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Research Article

Risk Factors of COVID-19 among Patients Attending a Tertiary Care Centre in Delhi: A Case Control Study

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A B S T R A C T

Introduction: COVID-19 is an infectious disease caused by a newly discovered coronavirus Severe Acute Respiratory Syndrome Corona Virus-2 (SARS CoV-2). Therefore, there is paucity of data on risk factors of COVID-19 in India which will help in designing preventive measures. Objective: To determine the risk factors of COVID-19 patients attending a tertiary care institution.

Methods: The study was conducted at tertiary care hosipital in South Delhi, India among the patients admitted in Covid-19 wards or visiting the hospital for testing of SARS CoV-2 infection. Contact data of test results was collected from the medical record and detailed information was collected through telephone calls. 103 cases were selected who were found test positive by RT PCR and 103 negatives were selected as controls. Data was collected using pre-tested Questionnaire. The data were first captured in paper-based case record form and then entered in a Microsoft Excel and analyzed in SPSS Software version 21.0.

Result: The mean age of all the participants was 37.63±15.32 years. On comparing cases and controls, it was found that symptoms like fever, general weakness, cough, sore throat, breathlessness and headache were significantly associated with cases, having an odds ratio of greater than 1 and p value< 0.05. On analysing various underlying medical conditions amongst controls and cases, it was found that there was a significant difference among cases and controls who had Diabetes Mellitus (DM) and Hypertension (p-value: 0.001) with a high odds ratio of 6.130 and 5.964 respectively. Around half of the cases (54.4%) and 23.3% of controls reported to have faced discrimination or changed attitude of their neighbours after revealing their RT-PCR report and this difference was statistically significant (p-value 0.001).

Conclusion: Study revealed that majority of symptoms were not predictors of COVID-19 and only occupations and history of contact remained significant risk factors of COVID-19 in multivariate analysis. A multicenter research study is required to learn more about risk factors.

Keywords: COVID-19, Case-Control Study, Delhi

Introduction

COVID-19 is an infectious disease caused by a newly discovered coronavirus-Severe Acute Respiratory Syndrome Corona Virus-2 (SARS CoV-2). The first cluster of cases were reported from Wuhan in China in December 2019 and it soon spread across the whole world in a very short period. The primary route of transmission of the disease from person to person is through droplets released during coughing, sneezing and speaking by an infected person. These droplets are relatively heavy, do not travel far and quickly sink to the ground.[1] As on date in the world, cumulative cases were 41,966,948; deaths were 1,142,158; around 31 million recovered and 9 millions were active cases. In India, there were 7,759,640 cases, 117,336 deaths, and 6,946,325 recovered.[2,3]

COVID-19 primarily attacks the respiratory system mainly lungs. Covid-19 is the third virus from the coronavirus family to be affecting human population in the last 20 years.[4] It is seen that most people infected with Coronavirus would develop mild symptoms like fever, cough, tiredness and recover without the need for hospitalization. In many cases, the traditional or home remedies may provide symptomatic relief, but there are no medicines that have been shown to prevent or cure the disease. Despite the fact that a lot of measures for prevention have been taken by the government and are being implemented at the community and personal level, the number of cases and its transmission has increased rapidly and impacted all domains of development in the world including healthcare.

Among various measures, social distancing was adopted by almost all governments in the world to reduce the transmission of the virus. Beside social distancing, the containment strategy also included contact tracing and surveillance, followed by quarantine and isolation because longer the contact with the infected person more chances of transmission of infection[5,6] especially in the early stages of an outbreak when specific treatments are limited. Importation of novel Coronavirus (COVID-19).

Beside sociodemographic and personal factors, it is also found that COVID-19 is also associated with social stigma which could be because of three main factors: 1) COVID-19 is due to a novel virus and there are still many unanswered questions related to the disease; 2) it is human tendency to be afraid of the unknown; and 3) there is fear, stress, anxiety and confusion among the public regarding its management and outcome. Such stigma leads to discrimination not only against patients but also against healthcare personnel.

Against this background, we conducted a case control study, to identify various risk factors of Covid-19, so that strategy for screening and prevention can be designed.

Methods

The study was conducted at a tertiary care center in Northern India. This study was conducted by the Department of Community Medicine among the patients admitted in Covid wards or visiting the hospital for Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) tests.

