Descriptive Epidemiology of COVID-19 Deaths during the First Wave of Pandemic in India: A Single-center Experience

Prakash Tendulkar[1] , Pragya Pandey[2] , Prasan K Panda[3] , Ajeet S Bhadoria[4] , Poorvi Kulshreshtha[5]

ABSTRACT

Background: With the looming threat of recurrent waves of coronavirus disease-2019 (COVID-19) in the presence of mutated strains, it is of paramount importance to understand the demographic and clinical attributes of COVID-19 related mortalities in each pandemic wave. This could help policy makers, public health experts, and clinicians to better plan preventive and management strategies to curb COVID-19 related mortality.

Materials and methods: This was a hospital record-based, retrospective cross-sectional descriptive study, at a tertiary care hospital in Rishikesh, India. The study included all deceased patients between March 2020 and January 2021 (first wave) who had tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by reverse transcription polymerase chain reaction (RT-PCR) and were hospitalized. The study was done to describe demography, clinical presentation, laboratory parameters, treatment given, and associated complications of all COVID-19 deaths.

Result: Out of 424 mortalities, 298 (70.38%) were males and 126 (29.62%) were females. Mean age of patients was 55.85 ± 16.24 years, out of which 19.5% were less than 45 years old, 33.6% were 45–60 years old, and 41.8% were more than 60 years old. Comorbidity in the form of type II diabetes mellitus was present in 41.4% [95% CI (41.4–51.1)], hypertension in 39.8% [95% CI (35.1–44.6)], and coronary artery disease (CAD) in 15.2% [95% CI (11.8–18.8)]. At the time of presentation, shortness of breath was present in 73.6% [95% CI (69.1–77.7)], fever in 64.92% [95% CI (60.1–69.4)], and cough in 46.1%, [95% CI (41.1–50.8)]. Deranged laboratory parameters were lymphopenia in 90.2% [95% CI (86.8–92.7)], transaminitis in 59.7% [95% CI (54.8–64.3)], and hypercreatinemia in 37.7% [95% CI (33.1–42.5)]. Complications manifested were acute respiratory distress syndrome (ARDS) in 78.3% [95% CI (74–82.1)] and shock in 54.7% [95% CI (49.8–59.5)]. Median time duration between onset of symptom and hospital admission was 5 days (interquartile range (IQR) = 3–5 days) and median length of hospital stay was 9 days (IQR = 4–14 days).

Conclusion: During the first pandemic wave, COVID-19 related mortality was 2.37 times higher among males, 2.14 times in the age group >60 than <45 years. The most common associated comorbidities (>40%) were type II diabetes mellitus and hypertension. The most common associated symptoms (>60%) were shortness of breath and fever. Lymphopenia was seen in >90% cases while liver involvement in 60% and kidney in 38% cases. Median hospital stay was doubled the prehospital illness.

Keywords: Coronavirus disease 2019, Mortality, Risk factors.

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INTRODUCTION

Coronavirus disease-2019 (COVID-19) was declared a global pandemic by the World Health Organization (WHO) on March 11, 2020. As of August 15, 2021, a total of 207,542,620 confirmed cases were diagnosed all over the world, with a total death of 4,367,396 (WHO data on COVID-19). India has reported over 32 million coronavirus cases as of August 14, 2021, with more than 31 million recoveries and around 430 thousand causalities in that Uttarakhand, an Indian state in the Himalayan region, reports over 340 thousand confirmed cases and 7,370 deaths (MOHFW, India data on COVID-19).

From January 2020 until February 2021 of first wave effects, September 2020 reported highest number of cases and causalities in India (MOHFW, India data on COVID-19). Seeing the dynamic nature of coronavirus, it is of utmost importance to understand the demographic and clinical attributes of COVID-19 related mortalities during each wave. This could help policy makers and clinicians to plan ahead to curb COVID-19 deaths.

