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Original Article

CLINICO-EPIDEMIOLOGICAL PROFILE AND HOSPITAL OUTCOMES OF COVID-19 PATIENTS DURING ALL THREE WAVES, AN EXPERIENCE FROM A RURAL TERTIARY CARE CENTER, EASTERN UTTAR PRADESH, INDIA

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ABSTRACT

Objective: In this study, an attempt has been made to report the clinical profile, exposure characteristics and outcomes of the COVID-19 patients admitted to our rural tertiary care facility.

Methods: It is a single-centric retrospective observational study and includes data from January 2020 to March 2022. The data were retrieved from patient files. We have recorded patient demography, clinical and laboratory parameters and outcome of the patients. Patients were categorized based on disease severity according to WHO guidelines. Appropriate statistical analysis was applied and p value<0.05 was considered as significant.

Results: A total of 2339 patients were included in this study. Total males were 67%, mean age group was 45.43±18.48 y (0 to 101 y), with majority belonging to 46-60 y age group (27.2%). Total comorbid patients were 29.3% with 9.4% accounting for more than one comorbidities. Most common comorbidity noted was diabetes mellitus 15.8% followed by hypertension 13.4%. Total mortality was noted to be 16.2%. Fever was the most common symptom (92%) followed by cough (51%) and myalgia (30%). Disease severity and outcome was significantly correlated with advancing age and the presence of underlying comorbidities.

Conclusion: Rural population had comparable proportion of comorbidities as well as mortality. Common risk factors for severe disease in rural setting were similar to urban setting and old age and more than one comorbidities. Country-wide rural data should be collected for a better understanding of COVID-19 disease in rural and remote population.

Keywords: Level-2 COVID hospital, Northern India, Rural tertiary care center, Clinical profile

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INTRODUCTION

The outbreak of cases of pneumonia of unknown etiology in Dec. 2019 was identified as COVID-19, which has since then divested the whole world. WHO declared it soon after as a global pandemic, which has engulfed the world and it stretched the public health facilities to its limits, yet was found wanting in managing its consequences [1]. It's debilitating impact and reach was so crippling to the large populations, especially the elderly and people with comorbidities, that WHO subsequently declared COVID-19 (coronavirus disease 2019) as a pandemic on March 11, 2020 [2]. The spread of COVID-19 has been in form of waves and its first wave waned after sometimes but the second wave proved much more damaging, engulfing larger populations. The virus also mutated to become more virulent and contagious, spreading by contact, droplets and aerosols.

As per the WHO data, by April18, 2022more than 500 million confirmed cases and more than 6 million deaths have been reported worldwide [3]. Southeast Asia especially India, with large population, had lesser incidence of cases per million population than the USA, yet the number of cases were second largest in the world. The demography, social practices, population density, practices corona appropriate behavior, timely locking down the cities played an important role in the overall incidence of the cases. In India, the first case of COVID-19 was identified on Jan 30, 2020 [4] and thereafter, the number has been increasing steadily due to local transmission and foci of community transmission. Although the coronavirus had a definite gnomonic proposition with some variance in mutation yet it presented with varied virulence in different societies and countries.

It is important to analyze and document the clinical behavior of this disease in the local population. Our study center, which has served as level-2 corona care facility, is located in the densely populated region of eastern Uttar Pradesh, India. Large part of the population is from the rural segment and from marginal to lower socio-economic conditions. In this study, an attempt has been made to report the clinical profile, exposure characteristics and outcomes of the COVID-19 patients admitted to our tertiary care facility.

MATERIALS AND METHODS

This retrospective study was conducted on the suspected COVID-19 patients admitted at our tertiary care center (Level-2 COVID facility) Basti, Uttar Pradesh, India, from Jan 2020 to Mar 2022. Data of all the patients admitted in this duration on epidemiological, demographic, clinical and laboratory parameters, with the microbiological diagnosis of COVID-19 was charted out. A total of 2339 patients of both sexes were admitted as laboratory-confirmed COVID-19 cases. The patients included in the study were managed as per the institutional protocol of COVID-19. The clinical features, laboratory parameters, medication and treatment outcomes were recorded and analyzed. This level-2 center served as a nodal facility and was designated as a referral facility for COVID-19 patients as per government policy [5]. Patients of all severity were referred for admission from the adjoining region of eastern Uttar Pradesh; the hospital had no control over patient selection. Patients were received in a screening area, evaluated on arrival and triaged to an

