

Original Article

Risk assessment of acquiring SARS-CoV-2 infection among employees of a tertiary cancer care center

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ABSTRACT

Objectives: Continuation of health-care facilities for non-COVID illness during the SARS-CoV-2 pandemic is mired with apprehension of infection to health care workers (HCWs). The lack of facilities can result in dire outcomes for patients of NCDs such as cancer. The Objective of this paper is to assess the risk of running a healthcare facility during the pandemic.

Material and Methods: A retrospective analysis was carried out at a tertiary cancer hospital to understand the quantum of risk to HCWs while providing care to patients of cancer and to SARS-CoV-2 patients, within the same set-up with optimal segregation. Data were collected for 6 weeks during which attendance, exposure, and infection status of doctors and nurses were recorded along with comorbidities.

Results: Of 1041 doctors and nurses who attended duties during the study period, 299 worked in dedicated COVID care areas while 742 worked in routine cancer care areas. The proportion of HCWs that developed symptoms or were tested positive for COVID-19 was 3.7% and 3.9%, respectively, with no statistically significant difference between the two. The proportion for the same was found to be 1.2% among the 645 staffs who were on leave. No correlation could be established between pre-existing comorbidities and risk of acquiring infection.

Conclusion: Providing COVID care and routine specialty care within the same hospital premises do not put the HCWs at a drastically increased risk of acquiring infection subject to clear demarcation of work areas, screening at gates by trained personnel, regulation of number of hospital visitors, and optimal use of PPEs.

Keywords: COVID-19, Cancer, Health care workers, Pandemic

INTRODUCTION

Globally, over 140 million have been infected with the SARS-CoV-2 virus.^[1] With almost 15 million infected cases, so far in India and over 0.17 million fatalities, the COVID-19 pandemic has taken a huge toll on India. The Mumbai Metropolitan Region with a population of over 26 million has recorded over 0.76 million SARS-CoV-2-positive cases,^[2] a fatality rate of 2.5% and recovery rate of 95%.^[3]

While efforts have been focused on ramping up the health infrastructure to tackle the COVID pandemic, the availability of health care for patients suffering from non-COVID illnesses has suffered and could lead to potentially poor outcomes. A global modeling study on the impact of the COVID-19 pandemic on surgeries projected that 59.7% of cancer surgeries were postponed in India during the peak 12 weeks of disruption last year, translating to 51,100 postponed cancer surgeries.^[4]

It has been reported that health care workers (HCWs) form 15%–20% of total positive cases in some countries.^[5,6] Studies have also suggested that the HCWs are at 3–12 times higher risk of acquiring infection in the US, the UK, and China.^[7,8] It is also to be noted that those who reported that they had inadequate access to PPE had a higher risk of acquiring the infection. This paper attempts to understand the risk of acquiring SARS-CoV-2 infection in HCWs in a tertiary cancer hospital while caring for cancer patients with SARS-CoV-2 infection while sustaining routine cancer care.

MATERIAL AND METHODS

This study was conducted from May 22, 2020, to July 4, 2020, at a premier Cancer Care Institute in Mumbai with 640 beds and employing more than 4000 staff. Considering the unique needs of cancer patients, the hospital dedicated 100 isolation

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beds including ICU beds for patients of cancer suffering from COVID. An exclusive fever OPD was established for assessing patients triaged as suspected SARS-CoV-2 infection based on screening being conducted at all entrances of the hospital.

A team of individuals trained for screening patients was deputed at all the hospital entrances. They conducted a surface temperature scanning and administered a COVID questionnaire to triage all visitors (patients as well as attendants) with a suspicion for harboring the SARS-CoV-2 virus. Those triaged as high risk were sent to the fever OPD where a reassessment was done by a clinician and advised RT-PCR for SARS-CoV-2 if indicated. The patients who tested positive on RT-PCR were sent to isolation wards (designated COVID care areas [DCCAs]) for admission and those tested negative were sent to the cancer care provider in the routine cancer care areas (RCCAs). Educational posters advocating cough hygiene and hand washing were placed at prominent areas of the hospital. The employees working in DCCA used complete PPE comprising Cap, N95 mask, face shield, and body coveralls with a segregated donning and doffing rooms with shower. The employees in RCCA used a Cap, face shields, and N95 mask and were also sensitized on infection control practices.

