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Original Research Article

A Study of Clinical, Laboratory, Radiological Characteristics among the Non-Survivors of COVID-19 Infection in the First and Second Waves.

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Conflict of interest: Nil

Abstract:

Background: Real world data comparing patients hospitalized during the different periods of the COVID-19 pandemic are scarce.

Objectives: To study and compare the clinical, laboratory characteristics among the non-survivors of COVID-19 infection in the first and second waves were the objectives.

Methods: In this retrospective, cross-sectional, observational study, the data of non-survivors with COVID-19 infection, hospitalized during the wave-1 and wave-2 was analyzed. laboratory parameters including inflammatory biomarkers, computed tomography (CT) thorax scores, treatment, critical care unit admissions, requirement of reparatory support were correlated.

Results: Case fatality rate (CFR) was 5.9% (N=190), high during wave-1 (6.3%; wave-2, 5.5%). Real-time reverse transcription polymerase chain reaction positivity was greater during the wave-2 ($p<0.01$). Mortality was high with O+ve blood group (43%). Predominant cause of death was respiratory failure following pneumonia (86.3%). Diabetes Mellitus was the common co-morbidity (51.05%).

Statistically significant difference in mean absolute leucocyte count, serum ferritin, lactate dehydrogenase (LDH), D-dimers, interleukin -6 (IL-6), potassium, liver injury, bilirubin were noted between the two waves. Mean C-reactive protein ($p=0.06$), serum ferritin ($p=0.01$) was higher in wave-1 and Mean D-Dimer ($p=0.033$). and IL-6 level($p<0.01$)in wave-2.

Higher CT scores ($p<0.01$)in greater number of patients, longer hospital stay ($p<0.01$)were observed in wave-2.

Conclusion:COVID-19 infection was associated with a high CFR, greater during wave-1. Higher serum ferritin and LDH in wave-1, D-dimer and IL-6 inwave-2 were noted, with lower neutrophil lymphocyte ratio, hypokalemia inwave-2. Male sex, age >45 years, O+veblood group, diabetes mellitus, abnormal inflammatory biomarker are the relatable risk factors.

Keywords: Case fatality rate; COVID-19 infection; D-Dimer; Interleukin-6; mortality; RT-PCR positivity.

Introduction

The SARS-CoV-2 global pandemic was accompanied by an ever-rising death toll attributed to the coronavirus disease 2019 (COVID-19). An outbreak caused by a novel corona virus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was reported first in Wuhan, China in late December 2019.[1]COVID-19 was first reported to the World Health Organization (WHO) on 31stDecember 2019. In January 2020, the WHO declared the COVID-19 to be a public health emergency of international concern. [1]Three months later, COVID-19 was declared a pandemic by the WHO, and as of May 14, 2020, more than 4.3 million cases of COVID-19 and 297 000 deaths were reported. [1] Early reports suggested an incubation period of 2 to 14 days, with clinical presentations ranging from mild infection to severe disease to fatal illness. [1] Approximately 25% of hospitalized patients with COVID-19 pneumonia require intensive care primarily for respiratory support in the setting of acute hypoxic respiratory failure with acute respiratory distress syndrome (ARDS),which occurred in ~ 60%-70% of COVID-19patients hospitalized to critical care unit. [2] In these reports, critically ill patients were older, more

likely to be male, and have underlying comorbidities.

The first wave of COVID-19 in India was between March2020 to January2021 and the second wave from March 2021 to June 2021 [3,4] Pandemic showed varied trend in the first and subsequent waves globally, particularly with the initial two waves. We analyzed various parameters related to morality in COVID-19.

Real world data comparing patients hospitalized in the same clinical setting during the different stages of the pandemic are scarce. The current study compared the mortality profile of the hospitalized patients during the peak period at a tertiary care referral center.

Materials and Methods

Study design& Setting

This was a retrospective, cross-sectional, observational study among the COVID-19 non-survivors in a rural tertiary care referral center.

