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A Comparison of the Common Biochemical Parameters in the First and Second Waves of COVID 19 in A Tertiary Care Hospital in Eastern India—our Experience

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Abstract

Background

India experienced a second wave of COVID 19 similar to Europe and USA.The second wave virtually wrecked havoc on the Indian healthcare system, with larger affected numbers and higher mortality figures. This led us to compare the biochemical alterations of the common biochemical parameters in the patients affected in the two waves.

Methods

The patients were divided into two groups; the first group representing patients of the first wave (15th September up to 30th November 2020) and the second group representing the second wave.(24th March to 5th September) The data (clinical biochemistry parameters namely, liver enzymes, urea ,creatinine and serum electrolytes) of the patients was tabulated under the two above mentioned groups and statistically analysed.

Results:

In the first wave, the mean values of alanine transaminase , aspartate transaminase, urea and creatinine, were 57.87 IU/l, 51.57 IU/l,49.46 mg/dl and1.42 mg/dl respectively. In the second wave, the mean values of the same were 77.75 IU/l and 83.6 IU/l, 50.56 mg/dl and 2.08mg/dl. The mean value of sodium and potassium in the first wave were139.1meq/l and 4.56 meq/l and in the second wave the values were 147.4 meq/l and 4.31 meq/l.

Conclusions:

A considerably greater increase in the biochemical parameters was noted in the second wave signifying greater metabolic derangements and hence greater mortality figures.

Keywords: First and second wave of Covid-19, liver enzymes, serum electrolytes, deviations from reference interval

Introduction

Coronavirus disease 2019 or COVID 19, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)first emerged in China and rapidly spread out all over the world to be declared a pandemic by WHO on 11TH March, 2020. [1].India was one of the worst affected countries in spite of a nationwide lockdown as a preventive measure against the pandemic. The devastation caused by the pandemic highlighted the gross shortcomings and disparities in healthcare not only in India but all over the world. Several countries were again hit by a second resurgence of the disease in 2021, commonly referred to as the second wave.[2-6] India also experienced a second wave of COVID 19 similar to Europe and USA.

The authors have earlier reported the deviations in the common biochemical parameters during the first

Covid wave.[7] During the second wave, the mortality statistics were even more dismal despite the fact that more reliable testing measures were available, newer therapeutic options and vaccines were available. Since such occurrences may occur in future also, it was deemed appropriate to study the differences in the deviations in the common biochemical parameters of the first two waves in India. For the clinician, such studies are necessary to help in triage and clinical decision making, therapeutic options and prognostication particularly in resource poor settings. For health care administration, it should help in pandemic preparedness and plan for a prognostic model by extrapolation of data, necessary to sustain the viability of the health system throughout the highs and the duration of the epidemic/ pandemic. But population studies are demanding because of technology, infrastructure and logistic issues with detection, diagnosis and prognosis of a large number of cases with varying degrees of severity and disease progression.[8]Therefore, this study for comparison of the alterations in the biochemical parameters in the two waves was taken up among hospitalised patients in whom the disease was confirmed by RT-PCR.

The objective of this study was to compare the alterations in the levels of the common biochemical parameters (namely, the liver enzymes, urea, creatinine and electrolytes) in patients infected by the SARS COV-2 during the first wave versus the second wave in a dedicated Covid hospital in Eastern India.

Materials And Methods

The study is basically a retrospective data analysis of the laboratory parameters of the patients admitted in College of Medicine and Sagore Dutta Hospital with a confirmed diagnosis of SARS-COV-2 during the first wave and the second wave. For the purpose of calculating the sample size, census method was applied i.e. data of all adult persons (≥ 18 years) with a confirmed diagnosis of SARS COV-2 admitted during the first and the second waves were included in the analysis. Thus, all adult persons with a confirmed diagnosis of SARS COV-2 who were admitted from 15th September up to 30th November 2020 (**first wave**) and from 24th March to 5th September (**second wave**) were included in the study. The patients were divided into two groups; the first group representing patients of the first wave (15th September up to 30th November 2020) and the second group representing the second wave.(24th March to 5th September) .The data (i.e, the clinical biochemistry parameters namely, liver enzymes, urea ,creatinine and serum electrolytes) of the patients was tabulated under the two above mentioned groups and statistically analysed.

