammatory response to the virus is mounted leading to tissue damage. Immune modulating agents would therefore be indicated at this stage (COVID-19 Treatment Guidelines, 2021). Use of the immune-modulator Tocilizumab was limited in our study. This could have been due to the cost implications since monoclonal antibodies are quite expensive. Close to half the patients in this study received Dexamethasone. It is a corticosteroid with a half-life of more than 36 h and is primarily used for the management of allergic reactions, cerebral edema and shock. The RECOVERY trial reported that dexamethasone 6 mg per day for 10 days dramatically reduced the mortality in COVID-19 patients on ventilators (The RECOVERY Collaborative Group, 2021). The probable mechanism is through the immunosuppressive effects that counter the overactive immune system in COVID-19 patients. Dexamethasone is therefore recommended in hospitalized COVID-19 patients requiring supplemental oxygen (NIH COVID-19 Treatment Guidelines Panel, 2021).

In addition to the antiviral and immune suppressing medications, supportive treatments are usually used to manage COVID-19 and its complications. Anticoagulants were used in 65% of the patients in our study. Respiratory insufficiency, a common manifestation of this disease can be related to diffuse pulmonary microthrombosis. COVID-19 has also been associated with increased thromboembolic events such as venous thromboembolism, catheter thrombosis and disseminated intravascular coagulopathy (Flumignan et al., 2020). However, there is limited information currently on the benefits and risks of prophylactic anticoagulation in these patients. Some retrospective studies have reported a reduction in all-cause mortality in those who received anticoagulants while other studies report no difference (Flumignan et al., 2020).

It has been suggested that high doses of intravenous vitamin C, together with hydrocortisone and Vitamin B1 improves outcomes in cases of sepsis as well as decreasing mortality in these patients (Mark et al., 2017). Ascorbic acid is an antioxidant and free radical scavenger that has anti-inflammatory properties, and serves as a cofactor in the generation of endogenous catecholamines. In states of oxidative stress, such as those observed in COVID-19 infections, Vitamin C supplementation has been routinely used (NIH COVID-19 Treatment Guidelines Panel, 2021). Just about a quarter of the participants in the current study received supplemental Zinc. The proposed use of Zinc in management of COVID-19 arises from the fact that increased intracellular zinc concentrations efficiently impair replication in a number of RNA viruses. However, there is insufficient data to recommend for or against its use (NIH COVID-19 Treatment Guidelines Panel, 2021).

An international web-based survey that investigated the pattern of antibiotic use in COVID-19 patients reported a preference of antibiotics with coverage of atypical organisms and Staphylococcus aureus. Combination of b-lactams and macrolides or fluoroquinolones was reported by 52.4% of physicians treating COVID-19 patients in that study (Beović et al., 2020). It has been suggested that a preceding viral infection may impair the host’s antibacterial host defenses, making the individual susceptible to secondary bacterial pneumonias (Ginsburg an Klugman, 2020). Diagnosis of this is challenging and while inappropriate antibiotic usage fuels resistance, failure to administer antibiotics where indicated is probably more disastrous.

Mortality in our study was 10% and was significantly associated with advanced age and having comorbidities. Similar findings were reported in Burkina Faso where 90.9% of deaths occurred among individuals aged 50 years or older. Underlying conditions were equally prevalent among deceased cases in that study (Skrip et al., 2020). In a retrospective review of 113 deceased corona virus patients in China, hypertension and other cardiovascular comorbidities were more frequent among deceased patients than in recovered patients (Chen et al., 2020). Male sex was also predominant in deceased cases in that study, contrary to what we observed in our hospital. However, we did observe that male gender was significantly associated with admission into the intensive care unit. In yet another study, patients above 65 years and who have comorbidities had an increased admission rate into the intensive care unit and mortality from the COVID-19 disease (Stasi et al., 2020). Therefore, patients with comorbidities should take all necessary precautions to prevent infection with COVID-19 since their prognosis is worse.

Conclusion

There is need to emphasize on prevention measures especially among the elderly and those with multiple comorbidities since these were likely to have severe disease. This study adds to the existing body of knowledge regarding COVID-19 distribution, specifically the Kenyan population. A limitation of the study was that we did not look at non-pharmacological management of this disease in our hospital.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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