Characteristics and outcomes changes in COVID-19 inpatients: A comparison of 4 waves

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BACKGROUND

Four Coronavirus disease 2019 (COVID-19) epidemic waves occurred in France between March 2020 and September 2021. These 4 waves had different intensities and anti SARS-Cov-2 therapies including the extensive use of corticosteroids, monoclonal antibodies, high-flow nasal oxygenotherapy, and generalization of vaccination. This single-center retrospective study compared patients' characteristics and outcomes during these four waves.

METHODS

We retrospectively analyzed the data of all consecutive inpatients with proven COVID-19 (based on polymerase chain reaction (PCR) testing of nasopharyngeal swab sampling) in a French tertiary care hospital from March 1 to July 31, 2020 (wave 1), August 1 to December 31 (wave 2), January 1 to June 30, 2021 (wave 3), and July 1 to September 30, 2021 (wave 4). Differences in baseline characteristics and outcomes i.e., intensive care unit (ICU) hospitalization and deaths were assessed. A patient with healthcare-associated COVID-19 was defined by a negative PCR upon admission and a positive PCR 48 h after admission. Continuous variables were compared using the Kruskal–Wallis test and categorical data by the Chi-square test (SAS 9.4 software).

RESULTS

2013 patients were hospitalized at the HCC for COVID-19 during the study period :817 (40.5%) during wave 1, 463 (23.0%) during wave 2, 572 (28.5%) during wave 3, and 161 (8.0%) during wave 4. **Table 1** summarizes the patients' main clinical characteristics, baseline biological results, and outcome according to COVID-19 waves. Wave 1 was the most important in terms of hospitalization and patients hospitalized during this wave were admitted later after COVID-19 symptom onset, had more serious disease at baseline (higher temperature, more frequent need for oxygen, higher C-reactive protein and lactate dehydrogenase levels, and lower lymphocytes), and were more frequently hospitalized in the ICU. Patients hospitalized during the 4th wave were younger and less comorbid probably and mostly not vaccinated. The highest death rates were found during the first 2 waves; 17% vs. 15% in wave 3 and 6% in wave 4. A higher percentage of healthcare-associated COVID-19 was found in wave 2. Although the last 3 months of 2022 were not included in the results of wave 4, this wave was characterized by a marked decrease in terms of hospitalizations and the lowest death rate.

CONCLUSIONS

Wave 1 patients were had more serious disease at baseline with the highest death and ICU hospitalization rates. Deaths were reduced during wave 3 and notably wave 4 with a marked decrease in the number of patients hospitalized during wave 4.

	Wave 1 (n = 817)	Wave 2 (n = 463)	Wave 3 (n = 572)	Wave 4 (n = 161)	All patients (n = 2013)	p-value
Gender (Male)	455 (55.7%)	249 (53.8%)	317 (55.4%)	87 (54.0%)	1065 (54.9%)	0.911 [4]
Age (years)						
Median [Q1, Q3]	71.34 [60.3;81.8]	76.22 [62.4;85.6]	71.27 [57.7;83.1]	57.80 [32,2;74.2]	71.62 [58.3;82.7]	<0.001 [1]
BMI (kg/m²)						
Median [Q1, Q3]	26.56 [23.37;30.80]	25.76 [22.22;29.71]	26.29 [23.17;30.39]	26.29 [21.91;30.51]	26.25 [22.86;30.42]	0.131 [1]
Risk factor(s)	711 (87.3%)	412 (89.4%)	516 (90.8%)	116 (74.4%)	1755 (87.8%)	<0.001 [4]
Chronic renal disease	78 (9.6%)	80 (17.4%)	88 (15.4%)	14 (9.0%)	260 (13.0%)	<0.001 [4]
Chronic liver disease	10 (1.2%)	16 (3.5%)	13 (2.3%)	1 (0.6%)	40 (2.0%)	0.028 [4]
Chronic cardio-vascular	554 (68.1%)	314 (68.1%)	400 (70.2%)	70 (44.9%)	1338 (66.9%)	<0.001 [4]
Chronic pulmonary disease	167 (20.5%)	121 (26.2%)	177 (31.1%)	39 (25.0%)	504 (25.2%)	<0.001 [4]
Diabetes	209 (25.7%)	133 (28.9%)	160 (28.1%)	24 (15.4%)	526 (26.3%)	0.004 [4]
Cancer	156 (19.2%)	128 (27.8%)	142 (24.9%)	22 (14.1%)	448 (22.4%)	<0.001 [4]
immunosuppression	11 (1.4%)	5 (1.1%)	19 (3.3%)	4 (2.6%)	39 (2.0%)	0.031 [4]
Pregnancy	2 (0.2%)	-	4 (0.7%)	3 (1.9%)	9 (0.4%)	0.019 [4]
Neurologic disorders	150 (18.4%)	115 (24.9%)	120 (21.1%)	18 (11.5%)	303 (20.1%)	0.001 [4]
Symptoms duration (days)						
Median [Q1, Q3]	6.0 [2;9]	3.0 [1;7]	4.0 [0;9]	7.0 [3;10]	5.0 [1;9]	<0.001 [1]
Body temperature (°C)						
Median [Q1, Q3]	37.9 [36.8;38.5]	37.0 [36.4;38.0]	37.1 [36.4;38.0]	36.9 [36.4;37.5]	37.30 [36.6;38.2]	<0.001 [1]
Ventilation						
Spontaneous ambient air	485 (64.0%)	302 (69.7%)	369 (70.6%)	105 (65.3%)	1261 (62.6%)	<0.001 [4]
Lymphocytes (G/L) Median [Q1, Q3]	0.790 [0.54;1.13]	0.840 [0.57;1.29]	0.900 [0.62;1.36]	0.940 [0.63;1.5]	0.840 [0.57;1.25]	<0.001 [1
CRP (mg/L) Median [Q1, Q3]	71.0 [31;127]	39.0 [11;85]	45.0 [13;107]	37.5 [6;98]	55.0 [16;108]	<0.001 [1
LDH (IU/L) Median [Q1, Q3]	310.0 [228;428]	253.5 [201;307]	259.0 [200;348]	303.0 [204;392]	275.0 [210;367]	<0.001 [1]
ICU hospitalization (%)	184 (22.5%)	56 (12.1%)	90 (15.7%)	30 (18.6%)	380 (17.9%)	<0.001 [4]
Deaths (%)	140 (17.1%)	81 (17.5%)	88 (15.4%)	10 (6.2%)	319 (15.8%)	0.001 [4]

Table 1: Patients' main clinical characteristics, biological results at baseline, and outcome according to COVID-19 waves. [1]Results are presented in the form n (%) [95% confidence interval], percentages are calculated for non-missing values only. [1] Kruskal–Wallis test, [4] Chi² test

BMI, body mass index; CRP, C-reactive protein; LDH, lactate dehydrogenase; ICU, intensive care unit

Wave 1 was the largest in terms of the number of hospitalizations.
Patients hospitalized during the 1st wave had more serious disease at baseline and had the highest ICU hospitalization rate. Waves 1 and 2 had the highest death rates.
In comparison the 4th wave was characterized by a marked decrease in the number of patients hospitalized. These patients were younger, less comorbid and had the lowest death rate.