High HIV prevalence in an early cohort of hospital admissions with COVID-19 in Cape Town, South Africa

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Introduction: Background

- The first cases of coronavirus disease 2019 (COVID-19) were detected in South Africa on 5 March 2020, and in Cape Town on the 11 March 2020.[1]

- Subsequently case numbers had escalated exponentially

- The Western Cape was the initial epicentre with just over 60% of all cases in South Africa at time of study

Introduction: co-morbidities

- The potential impact and mortality of COVID-19 in South Africa is unknown at this stage.
- Although South Africa has a relatively young population (median age of 25 years) [4], many South Africans of all ages have risk factors for severe COVID-19 outcomes, identified in other populations.
- Adult South Africans exhibit an unusually high background prevalence of hypertension (41.6 - 54%)[5], diabetes (12.8%)[6] and obesity (68% of females, 31% males).[7]
- Non communicable diseases are estimated to cause 43% of adult deaths in South Africa, of which 18% are caused by cardiovascular disease.[8]

Introduction: HIV/TB

- Of further concern, is that South Africa has the highest number of people living with HIV (PLHIV), estimated at 7.7 million.[9]

- It is unknown, what impact HIV, both treated and untreated, will have on COVID-19 outcomes.

- Furthermore, South Africa has one of the highest incidence rates of tuberculosis globally, being 520/100,000 population in 2018, [10] and the interaction of COVID-19 with tuberculosis is not clear.

Aims of the study

Our aims were to describe the clinical features, comorbidities and outcome of an early cohort of confirmed COVID-19 pneumonia patients admitted to a dedicated COVID-19 hospital, and specifically describe the prevalence, clinical profile and outcome of PLHIV.

Method

Study design, setting and population

- This single center descriptive study included all consecutive patients older than 18 years with a SARS-CoV-2 positive polymerase chain reaction (PCR) result and radiological evidence compatible with COVID-19 pneumonia admitted to Tygerberg Hospital between 24 March and 11 May 2020.

Method

Data collection

- All patients were followed up until discharge from hospital or death. The data was complete as at 23 May 2020.

Results

- *Baseline data*
- N = 116
  - Demographic and laboratory data were available for all patients.
  - Clinical data including symptoms and comorbidities was available for 113 patients
  - Chest radiographs for 115.
  - Outcome data was available for all patients.
  - The first patient was admitted on 25 March 2020 and the 116th patient on 11 May. Patient numbers gradually increased throughout the study period (Figure 1).
- The mean (standard deviation (SD)) age of patients was 48 (14) years and there were more females (n=71, 61%) than males (n=45, 39%). Patients who died were older (mean (SD)) age 55 (12) years vs 46 (14) years, $p<0.01$.

- The prevalence of HIV (n=24) in this cohort was 21%
  - mean (SD) age of 46 (9) years, with 18 being female (75%)
  - The mean (SD) CD_4 count of 325 (206) cells/mm^3 was available in 16 patients
  - Seventeen (71%) were on antiretroviral treatment (ART) with suppressed HIV viral loads, one patient (4%) was on ART but was failing the regimen, 4 patients had a history of defaulting ART (17%) and 2 patients were ART naïve (8%).
  - Patients with HIV had a trend towards shorter duration of symptoms prior to admission (5.4 vs 7.3 days, p=0.26).
- A total of 4 of patients reported being on treatment for tuberculosis (3.5%), while 9 gave a history of previous TB (8%). A history of smoking was present in eight cases (7.1%)

- *Clinical features*

Table 1: Symptoms at baseline

Symptoms	N=113	%
Cough	88	77.9
SOB	78	69
Fever	67	59.3
Myalgia	29	25.7
Chest Pain	22	19.5
Malaise	16	14.2
Headache	15	13.3
Diarrhoea	15	13.3
Sore Throat	12	10.6
Loss of Smell	11	9.7
Loss of Taste	8	7.1
Abdominal Pain	8	7.1
Haemoptysis	3	2.7