Contact data of test results was collected from the medical record and detailed information was collected through phone calls. Each patient was explained the purpose of the study and only those who consented verbally were included in the study. The researcher introduced themselves and after verifying the identity of the patient checked for their availability for telephonic conversation. It took around 8-12 minutes for the researcher to complete the interview, following which patient's queries regarding symptoms, treatment or any other doubt regarding Covid-19 was taken. All the patients tested between 1st February 2020 to 31st March 2020 formed the study pool, which were a total of 422 patients. The laboratory test results of COVID-19 Real Time Reverse Transcriptase Polymerase Chain Reaction (RT- PCR) tests reported as "positive for SARS Covid-19" were taken as Cases and "negative" test report were considered as controls. Out of 422 patients, we were able to contact 206 patients (103 cases and 103 controls). Others were not contacted due to their incorrect contact information, couldn't pick up call, didn't give consent, poor connectivity etc.

Questionnaire: The data was collected using pre-tested, and validated questionnaire designed by National Center for Disease Control, MoHFW, Government of India. It consisted of following items: demographic characteristics, occupation, associated comorbidities, signs and symptoms at the time of admission if admitted, contact history, mechanism of contact and travel history. Six items were on stigma due to COVID-19 status.

The data were first captured in paper-based case record form and then entered in a Microsoft Excel and analysed in SPSS Software version 21.0. Data validation checks were performed at regular intervals for the data entered in the worksheet of MS Excel. Data was expressed as proportion for categorical data and chi-square test or fisher exact test was used. To evaluate the association of factors with COVID-19, Odds Ratio (OR) with 95% Confidence Interval (CI), was calculated by comparing cases and controls. In logistic regression model significant factors in univariate analysis were included and <0.05 value was taken as statistically significant.

Institutional ethical approval was obtained before the start of study and informed consent was taken from each participant. Their privacy and confidentiality were assured.

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Result

A total of 103 patients with RT PCR positive report were identified as cases and with similar number of negative reports were kept as controls. Among the cases, there were 37.9% females and 62.1% males and among the controls, there were 33% females and 67% males which were not significantly different. The mean age of the cases was 41.94±15.23 years and that of controls was 33.31±14.22 years. The median age for cases was 39 years and for controls was 29 years. Around 32% and 53% of the cases and controls lied in the age group of 16-30 years respectively. The mean age of all the participants was 37.63±15.32 years (Table 1).

Table 1. Demographic profile of cases and controls

Parameters	Cases (n=103)	Controls (n=103)	OR	95% CI		p-value
				Lower	Upper	
Age (in years)						
≤30 (n=92)	33 (35.9)	59 (64.1)	0.352	0.199	0.621	0.000
31-45 (n=52)	29 (55.8)	23 (44.2)	1.363	0.725	2.564	0.336
46-60 (n=43)	28 (65.1)	15 (34.9)	2.19	1.089	4.405	0.026
≥60 (n=19)	13 (68.4)	6 (31.6)	2.335	0.851	6.405	0.092
Gender						
Female (n=73)	39 (37.9)	34 (33.0)	1.237	0.698	2.191	0.466
Male (n=133)	64 (62.1)	69 (67.0)				
Occupation*						
Professional (n=56)	23 (41.1)	33 (58.9)	0.61	0.328	1.135	0.117
Semi-professional (n=29)	9 (31.0)	20 (69.0)	0.397	0.171	0.921	0.028
Skilled (n=15)	2 (13.3)	13 (86.7)	0.137	0.03	0.624	0.003
Unskilled (n=2)	0 (0.0)	2 (100.0)	-	-	-	0.498
Unemployed (n=39)	18 (46.2)	21 (53.8)	0.827	0.411	1.663	0.594
Others (n=9)	5 (55.6)	4 (44.4)	1.263	0.329	4.842	0.733
Didn't Respond (n=56)	46(82.1)	10(17.9)	7.505	3.513	16.035	0.001

OR: Odds Ratio, CI: Confidence Interval

*Criteria of classification taken from Kuppuswami Socio-economic scale

Table 2.Symptoms and Signs among cases and controls at the time of hospital visit

