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## Original Article

# Lessons learned from an outbreak of COVID-19 in the head and neck surgery ward of a Japanese cancer center during the sixth wave by Omicron

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## ABSTRACT

**Introduction:** We describe a coronavirus disease (COVID-19) outbreak in a cancer center's head and neck surgery ward and the interventions to halt ongoing exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection among healthcare workers and patients with cancer.

**Methods:** Case definition included all healthcare workers and all patients associated to the ward from January 27 to January 31, 2022 with a positive SARS-CoV-2 antigen test. This retrospective descriptive study was conducted between January 27, 2022, and February 14, 2022.

**Results:** From January 28, 2022, to February 9, 2022, 84 cases (36 healthcare workers, 48 patients) were screened, and 26 (12 healthcare workers, 14 patients) were identified as SARS-CoV-2-positive. The proportion of healthcare providers who performed aerosol generating procedures on positive patients was 91% for positive cases and 49% for non-cases. Room sharing with patients with COVID-19 was 64% for positive cases and 21% for non-cases (57% vs. 21% with positive tracheostomy patients; 43% vs. 9% with positive cases using a nebulizer; 50% vs. 15% with positive cases requiring sputum suctioning, respectively). Compliance with the universal masking policy for patients was 36% of positive cases and 79% of non-cases.

**Conclusions:** This is the first report of a nosocomial outbreak of COVID-19 in a head and neck surgery ward during the Omicron pandemic. Notably, there were a high number of positive cases among healthcare workers who performed aerosol generating procedures for positive patients and patients who shared the room with a patient with COVID-19 with the potential to generate aerosols.

## 1. Introduction

The emergence of the Omicron variant (B.1.1.529 lineage), a new variant of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), is an urgent global health concern [1]. It has been recognized as the most recent variant of concern (VOC) in February 2022 [2]. Omicron spreads more rapidly than the Delta variant, which was the most dominant circulating strain worldwide since December 2021. The sixth

wave of coronavirus disease (COVID-19) in Japan, triggered by the Omicron variant, started in early January 2022. From January 24 to 30, 2022, the Omicron variant comprised over 99% of the sequenced samples in Japan and 97% of those in the Aichi Prefecture [3].

Patients with cancer have a significantly higher risk of COVID-19 infection and other severe illnesses [4]. A COVID-19 outbreak in a cancer center can have potentially fatal consequences for patients with cancer. However, to the best of our knowledge, there is only one report

**Abbreviations:** coronavirus disease, COVID-19; carbapenem-resistant Enterobacterales, CRE; methicillin-resistant *Staphylococcus aureus*, MRSA; severe acute respiratory syndrome coronavirus 2, SARS-CoV-2; variant of concern, VOC.

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of a COVID-19 outbreak in a cancer center in the literature (The University of Texas MD Anderson Cancer Center) [5]. In this report, only healthcare workers were infected, and no nosocomial infections occurred in patients; thus, the public health impact could not be adequately evaluated. Furthermore, this was not caused by the Omicron variant [5]. Whereas, in the April 2020 COVID-19 wave, an outbreak in the hematologic malignancy ward of a university hospital in Poland led to a case fatality rate of 36.8% among confirmed patients [6].

Here, we report an outbreak among healthcare workers and patients in the head and neck surgery ward of a Japanese cancer center during the sixth wave of COVID-19 caused by the Omicron variant. The head and neck surgery ward is a unique environment that facilitates the spread of infection. Previous reports have shown that patients with head and neck disease can generate aerosols via tumors and tracheostomy, which can lead to airborne transmission of pathogens, and that aerosols can also contaminate the environment [7]. This study aimed to describe an outbreak in a head and neck surgery ward and the interventions to halt ongoing exposure to SARS-CoV-2 infection among healthcare workers and patients with cancer.

