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Original Research Article

Occupational COVID-19 exposure among health care workers in obstetric unit in a Central Government Hospital in India: initial experience

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ABSTRACT

Background: Health care workers (HCW) are the frontline warriors who are at a high risk of acquiring the COVID-19. HCW in obstetrical department are at high-risk due to their close proximity with the patient for examination, giving treatment and in delivery. The objectives of this study were to evaluate the positivity rate of COVID-19 in the initial 3 months of pandemic in health care personnel working in obstetric unit in a tertiary care hospital.

Methods: Prospective cohort study was conducted in department of obstetrics and gynecology at tertiary care hospital in Delhi from 10 April to 10 June 2020. Predesigned questionnaire was used to record data of HCWs exposed to COVID-19 patients.

Results: In a period of 3 months (April-June 2020), 152 health care workers were exposed to 30 COVID-19 patients. Out of this, 10 HCW were found to be positive on testing, showing a positivity rate of 6.58%. Positivity ratio was 6:3:1 among nurses, auxiliary workers and doctors respectively. Labor room was area of high infection as 80% of HCW were infected in the labor room. 80% HCW acquired infection during patient care in hospital and 20% were infected in contact with asymptomatic COVID-19 positive HCW.

Conclusions: Positivity rate in obstetric department is comparable to that of general population. Appropriate infection prevention measures like use of PPE, handwashing and maintain safe distance from the patient is the key to prevention of infection. Gloves and N95 masks have been shown to provide superior protection as compared to triple layer masks. Nursing staff and auxiliary workers should be reinforced the importance of use of PPE, hand hygiene and physical distancing.

Keywords: Health care workers in obstetric ward, COVID-19 exposure, Positivity rate

INTRODUCTION

The outbreak of coronavirus disease (COVID-19) first emerged in Wuhan, Hubei Province, China, in December 2019.¹⁻³ On 30 January 2020, the WHO declared a public health emergency of international concern. The same day, first case of COVID-19 was reported in India.⁴ India is the most vulnerable country in South Asian region to COVID-19 and currently has the largest number of confirmed cases in Asia.⁵ Health care workers (HCW) are the frontline warriors in COVID-19 pandemic. They face an additional

occupational risk besides the risk faced by general population. Infection rate in reported health care workers in China, Italy, UK and Spain are 3.8%, 10%, 18% and 26% respectively.⁶⁻⁹

In China, higher infection rate was reported in non-first-line HCWs (1.4%) than first-line HCWs (0.5%).¹⁰ Factors associated with increased risk of infection in HCW are inadequate Personal protective equipment (PPE), inadequate hand hygiene, work overload, insufficient diagnostic testing and exposure to asymptomatic infected

patients.¹¹⁻¹³ The primary route for the spread of COVID-19 is thought to be through aerosolized droplets that are expelled during coughing, sneezing, or breathing, but there also are concerns about possible airborne transmission. HCW working in the departments like anesthesia, respiratory medicine eye, ENT, dental are more at risk to corona infection as they are near the airways of infected patients. The procedures performed by anesthetist's like tracheal intubation are aerosol-generating and there is robust evidence of an association transmission of infection during these procedures.¹⁴

In pregnancy, progesterone increases ventilation by increasing the sensitivity of respiratory center to carbon dioxide as a result the tidal volume and minute ventilation is increased.¹⁵ A pregnant woman breathes slightly faster and more deeply to exhale more carbon dioxide. Second stage of labor is a crucial event for transmission of infection as the patient hyperventilates and is unable to keep the mask in position. It is not possible for the HCW to maintain distance from the patient during labor. The hyperventilation in pregnancy and labor in obstetric unit might put the health care workers at higher risk of exposure.

There is paucity of literature about exposure risk in HCW in obstetric ward. The aim of the study was to determine the positivity rate of COVID-19 among HCW working in the department of obstetrics in a government hospital in Delhi and to determine the factors associated with increased risk of infection.

METHODS

This prospective cohort study was conducted in department of obstetrics and gynecology at central government tertiary care hospital in Delhi from April to June 2020. All HCW working in the department of obstetrics and gynecology who came in contact with COVID-19 positive patient/HCW from 10 April to 10 June 2020 were contacted telephonically and variables like age, gender, category of HCW, type of exposure, distance from patient, duration of contact, PPE used were recorded on excel sheet, after obtaining their consent. COVID testing of contact was done by RT-PCR from day 5 to day 10 or earlier if symptomatic or breach in personal protection noted and report was recorded. HCW who were in non-obstetrical departments and whose home contact was positive were excluded from the study. HCW were classified as symptomatic if they had symptoms like fever, chills, malaise, rhinorrhea, nasal congestion, sore throat, myalgia, dizziness, headache, nausea, diarrhea, anosmia, loss of taste.

