ORIGINAL ARTICLE

Comparative Study of COVID- 19 Pneumonia in First and Second Waves

Rahul Gupta, Anchal Gupta[1], Anshita Gupta[1]

Abstract

Background: The main aim of the study was to evaluate the different parameters of the COVID-19 pneumonia in India during the first and second waves.**Method:** Five hundred RT-PCR positive and HRCT documented COVID-19 pneumonia patients each from first wave (June 2020-December 2020) and second wave (March 2021-May 2021) were selected. The results were evaluated in terms of age groups affected, gender wise distribution, and CT severity score on HRCT. The final conclusion was done by comparing these variables from first wave with the ones during the second wave and inferences drawn upon thereof. **Results:** During the first wave, majority of the population involved belonged to more than 45years category whereas during the second wave majority belonged to the 18-45years category. Further, the severity of the disease was more during the second wave than the first wave with more males being affected than females in both the waves.**Conclusion:** Second COVID-19 wave in India was more severe than the first wave in terms of the number of patients affected as well as the severity of the pneumonia in the involved patients, likely due to continuously mutating variants of the virus & lifting up of the restrictions.

Key Words

COVID-19, HRCT, Pneumonia, First Wave, Second Wave

Introduction

COVID-19 pneumonia refers to the lung parenchymal disease caused by SARS CoV-2. The most common clinical symptoms include fever, cough, myalgia, dyspnoea and fatigue. [1] The diagnosis of this disease depends upon the real-time reverse transcriptase polymerase chain reaction .[2]

CT has played an important role in the evaluation of the coronavirus disease (COVID-19) pandemic for diagnosis as well as follow-up of COVID-19 patients. The CT manifestations of the COVID-19 pneumonia include multifocal ground glass and consolidative opacities in a peripheral distribution with predominantly apicobasal gradient .[3,4,5]

India witnessed the second surge of COVID-19 cases since March 2021 after a spell of decline when first peak was reached during October-November 2020. [6,7]

Material and Methods

A cross sectional study was conducted among the patients who had documented RT-PCR positive and CT documented COVID-19 pneumonia admitted in Chest Diseases Hospital of GMC, Jammu. Patients admitted during June 2020-December 2020 were included in the group of first wave and the patients during March 2021-May 2021 were included in the group of second wave. The study was conducted after seeking approval from the Institutional Ethics Committee of GMC, Jammu.

The records of patients admitted in various wards of CD Hospital were extracted from the record section. The

Departments of Chest Diseases (CD), and [1]Radiodiagnosis, Government Medical College, Jammu, Jammu & Kashmir, India,180001

Correspondence to: : Dr Anchal Gupta, Assistant Professor , Department of Radiodiagnosis, Government Medical College, Jammu, Jammu & Kashmir, India,180001

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CT scan films were reviewed by a team of radiologist and pulmonologist.

The parameters studied were:

1.CT Severity Score: The patients were classified as Mild, Moderate and Severe COVID-19 Pneumonia based on the CT Severity Score obtained from analysis of the HRCT Chest of the involved patients. Severity was assessed using the following scoring system which depends on the visual assessment of each lobe involved .[7,8,9,10].Each lobe was assigned a score that was based on the percentage of lobar involvement: score 0, 0% involvement; score 1, less than 5% involvement; score 2, 5%-25% involvement; score 3, 26%-49% involvement; score 4, 50% -75 % involvement; and score 5, greater than 75% involvement. There is a score of 0 to 5 for each lobe with a total possible score of 0 to 25. The sum of the lobar scores indicates the overall severity. The patients were categorized as mild COVID-19 disease (score 7 or less), moderate COVID-19 disease (score 8-17) and severe COVID-19 disease (score 18 or more).

2.Age-Wise Distribution: The age groups were divided into: a) Less than 18 years.b) 18-45 years.c) More than 45 years.3. Gender-Wise Distribution.4.

severity Indices status amongst the different age and gender groups.

Stratification of the two waves of pandemic: To the best of our knowledge, there was no distinct demarcation of the waves of COVID-19 pandemic available for India. As per the national records, peak of the first wave of COVID-19 pandemic in India was attained on September 16, 2020 with gradual decline with the nadir reached on February 1, 2021, after which cases again started increasing with the next peak reached on May 8, 2021 .[7]

Objectives: 1.To assess the severity of COVID-19 pneumonia using CT severity score among hospitalised patients. 2.To compare the CT severity score in patients during first and second waves. 3. To find association of age and gender with CT severity score.

