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Original Article

First and Second Waves of COVID-19: A Comparison of Clinical Characteristics and Disease Severity at an Isolation Center in Kano , Nigeria

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ABSTRACT

Background: Since the emergence of the Coronavirus Disease 2019 (COVID-19), many countries have experienced at least three wave patterns of the pandemic. The aim of our study is to compare the characteristics, and disease severity during the first and second waves of the pandemic in Kano, North-West Nigeria.

Methods: This was a retrospective cohort study of 332 patients with confirmed COVID-19, seen at the isolation center of Kano from April 2020 to March 2021. Data was extracted from the medical records of the patients using a proforma. Data were summarized using frequencies and percentages. Mean and standard deviation were used to present continuous variables. Chi-square test of statistical significance was used to obtain p-values to compare the clinical characteristics between first and second waves of the pandemic. A p-value of <0.05 was regarded as statistically significant.

Results: There were 134 and 198 admitted patients in the first and second waves of the pandemic. The mean age ± standard deviation was 46.18±18.52years and 43.19±18.43years for patients in the first and second waves respectively. There were 81.34% and 83.34% males in the first and second waves respectively. More severe disease (20.10% vs. 11.45 %, p=0.042) and higher mortality (16.67% vs. 2.24%, p<0.0001) were recorded in the second wave compared to the first wave. Less dexamethasone (10.6% vs. 19.67%, p=0.032) and ivermectin (8.59% vs. 17.93%, p=0.022) were used during the first wave.

Conclusions: The center recorded more severe cases and higher mortality during the second wave of the pandemic. We suggest more robust preparedness effort to be able to effectively combat future COVID-19 waves.

Key words: COVID-19, Severity, Nigeria, First wave, Second wave, Kano.

INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) first emerged in Wuhan City, Hubei Province, China in December 2019[1]. The causative agent, a novel coronavirus, was named SARS CoV-2 virus[1]. Egypt reported the first case of COVID-19 in Africa on the February 14, 2020[2].

By February 27, 2020, the first case of COVID-19 was reported in Nigeria while Kano State confirmed its first COVID-19 case on April 11 2020[3].

By April 27, 2020, lockdown was instituted in the state when about 640 people died of "unexplained causes" within a period of 2 weeks[4].

Since the emergence of the disease, many countries have described their experiences of the clinical characteristics of the first and second waves of the pandemic[2,5-7].

The changing genomic epidemiology of the virus[8], emerging evidence on utility or otherwise of repurposed medications for the treatment of the disease[8], use of non-pharmacological methods of disease prevention and the evolving overall experience of clinicians in the management of the disease may have contributed to the differences in the clinical characteristics of the different waves of the pandemic.

The investigation of the characteristics of the different waves of the pandemic allows us to consolidate the lessons learned and to potentially prepare effectively for future waves and pandemics.

Therefore, the aim of this study was to compare the clinical characteristics, disease severity and outcomes between patients admitted to an isolation center in Kano, North-West Nigeria during the first and second waves of the pandemic.

METHODS

Study design and setting:

A retrospective cohort study of patients admitted with COVID-19 at Kwanar Dawaki isolation center in Kano, Kano state, North-West Nigeria was conducted. The hospital is in Kano State (with a projected population of over 15 million based on the 2006 census) and has a capacity of 79-beds. In addition to management of patients with mild to moderate disease, the Kwanar Dawaki Isolation center was dedicated to management of patients with severe COVID-19 pneumonia in the state at the time of the study. Kano State Government funds the COVID-19 care program through the Kano State Task Force on COVID-19.

Study population/patients:

The study included all patients admitted at the study site during the first (April to October 2020) and second (November 2020 to March 2021) waves of the pandemic.

Treatment protocol and data collection:

The center uses a modified Nigerian Center for Disease Control (NCDC) guideline for management of COVID-19. Only SARS CoV-2 PCR positive patients were admitted at the center. Clinical evaluation and laboratory investigations of the newly diagnosed patients with COVID-19 were conducted at the center. The investigations included complete blood count, liver function tests, renal function tests, electrocardiography, chest radiography and other indicated tests.

Clinical management of the patients evolved over time and included use of combinations of the following medications as indicated: vitamin C, zinc sulphate, paracetamol, loratadine, azithromycin, hydroxychloroquine, oxygen, low molecular weight heparin, lopinavir / ritonovir, dexamethasone, ivermectin, calcium supplements and antibiotics as appropriate[9].

