

Clinical characteristics and outcome of patients presenting to emergency department during the second wave of COVID-19

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ABSTRACT

Background: COVID 19 resurgence in multiple waves and the highly infectious variant of SARS-CoV-2 (B.1.617) has wreaked havoc across healthcare systems in India. We conducted a study to delineate the clinico-epidemiological profile of COVID-19 patients in this second wave of the pandemic. **Methods:** This was a retrospective, single centre, observational study at the Emergency Department(ED) of a teaching institute in North India. The ED health records were screened for patient files with the diagnosis of COVID -19, age > 14 years, presenting from 10th April to 30th of May. ED clinical notes, disposition, and mortality data were retrieved and analysed. **Results:** 1647 files were screened and 253 eligible patients of COVID-19 were included in the study. 60% patients were male, mean age (+ SD) was 54 (+ 14.8 years). Shortness of breath (74.7%), fever (71.9%), cough (57.7%) were the common presenting symptoms. 20% of patients were nil comorbid; Diabetes (44.7%) and Hypertension (41.5%) were the common comorbid illnesses. 73.1% patients had severe COVID illness, 39.9% had oxygen saturation <90% on arrival and 33.2% had <70%. More than 90% patients required respiratory support on arrival. 25% of people presented to hospital after home isolation, of which 81% had severe COVID at presentation. 39 % patients of mild illness had received corticosteroids. **Conclusion:** The second wave of COVID-19 with rapid upsurge of cases overwhelmed the healthcare system with a higher proportion of severe COVID-19 cases and higher mortality, thus stressing the need for prior planning, preparation and strengthening healthcare systems across tiers.

Keywords: COVID-19, second wave, steroids

Introduction

Coronavirus disease-19 has affected the world, creating havoc by its resurgence in multiple waves.^[1-3] When countries across the globe were trying to relax curbs and bring normalcy in social life by pushing vaccination programmes and intervention like

universal masking and social distancing, a more contagious variant of SARS-CoV-2 emerged causing a public health challenge. SARS-CoV-2 lineage B.1.1.7 (United Kingdom), B.1.617 (India), B.1.315 (South Africa), and P. 1 (Brazil) were found to be 40% to 80% more infectious than the wild-type SARS-COV2 which caused the 1st wave.^[4] While the average six weekly global mortality during first wave was about 29 per million, it rose to about 68 per million during the second wave.^[5]

In India, the second wave of the COVID-19 pandemic was much deadlier than the first. In north India, the case number rose

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exponentially within a week and hospital systems were choked. The hospitals were inundated with patients seeking oxygen support for acute respiratory failure. The oxygen shortage was an added hurdle, causing thousands of patients frantically looking out for oxygen bed availability in hospital.^[6] The emergency department (ED) was at the forefront of this unprecedented crisis. The emergency physicians saw this COVID wave from very close quarters. While the respiratory symptoms were well known, the virulence and infectivity of this new strain B.1.617.2 (delta variant) was appearing to be more serious. Patients presented with rapidly progressive respiratory failure requiring high flow oxygen devices like high flow nasal oxygenation and non-invasive ventilation (NIV) right at the outset. With tertiary care centers filled beyond their capacity, there was spillage of case burden on secondary and primary care systems too. In view of the acuity of presentation and increasing virulence of the second wave, we decided to plan a single center retrospective study in order to identify key presenting symptoms and signs among COVID patients presenting during the second wave.

Methods

Study population and study setting

This was a retrospective, single-center, observational study following the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.^[7] The study was conducted in the ED at a teaching institute in North India. In India, the peak of the second wave of COVID-19 pandemic struck in April 2021. Between 1st April and 1st June 2021, our ED catered to 1647 COVID-19 confirmed admission requiring patients. We planned to conduct this study to delineate the clinico-epidemiological profile of COVID-19 patients in this second wave of pandemic. The duration of the study was from 10th of April to the 25th of June. The ethical approval was obtained from the Institute Ethics Committee before the commencement of the study (IEC – 363/04.06.2021).

