Archivos de Bronconeumología 59 (2023) 772–778

Sociedad Española de Neumología y Cirugía Torácica SEPAR

ARCHIVOS DE Bronconeumología

www.archbronconeumol.org

Scientific Letter

Clinical Outcomes of Critical COVID-19 in HIV-Infected Adults: A Propensity Score Matched Analysis

To the Director,

There is conflicting information regarding the severity and outcomes of COVID-19 in people living with human immunodeficiency virus (PLHIV). Data from previously published matched case–control studies showed no differences in severity or outcome between HIV-infected and HIV-negative patients.[1–3] Also, a cohort study of 2988 HIV-infected patients evaluating the association between HIV and COVID-19 diagnoses, hospitalisation, and in-hospital death in New York State reported poor outcomes in HIV-infected patients compared with HIV-negative patients.[4] There are no specific studies investigating the severity and outcomes of critically ill patients with COVID-19 and HIV-infection. We aim to investigate whether the clinical presentation, severity and outcomes of COVID-19 in critically ill HIV-infected patients were comparable to those seen in non-HIV-infected patients.

The CIBERESUCICOVID is a multicentre, observational, prospective/retrospective cohort study (NCT04457505) of 6512 consecutive patients with SARS-CoV-2 infection who were admitted to 69 ICUs in Spain between February 2020 and July 2022. Approved by the ethical committee – HCB/2020/0370. Data was collected as previously described.[5] The primary outcome was all-cause 90-day mortality. Secondary outcomes included all-cause in-hospital, 15-day, 30-day and 1-year mortality, length of ICU and hospital