Patients were classified as having mild, moderate or severe disease based on the NCDC guideline[9]. Briefly, mild to moderately symptomatic patients are those with or without fever but, temperature <38ºC, with or without cough, no difficulty in breathing and no underlying chronic heart or lung disease. Severe to critically ill patients have difficulty in breathing, respiratory rate greater than 30 cycles per minute, high fever with temperature >38ºC; or presence of underlying chronic medical conditions[9].

Data for this study was retrospectively collected from case notes of all COVID-19 patients that were admitted in the facility. The data was entered into Microsoft Excel spreadsheets, cleaned and subsequently analyzed using STATA statistical software.

Data analysis:

The study sample comprised of 332 observations comprising of all patients admitted at the facility during the first and second waves of the COVID-19 pandemic. Data analysis was done using STATA Version 13.0 (College Station, Texas). Frequencies and percentages were used to summarize data. Mean and standard deviation were used to present continuous variables. Chi-square test of statistical significance was used to obtain p-values to compare the clinical characteristics between first and second waves of the pandemic. A p-value of <0.05 was regarded as statistically significant.

RESULTS

Baseline characteristics, clinical symptoms, and outcome:

Of the 332 patients, 134 and 198 were admitted during the first and second waves of the pandemic, respectively. The mean age ± standard deviation was 46.18±18.52years and 43.19±18.43years for patients in the first and second waves respectively. There were 81. 34% and 83.34% males in the first and second waves respectively.

As shown in Table 1, in both the first and second epidemic waves, patients with severe disease tended to be older compared to those with non-severe disease. We also observed more patients that were ever married among those admitted in the second wave compared to the first wave (64 .86 % vs.2.25 %, p<0.0001). More severe disease (20 .10 % vs. 11 .45 %, p=0.042) and higher in-hospital mortality (16.67% vs. 2.24%, p<0. 001) were recorded in the second wave compared to the first wave.

Table 1: Baseline characteristics, clinical symptoms, and outcome of COVID-19 patients in Kano, Nigeria during the first and second waves stratified by disease severity

		Both waves	1st Wave			2nd Wave			*p-value	
Variable	Characteristics	All	All	Severe	Non-severe	All	Severe	Non-severe		N
	No (%)	N=332	N=134	N=15	N=116	N=198	N=39	N=155		
Sociodemographic variables	Male	274 (82.00)	106 (80.92)	10 (66.67)	96 (82.76)	162 (83.51)	33 (84.62)	129 (83.23)	0.640	332
	Age	44.40±18.49	46.17±18.51	57.73±17.44	44.46±17.97	43.19±18.43	58.07±16.66	39.18±16.91	0.150	332
	Marital Status (Ever Married)	219 (77.66)	119 (92.25)	12 (80.00)	107 (93.86)	96 (64.86)	23 (85.19)	73 (60.33)	<0.0001	282
Number of patients presenting with particular clinical symptoms	Fever	95(29.05)	38(29.01)	9(60.00)	29(25.00)	57(29.84)	15(39.47)	42(27.45)	0.818	327
	Cough	116(35.91)	46(35.38)	14(93.33)	32(27.83)	68(36.17)	24(63.16)	44(29.33)	0.857	302
	SOB	67(21.75)	23(17.56)	11(73.33)	12(10.34)	42(24.42)	25(67.57)	17(12.59)	0.153	308
	Anosmia	10(3.27)	4(3.05)	0	4(3.45)	5(2.94)	2(5.56)	3(2.24)	0.688	306
Days from onset of symptoms to admission	Fever	1.79±4.10	2.07±4.25	1.91±3.44	2.15±4.40	1.57±3.97	2.14±3.67	1.45±4.05	0.325	262
	Cough	2.29±5.08	2.97±6.23	3.7±3.46	2.9±6.52	1.77±3.9	5.58±7.33	1.02±2.13	0.071	258
	SOB	0.79±2.66	0.63±1.47	1.50±2.32	0.57±1.36	0.92±3.33	3.75±6.59	0.34±1.65	0.400	253
	Anosmia	0.24±1.16	0.44±1.54	0	0.51±1.64	0.07±0.65	0.11±0.57	0.64±0.67	0.027	250
Outcome	Dead	36 (10.84)	3 (2.24)	0	3 (2.59)	33 (16.67)	16 (41.03)	16 (10.32)	<0.0001	332

SOB= Shortness of breath; *p-value: for the test of statistical significance in the comparison between the first and second wave

Clinical signs:

As shown in Table 2, overall, on admission oxygen saturation did not differ between the first and second waves

(94.38%±10.28% *vs.* 94.84%±7.73%, p=0.651).