The following definitions were used for data analysis.

Health care worker

Any health care worker working in labor room, gynae ward and opd in department of obstetrics and gynecology.

They were further divided into 3 categories as- (a) doctor (resident and PG student); (b) nursing staff; and (c) auxiliary workers.

Source

Any pregnant patient or HCW with positive RT PCR for corona, both symptomatic and asymptomatic.

Contact

A contact of a COVID-19 case is any person (in our case HCW) who has had contact with: (a) A COVID-19 symptomatic case within a timeframe ranging from 48 hours before the onset of symptoms of the case to 14 days after the onset of symptoms; (b) HCW who has had contact with any asymptomatic source within a timeframe ranging from 48 hours before the sample was taken to 14 days after the sample was taken, which was reported positive for COVID-19.

Exposure was defined as coming in close contact with a confirmed COVID-19 positive patient or HCW. Close contact includes: (a) providing care for a person who has COVID-19; (b) being within 2 m of a person with COVID-19 for 15 minutes or more, or; (c) having exposure to respiratory secretions from a person with COVID-19 (e.g., being coughed or sneezed on, sharing a drinking glass or utensils).

Positivity rate in obstetrics ward was defined as number of health care workers exposed to patients and each other and subsequently testing positive in 14-days period.

$$\frac{\text{Number of HCW testing positive} \times 100}{\text{Total number exposed}}$$

Statistical analysis

The data was entered in MS excel spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean±SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non-parametric test was used.

Statistical tests were applied as follows- (a) quantitative variables were associated using independent t test (as the data sets were not normally distributed) between the two groups; (b) qualitative variables were associated using Fisher's exact test; (c) multivariate logistic regression was used to find out significant risk factors of COVID-19. A p value of <0.05 was considered statistically significant.

RESULTS

The index case of labor ward was admitted on 10 April and reported positive on 12 April 2020 following which 30 patients tested positive by RT PCR. All health care

workers exposed to the COVID positive patients were quarantined and all were tested with RT PCR from day 5-10 or on the day of developing symptoms at earliest. In a period of three months, 152 health care workers were exposed to COVID-19 patients. 10 health care workers were found to be positive on testing, showing a positivity rate of 6.58%. Out of 10 HCW infected with COVID-19, six were nursing staff (60%) and 3 were workers (30%). Out of 51 doctors exposed to COVID-19, one tested positive for COVID-19 in a period of 3 months (Figure 1).

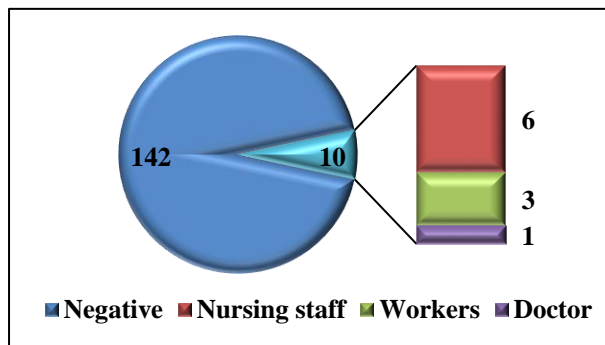


Figure 1: Positivity rate of COVID-19 of HCW.

The mean age of positive and negative HCW was 38 years and 33 years, respectively (Table 1). Nursing Staff comprised a greater proportion of positive employees compared to workers and doctors (10% vs 7% vs 2%). 80% (8/10) COVID positive HCW were infected in labor room while 20% were in OPD.

On analysis of safety measure used by HCW to prevent COVID-19 infection, it was seen that 98% of those who wore PPE, N95 mask, gown and gloves had less chance of getting infected and this difference was statistically significant. It was observed that 80% (8/10) of HCW who got infected were wearing triple layer face mask (Table 2).

On multivariate regression analysis glove and masks were independent protective factors for COVID-19 (Table 3).

All the HCW who tested positive were in close contact with the patient (<2 m). 60% had a prolonged contact (more than 15 minutes of exposure) with the patient. Also, 80% (8/10) has multiple exposures. However, when data of COVID positive and negative patient was compared in relation to exposure parameters it was not found to be statistically significant. (Table 4).

Table 1: Association of socio-demographic characteristics of HCW with COVID-19 infection.

Sociodemographic characteristics	COVID-19 negative (N=142) (%)	COVID-19 positive (N=10) (%)	P value
Age (years) mean±SD	33.44±7.53	38.7±11.53	0.189
Profession N (%)			
Doctor	51 (98.0)	1(2)	0.181
Nurse	52 (89.7)	6 (10.3)	
Worker	39 (92.8)	3 (7.1)	
Place of exposure			
Labor room	112(94.1)	8 (5.9)	0.018
OPD	3 (60)	2 (40)	
Ward	27(100)	0	

Table 2: Association of use of safety measures with COVID-19 infection.