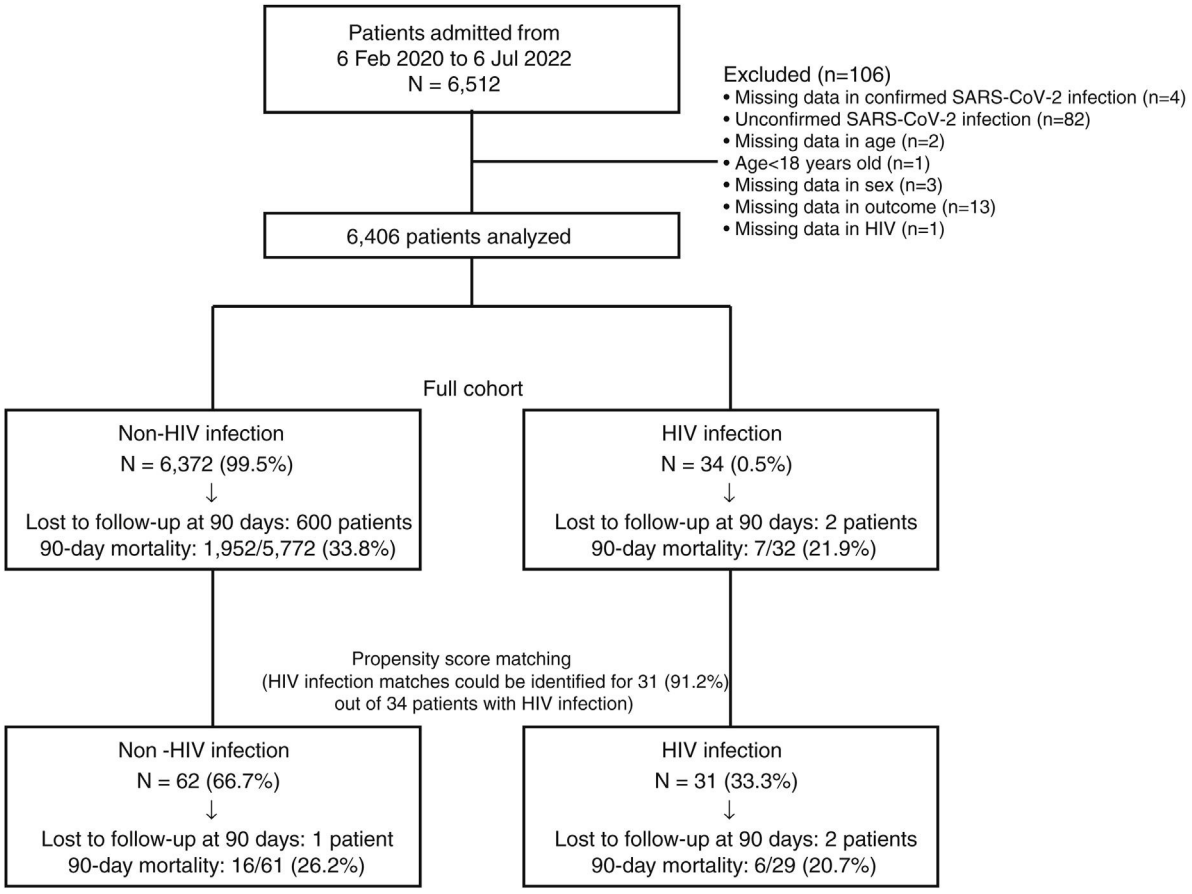

Fig. 1. Flow chart of the study population.

https://doi.org/10.1016/j.arbres.2023.07.029

stay, and ventilator and ICU-free days. Propensity score matching (PSM) method[6,7] was used to obtain the balance among baseline variables between patients with and without HIV. We used a 1:2 nearest-neighbour matching with age, sex, number of comorbidities and SOFA as covariates and an exact matching constraint on wave of COVID-19 and centre, without replacement and within a calliper width of 0.6. We estimated the 15-, 30- and 90-day, and 1-year mortality with 95% confidence intervals (CI).[8] We analysed the association between HIV infection and mortality by means of Cox regression analyses. Survival curves of patients with and without HIV were obtained using the Kaplan–Meier method and compared using the Gehan–Breslow–Wilcoxon test.[9]

Fig. 1 depicts patients flow-chart and Table 1 describes the full cohort (*N* = 6406: 6372 HIV-negative and 34 PLHIV) and the propensity score matching (*N* = 93, 62 HIV-negative and 31 PLHIV) cohort. In the full cohort, patients with HIV infection were younger, presented higher numbers of comorbidities, were more frequently current smokers, alcohol abusers, had higher APACHE II scores at ICU admission than patients without HIV infection. After PSM, no significant differences were found in age, number of comorbidities, proportion of smokers or alcohol abusers. However, the APACHE II score was higher in PLHIV (Table 1). Sex and SOFA did not differ between groups before and after PSM. In the full cohort, cardiac ischaemia was the only complication that differed between groups, showing a higher rate in the HIV infection group compared to non-HIV infection group. After PSM, no significant differences were found in any complication. Finally, all outcomes did not differ between groups before and after PSM. In the full cohort, the 15-, 30-, 90-day, and 1-year mortality rates were 12% (95% CI, 12–13%), 25% (95% CI, 23–26%), 34% (95% CI, 33–35%) and 39% (95% CI, 38–40%) in the non-HIV infection group, compared with 16% (95% CI, 3–28%), 22% (95% CI, 8–36%), 22% (95% CI, 8–36%) and 27% (95% CI, 11–42%) in the HIV infection group, respectively. After PSM, the 15-, 30-, 90-day, and 1-year mortality rates were 10% (95% CI, 2–17%), 21% (95% CI, 11–31%), 26% (95% CI, 15–37%) and 30% (95% CI, 18–42%) in the non-HIV infection group, compared with 14% (95% CI, 1–26%), 21%

Table 1
Demographics and clinical characteristics at admission, and complications and outcomes during ICU admission.

