Original Article

Mortality analysis of COVID-19 cases during the second wave and its comparison with the first wave: A hospital-based study

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Abstract

Objectives: This study was undertaken to determine the characteristics of COVID-19 deaths during the second wave and to compare these characteristics with the mortality during the first wave in a dedicated COVID hospital (DCH). **Study Design:** It was a hospital record-based descriptive study. **Methodology:** The study was conducted in a tertiary care COVID hospital, using a standard death audit proforma. The data were analyzed to know various demographic characteristics and factors related to mortality during the second wave from March to June 2021. The findings were compared with the mortality data during the first wave from April to July 2020 at the same hospital. **Results:** A total of 264 deaths occurred at the center during the study period with a mortality rate of 22.8%. Male cases were more in number, the age group was 21–70 years, the highest number of mortality was seen in the mid of the study period, duration of stay was five days on average and common causes of death were pneumonia alone or with acute respiratory distress syndrome with sepsis. In comparison to the first wave, the mortality rate was four times higher, the age group was younger and opportunistic infections viz. mucormycosis and aspergillosis were present during the second wave. **Conclusion:** The mortality rate was significantly higher and the younger age groups were involved during the second wave, with opportunistic fungal infections due to the use of immunomodulators.

Keywords: Age group, COVID care center, immunomodulators, mortality rate, opportunistic infection

Introduction

The COVID-19 vaccination drive in India was initiated on 16 January 2021, the day when active cases were only a few thousand in the country. However, precaution fatigue and negligence in following COVID-appropriate behavior invited the second wave of COVID-19. This wave of COVID-19 was more extreme in terms of infection rate in comparison to the first wave in the country as well as worldwide.[1–3] For India, the reasons behind it were multifactorial: new versions of the virus viz. double mutant B.1.617 variant from Maharashtra state, the B.1.1.7 variant from the UK, the P. 1 lineage from Brazil, and the B.1.351 lineage from South Africa among others, improper use of mask, lack of social distancing and administrative mismanagement at the start.[4] According to the Indian Council of Medical Research (ICMR), New Delhi, the infection rate was higher but the fatality rate was almost the same as the first wave.[5] During the second wave, the health system and the common public were aware of how to deal with it. It has, however, exerted a toll on

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Received: 10-02-2022 **Revised:** 04-05-2022
Accepted: 10-05-2022 **Published:** 31-10-2022

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_341_22

How to cite this article: Goyal P, Sikary AK, Sachdeva RA, Parashar L, Tarique A. Mortality analysis of COVID-19 cases during the second wave and its comparison with the first wave: A hospital-based study. J Family Med Prim Care 2022;11:6091-5.

the healthcare system causing a dearth of hospital beds, oxygen support, drugs, and other essentials for the COVID patients.

Sparse mortality data are available in India related to the first and second waves, and no study has yet compared the mortality data of the two. Hence the present study was conducted to analyze the deaths during the second wave at the center and compare it with the previous year's data to study the differences among various characteristics and factors.

Methods

This was a retrospective study conducted at a dedicated COVID center in Haryana. The study center has been designated as a COVID hospital by the State of Haryana since the first wave and continued to manage COVID cases during the second wave too with enhanced capacity. Medical records of all of the deceased were included for the month of March 2021 to June 2021. Brought dead cases were excluded. Collected records were analyzed according to various demographic characteristics, the severity of the condition at the time of admission, duration of stay on various respiratory support systems, cause of death, comorbidities, and complications. These data were then compared with data of previous years and analysis was done to know the differences amongst the above parameters.

The study used a standard COVID-19 Death Audit Performa[6] introduced by the State of Haryana, to collect the data in the same manner as was used in the previous year's data analysis.[7] The operational definition of the variables was the same as in the previous analysis.[7] COVID-19 death case: a COVID-19 death is defined for surveillance purposes as a death resulting from a clinically compatible illness in a probable or confirmed COVID-19 case, unless there is a clear alternative cause of death that cannot be related to COVID-19 disease; mild case: laboratory-confirmed COVID-19 cases presenting with fever and/or upper respiratory tract illness (influenza-like illness, ILI); moderate case: laboratory-confirmed COVID-19 cases presenting with pneumonia without signs of severe disease (respiratory rate 15 to 30/min, SpO_2 90%–94%); severe case: laboratory-confirmed COVID-19 cases presenting with severe pneumonia (with respiratory rate ≥ 30/min and/or SpO_2 < 90% in room air) or acute respiratory distress syndrome (ARDS) or septic shock; active surveillance: detection of flu-like cases in containment zones during house-to-house surveys, through mobile medical clinics in non-containment zones or during thermal checking in various offices and workplace settings and submitted for COVID-19 tests; passive surveillance: regular reporting of data by all institutions that were attended by patients for their flu-like symptoms.