The electronic health records (EHR) of our ED is a local area network-based computerised system in which the patients' details like scanned ED clinical notes, lab reports, radiological data, ED disposition, and mortality data are available. The EHR was screened for patient files with the diagnosis of COVID-19, limited to the ED admission dates from 10th April to 30th of May. Patients (age ≥ 14 years) who presented to our ED during the study period and diagnosed as COVID-19 illness (rapid antigen or nucleic acid amplification test positive) were included. Out of the 1647 patient files screened, we found 253 eligible patients of COVID-19 who had relevant all the clinical details (described in the subsequent paragraph) available in the EHR and got discharged before the end of our study period. Patients who were SARS-CoV-2 negative and brought dead were excluded from the study [Figure 1].

Data collection

A detailed data collection sheet was formulated using the Delphi method. Information was collected from the EHR with an emphasis

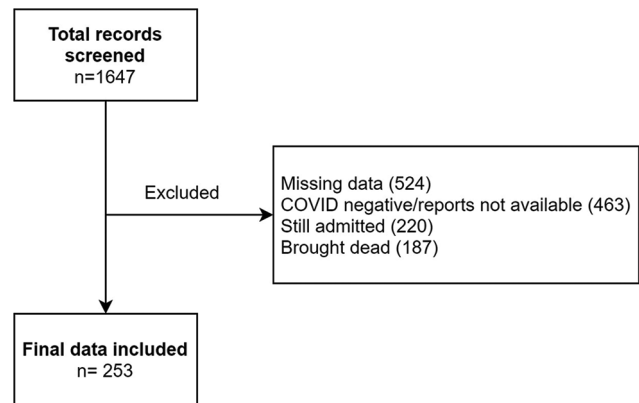


Figure 1: Plot for enrolment

on the demographic data (age, gender, date, and time of arrival to ED), presenting complaints, vitals at presentation to ED, triage category, comorbidities, SARS-CoV-2 testing, laboratory values on admission, radiological findings, management in the ED, treatment taken (especially steroids and oxygen therapy) for COVID-19 illness prior to ED presentation, previous COVID-19 infection details, and patients' vaccination status. The severity of COVID-19 infection at presentation was classified as mild, moderate, and severe according to the updated World Health organization (WHO) guidelines.^[8] Specific details on the date of onset of COVID-19 associated mucormycosis (CAM) symptoms, clinical features of CAM, risk factors of CAM, and steroid usage details for COVID-19 were also sought for. Outcomes like ED disposition, length of hospital stay, and mortality were retrieved from EHR and telephonic follow-up of the patients (or their relatives). Two investigators retrieved this above-mentioned information from the EHR and resolved any conflicts with discussion.

Statistical analysis

Counts and percentages were used to summarize categorical data. Mean and standard deviation were used to summarize normally distributed data, whereas median, range, and interquartile range were used to summarize non-normal continuous data. Normality of data was tested by Kolmogorov–Smirnov test. As this was a descriptive study, no analytical tests were applied on any subgroups. All the analyses were performed with IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp.

Results

Data from 253 patients were analyzed in this study who had a mean age of 54.4 ± 14.8 years, of whom 60% were male patients. The majority belonged to the age group between 18 to 60 years. Around 28% of the patients came from neighbouring states for treatment. Shortness of breath (74.7%), fever (71.9%), and cough (57.7%) were the most common presenting symptoms [Table 1]. A small proportion of these patients (10%) were infected with COVID-19 in the previous waves. Only 28 patients had received at least one dose of vaccination with two being fully vaccinated. Diabetes and hypertension were the

Table 1: Basic clinico-demographic profile

Characteristics	n=253
Age (years±SD)	54.4±14.8
Age group	
<18 years	3 (1.2%)
18-60 years	156 (61.7%)
>60 years	94 (37.2%)
Gender	
Male	152 (60.1%)
Female	101 (39.9%)
Mode of transport to hospital	
Private vehicle	122 (48.2%)
Private Ambulance	98 (38.7%)
State Ambulance	22 (8.7%)
Hired taxi/three wheeler	11 (4.4%)
Presenting Complaints	
Breathlessness	189 (74.7%)
Fever	182 (71.9%)
Cough	146 (57.7%)
Myalgia	77 (30.4%)
Headache	44 (17.4%)
Nausea & vomiting	38 (15.0%)
Altered mental status	21 (8.3%)
Loss of smell	20 (7.9%)
Diarrhea	13 (5.1%)
Loss of taste	12 (4.7%)
Hemoptysis	12 (4.7%)
Chills and rigors	12 (4.7%)
Others [#]	20 (7.9%)