Results And Analysis

The results obtained by statistical analysis are presented below. After tabulation in an EXCEL sheet, the descriptive statistics were calculated. Almost all the parameters were found to be non-parametric in distribution as seen in their skewness and kurtosis.

The table (Table 1) given shows the descriptive statistics of the biochemical parameters, (liver enzymes, urea creatinine and sodium and potassium) of the patients in the first and the second waves along with the respective reference intervals.

The succeeding figures show a diagrammatic statistical representation of the elevation of the biochemical parameters in the two waves depicting the differences.

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Figure 1- Figure showing the differences in the elevation of the liver enzymes in COVID patients in the two waves

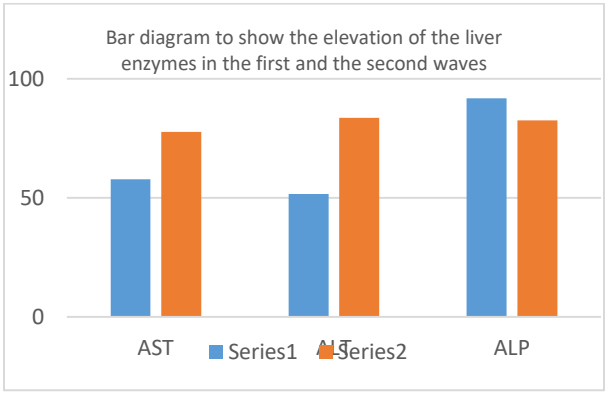


Figure 2: Bar diagram showing the elevation of serum urea in the patients in the first wave versus the second wave

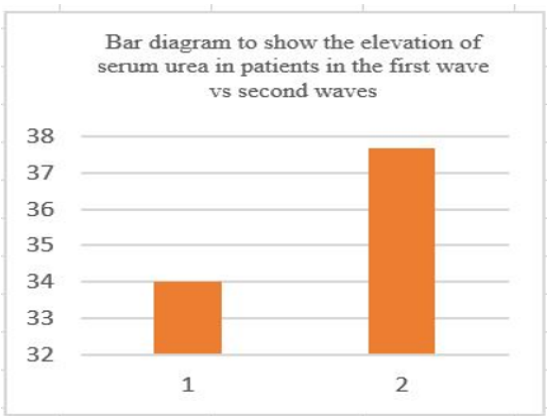
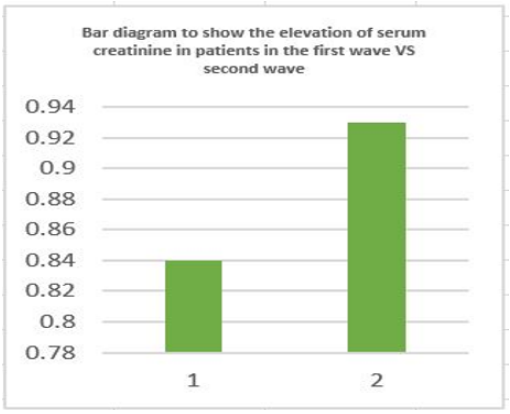


Figure 3: Bar diagram showing the elevation of serum creatinine in the patients in the first wave versus the second wave



Discussion

The earliest cases of COVID 19 were reported in India in March 2020.[1]The number of cases increased exponentially to constitute the first wave which declined by the end of November 2020. [9]At that time we had described the alterations in the common biochemical parameters, namely the liver enzymes, urea, creatinine and serum electrolytes in the affected patients in the first wave.[7] However, cases again began to be reported in February 2021 and this started the "second wave." This time, the

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increase in the number of cases was even more steeper and the numbers affected were larger and the mortality higher. The second wave virtually wrecked havoc on the Indian healthcare system .This led us to compare the biochemical alterations of the common biochemical parameters in the patients affected in the two waves admitted in our institute, which was a designated COVID hospital in Eastern India. Our observations from the comparison of the two waves are discussed briefly below.