Data were recorded pertaining to the category of HCW (doctors and nurses), their demographic details with comorbidities, area (RCCA or DCCA), and duration of work. Following comorbidities were noted as relevant – hypertension, cardiovascular disease, diabetes, renal disease, cancer, autoimmune disease, and organ transplant on immunosuppressant medications.

DCCAs were areas involving direct contact with known or suspected COVID-positive patients and included the COVID isolation wards, COVID ICU, and fever OPD. RCCAs were the remaining areas of the hospital involving no direct contact with known COVID-positive patients. Staff working in these areas had exposure to patients, coworkers, and visitors or attendants. Here, the potential exposure risk could be from asymptomatic infected colleagues or screened negative asymptomatic infected patients.

Staffs who developed signs and symptoms of COVID disease and high-risk contacts of tested positive cases were tested by RT-PCR.

The hospital mandatorily conducted SARS-CoV-2 RT-PCR tests of all patients posted for surgery, 48 h before surgery. These were patients who were screened at the hospital entrances and were triaged as not likely to have COVID and hence posted for surgery. Some of these asymptomatic preoperative patients tested positive for SARS-CoV2. The proportion of such cases was considered as a surrogate for the magnitude of asymptomatic carriage in asymptomatic patients and staff entering the hospital.

Thus, the quantum of exposure of HCWs working in RCCA to SARS-CoV-2 infected patients was effectively to a floating pool of 19,484 patients and their attendants who were triaged as low risk during the gates screening, during the study period. The mandatory pre-operative RT-PCR testing of 536 patients resulted into 66 positive cases, that is, 12.31% of the patients who were triaged as low risk at gate screening turned out to be tested COVID positive on RT-PCR. Using this as a surrogate for estimating the exposure to SARS-CoV-2 for those working in RCCAs, the potential quantum of exposure to SARS-CoV-2 for the HCWs working in RCCA was 12.3% (about 2400).

On the other hand, the HCWs in DCCA were exposed effectively to all the 405 SARS-CoV-2-positive patients admitted in the isolation wards or ICU during the tenure of the study and were thus the quantum of exposure was 100%.

Statistical analysis

The proportion of HCWs (medical and nursing staff) testing positive for SARS-CoV-2 in the backdrop of their attendance during the study period, age, comorbidity, and work area was analyzed. The continuous variable (age) was expressed as mean \pm standard deviation. The proportions of SARS-CoV-2 infections acquired (positivity) during the study period were compared for each category using Chi-square tests at a significance level of 5% [Table 1]. The positivity among the HCWs working in RCCA and DCCAs was described using percentage and 95% CI. A binary logistic regression was used to find out the weights of influence of inherent attributes of participants (input variables), that is, gender, age, comorbidity, area of work, category of HCW, and blood group, on the positivity (output variable). All analyses were carried out using IBM SPSS Ver 25.

RESULTS

The hospital employs a total staff of 4220 employees, of which 1686 are medical (742) and nursing (944) staff, classified as HCWs in this paper, and were the focus of this study. Of the HCWs studied, 645 were on leave during the study period for various reasons and 1041 attended duties. The proportion of staff deputed to DCCA was approximately 29% (299/1041) while the remaining 71% (742/1041) worked in the RCCA.

Of the 1041 staffs who attended duties during the study period, 50.4% (525/1041) were nurses and 49.6% (516/1041) were doctors. The mean age was 36.2 years (33–65 years) and the median was 33 years. About 70% (721/1041) of the studied staff were female and 25% (259/1041) of HCWs had pre-existing comorbidities.