Inclusion: 1. Hospitalised RT-PCR positive COVID-19 patients. 2. Patients of all age groups.

Exclusion: 1. Records in which CT scan films were not available. 2. Demographic data including age and sex not available. 3. Outcome information not available.

The information collected was tabulated and entered in Microsoft excel. The data was analysed using Open Epi version 3.01. The qualitative data was presented as percentages. To find association between different groups Chi Square test was used and $p<0.05$ was considered to be statistically significant.

Results

From the data interpretation of this study, we observed the following trends:

To include 500 patients during the first wave, we included data from seven months while for 500 patients in the second wave, we needed data only from three months giving the more number cases affected over a lesser time period during the second wave.

In terms of gender wise distribution, males were affected more during both the waves as compared to females (60.4% during first wave and 65.4% during second wave). The ratio of affected males to females increased from 1.52:1 in wave-1 to 1.89:1 in wave-2.

Table 1 shows that in the first wave, in age group <18 years, out of 15 cases, 66.66% were males and 33.33% were females. In age group 18-45 years, out of 120 cases, 68.33% were males and 31.66% were females. And in age group >45 years, out of 365 cases, 57.53% cases were males and 42.46% were females. This difference in age group and gender was not found to be statistically significant (p=0.09).

In the second wave, in age group <18 years, 73.33% were males and 26.66% were females. In age group 18-45 years, 68.57% were males and 31.42% were females. And in age group >45 years, 59.47% cases were males and 40.52% were females. This difference in age group and gender was again not found to be statistically significant (p=0.08) in the second wave also.

While if we compare males affected in first and second wave in different age groups, it was found that maximum were in >45 years age group in the first wave and in 18-45 years age group in the second wave. Similar findings were observed in females and in total number of patients. This difference was found to be statistically significant with p values<0.00 in all three categories. In first wave, the major population affected was from the age group of more than 45 years counting for 73% of our total affected patients, whereas in the second wave, the major population affected was from the age group of 18-45 years which accounted for 56% as compared to more than 45years group which accounted for 38% of total patients. During both the waves, the age group of less than 18years was affected least (3% during first wave and 6% during second wave).

Table 1. Age & Gender Wise Distribution of COVID-19 Patients In Wave-1 & Wave-2

	WAVE-1			WAVE-2		
AGE GROUP	MALES No (%)	FEMALES No (%)	TOTAL No (%)	MALES No (%)	FEMALES No (%)	TOTAL No (%)
<18years	10(66.66)	5(33.33)	15(100)	22(73.33)	8(26.66)	30(100)
18-45years	82(68.33)	38(31.66)	120(100)	192(68.57)	88(31.42)	280(100)
>45years	210(57.53)	155(42.46)	365(100)	113(59.47)	77(40.52)	190(100)
TOTAL	302	198	500	327	173	500
X2		4.65			5.02	
p		0.09			0.08	

Table 2. Comparative CT Severity Of Disease in Wave-1 and Wave-2

CT SEVERITY	MALES		FEMALES		TOTAL	
	WAVE 1 No (%)	WAVE 2 No (%)	WAVE 1 No (%)	WAVE 2 No (%)	WAVE 1 No (%)	WAVE 2 No (%)
MILD	110(36.42)	23(7.03)	83(41.91)	7(4.04)	193(38.60)	30(6)
MODERATE	147(48.67)	164(50.15)	90(45.45)	81(46.82)	237(47.40)	245(49)
SEVERE	45(14.90)	140(42.81)	25(12.62)	85(49.13)	70(14)	225(45)
TOTAL	302(100)	327(100)	198(100)	173(100)	500(100)	500(100)
X2	105.8		96.13		200.7	
p	<0.00		<0.00		<0.00	

Table 3. Comparative CT Severity Of Disease In Different Age Groups In Wave-1 and Wave-2

	WAVE-1			WAVE-2		
CT SEVERITY	**<18years No (%)**	**18-45years No (%)**	**>45years No (%)**	**<18years No (%)**	**18-45years No (%)**	**>45years No (%)**
MILD	8(53.33)	55(45.83)	130(35.61)	8(26.66)	14(5)	8(4.21)
MODERATE	4(26.66)	40(33.33)	193(52.88)	19(63.33)	125(44.64)	101(53.16)
SEVERE	3(20)	25(20.83)	42(11.50)	3(10)	141(50.36)	81(42.63)
TOTAL	15(100)	120(100)	365(100)	30(100)	280(100)	190(100)
X2		18			36.04	
P		0.00			0.00	

Table 2 shows that in the first wave, 47.4% patients had moderate severity of disease followed by 38.6% with mild and 14% with severe disease. In comparison in the second wave, 49% patients had moderate disease, 45% had severe disease while only 6% had disease with mild severity. This difference in severity of disease in the two waves was found to be statistically significant (p<0.00). While data from second wave showed predominant moderate and severe disease and only few had mild disease. This difference was found to be statistically significant (p<0.00).

