

Immunization Impact On Covid-19 Mortality In Second & Third Wave

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Abstract

Background

In India, COVID-19 infection, saw 3 waves with variation in clinical presentation and outcome in each wave. When the second wave (2021) was declining there was an unusual surge in COVID-19 positive cases, which led to global concern about the changes in virus characteristics. Global vaccine development was accelerated in response to the COVID-19 pandemic.

Materials and Methods

This is a retrospective study, conducted at our Tertiary hospital, CARE Hospitals Musheerabad, India. The demographic, laboratory evaluation and clinical outcomes of COVID-19 positive cases admitted during the second

(193) and third wave (106) were compared to evaluate the impact of immunization. We correlated the impact of vaccination against COVID-19 mortality during second & third waves along with laboratory parameters.

Results

The mean age was 63.78 years in third wave versus 55.14 years age in second wave ($p < 0.001$). Inflammatory markers values were almost similar in second & third waves. The mean mortality was significantly higher in the second wave ($p < 0.001$) when compared to the third wave.

Conclusion

Vaccination, herd immunity and decrease virulence of the SARS-COV2 during the third wave contributed to a decrease in mortality. Mortality was more in elder age group. Inflammatory markers were same during the second and third wave except for ferritin which was not much elevated. This could explain less lung involvement during third wave.

Key Word: Covid -19, Inflammatory Markers, Immunization

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I. Introduction

Coronavirus disease 2019 (COVID 19) began in late 2019 in Wuhan, China and spread across the world causing a pandemic and global shutdown around the world [9]. As the second wave was declining, there was an unusual surge in COVID-19 positive cases, which led to global concern about the change in virus characteristics. Several factors had an impact on whether newly diagnosed COVID 19 cases were increasing or decreasing in particular locations. These factors include: the effectiveness of vaccines, human behavior, infection prevention policies, changes of the corona virus itself, and the number of people who were vulnerable because they had not developed immunity, either from natural infection or through vaccination. Yet, the second wave in 2021, unleashed a deadly outbreak globally and emphasized the importance of an effective and reliable vaccination regimen to control the ongoing pandemic during that time.

The current study aims to highlight the different characteristics of the COVID-19 in terms of inflammatory markers, demographic and vaccination outcome in the second and third waves of COVID-19 at our tertiary care hospital.

II. Material And Methods

This is a retrospective comparative study, carried out on admitted COVID-19 positive cases at Care Hospitals, Musheerabad, Hyderabad. A total 299 adult subjects (both male and females) including all age groups were for in this study. The demographic, laboratory and clinical outcomes of COVID-19 admitted positive cases admitted during the second wave (193 cases) and third wave (106 cases) were compared to evaluate the impact

of immunization.

Study Duration: Second wave: April-May 2021
Third wave: January- March 2022

Inclusion Criteria: COVID-19 positive cases confirmed by RT-PCR (Reverse Transcriptase Polymerase Chain Reaction)

Exclusion Criteria: Individuals aged < 18 years are excluded

Data Collection:

Base line data collected at the time of admission was age and gender of the patient, vaccination status, clinical findings and laboratory investigations. Complete blood picture with absolute lymphocyte count and neutrophil- lymphocyte ratio (NLR) were analyzed on Fully automated 5 part Sysmex XN-350 hematology analyzer. Routine investigations were analyzed on fully automated Beckman Coulter AU 480 Clinical Chemistry autoanalyzer. Ferritin and IL-6 were performed on Beckman Coulter Access 2 immuno analyzer.

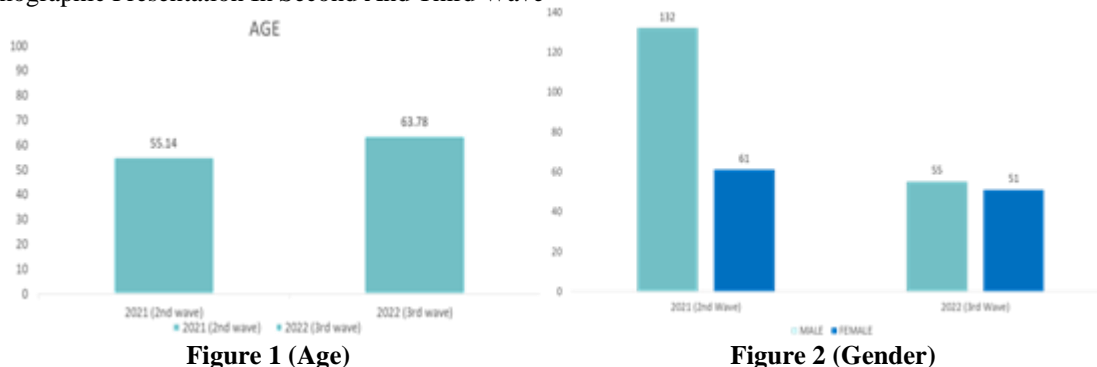
Statistical analysis

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). Student's *t*-test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by nonparametric Mann-Whitney test. In addition, paired *t*-test was used to determine the difference between laboratory parameters in second and third wave. Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two groups. The level $p < 0.05$ was considered as the cutoff value or significance.

