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Original Research Article

Demographic Comparison of the First and the Second Waves of Covid-19 Disease: A Study in a Tertiary Care Hospital of North India

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Abstract

Introduction: The new corona virus, also known as COVID-19, is a virus that causes respiratory disease. It was discovered in December 2019 in Wuhan, China, and has spread to other countries. Corona viruses are large, enveloped, positive-stranded RNA viruses. On March 11, 2020, the World Health Organization (WHO) designated the viral outbreak a worldwide pandemic. As of September 15, 2021, the virus has infected over 226672138 individuals and killed over 4663045 infected ones. India accounts for 14.7% of infections (more than 33 million) and 9.5% of fatalities (more than 4 million).

Aim and Objectives: This hospital-based, retrospective study was conducted in the Department of Microbiology, SKIMS Soura, Srinagar. We designed this study with the following primary objectives: 1. To estimate and analyze SARS- CoV-2 infection positive rate during first and second covid-19 waveforms. 2. Estimate the pattern of 1st and 2nd Covid-19 waveform.

Material and Methods: All pertinent clinical, demographic, and epidemiological data were collected during peak months of COVID-Wave I (Sep-Dec 2020) & COVID-Wave II (April-July 2021).The samples obtained from patients visiting Covid-19 clinic (OPD) and IPD were processed in the bio safety level II lab. A real-time RT-PCR test was utilized in line with the manufacturer's instructions to detect ribonucleic acid (RNA) of SARS-CoV-2 from VTM's containing NP/OP swabs from patients suspected of COVID-19. A positive result on a realtime RT-PCR assay of nasopharyngeal and/or oropharyngeal swab specimens were defined as a confirmed case of Covid-19.

Results: A total of 27851 patients were included in our study in peak months of the1st wave (September to December 2020) of COVID-19 and 31871 patients in the 2nd wave (April to July 2021). The findings of this study demonstrate that during the first and the second-wave, hospitalized patients were majority males, younger in the age group of 19-30 years. The

majority of patients during the first wave of COVID-19 reported in the out-patient department, while during the second wave, patients reported through the In-patient department of the hospital. Also, the total number of cases reported and positivity rate during the COVID-19 first wave was less than the second wave.

Conclusion: We compared the baseline characteristics of wave II with that of Wave I, in which we found that in COVID wave II more individuals were affected, the younger population was infected, more patients were admitted. We also found that the pattern of the two waves does not show any seasonality. Our data could be used to inform Kashmiri population about the epidemiology and demography of Covid-19 waves so that people understand the nature of the situation and follow all the COVID-19 appropriate behaviours more strictly.

Keywords: Coronavirus, Waves, Demography, Mortality.

Introduction

The new coronavirus, also known as COVID-19, is a virus that causes respiratory disease. It was discovered in December 2019 in Wuhan, China, and has spread to other countries [1]. On March 11, 2020, the World Health Organization (WHO) designated the viral outbreak a worldwide pandemic [2]. As of September 15, 2021, the virus has infected over 226672138 individuals and killed over 4663045 infected ones [3]. India accounts for 14.7% of infections (more than 33 million) and 9.5% of fatalities (more than 4 million) [3]. More than six months of lockdown have slowed the spread of the SARS-CoV-2 virus also it had an impact on the national economy, commerce, travel, tourism, industries, and so on. On March 18, 2020, the first case of COVID-19 in Kashmir province (J&K) was reported in Srinagar [4]. On March 24, 2020, the government enforced the first phase of the coronavirus lockdown in Kashmir. Interstate and within state traffic were halted during this period. Except in an emergency, people were not allowed to go outdoors. All government and private workplaces, except critical services, were urged to work from home. The use of universal masking has been made mandatory. The lockdown imposed in the aftermath of COVID-19 lasted from March 21, 2020, until June 3, 2020 [5]. Mild or asymptomatic infections were prevalent during the COVID-19 era, and they were a significant source of infection transmission [6].

A surveillance system based on reverse-transcriptase PCR (RT-PCR) testing and rapid antigen testing (RAT) was the primary tool available with the healthcare system to detect the active Covid-19 cases. Consequently, several RT-PCR laboratories were established or start working under the aegis of the Indian Council of Medical Research, New Delhi (ICMR) throughout the Indian states. One such high-end BSL-II laboratory worked round the clock, all days of the week, collecting and analysing samples at the postgraduate department of Microbiology, Sher-e-Kashmir Institute of Medical Science, Srinagar.

Since the beginning of the Covid-19 in Kashmir province, a total of two peak waves have been reported by health authorities based on the registered number of cases. Still, no such data or analysis is available in the public domain.