Of the 1041 HCWs who attended duties during the study period, 40 turned positive (3.8%, 95% CI: 2.8–5.2). Among

Table 1: Statistical results.

n=1041	SARS-CoV-2 infection		Univariate		Logistic regression		
	Absent n (%)	Present n (%)	Test statistics	Significance (P)	RR	95% CI	Significance (P)
Age							
Mean	36.04	38.75			1.03	0.99–1.07	0.14
SD	9.19	9.5					
Min–Max	33–65	38.5–55					
Age							
>50	93 (94.9%)	5 (5.1%)	0.47	0.42			
<=50	908 (96.3%)	35 (3.7%)					
Gender							
Female	689 (95.6%)	32 (4.4%)	2.25	0.16	1.48	0.57–3.85	0.42
Male	312 (97.5%)	8 (2.5%)			1		
Category							
Medical	501 (97.1%)	15 (2.9%)	2.42	0.15	1	0.54–2.73	0.65
Nursing	500 (50.0%)	25 (62.5%)			1.21		
Comorbidity							
Absent	753 (96.3%)	29 (3.7%)	0.15	0.71	1	0.48–2.18	0.96
Present	248 (95.8%)	11 (4.2%)			1.02		
Area of work							
RCCA	713 (96.1%)	29 (3.9%)	0.03	1.0	1	0.52–2.29	0.83
DCCA	288 (96.3%)	11 (3.7%)			1.09		
Blood group							
A	223 (95.7%)	10 (4.3%)	3.87	0.28	1		
B	326 (97.0%)	10 (3.0%)			0.68	0.27–1.68	0.41
AB	89 (92.7%)	7 (7.3%)			1.82	0.67–4.98	0.24
O	345 (96.4%)	13 (3.6%)			0.82	0.35–1.91	0.64

DCCA: Designated COVID care area, RCCA: Routine cancer care area

299 HCWs in DCCA, 11 tested positive (3.7%, 95% CI: 2.07–6.5) compared to 29 HCWs testing positive in RCCA 29/742= 3.9%, 95% CI: 2.7–5.6 ($P = 0.86$).

Of the 645 HCWs who were on leave during the entire study period representing no occupational exposure to SARS-CoV-2, 8 reported COVID disease (8/645 = 1.2%) (95% CI: 0.6–2.4) while at home. This could represent the risk of acquiring the infection due to ambient exposure. Thus, the SARS-CoV-2 positivity rates among HCWs in DCCA, RCCA, and HCWs on leave were 3.7%, 3.9%, and 1.2%, respectively, with corresponding quantum of exposures of 100%, 12%, and minimal baseline exposure, respectively.

There were no COVID-related deaths among the staff of the hospital during the study period as well as during an overall duration of the pandemic, that is, from March 2020 to December 2020.

A multivariate analysis was done with binary logistic regression wherein the output parameter was the “Possibility of Acquiring the Infection” and the input parameters were gender, age, blood group, pre-existing comorbidities, category of HCW, and area of work (DCCA or RCCA). There was no significant correlation with any of the factors [Table 1].

DISCUSSION

During the study period, the hospital looked after 282 cancer patients with COVID disease. This number has neared 2000 by the end of December 2020. These were patients who needed special clinical expertise and could not be effectively managed at routine COVID care facilities. The hospital also delivered services to routine cancer patients during the pandemic at 60% volumes compared to the same period previous year.

As per GLOBOCAN 2018,^[9] the national cancer incidence for India is 1.1 million and the prevalence is 2.26 million. With 0.78 million deaths for the year, the case fatality rate works out to 22.9%. This is almost 16 times higher compared to the case fatality rate of COVID cases in India which is approximately 1.45% (0.14 million deaths for 9.8 million cases). If access to health care for cancer patients is not provided timely, the consequences in terms of mortality rates would be dramatic.

The hospital set-up where this study was conducted has been running both COVID care and routine cancer care facilities within the same premises, albeit with a clear-cut demarcation and segregation. A difference of exposure of the scale of 12.31%

versus 100% is certainly wide and therefore has the potential to show widely different positivity patterns among HCWs.