Table 2: Comorbidities according to patient outcome

	Survivors		Deaths				
	N=85	%	N=28	%	OR	95%CI	p
Hypertension (HPT)	30	35	16	57	2.4	1.02 to 5.84	0.07
Diabetes (DM)	29	34	14	50	1.9	0.81 to 4.59	0.20
HPT + DM	19	22	11	39	2.3	0.90 to 5.61	0.13
HPT + DM vs none (64 vs 20)	19	30	11	55	2.9	1.03 to 8.12	0.07
Hypercholesterolaemia	8	9	2	7	0.7	0.15 to 3.71	1
Obesity	23	27	9	32	1.3	0.51 to 3.22	0.78
HPT + DM + Obesity	7	8	6	21	3.0	0.93 to 9.98	0.08
HPT + DM + Obesity vs none (43 vs 15)	7	16	6	40	3.4	0.92 to 12.74	0.08
Cardiac Disease	5	6	1	4	0.6	0.07 to 5.30	1
Malignancy	1	1	0	0	0	N/A	1
HIV	18	21	6	21	1.0	0.36 to 2.88	0.81
Current tuberculosis	2	2	2	7	3.2	0.43 to 23.80	0.26
Previous tuberculosis	5	6	4	14	2.7	0.66 to 10.72	0.22
Other Chronic Lung Disease	3	4	3	10	3.3	0.62 to 17.28	0.16
Connective Tissue Disease	1	1	0	0	0	N/A	1
Chronic Kidney Disease	5	6	3	11	1.9	0.43 to 8.61	0.41

	HIV+	%	HIV -	%	p
	24	21	89	79%	
Demographics					
Age (mean)	46.2		49.1		0.2
Male	6	25.0	38	42.7	0.18
Female	18	75.0	51	57.3	0.18
Symptoms					
Cough	17	70.8	71	79.8	0.51
Haemoptysis	2	8.3	1	1.1	0.11
Dyspnoea	17	70.8	61	68.5	1.00
Fever	15	62.5	52	58.4	0.89
Sore Throat	0	0.0	12	13.5	0.07
Loss of Smell	1	4.2	10	11.2	0.45
Loss of Taste	0	0.0	8	9.0	0.20
Diarrhoea	4	16.7	11	12.4	0.73
Abdominal Pain	1	4.2	7	7.9	0.69
Chest Pain	5	20.8	17	19.1	1.00
Headache	1	4.2	14	15.7	0.19
Malaise	4	16.7	12	13.5	0.74
Myalgia	5	20.8	24	27.0	0.73
Co-morbidities					
Hypertension	8	33.3	38	42.7	0.55
Diabetes	10	41.7	33	37.1	0.86
Dyslipidaemia	1	4.2	9	10.1	0.46
Obesity	5	20.8	27	30.3	0.51
Cardiac Disease	1	4.2	5	5.6	1.00
Malignancy	0	0.0	1	1.1	1.00
Current tuberculosis	2	8.3	2	2.2	0.21
Previous tuberculosis	6	25.0	3	3.4	<0.01
Other Chronic Lung Disease	2	8.3	4	4.5	0.61
Connective Tissue Disease	0	0.0	1	1.1	1.00
Chronic Kidney Disease	2	8.3	6	6.7	1.00

Table 4: Baseline arterial blood gas (ABG) and laboratory results in survivors and deaths

