Get Acquainted with the Secret "It's Duration and not the Type of Contact that matters in COVID-19"

Hamzullah Khan (1)
Mian Mohammad Naveed (2)
Ghazan Khan (3)
Mohammad Zahid Khan (4)
Abu Zar (5)
Fazli Bari (6)

(1) Associate Professor Hematology, Director Research & Development, Nowshera Medical College, MTI Nowshera
(2) Focal person COVID-19, Mian Rashid Husssain Shaheed Memmorial Hospital Nowshera2
(3) Department of Psychiatry, Nowshera Medical College, MTI Nowshera
(4) Deputy Medical Superintendant, Focal Person COVID-19, Qazi Hussain Ahmed Medical Complex Nowshera
(5) Focal person COVID-19 District Nowhsera, District Health Office, Nowshera
(6) Chairman infectious control committee, Nowshera Medical College, MTI Nowshera

Acknowledgment:
Dr Mohammad Arif- Hospital Director, Qazi Hussain Ahmed Medical Complex Nowshera

Corresponding author:
Dr. Hamzullah Khan
Associate Professor
Department of Pathology
Nowshera Medical College, Nowshera, Pakistan
Email: hamzakmc@gmail.com

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Abstract

Objectives: To quantitatively analyze the impact of type of contact and duraton of contact with infectivity of novel Corona virus.

Material and methods: We analyzed 378 suspects/ cases to prove our null hypothesis. Relevant information was recorded on a predesigned proforma prepared in accordance with the objective of the study, in SPSS version 25th.

Results: Out of 378 suspects, 180(47.61%) were advised PCR based on their higher score on the approved scale. Of the total tested cases, 41/180(22.77%) were COVID-19 positive. History of contact with positive COVID-19 patients was contributing in 35/41(85.36%) confirmed cases. We observed that 25/41(60.97%) of the positive cases had a contact history > 5 days. The relationship of duration of contact with COVID-19 infection was statistically significant (*p=0.001*). 22/41(53.65%) of the positive cases had history of hand shake and hugging, followed by 8/41(19.5%) hand shake only and 5/41(12.19%) with history of mass gathering with a significant relation with viral infectivity (*p=0.02*). A moderate uphill positive correlation of duration of contact was recorded with test positivity (*p=0.001, rho=0.33*) as compared to type of contact (*p=0.14, rho=0.11*). We observed that contact with strong suspect/ COVID-19 patients irrespective of type or duration of contact , the probability and relative risk of acquiring infection was 6 times (*OR=6.1, rr=1.82*) more than in case with no history of contact. When the type of contact was kept as static variable and measured the probability for an increase in duration of contact , the probability and relative risk of COVID increases by 26 times (*OR=26, rr=2.83*) as compared to no contact group. At static duration of contact variable, the probability and relative risk for type of contact for COVID-19 was (*OR=1.4, rr=1.03*) as compared to no contact group.

Conclusion: It is the duration of contact and not the type of contact that has a statistically significant correlation and a higher probability of exposure to COVID-19.

Key words: COVID-19, type of contact, duration of contact , correlation, relationship, risk estimation.

Introduction

In China unprecedented measures were taken well in time to control the rapid spread of COVID-19 epidemics. They succeeded in keeping people in homes that were properly achieved by their improved awareness, attitude and approach towards COVID-19(1). COVID-19 (Corona virus disease) was first reported from the metropolitan city, Wuhan, Hubei province of China in Dec 2019 and caused severe respiratory disease/pneumonia. The etiology of COVID-19 is yet to be confirmed, but the majority of scientists agree that it most likely originated from the zoonotic Corona virus, SARS-CoV that emerged in 2002(2). Corona Virus disease termed as COVID-19, is an emerging highly contagious respiratory disease that is caused by novel Corona virus. Its main clinical symptoms are fever, dry cough, fatigue, and dyspnea(3). Regarding the spread of the disease, the basic reproduction number for COVID-19 is 2.3 as compared to influenza virus with a reproduction number of 1.3. Hence the risk of transmission in case of COVID-19 is 1.8 times more than influenza virus (4).