Data were entered into Microsoft Excel 2020 and were statistically analyzed using IBM Statistical Package for the Social Sciences (SPSS) v25.0. Descriptive data were presented as numbers and percentages. *P* value was calculated for the difference between two proportions at the time of comparison between the two studies and value < 0.05 was considered significant and value < 0.001 was considered highly significant. Any decimal number was depicted up to one decimal point.

COVID-19 was declared notified disease under Indian Epidemic Act, 1897 (amendment 2020). The data analyzed in this study was part of the State of Haryana's audit of COVID-19 deaths across the state. Permission to study and publish the data was taken from the appropriate authority. Anonymity and confidentiality of the data were maintained throughout the study and analysis.

Result

As per the hospital census, 1160 cases were admitted and 264 COVID-19 patients died in the hospital during the study period. The recovery rate was 77.2% with a 22.8% mortality rate.

All the deceased came to know about their COVID status as a result of passive surveillance when they attended flu clinics and were referred from other COVID-designated centers. At the time of admission, 64% had moderate disease and 36% had severe (12 cases on ventilators). Initially, 247 cases were put on various respiratory supports, that is, 139 cases (56.3%) on nasal prongs or non-rebreathing mask (NRM), 86 cases (34.8%) on non-invasive ventilation (NIV), and 22 cases (8.9%) on ventilator directly, depending upon the assessment of the severity of respiratory embarrassment. Eventually, all of the deceased required ventilatory support. The total duration of respiratory support, including NRM, NIV, and ventilator was from a few hours to 40 days with most of them staying for five days. The duration of ventilatory support was from a few hours to 10 days with most of them staying for one day. The total duration of ICU stay was a few hours to 40 days.

More than three-fourths of the deaths occurred in the age group of 21–70 years, with the maximum number being in the age group of 41–60 years (52.7%). Males (63.3%) were affected more than females (36.7%) [Table 1].

To show the trends of deaths, the study period was divided into 17 calendar weeks, the first week being the week of the first death reported. Weekly number of death had increased from one in the

Table 1: Demographic details of the cases

Age group (years)	*n* (%)
0-10	2 (0.8%)
11-20	11 (4.2%)
21-30	22 (8.3%)
31-40	39 (14.8%)
41-50	70 (26.5%)
51-60	69 (26.1%)
61-70	40 (15.2%)
71-80	9 (3.4%)
81-90	2 (0.8%)
Gender	
Male	167 (63.3%)
Female	97 (36.7%)

first week to 48 in the eighth week and then decreased to three in the 17th week [Graph 1].

Common direct causes of death were found to be pneumonia only (79.9%), pneumonia with ARDS (12.5%), and pneumonia with ARDS and sepsis (2.6%). Mucormycosis was seen in eight cases and aspergillosis in two cases which were complicating pneumonia, sepsis, and ARDS. Other direct causes of death were pneumothorax, upper gastrointestinal (GI) bleeding, and acute kidney injury superimposing on pulmonary involvement [Graph 2].

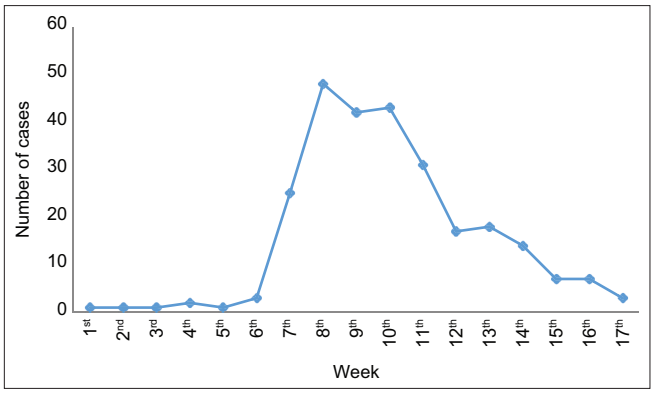
About 58.3% of the deceased had comorbidities at the time of admission and 44.2% of them had more than one comorbidity. Major reported comorbidities were hypertension (29.5%) and diabetes (28.4%) followed by chronic kidney disease, chronic lung disease, central nervous system diseases, cardiac disease, thyroid disorder, obesity, prostate disorder, bone disorder, anemia, liver disorder, and Alzheimer's disease, alone or in various combinations [Graph 3].

The previous study done at the center had 95 deaths during the months of April to July with 1824 admissions during that study period. The mortality rate was 5.2% in comparison to 22.8% in this study ($P < 0.001$). Compared to the previous wave in which the common age group was 41–70 years, the more common age group in this study was 21–70 years ($P < 0.001$) [Graph 4]. Gender-wise, there was no significant difference as the male/female ratio was 1.7:1 in this study while it was 1.8:1 ($P = 0.865$) in the previous study.