	Survivors				Non-survivors				
ABG	n	mean	SD	95%CI	n	mean	SD	95% CI	p
SaO_2 (%)	61	94	5.1	± 1.30	19	82	14.1	± 6.80	0.001
p_aO_2 (kPa)	64	10.5	4.2	± 1.04	25	8.1	4.4	± 1.80	0.03
FiO_2 (%)	67	0.33	0.19	± 0.05	24	0.41	0.27	± 0.11	0.17
P:F ratio	63	288	156	± 39.28	24	188	112	± 47.31	0.002
p_aCO_2 (kPa)	63	4.7	1.3	± 0.32	24	5.1	2.4	± 1.00	0.44
pH	63	7.44	0.06	± 0.02	25	7.4	0.11	± 0.05	0.10
Bloods									
Sodium (mmol/L)	84	136	4.3	± 0.93	31	137	8.0	± 2.94	0.77
Potassium (mmol/L)	76	4.2	0.6	± 0.13	31	4.3	0.9	± 0.33	0.75
Urea (mmol/L)	85	6.0	5.3	± 1.15	31	12.0	12.1	± 4.43	0.01
Creatinine (umol/L)	85	101	150	± 32.43	31	194	321	± 117.42	0.13
WCC (x 10^9/L)	84	7.8	3.8	± 0.83	31	11.6	6.7	± 2.44	0.004
Neutrophils (N) (x 10^9/L)	77	5.95	3.92	± 0.89	28	9.22	6.40	± 2.48	0.02
Lymphocytes (L) (x 10^9/L)	77	1.55	1.87	± 0.42	28	1.44	1.46	± 0.57	0.76
N:L Ratio	74	6	6	± 1.38	28	10	9	± 3.31	0.06
Haemoglobin (g/dL)	84	12	2.6	± 0.57	31	12	2.0	± 0.73	0.37
MCV (fL)	83	88	7.7	± 1.67	31	90	6.9	± 2.54	0.17
Platelets (x 10^9/L)	84	285	125	± 27.13	31	303	149	± 54.58	0.55
C-reactive protein (mg/L)	72	128	105	± 24.61	31	204	102	± 37.19	0.001
LDH (u/L)	46	400	165	± 48.97	20	658	199	± 93.12	< 0.0001
ALT (u/L)	52	36	30	± 8.25	22	38	32	± 14.11	0.77
Troponin T (ng/L)	15	17	15	± 8.48	11	65	84	± 56.64	0.09
Creatine kinase (u/L)	6	284	469	± 491.51	2	614	724	± 6507.52	0.65
HbA1c (%)	42	9.1	3.5	± 1.08	14	9.0	3.4	± 1.98	0.89
Cholesterol (dL)	12	4.5	0.9	± 0.55	7	3.9	2.4	± 2.25	0.573
Ferritin (ug/L)	23	976	775	± 334.44	14	2381	2448	± 1223.84	0.045
CD4 (HIV+) (cells/mm^3)	11	335	221	± 148.60	5	304	193	± 239.79	0.79
VL (HIV+)	10	LDL			3	LDL			
D-Dimer (mg/L)	19	1.8	4.05	± 1.95	9	3.8	6.57	± 2.67	0.41
PT (sec)	14	17.1	8.8	± 5.06	11	20.1	23.7	± 15.9	0.70

Table 5: Baseline Chest Radiography features

N = 115	n	%
Consolidation	15	13
focal	2	1.7
lobar	4	3.5
multilobar	6	5.2
bilateral	3	2.6
Alveolar Infiltrates	18	15.7
focal	0	0
lobar	3	2.6
bilateral	15	13
Reticular Infiltrates	88	76.5
focal	0	0
lobar	1	0.9
bilateral	87	75.7
Micronodular Infiltrates	39	33.9
focal	1	0.9
lobar	0	0
bilateral	38	33
Underlying Disease		
PTBLD	4	3.5
COPD	0	0
ILD	2	1.7
Aspergilloma	1	0.9
Other	0	0
Laterality		
peripheral	12	10.4
central	2	1.7
diffuse	90	78.3
Distribution		
basal	20	17.4
apical	2	1.7
diffuse	82	71.3