## 2. Patients and methods

### 2.1. Study design and population

This single-unit retrospective descriptive study was conducted between January 27, 2022, and February 14, 2022, in the head and neck surgery ward of the Aichi Cancer Center Hospital, a 500-bed tertiary care center in Aichi Prefecture, Japan. This hospital has 23 clinical departments and admits approximately 11,000 patients annually. The ward had not previously experienced a COVID-19 outbreak, defined as two or more cases of SARS-CoV-2 positivity in the same unit at overlapping times. The ward is a 46-bed unit with 9 four-bedrooms, 2 two-bedrooms, and 6 private rooms without negative pressure (Fig. 1).

The study population consisted of all patients with cancer admitted to the ward and all healthcare workers who accessed the ward during the study period. The Division of Infectious Diseases and the Department of Infection Control and Prevention are charged with the prevention of nosocomial infections and ensuring the safety of medical staff [8].

### 2.2. Definition of study period

The study period was the period of communicability before the onset of the primary case and 10 days after the 6th day of negative confirmation of a non-isolated case based on the testing strategy.

### 2.3. Case definition

Case definition included all healthcare workers and all patients associated to the ward from January 27 to January 31, 2022 with a positive SARS-CoV-2 antigen test using the Lumipulse G SARS-CoV-2 Ag assay (Fujirebio, Tokyo, Japan), which detects the SARS-CoV-2 nucleocapsid (N) protein [9]. Non-case definition included all healthcare workers and all patients associated to the ward from January 27 to January 31, 2022 with a negative SARS-CoV-2 antigen test. Cases with judgment-pending results in Lumipulse G were confirmed using the Loopamp™ SARS-CoV-2 Detection Kit (Eiken Chemical, Tokyo, Japan) [10], which targets genes encoding the nucleocapsid (N) and the RNA-dependent RNA polymerase of SARS-CoV-2, or the ID NOW COVID-19 assay (Abbott Rapid Diagnostic, Scarborough, ME, USA), which uses isothermal nucleic acid amplification of RNA-dependent RNA polymerase viral targets [11,12]. Saliva or nasopharyngeal swab specimens were obtained from all members of the ward (including all healthcare workers and patients). The type of variant strain was not evaluated by laboratory methods.

### 2.4. Testing strategy

All healthcare workers and patients associated with our head and neck surgery unit from January 27 to January 31, 2022 were screened for SARS-CoV-2. Screening was conducted for 6 consecutive days until negative results were obtained, and the testing was conducted on day 10 after confirming whether the result of the test conducted on day 6 was negative. When the test on day 10 gave negative results, the testing was terminated. When non-isolated patients and healthcare workers who were not suspended from work tested positive, the number of days of testing was reset, and they were screened consecutively until negative results were obtained for 6 consecutive days.

### 2.5. Definition of variables

The incubation period of COVID-19 infection can last up to 10 days with an average of 3 days [13]. The period of communicability in symptomatic individuals was between 2 days before onset and 10 days from the date of onset or over 72 h after symptom resolution, whichever was longer, whereas that in asymptomatic individuals was 2 days before the positive specimen collection date and 10 days post-laboratory confirmation [14,15]. Definitions of other variables are presented in **Supplementary Methods** [16,17].