Ethical Guidelines followed by the Investigators

Approval from the Institutional Ethics Committee, registered with the Department of Health Research was obtained before the start of the study. Data of hospitalized patients during March 2020 to June 2021 for COVID-19 were obtained from the medical records department, after re-confirming patient credentials. The time period was divided into first wave (wave-1, March 2020 to January 2021) and second wave (wave-2, March 2021 to June 2021) of COVID-19.

Aim and Objectives

The aim of the study was to compare 28-day mortality profile of patients during the first and second wave of COVID-19. To study and compare the clinical, laboratory characteristics among the non-survivors of COVID-19 infection in the first and second waves and study the role of inflammatory markers in assessing the severity and clinical course of COVID-19 were the objectives of the study.

Outcome Measures

Primary: descriptive comparison of clinical features (%), laboratory investigations (mean values) between wave-1 and wave-2 of COVID-19 infection.

Secondary: comparison of inflammatory markers (mean) between wave-1 and wave-2 of COVID-19 infection.

Selection of Participants

Adults of both sexes diagnosed with COVID-19 either by throat swab reverse transcription polymerase chain reaction (RT PCR) or by rapid antigen testing for COVID-19 were included by consecutive sampling. All patients hospitalized during the wave-1 (March 2020 to January 2021) and the wave-2 (March 2021 to June 2021) of COVID-19 were categorized accordingly. Patients with known history of chronic inflammatory conditions, autoimmune disorders and malignancy were excluded. The socio-demographic characteristics, clinical, biochemical, radiological parameters and clinical outcomes of hospitalized patients during the two waves of COVID-19 pandemic were recorded.

Methods of Measurement

Total lymphocyte count (TLC), neutrophil lymphocyte ratio(NLR), blood C-reactive protein (CRP),serum lactate dehydrogenase (LDH), serum ferritin, D-dimer,interleukin-6, liver function tests, renal function tests, serum electrolytes computed tomography (CT) thorax scores, administration of remdesivir and dexamethasone, critical care unit admissions, requirement of mechanical ventilator support were noted and correlated with the disease severity and clinical course of COVID-19.

Interventions

Patients received treatment as per the hospital standard protocols.

Data collection and processing

Pooled data were analysed by the SPSS software (version 22, IBM Corporation, Armonk, New York, United States).

Statistical Methods Used

Results

Of the 3222 hospitalized patients with COVID-19 (wave 1, 1275, 39.57%; wave 2, 1947, 60.43%) infections in both the waves of the pandemic combined, there were 190 non-survivors, with an overall case fatality rate (CFR) of 5.9% (wave-1, n=83,CFR 6.3%; wave-2, n=107, CFR 5.5%).

There were 140 (73.68%) males and 50 (26.32%) females. Ninety-five (50%) were in the age group of >45 years-65 years (table 1).

Table 1:Age, Sex and COVID mortality (original)

Parameters	Wave-1 (n=83)	Wave-2 (n=107)	Total (N=190	P value
Age (years)				
18-45	09 (10.84%)	10 (9.35%)	19 (10%)	
46-65	41 (49.4%)	54 (50.41%)	95 (50%)	
66-75	33 (39.76%)	42 (39.25%)	75 (39.47%)	0.8
>75	0	01(0.94%)	1 (0.53%)	
Sex				
Male	68 (81.93%)	72	140 (73.68%)	0.03
Female	15 (18.01%)	35	50 (26.32%)	

At the time of hospitalization, 160 (84.2%) patients were RT PCR positive, greater during the wave-2 ($p<0.01$) (Table 2).