We designed this study with primary objective to find out the prevalence of SARS-CoV-2 infection and study the demographic variables among patients visiting our hospital, testing positive for

COVID-19 during the two peaks of the pandemic.

Methods:

This hospital-based, retrospective study was conducted in the Department of Microbiology, SKIMS Soura, Srinagar, a tertiary care centre that serves the bulk of the Kashmir division's population. All pertinent clinical, demographic, and epidemiological data were collected during peak months of COVID-Wave I (Sep-Dec 2020) & COVID-Wave II (April-July 2021). Individuals with acute respiratory infection (influenza-like illness and severe acute respiratory infection), high-risk contacts and asymptomatic close contacts of COVID-19 positive patients, hospitalized patients scheduled for surgery, pregnant women nearing their due date, and travellers who met the ICMR screening criteria (dated May 18, 2020) were screened [7]. The study included all patients who were screened for SARS-CoV-2 using RT-PCR. A positive result on a real-time RT-PCR assay of nasopharyngeal and/or oropharyngeal swab specimens was defined as a confirmed case of Covid-19. During the peak months of 1st wave (September to December 2020) and the 2nd wave (April to July 2021), a total of 59722 samples from clinically probable COVID-19 cases were collected and processed at our department's virology section.

Collection of Samples

All health care workers (HCWs) involved in sample collection and transport were properly trained and given applicable SOPs. A full set of personal protective equipment (PPE) was worn before beginning sample collection. Before the collection of the specimen all the relevant demographic, and epidemiological information was recorded. The CDC recommends collecting and testing upper respiratory samples for initial diagnostic testing of SARS-CoV-2 infections[8]. In our study either nasopharyngeal and/or oropharyngeal swab specimens were collected. A dry, synthetic swab was used to collect nasopharyngeal from deep nostrils. The swab was pushed into the nostril, parallel to the palate, and back to the nasopharynx. It was spun three times after being left in place for a few seconds. For oropharyngeal specimen collection a swab was inserted into the posterior pharynx and tonsillar areas and rubbed over both tonsillar pillars and posterior oropharynx without touching the tongue, teeth, and gums. The swab was then slowly removed, and the tip was placed in a vial containing 3ml of viral transport media (VTM), while breaking the applicator's stick, and was then transported as rapidly as possible to the COVID testing lab at 4^0 C.

Sample Processing

The samples obtained from patients visiting Covid-19 clinic (OPD) and IPD were processed in the biosafety level IIlab. A real-time RT-PCR test was utilized in line with the manufacturer's instructions to detect ribonucleic acid (RNA) of SARS-CoV-2 from VTM’s containing NP swabs from patients suspected of COVID-19. All specimens were extracted and purified initially using the QIAamp Viral RNA Mini-Kitsfrom Qiagen, with each kit having 250 reactions and later using Gene Mag Viral DNA/RNA purification kits by Genetix Biotech Asia with each kit having 96 reactions We were able to extract highly pure RNA by following the kit manufacturer's instructions and recommended procedures. During the early months of the pandemic, nasopharyngeal samples were tested using kits manufactured by the National Institute of Virology (NIV) in Pune in accordance with ICMR recommendations [9]. Extracted and purified RNA was reverse transcribed toc-DNA and amplified and analyzed on the ABI 7500 Fast DX RT-PCR system. The assay protocol was a two-step process in which the E gene was employed for screening. All specimens that tested positive in the screening test were verified

by a second reaction targeting the ORF and RdRP genes [10]. Several more test kits were utilized later in the pandemic, including the Thermo Fisher TaqPath COVID-19 SARS-CoV- 2 test (ORF1ab, N, and S gene detection& IC detection), LabGun COVID-19 Assay (RdRP, E, and IC detection), and others. An internal control (IC) was examined for each patient sample to confirm the integrity and verification of RT-PCR assay results, as well as evaluating one replication of the positive control and one replication of the negative control in each batch. Atest result was defined as positive when reaction amplification curves crossed the cycle threshold line (Ct value) within 36 cycles.

Statistical analysis: Data was entered in a Microsoft Excel spreadsheet. Continuous variables were summarized as mean and standard deviation. Categorical variables were summarized as percentages. The Chi-square test was used to test independence between two categorical variables. A p-value of less than 0.05 was considered statistically significant. All statistical analysis was done using SPSS 20.0.