isolation facility, ward, high-dependency unit (HDU) or intensive care unit (ICU) as per clinical assessment. A focused history, including travel and exposure history and comorbidities, were recorded. After initial clinical evaluation, patients with dyspnoea, respiratory rate (RR)>30/min, or oxygen saturation (SpO_2)<94 per cent on room air, clinical diagnosis of pneumonia and those deemed to be at risk for severe disease were subjected to chest radiography. Baseline haemogram, liver, and kidney function tests were done for all symptomatic patients and those at risk of severe disease. Patients with age>60 y and those with cardiovascular risk factors (hypertension, coronary artery disease); diabetes mellitus; immune-compromised state and chronic respiratory, liver or kidney diseases were considered at high risk for progression to severe disease. Severe and critical disease was defined as per ICMR and WHO guidelines [5, 6].

Dates of symptom onset and resolution were recorded. Time elapsed between the onset and resolution of symptoms was taken as time to clinical resolution. Treatment protocol was followed as per the international [6] and local institutional guidelines.

Throat and nasopharyngeal samples were collected using nylon or Dacron swabs from patients suspected of having SARS-CoV-2 infection. Samples were tested for SARS-CoV-2 genes by multiplex rRT-PCR.

Statistical analysis: Categorical variables were presented as frequency and percentages (n; %). Comparability of groups was analyzed by the Chi-square test, and p value<0.05 as appropriate. IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA) software was used for statistical analyses.

Ethical consideration: Institutional ethics committee approved this study.

RESULTS

A total of 2339 laboratory-confirmed COVID-19 suspected patients were studied, of whom 1566 (67%) were males and 773 (33%) were females, the overall mean age was 45.43years among these minimum admissions were recorded below one year age (0.4%) and maximum admissions were in 46-60 y age group 635(27.2%). There were 135 (5.8%) migratory population who were tested positive for COVID-19 by RT-PCR, out of which 6(4.4%) migrated to our city from other districts of Uttar Pradesh, 120(88.9%) migrated from other states of India and 9(6.7%) migrated from outside of India during the first and second waves of COVID-19 pandemic. Out of total patients, 1653(70.7%) had no comorbidity, 466(19.9%) had single comorbidity and 220(9.4%) patients had multiple underlying comorbidity. Other 167 patients had to be transferred to other higher centers or left against medical advice and were excluded from the study. Out of total admissions, 378 (16.2%) patients died due to COVID-19, and 1961(83.8%) patients were discharged successfully [table 1].

Table 1: Baseline characteristics of the patients admitted in our COVID hospital (n=2339)

Parameters	n (%)
Age in years'	Mean age: 45.43 y (SD±18.48)
Gender	
Male	1566 (67.0)
Female	773 (33.0)
Age	
<1 y	9 (0.4)
1-15 y	90 (3.8)
16-30 y	501 (21.4)
31-45 y	578 (24.7)
46-60 y	635 (27.2)
>60 y	526 (22.5)
Comorbidities	
No comorbidity	1653 (70.7)
One comorbidity	466 (19.9)
>1 comorbidity	220 (9.4)
Outcome	
Discharged	1961 (83.8)
Deceased	378 (16.2)

The number of COVID-19 cases started to rise and admitted to our level-2 COVID hospital in Feb 2020 and highest number of cases was recorded in the month of July, the cases begin to decline from the month of September 2020. The lowest number of cases was recorded in February 2021, then the case again begins to rise from Feb 2021 and peaked in the month of Apr; again, cases begin to decline and became almost zero by mid-Jun 2021. During all three waves of COVID-19 pandemic, the deaths were recorded from May 2020 and the highest number of death occurred during the months of Aug and Sep; after that the death rate begins to decline. No deaths were recorded during the months of Jan, Feb and Mar 2021. The cases of death were again reported from Apr 2021 and there was acute rise in the number of deaths from Apr to May 2021 and two deaths were recorded after the month of Jun, and again, admission of COVID-19 cases (n=16) started in Jan 2022 till Feb 2022 and two deaths out of 16 admissions were recorded [fig. 1].