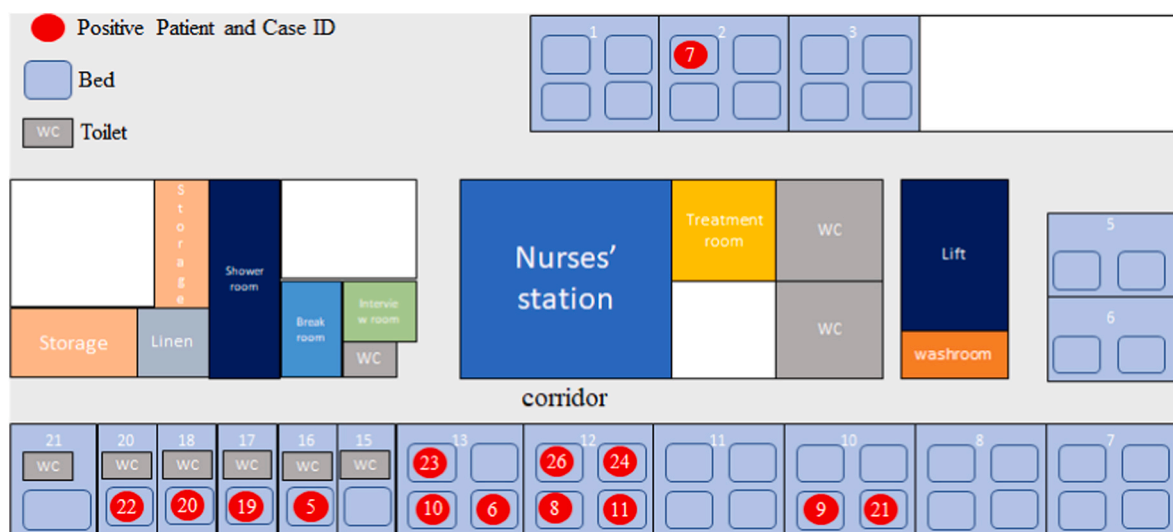


Fig. 1. Schematic diagram of the layout of a Head and Neck Surgery ward during the COVID-19 outbreak. There are no negative-pressure rooms.

2.6. Ethical considerations

This study was approved by the Institutional Review Board of the Aichi Cancer Center Hospital (approval number: 2021-0-211) and was conducted according to the principles of the Declaration of Helsinki. The requirement for informed consent was waived because this study only used the data collected in clinical practice.

2.7. Data analysis

The proportions of characteristics of infected healthcare workers and patients were compared with those of uninfected healthcare workers and patients. All analyses were performed using Excel Version 1904 (Microsoft Corporation, Redmond, WA, USA).

3. Results

3.1. Description of outbreak

On January 31, 2022, two nurses in the ward tested positive for SARS-CoV-2 (Case IDs 1 and 2, Fig. 2), and a COVID-19 outbreak was declared. Case ID 1 worked on January 29, despite having a fever and sore throat. On the same day, screening of all healthcare workers and patients associated with the ward for SARS-CoV-2 was performed, and an additional six cases were identified as positive, including one nurse (Case ID 3, Fig. 2), four patients (Case IDs 5, 6, 7, and 8, Figs. 1 and 2), and one physical therapist (Case ID 4, Fig. 1). One of the four patients was admitted on January 27, 2022 and had a negative screening test upon admission (Case ID 5, Figs. 1 and 2). Although sharing meals with non-household members is prohibited by the hospital rules, two nurses (Case IDs 1 and 16, Fig. 2) and one physical therapist (Case ID 4, Fig. 2) had a history of sharing meals with non-household members in the previous week.

During the outbreak period January 28, 2022 to February 9, 2022, 84 cases (36 healthcare workers and 48 patients) were screened, and 26 cases were identified as SARS-CoV-2-positive (12 healthcare workers

and 14 patients). Fig. 3 shows the epidemic curve of confirmed symptomatic COVID-19 cases according to the date of symptom onset. Cases 1, 3, 4, and 15 did not use ethanol hand sanitizers (Fig. 2). Two of these four positive healthcare workers (Cases IDs 1 and 15) used benzalkonium chloride hand sanitizer. Of the 14 positive patients, one was infected with a carbapenem-resistant Enterobacterales (CRE) (Case ID 19 in Figs. 1 and 2), and another with a methicillin-resistant *Staphylococcus aureus* (MRSA) carrier (Case ID 20 in Figs. 1 and 2), with contact precaution measures in two private rooms.

After implementing infection control measures following outbreak identification, one non-isolated case tested positive on February 4 (Case ID 22, Figs. 1 and 2), and consecutive screening tests were performed until February 10. Finally, a negative screening test was confirmed on February 14, and the outbreak in the ward converged because there were no COVID-19 cases until 10 days after the occurrence of the last non-isolated case.

3.2. Infection prevention and control practice

After the first two nurses tested positive, the information was shared with the ward manager, and multiple interventions were promptly implemented on January 31, 2022 (Supplementary Methods and Results).