Symptoms and signs at admission	Cases (n=103)	Controls (n=103)	OR	95% CI		p-value
				Lower	Upper	
Fever (n=73)	53 (72.6)	20 (27.4)	4.399	2.36	8.199	0.001
General weakness (n=54)	39 (72.2)	15 (27.8)	3.575	1.817	7.035	0.001
Cough (n=56)	43 (76.8)	13 (23.2)	4.962	2.461	10.002	0.001
Runny Nose (n=9)	5 (55.6)	4 (44.4)	1.263	0.329	4.842	0.733
Sore throat (n=31)	21 (67.7)	10 (32.3)	2.382	1.06	5.351	0.032
Breathlessness (n=39)	29 (74.4)	10 (25.6)	3.645	1.669	7.958	0.001
Diarrhoea (n=6)	3 (50.0)	3 (50.0)	1	0.197	5.074	1.000
Pain (Muscular, Chest, Abdomen, joint) (n=22)	9 (40.9)	13 (59.1)	0.663	0.27	1.627	0.367
Nausea/ Vomiting (n=27)	21 (77.8)	6 (22.2)	4.14	1.595	10.746	0.002
Headache (n=31)	26 (83.9)	5 (16.1)	6.618	2.428	18.036	0.001
Irritability/ Confusion (n=9)	7 (77.8)	2 (22.2)	3.682	0.746	18.168	0.088
Asymptomatic (n=89)	24 (27.0)	65 (73.0)	0.178	0.097	0.326	0.001

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Table 3.Underlying existing medical conditions among cases and controls

Underlying existing Medical Condition	Cases (n=103)	Controls (n=103)	OR	95% Confidence Interval		p-value
				Lower	Upper	
Chronic Renal Disease (n=3)	2 (66.7)	1 (33.3)	2.020	0.180	22.628	0.561
Diabetes (n=19)	16 (84.2)	3 (15.8)	6.130	1.728	21.745	0.002
Hypertension (n=24)	20 (83.3)	4 (16.7)	5.964	1.961	18.141	0.001
Asthma (n=2)	1 (50.0)	1 (50.0)	1	0.062	16.206	1.000
Liver disease (n=4)	2 (50.0)	2 (50.0)	1	0.138	7.237	1.000
Heart disease (n=7)	5 (71.4)	2 (28.6)	2.577	0.488	13.594	0.249
Immunocompromised condition including HIV, TB (n=4)	1 (25.0)	3 (75.0)	0.327	0.033	3.195	0.313
Any Other (n=21)	12 (57.1)	9 (42.9)	1.377	0.554	3.425	0.490
None (n=144)	61 (42.4)	83 (57.6)	0.35	0.187	0.655	0.001

On comparing cases and controls, it was found that symptoms like fever, general weakness, cough, sore throat, breathlessness and headache were significantly associated with cases, having an odds ratio of greater than 1 and p-value< 0.05. Tachypnoea (7), abnormal X-ray of lungs (11) and abnormal lung auscultation (11) were only seen in cases but not seen in controls.

Various comorbidities were identified among cases and controls. Apart from those shown in the table, two of the cases reported to be suffering from Chronic Obstructive Pulmonary Disease (COPD) and 2 controls had malignancies.

On analysing various underlying medical condition against controls and cases, it was found that there was a significant difference among cases and controls who had Diabetes (p-value:0.002) and Hypertension (p-value: 0.001) with a high odds ratio of 6.130 and 5.964 respectively.

Around 43% of the patients who visited the hospital for getting tested had a history of contact with a COVID-19 case or suspect.

Among the cases, 35.9% of the patients reported to have a contact, and among the controls, around 50.5% reported to have a contact with a COVID-19 positive case.

Table 4.Contact history among cases and controls

	RT PCR Report		Chi square	p-value
	Positive (n=103)	Negative (n=103)		
H/O contact with COVID-19 case				
Yes (n=89)	37 (35.9)	52 (50.5)	4.451	0.035
No (n=117)	66 (64.1)	51 (49.5)		
If yes, then				
Laboratory confirmed case of COVID-19 (n=64)	29 (78.4)	35 (67.3)		
Person who is under investigation for COVID 19 while that person was ill (n=25)	8 (21.6)	17 (32.7)	1.312	0.252
If yes, then what setting				
While taking samples/ other investigations(n=11)	0 (0.0%)	11 (100.0)	-	0.002
Clinical care of case (among HCW) (n=28)	11 (39.3)	17 (60.7)	0.088	0.767
Housekeeping (Hospital) (n=5)	2 (40.0)	3 (60.0)	0.005	0.941
Caregiver of the case (Specify details of case) (n=17)	8 (47.1)	9 (52.9)	0.260	0.610
Visit to a place where COVID-19 cases are treated or sampled (specify details) (n=9)	7 (77.8)	2 (22.2)	5.403	0.020
others, specify (n=27)	8 (29.6)	19 (70.4)	2.276	0.131
Not known (n=3)	3 (100.0)	0 (0.0%)	-	0.068

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Among those who reported to have a contact with confirmed or suspect case, various mechanisms of contact were, visit to a place where COVID-19 positive cases are treated or sampled, the person was primary caregiver of the case, the person was housekeeping the area, provider of clinical care and sample taking (healthcare workers).