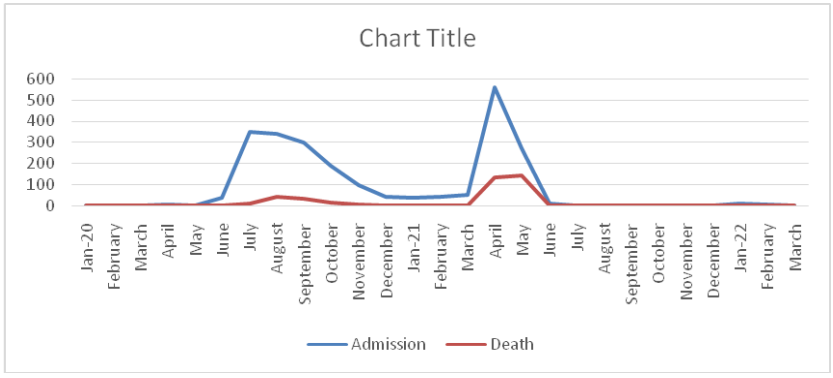

Fig. 1: Trends of outcome of patients admitted in our COVID hospital from January 2020 to February 2022 (n=2339)

Among 2339 COVID-19 patients, 2.3% of asymptomatic patients were admitted in our hospital. Among symptomatic patients (97.7%), fever was the most common symptom (92%) followed by cough (51%) and myalgia (30%). The uncommon symptoms recorded were nausea and vomiting (9.6%), sore throat (10.6%), and loss of taste and smell (6%) [fig. 2].

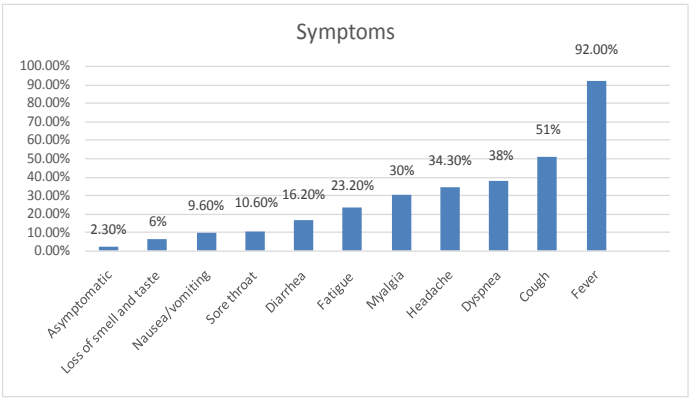

Fig. 2: Symptom profile of the admitted RT-PCR-confirmed COVID-19 patients

In present study, diabetes mellitus, 370(15.8%) was the most common comorbidity, followed by hypertension 314(13.4%). Comorbidities that were very uncommon were leukemia, myasthenia gravis, pleural effusion 2(0.1%) each and brain tumor and carcinoma liver 1(0.4%) each fig. 3.

At the time of admission, among 2339 RT-PCR-confirmed COVID-19 cases,83.1% had body temperature>38.5 °C, 2.1% had<36.0 °C,13% had respiratory rate>30/min, SpO_2<90 in 11.8% cases; out of these findings, 19.2% cases were severe and 4.4% were critically ill. Maximum deaths were recorded in patients with hypothermia (49/50), along with RR>30/min (295/304), SpO_2<90 (241/276), and critically ill (101/103). At the time of admission, the above parameters was noted to be statistically significant p<0.05 table 2.

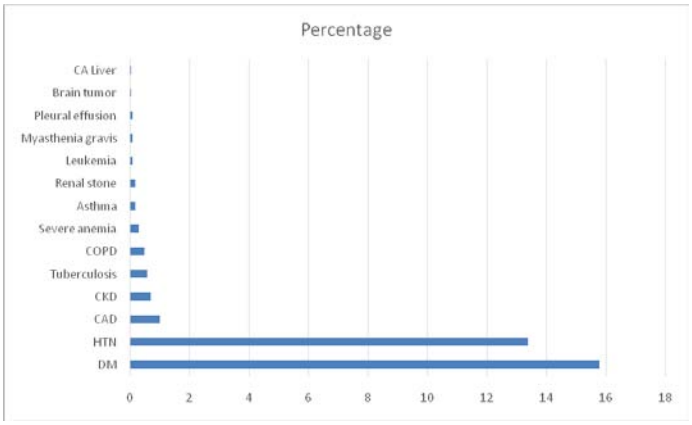

Fig. 3: Comorbidities

Table 2: Clinical parameters at the time of admission and outcome of the COVID-19 patients

