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Original research article

The epidemiological characteristics of the admitted cases of COVID-19 in a tertiary hospital in India

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Abstract

Introduction: COVID -19 disease broke out in Wuhan, China at the end of 2019 and the deadly virus spread out rapidly worldwide by the end of March 2020. India has the second largest number of cases in the world with 1,05,95,660 COVID 19 cases and has had 1,52,718 deaths at the end January 2021.[3] As it is a new emerging infectious disease, it is a challenging task for the health system to manage the pandemic. This study will provide epidemiological characteristics of COVID-19 in Indian population which will help to make new policies and programs.

Aim and Objective: To study the epidemiology of COVID-19 cases in a tertiary care hospital in North India.

Materials and Methods: This Retrospective study included 2985 patients treated as COVID -19 positive cases admitted in AIIMS Trauma centre-JPNATC (Jai Prakash Narayan Apex Trauma Centre – JPNATC). The patient's data were collected between 1st April 2020 to 30th October 2020 from AIIMS -EWD and CPRS platform were COVID 19 data recorded. Demographic details such as age, gender, date of admission for COVID-19 and the outcome were collected and analyzed.

Results: A total number of 2985 cases were included in this study. The mean±SD age of the male patients were 44.37 ±19.65 and mean±SD female patients were 45.75 ± 19.58. The majority were male patients constituted 62.5% of the sample. The mean±SD age of the male patients were died during the treatment 51.75 ±18.68 and female 51.31 ± 18.71. The death ratio of male: female was 1.78

Keywords: SARS-CoV-2, MERS, RNA, Epidemiology, Demography

Introduction

In 2019, a new coronavirus was identified as the cause of disease outbreak originated in Wuhan, China and it spreads out worldwide, which leads to the current pandemic situation. The virus is now known as the severe acute respiratory syndrome coronavirus [2] (SARS-CoV-2). Coronaviruses are viruses that cause illnesses such as common cold, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) [1]. It is an infectious disease and its pathogenic organism is a positive single-stranded RNA virus.The disease caused by SARS-CoV-2 virus is called coronavirus disease 2019 (COVID-19)[2]. It spreads the same way the other coronaviruses spread, mainly through person-to-person

contact. The severity of the COVID 19 infections range from mild to deadly. COVID-19 virus can spread from an infected person's nose and mouth through small droplets and aerosols while they breathe, cough, sneeze, sing, or speak. The virus may also spread via contaminated surfaces[3].

In March 2020, the World Health Organization (WHO) has declared the COVID-19 outbreak as a pandemic. In India, first COVID-19 positive case was reported on January 30th 2019 at Kerala on a student returned from Wuhan to Kerala. Three positive cases were reported at the end of first week of February 2020. COVID-19 cases have been increased rapidly across various Indian States since March 2020. Currently, national level dashboard, state level media bulletins[9, 10] syndromic data from sentinel sites and laboratories are used to display the current status of COVID-19 in India.[4]

The Ministry of Health and Family Welfare has confirmed a total number of 1,05,95,660 COVID 19 cases in India till 20th January 2021 and a total of 1,02,45,741 cases have been cured, however India has had 1,52,718 deaths. India has the second largest number of cases in the world as on date 20th January 2021.[3]

New Delhi, the capital of India, is a metropolitan city and has a very high density of population. Migrant workers from almost all parts of India and neighboring countries reside in Delhi[5]. With such a huge population it is practically difficult to impose the various Non-Pharmacological interventions or NPI. However, the early intervention like strict lockdown, containment efforts, modulated movement restrictions and monitoring of transmission dynamics has been a way forward.[5] The Delhi government publishes daily data of the number of cases in Delhi and the cumulative cases. This can be very useful in finding out how the disease is trending in the capital. Health and welfare -Delhi government daily bulletin reports showing 31/1/2021 reports that Cumulative COVID-19 Positive Cases was 635096, Cumulative Positivity Rate 5.91 %, Recovered/Discharged/Migrated 622882, Deaths 10853And Case Fatality Rate 1.71 %.[6]