Variables	Full cohort (*N* = 6406)				Propensity score matching (*N* = 93)			
	No	Non-HIV infection (*N* = 6372)	HIV infection (*N* = 34)	*P*-value	No	Non-HIV infection (*N* = 62)	HIV infection (*N* = 31)	*P*-value
Waves of COVID-19	6406			0.729	93			>0.999
First: 8/1/2020 to 9/5/2020		3048 (48)	18 (53)	–		32 (52)	16 (52)	–
Second: 10/5/2020 to 7/12/2020		1839 (29)	11 (32)	–		22 (35)	11 (35)	–
Third: 8/12/2020 to 9/3/2021		873 (14)	5 (15)	–		8 (13)	4 (13)	–
Fourth: 10/3/2021 to 15/6/2021		187 (3)	0 (0)	–		0 (0)	0 (0)	–
Fifth: 16/6/2021 to 13/10/2021		245 (4)	0 (0)	–		0 (0)	0 (0)	–
Sixth: 14/10/2021 to 27/3/2022		163 (3)	0 (0)	–		0 (0)	0 (0)	–
Seventh or higher: 28/3/2022 to 6/7/2022		16 (0.3)	0 (0)	–		0 (0)	0 (0)	–
Age, median (*Q1*; *Q3*), years	6406	63 (54; 71)	51 (47; 65)	**<0.001**	93	57.5 (46; 64)	51 (48; 65)	0.619
Male sex, *n* (%)	6406	4484 (70)	26 (76)	0.437	93	46 (74)	23 (74)	>0.999
BMI, median (*Q1*; *Q3*), kg/m^2	5631	28.9 (26; 32.3)	26.9 (23.6; 33.1)	0.174	77	29.4 (26.5; 31.9)	26.9 (23.9; 34.6)	0.277
Number of comorbidities, median (*Q1*; *Q3*)	5745	2 (1; 3)	2.5 (2; 4)	**<0.001**	84	3 (1; 4)	2 (2; 4)	0.931
Comorbidities, *n* (%)								
Diabetes mellitus	6406	1577 (25)	11 (32)	0.306	93	24 (39)	8 (26)	0.217
Hypertension	6405	3208 (50)	18 (53)	0.763	93	41 (66)	15 (48)	0.099
Metabolic disease	6396	1955 (31)	8 (24)	0.364	93	35 (56)	7 (23)	**0.002**
Chronic liver disease	6405	225 (4)	4 (12)	**0.032**	93	3 (5)	3 (10)	0.397
Chronic heart disease	6405	819 (13)	3 (9)	0.614	93	21 (34)	3 (10)	**0.012**
Chronic lung disease	6406	985 (15)	4 (12)	0.811	93	16 (26)	3 (10)	0.069
Chronic renal failure	6405	455 (7)	3 (9)	0.732	93	8 (13)	2 (6)	0.487
Immunosuppression[a]	6403	237 (4)	34 (100)	**<0.001**	93	5 (8)	31 (100)	**<0.001**
Solid transplantation		109 (2)	2 (6)	0.117		3 (5)	2 (6)	>0.999
Bone transplantation		6 (0.1)	0 (0)	>0.999		0 (0)	0 (0)	–
AIDS or HIV infection		0 (0)	34 (100)	–		0 (0)	31 (100)	–
Other		147 (2)	1 (3)	0.549		2 (3)	1 (3)	>0.999
Smoking habit	5915			**0.007**	88			0.396
No smoke		3706 (63)	17 (55)	0.349		31 (53)	16 (55)	–
Current smoke		347 (6)	6 (19)	**0.009**		7 (12)	6 (21)	–
Former smoke		1831 (31)	8 (26)	0.524		21 (36)	7 (24)	–
Alcohol abuse (current or former)	5847	317 (5)	7 (23)	**<0.001**	85	4 (7)	5 (18)	0.148
Nursing-home, *n* (%)	6252	103 (2)	1 (3)	0.416	91	0 (0)	1 (3)	0.319
Previous 30 days admission, *n* (%)	6404	229 (4)	3 (9)	0.124	93	5 (8)	2 (6)	>0.999
Days since initial symptoms to ICU admission, median (*Q1*; *Q3*)	6365	9 (7; 12)	7 (5; 10)	**0.013**	93	8.5 (6; 12)	9 (5; 10)	0.508
Treatment before admission, *n* (%)								
Angiotensin-converting enzyme inhibitor	3175	1225 (39)	5 (29)	0.429	55	21 (51)	2 (14)	**0.016**
Statin	6366	1983 (31)	12 (35)	0.618	91	26 (42)	10 (32)	0.366
Non-steroidal anti-inflammatory drug	6280	755 (12)	2 (6)	0.422	90	13 (21)	2 (7)	0.131
Corticosteroids	6363	521 (8)	3 (9)	0.750	90	9 (15)	3 (10)	0.744
Antibiotics	6358	860 (14)	5 (15)	0.802	93	11 (18)	4 (13)	0.550
SARS-CoV-2 vaccine	3561	269 (8)	0 (0)	0.622	43	0 (0)	0 (0)	–
Two doses of SARS-CoV-2 vaccine	216	151 (70)	0 (0)	**<0.001**	0	0 (0)	0 (0)	–

Table 1 (*Continued*)