Nearly, 96% of the cases and 93% of the controls did not give history of international travel in the past one month.

Around half of the cases (54.4%) and 23.3% of controls reported to have faced discrimination or changed attitude of their neighbours after revealing their RT-PCR report and this difference was statistically significant (p-value 0.001).

Table 5.Emotional response to RT-PCR report among study participants and their family members.

Emotional response	Cases (n=103)	Controls (n=103)
Response of study participants		
Neutral (n=83)	18 (21.7)	65 (78.3)
Worried (n=78)	44 (56.4)	34 (43.6)
Anxious (n=58)	30 (51.7)	28 (48.3)
No reaction(n=19)	2 (10.5)	17 (89.5)
Sad(n=14)	11 (78.6)	3 (21.4)
Denial (n=10)	9 (90.0)	1 (10.0)
Strong (n=1)	1 (100.0)	0 (0.0)
Response of family members		
Supportive(n=102)	54 (52.9)	48 (47.1)
Worried (n=47)	38 (80.9)	9 (19.1)
No reaction (n=27)	0 (0.0)	27 (100.0)
Neutral (n=21)	0 (0.0)	21 (100.0)
Did not inform family(n=9)	7 (77.8)	2 (22.2)
Sad (n=7)	6 (85.7)	1 (14.3)

Table 6.Regression analysis of factors associated with COVID-19

Variables in the Equation	B	S.E.	Sig.	Exp (B)	95.0% C.I.for EXP(B)	
					Lower	Upper
Age	0.021	0.013	0.114	1.021	0.995	1.048
Fever Chills	0.636	0.496	0.2	1.889	0.714	4.997
General weakness	-0.18	0.514	0.726	0.835	0.305	2.289
Cough	0.691	0.541	0.202	1.996	0.691	5.767
Sore throat	0.148	0.538	0.784	1.159	0.404	3.326
Breathlessness	-0.458	0.57	0.421	0.632	0.207	1.933
Nausea/ Vomiting	0.19	0.756	0.802	1.209	0.275	5.317
Headache	1.108	0.782	0.157	3.027	0.654	14.02
Asymptomatic	-0.63	0.542	0.245	0.533	0.184	1.541
Diabetes	0.374	0.758	0.621	1.454	0.329	6.425
Hypertension	0.813	0.677	0.229	2.256	0.599	8.498
Occupation	0.304	0.083	0.001	1.355	1.151	1.594
History of contact with COVID-19 case	0.956	0.436	0.028	2.601	1.108	6.108
Have you travelled outside India in the past one month	-1.242	0.786	0.114	0.289	0.062	1.349
Constant	-2.611	0.838	0.002	0.073		

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Factors occupational and history of contact with COVID-19 case were independently associated with RT PCR positive cases whereas no other clinical symptoms or comorbid condition or factor found to be predictor of cases in the present study (Table 6).

Discussion

COVID-19 pandemic has now spread to most of the countries in the world and extensive research in terms of demographic profile, clinical course, co-morbidities and various associated social and emotional impacts of the disease is urgently required in order to completely understand the epidemiology and its long-term impact on the human race. The current study is an effort towards estimating the problem in a developing country and understanding contribution of a number of factors in the occurrence of the disease.

In our study, when cases and controls were compared according to age, the odds ratio increased with age, with a maximum odds ratio of 2.335 in people with age> 60 years. The maximum proportion of cases and controls lied in the age group of ≤30 years and the mean age for all the participants was 37.63±15.32 years. The median age for cases was 39 years and for controls was 29 years. The proportion of females (35%) as compared to males was slightly less.