The purpose of this study is to analyze the epidemiological characteristics of the admitted patients between 3rd April 2020 to 31st October 2020 in Jai Prakash Narayan Apex Trauma Centre -AIIMS, which was the core tertiary Care COVID Centre during the pandemic. Based on the study findings, we are able to assess and contextualize the severity of COVID-19 and examine how age-specific prevalence affects the population IFR and the total incidence of fatalities.[7] As it is a new emerging infectious disease, it is a challenging task for the health system to manage the pandemic with less manpower, scarcity of beds, medical equipment's, medicines and other life supportive instruments. This study will provide epidemiological characteristics of COVID-19 in Indian population which will help to make new policies and programs. The COVID-19 pandemic has presented public health with its biggest infectious disease challenge since the 1918 influenza pandemic. Although we are early in the pandemic, several issues have already arisen that necessitate their incorporation into educational and training materials for future field epidemiologists. As the pandemic continues, it is important to continue to document challenges and how these can be overcome in future public health emergencies. For the discipline of field epidemiology, there are always more lessons to be learned.

Methodology

This is a quantitative descriptive study exploring epidemiological features of COVID-19 patients admitted in tertiary care hospital. The primary objective of the study was to identify the ratio of male to female mortality and morbidity and the secondary objective was to identify the age specific mortality and morbidity pattern of the patients admitted in the COVID-19 wards and ICU of AIIMs Trauma centre-JPNATC (JAI PRAKASH NARAYAN APEX TRAUMA CENTRE – JPNATC).

The data was retrieved retrospectively of the patients admitted from 3rd April 2020 until 30th October 2020 from a database system called EWD of AIIMS. EWD is a separate personalized database system generated to maintain the records of the patients admitted at AIIMS. Retrieval was done after seeking due permission from the authorities.The study subjects were all the COVID-19 positive cases admitted in JPNATC who were referred from the Main AIIMS Hospital. The patients were only referred to this tertiary care after being confirmed for COVID-19 at AIIM as per ICMR guidelines (case definition)[14].

Patient characteristics such as name, age, gender, date of admission and outcome (date of disposal in the form of transfer, death or discharge) were collected from the database. The collected data was stored in a Microsoft Excel file. The document containing the study data was encrypted with a password and the device was kept safe and secure for data security. The personal identifiers of the patients (Patients' names and addresses) were kept confidential and secure. Each patient was given Unique ID number to make each entry anonymous.

Analysis

The cases of death were analyzed using CPRS (Computer-Based Patient Record System). CPRS is a hospital information system primarily functions to store and arrange clinical data systematically to provide clinical enhancement to clinical and non-clinical personnel of the hospital. CPRS also helps in research studies by providing systematically captured and arranged clinical data for research evaluation[8]. Descriptive statistics were analyzed using SPSS 21.0 . Chi-square test was performed to see if there is significant difference between male and female mortality due to COVID-19 in the study subjects. Age variable was further categorized in age groups to see if there is any significant hike in any age group compare to other groups. We also compared COVID-19 cases admitted in this hospital with cumulative COVID-19 cases in New Delhi to see the case burden of COVID-19 cases in this hospital.

Results

A total of 2985 patients were treated during the period under report. It included 1866 (62.5%) males and 1119 (37.5%) females. Male to female ratio was 1.67:1. The demographic characteristics are shown in table-1. The youngest subject was 4 months old whereas the oldest subject was 97 years old. The mean age of the males is 44.37 and the mean age of the females is 44.75. The mean age of the entire sample is 44.51 years.

Table 1: Patients' demographic characteristics

	N (%)	Min. Age	Max. Age	Mean ± SD	Median	Mode
Male	1866 (62.51%)	4 mo.	91	44.37 ±19.65	46	50
Female	1119(37.5%)	8 mo.	97	45.75 ± 19.58	46	60
Total	2985 (100)	4 mo.	97	44.51 ± 19.62	46	50

Out of total 2985 patients tested positive COVID 19 and admitted in AIIMS New Delhi. The outcomes of the admitted patients were shown in figure-1. A total of 2290(76.7) patients were completely cured of COVID-19 symptoms hence discharged, 580 (19.4) patients died during the treatment, 87(2.7) patients were tested positive for COVID-19 and were sent to AIIMS for further investigation due to co-morbidities, 12(0.4) patients left against medical advice, 11(0.4) were opt home quarantine and denied to stay back at the hospital. 4 patients took discharge in request, and 1 patient absconded.