Use of safety measures	No. of exposed HCW using measures	COVID-19 negative (N=142) (%)	COVID-19 positive (N=10) (%)	P value
PPE worn	73	72 (98.63)	1 (1.37)	0.018
Mask-N95	74	73 (98.65)	1 (1.35)	0.012
Mask- triple layer mask	77	69 (89.38)	8 (10.39)	0.586
Gown	62	61 (98.39)	1 (1.61)	0.048
Gloves	115	112 (97.39)	3 (2.61)	0.002
Face shield	35	35 (100)	0 (0)	0.118
Hand hygiene	147	137 (93.20)	10 (6.80)	1

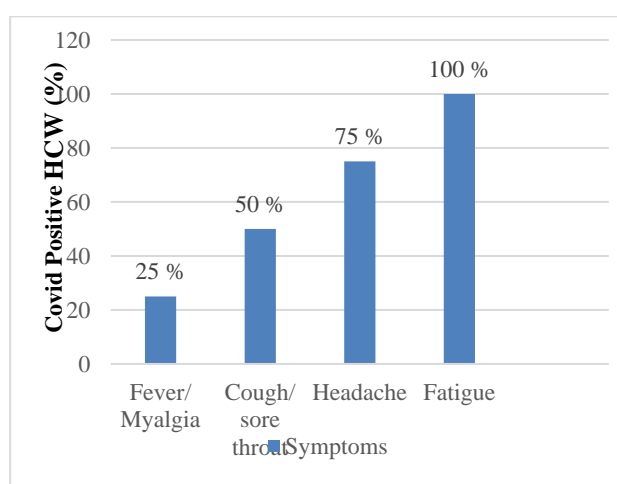
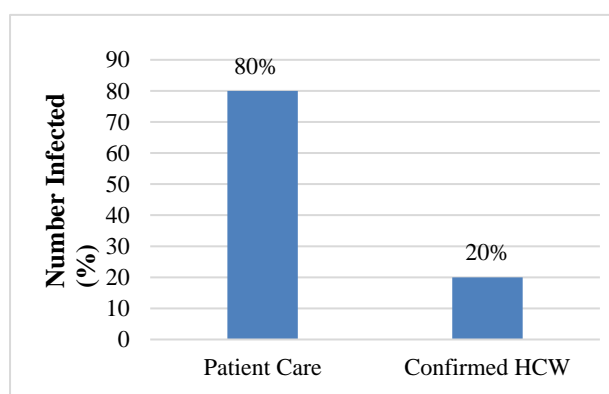
Table 3: Multivariate regression analysis to determine best protective equipment.

COVID-19	Beta coefficient	Odds ratio (95%CI)	P value
PPE worn	-0.654	0.520 (0.038-7.029)	0.623
Gloves	-3.056	0.047 (0.006-0.374)	0.004
Gown	-1.587	0.204 (0.010-4.235)	0.305
N95	-4.230	0.015 (0-0.6)	0.026

Table 4: Association of exposure parameters with COVID-19 infection.

Exposure parameters	COVID-19 negative (N=142)	COVID-19 positive (N=10)	P value
Distance from patient (m)			
<2	137 (93.2)	10 (6.8)	1
>2	5 (100)	0 (0)	
Duration of contact (min)			
<15	112 (94.9)	6 (5.1)	0.232
>15	30 (88.2)	4 (11.8)	
Number of exposure (in times)			
1	52 (96.3)	2 (3.7)	0.496
>1	90 (91.8)	8 (8.2)	

Of HCW who tested positive, 60% (6/10) were asymptomatic while 40% (4/10) were symptomatic. The most common symptoms at the time of survey completion were fatigue (100%), headache (75%), cough and sore throat (50%), and fever and muscle aches (25%) Figure 2. Of the 10 HCW who were infected by the working environment in hospital found, 8 (80%) had close contact with confirmed patients and 2 (20%) were exposed to their confirmed colleagues (Figure 3).

**Figure 2: Symptoms in COVID positive symptomatic HCW.****Figure 3: Suspected cause of infection in COVID positive HCW.**

DISCUSSION

COVID-19 infection has challenged the health systems of both developed and developing countries. Health care workers are at a higher risk of acquiring the disease and they can be a source of secondary transmission among patients, family members, and the community. Adequate preventive measures can protect them and the community from this disease.