Variables	Full cohort (*N* = 6406)				Propensity score matching (*N* = 93)			
	No	Non-HIV infection (*N* = 6372)	HIV infection (*N* = 34)	*P*-value	No	Non-HIV infection (*N* = 62)	HIV infection (*N* = 31)	*P*-value
Characteristics at ICU admission								
Glasgow Coma Scale, median (Q1; Q3)	5196	15 (15; 15)	15 (15; 15)	0.664	74	15 (15; 15)	15 (15; 15)	0.652
APACHE-II score, median (Q1; Q3)	3708	12 (9; 15)	16.5 (14; 20)	**<0.001**	51	10 (6; 13)	16.5 (14; 18)	**<0.001**
SOFA score, median (Q1; Q3)	4416	5 (3; 7)	5.5 (4; 8)	0.288	61	4 (3; 7)	5.5 (4; 8)	0.297
SOFA haemodynamic component, median (Q1; Q3)	6165	0 (0; 4)	0 (0; 4)	0.890	87	0 (0; 4)	0 (0; 4)	0.779
SOFA renal component, median (Q1; Q3)	6305	0 (0; 0)	0 (0; 1)	0.052	93	0 (0; 1)	0 (0; 1)	0.614
Temperature, median (Q1; Q3), °C	5982	36.7 (36; 37.5)	36.8 (35.8; 37.8)	0.693	88	36.8 (36; 37.7)	37 (35.9; 38)	0.572
Respiratory rate, median (Q1; Q3), bpm	5719	25 (21; 30)	26 (23; 35)	0.153	81	24.5 (22; 30)	25 (23; 35)	0.379
Arterial blood gases at ICU admission								
PaO_2/FiO_2 ratio, median (Q1; Q3)	5351	112 (80; 164)	94 (79; 151)	0.343	77	112 (79; 176)	92.5 (79; 151)	0.176
PaO_2/FiO_2 ratio in ventilated patients, median (Q1; Q3)	5063	111 (80; 162)	94 (79; 148)	0.367	70	107 (79; 174)	89 (76; 130)	0.145
PaO_2/FiO_2 ratio categories in ventilated patients, n (%)	5063			0.055	70			0.222
Severe (<100)		2126 (42)	15 (60)	–		22 (47)	15 (65)	–
Moderate (≥100 to <200)		2160 (43)	4 (16)	–		15 (32)	3 (13)	–
Mild (≥200 to <300)		546 (11)	4 (16)	–		3 (6)	3 (13)	–
No ARDS (≥300)		206 (4)	2 (8)	–		7 (15)	2 (9)	–
pH, median (Q1; Q3)	5787	7.41 (7.34; 7.46)	7.38 (7.3; 7.42)	0.094	86	7.42 (7.36; 7.46)	7.38 (7.31; 7.43)	0.142
$PaCO_2$, median (Q1; Q3), mmHg	5628	39 (34; 46.8)	38.5 (31; 59.2)	0.869	81	38 (34.1; 43)	39.8 (31; 60)	0.504
$PaCO_2$ in ventilated patients, median (Q1; Q3), mmHg	5265	39.3 (34; 47)	38.5 (31; 59.2)	0.811	71	38 (34.2; 45.5)	41 (31; 60)	0.535
Laboratory findings at ICU admission								
Haemoglobin, median (Q1; Q3), g/dL	6144	13.2 (12; 14.4)	12.4 (11; 14)	**0.037**	92	12.3 (11.5; 14.8)	12.5 (11; 14.1)	0.661
Leucocyte count, median (Q1; Q3), 10^9/L	6293	8.9 (6.4; 12.5)	8.9 (7.1; 14)	0.516	93	8.1 (6.1; 12.1)	8.7 (7.1; 14)	0.401
Lymphocyte count, median (Q1; Q3), 10^9/L	6202	0.69 (0.47; 0.98)	0.79 (0.6; 1.4)	**0.032**	93	0.73 (0.4; 1.2)	0.73 (0.53; 1.4)	0.498
