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ORIGINAL ARTICLE

The distribution of surface contamination with SARS-COV-2 in various parts of an emergency department at a tertiary care hospital in Dubai- a prospective study

Malik Zaka Ullah[1*], Ayesha Maklai[2], Zebunnisa Sohail[1], Firas Jaafar Kareem Al Najjar[3], Maya Habous[4]

ABSTRACT

Objective: This study aimed to find if certain places are more contaminated by SARS COV-2 than the others in an Emergency Department (ED) of a tertiary care hospital.

Methods: This was a prospective cross-sectional study carried out at the tertiary care hospital of Dubai. The study was carried out over a course of 4 weeks. Total 50 swab samples were taken. Twenty five were collected from the "dirty" areas and twenty five from the "clean" areas. Patients who had a positive SARS-COV-2 polymerase chain reaction (PCR) test in both areas were included in the study.

Results: From a total of 50 swabs collected, large number of swabs was collected from resuscitation and major treatment area (38% and 30%, respectively). Of total, positive SARS-COV-2 PCR was detected on 38% of swabs. Of which 44% were from dirty areas and 32% were from clean areas. Considering areas of ED positive SARS-COV-2 PCR, it was detected majorly from zone 4 (50%) followed by major (40%) and minor treatment areas (33.3%), respectively.

Conclusion: The detection of the virus in 32% of the samples taken from clean areas emphasizes on the importance of using personal protective equipment and hand hygiene measures even when working in areas where patients have been triaged without the presence of symptoms suggestive of a COVID-19 infection.

Keywords: Surface contamination, SARS-COV-2, emergency department, tertiary care hospital, Dubai.

Introduction

What started off as a few cases of unidentifiable respiratory disease, ever since March 11, 2020, had been declared a global pandemic; the SARS-COV-2 infection. As of May 20, 2020, the number of cases worldwide has crossed 5 million [1]. Numerous studies and trials have looked into the mode of transmission of the virus and its viability on different surfaces and environments [2]. One observation has been noted with time that hospitals are high risk areas, and potential sources of infection transmission [3,4], especially with the patient burden and shortage of resources.

But very few studies have investigated the source of nosocomial spread. Of late, 3 studies have emerged from China, having investigated the prevalence of SARS-COV-2 infection in their hospital premises [4-6]. One study by Ye et al. [4] conducted in 2020 investigated different areas in a hospital for the presence of COVID-19 infection [Emergency Department (ED) & wards], and concluded that the most contaminated areas were those with highest infected patient load, and it was stressed that fomites (and touchable surfaces) acts as a second source of infection transmission.

The second recently published study by Guo et al. [5] compared surface and aerosol samples from COVID-

Correspondence to: Malik Zaka Ullah
*Emergency Physician, King's College Hospital, Dubai, United Arab Emirates.
Email: zakaahmedd1@gmail.com
Full list of author information is available at the end of the article.
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ICU and general COVID-wards, and found increased prevalence of environment contaminations in COVID-ICU (attributable to the burden of sick patients, and the performance of aerosol generating procedures in the vicinity). Based on the findings of their study, Guo et al. [5] also proposed that the aerosol transmission distance of SARS-CoV2 might be greater than 2 meters (4 meters to be exact). This puts hospital staff at greater risk of infection and the need for stronger infection control protocols.

A third newly released study by Wu et al. in 2020 [6] reaffirmed similar findings of environmental contamination predisposing to the increased risk of nosocomial transmission of SARS-COV-2 infections.

Nosocomial infection contributes to a large proportion of COVID-19 cases, but the extent to which environmental contamination contributes to the rate of nosocomial infection has not been studied well. Keeping in mind these findings, the current study outcomes would contribute in improving the safety practices at the study hospital by assessing the risk of infection transmission between different areas. Thus, this study aims to highlight the spread of SARS-COV-2 in different areas of an ED of a tertiary care hospital, comparing the presence of the virus on surfaces of "clean" areas versus "dirty" areas. Clean areas being where patients who do not meet the COVID19 case definition are treated, whereas dirty areas are reserved for patients under investigation (PUI) or management for COVID19.

It was hypothesized that contamination rates would be higher in "dirty" areas where PUI are observed such as the major treatment area and zone 4 (negative pressure resuscitation area room for SARS-COV-2 patients), compared to low risk in "clean" areas, where patients who are at low risk of SARSCOV-2 infection are managed, such as the minor treatment area and the resuscitation area.

Subjects and Methods

This prospective cross-sectional study was carried out at the tertiary care hospital of Dubai over a period of 3 months. As mentioned above, early triage at the study hospital helps differentiate the patients into designated areas, based on presence of a flu-like or respiratory illness suggestive of COVID-19 infection, defined as per local policy guidelines. An equal number of samples were collected from the two "dirty" areas and two "clean" areas. Zone 4 is the resuscitative negative pressure area for sick patients with respiratory symptoms and major treatment area is dedicated for the isolation of PUI of COVID19. The resuscitation bay and minor area are reserved for patients who are afebrile and do not exhibit respiratory or flu-like symptoms.