This is a single-center cross-sectional study to describe the clinical characteristic of deceased COVID-19 patients admitted at a tertiary care hospital in Rishikesh. The study was carried out to assess risk factors, comorbidities, clinical signs and symptoms, laboratory parameters, treatment course, associated complications, the time interval between symptom onset, and hospital admission as well as the time interval between hospital admission and death.

[1,3]Department of Internal Medicine, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India

[2,4]Department of Community and Family Medicine, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India

[5]Department of Physiology, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India

Corresponding Author: Prasan K Panda, Department of Internal Medicine, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India, Phone: +91 9868999488, e-mail: motherprasanna@rediffmail.com

MATERIALS AND METHODS

This was a hospital record-based, retrospective descriptive study. The study includes data of all deceased patients who had tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by reverse transcription polymerase chain reaction (RT-PCR)

between March 2020 and January 2021 and were subsequently hospitalized for COVID-19 illness. Data were accessed from patient records that were uploaded at All India Institute of Medical Sciences (AIIMS) Rishikesh at the e-hospital portal, Health Information Management System, Government of India.

Appropriate ethical approval was obtained from the institute's ethical committee, AIIMS, Rishikesh, before accessing the desired data. Data were entered in a Microsoft Excel spreadsheet. Categorical variables were described as frequency and proportion. Continuous variables were described as mean ± standard deviation or median with IQR as applicable.

RESULTS

Out of the total reported COVID-19 cases in Uttarakhand until January 2021 (first wave), 2,396 got admitted at this tertiary care hospital and 424 causalities were reported. Out of this, 297 (70.3%) were males and 125 (29.7%) were females. The mean age of the patients in years was 55.85 ± 16.24 years, out of which 19.5% were less than 45 years old, 33.6% were 45–60 years old, and 41.8% were more than 60 years old.

The most common symptoms among the deceased were shortness of breath [73.6%, 95% CI (69.1–77.7)], fever [64.92%, 95% CI (60.1–69.4)], and cough [46.1%, 95% CI (41.1–50.8)]. Other less common symptoms include sore throat [12.5%, 95% CI (9.98–16.43)], chest pain [11.2%, 95% CI (8.51–14.59)], altered mental status [9.8%, 95% CI (7.4–13.28)], abdominal pain [6.5%, 95% CI [4.2–8.9)], diarrhea [6.3%, 95% CI (4.04–8.69)], headache [2.2%, 95% CI (0.09–3.80)], and loss of taste and smell [1.1%, 95% CI (0.15–2.20)] (Fig. 1).

Tachypnea (RR >20) was present in 339 [80%, 95% CI (76.14–83.76)] patients. Two-hundred and seventy-five [64.86%, CI (60.10–69.40)] patients had hypoxia and needed oxygen support at admission, i.e., severe COVID-19. Thirty-six [8.1%, 95% CI (5.83–11.14)] patients had hypotension at admission.