3.3. Characteristics and comparison of the SARS-CoV-2 infection among healthcare workers

Table 1 shows the characteristics of 12 cases of SARS-CoV-2 infection comprising 10 (83%) nurses, one (8%) doctor, one (1%) physical therapist, and 43 non-cases among healthcare workers. The median age of all healthcare workers was 36 years (range 21–59 years), and 31 (56%) patients were women. A history of sharing meals with non-household members was observed in 25% of the positive cases and 67% of the non-cases. Healthcare workers who had been vaccinated with the booster dose for more than 14 days comprised 25% of the positive cases and 67% of the non-cases. All healthcare workers followed the universal

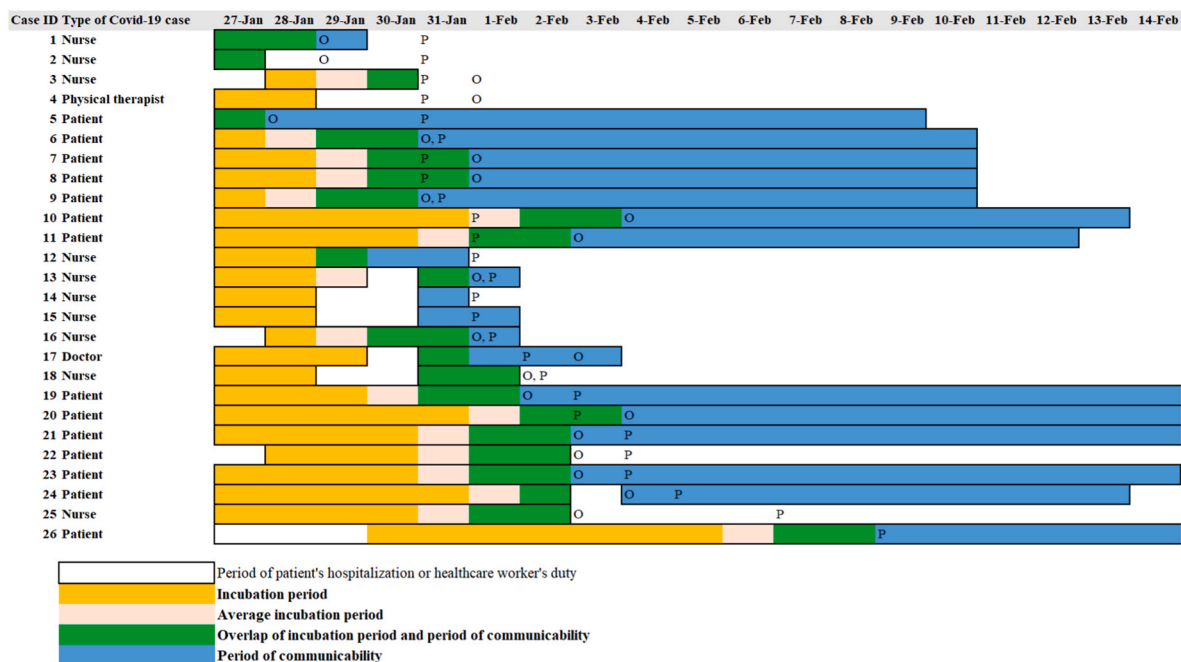
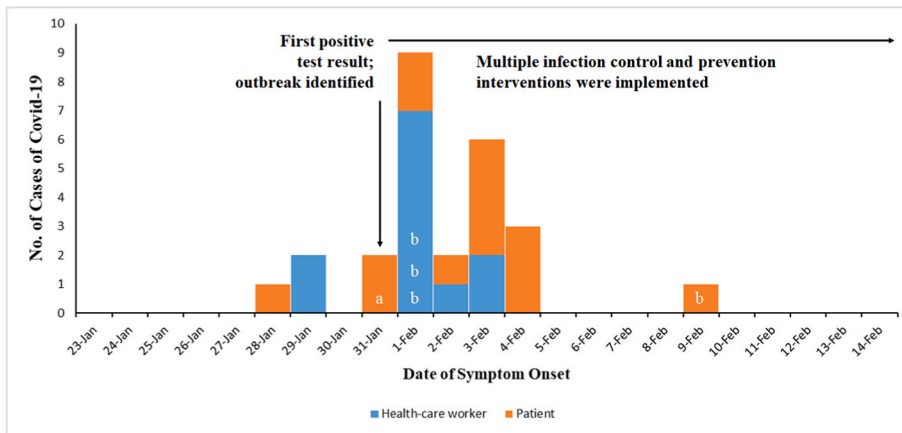


Fig. 2. Gantt chart of confirmed SARS-CoV-2-positive cases included in this study (N = 26).

