

RT-PCR Result of SARS-CoV-2 Viral RNA in Cadavers and Viral Transmission Risk to Handlers

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ABSTRACT

During the onset of the pandemic, a common research question was asked by the hospital staff, and family members who were handling COVID-19-infected cadavers, "does COVID-19-positive dead body harbor SARS-CoV-2 viral RNA?" Several research findings were reported but due to the lack of proper research findings, the question remained unanswered. The present study was planned to observe the virus transmission risk from cadavers to the handlers.

A pilot study was conducted on 54 cadavers who died in COVID-ICU (SARS-CoV-2-positive diagnosed by RT-PCR) during 2021–2022. Skin swab sample from 54 dead bodies and 54 glove samples of handlers were taken within 1 hour of death for the RT-PCR test. Viability results from RT-PCR show that the infection risk was 50% in cadavers, whereas the transmission risk to handlers while handling was 7%, which is minimal. The SARS-CoV-2 viability was high in cases of those died after a long time of infection.

Based on the RT-PCR result and data analysis the interpretation of the study was that the SARS-CoV-2 transmission risk from dead bodies to the handlers is minimal but the SARS-CoV-2 viability persists in the cadavers. This fact is helpful for the people who will conduct funeral activities, autopsy staff, and hospital staff handling dead bodies.

Keywords: Cadaver, Pandemic, RT-PCR, SARS-CoV-2, Transmission risk.

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HIGHLIGHTS

- The SARS-CoV-2 transmission risk from dead bodies to the handlers is minimal
- The SARS-CoV-2 viability persists in the cadavers as per RT-PCR result

INTRODUCTION

Does COVID-19-positive dead body harbor SARS-CoV-2 viral RNA? Queries were asked by the hospital staff, and family members who are handling COVID-19-infected cadavers but due to the lack of proper research findings, the question remained unanswered.^{1,2} The presence of viral RNA in COVID-positive patients for more than 5 months was reported in many articles. but the scenario after death is for how many hours the virus survives and the percentage of transmission risk to handlers.^{3–5} In the case of the Influenza virus, RNA survives in frozen bodies for decades.³ Ebola virus was detected in the 3 days postmortem sample of infected macaques.⁶

COVID-19 is caused by the SARS-CoV-2 virus, which belongs to the *Coronaviridae* family. It is highly infectious encapsulated virus because of the high transmission rate in early 2020, WHO declared this a pandemic. By May 2021, more than 152 million people were infected and out of which 3.19 million deaths were recorded.⁷ Social instability and trauma due to the rapid spread of SARS-CoV-2 were extremely high all over the World. As per the independent national survey of 0.14 million adults, and data of COVID-19 patients from June 2020 to July 2021, the death rate was 29%. This death rate contributed highly toward increasing depression, fear, and anxiety toward the preparation, burial procedures, and rituals. Dead body handlers were confused while handling the dead bodies, similarly, autopsy staff were perplexed to do autopsies.

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To avoid the viral transmission, WHO has set up strict guidelines for clinical staff, housekeeping staff, mortuary staff, transport staff, family members, crematorium staff, burial staff, and religious staff.

As per the guidelines, COVID-19 dead bodies were handled with protective masks, gloves, gowns (category 2 or 3), etc. SARS-CoV-2 virus mostly transmits through droplets and aerosols, whereas in deceased persons aerosol transfer is unlikely to happen. Direct contact with skin can be a possible way of viral transmission. So the present study aimed to find out the COVID-19 transmission risk from a cadaver to handlers. The findings of the viral RNA in the skin sample do not give information that the virus is alive or dead in the dead body but it can give an idea about the transmission risk to handlers. Here we detect the viral RNA in the skin swab taken from the perioral region of the COVID-19 dead body after 1 hour of death and simultaneously from the gloves sample of handlers.

MATERIALS AND METHODS

In a cross-sectional study, COVID-19 patients who died in ICUs were included for the study. Samples were collected within 1 hour of death to check the disease transmission from cadaver to handler while handling. A total of 54 cadavers and 54 handlers' samples were analyzed for the detection of viral RNA. Skin swab samples of the cadaver and gloves swab sample of the handlers were collected in a universal viral transport media tube and were analyzed as per the standard RT-PCR protocol for SARS-CoV-2 RNA detection. The positivity was detected at cycle threshold (Ct) values of ≤ 37 in the target site, gene sequence of N gene and ORF1ab. Nucleic acid amplification by RT-PCR is a gold standard method for clinical diagnostic of SARS-CoV-2.

RESULTS AND DISCUSSION

We detected N and *ORF1ab* gene targets by RT-PCR in 23 skin samples of cadavers from 54 cadavers, whereas in the case of the gloves' samples, the target gene was detected in 4 samples from 54 handlers' gloves. The percentage of the SARS-CoV-2 positivity in cadavers was 42.59, and in the gloves sample, it was 7%. The SARS-CoV-2 positivity in cadavers was significantly higher (*p*-value: 0.000024) than in the handler's gloves sample (Table 1).

The correlation between patients who died after a hospital stay and their RT-PCR result was analyzed. All the patient's data which include the reason for death, comorbidities, interventions, and duration of hospital stay was retrospectively retrieved and analyzed, correlated with the positivity of SARS-CoV-2. The results

show a positive correlation between the duration of the hospital stay. Maximum positivity was detected in cadaver samples of those have died after 9 days of hospital stay and the RNA positivity was detected both in the cadaver sample and gloves sample of handlers which had been collected from the patients who died after 5 days of hospital stay and after 11 days of hospital stay (Figs 1 and 2).