In comorbidity, diabetes mellitus [41.4%, 95% CI (41.4–51.1)] was the most common disease. Other comorbidities were hypertension [39.8%, 95% CI (35.1–44.6)], coronary artery disease (CAD) [15.2%, 95% CI (11.8–18.8)], chronic obstructive airway disease (COPD) [8.3%, 95% CI (6.04–11.41)], chronic kidney disease (CKD) [7.6%, 95% CI (5.43–10.60)], malignancy [5.4%, 95% CI (3.26–7.58)], chronic neurological disorder [3.6%, 95% CI (1.77–5.29)], and chronic liver disease (CLD) [(3.4%, 95% CI (1.60–5.00)] (Fig. 2). One-hundred and eighty-eight patients (44%, 95% CI (39.55–49.21%)] had ≥2 of these comorbidities. Out of all deceased, seven [1.65%, 95% CI (0.67–3.37%)] were pregnant.
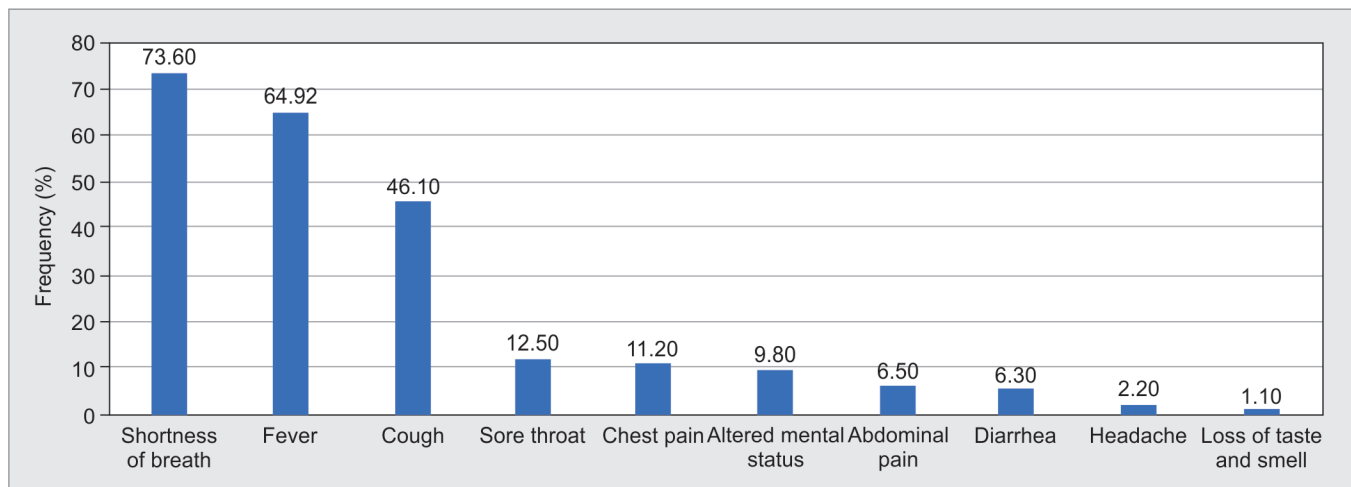

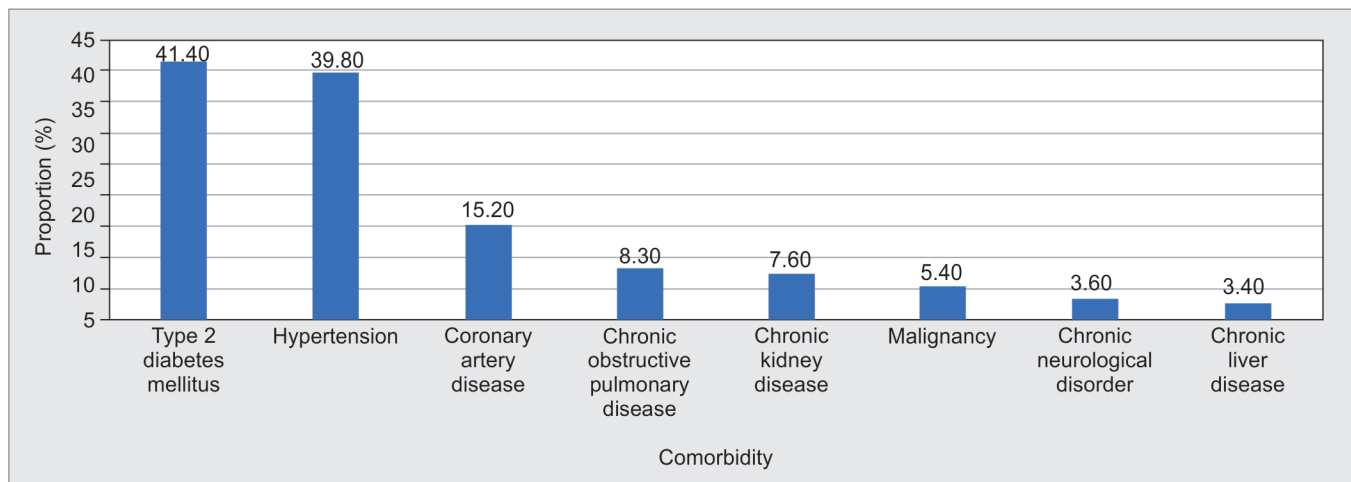**Fig. 1:** Symptoms in deceased COVID-19 patients

