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MAYO CLINIC

Risk of SARS-CoV-2 Transmission Among Coworkers in a Surgical Environment

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Abstract

Health care workers are at high risk for contracting coronavirus disease 2019. However, little is known about the risk of transmission between coworkers. The objective of this study was to determine the risk of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) between coworkers in a surgical environment. This was an observational study of 394 health care workers in a surgical environment who were exposed to 2 known SARS-CoV-2–positive coworkers. Standard infection precautions were in place at the time of the exposure. All 394 exposed workers initially underwent nasopharyngeal swab testing for SARS-CoV-2 using the polymerase chain reaction technique. Of the original group, 387 were tested again with the same technique 1 week later. Of 394 SARS-CoV-2–exposed health care workers initially tested, 1 was positive. No new positive cases were found on repeated testing of 387 participants 1 week later. The risk of transmission of SARS-CoV-2 in a health care unit with universal masking and appropriate hand hygiene is low. This finding should provide some reassurance to surgical practices as they reopen.

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Infections of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) among health care workers is a serious consequence of the coronavirus disease 2019 (COVID-19) pandemic. Of the COVID-19 cases reported to the US Centers for Disease Control and Prevention (CDC) between February 12 and April 9, 2020, that contained information about workers, 19% were identified as health care personnel. Most were never hospitalized, but 27 deaths were reported.[1] Many health care workers have reportedly become ill with the virus, but data on the risk of infection from other coworkers are limited.[2,3]

In this article, we report the outcome of a widespread surveillance program in a surgical area that was implemented as a result of health care workers testing positive for SARS-CoV-2 at Mayo Clinic, Jacksonville, Florida. At the time of the study, standard precautions for a surgical environment were in place, and N95 masks or powered air-purifying respirators were only to be used for patients with known or suspected COVID-19. A universal masking policy for all health care employees at all times while in the institution was not implemented until March 31. Jacksonville, Florida, in Duval County, had a low known prevalence of disease: 266 positive tests and 4700 negative tests for the week of March 29, 2020, according to the Florida COVID-19 Data and Surveillance Dashboard website from the Florida Department of Health. Only 7 patients were hospitalized with COVID-19 at Mayo Clinic Hospital, Jacksonville, Florida, on March 30, 2020, the time of the outbreak. The aim of the current study was to determine the risk of transmission of SARS-CoV-2 between coworkers in a surgical environment.

METHODS

Mayo Clinic Hospital is a medium-sized (304-bed) hospital in Jacksonville, Florida, with 17,561 surgeries performed in 2019. On March 31, 2020, the hospital's Infection Control and Employee Health offices were informed of a positive result of nasopharyngeal polymerase chain reaction (PCR) testing for SARS-CoV-2 for an employee, a cardiac

perfusionist (index case 1), who was tested on March 30 because of a positive household contact. On the same date, a second positive case was reported in another employee, an anesthesia technician (index case 2), who was previously tested outside the institution on March 26, 2020, because of symptoms, with results reported on March 31, 2020. These index cases spurred surveillance testing of all surgical employees who potentially had workplace contact with the index cases. Because of the overall institutional concerns at the time of the outbreak, it was decided to rapidly proceed with widespread testing in the surgical area. Minimal contact tracing was performed before the testing, and all employees working in the surgical area from March 23 through 31, 2020, were offered testing. Employees involved in the surveillance program were tested for SARS-CoV-2 viral RNA via nasopharyngeal swab using a PCR assay (cobas 6800 System; Roche). The employees were tested with this technique twice, 1 week apart (March 31-April 1 and April 7-13, 2020). We retrospectively collected data from the patient electronic health record and an employee health database related to this surveillance testing program. The Mayo Clinic Institutional Review Board determined this study to be exempt.

RESULTS

On March 30, 2020, index case 1 was placed in quarantine after informing Employee Health of active symptoms, exposure to a positive household contact, and receiving SARS-CoV-2 testing. The next day, index case 1 and Employee Health received confirmation of a positive SARS-CoV-2 test result. Further investigation revealed that the patient's household contact was symptomatic on March 23 and tested positive on March 28. Index case 1 was symptomatic beginning on March 23 and worked in the surgical area on March 25 and 27. On March 31, 2020, index case 2 was placed in quarantine after informing Employee Health of a positive SARS-CoV-2 result received from an outside facility. Further investigation in this case indicated that the patient's symptoms began on March 26, and no potential source was identified. Index case 2 worked in the surgical area on March 23, 24, 25, and 27. Index cases 1 and 2 continued to be monitored, with neither requiring hospitalization. Both were sequentially tested with nasopharyngeal PCR until 2 consecutive negative results were confirmed on 2 separate samples, in accordance with CDC return-to-work testing strategy guidelines in place at the time of the study (Table 1).

Employee Health determined that 394 other employees worked in the surgical area at the same time as the index cases, and all were recommended to undergo SARS-CoV-2 PCR testing as surveillance. None refused. The CDC Risk Assessment Levels for most personnel, including the 2 index cases, were designated as "unknown" (n=40) or "not available" (n=347); 5 employees were categorized as "high risk" because of extensive exposure to the index cases, and 4 were designated "low risk." These employees spanned multiple departments and work roles (Table 2). Of the 394 employees initially tested, 393 were negative, and 1 was positive (positive surveillance case, in the "unknown" risk category). Results were available for all within 24 hours.