Table 2: Patients variables and COVID-19 mortality (original)

Variables (n=190)	Wave-1 (n=83)	Wave-2 (n=107)	Total (N=190)	P value
RT PCR				
Positive	58 (69.88%)	102 (95.33%)	160 (84.2%)	<0.01*
Negative (with +ve CT thorax)	25 (30.12%)	05 (4.67%)	30 (15.8%)	
Admission to Deaths (days)				
≤ 4.0	35 (42.17%)	17 (15.89%)	52 (27.37%)	<0.01*
4 - 9.0	12 (14.46%)	34 (31.78%)	46 (21.24%)	
9.1 - 15.0	10 (12.05%)	76 (71.03%)	86 (45.26%)	
>15.1	02 (2.41%)	04 (3.74%)	06 (3.16%)	
Abnormal BP during hospital stay				
Yes (High)	07 (8.43%)	10 (9.35%)	17 (8.9%)	0.8
No	76 (91.57%)	97 (90.65%)	173(91.1%)	
SpO_2 (%)				
90-93	14 (16.87%)	22 (20.56%)	36 (18.95%)	0.417
≥ 94	35 (42.17%)	51 (47.66%)	86 (45.26%)	
<90	34 (40.96%)	34 (31.77%)	68 (35.79%)	
Blood Group				
O+	34 (40.96%)	48 (44.86%)	82 (43.1%)	0.003*
B+	31 (37.35%)	27 (25.23%)	58(30.5%)	
B-	05 (6.02%)	0	5(2.6%)	
AB+	01 (1.21%)	05 (4.67%)	6(3.1%)	
AB-	0	01 (0.94%)	1 (0.5%)	
A+	09 (10.84%)	26 (24.3%)	35(18.4%)	
A-	03 (3.62%)	0	3(1.5%)	

BP= Blood pressure; CT= Computed tomography; RT PCR=Real-time reverse transcriptase-polymerase chain reaction
There was no statistically significant ($p=0.08$) change in the mean oxygen saturation(SpO_2) (1^{st} vs 2^{nd} , 84.27±19.839 vs 88.42±12.638).

Mortality was high among those with O+ve blood group (n=82, 43%). Predominant cause of death was respiratory failure following COVID pneumonia in 164 (86.3%) patients. Diabetes Mellitus was the common co-morbidity (n=97 (51.05%).

Laboratory Parameters

Statistically significant difference in mean absolute leucocyte count, serum ferritin level, LDH, D-dimers, IL-6, potassium were noted between the two groups. Liver injury (as denoted by raised liver enzymes), raised bilirubin level were also statistically significant (table 3).

Table 3: Comparison of Laboratory parameters of COVID-19 mortality (original)