Parameter at admission	Discharged n (%)	Death	p-value
Temperature (°C)			
>38.5 (n=1944; 83.1%)	1642 (84.5%)	302 (15.5%)	<0.0001*
<36 (n=50; 2.1%)	1 (2.0%)	49 (98.0%)	
36-38.5 (n=345; 14.7%)	318 (92.2%)	27 (7.8%)	
Respiratory rate per min			
>30 (n=304; 13%)	9 (3%)	295 (97.0%)	<0.0001*
<30 (n=2035; 87%)	1952 (96%)	83 (4%)	
SpO2 (%)			
>94 (n=1431; 61.2%)	1397 (97.6%)	34 (2.4%)	<0.0001*
≥ 90-94 (n=632; 27.0%)	529 (83.7%)	103 (16.3%)	
<90 (n=276; 11.8%)	35 (12.7%)	241 (87.3%)	
Disease severity status			
Non-severe (n=1786; 76.4%)	1763 (98.7%)	23 (1.3%)	<0.0001*
Severe (n=450; 19.2%)	196 (43.6%)	254 (56.4%)	
Critical (n=103; 4.4%)	2 (1.9%)	101 (98.1%)	

Laboratory parameters of the admitted patients were mean hemoglobin (Hb): 12.04 g/dl, mean platelet count: 154,826/mcl, total leucocyte count (TLC): 13377/mcl, serum protein: 7.18 g/dl, bilirubin: 0.72 mg/dl and alkaline phosphatase was 237 IU/l. The time to negative COVID-19 test was 6-39 (mean: 8.05) days table 3.

Table 3: Comparative profile of laboratory parameters

Laboratory parameters			
Variable	**Death (mean±SD)**	**Recovery (mean±SD)**	**P-value**
Hb	10.7498 (2.4238)	12.318(2.2728)	0.0001*
TLC	14003.29 (8960.533)	9314.04 (5359.441)	<0.0001*
N	79.91 (5.407)	68.33 (9.907)	<0.0001*
L	18.75 (16.746)	27.20 (9.101)	<0.0001*
E	2.97 (3.842)	3.03 (1.081)	0.572
M	0.89 (0.939)	1.61(1.748)	<0.0001*
platelets	1.8493(1.039)	1.8687 (0.91194)	0.740
PT	16.602 (5.1574)	15.291 (3.0167)	0.017*
iNR	1.2711 (0.43510)	1.1457 (0.22401)	0.006*
Sr. Bilirubin	1.2914 (1.62154)	0.7405 (0.90142)	<0.0001*
Sr. Direct/Indirect	0.7268 (0.93420)	0.4049 (0.54943)	<0.0001*
SGOT	104.928 (88.5491)	50.231 (47.8165)	<0.0001*
SGPT	94.223 (80.2177)	51.061 (48.0880)	<0.0001*
ALP	464.629 (695.0998)	286.138 (254.7424)	<0.0001*
Urea	76.3822 (50.02547)	34.9876 (30.95281)	<0.0001*
Creat	2.1189 (3.20607)	2.0895 (10.57761)	0.964
Na	137.948 (7.2639)	136.976 (3.6280)	<0.001*
K	4.1894 (0.95513)	4.3828 (0.94114)	0.002*
Ca	4.2349(1.12045)	4.5213 (0.54298)	<0.0001*
LDH	1021.4250 (478.38)	627.9320 (342.40070)	<0.0001*

*p-value statistically significant at 0.05.

There was no significant difference observed in disease severity between male and female (p 0.627). The disease severity and time to recovery was significantly associated with comorbidity (p value<0.0001 each). A total of 378 (16.2%) patients died after admission, of which 257 (16.4%) were among males and 121 (15.7%) were among females, death rate was noted to have increasing trends and was directly proportional to age group (p<0.0001). Patients with underlying comorbidities had greater chances of mortality (p<0.0001) table 3 and table 4. Time to recovery was significantly higher among patients with one or more comorbidities table 5.

Complications in critically ill COVID-19 (n=294) patients included septicemia and septic shock 121(41.2%), ARDS 108(36.7%), ARF 31(10.5%), respiratory failure 16(5.4%), cardiac failure and thromboembolism 6(2.0%) each.

Table 4: Demographic characteristics of RT-PCR-confirmed COVID-19 patients and relation with disease severity

Patient characteristics	Non-severe N (%)	Severe N (%)	Critical N (%)	p-value
Gender				
Male	1250 (79.8%)	117(7.5%)	199 (12.7%)	0.627
Female	628 (81.2%)	50 (6.5%)	95 (12.3%)	
Age group				
≤1 y	9 (100%)	0 (0%)	0 (0%)	0.0001*
1-15 y	87 (96.7%)	0 (0%)	3 (3.3%)	
16-30 y	473 (94.4%)	18 (3.6%)	10 (2%)	
31-45 y	482 (83.4%)	43 (7.4%)	53 (9.2%)	
46-60 y	451 (71.0%)	76 (12%)	108 (17.0%)	
>60 y	376 (71.5%)	30 (5.7%)	120 (22.8%)	
Comorbidity				
No comorbidity	1553 (94%)	78 (4.7%)	22 (1.3%)	0.0001*
One comorbidity	281 (60.3%)	61 (13.1%)	124 (26.6%)	
>1 comorbidity	44 (20.0%)	28 (12.7%)	148 (67.3%)	

*p-value statistically significant at 0.05.