[#]Rhinorrhoea (8) Sore throat (3) Chest Pain (3) Focal neurological Deficit (2) Epistaxis (2) Hematemesis (1) abdominal pain (1)

Table 2: Previous medical history and vaccination status

Comorbidities	n=253
Diabetes	113 (44.7%)
Hypertension	105 (41.5%)
Hypothyroid	22 (8.7%)
Coronary artery disease	18 (7.1%)
Malignancy	14 (5.5%)
Chronic Kidney Disease	11 (4.3%)
Old cerebrovascular accident	8 (3.2%)
Chronic Liver Disease	7 (2.8%)
Obesity	6 (2.4%)
Bronchial asthma	6 (2.4%)
Others [@]	24 (9.4%)
No comorbidity	50 (19.8%)
Previous COVID-19 infection	
Yes	228 (90.1%)
No	25 (9.9%)
Vaccination status	
No	225 (88.9%)
Partial	26 (10.3%)
Full	2 (0.7%)

[@]Structural heart disease (5) 1 Renal transplant (4) Psychiatric illness (4) Immunosuppressant drugs (4) Chronic Pulmonary obstructive disease (4)

most common comorbidities present in patients but around 20% of patients had no comorbidity [Table 2].

About 25% chose to isolate themselves at home after being diagnosed with COVID-19. About 77% (48 out of 63) of these patients had associated comorbid illness. Zinc and Vitamin C

were the most common supplements taken during home isolation. Two of these patients used an oxygen concentrator at their home [Table 3]. Fifty one out of the 63 patients (81%) on home isolation had severe COVID-19 at presentation to our hospital. A similar percentage of patients (25%) were admitted to other hospitals before coming to our center. Forty seven patients out of the 64 (73.4%) admitted in other hospitals received oxygen support. Nine out of the 23 mild COVID-19 cases (39.1%) received steroids.

On arrival to our center, 188 patients had a saturation of less than 90% and more than 90% of patients required respiratory support in some form (NIV, NRBM, face mask, and invasive ventilation). Out of the 50 patients who had no comorbid illness, 41 patients had severe COVID-19 at presentation. We could admit 153 (60.7%) patients to different COVID wards and ICUs of our hospital, while the rest 100 (39.5%) were managed in the ED itself. Mortality in the patients we included was 63.3%. The majority of patients expired within 7 days of their hospital admission. The median length of stay of patients who were discharged after being cured was 24.5 days [Table 4].

Discussion

This study was done in the background of the highly infectious double mutant variant of SARS-CoV-2 (B.1.617 lineage) creating disruption in India. This variant B.1.617.2 also termed as delta variant was 1st detected in India in late 2020.^[9] During the 1st wave, we had reported the main clinical characteristics of 116 patients with COVID-19.^[10] In comparison, during the current wave, the mean age of patients we included was higher (54 years vs 47 years), though the proportion of male patients are similar in both these studies. Various studies from India have reported a lower mean age of patients affected when compared with western countries.^[1,11] The presenting symptoms were similar in both the waves with breathlessness, fever, and cough being the predominant complaints. The comorbidity profile was also similar with diabetes and hypertension being the most common concomitant chronic illness.