Table 2: Clinical signs among COVID-19 patients in Kano, Nigeria during the first and second waves stratified by disease severity

	Both waves	1st Wave			2nd Wave			*p-value	
Variable	All	All	Severe	Non-severe	All	Severe	Non-severe		N
No (%)	N=332	N=134	N=15	N=116	N=198	N=39	N=155		
Admission SPO2 (%)	94.65±8.84	94.38±10.28	88.26±10.92	95.13±10.04	94.84±7.73	85.94±12.89	97.13±2.77	0.651	314
Highest Temperature (°C)	36.56±2.33	36.64±3.48	37.12±0.53	36.57±3.75	36.49±0.47	36.70±0.45	36.43±0.46	0.613	265
Lowest Temperature (°C)	36.53±19.03	38.36±28.53	35.77±0.64	35.65±3.77	35.13±3.86	35.57±0.90	35.00±4.42	0.301	256
Highest SBP (mmHg)	138.67±23.64	140.35±27.57	147.8±18.58	139.47±28.66	137.49±20.42	148.25±19.98	134.65±19.66	0.297	309
Highest DBP (mmHg)	90.76±17.64	92.03±21.26	91.46±17.76	92.26±21.92	89.86±14.53	91.30±14.05	89.56±14.70	0.287	308
Lowest SBP (mmHg)	111.00±19.94	111.85±21.35	101.2±19.56	113.57±21.31	110.37±18.87	107±24.46	111.17±17.21	0.532	291
Lowest DBP (mmHg)	72.02±13.48	73.87±13.47	64±9.38	75.38±13.49	70.65±13.36	67.79±15.00	71.41±12.92	0.046	308

SBP= systolic blood pressure, DBP= Diastolic blood pressure; *p-value: for the test of statistical significance in the comparison between the first and second wave

Laboratory findings:

As shown in Table 3, the mean hemoglobin (Hb) concentration, platelets, aspartate aminotransferase, serum potassium were significantly lower in the first wave compared to the second wave. However, mean lymphocyte was significantly higher in the first wave compared to the second wave (Table 3).

Table 3: Laboratory findings among COVID-19 patients in Kano, Nigeria during the first and second waves stratified by disease severity

	Both wave	1st Wave			2nd Wave			*p-value	
Variable	All	All	Severe	Non-severe	All	Severe	Non-severe		N
No (%)	N=332	N=134	N=15	N=116	N=198	N=39	N=155		
Platelets (1000 cells/µl)	240.18±167.88	150.66±188.19	315±19.79	130.12±189.89	292.16±132.02	307.71±140.71	279.35±127.30	0.007	49
Lymphocytes (1000 cells/µl)	17.88±17.37	8.50±13.51	11.79±14.99	8.11±13.77	23.83±17.09	18.95±14.83	27.56±18.18	0.006	49
Creatinine (mmol/l)	149.08±233.76	174.70±288.85	250.82±355.16	160.07±280.28	120.71±151.95	164.79±207.43	76.64±27.27	0.383	59
AST (IU/l)	23.89±28.13	15.8±26.63	44.13±28.82	8.07±21.20	38.06±26.39	41.9±32.37	31.66±15.60	0.086	22
ALT (IU/l)	22.50±26.58	13.76±26.05	34.53±33.4	8.1±22.24	39.98±18.71	41.8±22.55	37.56±16.51	0.046	21
Hb (g/dl)	11.54±9.41	4.96±5.85	10.5±3.95	4.27±5.76	15.62±8.92	13.65±7.16	17.22±10.07	0.003	47
K+ (mmol/l)	3.03±1.74	2.36±1.87	3.11±1.78	2.22±1.88	3.68±1.34	3.44±1.63	4.05±0.56	0.005	65

AST= Aspartate aminotransferase, ALT= Alanine aminotransferase, Hb=Haemoglobin, K+=potassium; *p-value: for the test of statistical significance in the comparison between the first and second wave

Treatment:

Hydroxychloroquine (21.51% *vs.* 1.5%, p<0.0001), lopinavir /ritonavir (77.86% *vs.* 7.59%, p<0.0001), ceftriaxone (31.06% *vs.* 20.33%, p=0.031), azithromycin (83.46% *vs.* 70.27%, p=0.007) and non-steroidal anti-inflammatory drugs (NSAIDS) (26.32% Vs.3.91%, p<0.0001) were given to more patients in the first wave compared to the second wave. However, less dexamethasone (10.6% *vs.* 19.67%, p=0.032) and ivermectin (8.59% *vs.* 17.93%, p=0.022) were used during the first wave (Table 4).