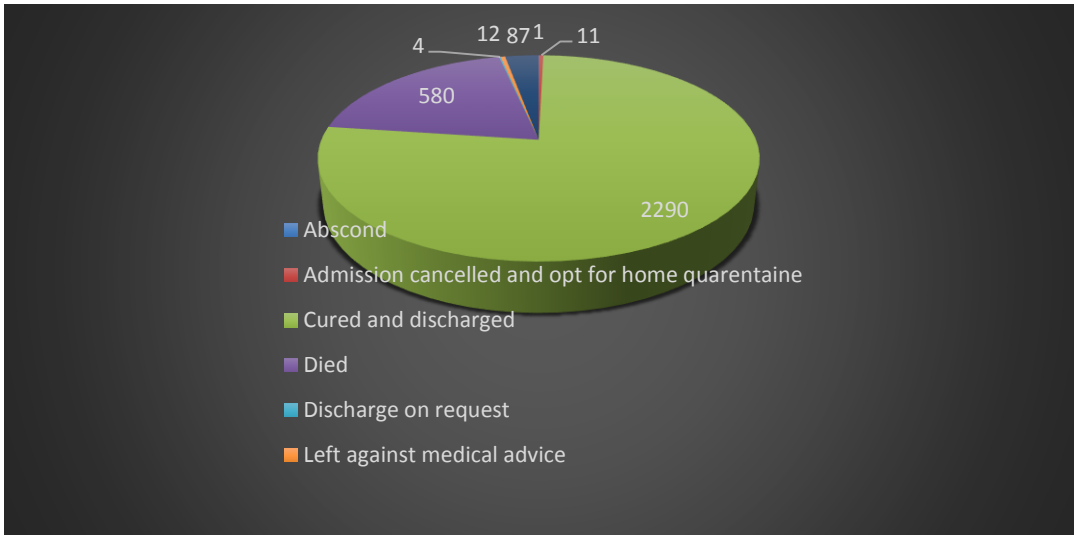

Figure1: Pie-chart representing the disposal of patients of COVID-19 cases

There were 580 deaths occurred in the sample of which 371(64%) were males and 209(36%) were females. (figure-2).

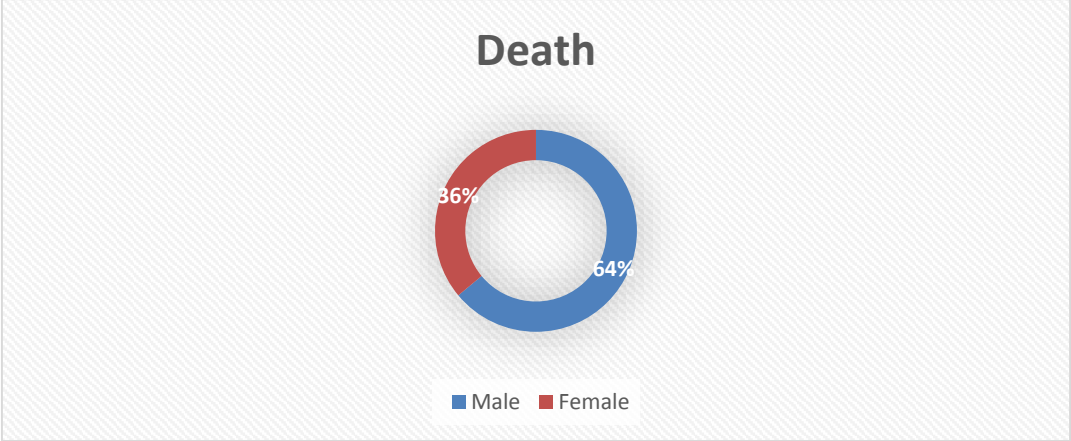

Figure 2: Showing the gender ratio of COVID-19 deaths

Chi Square test (Goodness of FIT) was applied to see whether the ratio of more males dying is just by chance or the disease is actually causing more fatality in males. The calculation formula with expected and observed values are highlighted in the table-2.
The calculated value of Chi square at alpha of 0.05 is 45.24 which is greater than tabulated value 3.841. The result indicates that there is a significant difference between in deaths of males and females due to COVID-19. The result rejects the null hypothesis suggesting that the higher number of male mortality is not merely by chance but rather significant.