SARS-CoV-2 positivity in the handler's gloves sample was detected as high in 5 days of hospitalized COVID-19 patients' dead bodies. Transmission risk was high while handling dead bodies of infected patients with a hospitalization duration of 5 days and 11 days (Fig. 2).⁴ Although RNA was found in around 50% of cadavers, even with this, transmission to gloves is ~7% (Minimal). This does not equate to the risk of transmission because this may be a non-viable RNA or virion particle. The transmission risk to autopsy staff was also studied by a team by assessing the virus's persistence for different hours and reported that the positivity was high in 2 hours sample of cadaver and gradually decreased at 24 hour sample of cadavers but all the swab samples of pathologic staff those handling cadavers were negative.⁵ Detection of viral RNA in cadaver does not equate the disease transmission but gives an indication about risk of transmission.⁶

From this, we could speculate that the virus can stay for a longer period in the tissue as previously reported by similar studies.⁷⁻¹² Transmission risk of SARS-CoV-2 from dead body can be explored for autopsy.

CONCLUSION

The SARS-CoV-2 transmission risk from dead bodies to the handlers while handling is minimal. This fact becomes helpful for the people who conduct funeral activities, autopsy staff, and hospital staff

Table 1: SARS-CoV-2 positivity percentage in cadavers after death and in handler's gloves sample

| Type of sample | No. of SARS-CoV2-positive/ <i>n</i> = 54 | Percentage of positivity (%) | <i>p</i> -value |
|-------------------------------|---|------------------------------|-----------------|
| Total cadaver sample | 23/54 | 42.59 | 0.000024 |
| Total glove sample of handler | 4/54 | 7.4 | |

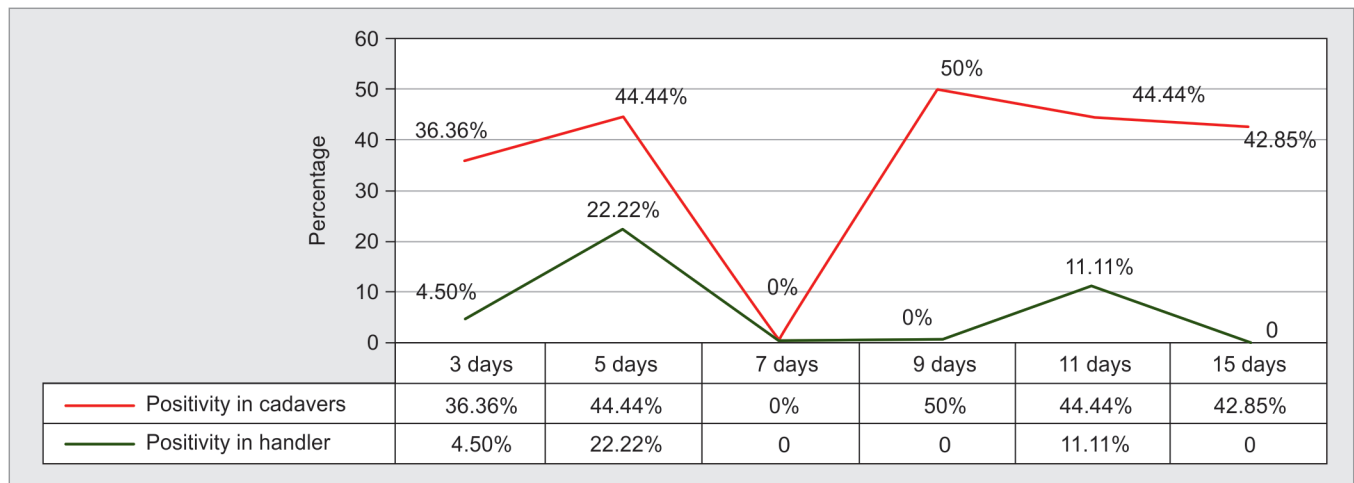


Fig. 1: Percentage of SARS-CoV-2 positivity in cadavers with duration of the hospital stay

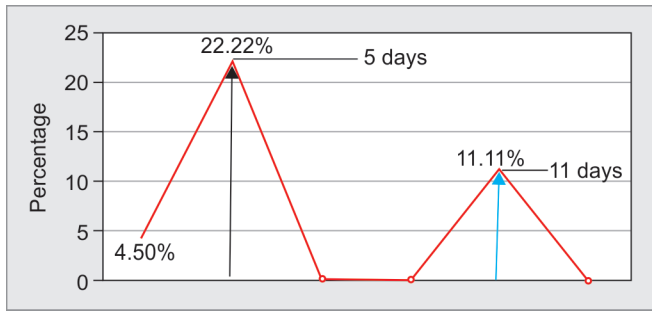


Fig. 2: Transmission rate of SARS-CoV-2 from cadaver to handler in relation to duration of hospital stay

handling dead bodies. SARS-CoV-2 positivity in cadaver is still 50% so transmission risk is to be explored for autopsy.

CONTRIBUTION

Conceptualized by Pradeep Pattnaik, Ramnath Misra, Methodology by Ramnath Misra, Bandita Panda, Sample Collection and Investigation by Gyanraj Singh, Nipa Singh, A Raj Kumar Patro. Data analysis, interpretation, drafting, and editing by Bandita Panda, Ramnath Misra, and Supervision by Ramnath Misra.

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