Neutrophil count, median (Q1; Q3), 10^9/L	6171	7.7 (5.2; 11.1)	7.4 (5.7; 12.5)	0.696	93	7.1 (4.7; 11.3)	7.3 (5.7; 12.9)	0.436
Monocyte count, median (Q1; Q3), 10^9/L	5988	0.36 (0.2; 0.53)	0.35 (0.28; 0.5)	0.569	92	0.4 (0.2; 0.54)	0.33 (0.25; 0.5)	0.822
Platelet count, median (Q1; Q3), 10^9/L	6291	232 (177; 303)	222 (144; 299)	0.210	93	212 (156; 272)	230 (160; 316)	0.483
D-dimer, median (Q1; Q3), ng/mL	5376	980 (500; 2300)	949 (522; 1855)	0.737	82	647 (356; 2250)	1100 (544; 1970)	0.200
C-reactive protein, median (Q1; Q3), mg/L	5977	127 (61; 219)	167 (82; 245)	0.240	91	111 (69; 194)	172 (91; 221)	0.065
Serum creatinine, median (Q1; Q3), mg/dL	6303	0.83 (0.67; 1.08)	0.99 (0.78; 1.51)	**0.037**	93	0.89 (0.74; 1.5)	0.99 (0.72; 1.51)	0.741
LDH, median (Q1; Q3), U/L	5203	477 (362; 654)	465 (351; 529)	0.194	81	439 (303; 591)	472 (357; 589)	0.347
Ferritin, median (Q1; Q3), ng/mL	3341	1151 (609; 1915)	921 (339; 1756)	0.520	48	800 (473; 1365)	921 (339; 1756)	0.556
Respiratory support at ICU admission[b]	6391			0.376	93			0.531
Conventional oxygen therapy		442 (7)	4 (12)	–		8 (13)	3 (10)	–
High-flow nasal cannula		1760 (28)	12 (35)	–		27 (44)	11 (35)	–
Non-invasive mechanical ventilation		750 (12)	2 (6)	–		1 (2)	2 (6)	–
Invasive mechanical ventilation		3405 (54)	16 (47)	–		26 (42)	15 (48)	–
Septic shock at ICU admission[c]	5864	428 (7)	3 (10)	0.494	87	4 (7)	1 (4)	>0.999
Complications during ICU admission, *n* (%)								
Bacterial pneumonia[d]	6366	1748 (28)	11 (33)	0.463	92	21 (34)	10 (33)	0.959
Pneumothorax	6394	511 (8)	2 (6)	>0.999	93	2 (3)	2 (6)	0.598
Pleural effusion	6389	658 (10)	6 (18)	0.159	93	5 (8)	5 (16)	0.292
Organising pneumonia	6307	291 (5)	3 (9)	0.186	91	3 (5)	3 (10)	0.379
Tracheobronchitis	6358	55 (1)	0 (0)	>0.999	91	2 (3)	0 (0)	>0.999
Pulmonary embolism	6245	594 (10)	2 (6)	0.765	91	8 (13)	2 (7)	0.488
Endocarditis	6391	20 (0.3)	0 (0)	>0.999	92	0 (0)	0 (0)	–
Myocarditis/pericarditis	6396	107 (2)	0 (0)	>0.999	92	0 (0)	0 (0)	–
Cardiomyopathy	6394	118 (2)	0 (0)	>0.999	92	0 (0)	0 (0)	–
Heart failure	6395	146 (2)	0 (0)	>0.999	93	0 (0)	0 (0)	–
Cardiac ischaemia	6393	114 (2)	3 (9)	**0.024**	93	1 (2)	3 (10)	0.106
Bacteraemia	6386	1645 (26)	5 (15)	0.160	92	16 (26)	5 (17)	0.328
Stroke	6392	111 (2)	0 (0)	>0.999	93	0 (0)	0 (0)	–