Table 2: Chi-square test (Goodness of Fit) (N=2985)

Category	Observed (O)	Expected (E)	$(O-E)^2 / E$	The Formula for Chi Square Is $\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$ where: c = degrees of freedom, O = observed value(s), E = expected value(s)
Males	371	290	22.62	
Females	209	290	22.62	
TOTAL			45.24	

Ho (null hypothesis) = π male = π female =0.50
Ha (alternative hypothesis) is π male and π female are not equal.
Df = (k-1) = (2-1) = 1
χ^2 (calculated value) = 45.24
χ^2 (Tabulated value) = 3.841 at p=0.05 at the degree of freedom 1
To seek the association between age and mortality among COVID-19 fatalities, age was categorized in age-groups. The categorization of age-groups is shown in table-3.

Table 3: Case fatality for different age groups

Age Category	Out Come								
	Cured and Discharged	Death	Abscond	admission cancelled and opt for home quarantine	Discharge on request	Left against medical advice	Transfer out to other department and facilities	**Total**	P-Value
0 to 14 yrs	186(8.1%)	18(3.1%)	0	1(0.5%)	0	0	5(2.4%)	210	P<.000 $X^{2=}$134.214
15 to 29 yrs	426(18.6%)	63(10.9%)	1(0.2%)	4(0.8%)	2(0.9%)	3(0.6%)	20(3.9%)	519	
30 to 44 yrs	543(23.7%)	108(18.6%)	0	3(0.4%)	1(0.1%)	2(0.3%)	14(2.1%)	671	
45 to 59 yrs	661(28.9%)	174(30.0%)	0	1(0.1%)	0	3(0.5%)	31(3.6%)	870	
60 to 74 yrs	386(16.9%)	149(25.7%)	0	1(0.1%)	1(0.2%)	4(0.7%)	14(2.5%)	555	
75 years and above	88(3.8%)	68(11.7%)	0	1(0.2%)	0	0	3(1.9%)	160	
TOTAL	2290	580	1	11	4	12	87	2985	

The sample was categorized in 6 groups with age range of 14 years in each group starting from 0-14 years until 75 years and above. The highest fatality rate (30.0%) was seen in age group of 45 to 59 years and the lowest fatality rate (3.1%) was noticed in age group of 0-14 years. Higher fatality proportion was noticed in older age group. Higher fatality proportion of 30%, 25.7%, 18.6% and 11.7%, 10.9% and 3.1 per cent was noticed among the age groups 45-59, 60-74, 30-44 and 75 years and above, 15-29 and 0-14 respectively. The Chi squire result indicates that there is a significant difference between in deaths and age p value (0.00) is less than 0.05. The result accepts the null hypothesis suggesting that the chance of mortality rate increase with the age.
The graphical representation shown in figure-3 clarifies the trend of higher mortality among older people and higher survival proportion among younger subjects.