Studies from the epidemic areas have reported different presentations of COVID suspects/patients. A study from China reported fever (23, 82.1%), dry cough (22, 81%) and dyspnoea (14, 50.0%) and lymphopaenia (23, 82.1%) in their study patients(5). There is limited detail known about the clinical features, presentation and even the incubation period of this deadly virus, which has an impact on the control and surveillance of an infectious disease. The incubation period of the 2019-nCoV is reported from 6 days to 12 days(6). The at risk populations are close contacts of COVID-19 infected patients, healthcare workers, family members of infected patients. A study from the mainland China reported that the infectivity ratio was (89%) in family members and other close contacts of COVID-19 patients(7).

In Pakistan the so for reported data from government sources declares 11,940 confirmed cases with 253 deaths(8). There is a need to know the causes and mechanisms of the spread of the virus in our population. Therefore present study was designed to determine the statistical significance of type and duration of contact with COVID-19 patients and its relation with viral infectivity in our population.

Material and Methods

This cross sectional study was conducted from 5th February to 27th April 2020 in a major tertiary care hospital of Nowshera in collaboration with District Health Office Nowshera. A total of 378 suspected COVID-19 patients were included. Assuming 4% prevalence of COVID-19 in the general population from the study of Zhou X et al (9); a reference population of 100,000 patients was estimated to reside in the catchment area of our hospital, belonging to district Nowshera of Khyber Pakhtunkhwa, Pakistan. A sample size of 378 was calculated through Open-epi software, an online sample size calculator, with Absolute precision of 5%, confidence interval of 95%, and a drop out of 10%.

All the suspects who attended the COVID-19 clinic irrespective of age and gender were randomly selected. All patients with any type of symptoms who came to emergency or outdoor patients department were excluded. Ethical endorsement was obtained from the institutional ethical review board of Nowshera Medical College hospital administration before the execution of the survey. Prior informed consent was obtained from all suspects and they were assured of confidentiality. All those suspects with COVID proforma score more than 5 were subjected for testing their nasopharyngeal swabs for 2019-nCoV. This scoring system applies only on sampling from QHAMC. Data of COVID-19 clinic of Qazi Hussain Ahmed Medical Complex 274 (72.5%), however the patients whose PCR was sent by the district health authorities were also included from the district line list 104 (27.5%). All samples were sent under strict observance of protocols to the Public health research laboratory of Khyber medical university Peshawar (a designated Lab for PCR of 2019nCoV by the Government of Khyber Pukhtunkhwa). All the suspects with score less than five were not subjected to lab investigation, advised precautionary measures and sent home.

Operational definitions

Child: Article 1 of The United Nations Convention on the Rights of the Child defines a child as “for the purposes of the present Convention, a child means every human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier” (10).

Adult: Young adult 19-35 years, middle-aged adult 36-55 years and older adult > 56 years(11).

Data was entered in SPSS 25th version and descriptive and correlation statistics were applied. The frequency and proportion of numerical and categorical variables were presented in percentages. Correlation tests using Spearman ranked correlation was used to determine the correlation of PCR positivity with type and duration of the contacts. Chi-square test was used to show a relationship of the viral infectivity with age categories, type of contact, duration of contact s of the suspects/cases. Relative risk analysis was done for risk estimation in groups with and without history of contact in general, and for the individual variables (type and duration of contact) with strong suspects/COVID-19 patients. Odd ratio was calculated to show the probability of COVID-19 in patients with and without history of contact, type of contact and duration of contact .

The criteria and scoring for patient selection for PCR testing mentioned in Table 1 was approved by the administration of QHAMC on the recommendation of the infectious disease control committee, keeping in view the shortage of Viral Transport Media (VTM) supplied by the government.

Results

Out of 378 suspects, 180(47.61%) were advised PCR based on their higher score on the approved scale. Of the total tested cases 41/180(22.77%) were COVID-19 positive. History of contact with positive COVID-19 patients was contributing in 35/41 (85.36%) confirmed cases. We observed that 25/40 (60.97%) of the positive cases had a contact history > 5 days. The difference in the duration of contact and its relation with COVID-19 infection in term of positivity of test by PCR was highly statistically significant using Chi-Square test (*p=0.001*). (Table 2).