III. Results

There were a total of 299, 193 and 106 confirmed cases with COVID-19 who were admitted during the second and third wave, respectively at Care Musheerabad tertiary care hospitals. We observed highest percentage of cases during second wave between 50-80 years age, 55-80 years in third wave

Demographic Presentation In Second And Third Wave



Mean age of patients in the second and third waves were 55.14 years and 63.78 years respectively. ($p < 0.001$) (Figure 1, Table 1). Among the 299 confirmed cases with COVID-19, 32 (68.3%) individuals were males and 61 (31.6%) were females in second wave (Figure 2). However, this proportion for male gender was 51.8% in third wave.

Group Statistics

| | Year | N | Mean | Std. Deviation | Std. Error Mean |
|-----|------|-----|-------|----------------|-----------------|
| Age | 2022 | 106 | 63.78 | 16.319 | 1.585 |
| | 2021 | 193 | 55.14 | 14.713 | 1.059 |

Table 1 Independent t-test for equality of means

Laboratory parameters showed similar pattern in both second and third waves except ferritin which was significantly increased in second wave. ($p < 0.001$) (Table 2).

In our study we observed lymphopenia, significant elevation in NLR Ratio, elevated inflammatory markers in both waves.

Biomarkers:

| Group Statistics | | | | | |
|------------------|------|-----|----------|----------------|-----------------|
| | Year | N | Mean | Std. Deviation | Std. Error Mean |
| IL-6 | 2022 | 77 | 187.3855 | 412.64912 | 47.02573 |
| | 2021 | 180 | 111.6273 | 319.62587 | 23.82351 |
| ferritin | 2022 | 59 | 272.92 | 334.093 | 43.495 |
| | 2021 | 170 | 419.91 | 412.939 | 31.671 |
| TLC | 2022 | 103 | 4492.52 | 2882.003 | 283.972 |
| | 2021 | 190 | 4961.58 | 2600.612 | 188.668 |
| Neutrophils | 2022 | 103 | 79.32 | 13.691 | 1.349 |
| | 2021 | 190 | 78.78 | 11.331 | .822 |
| Lymphocyte | 2022 | 103 | 15.56 | 10.941 | 1.078 |
| | 2021 | 190 | 16.32 | 10.634 | .771 |
| NLR-ratio | 2022 | 103 | 9.51 | 8.853 | .872 |
| | 2021 | 190 | 10.17 | 14.105 | 1.023 |
| ALC | 2022 | 106 | 1219.35 | 763.850 | 74.192 |
| | 2021 | 191 | 1113.90 | 851.742 | 61.630 |

Table 2: Laboratory parameters in both waves

Although both the second and third waves were triggered by increased social activity, vaccination awareness strengthened during third wave which may be one of the reasons for low mortality in third wave (Figure 3 & 4)

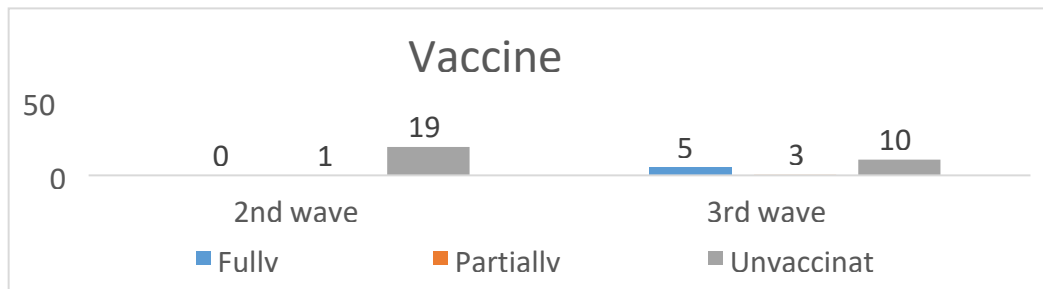


Figure 3: Vaccinated Status in both waves

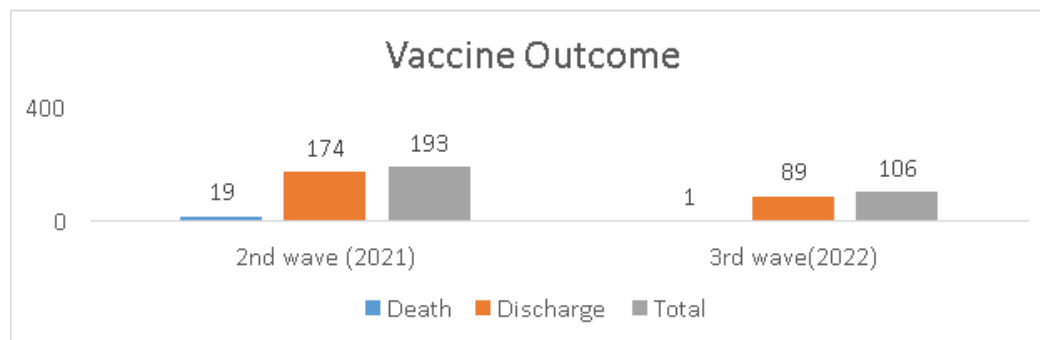


Figure 4: Vaccination Outcome: Mortality in both waves

Males were predominantly affected in both waves. (Figure 5)