Table 5: Depiction of time to recovery and death among admitted COVID-19 patients

Patient characteristics	Time to recovery N (%)				Recovery	Death	p-value
	≤7 d	8-14 d	>14 d	P value			
Gender							
Male	619 (47.3%)	621 (47.4%)	69 (5.3%)	0.060	1309 (83.6%)	257 (16.4%)	0.639
Female	344 (52.8%)	273 (41.8%)	35 (5.4%)		652 (84.3%)	121 (15.7%)	
Age group							
≤1 y	6 (66.7%)	3 (33.3%)	0 (0%)	0.074	9 (100%)	0 (0%)	0.0001*
1-15 y	55 (63.2%)	27 (31.0%)	5 (5.8%)		87 (96.7%)	3 (3.3)	
16-30 y	247 (51.4%)	213 (44.3%)	21 (4.3%)		481 (96.0%)	20 (4.0%)	
31-45 y	244 (49.5%)	221 (44.8%)	28 (5.7%)		493 (85.3)	85 (14.7%)	
46-60 y	236 (47.3%)	232 (46.5%)	31 (6.2%)		499 (78.6%)	136 (21.4)	
>60 y	175 (44.6%)	198 ((50.5%)	19 (4.8%)		392 (74.5%)	134 (24.5%)	
Comorbidity							
No comorbidity	765 (46.8%)	818 (50.0%)	51 (3.1%)	0.0001*	1634 (98.9%)	19 (1.1%)	0.0001*
One comorbidity	182 (66.9%)	64 (23.5%)	26 (9.6%)		272 (58.4%)	194 (41.6%)	
>1 comorbidity	16 (29.1%)	12 (21.8%)	27 (49.1%)		55 (25.0%)	165 (75.0%)	

DISCUSSION

Our study represents a large data set from a rural and semi-urban tertiary care center providing dedicated care to COVID 19 patients in large region of Northern India. In fact, it is among very few reported literature on COVID 19 profile and outcomes from rural COVID 19 treatment centers. The first case of COVID 19 in India was reported on 30th January 2020 and this study includes the initial most case from Northern Uttar Pradesh in 1st week of Feb 2020 [7]. Our center followed the same trajectory of cases, with 1st wave peak around April to July with flattening around September 2020 as documented by ICMR, whereas the 2nd wave abruptly peaked in March 2021 and continued till May to flatten around June-July 2021. Mortality also followed the same pattern and coincided with national data [7].

The institution located in the district had a high migrant worker population, which includes both international as well as national (other states) workers. Hence, there was influx of workers from other places, especially during 1st wave and almost all the workers stayed till 2nd wave. The migrant population included 5.8% of the study subjects.

The national COVID registry created by ICMR provides us the national data on the clinical profile and outcomes of both the waves. In our study, among symptomatic patients (97.7%), fever was the most common symptom (92%) followed by cough (51%), dyspnea (37.8%), and myalgia (30.0%). Gastrointestinal complaints (16.2%) and sore throat was seen in less than 10% cases. Anosmia and ageusia were seen in less than 10% cases. According to the registry data, fever was seen in more than 70%, dry cough around 40%, myalgia around 15%, anosmia and aguesia around 5-10%, dyspnea around 40% cases. Therefore, our data is in accordance with national data [7].

In our study, 29.3% patients had one or more than one comorbidities and predominate included diabetes (15.8), hypertension (13.4%), coronary artery diseases (1.0%) and chronic kidney diseases (0.6%). Uncommon comorbidities included tuberculosis (pulmonary and extra-pulmonary), leukemia, and myasthenia gravis, suspected cases of liver and brain tumor. A recent literature from Northern India also reported uncommon comorbidities in form of tuberculosis 13(28.3%) with predominant cases of extra-pulmonary, acute leukemia 1(2.2%) and myasthenia gravis 2(4.4%) [8]. The frequency of uncommon coexisting illnesses in our study is in accordance with Indian data. 53.8% of patients with one or more comorbidities died of COVID-19. This large review found the range of reported mortality was 3.14% to 61.5% with overall prevalence of 17.6%. The factors associate to mortality among COVID-19 patient has predominantly included older age, male sex, and current smoker and other factors influencing mortality included-COPD, cardiovascular disease, diabetes, hypertension, obesity, cancer, acute kidney injury and increase and increased d dimer [9]. Now, tuberculosis has been established as risk factor for severe COVID-19 disease [8, 10].