Outcome

- Most patients (64%) were admitted to the general ward (n=74), and 36% were admitted to ICU (n=42). When compared to HIV negative patients, more HIV positive patients tended to be admitted to the wards (n=19, 79% vs n=55, 62%) compared to ICU (n=5, 21% vs n=34, 38% p=0.18). In the wards the median (Interquartile range (IQR)) length of stay (LOS) was 6 (3-10) days and the ICU median (IQR) LOS was 6 (3-10) days. HIV positive patients had a similar LOS (6 days IQR 3.5-10.5 days range 0-26 vs. 6 days (IQR 3-10d) range 0-28) to HIV negative patients. In this early cohort the median time from admission to ICU was <1 day. In the patients discharged from ICU the median (IQR) LOS was 15.5 (10-17) days.
- The **overall survival rate of all admissions was 86/116 (73%).** In this early cohort the survival was similar in patients **with HIV (n=18, 75%) compared to those without HIV (n=67, 75%)**. In those admitted to the **wards (n=63/74) the survival was 85%, and 52% in those admitted to ICU** (n=22/42).

Conclusion

- In this early report of the first 116 COVID-19 patients admitted to a referral hospital in Cape Town, South Africa serving a population with a high prevalence of HIV we found that **PLHIV did not appear to have significantly worse outcomes** when compared to their HIV-negative counterparts.
- Our population despite being younger than other reported populations, exhibited a **similarly high prevalence of cardiovascular comorbidities**, including hypertension, diabetes mellitus and obesity.
- Perhaps unsurprisingly, given the high background prevalence of HIV in South Africa [11], there was a **higher prevalence of HIV** in our study population when compared to studies elsewhere. [12, 13]
  - However, the HIV prevalence (21%) in this early cohort appears to be almost double than the estimated Western Cape provincial HIV prevalence of 12.6% in the age group 15-49 years. [11]
  - The reasons for this proportionally higher burden of HIV in our COVID-19 admission interpreted with caution. It is unclear whether unknown referral bias played a role, or whether patients with HIV represent an increased risk of hospitalisation, compared to an HIV negative population.

- However, reassuringly these patients **did not exhibit an increased mortality**, as was predicted prior to the COVID-19 pandemic reaching South Africa.
- The data from our study suggest that patients co-infected with HIV and SARS-CoV-2 have higher CD_4 cell counts, suppressed HIV viral loads, and have concurrent cardiovascular comorbidities, including diabetes, hypertension and obesity.
- Interestingly, the CD_4 count and viral load, did not differ between survivors and non-survivors with HIV, as may have been anticipated. However, the small sample size of HIV positive patients, limits drawing definitive conclusions on these matters, and larger cohort studies are urgently needed.

- The proportion of patients in the study admitted to ICU appear to much higher than described in the United Kingdom [12] and New York [14].
- The overall outcome in our study population, however is similar to mortality rates described in the literature of around 24.5 - 26%. [12, 14]
- Encouragingly, the presence of HIV did not appear to significantly influence the outcome.
- Significant risk factors for mortality in our population echo those found in other populations around the world, namely low P_aO_2, low P:F ratio, high CRP, high ferritin and high N:L ratio.

Limitations

- study was retrospective, data was not available for all variables, and data was reliant on that captured by the treating physician.
- weight and body mass indexes were not available for all patients, and obesity may have been underrepresented in this study.
- the sample size of HIV-positive patients was small limiting definitive conclusions

Conclusion

In conclusion, our findings suggest that PLHIV with COVID-19 may have a high probability for admission to hospital, but had similar presentations, comorbidities, and outcomes when compared to the HIV negative study population. Large multicentre studies are needed to confirm these findings.

Thank you

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- Coenraad FN Koegelenberg[3]; M Saadiq Moolla[1]; Elizabeth H Louw[3]; Abdurasiet Mowlana[1]; André Nortjé; Ramiz Ahmed [1]; Nicole Brittain[1]; Usha Lalla[3]; Brian W Allwood[3]; Hans Prozesky[2] ; Neshaad Schrueder[1]; Jantjie J Taljaard[2]