Table 1 (*Continued*)

Variables	Full cohort (*N* = 6406)				Propensity score matching (*N* = 93)			
	No	Non-HIV infection (*N* = 6372)	HIV infection (*N* = 34)	*P*-value	No	Non-HIV infection (*N* = 62)	HIV infection (*N* = 31)	*P*-value
Delirium	6380	1198 (19)	8 (24)	0.490	93	11 (18)	8 (26)	0.363
Coagulation disorder[e]	6384	1975 (31)	8 (24)	0.396	92	19 (31)	7 (23)	0.465
Disseminated intravascular coagulation[f]	1944	806 (42)	3 (38)	>0.999	26	9 (47)	2 (29)	0.658
Anaemia[g]	6398	3939 (62)	22 (65)	0.736	93	40 (65)	20 (65)	>0.999
Rhabdomyolysis	6374	225 (4)	1 (3)	>0.999	93	1 (2)	1 (3)	>0.999
Acute renal failure[h]	6397	2081 (33)	11 (32)	0.965	93	25 (40)	10 (32)	0.449
Pancreatitis	6384	57 (1)	0 (0)	>0.999	93	1 (2)	0 (0)	>0.999
Liver dysfunction	6396	2036 (32)	7 (21)	0.155	93	17 (27)	7 (23)	0.615
Hyperglycaemia	6394	4687 (74)	24 (71)	0.682	93	46 (74)	23 (74)	>0.999
Haemorrhage	6395	481 (8)	1 (3)	0.514	93	6 (10)	1 (3)	0.418
Outcomes								
In-hospital mortality, n (%)	6406	1950 (31)	8 (24)	0.372	93	16 (26)	7 (23)	0.734
15-Day mortality, n (%)[i]	6191	769 (12)	5 (16)	0.589	91	6 (10)	4 (14)	0.720
30-Day mortality, n (%)[j]	5998	1463 (25)	7 (22)	0.728	91	13 (21)	6 (21)	0.976
90-Day mortality, n (%)[k]	5804	1952 (34)	7 (22)	0.154	90	16 (26)	6 (21)	0.568
1-Year mortality, n (%)[l]	5191	2015 (39)	8 (27)	0.166	83	17 (30)	7 (26)	0.677
Length of ICU stay, median (Q1; Q3), days								
All patients	6402	14 (7; 27)	11.5 (7; 20)	0.404	94	17 (8; 29)	12 (7; 23)	0.392
Surviving patients	4445	13 (7; 27)	11.5 (7; 23)	0.659	70	17 (7; 29)	12 (7.5; 25.5)	0.642
Length of hospital stay, median (Q1; Q3), days								
All patients	6400	23 (14; 39)	18 (12; 40)	0.477	93	25 (15; 43)	22 (12; 42)	0.729
Surviving patients	4446	26 (16; 44)	25.5 (15; 42)	0.699	70	26.5 (15; 45)	27.5 (15; 42.5)	0.995
Ventilator-free days, median (Q1; Q3)	4900	0 (0; 16)	9 (0; 18)	0.306	66	0 (0; 14)	9 (0; 18)	0.399
Invasive mechanical ventilation length, median (Q1; Q3), days[m]								
All patients	4714	15 (8; 27)	13 (8; 19)	0.348	62	17.5 (9; 25.5)	13 (9; 19)	0.205
Surviving patients	2939	14 (8; 27)	13 (9; 19)	0.582	43	20 (9; 26)	13.5 (9; 23)	0.399
ICU-free days, median (Q1; Q3)	6403	3 (0; 19)	12 (0; 20)	0.339	93	2.5 (0; 19)	12 (0; 19)	0.567
Readmission, n (%)[n]	3254	417 (13)	5 (21)	0.227	62	4 (10)	4 (18)	0.438
Chest X-ray, n (%)[o]								
Abnormal	3171	2845 (90)	23 (96)	0.723	62	35 (88)	21 (95)	0.409
Persistent infiltrates	3171	71 (2)	0 (0)	>0.999	62	2 (5)	0 (0)	0.535
Diffuse interstitial lung disease	3171	12 (0.4)	0 (0)	>0.999	62	0 (0)	0 (0)	–
Fibrotic tract	3171	69 (2)	0 (9)	>0.999	62	2 (5)	0 (0)	0.535
Emphysema	3171	5 (0.2)	0 (0)	>0.999	62	1 (3)	0 (0)	>0.999
Others	3171	50 (2)	1 (4)	0.323	62	1 (3)	1 (5)	>0.999
CT scan, n (%)[o]								
Abnormal	3172	3020 (96)	24 (100)	0.623	62	39 (98)	22 (100)	>0.999
Persistent infiltrates	3172	202 (6)	1 (4)	>0.999	62	5 (13)	1 (5)	0.409
Diffuse interstitial lung disease	3172	35 (1)	0 (0)	>0.999	62	1 (3)	0 (0)	>0.999
Fibrotic tract	3172	183 (6)	0 (0)	0.397	62	2 (5)	0 (0)	0.535
Emphysema	3172	58 (2)	0 (0)	>0.999	62	0 (0)	0 (0)	–
Pulmonary embolism	3172	7 (0.2)	0 (0)	>0.999	62	0 (0)	0 (0)	–
Others	3172	258 (8)	2 (8)	>0.999	62	4 (10)	2 (9)	>0.999