P: date of positive specimen collection, O: Onset date, Incubation period: up to 10 days from exposure to onset of symptom, Overlap of incubation period and period of communicability: 2 days prior to onset date, Period of communicability: For symptomatic individuals: 2 days prior to onset and 10 days post onset or symptom resolution over 72 h, whichever is longer; For asymptomatic individuals: 2 days prior to the date of positive result and 10 days post-laboratory confirmation.



**Fig. 3.** Epidemic curve of confirmed symptomatic COVID-19 cases according to the date of symptoms onset (n = 26).

Multiple interventions were implemented on January 31, 2020: 1) the ward was closed, 2) all SARS-CoV-2-positive inpatients were moved to another ward dedicated to COVID-19, 3) patients sharing rooms with positive patients were isolated in private rooms in this ward, 4) SARS-CoV-2-positive healthcare workers were suspended from duty until symptoms improved for at least 72 h, 10 days after onset, 5) self-monitoring of symptoms and subsequent rapid SARS-CoV-2 testing of all healthcare workers, 6) prohibited the use of non-alcohol hand sanitizers, 7) enhanced cleaning of wards with alcohol solutions including high-frequency contact surfaces, 8) closed the break room, 9) initiated screening of all patients and medical personnel, 10) enforced compliance with hospital rules, and 11) had all healthcare workers in the wards wear N95 masks and face guards.

<sup>a</sup> One of the confirmed cases tested positive, although

the patient’s date of onset was unknown.

<sup>b</sup> Four of the confirmed cases tested positive, although they were asymptomatic.

**Table 1**

Characteristics of healthcare workers working in a head and neck surgery ward in a COVID-19 cluster between January 28, 2022, and February 14, 2022.

Characteristics	Overall (N = 55)	COVID-19 cases (n = 12)	Non-cases (n = 43)
Age, years, median (range)	36 (21–59)	29.5 (21–53)	37 (21–59)
Sex, n (%)			
Male	24 (43.6)	3 (25.0)	21 (48.8)
Female	31 (56.4)	9 (75.0)	22 (51.2)
Occupation, n (%)			
Nurse	30 (54.5)	10 (83.3)	20 (46.5)
Doctor	16 (29.0)	1 (8.3)	15 (34.9)
Other healthcare workers <sup>a</sup>	9 (16.4)	1 (8.3)	8 (18.6)
History of sharing meals with non-household members <sup>b</sup> , n (%)			
Yes	3 (5.5)	3 (25.0)	0 (0)
No	52 (94.5)	9 (75.0)	43 (100)
Universal masking, n (%)			
Yes	55 (100)	12 (100)	43 (100)
No	0 (0)	0 (0)	0 (0)
Vaccination status, n (%)			
≥14 days post-dose 3	32 (58.2)	3 (25.0)	29 (67.4)
<14 days post-dose 3	23 (41.8)	9 (75.0)	14 (32.6)
Direct contact with patients with COVID-19, n (%)			
Yes	43 (78.2)	12 (100)	31 (72.1)
No	12 (21.8)	0 (0)	12 (27.9)
Direct contact with patients with COVID-19 not wearing a mask, n (%)			
Yes	40 (72.7)	12 (100)	28 (65.1)
No	15 (27.3)	0 (0)	15 (34.9)
Involved in aerosol generating procedures for patients with COVID-19, n (%)			
Yes	32 (58.2)	11 (91.7)	21 (48.8)
No	23 (41.8)	1 (8.3)	22 (51.2)
Use of break room, n (%)			
Yes	23 (41.8)	9 (75.0)	14 (32.6)
No	32 (58.2)	3 (25.0)	29 (67.4)
Use of alcohol hand sanitizer, n (%)			
Yes	48 (87.3)	8 (66.7)	40 (93.0)
No	7 (12.7)	4 (33.3)	3 (7.0)

<sup>a</sup> Other healthcare workers included three nursing aides, three physical therapists, one speech therapist, and two pharmacists.