Ward *et al.*^[10] suggested a 2.5-fold increased risk of infection for HCWs in patient facing roles compared to non-patient facing roles, based on serology tests.

In a study by Baveja *et al.*^[11] in a tertiary hospital in Mumbai, an overall seropositivity of 6.9% was found among the hospital staff. Furthermore, there was no difference in seropositivity between staff in COVID and non-COVID areas, thereby concluding that seropositivity for SARS-CoV-2 in HCWs was probably more related to community-level transmission than hospital transmission. Our results indicate that the risk of acquiring the infection was not significantly dependent on the area of work or the quantum of exposure. The HCWs from DCCA tested positive were 3.7% (11/299), (95% CI: 2.07–6.5) and those working in RCCA tested positive were 3.9% (29/742), (95% CI: 2.7–5.6).

As the RT-PCR tests were done only on symptomatic HCWs and high-risk contact HCWs, asymptomatic cases may not have factored in these results. Furthermore, the HCWs in this study had a younger age profile with 70% of staffs being below 40 years of age and 75% of staffs having no comorbidities.

The results reflect the impact of triaging of patients at hospital gates, cost-effective infection control measures customized to the location setting such as rational PPE usage and measures to reduce overcrowding through teleconsultations.

Some staff would travel using public transport means such as buses or pooled cars, which come with their own contributory risk of testing positive. Contact tracing has been found to be one of the highly effective means of curtailing risk to staff while continuing duties with low-risk staff.^[12] Our hospital had a dedicated team that would conduct contact tracing, if any staff or patient was detected COVID positive from the RCCA or DCCA. High-risk contact staff with no quarantine facilities was provided accommodation.

Although the risk of acquiring infection, among those who attended duties during the study period, was approximately 3.8% for medical and nursing staff, it is debatable, what proportion of those positive cases can be attributed to infection acquired in the hospital. Even if it is assumed that all the cases can be attributed to hospital acquired infection, one needs to weigh it against the magnitude of patients treated.

During the period of study, the hospital continued offering services to all patients who visited despite the COVID pandemic, thereby conducting nearly 1500 surgeries (500 major and 1000 minor), administering nearly 5000 chemotherapy sessions and providing about 250 radiotherapy sessions which are roughly 40%, 47%, and 56% of the same services in the corresponding period previous year. The

number of new patient registrations during the study period went down to 30% of corresponding period previous year, arguably due to the nation-wide lockdown but this was offset partly by proactive telephonic follow-ups and teleconsultation. Due to the designated cancer-COVID care facility, the hospital could take care of nearly 500 cancer patients suffering from COVID. These were patients who required specialized healthcare to deal with the combined disease, many of whom would have been left unattended otherwise.

The above discussion makes a strong case to continue running of various primary and specialty health-care services with due precautions.

This could translate to numerous lives saved, especially when compared to the untenable option of suspending specialty hospital services to protect the HCWs and patients as that would potentially impact immediate and future morbidity and mortality from cancer and other non-communicable diseases in the nation. With the present burden and health infrastructure in various cities in the world comparable to Mumbai, this model can be replicated to sustain routine non COVID care in hospitals in addition to COVID care on the same premises with reasonable safety to patients and staff.

The staffs that were on official leave, either voluntarily or due to certain pre-existing vulnerabilities such as age, pregnancy, or other comorbidities, were found to have lesser positivity rate (1.2%) than those who attended duties (3.8%). This can be attributed to very minimal exposure to SARS-CoV-2 and an increased sense of carefulness. This also led to reduced risk to staff who attended duties during the study period. Health-care facilities must meticulously identify such HCWs and offer them work involving low exposure to potentially infected patients.

CONCLUSION

A large number of cancer patients, with or without COVID, would have been deprived of treatment as well as continuum of care and thereby faced severely poor outcomes of the disease if the cancer center in this study had not been functioning as above. It may be concluded from our study that the risk to hospital staff of acquiring infection at work during the pandemic can be kept well under control if adequate safety measures are adopted by the hospital and its staff.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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