We noted that 22/41 (53.65%) of the positive cases had history of hand shake and hugging, followed by 8/41(19.5%) with history of simple hand shake and 5/41 (12.19%) with history of mass gathering. The difference in the type of contact and its relation with COVID-19 infection in terms of positivity of test by PCR was statistically significant using Chi-Square test (*p=0.02*). (Table 3).

Using Spearman correlation test to quantify the strength of correlation of type and duration of contact with infectivity (test positivity) we observed a moderate uphill positive correlation of duration of contact with test positivity (*p=0.001, rho=0.33*) as compared to type of contact that was not statistically significant (*p=0.14, rho=0.11*). Hence the relationship (one sided from cause to effect) that was observed in Table 3 is attributed to have occurred by chance as there is no correlation of type of contact with test positivity (double sided-interrelation). Here the lesson learned is that it is the duration of contact that is directly related to infectivity and not the type of contact. (Table 4)

Furthermore using risk analysis to stratify the contribution of type of contact versus duration of contact , we observed that contact with strong suspect/ COVID-19 patient irrespective of type or duration of contact , the probability of acquiring infection is 6 times (*OR=6.1*) more than in the case with history of no contact. Similarly the relative risk for contact is (*rr=1.82*) as compared to no history of contact (0.27), confirms it to be a strong risk factor.

Now when we kept the type of contact as static variable and measured the probability for an increase in duration of contact (from 2 hours to more than 5 days), astonishingly it was observed that probability of COVID increased by 26 times (*OR=26*) with relative risk of (*rr=2.83*) as compared to no history of contact (0.10).

When we kept the duration of contact as the static variable and measured the probability for type of contact (from simple hand shaking to hugging and mass gathering), it was observed that probability of COVID increased by 1.4 times (*OR=1.4*) with relative risk of (*rr=1.03*) as compared to no history of contact (0.7). (Table 5)

This analysis statistically supports that it is the *duration of contact* that matters in COVID-19 infection and not the *type of contact.*

Table 1. Criteria for COVID-19 scoring system.	
Fever, Cough, Sorethroat	1 each
Shortness of breath, Travel history to an epidemic areas	2 each
Contact history with confirmed case/ Close relatives of the COVID-19 patients	6
TOTAL :	13
Strategy to act:	
Score <5 :	Quarantine / stay home
Score:6-8	Do Labs & Inform Focal Person
Score:8-10	Labs : Needs Isolation/admission inform Focal Person

Table 2. Viral infectivity and *duration of contact*									
		Duration of contact							Chi-Square test
		2-5 hours	48 hours	3-5 days	>5 days	Not remembered	No Contact	Total	
PCR Categories	Positive	3	7	5	20	3	3	41	
	Negative	9	35	30	27	9	227	337	
Total		12	42	35	47	12	230	378	*p=0.001*

Table 3. Viral infectivity and *type of contact*

		Type of contact					Total	Chi-Square test
		Hand shake	Hand shake and Hug	Mass gathering	No contact	Healthcare worker		
PCR Categories	Positive	8	22	5	6	0	41	
	Negative	54	16	2	44	23	139	
Total		62	40	7	48	23	180	*p=0.02*

Table 4. Spearman's correlation test to quantify the strength of correlation of type and *duration of contact* with infectivity

			PCR Categories	*Duration of contact*	*Type of contact*
Spearman's Rho	PCR Categories	Correlation Coefficient	1.000	*.327***	.110
		Sig. (2-tailed)	.	*.000*	.142
		N	378	378	180
	Duration of contact	Correlation Coefficient	*.327***	1.000	.634**
		Sig. (2-tailed)	*.000*	.	.000
		N	378	378	180
	Type of contact	Correlation Coefficient	.110	.634**	1.000
		Sig. (2-tailed)	.142	.000	.
		N	180	180	180