This difference in severity during the two waves was found to be statistically significant (p<0.00, p<0.00) in both males and females.

Table 3 shows that in the first wave, in age group <18 years, 53.33% cases were with mild severity, followed by 26.66% with moderate disease and 20% with severe disease. Among 18-45 years age group, similar findings were observed. While in ages more than 45years, 52.88% had moderate disease, followed by mild (35.61%) and severe disease (11.50%). This difference in severity in different age groups was found to be statistically significant (p<0.00). In the second wave, in ages <18 years, moderate cases (63.33%) were followed by mild (26.66%) and then severe disease (10%). While in ages 18-45 years, maximum number of patients had severe disease (50.36%) followed by 44.64% moderate disease and only 5% cases had mild disease. In age group >45 years, 53.16% cases had moderate disease, 42.63% had severe disease and only 4.21% cases had mild disease. This difference in severity of disease in different age groups in second wave also was found to be statistically significant (p<0.00).

Fig 1. HRCT Chest Image in aPatient with Mild COVID-19 Pneumonia

Fig 3. HRCT Chest Image in a Patient with severe COVID-19 Pneumonia

Further when CT severity was compared in different age groups (wave 1 vs wave 2), the difference was found to be statistically significant ($p<0.00$) in all thre categories. The mortality in hospitalized patients was less in first wave (12%) as compared to 29% in second wave.

Discussion

This study presents a comparative analysis of the severity of COVID -19 pneumonia in hospitalized patients during the first and second waves of SARS CoV-2 pandemic admitted in a tertiary care hospital of Jammu division. Main strength of the study was the relative large number of patients inducted in the study.

In first wave, the major population affected was from the age group of more than 45 years , whereas in the second wave, the major population affected was from the age group of 18-45 years age group. This younger demographic shift can probably be attributed to a number of factors:

The vaccination programme in our country was prioritized

Fig 2. HRCT Chest Image in a Patient with Moderate COVID-19 Pneumonia

for high-risk groups such as frontline workers since January 16, 2021 and the geriatric population was vaccinated since March 1, 2021, while the younger age-groups remained largely unvaccinated. [11,12,13,14] This could be one of the important reasons for the change in age pattern seen for hospitalized patients. Also, pandemic fatigue and the restrictive measures becoming less stringent since the decline in cases from September 2020, with the younger ones stepping out for work, could have resulted in higher rate of infection among them. Hospitalization among younger ones might be a reflection of the early care-seeking behaviour prompted by the experiences of the first wave. Our results were consistent with the study by Jain VK *et al.* [15] Similar conclusions were drawn in a study by Hippich *et al* .[16]

Severity of disease and mortality among hospitalized patients also increased in the second wave as compared to the first wave. It is pertinent to mention here that it is the mortality in hospitalized patients that increased and not the case fatality rate. Our results of increased mortality in hospitalized patients in second wave was consistent with study by Gunjan K *et al.* [6] This could again be attributed to multiple factors. Firstly due to phenomenon of "silent hypoxia" the severe patients reported late to the healthcare facility. Secondly self medication at home has largely led to a delay in hospitalization, thus deteriorating their condition. Thirdly sudden drop in oxygen saturation of apparently improving individuals due to unknown reasons. Then presence of different immune responses among individuals could be another reason. Then the high prevalence of circulating variants double mutant and triple mutant strains of SARS -CoV-2 in the second wave in different regions of India

which are more pathogenic than the initial strains. The SARSCoV-2 double-mutant strain B.1.617, possessing the key structural mutations Glu484Gln and Leu452Arg in the spike protein, is highly infectious and less affected by current vaccine responses, and is a central cause of the COVID-19 surge in India. [17] Similarly, Sahoo and colleagues [18] reported the presence of a triple-mutant strain, B.1.618, carrying the potent mutations Glu154Lys, Pro681Arg, and Gln1071His in addition to others, that is also strongly associated with India's deteriorating COVID-19 situation. As per the data of positive samples sent from GMCH Jammu to National Centre for Disease Control, Delhi for genetic sequencing, 68.5% of infected patients were reported to have B.1.617.2 variant, generally known as the double mutant and classified as the variant of concern by the WHO. [19] Delta variant led to raging second wave in Jammu region. [19] Lastly due to sudden explosive rise in cases in the second wave had overburdened the health infrastructure and triaging only more severe patients to be hospitalized, possibly leading to increased mortality among hospitalized patients.