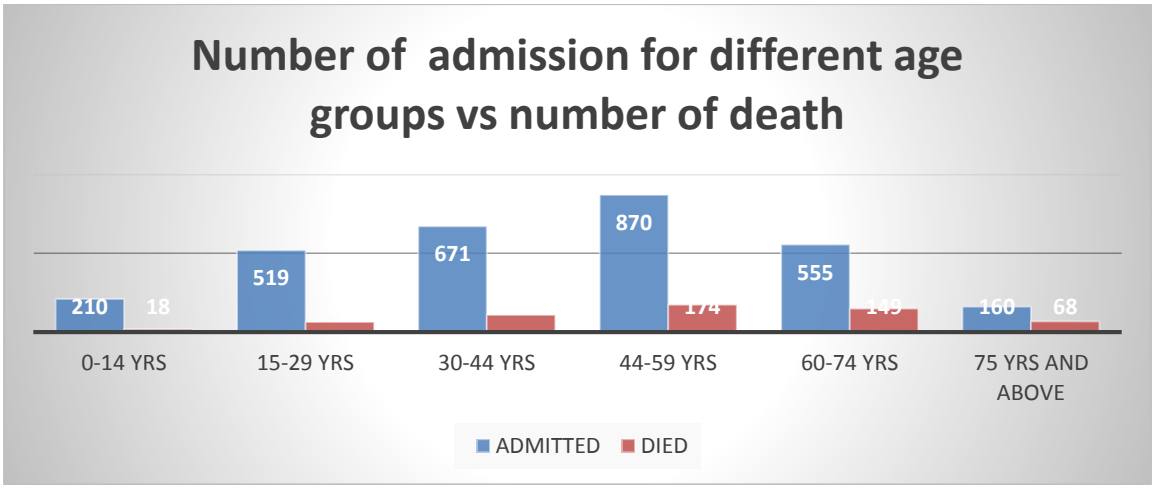

Figure 3: Number of deaths vs. an admission for different age groups

Two graphs in figure-4 and figure-5 represents the cumulative cases in New Delhi and cases admitted at JPNATC. Both graphs collectively indicate the similarity in case burden against time.

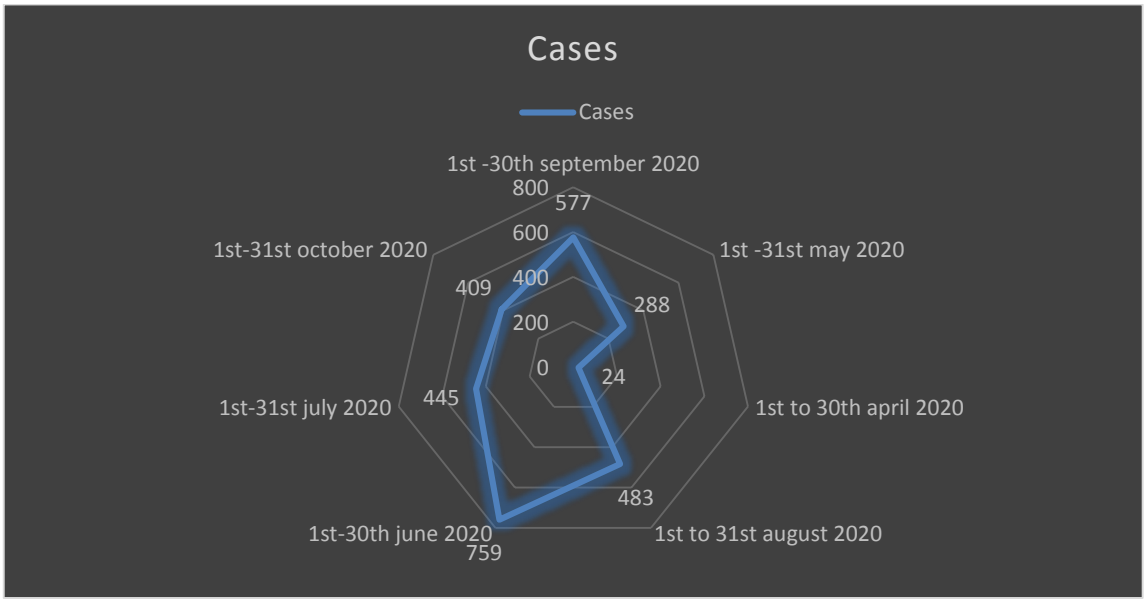

Figure 4: Cumulative COVID-19 cases in New Delhi from 3 April 2020 to 12 June 2020