Table 4: Drug treatment modalities used for COVID-19 patients in Kano, Nigeria during the first and second waves stratified by disease severity

	Both waves	1st Wave			2nd Wave			*p-value	
Variable	All	All	Severe	Non-severe	All	Severe	Non-severe		N
No (%)	N=332	N=134	N=15	N=116	N=198	N=39	N=155		
HCQ	22(9.73)	20(21.51)	4(26.67)	16(20.51)	2(1.50)	0	2(1.87)	<0.0001	226
LPV/r	113(40.94)	102(77.86)	15(100.00)	86(74.78)	11(7.59)	3(11.54)	8(6.78)	<0.0001	279
Ceftriaxone	78(24.84)	41(31.06)	12(80.00)	29(25.00)	37(20.33)	27(71.05)	10(6.99)	0.031	314
Azithromycin	241(75.79)	111(83.46)	15(100.00)	94(81.03)	130(70.27)	37(97.37)	92(63.01)	0.007	316
Low molecular weight heparin	317(99.06)	42(31.58)	14(93.33)	28(24.14)	59(31.55)	35(92.11)	24(16.22)	0.996	320
NSAIDS	42(13.46)	35(26.32)	4(26.67)	31(26.72)	7(3.91)	4(10.53)	3(2.14)	<0.0001	312
Dexamethasone	50(15.87)	14(10.61)	3(20.00)	11(9.57)	36(19.67)	24(63.16)	12(8.33)	0.032	315
Ivermectin	44(14.10)	11(8.59)	2(13.33)	9(8.11)	33(17.93)	21(55.26)	12(8.28)	0.022	312

HCQ: hydroxychloroquine, LPV/r: ritonavir-potentiated lopinavir, NSAIDS: non-steroidal anti-inflammatory drug; *p- value : for the test of statistical significance in the comparison between the first and second wave

Comorbidities and complications:

As shown in Table 5, occurrence of acute kidney injury, cardiac complications, hypertension, and diabetes mellitus did not differ significantly when the first wave was compared to the second wave.

Table 5: Comorbidities and complications with disease severity and difference between the waves

	Both waves	1st Wave			2nd Wave			*p-value	
Variable	All	All	Severe	Non-severe	All	Severe	Non-severe		N
No (%)	N=332	N=134	N=15	N=116	N=198	N=39	N=155		
AKI	13(4.05)	5(3.76)	2(13.33)	3(2.59)	8(4.26)	5(13.51)	3(2.00)	0.824	321
Sepsis	10(3.13)	5(3.76)	1(6.67)	4(3.45)	5(2.67)	2(5.56)	3(2.00)	0.584	320
Dyselectrolytemia	11(3.54)	4(3.01)	0	4(3.45)	7(3.93)	3(9.09)	4(2.78)	0.663	311
Respiratory failure	10(3.27)	4(3.03)	0	4(3.48)	6(3.45)	3(9.09)	3(2.14)	0.839	306
Cardiac complication	19(6.17)	11(8.27)	3(20.00)	8(6.90)	8(4.57)	4(10.53)	3(2.21)	0.187	308
Hypertension	89(27.73)	43(32.82)	8(53.33)	34(29.82)	46(24.21)	18(48.65)	27(17.76)	0.091	321
DM	32(9.91)	10(7.52)	5(33.33)	5(4.31)	22(11.58)	9(23.68)	12(7.95)	0.184	323
Asthma	9(2.93)	2(1.50)	0	2(1.72)	7(4.02)	0	7(5.19)	0.213	307

AKI= Acute kidney injury, DM= Diabetes mellitus.; *p-value: for the test of statistical significance in the comparison between the first and second wave

DISCUSSION

Our study presents a comparison of clinical characteristics of hospitalized COVID-19 patients during the first and second waves of the pandemic. Although the clinical signs and symptoms of the disease were similar in the two waves, there are substantial differences in the treatment, disease severity and mortality among the patients seen at our isolation center during the two waves.