Results:

A total of 27851 patients were included in our study in peak months of the 1st wave (September to December 2020) of COVID-19 and 31871 patients in the 2ndwave (April to July 2021). During COVID-19 Wave-I, the mean age was 47.54 ±19.0 years, and 39.76±17.17 years during COVID-19 wave-II. During COVID-19 wave-I, the median age was 47 years and 37 years during COVID-19 wave-II, respectively. During the COVID-19 wave-I, the highest positivity was noticed in the age group 46-60 years (27.8%), while the highest positivity was observed in the age group 31-45 years (31.1 %) during the COVID-19 wave-II respectively. Table 1 describes the test positivity rate of the patients during the peak months (September to December 2020) of the first wave and the patients during the peak months (April-July 2021) of the second wave which was found to be 16.90% and 20.50% respectively. In our study the mortality rate amongst hospitalized patients was higher in case of first wave as compared to second i.e 10.8% and 2.4% respectively (Table 1). In Wave-I most 1308(27.8%) of the patients with reported symptoms were in the age group of 46-60 years, followed by 1234(26.2%) patients in the age group of >60 years. The majority of patients, 2844(60.4%), were males, almost one half proportion of patients reported each month, majority 57.8% reported to Outpatient department. Males were more affected as compared to females, with a male-female ratio of 6:4. During our study period, i.e the peak season of covid wave I, the maximum number of cases were found in the month of September 28.5%.[Table 1]while as in wave-II most 2030(31.1%) of the patients with reported symptoms were in the age group of 31-45 years, followed by 1800 (27.6%) patients in the age group of 19-30 years. The majority of patients, 3684(56.46%), were males, and almost the proportion of patients decreased over the month from April to July 2021, majority 99.8% reported to Inpatient department. Males were more affected as compared to females in Wave II, with a ratio of 1.3:1 More number of these in COVID wave II were detected (49.7%) in the month of May followed by the month of April (35%) as compared with the rest of the months. [Table 2] Furthermore, a comparison between the age of the patients, gender, route of admission and month of admission during the COVID-19 pandemic were compared with the test positivity rate. The relationship was found to be statistically significant ($p<0.001$).

Comparison of positivity rate during peak months wave I and wave II of COVID-19 shown in [Table 1]. The positivity rate during the two waves was found to be statistically significant with the mode of admission status. (p-value <0.001).

Table 1: Positivity rate, mortality rate and baseline characteristics during peak months of COVID-Wave 1 (September-December-2020) and COVID-Wave II (April-July-2021).

Characteristics	Sub-class	Wave I n(%)	X^2 df p-value	Wave II n(%)	X^2 df p-value
Positivity rate	-	4709/27851(16.90)	-	6524/31871(20.50)	84.58 0.001*
Mortality rate among hospitalized patients	-	211/1986(10.8%)	-	162/6511(2.4%)	211.30 0.001*
Age of the patients	< 18 years	258 (5.50)	566.060 (12) 0.001*	534 (8.20)	79.241 (12) 0.001*
	19-30 years	888 (18.90)		1800 (27.60)	
	31-45 years	1021 (21.70)		2030 (31.1)	
	46-60 years	1308 (27.80)		1286 (19.7)	
	>60 years	1234 (26.20)		874 (13.4)	
Gender	Male	2844 (60.30)	75.369 (6) 0.001*	3684 (56.46)	7.548 (3) 0.056*
	Female	1865 (39.70)		2840 (43.53)	
Month wise distribution of cases	Sep 20' | April 21#	1342 (28.5)	210.591 (9) 0.001*	2281 (35.00)	875.195 (9) 0.001*
	Oct 20' | May 21#	1227 (26.10)		3240 (49.70)	
	Nov 20' | June 21#	1267 (26.90)		663 (10.20)	
	Dec 20' | July 21#	873 (18.50)		340 (5.20)	
Block Location	IPD	1946 (41.3)	162.702 (3) 0.001*	6508(99.8)	14.746 (6) 0.022*
	Maternity Hospital	40 (0.80)		3 (0.01)	
	Covid Clinic (OPD)	2723 (57.80)		13 (0.20)	

'Wave I# Wave I

Discussion:

The current study looked at COVID-19 patterns and indices observed at SKIMS from September-December 2020 [COVID-19 Wave-I] and April-July 20201[COVID-19 Wave-II], with a particular focus on the second wave, which impacted India in the first and second quarter of 2021. While the country is taking considerable measures to speed up the vaccination program to control the pandemic as quickly as possible, the SARS-CoV-2 viral modifications that make it highly contagious have created a public

health problem. In India, the first wave reached its apex in September 2020 [11]. The end of the first wave was most likely due to a mix of circumstances, including practical government actions, increasing awareness, and, most crucially, medical professionals' experience treating the condition during their first encounter.