<sup>b</sup> Within one week prior to the outbreak.

masking policy, but the proportion of positive patients with a direct contact with those not wearing masks was 100% of the positive cases and 65% of the non-cases. The percentage of healthcare providers who performed aerosol generating procedures on positive patients was 91% for positive cases and 49% for non-cases. Break room use was observed

in 75% of positive cases and 33% of non-cases. Non-use of alcohol hand sanitizers was observed in 33.3% of positive cases and 7% of non-cases.

### 3.4. Characteristics and comparison of the SARS-CoV-2 infection among patients with cancer

Table 2 shows the characteristics of 14 cases of SARS-CoV-2 infection and 34 non-cases among patients with cancer. The median age was 71.5 years (range 32–85 years), and 34 (71%) were men. The proportion of patients with head and neck cancer was 86% of the positive cases and 88% of the non-cases. Regarding vaccination status, patients who had been vaccinated with the second dose for more than 14 days comprised 79% of positive cases and 91% of non-cases. None of the patients received the booster dose. Room sharing with patients with COVID-19 was observed in 64% of positive cases and 21% of non-cases (57% vs. 21% for those sharing rooms with positive tracheostomy patients; 43% vs. 9% with positive cases using a nebulizer; 50% vs. 15% with positive cases requiring sputum suctioning, respectively). Compliance with the universal masking policy for patients was observed in 36% of positive cases and 79% of non-cases.

### 3.5. Severity of illness and outcome of COVID-19 healthcare workers and patients with cancer

Of the 12 healthcare workers with COVID-19, 3 were asymptomatic and 9 had mild illness. Of the 14 patients with cancer with COVID-19, 5 had mild illness, 6 had moderate illness, 3 had severe illness, and none had critical illness. Two patients with moderate illness experienced episodes of asphyxia due to sputum obstruction in a dedicated COVID-19 ward and were admitted to the intensive care unit and administered ventilators. SARS-CoV-2-positive patients were treated with sotrovimab (n = 12) or remdesivir, dexamethasone, and heparin (n = 3). Four secondary infections were noted as follows: bacterial pneumonia caused by *Pseudomonas aeruginosa* (n = 1), bacterial pneumonia and bacteremia caused by MRSA (n = 1), and aspiration pneumonia (n = 2). No deaths occurred within 30 days of symptom onset.

## 4. Discussion

This study described a COVID-19 outbreak in the head and neck surgery ward of a cancer center in Japan during the sixth wave due to the Omicron variant, which was quickly contained through rapid infection prevention and control measures. Since the head and neck



**Table 2**  
Characteristics of patients admitted in a head and neck surgery ward in a COVID-19 cluster between January 28, 2022, and February 14, 2022.