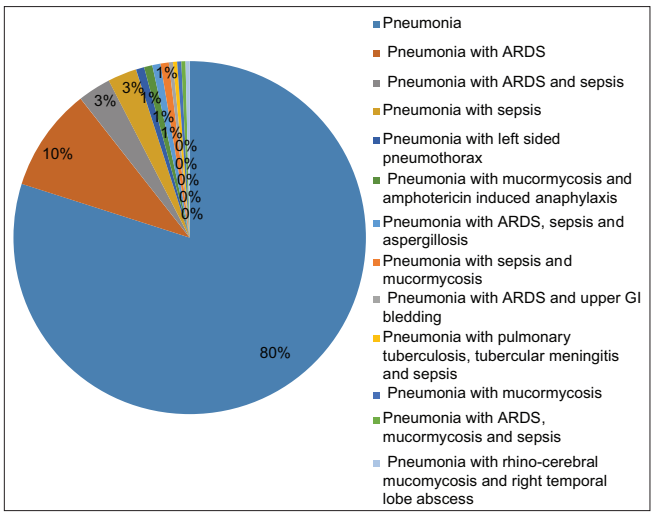
Awareness of COVID-19 was present in all of the deceased in this study, whereas it was present in three-fourth of the cases in the previous study. For the severity of the condition at the time of admission, mild, moderate, and severe cases were 9.5%, 26.3%, and 64.2%, respectively, during the old study, while it was 0, 64.0% ($P < 0.001$), and 36% ($P < 0.001$), respectively, during the present study [Graph 5].

The mean duration of ICU stay was 5.0 days in the old study in comparison to 5.8 days in the present study ($P = 0.99$). While in the previous study, about half of the cases were detected after contacting health centers for flu and another half were when the cases were investigated for other diseases, in the present study, all of the cases were detected at flu clinics.

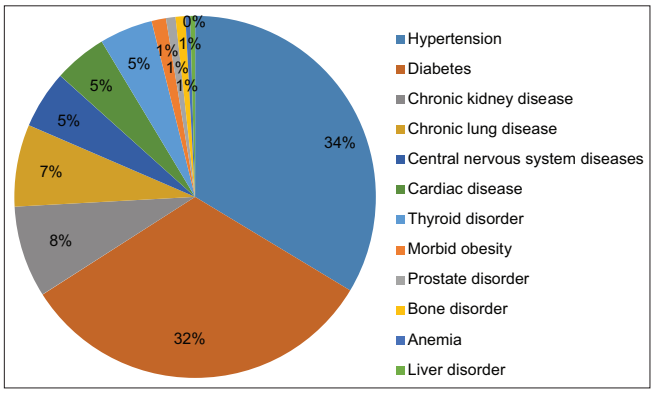
In both the studies, there was a mid-study period peak. However, in the present study, the peak was higher than in the previous study [Graph 6]. Comorbidity and cause of death in this study was not much different from the previous study, except cases of mucormycosis and aspergillosis were seen as a complication of steroids and immunomodulators.



Graph 1: Weekly trend of COVID deaths in the second wave



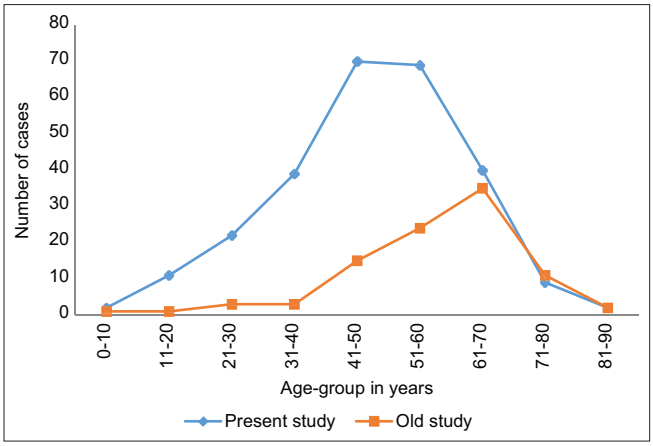
Graph 2: Underlying causes of deaths in the second waves



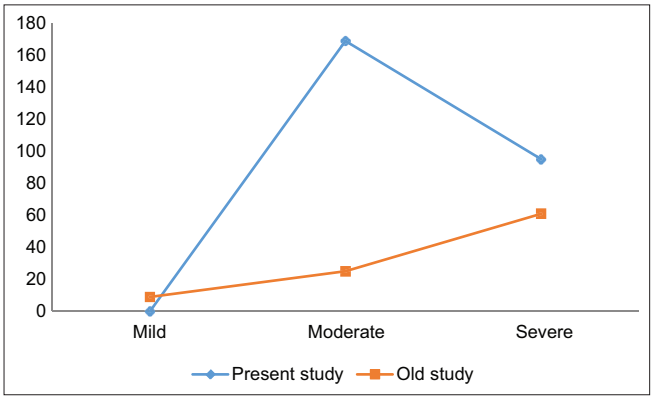
Graph 3: Comorbidities associated with COVID in the deceased in the second wave (Reported as single or in various combinations)