Further review of the positive surveillance case revealed that symptom onset was on March 18, 12 days before the confirmatory PCR test (Table 1). No potential community exposure was identified, and it was determined to be an unknown exposure. Given the timing of the symptoms, the surveillance case infection was believed unlikely to have resulted from exposure to either index case. The surveillance case worked in the surgical area every day from March 23 through March 31.

Neither index case was in definite contact with each other or the surveillance case, although all 3 worked in the surgical area at the same time for at least 2 days during the potentially infectious period. Neither index case nor the surveillance case was in known contact with a COVID-19—positive patient at work.

On subsequent testing 1 week later, 386 employees were negative, and the 3 previously

TABLE 1. Sequence of Index Cases, Initial Test Date, and Subsequent Testing in 2020

Case	Symptoms	Symptom onset date	Initial positive testing	Subsequent positive testing	Subsequent negative testing
Index case 1	Nasal stuffiness, sore throat	March 30	March 30	April 10	April 13, April 14
Index case 2	Anosmia, headache	March 26	March 26	April 6, April 9, April 13, April 16	April 23, April 24
Positive surveillance case	Body aches, fatigue, fever, anosmia	March 18	March 31	April 13, April 18, April 22, April 27, May 5	April 16, April 26, May 12, May 14

noted positive cases (2 index cases and 1 surveillance case) were still positive. No new positive cases were identified. Of 7 employees who did not complete subsequent testing, 2 were determined not to be exposed and 5 did not complete testing. Of the 5 employees who did not complete subsequent testing, 4 were not placed in quarantine, did not report symptoms, and did not receive further PCR or serologic testing. The other employee was placed in isolation on April 3 because of reported symptoms of headache, sinus congestion, postnasal drip, and cough on April 2. Review of work history revealed that this employee had contact with index case 1 on March 27. This employee's symptoms were improving on April 5. The employee was confirmed symptom free on April 9 and was cleared to return to work starting April 10 because the initial test was negative and it had been 14 days since the exposure date. No further PCR or serologic testing was performed.

TABLE 2. Characteristics of Screened Population

Characteristic	No. of employees (N=396)
Sex	
Men	174
Women	222
Age range (y)	
21-35	131
36-50	161
51-72	104
Role	
CRNA	69
Nurse	75
APP	25
Physician	102
Technician/assistant/specialist	81
Resident physician	39
Other	5

APP, advanced practice provider; CRNA, certified registered nurse anesthetist.

Of the 394 employees tested in the surveillance program, 8 were placed in isolation for 14 days because of symptoms, and 17 without symptoms were placed in quarantine for 14 days because of high risk of exposure or recent travel.

DISCUSSION

An interesting aspect of this study is the discovery that the surveillance case had symptoms that predated those of the index cases and was working in the surgical area more extensively than either of the index cases during a time of potential infectivity. Because no definitive source of infection was identified for index case 2, it is possible that they were exposed to the surveillance case. More robust contact tracing, potentially through the use of real-time location monitoring systems, may have been able to make a stronger case for that scenario. Real-time monitoring systems with rapid information about contacts also may have decreased the number of personnel requiring testing.[4]

Another issue of note is that both index case 2 and the surveillance case had anosmia as a symptom. This was not a recognized symptom at the time of the study but has since been added as a symptom associated with COVID-19.[5]

At the time of the study, the institution was using the CDC test-based strategy for return to work. This strategy has since been abandoned in most circumstances because of long periods of positivity that most likely

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are not indicative of ongoing infectivity.[5] Support for this point in our study is that the surveillance case continued to test positive for almost 8 weeks after the onset of symptoms.[6]

The COVID-19 pandemic has placed considerable strain on the health care workforce, and many health care workers are at risk for contracting the disease.[7,8] This study, strengthened by excellent participant compliance and follow-up, reveals that the risk of contracting the disease from coworkers in a low-prevalence environment (in the community and the institution) with standard precautions is very low. Of note, even though standard precautions were in place, surgical mask use was very prevalent in this area as part of standard precautions. Although this study is limited by being performed at a single location with low prevalence of overall disease in the community and the hospital at the time of the surveillance, it should provide some reassurance to health care workers as hospitals and other medical establishments pursue reopening practices to patients. The results could also potentially be extrapolated to nonsurgical areas with the adoption of universal masking protocols at most institutions.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Mark A. Parkulo: Conceptualization, Methodology, Funding acquisition, Formal analysis, Data curation, Writing - original draft, Writing - review & editing, Supervision. **Todd M. Brinker:** Funding acquisition, Formal analysis, Data curation, Writing - review & editing. **Wendelyn Bosch:** Funding acquisition, Formal analysis, Data curation, Writing - review & editing. **Arta Palaj:** Funding acquisition, Formal analysis, Data curation, Writing - review & editing. **Marie L. DeRuyter:** Funding acquisition, Formal analysis, Data curation, Writing - review & editing.

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Abbreviations and Acronyms: **CDC** = US Centers for Disease Control and Prevention; **COVID-19** = coronavirus disease 2019; **PCR** = polymerase chain reaction; **SARS-CoV-2** = severe acute respiratory syndrome coronavirus 2

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