In a nationwide retrospective case control study conducted in Korea,[7] wherein the definition of cases was same as in the current study, the maximum proportion of participants were in the age group 18-49 years. The proportion of females (59.5%) was greater than males. Similar results were found in China,[8] where the clinical characteristics of COVID-19 patients were studied. The median age of the participants was 47 years, maximum patients were in the age group 15-49 years and there were 41.9% females. Jin Jin Zhang et al[9] in a study in Wuhan found that the proportion of males and females were almost equal, the median age of the cases was 57 years and 70% of the cases were aged more than 50 years. Similarly Sijia Tian et al[10] found during the early phase of the pandemic, that the median age of the patients among the admitted hospitals across Beijing was 47.5 years and the proportion of females was slightly more than the males. Pranab Chatterjee et al reported the mean age of the cases as 34.73 years in a case control study among health care workers in India.[11]

In concert with recent studies, we found the most common symptoms among the cases were fever (51.4%), cough (41.7%), breathlessness (28.1%), headache (25.2%) and nausea/ vomiting (20.3%). Clinical characteristics among patients admitted in Wuhan[9] revealed a similar picture with slightly higher percentage of cases suffering from symptoms, that is 91% patients had fever, 75% cough, 36.7% having dyspnoea and 39.6% had Gastrointestinal symptoms. In a study conducted in patients admitted in China[8] till January 2020, 43.8% patients had fever and 67.8% had cough. In another study conducted in Beijing,[10] the most common symptoms were fever (82.1%) and cough(45.8%). The reason that comparatively lesser patients in the current study presented with symptoms, could be that we included all the patients who visited the testing facility whereas in other studies which have described the symptoms of the patients have only taken the admitted patients. That means in the current study, the patients who are not very sick and could be managed by home isolation are included as well, who might not be symptomatic.

Diabetes and hypertension were both found to be high risk factors for developing COVID-19 infection in our study. The odds ratio for diabetes was 6.130 and for hypertension was 5.964. Other important comorbidities which proved to be associated with COVID-19 in the study were renal disorders (OR=2.020) and heart diseases (OR=2.577). The findings of the current study are relatively consistent with the case control study conducted by Wonjun Ji et al.[7] in Korea, where Diabetes and Hypertension were indicated as risk factors for COVID-19.

In our study, 19.4% of the cases were hypertensive, 15.5% were diabetic, 4.8% had heart disease and 1.9% had renal diseases as reported by them. In other studies conducted in Wuhan,[9] Korea[7] and China[8] the respective prevalence among cases were- hypertension (30%, 14.2%, 15%), diabetes (12.1%, 14.2%, 7.4%), heart disease (5%, 10%, 2.5%), renal diseases (1.4%, 4%, 0.7%). There are slight differences in the occurrence of comorbidities among the RT-PCR positive cases which can be attributed to different study setting, different study designs and wide variability in the sample size of various studies.

Finally, in the present study, around 35% of the cases reported to have contact with a COVID-19 positive case. This is in contrast to the results reported by Sijia Tian et al.,[10] where around 60.4% patients reported to have a close contact with cases. This variability can be explained by the fact that the present study is conducted approximately 2 months after the introduction of the Corona virus in the human population, and by then transmission was high and with time it became difficult to exactly identify a case and its contact, whereas the study in Beijing was conducted in the initial phase of the spread of the virus when the cases were few and contact history could be elicited easily.

It was seen that there were numerous reactions to the RT-PCR report among the cases and controls, which indicates the importance of considering mental health issues during this pandemic. This becomes even more important while considering the fact that half of the positive cases experienced discrimination in some or the other form.

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Factors independently associated with the positive cases were age, occupational and history of contact which is similar in place of similarly to observation throughout world. But travel history was not associated with cases which could be due to policy of strict screening at airports therefore only negative patients were able to enter in the country. Except occupational and history of contact no disease symptomatology or comorbid condition was predictor of RT PCR positive cases whereas in other study certain symptoms such as fever, dry cough, loss of smell and tastes were identified as strong predictor of COVID-19.[12]

Limitations

The study was limited to the data extracted from RT-PCR testing centre in a tertiary care centre, representing the patients visiting one hospital in South Delhi, therefore data from other smaller testing centres was missed which could have improved results.

Conclusion

In the present case control study, age, occupation, fever, general weakness, cough, sore throat, breathlessness, nausea vomiting, headache, diabetes, hypertension, and history of contact with COVID-19 cases were found to be associated with cases having high Odds ratios in univariate analysis. But in logistic regression analysis only occupations and history of contact with COVID-19 cases were independently associated with cases than control. A multicentre study is required to assess the risk factors so that a preventive strategy can be drafted at the national level.

Conflicts of Interest: One author is Editor in Chief of the Journal.

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