Parameters	Wave-1 (n=83)	Wave-2 (n=107)	Total (N=190)	P value
Total WBC Count (cells/mm^3) (n=190)				
4000-11000	43 (51.81%)	56 (52.34%)	99 (52.1%)	0.193
>11000	34 (40.96%)	35 (32.71%)	69(36.3%)	
<4000	06 (7.23%)	16 (14.95%)	22(11.5%)	
Absolute lymphocyte count (cells/mm^3) (n=190)				
700-1000	32 (38.55%)	60 (56.07%)	92 (48.4%)	0.03*
>1000	25 (30.12%)	18 (16.8%)	43(22.6%)	
<700	26(31.3%)	29(27.1%)	55 (30%)	
Neutrophil Lymphocyte ratio (n=190)				
3.2-5	26 (31.33%)	33 (30.84%)	59(31%)	0.242
>5	46 (55.42%)	50 (46.73%)	96 (50.5%)	
<3.1	11(13.25%)	24 (22.43%)	35 (18.4%)	
Serum Ferritin level (ng/mL) (n=154)				
270-1000	27 (40.91%	43 (40.19%)	70 (39.1%)	0.01*
1000- 2000	06 (9.09%)	24 (22.43%)	30 (16.7%)	
>2000	04 (6.06%)	07 (6.54%)	11 (6.1%)	
<270	29 (43.94%)	14 (13.08%)	43 (24. %)	
LDH level (units/L) (n=176)				
500-1000	20 (26.67%)	43 (42.57%)	63 (35.79%)	<0.01*
250-500	26 (34.67%)	43 (42.57%)	69 (39.20%)	
>1000	01 (1.33%)	04 (3.96%)	05 (2.84%)	
<250	28 (37.33%)	11 (10.89%)	39 (22.16%)	
D-Dimer level (mg/L FEU)				
500-1000	12 (17.91%)	20 (19.42%)	32 (18.82%)	<0.01*
1000-2000	06 (8.96%)	15 (14.56%)	21 (12.35%)	
>2000	06 (8.96%)	05 (4.85%)	11 (6.47%)	
<500	43 (64.18%)	63 (61.17%)	106 (62.35%)	
IL 6- level (pg/mL) (n=131)				
50-150	07 (13.73%)	19 (23.75%)	26(24.7%)	<0.01*
15-50	11 (21.57%)	23 (28.75%)	34(32.3%)	
>150	05 (9.80%)	21 (26.25%)	26(24.7%)	
<15	28 (54.90%)	17 (21.25%)	45(42.8%)	
Renal failure (N=190)				
Yes	29 (34.94%)	25 (23.36%)	54(28.4%)	0.079
No	54 (65.06%)	82 (76.64%)	136(71.6%)	
Transaminase level (U/L) (n=124)				
>1000	17 (100%)	0	17(13.7%)	<0.01*
Normal	0	88 (82.24%)	88(64.5%)	
40-1000	0	19 (17.76%)	19 (15.3%)	
Bilirubin (N=164)				
Raised	03 (5.17%)	04 (3.77%)	07 (4.27%)	<0.01*
Normal	55 (94.83%)	102 (96.23%)	157 (95.73%)	
Sodium (N=188)				
Hyponatremia	20 (24.7%)	20 (18.7%)	40(21.2%)	0.16
without hyponatremia	61 (75.3%)	87 (81.3%)	148 (78.7%)	
Potassium (N=190)				
3-5.5	73 (88%)	80 (74.66%)	153 (80.5%)	0.029*
>5.5	08 (9.64%)	14 (13.08%)	22(11.5%)	
<3	02 (2.41%)	13 (12.15%)	15(7.8%)	
New onset diabetes during COVID-19 (n=171)				
Yes	06 (7.5%)	04 (4.4%)	10 (5.8%)	0.24
No	74 (92.5%)	87 (95.60%)	161 (94.2%)	

FEU = fibrinogen equivalent units; N=190. *statistically significant

Leucocytosis (n=69, 36%) with a mean white blood cell count of 10571.2/µL was observed. Serum ferritin values were between 500-1000 ng/mL for 63 (39.1%).Mean CRP levels were 117 mg/dL in wave-1 and 102 mg/dL in wave-2(p=0.06).D-Dimer levelof>500mg/fibrinogenequivalent units (FFU) was observed in 64/138 (45.8%) patients. Mean±SD D-Dimer level was 244 ±341 (maximum=1545) and significantly higher in wave-2 (mean279.4) than wave-1 (mean165.4)(p=0.033) (table 3).

Interleukin-6 level of> 50was reported in 52 (53.8%) non-survivors; mean IL-6 level in the study population was 80 and significantly higher in wave-2 (mean93.5 Vs wave-1mean =52.5)(p<0.01). Ahigher level of transaminases was recorded in 36 (29%) (n=124) patients.

The mean difference between highest levels of D-dimer and IL-6 during the two waves was statistically significant (table 4).