Dry swabs from the surfaces surrounding the patients whose polymerase chain reaction (PCR) results for SARS-COV-2 were positive in both areas were collected. Surfaces swabbed included but not limited to the bed rails, linen, blood pressure cuff, pulse oximeter, and patient's belongings. Samples were collected while the patients were still on the bed and none of the surfaces in contact with the patients were sanitized or cleaned. The sample was then immediately sent in a cool box to the hospital laboratory and PCR tested for the virus.

The lab was blinded to the patient's PCR result and the area the swab was collected from, codes were used for each sample to ensure this process. However, sample collectors were not blinded to the patient's COVID 19 PCR test result. The study was carried out over the course of 4 weeks. Total 50 swabs sample were taken. Twenty five were collected from the "dirty" areas and 25 from the "clean" areas. Patients who had a positive SARS-COV-2 PCR test in both areas were included in the study. Although patients who had a negative SARS-COV-2 PCR result did not have their surrounding surface tested and were excluded from the study.

Microsoft Excel spreadsheet was used to collect data from electronic medical record system-SALAMA and the hospital layout map regarding the area from where the swabs were collected, time of collection, and results. The sample was split into two 2 groups, clean and dirty, categorical data was used. We used chi square and Fischer test to compare the percentage of positive swabs between the 2 groups. The categorical variables were then presented as count/percentage. SPSS 24 was used for statistical analysis.

Results

A total of 50 swabs were collected, including 25 swabs from the dirty areas that were major treatment area and Zone 4, while 25 swabs from clean areas that were resuscitation and minor treatment area. Large number of swabs, that is 38% and 30% were collected from resuscitation area (clean area) and major treatment area (dirty area), respectively (Figure 1).

Further, from total, positive SARS-COV-2 PCR was detected on 38% of swabs. Of which 44% were from dirty areas and 32% were from clean areas. However, there was no significant evidence of association between the area and contamination with SARS-COV-2 (p-value = 0.382) (Figure 2).

Moreover, considering areas of ED positive SARS-COV-2 PCR, it was detected majorly from zone 4 (50%) followed by major (40%) and minor treatment areas (33.3%), respectively. Exact Confidence Interval (CI) was used to compare the percentage of clean and dirty swabs. The CI for the current study was 0.2455-0.5145,

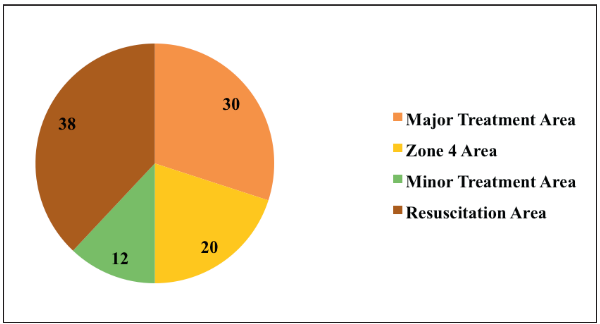

Figure 1. Percentage of samples collected from different areas (n = 50).

while the CI for the dirty and clean areas was 0.2440-0.6507 and 0.1495-0.5350, respectively (Figure 3).

Discussion

This study expected to find a difference in the surface contamination in dirty areas compared to the clean areas. The study results, however, showed only a small difference between both areas with 11 samples that detected SARS-COV-2 in the dirty areas and 8 samples in the clean areas with CI of 0.2440-0.6507 and 0.1495-0.5350, respectively. It was reassured that 62% of the samples in both areas collectively tested negative for the virus. Nevertheless, the detection of the virus in 32% of the samples taken from clean areas emphasizes on the importance of using personal protective equipment (PPE) and hand hygiene measures. The use of PPE and hygiene maintenance is also emphasized in other studies to prevent the transfer of infection [7].

It also highlights the importance of changing bed linen, cleaning, and sanitizing the surfaces that came into contact with the patient including medical equipment such as the blood pressure cuff and ultrasound machine probe. Utilizing one time use disposable medical equipment might be of aid in limiting the spread of the virus, although it is not a budget or environment friendly option. Thus, continuous disinfection and cleaning of regularly touched surfaces should be done to avoid the potential contamination of environment by SARS-COV-2 [8,9]. This is particularly important because it has been established through the studies that RNA of SARS-COV-2 could reside on contaminated surfaces from few hours to few days [10] with presence of its RHA in air for up to 3 hours of aerosolization [11].

Overall, positive SARS-COV-2 PCR was detected on 38% of swabs in the current study. It is comparable to the results of a systematic review conducted on a total of 37 publications, reported contamination of surfaces by SARS-COV-2 largely in hospitals and healthcare facilities and around 17.7% samples were positive [12]. Where the highest detection rates were diagnostic laboratories, isolation wards, and long-term care facilities.