In the first wave, the mean values of alanine transaminase and aspartate transaminase were 57.87 IU/l and 51.57 IU/l, median values were 41.8 IU/l and 41.7 IU/l and 95% confidence intervals were 51.3-64.4 IU/l and 47.5-55.5IU/l respectively. This rise in the transaminases in the first wave prompted some authors to describe the condition as "transaminitis". But in the second wave, the rise was even more phenomenal. The mean values for the same were 77.75 IU/l and 83.6 IU/l, median values were 46 IU/l and 49.5 IU/l and 95% confidence intervals were 78.75-88.65 IU/l and 58.68-96.8 IU/l in the second wave. Interestingly, the mean value for alkaline phosphatase was 83.6 IU/l, median 49.5IU/l and 95%CI 58.86-96.8 IU/l in the second wave as against a mean of 91.9 IU/l , median of 52 IU/l and 95%CI of 81.21-99.76 IU/l in the first wave were observed. It may be noted that this reduced elevation in alkaline phosphatase in contrast to the transaminases was observed in the first wave as well. [7]The reason for this contrasting behavior of the transaminases and alkaline phosphatase is not well understood. The hepatotoxicity has been attributed to various causes like, the viral onslaught, hypoxia associated with pneumonia and also hepatotoxic drugs. Perhaps, the hepatic parenchymal injury was more severe in the second wave.

Secondly, in the first wave, the mean value of urea was 49.46 mg/dl, median 34mg/dl and 95% CI 42.8-56.12 mg/dl. The mean value of urea was 50.56 mg/dl, median 37.7 mg/dl and 95% CI 44.15-56.96 mg/dl in the second wave. In case of creatinine, in the first wave, the mean value was 1.42 mg/dl, median 0.84 mg/dl and 95%CI was 1.75-1.80 mg/dl and the values were 2.08mg/dl, 0.93 mg/dl and 1.71-3.45 mg/dl, respectively in the second wave. In case of sodium, the mean was 139.1meq/l, median 139.7 meq/l and 95% CI was 137.95-140.26 meq/l in the first wave. In the second wave, the values were 147.4 meq/l, 141.8 meq/l and 137.95-140.26.In case of potassium, the mean values were 4.56 meq/l and 4.31 meq/l, median 4.12meq/l and 4.39meq/l and 95%CI3.95-4.6 meq/l and4.29-4.82 meq/l in the first and second waves respectively. In our previous report, we had observed that the renal injury was actually a part of the larger immune damage caused by the cytokine storm induced by the proinflammatory cytokines.(TNF-α, IL-1, IL-6, interleukin (IL)-12, and interferon (IFN)-α).This implies that the cytokine storm was perhaps much greater in the second wave leading to higher mortality figures and amore dismal outcome.[7]

Interestingly, in some other similar studies, most of the inflammatory markers were found to be less severe during the second wave but neutrophils and leucocytes were observed to be higher in the second wave.[7]

Clinically, there were differences observed in the presentation of the patients in the two waves. In the first wave, the patients typically presented with fever, sore throat , anosmia and dry cough with varying prognosis with evidence of multisystem involvement .In the second wave, though majority of patients presented with pneumonia, higher proportion of patients presented with diarrhoea and gastrointestinal infections, pink eye or conjunctivitis, headache and skin rashes.(9) In our institution, we also admitted a higher number of cases with diarrhoea and other gastrointestinal symptoms.

Biochemically, the increase in the biochemical parameters appears to be higher in the second wave. This would naturally suggest that the damage done to the internal organs in these patients of the second wave was greater which probably led to higher mortality rates. In the first wave, we had observed that COVID was a multisystem disease as evident from the autopsy findings of widespread micro-thromboses and acute tubular injury and reactive lymph node changes.[7]. The same holds true in the second wave also as seen from the blood parameters. The higher hospitalisation rates and mortality figures were probably because, a new mutant varieties of the SARS-COV-2 virusB.1.617 lineage was detected in India during the second wave. These "double mutant" virus (L452R + E484Q and L452R + T478Kmutations occurring together) was responsible for the surge in the COVID cases.[10].The mutation