Table 4: Highest Laboratory parameters among the non-survivors(original)

Laboratory parameter	COVID-19 waves (Mean±SD)		P value
	Wave-1	Wave-2	
Total WBC Count	10716.7±5025.2	10506.3±4635.4	0.778
CRP Level	117.0±48.9	102.3±50.0	0.06
Ferritin level	741.2±407.3	715.8±374.2	0.674
LDH level	539.1±132.9	520.7±154.3	0.428
D Dimer-Highest level	165.4±71.8	279.4±403.7	0.033*
IL 6-Highest level	52.5±49.4	93.5±82.4	0*
Serum Sodium	136.8±11.5	136.2±8.6	0.769
Serum Potassium	4.6±0.7	4.5±0.7	0.225

Higher CT scores were observed in 163 of 190 (85.7%) patients who were admitted in the hospital. Higher CT scores were observed in greater number of patients in the wave-2 than wave-1 (P<0.01) (table 5).

CT thorax score was >15 in 35 (21.4%). Patients were managed with steroids (n=175, 91.2%), heparin (n=170, 89.4%), remdesivir (n=120, (63.1%); all treatment parameters except remdesivir were statistically significant (table 5).

Table 5: Computed tomography (CT) thorax score and management (original)

Parameters	1st COVID-19 wave (n=83)	2nd COVID-19 wave (n=107)	Total (N=190)	P value
CT Thorax – CTSS (n=163)				
9 to 15	08 (11.94%)	44 (45.83%)	52 (31.9%)	<0.00001*
>15	14 (20.9%)	21 (21.88%)	35 (21.4%)	
<9	45 (67.16%)	31 (32.29%(	76 (46.6%)	
Non-invasive ventilation				
Yes	46 (55.42%)	30 (28.04%)	76 (40%)	<0.01*
No	37 (44.58%)	77 (71.96%)	114 (60%)	
Invasive ventilation				
Yes	30 (36.15%)	04 (3.74%)	34 (17.9%)	<0.01*
No	53 (63.86%)	103 (96.26%)	156(82.1%)	
Steroids				
Yes	70 (84.34%)	105 (98.13%)	175 (92.1%)	<0.01*
No	13 (15.66%)	02 (1.87%)	15 (7.9%)	
Heparin				
yes	65 (78.31%)	105 (98.13%)	170 (89.47%)	<0.01*
No	18 (21.69%)	02 (1.87%)	20 (10.53%)	
Remdesivir				
yes	47 (56.63%)	73 (68.22%)	120 (63.1%)	0.1
No	36 (43.37%)	34 (31.78%)	70 (36.9%)	

N=190, unless mentioned.

Mean hospital stay among the non-survivors was longer during the second wave of COVID-19 (1st vs second , 5.553±5.608 vs 10.795±4.948) and was statistically significant (p<0.01).

Discussion

COVID-19 pandemic affected the world in rapidly occurring waves, demonstrated a changing landscape of healthcare support, hitting a few geographical regions worse. It was believed initially that mortality was high in the first wave of COVID-19 due to poor understanding of pathology and complications. However, many available reports [5-11] state that second wave was more devastating and recorded a higher rate of mortality despite vaccine availability probably due to rapid change in the viral strain. Global reports indicate a diversified presentation between the two waves of COVID-19.

A study from Switzerland has noted that those who were not Swiss citizens were more affected and had

a high mortality rate compared to their Swiss counterparts highlighting a bigger issue than the availability of good health care system.[12]Ethnic differences in the COVID-19 mortality rate prompted more in-depth research on the risk factors. [13-14] s the reports poured in, particularly few highlighting an increased mortality rate during the second wave, there was a need to retrospect and analyze the scenario. There were not many reports from India that compared the mortality during the two waves.

There is no clear picture yet regarding which wave was worse as reports from different parts of the world are confounding. Contrary to the reports that firs wave resulted in a high mortality rate, [15-20] Gray et al., [13] reported a high mortality during the first wave (40%-50%) in March 2020, which reduced to 11% in August 2020, which again increased to 21% in January 2021, thereafter showed a continual regression. A report from Brazil showed no significant difference in the in-hospital mortality between the two waves (first vs second waves, 12.3% vs 12.1%). [21]

Pooled data from Europe showed increased all time mortality during the second wave. [22] But in contrary, a report from England showed a lower crude death rate during the second wave (21.8% vs first wave 29.4%). [23] Cusinato et al., [24] too observed fall in crude death rate in the second wave, but noticed an increased risk factors.