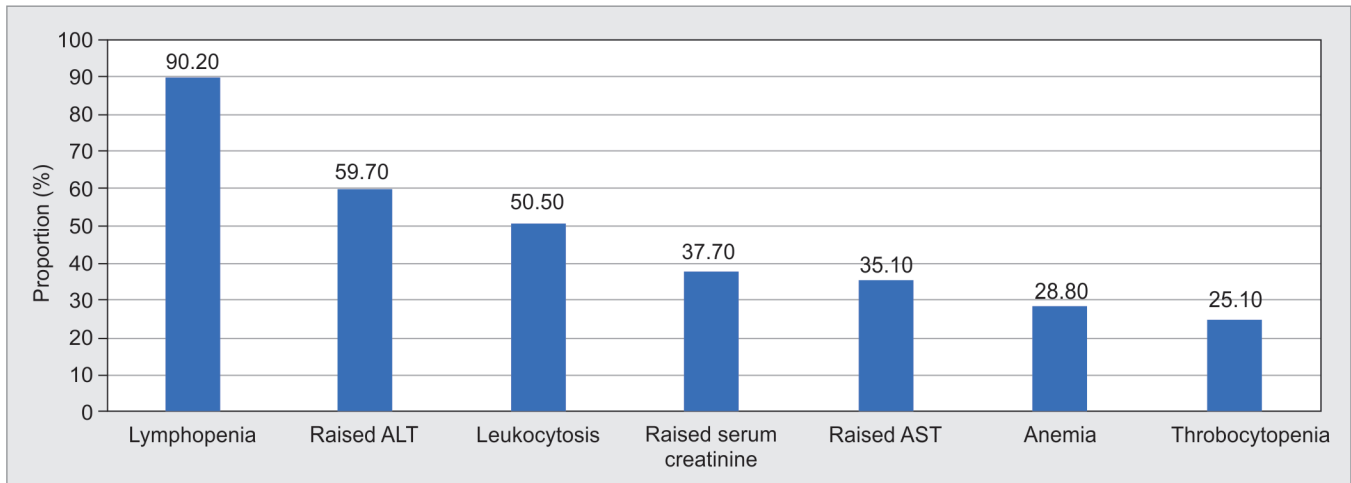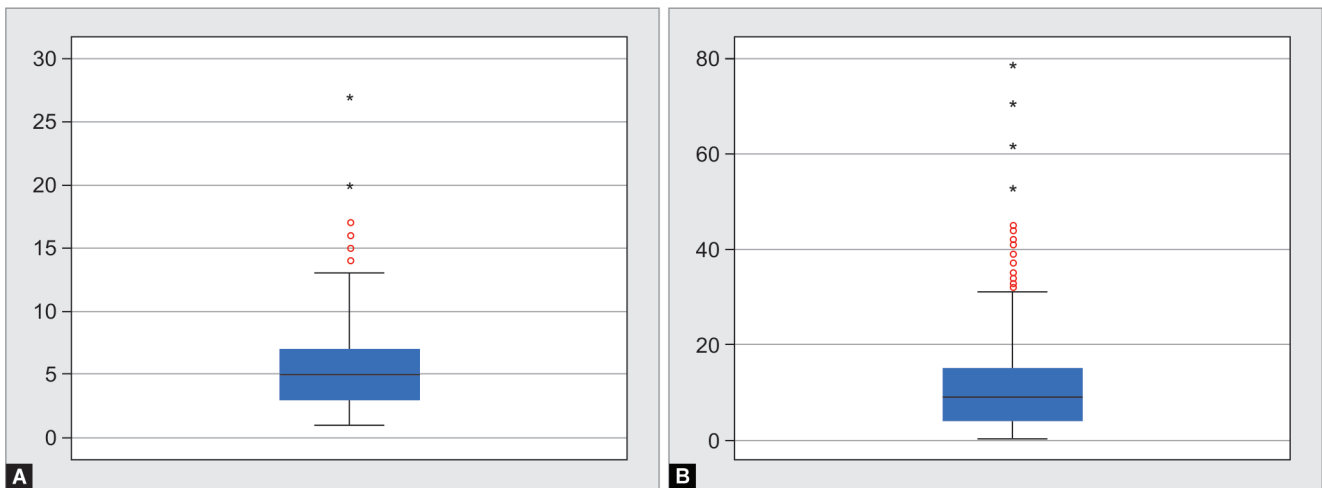**Fig. 2:** Comorbidity in deceased COVID-19 patients