Another study concluded that contamination of environment with SARS-COV-2 could possibly be found in seroconverted patients in hospital ICU or isolation wards. Further the risk of SARS-COV-2 contamination was much higher in the high touched areas compared to low touched surfaces. Thus, it is recommended to increase the precautions related to SARS-COV-2 transmission and standard protocols for maintaining the pandemic periods to decrease the risk of infection in healthcare settings [13].

Likewise one more study conducted by Choi et al. in 2021 [14] reported that contamination of environment by SARS-COV-2, especially the patient room is due to the shedding of virus from the patient, either the patients is asymptomatic or symptomatic and also that the SARS-COV-2 virus could survive on the surfaces for an extended period. Indeed virus contact event could be sequential

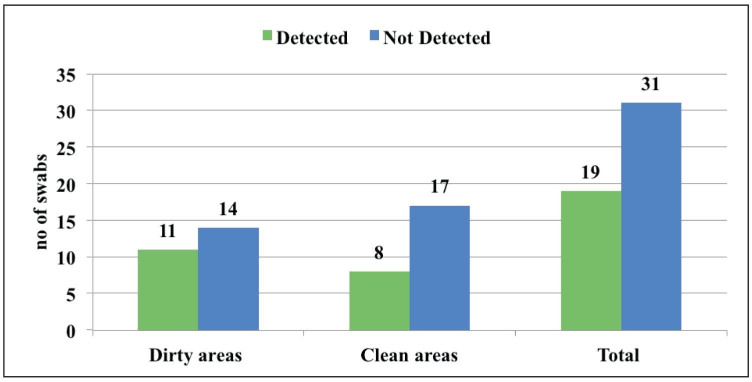

Figure 2. *Presence of SARS-COV-2 in dirty and clean areas collectively (n = 50).*

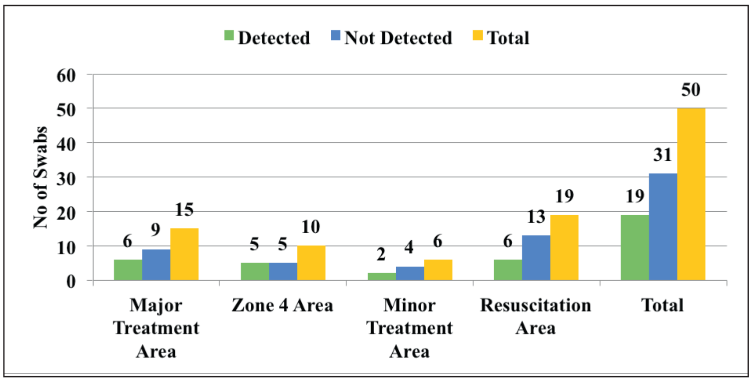

Figure 3. *Presence of SARS-COV-2 in different clean and dirty areas (n = 50).*

and could spread from one surface to another through a successive touch in multiple areas in a healthcare facility [15,16].

Disputable results have been achieved from previous studies where hospital environment contamination by SARS-COV-2 is detected through reverse transcription-quantitative PCR (RT-QPCR) [3,4,6] and TCID50 assay [17]. As it was notified that TCID50 assay is better that RT-QPCR in detection because the latter could not reflect viable contamination of SARS-COV-2 accurately.

Further, the small sample size for the study, and blinding of the collectors were one of the limitations of this study. One more limitation was the viral load in United Arab Emirates as the sample was collected between first and second wave might also affect the outcome. Thereby, more studies should be conducted in future with a larger sample size to assess the association between area and contamination. Moreover, studies should also be conducted to study the cleaning agents. Furthermore, results of the contamination should be interpreted and evaluated with caution as SARS-CoV-2 RNA could be influenced by number of factors including detection method, sampling procedure, sampling area, cleaning and disinfection, and also the rates of contamination which could definitely hinder in the collection of data and assessment of results.

Conclusion

The detection of the virus in 32% of the samples taken from clean areas emphasizes on the importance of using PPE and hand hygiene measures even when working in areas where patients have been triaged without the presence of symptoms suggestive of a COVID 19 infection.

List of Abbreviations

CI	Confidence interval
ED	Emergency department
PPE	Personal protective equipment
PUI	Patients under investigation

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

None.

Consent to participate

Written informed consent was obtained from all the participants.

Ethical approval

The study was approved by Dubai Scientific Research Ethics Committee, DSREC-06/2020_16, dated: 16/06/2020.

Author details

Malik Zaka Ullah[1], Ayesha Maklai[2], Zebunnisa Sohail[1], Firas Jaafar Kareem Al Najjar[3], Maya Habous[4]

1. Emergency Physician, King's College Hospital, Dubai, United Arab Emirates
2. Emergency Physician, Rashid Hospital Trauma Center, Dubai Academic Health Corporation, Dubai, United Arab Emirates
3. Consultant Emergency Department, Rashid Hospital Trauma Center, Dubai Academic Health Corporation, Dubai, United Arab Emirates
4. Head of Microbiology and Infection Control, Pathology and Genetics, Rashid Hospital Trauma Center, Dubai Academic Health Corporation, Dubai, United Arab Emirates

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