COVID-19 related mortality was comparatively less in Indian and South Asian population, [25] but similar to the global trend, there were more fatalities during the second wave. [4, 26-29] Bogram et al., [30] analysed pooled data from an Indian city and reported that wave-2 posed a greater burden, with a greater case fatality rate in the first wave and among elderly (>60 years). Documented mortality rate declined from 2.5% to 1.1%, overall case fatality rate from 1.80 per 1000 person-days (PD) to 0.77 per 1000 PD during wave-2. Risk of death was greater (x1.49 times) during wave-1 and was less by 35% in wave-2.

A study from the Central India showed a statistically significant increase in case fatality rate (from 1.2% to 1.4%) in wave-2 and death rate by 2.7 times. [31] In our study, case fatality rate was high in wave-1 (6.3% vs wave-2, 5.6%). Male, age >45 years were the risk factors. In wave-2, a higher proportion of the patients were RT PCR positive (95% vs wave-1, 69.88%).Desaturation, one of the riskfactors for mortality was high in wav-1 (59% vs 31.78%). Both the waves affected those with O^{+ve}blood group the most, probably because of the it is one of the common group, followed by $B^{+ve}$and A^{+ve}. Diabetes mellitus (56%) was the significant comorbidity among the non-survivors. Prakash et al., [32] noted no significant difference in the age-wise mortality in wave-2, but 35.1% of the non-survivors did not have any associated co-morbidity.

We noticed leucocytosis in both the waves, but leucopenia (<4000cells/mm^3) was less frequent in wave-1, which was 2.5 times high during wave-2, but without any statistical significance. Absolute lymphocyte count, an indirect indicator of immunity, was low (< 700/mm^3)in greater proportion of patients in wave-1 (31.3% vs wave-2,27.1%). Overall, 43% had normal absolute lymphocytecount.Neutrophil lymphocyte ratio, an emerging marker considered to be an indicator of the status of underlying immune system and pathology [33] was abnormal in 68.9%, with 50.5% having a ratio >5 (p>0.05). Serum ferritin level, indicator of inflammatory status of the body, was high in 6.1% without a significant difference between the two waves and low in 24.1%, significantly low in wave-2 (<270; wave -2, 13.08% vs wave-1, 43.94%) D-dimer was abnormal in 85%,with 77% having low levels, but without any significant difference between the two waves.LDH, a maker for tissue damage, wasout of range in 39%, with predominant lower lever level (34.5%). Abnormal IL-6 levels were noted in 57.2% overall, with 42.8% having <15pg/mL, but proportionately higher in wave-2 with 78.75% patients having abnormal values when compared with wave -1 (45%).

We report a statistically significant highest levelsfor D-dimer (p=0.033) and IL-6 (p=0). D-dimer pattern reflects the risk category. Serially followed D-dimer can show a low-pattern, early peak, mid-peak, fluctuating, late peak and high pattern. Persistently low-pattern and early peak are categorized into low risk, mid-peak and fluctuating to high-risk and late-peak and high pattern into malignant. We cannot comment on the pattern of D-Dimer level as we did not analyse the same. Botero et al., [34] opine that serially monitoring the D-dimer can indicate the risk category of patients for better management as there is an increased risk among those with D-dimer trends. Hong et al.,[35]studied the changes in the laboratory parameters and their observations were relevant to CRP, creatinine and D-dimer, which demonstrated lower levels during the wave-1; reduction in CRP level was faster in the second wave of COVID-19 whereas, D-dimer increased rapidly during the first wave and maintained almost a plateau during the second wave. Overall, laboratory values were better in wave-2, and varied geographically. Jasuja et al., [36] observed a higher level of D-dimer and IL-6, and noted a direct relationship with mortality. However, in our study, there was no significant difference observed in the CRP level between both the waves (p=0.06).