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affected the region concerned with the viral entry and rendered the virus more infectious, more transmissible, less affected by antibodies and thus less likely to be prevented by vaccines.[10-12] Further, it encouraged re-infections and thus compromised herd immunity. Triple mutant variants were also believed to be in circulation which was more transmissible and unaffected by the immune response. All this contributed to increased pathogenicity and the virulence of the infective strain. So, greater infectivity coupled with grater severity of disease lead to-- too many people falling sick within a very short period of time and increase in hospitalization rates.As a result, a higher number of patients were infected and with paucity of beds, the situation was dismal. There were other reasons as well. They include premature optimistic opening up of borders, lifting of lockdowns, lack of adherence to COVID appropriate behaviour by the general public, pandemic fatigue,etc [9]. People tried to return to their usual economic activities after being cowed down too long due to lockdowns without paying heed to the ongoing pandemic situation. Apart from this, another reason was the failure to anticipate the severity of the second wave. The healthcare system should have been adequately prepared with larger number of beds and facilities during the interim period. It was speculated, that the second wave would be less severe than the first as seen in some other countries while in actuality, it was exactly the opposite in India.[9].

Many other similar studies reported similar findings. The devastation caused in the second wave in India was similar to that seen in other developing countries like Brazil.[14] In fact, Brazil experienced worse mortality rates in the areas which were economically backward and underdeveloped. In the neighbouring countries of Pakistan and Nepal, the experience was similar so far as mortality figures are concerned.[3] The second Covid surge was also experienced by Belgium, France, Germany, Spain, Ireland and Czech Republic and many more countries. But similar studies published in many other countries exhibited varied or even conflicting reports. [15,16]. The mortality figures were lower in the European countries and in the Mediterranean areas.[6] In a study in South Africa, the serum creatinine was lower in the second wave compared to the first.[17,18].Similarly, authors from New York reported lower values of the liver enzymes in the second wave.[19]

The following limitations of our study merit mention. Firstly, this was a single centre experience. It was not possible to calculate the severity and hospital outcomes of the patients formally as done by Dominigo.[20] The data collection was restricted in the sense that it could not include the comparative data regarding medications, length of ICU stay and consistent follow up of the discharged patients.

Conclusion

This study was a retrospective analysis of the biochemical parameters of the patients infected by the SARS-COV 2 in the first and the second waves. A statistically significant increase in the liver enzymes, urea, creatinine and electrolytes was noted in both the waves. But this increase was much greater during the second wave compared to the first. Higher virulence, infectivity and pathogenicity of the strain along with unpreparedness of the health system –all culminated in more severe disease and higher mortality figures in the second wave.

References:

1. Andrews MA, Areekal B, Rajesh KR, Krishnan J, Suryakala R, Krishnan B, Muraly CP, Santhosh PV. First confirmed case of COVID-19 infection in India: A case report. Indian J Med Res. 2020 May;151(5):490-492.
2. Asghar MS, Yasmin F, Haris A, Nadeem A, Taweesedt PT, Surani S. Comparison of first and second waves of COVID-19 through severity markers in ICU patients of a developing country. *J Community Hosp Intern Med Perspect*. 2021;11(5):576-584. Published 2021 Sep 20.
3. Castro FD. Modelling of the second (and subsequent) waves of the coronavirus epidemic. Spain and Germany as case studies. *MedRxiv*. 2020. [Preprint].
4. Ali A, Bai J, Ma Z. Second wave of Covid-19 in Pakistan; are more episodes down the road? *BMJ*. 2020;371.
5. Yorifuji T, Matsumoto N, Takao S. Excess All-Cause Mortality During the COVID-19 Outbreak in Japan. J Epidemiol. 2021 Jan 5;31(1):90-92.
6. Fan G, Yang Z, Lin Q, Zhao S, Yang L, He D. Decreased Case Fatality Rate of COVID-19 in the