The mortality at our center was 16.2% and that of national data ranged between 10.1-13.1% of admitted deaths during covid waves [7]. A recent systemic review of global mortality in COVID-19 among hospitalized patients reported to be 17.6% [9]. Hence, even the mortality at a rural and semi-urban based setting had a comparable mortality rate. This could be attributed to the fact that there was severe shortage of beds at major tertiary care centers in city and many sick and critical patients were managed at level-2 hospitals in rural and semi-urban area. On the other hand, as most of the published data are from tertiary care institutions located in urban region our data shows a significant and quality management of cases even at semi-urban care settings. Thus, rapid training of existing staffs and availability of devices as BiPAP, High Flow Nasal Oxygen (HFNO) device and ventilators at centers has improved the outcome of such admitted patients. In our study, the laboratory features significantly differing among patients with mortality included neutrophilic leukocytosis, anemia, hepatitis, coagulopathy, lower serum levels of sodium and calcium, higher serum potassium, urea, CRP and LDH. Similar study from Northern Uttar Pradesh showed important laboratory findings that significantly differ among mild, moderate and sever cases and included serum calcium, random sugar, CRP, fibrinogen, prothrombin time, International Normalize Ratio (INR), ferritin, LDH and pro-calcitonin levels [11, 12].

The factors associate to mortality among COVID 19 patient has predominantly included older age, male sex, and current smoker and other factors influencing mortality included-COPD, cardiovascular disease, diabetes, hypertension, obesity, cancer, acute kidney injury and increase and increased d dimer [9].

The rural area was more or less equally affected by COVID19 pandemic, especially by the end of the second wave. The overwhelming patient overload at urban centers and oxygen supply shortage was evident. The rural centers, although incompletely prepared, delivered services at the same time [13]. To the contrary, rural centers, which were designated as level 1 and 2 also provided level 3 supports and care to the sick and critically ill patients of COVID-19 in India and included ours too. Despite so much contribution to the pandemic, there is spares literature from such rural and semi-urban regarding their experience in the management of the pandemic [14]. There is extensive literature on preparedness and effect of COVID 19 on rural population apart from sero-surveillance data but clinical data and outcome studies are missing. We highlight our study as an experience from rural centre with details of patients' clinical features and outcome. Most of the literatures are from Southern India [15-17] with isolated one from Northern India [18]. The data set of South India had a patient population of 250, 182 and 1754, whereas the Northern India had 81 subjects. Thakur K *et al.* [15] found 74% admitted patients had comorbidities, whereas Teli J G *et al.* [17] documented that 84% patients dying of COVID had comorbidities. In our study, 29.3% patient had comorbidities and of them 52.3% died. Mean age group in our study was 45.43 y and the predominant age group in Thakur *et al.* was 31-51 in about 50% cases and similar finding was seen in S N Hasan *et al.* [18]. The both wave cumulative mortality in our study was around 16% and only Teli J G *et al.* [17] documented the mortality around 4.3%. The spectrum clinical features included fever (29-84%), headache (16-50%), cough (32-59%), asthenia (16-70.3%), myalgia (16-58%), shortness of breath (10-27%), gastrointestinal symptoms (0.06-14%), loss of smell and taste (33-72%) and rhinorrhoea (6-16%). The clinical spectrum in our study is in accordance [16,17,18]. Only Teli J G *et al.* documented the laboratory findings among death cases and had elevated inflammatory markers in all the subjects like Ferritin, CRP, D-dimer and LDH. In our study, we found similar trend among mortality cases but there was inconsistent data of ferritin and d-dimer [17]. This could be attributed to rural setting and hence, many cases might have missed the vital advantages of these investigations.

CONCLUSION

India has managed COVID-19 pandemic at rural setting by supply of resources and rapid and regular training. Rural population had comparable proportion of comorbidities as well as mortality. Common risk factors for severe disease in rural setting were similar to urban setting and old age and more than one comorbidities. Country-wide rural data should be collected for better understanding of COVID-19 disease in rural and remote population.

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Nil

AUTHORS CONTRIBUTIONS

All authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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