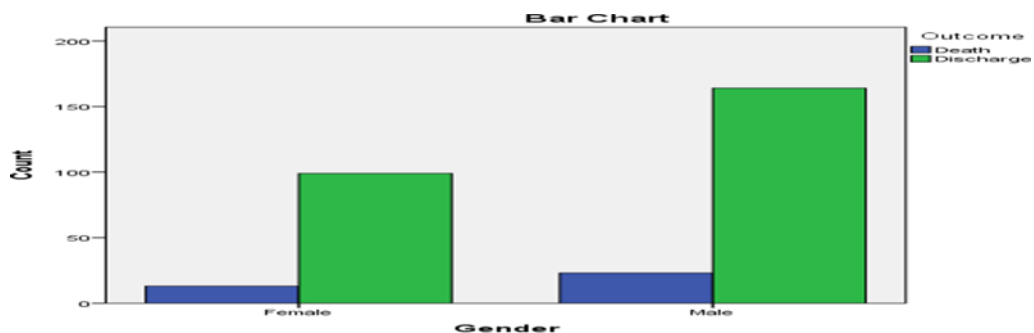


Figure 5: Vaccination Outcome status as per Gender: Mortality in both waves

IV. Discussion

The current study demonstrates the ferocity of the second wave of COVID 19 pandemic, and how inflammatory markers presented in both waves at a single tertiary care center. As compared to the second and third waves, the cases during the second wave of pandemic presented at a younger age group. Our study showed younger age group were more affected in the second wave, when compared to the third.

In our study, we evaluated the inflammatory markers in all admitted positive cases and observed elevation of the markers in both waves. Out of all biomarkers, ferritin was significantly high in second wave (mean=419 ng/ml) when compared to the third wave (mean=272 ng/ml). In the study done by Lee et al, ferritin levels more than 300ng/ml was considered as hyperferritinemia, which was associated with decreased lung function.[10] We observed more pulmonary complications in second wave, this aligns with the study done by Lee et al. Since the beginning of COVID-19 outbreak, the hematological, biochemical, inflammatory, and immunological factors to predict patients with severe or fatal forms of COVID-19 has been of great scientific importance. To predict the severity of the disease in the early stages, it is critical to obtain a full profile of the laboratory analysis. According to the reviewed literature abnormal hematological, inflammatory, and biochemical parameters are associated with severe prognosis in COVID-19 cases and can thus be used as predictive factors. Corona virus evokes, a severe inflammatory response that leads to cytokine storm, which results in significant irreversible multi organ damage and thus increase the rates of morbidity and mortality. The ongoing cytokine storm, also results in respiratory compromise resulting in development of hypoxia.[8] Thus, by analyzing this cytokine storm before its appearance, a good amount of death rates could be brought to a standstill. As cytokine storm is an inflammatory response, various acute phase reactants like serum ferritin will be altered.

The cause of higher mortality rate during the second wave could be multifactorial. The pulmonary complications were significantly higher in second wave. The delta variant of the virus which was primarily responsible for the second wave had predisposition to involve mucus membranes, thus caused pneumothorax and similar complications[1]. However increased mortality in males, in second wave may be due to age, gender, comorbidities, hospital stay, vaccination status, oxygen requirement and treatments [2,3]. Several studies reported that disease severity and mortality is worse in men [4,5,6,7], we observed the same in our study.

Although the exact cause for the difference of the patients age between the covid waves unknown, the probable virulence of the delta variant predominant in the second wave may be possible explanation.

On follow-up of these patients, we found that most of them had no frequent hospital admissions and morbidity Omicron variant during the third wave, presented with milder form of disease. Furthermore, COVID vaccine campaign that was conducted prior to third wave, provided immunity against serious disease contributing to milder disease.

Limitations Of Study:

Our study had certain limitations. Firstly, it was a single-center and retrospective study. Secondly, we did not collect data on secondary infections, hypertension, diabetes mellitus etc.

V. Conclusion

In conclusion, early timely interventions with strengthened vaccination, herd immunity and decreased virulence of SARS-COV2, during the third wave contributed to a decrease in mortality. Mortality was more in the elderly age group. Inflammatory markers were similar in the second wave and third wave except ferritin which was not much elevated. This could explain less lung involvement during third wave [10].

References

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