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Second Wave: A study in 53 countries or regions. Transbound Emerg Dis. 2021 Mar;68(2):213-215.
7. Chatterjee S, Ray I, Chakrabarty I.,Mistri S. Deviations in the Basic Biochemical Parameters In COVID Patients :Our Experience in a COVID Hospital in Eastern India. JIMA**.** J Indian Med Assoc 2021; 119(6): 38-40.
8. Mollinedo-Gajate I, Villar-Álvarez F, Zambrano-Chacón MLÁ, Núñez-García L, de la Dueña-Muñoz L, López-Chang C,et al. First and Second Waves of Coronavirus Disease 2019 in Madrid, Spain: Clinical Characteristics and Hematological Risk Factors Associated With Critical/Fatal Illness. Crit Care Explor. 2021 Feb 22;3(2):e0346.
9. Zirpe KG, Dixit S, Kulkarni AP, Pandit RA, Ranganathan P, Prasad S,et al. The Second- vs First-wave COVID-19: More of the Same or a Lot Worse? A Comparison of Mortality between the Two Waves in Patients Admitted to Intensive Care Units in Nine Hospitals in Western Maharashtra. Indian J Crit Care Med. 2021 Dec;25(12):1343-1348.
10. Khan MI, Baig MH, Mondal T, Alorabi M, Sharma T, Dong JJ, Cho JY. Impact of the Double Mutants on Spike Protein of SARS-CoV-2 B.1.617 Lineage on the Human ACE2 Receptor Binding: A Structural Insight. Viruses. 2021 Nov 17;13(11):2295.
11. Plante J.A., Mitchell B.M., Plante K.S., Debbink K., Weaver S.C., Menachery V.D. The variant gambit: COVID-19's next move. *Cell Host Microbe*. 2021;**29**:508–515.
12. Li Q., Wu J., Nie J., Zhang L., Hao H., Liu S., Zhao C., Zhang Q., Liu H., Nie L., et al. The Impact of Mutations in SARS-CoV-2 Spike on Viral Infectivity and Antigenicity. *Cell*. 2020;**182**:1284–1294.
13. Kundavaram APP, Selvan S, Raja V, Mathiyalagan P, Kanagarajan R, Reddy NP, Rajendiran N, Hazra D, Gunasekaran K, Moorthy M, Lenin A, Mathew D, Iyyadurai R, Varghese GM, Dj C, Joy M, Peter JV. Retrospective study of comparison of clinical severity and outcome of hospitalised COVID-19 patients during the first and second waves of the pandemic in India. BMJ Open. 2022 Nov 21;12(11):e062724.
14. F Zeiser, Bruna Donid, Cristiano Andre da Costa, Gabriel de Oliveira Ramos,Juliana Nichterwitz Scherer, First and second COVID-19 waves in Brazil: A cross-sectional study of patients' characteristics related to hospitalization and in-hospital mortality . The Lancet Regional Health Lancet Reg Health Am. 2022 Feb;6:100107
15. Brehm TT, Heyer A, Roedl K, et al. Patient characteristics and clinical course of COVID-19 patients treated at a German tertiary center during the first and second waves in the year 2020. J Clin Med 2021;10:2274.
16. Jalali SF, Ghassemzadeh M, Mouodi S, et al. Epidemiologic comparison of the first and second waves of coronavirus disease in Babol, North of Iran. Caspian J Intern Med 2020;11:544–50.
17. Jassat W, Mudara C, Ozougwu L, et al. Difference in mortality among individuals admitted to hospital with COVID-19 during the first and second waves in South Africa: a cohort study. Lancet Glob Health 2021;9:e1216–25.
18. Lalla U, Koegelenberg CFN, Allwood BW, Sigwadhi LN, Irusen EM, ZemlinAE,et al Comparison of patients with severe COVID-19 admitted to an intensive care unit in South Africa during the first and second wave of the COVID-19 pandemic. Afr J Thorac Crit Care Med. 2021 Dec 31;27(4):10.7196
19. Hoogenboom WS, Pham A, Anand H, Fleysher R, Buczek A, Soby S.et al. Clinical characteristics of the first and second COVID-19 waves in the Bronx, New York: A retrospective cohort study.Lancet Reg Health Am. 2021 Nov;3:100041..
20. Domingo P, Pomar V, Mur I, Castellví I, Corominas H, de Benito N. Not all COVID-19 pandemic waves are alike. Clin Microbiol Infect. 2021 Jul;27(7):1040.e7-1040.e10.

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