There were some limitations of the present investigation. Data collected was only from the in patient facility. Asymptomatic patients were not enrolled in the study. Data on socio economic and behavioural characteristics could not be collected due to huge caseload on the hospital. There were a lot many patients who did not have access to the healthcare facility but had severe disease and collapsed without reaching hospital.

Conclusion

To conclude, second wave had steeper rise of cases, more younger demography with greater severity of disease and increased mortality among hospitalized patients.

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Conflicts of Interest

There are no conflicts of interest.

References

1. Centres for disease control and Prevention:Interim clinical guidance for management of patients with confirmed Corona virus disease (COVID_19). Available at https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html
2. Coronavirus disease 2019 (COVID-19) - UpToDate https://www.uptodate.com › landing › covid19
3. Shi H, Han X, Jiang N, Cao Y, Alwalid O, Gu J, Fan Y, Zheng C. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. Lancet Infect Dis 2020 ;20(4):425-34.
4. Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study. AJR Am J Roentgenol 2020 ;214(5):1072-77.
5. Ojha V, Mani A, Pandey NN, Sharma S, Kumar S. CT in coronavirus disease 2019 (COVID-19): a systematic review of chest CT findings in 4410 adult patients. Eur Radiol 2020 ;30(11):6129-38.
6. Gunjan K, Aparna M,Sharma RK. National Clinical Registry for COVID-19 Team Clinical profile of hospitalized COVID-19 patients in first & second wave of the pandemic, Indian Journal of Medical Research 2021; 153(5-6): 619-28.
7. Ministry of Health and Family Welfare |Accessed on May 30, 2021 Available From: https://www.mohfw.gov.in/
8. Chang YC, Yu CJ, Chang SC, Galvin JR, Liu HM, HsiaoCH, et al. Pulmonary sequelae in convalescent patientsafter severe acute respiratory syndrome: evaluation withthinsection CT. Radiology 2005;236(3):1067-75
9. Radiology Assistant. COVID-19 Imaging findings [online].Available at https://radiologyassistant.nl/chest/covid-19/covid19-imaging-findings.
10. Pan F, Ye T, Sun P, Gui S, Liang B, Li L. Time course of lung changes at chest CT during recovery from corona virus disease 2019 (COVID-19). Radiology 2020;295(3):715-21.
11. Rajesh Ranjan, Aryan Sharma, Mahendra K. Verma; Characterization of the Second Wave ofCOVID-19 in India. medRxiv 2021;04:17
12. Gupta N, Kaur H, Yadav P. Clinical characterization and Genomic analysis of COVID-19 breakthrough infections during second wave in different statesofIndia. medRxiv 2021; 07:13
13. The World's Largest COVID-19 Vaccination Campaign - The Lancet Infectious Diseases.accessed on May 30, 2021 Available from: https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(21)000815/fulltext.
14. Day 45- Next Phase of COVID-19 Vaccination Commences.accessed on May 30, 2021 Available from: http://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1701807.
15. Jain VK, Iyengar KP, Vaishya R. Differences between first wave and second wave of COVID-19 in India. Diabetes Metab Syndr 2021;15:1047-48
16. Hippich M, Sifft P, Zapardiel-Gonzalo J, Böhmer MM, Lampasona V, Bonifacio E, Ziegler AG. A public health antibody screening indicates a marked increase of SARS-CoV-2 exposure rate in children during the second wave. Med (N Y) 2021 Apr 3 doi: 10.1016/j.medj.2021.03.019
17. Cherian S, Potdar V, Jadhav S. Convergent evolution of SARS-CoV-2 spike mutations, L452R, E484Q and P681R, in the second wave of COVID-19 in Maharashtra, India. bioRxiv. 2021 doi: 10.1101/2021.04.22.440932. published online May 3. (preprint).
18. Sahoo JP, Mishra AP, Samal KC. Triple mutant Bengal strain (B.1.618) of coronavirus and the worst COVID outbreak in India. April 27, 2021. https://bioticainternational.com/ojs/index.php/biorestoday/article/view/837.
19. www.hindustantimes.com,13-06-2021.