The concerning aspect of the 2nd wave was the proportion of severe COVID-19 cases which presented to our hospital (73.1%). The sharp rise in cases due to the highly infectious variant led to 0.2 million active cases a day by April 15th, which was double the peak seen in the 1st wave.^[12] Higher percentage with a steeper rise in curve led to higher absolute number of patients, causing an overwhelmed healthcare system. In the 1st wave, the guidelines recommended admission of any patient with comorbidities for observation and early management in case of deterioration.^[13] During the current wave, a large number of cases in a short period of time led people to isolate themselves at home and present to the ED when their condition had significantly deteriorated. Besides the acute resource crisis, limited evidence led to higher thresholds to initiate oxygen therapy. In our study, we found that one-fourth of the patients isolated themselves at home after

Table 3: Treatment received prior to reaching our hospital

Patients on home isolation	n=63 (24.9%)
Median (IQR) days at home	5 (4-10) days
Management at home	
Zinc	58 (92.1%)
Vitamin C	56 (88.8%)
Azithromycin	33 (52.3%)
Ivermectin	27 (42.8%)
Budecort Inhaler	10 (15.8%)
Doxycycline	9 (14.2%)
Favipiravir	9 (14.2%)
Steroids	5 (7.9%)
Iron supplement	3 (4.7%)
Oxygen concentrator	2 (3.1%)
Patients previously admitted	n=64 (25.3%)
Median (IQR) days of admission	10 (5-15) days
Respiratory support received outside	
Face mask	33 (51.6%)
Non-invasive ventilation	9 (14.1%)
Invasive ventilation	5 (7.8%)
None	17 (26.6%)
Steroids received	
Dexamethasone	23 (35.9%)
Methylprednisolone	19 (29.7%)
Methylprednisolone + dexamethasone	2 (3.1%)
Prednisolone	2 (3.1%)
None	18 (28.1%)

Table 4: Management at our hospital

Characteristic	n=253
Saturation at arrival	
>90%	68 (28.9%)
71%-89%	101 (39.9%)
<70%	84 (33.2%)
Severity	
Mild COVID	23 (9.1%)
Moderate COVID	45 (17.8%)
Severe COVID	185 (73.1%)
Initial respiratory support	
Non-rebreather mask	84 (33.2%)
Invasive ventilation	60 (23.7%)
Non Invasive Ventilation	37 (14.6%)
Face mask	26 (10.3%)
CPAP on BAINS	11 (4.3%)
High flow nasal cannula	10 (4.0%)
None	25 (9.9%)
Steroids received	
Dexamethasone	232 (91.7%)
Methylprednisolone	16 (6.3%)
None	5 (2.0%)
Final outcome	
Discharged	93 (36.7%)
Died	160 (63.3%)
Median Length of stay (IQR) in days	
Patients who got discharged	24.50 (11.25-33.00)
Patients who Died	6.0 (3.0-10.8)
Mortality	
0-7 days	93 (58.1%)
7-14 days	44 (27.5%)
14-28 days	19 (11.9%)
>28 days	4 (2.5%)

diagnosis and more than 80% of them ended up having severe disease on presentation to ED. This highlights the need for proper preparation by using mathematical prediction models and augmenting our health care system to prevent a large number of casualties in subsequent waves.^[14] It also emphasizes the need to reexplore the home-isolation strategies, target oxygen saturation in early illness to avoid losing the lead time for early intervention, and prevent progression to severe disease.^[15] Primary and secondary care physicians being adept with the update in case management guidelines and an early point of healthcare contact in such situations can play a pivotal role in appropriate guidance of patients and timely referral of cases.

Our study also highlights the irrational over-the-counter use of various multivitamins, antiviral, and antibiotics. Favipiravir and Ivermectin have been prescribed on the basis of *in-vitro* studies when large clinical trials were lacking.^[16,17] The PRINCIPLE Trial Collaborative Group found that azithromycin and doxycycline have no role in the recovery of COVID-19 patients.^[18] The inappropriate use of antibiotics will only lead to increased antimicrobial resistance and cause side effects to patients. Another important difference that our study highlights is the use of steroids in the second wave. The significant mortality benefit of dexamethasone in the RECOVERY trial in patients requiring respiratory support changed the treatment guidelines.^[19] We found that patients who received some form of treatment outside before reaching us were already started on steroids. The dose and form of steroids varied significantly, with some starting on low-dose steroids and others starting with higher doses and then tapering it off. Steroids were even started in mild disease and those on home isolation in few patients (7.9%), as they are easily available over the counter. This has led to the unscrupulous use of steroids causing a wave of secondary infections particularly mucormycosis.^[20] This again highlights the important role of primary physicians, who are usually the first point of contact for patients in early disease to prescribe medicines rationally based on current evidence.