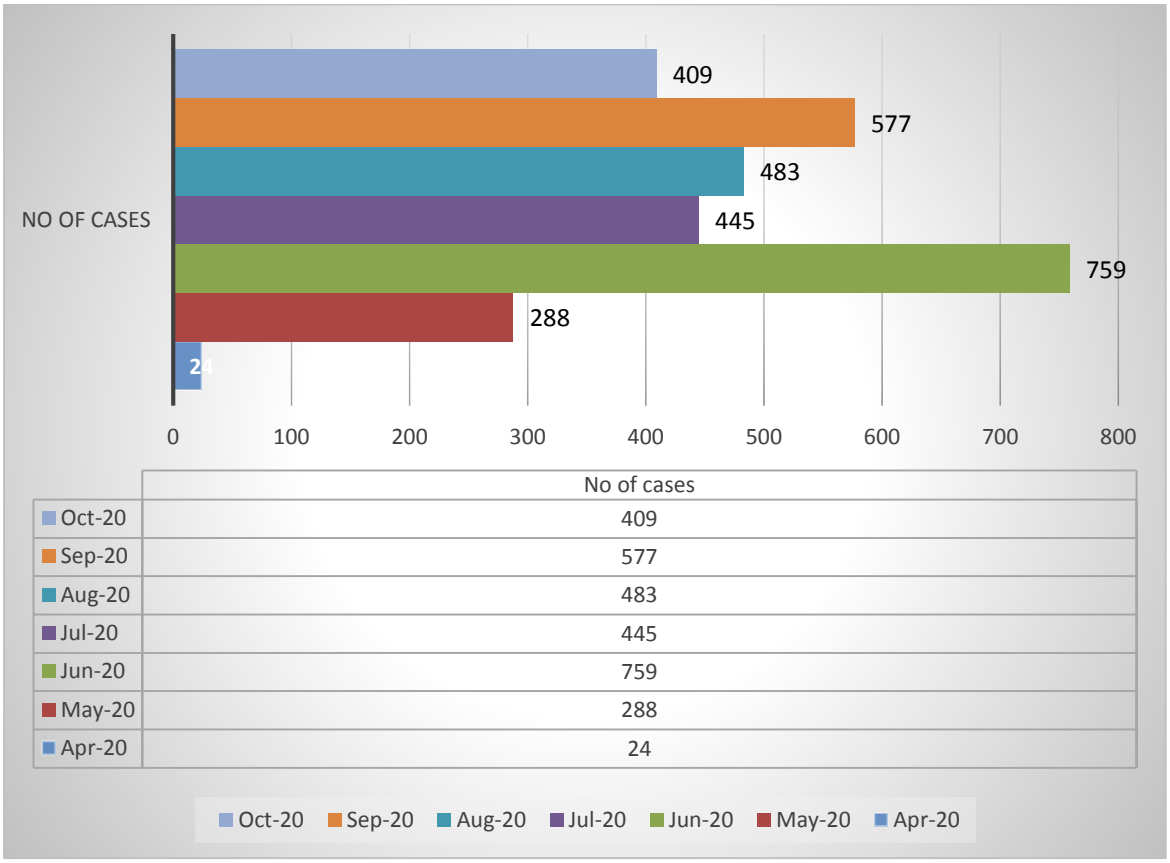

Figure 5: Number of cases admitted at JPNATC from 3 April 2020 to 12 June 2020

A total of 2985 cases admitted at JPNATC from 3 April 2020 to 30th October 2020. Out of total 2985 cases, more number of cases admitted in the month of June 759 and least number of cases admitted in the month of April.

Table 4: age category Vs Duration of Hospital stay

S.N	Variable-	Duration of Hospital Stay					Total Number	P-value
1	Age category	24 hour	1 week	2 week	3 week	4 week and above		
2	0-14years	4(7.5%)	132(8.4%)	53(5.7%)	15(4.9%)	6(4.8%)	210(7)	
3	15-29 years	7(13.2%)	320 (20.3%)	128(13.8%)	48(15.7%)	16(12.8%)	519(17.4%)	p<0.00
4	30-44 years	13(24.5)	362(23%)	209(22%)	61(20%)	31(24.8)	671(29.1%)	
5	45-59 years	12(22.6%)	442(28.1%)	286(30.8%)	91(29.8%)	39(31.2)	870(29.1%)	
6	60-74 years	13(24.5%)	255(16.2%)	191(20.6%)	70(23%)	26(20.8%)	555(18.6%)	
7	75 years and above	4(7.5%)	62(3.9%)	67(7.2%)	20(6.6%)	7(5.6%)	160(5.4%)	
	Total	53(100%)	1573(100%)	929(100%)	305(100%)	125(100%)	2985(100%)	