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5 5.1. Risk Estimate for COVID-19 with positive contact, irrespective of duration and *type of contact*			
		95% Confidence Interval	
	Value	Lower	Upper
Odds Ratio for PCR Categories (Positive / Negative)	*6.6*	2.70	16.12
For cohort Contact History = Yes	*1.82*	1.53	2.15
For cohort Contact History = No	0.27	0.13	0.58
N of Valid Cases	378		
5.2. Risk Estimate for COVID-19, based on *duration of contact* not biased of *type of contact*			
		95% Confidence Interval	
	Value	Lower	Upper
Odds Ratio for PCRCAT (Positive / Negative)	*26.13*	7.89	86.54
For cohort with *duration of contact* = contact (24-hours to more than 5 days)- keeping the *type of contact* un-biased	*2.83*	2.38	3.38
For cohort with history of contact = No	0.10	0.03	0.32
N of Valid Cases	378		
5.3. Risk Estimate for COVID-19 based on *type of contact* , not biased by *duration of contact*			
		95% Confidence Interval	
	Value	Lower	Upper
Odds Ratio for PCRCAT (Positive / Negative)	*1.38*	0.47	4.08
For cohort with *type of contact* = Yes (from Hand shake to hug and mass gathering)- keeping the duration unbiased	*1.03*	0.93	1.15
For cohort *type of contact* = No	0.74	0.28	1.97
N of Valid Cases	378		

Discussion

Research on population is a process to answer a question, to prove or disprove an assumption or hypothesis for a specified population on a specific issue. Here in the present study our null hypothesis was that rate of infectivity is the same for the variables, type and duration of contacts. We tried to know about what matters more, the type of contact or duration of contact . We recruited 378 suspects where 191 (51.1%) of the suspects had history of contacts with strong suspects/patients. There were 41 (27.7%) cases that were positive out of 148 cases that were selected from the total sampling under a strict criteria due to limited number of Viral transport media.

Scoring in such a situation is the need of time to avoid wastage of resources. In many countries they keep in mind the risk factors in the form of age, gender, travel history, higher markers level like d-dimers>1ug/ml etc are the clues that helps clinicians to identify patients for further trial(12).

We observed that 25/41 (60.97%) of the positive cases had a contact history > 5 days. The relationship of duration of contact with COVID-19 infection was statistically significant (*p=0.001*). Anzai A et al(13) reported a lower rate of infectivity proportion of 30% for history of close contacts while Qiu H et al(7) reported 89% in a study reported from mainland China.

The rate of infectivity depends widely on the incubation period that is reported between 2-14 days in the literature and also on the duration of exposure and also on the immune status of the patient to acquire infection(14).

A study reported in Lancet showed that the attack rate in COVID-19 infection in close contacts of the confirmed cases is 7%, but 80% of the suspects would develop mild symptoms but that would resolve and may not progress into the disease (COVID-19), while a further 3% would need intensive care. The exposure duration matters irrespective of the type of contact s with these cases that supports our findings(15).

A moderate uphill positive correlation of duration of contact with test positivity was (*p=0.001, rho=0.33*) as compared to type of contact (*p=0.14, rho=0.11*). When the type of contact was kept as a static variable and measured the probability for an increasing duration of contact , the probability and relative risk of COVID increases by 26 times (*OR=26, rr=2.83*). Another study from China reported that

there was a moderate uphill positive Spearman correlation of duration of exposure in days with COVID-19 and its complications (*p=0.01, r=0.68*) (16) that coincides with our findings.

Hence stress should be given on duration of exposure to a positive cases as compared to type of contact like shaking hand, hugging or mass gathering. China has succeeded to control and get rid of this deadly virus by taking strict action, including suspension of public transport, closing of recreation places, ban on social gathering and isolation and care of suspected cases in quarantine to succeed in the fight against Corona(1,13,17).

Finally we concluded that it is the duration of contact and not the type of contact that has a statistically significant correlation with COVID-19 infection. This would support the WHO declaration that the dead body can be buried with all religious privileges in a short span of time. Because it is the duration of contact that means and to the lesser extent type of contact.

There are some limitations like delayed diagnosis, stigma associated with disease, lesser exposure to contact patients for their opinion and proper history in this crucial timings, that does not allow us to know the exact time required for transmission of virus from a diseased patient to an asymptomatic person to get infected. This would help the clinicians and public health experts to decide "how much duration" for transmission of infection. This would resolve many issues like burial of the deceased with Corona and to give them proper religious protocol and to please the relatives of the deceased as there is a social stigma associated with this disease and people are afraid to attend the hospitals and they die at home, not tested and this is more dangerous in term of viral transmission behind the stigma.

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