Fig. 3: Laboratory parameters in deceased COVID-19 patients

Figs 4A and B: Box plots showing (in days) symptom onset to hospital admission. (A) and duration of the length of hospital stay; (B) in deceased COVID-19 patients

If we see in laboratory parameters at admission, lymphopenia was present in 403 [90.2%, 95% CI (86.8–92.7)] patients, leukocytosis in 214 [50.5%, 95% CI (45.71–55.23)], anemia in 122 [28.8%, 95% CI (24.46–33.08)], and thrombocytopenia in 112 [25.1%, 95% CI (22.21–30.61)] patients. Two-hundred and fifty-three (59.7%, 95% CI (55.00–64.33)] patients had raised alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels in 149 [35.1%, 95% CI (54.8–64.3)]. One-hundred and sixty [37.7%, 95% CI (33.1–42.5)] patients had creatinine of more than 1.2 mg/dL (Fig. 3).

Three-hundred and thirty-two patients (78.3%, 95% CI) needed intensive care unit (ICU) facility at admission. Two-hundred and thirty-seven (55.9%, 95% CI) patients started on noninvasive ventilation (NIV) support at admission. Two-hundred and thirty-two [54.7%, 95% CI (49.8–59.5)] developed shock during the hospital stays and needed inotropic support. Forty-six (10.3%) patients needed renal replacement therapy during the hospital stay. One-hundred and forty-four [33.96%, CI (29.5–38.5)] patients were managed with intravenous (IV) steroids. Acute respiratory distress syndrome (ARDS) was present in 292 [68.87%, CI (64.22–73.25)] patients, and sepsis was present in 171 patients [40.33%, CI (35.7–45.0)].

Median time duration between onset of symptom and hospital admission was 5 days (IQR = 3–8 days) and median length of hospital stay was 9 days (IQR = 4–14 days) (Fig. 4).

DISCUSSION

The median duration of hospital stays in a study in China was 10–13 days, similar to the present study.[1,2] Similarly in one of the hospital-based COVID-related death studies from the United States, the median interval from hospital admission to death was 5 days (IQR: 3, 8).[3] Results of another hospital-based study from South India show that the median time interval between symptom onset and hospital admission was 4 days (IQR: 2, 7) and between admission and death was 4 days (IQR: 2, 7).[4]

As we are witnessing the current trend globally, a high mortality in the COVID-19 pandemic is a big concern. Strikingly, most of the deaths are seen in the male population than female.[3,4] Results of a hospital-based COVID related death study from the United States show that 60.6% of the deceased patients were males.[3] One review article supports the evidence that "ineffective anti-SARS-CoV-2 responses, coupled with a predisposition for inappropriate

hyperinflammatory responses, could provide a biological explanation for the male bias in COVID-19 mortality."[5] The present study shows a similar trend, and out of total patients, 70.3% of the patients were males. Another explanation for reports of higher mortality in males could be limited healthcare access to females leading to low footfalls in hospitals.[6] In the present study, the age of approximately 42% of the deceased patients was more than 60 years. A number of studies have substantiated these findings and inference.[3,4,7,8]