Duration of hospital stay ranges from 24 hours to 4 weeks and more. 1573 people admitted in hospital for 2 weeks, out of total 1573, more number of patients were aged between 45-49 years. Duration of hospital stay and age statistically significant (p-value is 0.00 is less than 0.05)

Discussion

This study aims to explore epidemiological characteristics of COVID-19 patients admitted in a tertiary care hospital in New Delhi. Before discussing the outcomes of the study and comparing to the other relevant literature, it is noteworthy that novel COVID-19 is relatively new and dynamic.

A total number of 733 patients were treated at this hospital during the study period. The demographic details reveal that males are more likely to get infected with COVID-19 compare to females with male to female ratio 1.6:1. Findings from other studies of the same remain persistent with this study.[9, 10] However, the reason for such male preponderance is not yet known. A possible reason could be males are more likely to engage in outdoor activities compare to females. Another possible reason could be the presence of X chromosome in the females. The X chromosome is known to contain the largest number of immune-related genes of the whole human genome. For this reason, X chromosome has recently become subject of great interest and attention and numerous studies have been aimed at understanding the role of genes on the X chromosome in triggering and maintaining the autoimmune aggression[9]. The same analogy can be attributed to higher cases of deaths in males. We found a gender ratio of 2:1 for male to female deaths due to COVID in the study sample. A study conducted in China also suggests higher frequency of male mortality.[10]

We also noticed that the people from older age group had higher proportion of deaths due to COVID-19 infection compare to younger age groups. The study primarily assessing gender differences of COVID-19 cases also shows corresponding results.[10] Old age is associated with physiological changes because of ageing, co-morbid conditions and decreased immunity due to which this age group is more likely to expose with various illnesses.[11] However, our study found the maximum percentage of people in the age groups 45-59 are being infected with the disease. This observation again leads to an assumption that the age group is more actively associated with outdoor activities due to work/ business purposes. Further investigations can rule out outdoor activities of younger age groups (children, teenagers and young adults who are not employed with work/ business and students) as the education system was completely shifted for virtual learning and assessment[11].

This study remains persistent with most studies in the literature to support the findings that males are more likely to get infected as well as to have a higher morbidity and mortality due to COVID-19 infection [11, 10]. The finding helps to develop interventions to control the spread of the disease. It also encourages further studies to evaluate the gender based detailed studies to see gender specific COVID-19 pattern.
The reason behind higher mortality among male subjects remain unclear except some theories mentioned above. This develops urgent need for research in the direction to explore the possible factors behind the observation. Other than genetical factors mentioned above, it would be interesting to assess social and behavior factors for higher prevalence and higher mortality in male gender.

Limitations

The study has shown demographic characteristics of COVID-19 patients, specifically the relation between gender and mortality due to COVID-19 infection and how the disease reacts to different age groups. However, we did not include a factor of comorbidity due to time and resource constraints considering how important role comorbidity has to play with morbidity and mortality of COVID-19 cases. It is interesting to see how COVID-19 is reacting to the cases with different comorbidities in different age groups. The study also could not assess the spread of the disease in terms of exposure and contact tracing due to unavailability of data. The data for the study was retrieved from the database of the hospital directly. Hence, it was not possible to get such details from the contacts of the cases.

Conclusion

The study concludes that men are more at risk with COVID-19 exposure and COVID-19 related mortality. Another significant finding from the study shows that the older age people are more vulnerable to this disease. The interventions specifically targeted to male gender groups and older age groups and the interventions may help to reduce COVID-19 spread and its attributed mortality in such specific age groups and gender groups.

Conflict of Interest: - Nil

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