The first case reported in our department was a case of heart disease with term pregnancy on 10 April 2020, who was asymptomatic and was referred from another government hospital. She developed symptoms on day 2 and subsequently tested positive. This was followed by twenty-nine more patients testing positive in a period of 3 months. Over a period of 3 months rigorous prevention measures have been taken in our hospital to prevent or limit transmission in a health care setting. Standard operating protocols have been developed to avoid any risk to the health care worker.

Our study found 6.58% positivity rate of COVID-19 in the health care workers in obstetric unit which was similar to that of general population in the initial 3 months of first wave of COVID pandemic. We couldn't find studies on determining positivity rate exclusively in obstetrics and gynaecology department. However, a study by ICMR found 0.82 percent of the total cases in India were health care workers.¹⁶ A study, published in Lancet found an increased risk of COVID-19 among health care workers as compared to general population.¹⁷ Study from UK has reported 18% prevalence of COVID-19 in HCWs.¹⁸ Infection rate in HCW in our study was less than that reported in other countries as appropriate preventive measure to control infection spread were taken timely.

We found that 20% of HCW infected were exposed to an infected co-worker which was similar to study by Zabarsky et al who reported that 25% of health care personnel got infected after were exposed to an infected patient or co-worker.¹⁹ In our study, majority of affected HCWs had a mild disease with no ICU stay or mortality. The possible reason for this could be that most of the

affected HCWs in Obstetric Unit were young adults (mean-38 years) with no associated morbidity.

Infectivity rate in HCW depends upon virulence of organism, which is very high in COVID-19, immunity of the exposed person (which is difficult to measure) and nature of work. Obstetrical department has unique issues as labor cannot be postponed compared to other medical fields where patient contact and elective surgery can be postponed for a time period. Labor room can be regarded as an aerosol generating area as women during the second stage of labor hyperventilates and it is difficult for a laboring patient to wear mask. During this time, most of the health care workers are in close contact with their patients for an extended duration which puts the health care workers at risk of infection. In our study, 80% of the health care workers infected were exposed COVID-19 patient in labor room. Higher rate of infection was found among nurses and ancillary workers. Doctors were the least infected in the period of 3 months as all infection prevention precautions were rigorously followed by them. Our results were similar to a study in Tertiary care hospital in China who found higher infection rate in non-first-line HCWs had a (1.4%) than first-line HCWs (0.5%).¹⁰

Study in Wuhan, China retrospectively analyzed risk factors in seventy-two health care workers with COVID-19. They found that health personnel working in high-risk department HRD [respiratory department, infection department, intensive care unit (ICU), and surgical department] and with suboptimal hand hygiene after contacting patients had a higher risk of COVID-19. Higher risk with longer duty hours was found, especially in HRD.¹⁴ In a review of eleven studies by Mhango et al it was found that lack of personal protective equipment, exposure to infected patients, work overload, poor infection control, and pre-existing medical conditions are the major risk factors for COVID-19 among health care workers.²⁰ Our study too confirmed that those who were wearing PPE, N-95 mask, gown and gloves were at less risk of COVID-19 infection. Electron microscopy has measured the COVID-19 virus to be between 70-90 nm in diameter. Surgical facemasks provide very little protection for particle sizes 10-80 nm while N95 masks are at least 95% effective for particle sizes WHO recommends the use of N95 when performing an aerosol generating procedure are performed on the patients.²¹ Our study showed that HCW wearing triple layer in labor room were at high risk of infection as compared to those wearing N95 mask.

The limitation of our study was that it was a single center short term study. Secondly, we took hospital as high-risk area where as health care workers could have acquired the disease through asymptomatic carriers at home or while commuting which was difficult to exclude. Additional multicentric large studies are needed to confirm our findings. Strength of our study was that it was the first study to access exposure of HCW in obstetric unit exclusively. We had an acceptable positivity rate in HCW of 6.5% because of the prompt measures taken by the

faculty and administration. At the time when ICMR was suggesting testing of symptomatic patients, we started with mandatory testing for all patients as initially we had all asymptomatic patients testing positive. PPE was provided to all HCW with periodic evaluation by our microbiology department. We also insisted on mask on patient and absolute restriction of relatives in obstetric unit. A single point entry (triage) for patients and segregation of patients as COVID positive, negative and suspected/unknown category was done. Quick understanding and constant supervision was the reason of low positivity rate.

CONCLUSION

Positivity rate in obstetrics department is comparable to general public if adequate PPE is worn and COVID-19 appropriate behavior is strictly followed. Appropriate infection prevention measures like use of PPE, handwashing and maintain safe distance from the patient is the key to prevention of infection. N95 masks have been shown to provide superior protection as compared to triple layer.

Recommendations

Nursing staff and auxiliary workers should be reinforced the importance of use of PPE, hand hygiene and physical distancing.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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