A study that carried out on Italian deceased patients reveals that 35.5% of the deceased were with diabetes mellitus, 30% with an ischemic heart disease, 20.3% with active cancer, 24.5% with atrial fibrillation, 6.8% with dementia, and 34 (9.6%) with a history of stroke.[4] Results of another hospital-based study from South India show that diabetes mellitus (62%), hypertension (49.2%), and CAD (17.5%) were the commonly reported comorbidities among the patients who lost their lives.[9] Our study also corroborates these findings, with diabetes mellitus being the most common disease followed by hypertension, CAD, COPD, CKD, malignancy, chronic neurological disease, and CLD. In the present study, 188 (44%) of the deceased had presented with two or more such preexisting disorders.

Dyspnea was the most common presenting complaint in the present study which is consistent with the finding of other studies.[10,11] Approximately 73.6% of the patients complained of dyspnea at the time of presentation, and 78.3% of the patients were in a dire need of an ICU admission.

One study carried out in China shows that 83.2% of the patients were detected with lymphopenia on admission.[12] Lymphopenia at the time of initial presentation is associated with poorer prognosis in COVID-19 patients as reported in a Korean study.[13] In the present study, 90.2% of the deceased patients had lymphopenia at the time of admission. One meta-analysis states that as compared to moderate cases, severe COVID-19 cases had anemia at presentation [weighted mean difference (WMD), −4.08 g/L (95% CI −5.12; −3.05)].[14] About 28.8% of the patients had a hemoglobin of ≤11 g/dL a admission. A meta-analysis suggests that thrombocytopenia enhanced the risk of severe COVID-19 death by over fivefold.[15]

One previous retrospective study suggests that both prerenal and intrinsic acute kidney injuries (AKIs) were associated with higher mortality.[16] A meta-analysis concluded that the risk of death in patients with AKI in COVID-19 increases significantly (OR 11.05, 95% CI (9.13–13.36)).[17] another article reports that out of 3,993 patients COVID-19 positive patients, 1,835 (46%) developed AKI and about 347 (19%) required dialysis.[18] In the present study, 37.7% of the patients had raised creatinine levels at admission. But, only 7.6% of patients were known for CKD, and the rest 30.1% had AKI which could be attributed due to COVID-19 infection.

The shock was also a complication in the ICU patients. One meta-analysis suggested that in critically ill patients, 32% of the patients developed shock.[19] In the present study, 8.1% of the patients presented with shock at admission and 54.7% of the patients needed inotropic support in the hospital.

ARDS is the leading cause of COVID-19 related mortality. Previous systematic reviews and meta-analyses also validate this observation. The ARDS is considered as the most common complication, in both mild and severe COVID-19 patients.[20] In the present study, 68.87% of the deceased patients had ARDS complicating the disease.

Conclusion

In the Himalayan region of Uttarakhand, during the first wave of pandemic, a large proportion of RT-PCR-positive COVID-19 deceased were elderly males with preexisting comorbidities, which were inclusive of, however not limited to, type II diabetes mellitus, hypertension, and cardiovascular disease. The most common presenting complaints were shortness of breath, fever, and cough. The most common deranged laboratory parameters are decreased lymphocyte count, elevated serum glutamic-pyruvic transaminase (SGPT)/ALT, and raised serum creatinine. Median prehospital illness was half the duration of the hospital stay.

Authors' Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Ethics and Data Sharing

The study was done after institute ethical approval and as per the Declaration of Helsinki. After obtaining approval from the corresponding author, de-identified data can be shared.

Acknowledgments

Orcid

Prakash Tendulkar ● https://orcid.org/0000-0002-3185-8881
Pragya Pandey ● https://orcid.org/0000-0003-4590-5762
Prasan K Panda ● https://orcid.org/0000-0002-3008-7245
Ajeet S Bhadoria ● https://orcid.org/0000-0002-6947-7910
Poorvi Kulshreshtha ● https://orcid.org/0000-0001-8616-5057

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