The cases again began to rise at the end of February, and increased sharply by March 2021, suggesting the start of the second wave in India [12]. The abrupt surge in cases after a relatively long 'cooling' period was unexpected, albeit it could be linked to a highly infectious double mutant version of SARS-CoV-2 (B.1.617 lineage), careless population behavior, and relaxation of treatments such as lockdown and others. Furthermore, the second wave spread faster than the first, propelling India to the top list of countries affected by the COVID-19 pandemic worldwide. In 2021, India was first in the world in daily cases and third in daily deaths due to the virus. In April, the number of daily cases nearly tripled in contrast to the United States [13], despite the Case Fatality Rate (CFR) being comparatively low, as witnessed in some countries such as Brazil, where the number of deaths per infection also known as CFR, was very high [14]. On the other hand, healthcare systems were overburdened due to the uncoordinated growth in the number of cases and were on the verge of collapsing.

Meanwhile, Around March 2021, tourism and cultural activities began and in the month of April, a tulip festival was celebrated, drawing tens of thousands of people to the garden [15,16]. Outside the lawn, queues were seen discarding inappropriate behaviour and social isolation. In Kashmir, the number of cases began to rise in March, and by April, there were approximately 20,000 cases every day, peaking in the first half of May. The primary epidemiological and other features and the test positivity rate of the first wave and second wave i.e., September-December 2020 in the first wave and April-July in second wave respectively were studied. During the second wave, more patients were admitted, younger and more positive patients were reported, consistent with earlier studies in numerous countries [12,13].

In our study we found predominance of male population during both first and second waves which is in accordance with the study conducted by Khan M, et al. in Peshawar, Pakistan, where it was discovered that among 121 RT-PCR positive patients, 70.25 % were male, 29.8% were female, and the bulk of the cases ranged in age from 25 to 60 years [17]. Soni et al. identified a median age of 33 years in another study conducted at PGI, Chandigarh, India, similar to our data [18]. In their investigation, Gupta et al. discovered a mean age of 40.3 years (range 16-73 years) and a male preponderance (66.7%) among patients testing positive for SARS-CoV-2 infection [19]. Patients in our study who tested positive for SARS-CoV-2 disease were younger (median age=32 years) than those in China (median age=56 years) [20] and New York (median age=63 years) [21]. Males are the working members of most households in most developing nations, exposing themselves in workplaces and explaining the more considerable prevalence. The elevated infection rates among teenagers and young adults can be linked to increased outdoor exposure and the associated risk of transmission from cases in crowded settings, gatherings, and workplaces. Non-compliance with preventive measures (safe distance, masks, hand washing) can also leave people vulnerable to COVID-19.Although it has been claimed that a novel version of SARS-CoV-2 developed in early summer 2020 [22], the reasons for the significant differences between the two waves are unknown. The disease was subsequently spread throughout the country by infecting the general population in that area. Furthermore, young people's failure to

follow social distancing norms may have aided contagion among young, healthy adults and children [12,4]. The mortality rate was more in first wave as compared to second wave in case of hospitalized patients, the decrease in patient age resulted in a fall in the case fatality rate, as those who died were five years older than those who died in the first wave. This improvement in admitted patient outcomes could be attributed to our country's health system, like many others, have improved since then. We have more experience, better treatment regimens, and more diagnostic testing, allowing severe cases to be discovered sooner and treated more effectively. In this regard, patients were given dexamethasone more frequently during the second period, as suggested by the RECOVERY study [23], and hydroxychloroquine and lopinavir-ritonavir were replaced with redelivering and tocilizumab, which have been shown in several studies to be more effective in preventing death and reducing hospital stays [24–27].

Strengths of the study: The large sample size of this study is one of its strengths. This is a single-centre study in one of the largest tertiary care hospitals covering Kashmir's larger geographic area. Furthermore, we have reached the statistical significance limit for calculating comparison between age, gender, testing location and month of testing with the positivity rate. However, we believe the findings are significant since they could reflect many other such centers in the Northern region of India, yet there is currently little information on the subject.

Limitations of study: Although we gathered information on a large number of patients, but we only analyzed the records of the patients visiting our hospital; hence, we could not take into account any non-hospitalized COVID-19 patient with mild disease or those visiting other health care facilities, this may be a source of bias in this study.

Conclusion:

We compared the baseline characteristics of wave II with that of Wave I, in which we found that more cases were affected, the younger population was infected, more patients were admitted in COVID wave II. We also found that the pattern of the two waves does not show any seasonality.Our data could be used to inform Kashmiri population about the epidemiology and demography of Covid-19 waves so that people understand the nature of the situation and follow all the COVID-19appropriate behaviours more strictly. If the initial response is delayed, the COVID-19 pandemic can spread explosively in local communities, making it difficult to control using subsequent social distancing strategies. The lessons learned from this fight are essential to prevent any further wave from entering our region.

Ethical Clearance: Has been taken from Institutional Ethical Committee, under protocol number: IEC/SKIMS Protocol #RP 014/2022

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