Abbreviations: HIV indicates human immunodeficiency virus; Q1, first quartile; Q3, third quartile; BMI, body mass index; AIDS, acquired immunodeficiency syndrome; ICU, intensive care unit; APACHE, acute physiology and chronic health evaluation; SOFA, sequential organ failure assessment; PaO_2, partial pressure of arterial oxygen; FiO_2, fraction of inspired oxygen; LDH, lactate dehydrogenase. Percentages calculated on non-missing data. *P*-values marked in bold indicate numbers that are statistically significant at the 95% confidence limit.

[a] Possibly > 1 cause of immunosuppression.

[b] Patients who received high-flow nasal cannula but needed non-invasive mechanical ventilation were included in the non-invasive mechanical ventilation group. Patients who received high-flow nasal cannula and/or non-invasive ventilation but needed intubation were included in the invasive mechanical ventilation group.

[c] Criteria for the Sepsis-3 definition of septic shock include vasopressor treatment and a lactate concentration > 2 mmol/L at ICU admission.

[d] Clinically or radiologically diagnosed bacterial pneumonia managed with antimicrobials. Bacteriologic confirmation was not required.

[e] Abnormal coagulation was identified by abnormal prothrombin time or activated partial thromboplastin time.

[f] Disseminated intravascular coagulation was defined by thrombocytopenia, prolonged prothrombin time, low fibrinogen, elevated D-dimer and thrombotic microangiopathy.

[g] Haemoglobin consistently below 120 g/L for non-pregnant women and 130 g/L for men.

[h] Acute renal injury was defined as either an increase in serum creatinine by ≥0.3 mg/dL within 48 h or an increase in serum creatinine to ≥1.5 times that at baseline.

[i] Calculated only for patients with 15-day follow-up in the full cohort (6159 in the non-HIV infection group and 32 in the HIV infection group) and in the propensity score matching (62 in the non-HIV infection group and 29 in the HIV infection group).

[j] Calculated only for patients with 30-day follow-up in the full cohort (5966 in the non-HIV infection group and 32 in the HIV infection group) and in the propensity score matching (62 in the non-HIV infection group and 29 in the HIV infection group).

[k] Calculated only for patients with 90-day follow-up in the full cohort (5772 in the non-HIV infection group and 32 in the HIV infection group) and in the propensity score matching (61 in the non-HIV infection group and 29 in the HIV infection group).

[l] Calculated only for patients with 1-year follow-up in the full cohort (5161 in the non-HIV infection group and 30 in the HIV infection group) and in the propensity score matching (56 in the non-HIV infection group and 27 in the HIV infection group).

[m] Duration of invasive mechanical ventilation was measured from initiation of ventilation until either successful extubation, successful permanent disconnection or death.

[n] Within 1 year of hospital discharge.

[o] At 1 year of hospital discharge.

(95% CI, 6–35%), 21% (95% CI, 6–35%) and 26% (95% CI, 9–42%) in the HIV infection group, respectively. In the full cohort, Cox regression analyses for 15-, 30-, 90-day, and 1-year mortality did not find significant differences between groups, giving HRs of 1.24 (95% CI, 0.52–2.99), 0.92 (95% CI, 0.44–1.94), 0.66 (95% CI, 0.32–1.40) and 0.73 (95% CI, 0.36–1.46), respectively. After PSM, Cox regression analyses for 15-, 30-, 90-day, and 1-year mortality did not find significant differences between groups, giving HRs of 1.40 (95% CI, 0.39–4.95), 1.01 (95% CI, 0.38–2.65), 0.81 (95% CI, 0.32–2.07) and 0.89 (95% CI, 0.37–2.15), respectively.