Our study revealed a large proportion of patients presenting to our emergency with severe COVID-19 requiring oxygen support. The finding was similar to the study by Budhiraja *et al.*^[21] 2021 from North India, where they found more patients required oxygen support (74.1% vs 63.4%) during this second wave compared with the first. About 33% had a saturation of less than 70% on arrival requiring high oxygen support. Most of our patients required a non-rebreather mask, NIV, and invasive ventilation for hypoxia. Due to the sudden surge of a large number of patients requiring NIV, we resorted to continuous positive airway pressure using the BAINS circuit. This is an effective method in a low-resource setup previously studied in children.^[22]

Our study revealed a high mortality rate of 63%. This could be due to various reasons; first, we are a tertiary care hospital receiving a large proportion of severe COVID cases at presentation; second, due to the rapid surge of cases and lack of

adequate ICU facilities, a large proportion of cases were managed in the ED creating a backlog and disaster like situation; third, by the time the second wave hit India, the vaccination program had just started, hence a large proportion of the patients were still unvaccinated. Various studies have shown that vaccination has prevented serious illness in patients when compared with the unvaccinated ones.^[23,24] In terms of overall deaths in the country during the peak, the second wave was found to be 3.6 times lethal in comparison to the first wave.^[25] A similar study comparing the two waves found that there was a 40% increase in mortality in the second wave.^[21] This corresponds with temporal trends of the previous large pandemic of Spanish flu.^[26] In our study, we found that 41 out of the 50 patients with no comorbidity had severe illness with high mortality. This could be due to the delayed presentation and more deadly nature of the delta variant. The majority of patients who succumbed in our hospital did so within 7 days of admission, showing the advanced stage of illness at the time of presentation. Duration of hospitalization for patients who recovered from the disease was almost 25 days, this is in contrast to other studies where lower days of hospitalization were seen in the 2nd wave.^[1,21] This could be explained by the higher proportion of severe illness included in our study, leading to increased recovery time in these patients. Maslo *et al.*^[25] in their study from South Africa reported a longer duration of hospitalization and higher mortality in the second wave cohort. Although the overall death rate was found to be similar to the 1st wave in India, due to the significantly high number of infections and patients requiring oxygen support, the total deaths have been high.^[27] This has possessed a unique challenge of augmenting critical care units and medical oxygen supply for future waves.

Limitations

The study being conducted at a tertiary care center, the overall profile of patients was in the severe category. The included patients in our study were just a fraction of the total cases that came during the study period, and are thus not representative of the general population and prone to selection bias.

Conclusion

While the age and comorbidity profile of the second wave of COVID-19 was comparable to the first wave, it posed a challenge of rapid escalation of numbers, large proportion of severe cases, and higher mortality. Non-evidence-based, over prescription of antimicrobial agents and corticosteroids, tackling the shortage of critical healthcare resources during the peak are the issues that need to be addressed. Continuous Positive Airway Pressure using the BAINS circuit for hypoxic patients, as an innovative interim short-term stabilisation technique, can be further studied, for use in low resource settings and during transfer of patients. Home-isolation recommendations need to be reexplored to avoid loss of crucial lead time and delay in seeking healthcare. Primary and secondary care systems can play a pivotal role by being adept with the new management updates, apt healthcare guidance, early recognition of deterioration, timely referral, and

judicious prescription practices. Strengthening the health care system across tiers, prior planning, and preparation are essential to prevent large numbers of fatalities in successive waves.

Author contribution

Joint first authors (contributed equally) - RM, JB; Conceptualization - AK, AKS, JN, PA, ME; Methodology - RM, AKS, RB; Software -RM, AKS; Data Collection and Validation - AKS, JB, RR, MI, JA, RPK; Formal Analysis - RM, AKS; Writing (Original Draft) - AR, AKS, RB, RM; Writing (Review and Editing) - AK, RB, RM, PA, JN, ME; Visualization - AR, AKS, PR; Supervision - AK, PA, JN; Project administration - AK, PA, JN, ME, PR.

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Conflicts of interest

There are no conflicts of interest.

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