Disturbance in electrolyte balance is common in those with COVID-19 infection, which needs a prompt early recognition and correction. In the present study, hyperkalemia of > 5.5 was observed

in 22 (11.5%) patients while hyponatremia wasrecorded in 40 (21.2%) (n= 188) patients.

Laboratory values showed pronounced variations during wave-2 as noted by Singh et al., [37] Lymphopenia, lower lymphocyte-to-neutrophil ratio, higher levels of inflammatory biomarkers particularly IL-6, serum ferritin and C-reactive protein during the second wave. [37] Dogra et al., [38] reported higher levels of CRP, D-dimer, HRCT score, liver enzymes, serum ferritin, blood urea and creatinine during wave-2 and lower levels of IL-6, oxygen saturation level (with and without support). Correspondingly, stay in intensive care unit and hospital were longer inwave-2.

Reports from our neighboring country denoted an early peak in rise of leucocytes, neutrophils, lower levels of lymphocytes, early lower levels of platelet count during wave-2, of which, neutrophil and lymphocyte count correlated with in-hospital mortality. Second wave also witnessed an early peak rise of urea. First wave saw higher peak levels of CRP, serum ferritin, LDH, procalcitonin, D-dimer and correlated with the requirement for ventilatory support and mortality. [39]

COVID-19 infection caused liver injury identified by increased liver enzymes in a small albeit significant proportion of the study population (13.7%; $p<0.01$). serum bilirubin was raised in a few (n=07 overall; 4.3%). Kidney injury was reported in 28.4%, without any significant difference between the two waves.

Our study reports a statistically significant CTSS score ($p<0.00001$) with an overall 68%having abnormal values, of whom 46.6% had a score of <9 . Requirement of invasive and non-invasive ventilation was high during wave-2.

Observations of Kapoor et al., [40] too indicate worse outcomes in wave-2 in terms of lower oxygen saturation, higher prevalence of severe cases, acute kidney injury, ARDS, liver injury documented by increased liver enzymes, and mortality (wave-2, 29% vs wave-1, 9.6%) ; additionally, requirement for oxygen therapy, respiratory support were higher in wave-2. Similar observations in the laboratory markers were noted by Tendulkar et al. [4]

Our patients received steroids (overall 92.1%), heparin (overall 89.4%), while remdesivir was administered to 63.1%.In wave-1, mean hospital stay was shorter (5.5 days) than wave-2 (10.7 days; $p<0.01$). During the first wave,there was an inadequate oxygen supply over demand; torrential caseloads in second wave even with more demand with adequate O_2 supply resulted in an increase in the hospital stay but mortality could not be prevented in the high-risk groups.

Being a single center study, our observations cannot be generalized. Serially analyzing the laboratory markers would have shown the trend during the two waves. Comparing with the national data would have been beneficial in drawing a clear conclusion. Nevertheless, we cannot deny that our observations throw light on the laboratory profile and indicators of mortality in COVID-19 patients. We emphasize that the lessons learnt from this pandemic should not be forgotten, and be ready to apply them in clinical practice.

Conclusion

Mortality in COVID-19 infection was high with a CFR of 5.9%, being high during wave-1. RTPCR positivity was greater during wave-2. Respiratory failure following COVID pneumonia was the predominant cause of mortality.

There was a significant difference in the inflammatory biomarkers between the two waves; Higher serum ferritin and LDH in wave-1, D-dimer and IL-6 inwave-2 were noted, with lower neutrophil lymphocyte ratio, hypokalemia in wave-2. These inflammatory biomarkers depict mortality trend. Hospital stay was longer during wave-2.Male sex, age >45 years, O positive blood group, presence of comorbidiy particularly diabetes mellitus,abnormal inflammatory biomarker are the relatable risk factors.

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