Of the 34 PLHIV included in the study, 26 (76%) were males, with a median (IQR) age of 51 (47; 65) years. Data on the probable route of exposure were available in 47% of cases. HIV infection was acquired by men who have sex with men and intravenous drug use in 7 (44%) and 5 (31%) cases, respectively. Data on available ART therapy was available in 29 cases (85%). Twenty-five out of 29 cases (86%) were on antiretroviral therapy (ART) at the time of hospital admission. ART regimens were based on integrase inhibitors, non-nucleoside reverse transcriptase inhibitors, protease inhibitors, and other regimens in 11 (44%), 9 (36%), 3 (12%), and 2 (8%) cases, respectively. Data on HIV-RNA viral load in plasma was available in 27 patients (79%). Twenty-one out of 27 patients (84%) had an undetectable HIV-RNA viral load in plasma (<50 copies/mL). Data on CD4+ T cell count was available in 21 patients (62%). The median (IQR) last CD4+ T cell count was 518 (421; 823)/mm^3. The percentage of PLHIV with less than 200 CD4 cells/mm^3 was 4.7%. Three patients (10%) presented co-infection with HCV, and three patients (10%) had HBV co-infection. There were also no differences regarding outcomes between HIV-infected patients with undetectable and detectable HIV viral load.

This is the first national multicentre study that describes the clinical characteristics and outcomes of critical COVID-19 in PLHIV admitted to the ICU and compares them with the HIV-negative general population, concluding that the short- and medium-term prognosis is similar in PLHIV who are virological suppressed on ART and are not immunosuppressed (CD4 $\geq$ 200 cells/mm^3). In our study PLHIV accounted for approximately 0.5% of total hospitalised, critically ill COVID-19 cases in the ICU. This data is in line with previous studies.[2–4] Despite PLHIV presenting higher APACHE-II scores at ICU admission, outcomes did not differ between groups before and after PSM (in-hospital, 30-, 90-day and 1-year mortality). Similar results were reported by previous studies in hospitalised patients.[10–12] Data from a recent systemic review and meta-analysis that included data from 28 studies found no difference in the risk of death between HIV-infected patients and HIV-negative (OR, 1.09; 95% CI, 0.93–1.26; $P > 0.001$).[12]

The major strengths of this study include its multicentre nature, the consecutive inclusion of all patients from each unit, thorough checking of data quality, and the high number of patients analysed and long-term follow-up. On the other hand, despite exhaustive propensity score analysis for underlying conditions, a possible limitation of the propensity score methods is their inability to control for unmeasured confounding. A main limitation is the small number of cases, precluding any robust conclusions. In particular, the analysis of outcomes using this size sample may have led to a large type-II error that prevents us from generalising our results. However, there are no similar studies investigating the severity and outcomes of critically ill patients with COVID-19 and HIV-infection, so this information is of value. Also, these results do not apply to PLHIV who are off ART and/or are immunosuppressed, because they are underrepresented in our study. Finally, as we examined real-world data, limitations associated to their observational nature and missing data should be considered.

Although limited by the small sample size, our main conclusion is that critically ill COVID-19 in non-immunosuppressed and virologically suppressed HIV-infected individuals seems to present neither a more severe disease nor a worse clinical outcome than HIV-negative patients. Further research in large cohorts should be encouraged to improve our knowledge on the impact of SARS-CoV-2 in critically ill HIV-infected patients.

Authors' contributions

All the authors contributed to the conception and design, acquisition of data, drafting of the article, critical revision, and final approval of the manuscript.

Funding

Financial support was provided by Instituto de Salud Carlos III de Madrid (COV20/00110, ISCIII); Fondo Europeo de Desarrollo Regional (FEDER); "Una manera de hacer Europa"; Centro de Investigación Biomedica En Red–Enfermedades Respiratorias (CIBERES); and Donation program "estar preparados" UNESPA, Madrid, Spain. JMM received a personal 80:20 research grant from Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), Barcelona, Spain, during 2017–23. CC received a grant from the Fondo de Investigación Sanitaria (PI19/00207), Instituto de Salud Carlos III, co-funded by the European Union.

Conflict of interests

JMM has received consulting honoraria and/or research grants from AbbVie, Angelini, Contrafect, Cubist, Genentech, Gilead Sciences, Jansen, Lysovant, Medtronic, MSD, Novartis, Pfizer, and ViiV Healthcare, outside the submitted work. All other authors have no conflicts.

Acknowledgments

We want to express our appreciation to all CIBERESUCICOVID members for their contribution to this work and their precious task and effort in clinical care and daily practice with all our patients.

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