Similar to our findings, there was no difference in age and gender of the patients admitted during the first and second waves of the pandemic in Spain[5]. However, patients tended to be younger during the second wave compared to first wave in Japan[7]. Furthermore, in both the first and second waves of the pandemic, patients with severe disease tended to be older compared to those with non-severe disease in our cohort and among Japanese patients with COVID- 19[7]. Overall, more patients presented with cough and shortness of breath among those with severe disease in both the first and the second waves in our cohort. Furthermore, more cases of severe disease (20.10% vs. 11.45%, p=0.042) and higher mortality (16 .67 % vs. 2.24 %, p<0.0001) were recorded in the second wave compared to the first wave in our study. This is consistent with the fact that the African continent in general, had more severe second wave compared to the first wave highlighting the need for continued contextual and situational analysis to deploy the best strategies to control the pandemic[2].

Overall, oxygen saturation on admission did not differ between the first and second waves as reported among Japanese patients with COVID-19[7]. This contrasts to the reports from Brazil where an increase in the average figures per week for patients with hypoxemia was reported in the second wave compared to the first wave[6].

Among our cohort, the mean Hb concentration, platelets, aspartate aminotransferase, serum potassium were lower in the first wave compared to the second wave. However, mean lymphocyte was higher in the first wave compared to second wave.

These findings may be related to the higher disease severity in the second wave compared to the first wave observed among hospitalized African patients coinciding with the emergence of the delta variant[2].

Hydroxychloroquine (21 .51 % vs. 1 .5 %, p< 0 .0001), lopinavir /ritonavir (77 .86 % vs. 7.59 %, p<0.001), and azithromycin (83 .46 % vs. 70 .27 %, p=0.007) were more frequently administered to patients in the first wave compared to the second wave in our cohort as well as among Spanish cohort (hydroxychloroquine and lopinavir/ritonavir) [10]. The lack of use of these drugs during the second wave is not surprising given the emerging evidence that revealed lack of efficacy of hydroxychloroquine[11,12], lopinavir / ritonavir[12,13], and azithromycin[14] for treatment of COVID -19 and potential adverse effects from the former.

However, more corticosteroids were used during the second wave in our cohort as in other countries[7,10]. This is likely due to emerging evidence showing the usefulness of steroids among patients with severe COVID-19[15,16]. Ivermectin use during the second wave was due to evidence for its usefulness[17,18], although subsequently it was shown to have no benefit[19,20].

In our study, acute kidney injury, cardiac complications, hypertension and diabetes were seen more frequently among patients with severe disease in both the first and second waves of the pandemic which is in keeping with previous reports[21-24]. Overall, these findings did not differ significantly when the first wave was compared to the second wave.

It is also important to note the 'learning curve' of clinicians in managing cases over time at our center. It would also be fair to state that in our center, at the beginning of the pandemic, healthier persons were admitted as anyone who had a positive test result was isolated regardless of symptoms while subsequently guidelines introduced home-based care for the asymptomatic persons and allowing only seriously sick or symptomatic patients to be isolated. Indeed, societal attitude meant only the very sick are admitted in latter waves in contrast to first wave when positivity was construed to mean death sentence and immediate hospitalization.

This study is limited by the fact that it's a single center report making the findings not generalizable. It is also limited by the retrospective design and the substantial missing data especially the laboratory component. Despite these limitations, our study has succeeded in comparing the clinical characteristics and the COVID-19 disease severity during the first and second waves of the pandemic in an isolation center in North-West Nigeria.

In conclusion, the center recorded more severe cases and more mortality during the second wave of the pandemic. Our findings can potentially impact COVID-19 care and public health response in Nigeria and /or Africa as they suggest more robust preparedness efforts to be able to effectively combat future COVID-19 waves.

DECLARATIONS

Competing interests: None.
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Author contributions: DFM, BHA, IG and HAG conceived and designed the study. DFM conducted literature search. DFM, IG, SAK and HAG performed data acquisition while DFM conducted data analysis. DFM, BHA, SAK, IG, HM, YAM, HI and HAG drafted and reviewed the manuscript for scientific content and accuracy of statistical analyses
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