Discussion

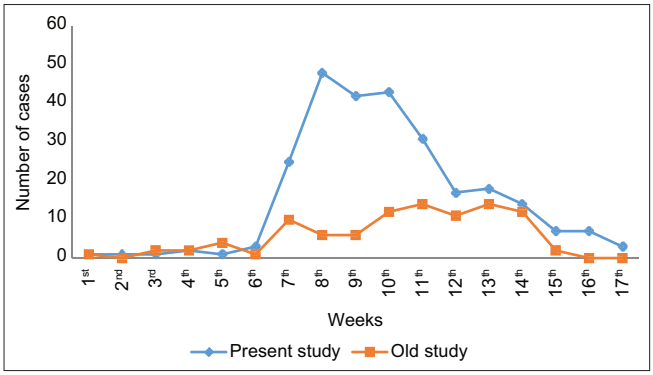
No of the study from India has compared mortality data of the first and second waves of COVID-19 infection. The selected hospital, being the only designated referral center for COVID-19 patients in the district, witnessed 264 COVID-19 deaths out of 301 in the entire district. The peak of the wave was observed during the eighth week and afterward, cases started to decline. Most of the deaths occurred in the ICU with an average survival of six days. Most of the deceased were in the age group of third to sixth decades and were male. All of the admitted patients were in moderate or severe condition. The average stay



Graph 4: Comparison between first and second wave on the basis of age group



Graph 5: Comparison between first and second wave on the basis of severity of condition at the time of admission



Graph 6: Comparison of weekly deaths in the first and second wave

on the respiratory support system was five days. Most of the deaths were due to pneumonia followed by ARDS. More than half of the deceased had comorbidities, mostly hypertension, diabetes, and renal diseases. A few cases developed opportunistic infections like mucormycosis and aspergillosis.

We have compared the findings of this study with that of the previous study at our center.[7] We found that this study had 4.4 times the mortality rate of the previous study, with peaks higher than the previous one. All of the cases were aware of the COVID treatment centers during the present study. The age group was two decades younger in the present study; however, gender-wise there was no difference. All of the cases in this study were detected at flu clinics compared to only half of the cases during the previous study. This time, the cases were admitted comparatively more in moderate condition and less in severe condition. Cause of death, complications, and comorbidities were similar, except mucormycosis and aspergillosis cases during the current study.

These findings of the present study and comparison with the previous study showed no unusual findings. Increased number of cases, younger age, and awareness among the general public about flu clinics and COVID treatment centers are the normal scenarios in a subsequent wave of a pandemic.[8] The present study also matches with the predictions and findings of the second wave of COVID-19 by various researchers worldwide and from India.[9–11] A study by Jain *et al*.[10] observed an increased death rate in the second wave than the first and is contrary to our study results. This might happen due to the dearth of ICU beds in the district leading to selective admission of moderate-to-severe cases during the second wave leading to deaths of cases at home. Fungal infections, that is, aspergillosis and mucormycosis are also documented.[12,13] The reason behind these emerging fungal infections is the use of immunosuppressant drugs for the management of COVID infection.[12–14] In the present study all cases were aware of the COVID treatment centres but due to overburdened secondary/tertiary centres and lack of faith in primary health centres they preferred either self-treatment or consultation from a quack. Further irrational usage of immunosuppressants by primary healthcare physicians aggravated the situation. Keeping into consideration that almost 65% population in India is rural dependent on primary healthcare physicians, it is of utmost concern to strengthen skills and knowledge of primary level healthcare providers.

Limitations

Due to the retrospective study design, the temporal association between various risk factors and COVID mortality could not be established. Moreover, only deaths till 30 June 2021 were included and due to this, the study failed to include all those who were admitted during the study period but died afterward.

Conclusion

Most of the deceased in the second wave were young (41-60 years) with co-morbidity/s, hypertension being the commonest. In comparison to the first wave, awareness about the disease and treatment centres was better however number of admissions to hospital after disease progression and mortality was higher. Irrational usage of immunosuppressants led to opportunistic infections. In order to raise faith among general public it is imperative to strengthen primary health care.

Acknowledgement

The authors acknowledge the support and guidance provided by Dr Usha, Director, Directorate of Health Services (IDSP),

Government of Haryana, Dr. Asim Das, Dean of the college and, ICU staff of the hospital.

Statement of ethical approval

The data analyzed in this study was part of the State of Haryana's audit of COVID-19 death across the state. Permission to study and publish the data was taken from the appropriate authority. Anonymity and confidentiality of the data were maintained throughout the study and analysis.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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