Characteristics	Overall (n = 48)	COVID-19 cases (n = 14)	Non-cases (n = 34)
Age, years median (range)	71.5 (32–85)	74.5 (56–85)	67.5 (32–85)
Sex			
Male	34 (70.8)	12 (85.7)	22 (64.7)
Female	14 (29.2)	2 (14.3)	12 (35.3)
Type of malignancy			
Head and neck cancer	42 (87.5)	12 (85.7)	30 (88.2)
Others <sup>a</sup>	6 (12.5)	2 (14.3)	4 (11.8)
Vaccination status			
≥14 days post-dose 2	42 (87.5)	11 (78.6)	31 (91.2)
Unvaccinated or ≥14 days post-dose 1 <sup>b</sup>	6 (12.5)	3 (21.4)	3 (8.8)
Tracheotomy			
Yes	27 (56.3)	10 (71.4)	17 (50.0)
No	21 (43.8)	4 (28.6)	17 (50.0)
Requiring sputum suctioning			
Yes	19 (39.6)	9 (64.3)	10 (29.4)
No	29 (60.4)	5 (35.7)	24 (70.6)
Universal masking			
Yes	32 (66.7)	5 (35.7)	27 (79.4)
No	16 (33.3)	9 (64.3)	7 (20.6)
Roomed with a patient with COVID-19			
Yes	16 (33.3)	9 (64.3)	7 (20.6)
No	32 (66.7)	5 (35.7)	27 (79.4)
Roomed with a patient with COVID-19 with tracheotomy			
Yes	15 (31.3)	8 (57.1)	7 (20.6)
No	33 (68.8)	6 (42.9)	27 (79.4)
Roomed with a patient with COVID-19 using a nebulizer			
Yes	9 (18.8%)	6 (42.9%)	3 (8.8%)
No	39 (81.3%)	8 (57.1%)	31 (91.2%)
Roomed with a patient with COVID-19 requiring sputum suctioning			
Yes	12 (25.0%)	7 (50.0%)	5 (14.7%)
No	36 (75.0%)	7 (50.0%)	29 (85.3%)
Direct contact with a COVID-19 healthcare worker			
Yes	44 (91.7)	13 (92.9)	31 (91.2)
No	4 (8.3)	1 (7.1)	3 (8.8)
Direct contact with COVID-19 healthcare worker using non-alcohol hand sanitizers			
Yes	40 (83.3)	11 (78.5)	29 (85.3)
No	8 (16.7)	3 (21.4)	5 (14.7)

<sup>a</sup> Others included brain tumor (n = 1), esophageal cancer (n = 1), lung cancer (n = 1), gastric cancer (n = 1), intraductal papillary mucinous neoplasm (n = 1), and pancreatic neuroendocrine tumor (n = 1).

<sup>b</sup> One patient was ≥14 days post-dose 1, and five were unvaccinated.

surgery ward is a unique environment, our findings provide important insights into the enhancement of infection prevention and control measures in hospitals with head and neck surgery wards.

The nurse with case ID 1 worked on January 29, 2022, with fever and sore throat and was an index case in this outbreak. The nurses with Case ID 1 and Case ID 2 were considered primary cases. A patient who tested negative on admission later turned out to be positive after developing fever the following day (Case ID 5), and the possibility of another primary case was considered. However, the patient was admitted to a private room at the time of admission, and thus, could not be considered as the main case of infection spread. Three of the healthcare workers who tested positive, including one nurse in the index case, had a history of sharing meals with non-household members, which was considered a possible risk factor for infection among healthcare workers. As part of our enhanced infection prevention and control measures, we strictly prohibited sharing meals with non-household members. In the index case, a nurse used benzalkonium chloride hand sanitizer instead of ethanol, which was considered another risk factor for the spread of infection. The efficacy of non-alcoholic hand sanitizers, especially products containing benzalkonium chloride, against SARS-CoV-2 is controversial and is not recommended for use by the United States Centers for Disease Control and Prevention or the World Health Organization [18]. In our cohort, four healthcare workers did not use ethanol

hand sanitizer, which was considered a possible risk factor for their SARS-CoV-2 infection. Therefore, the use of non-ethanol hand sanitizer was prohibited.

The effectiveness of the vaccine against the Omicron variant is significantly lower than that of the Delta variant [19]. However, in individuals who received two doses of mRNA-1273 (Moderna) and BNT162b2 (Pfizer) vaccines, followed by a booster dose of mRNA-1273 or BNT162b2, vaccine effectiveness against symptomatic disease temporarily increased to approximately 65–75% at weeks 2–4 [19]. In our cohort, booster vaccination for healthcare workers started in early January 2022, and at the time of the outbreak, many healthcare workers had not been vaccinated for two weeks. The proportion of healthcare workers who had been vaccinated with booster dose for more than 14 days was higher in the non-cases than in the positive cases, indicating the effectiveness of vaccination. The effectiveness of two doses of the mRNA vaccine in preventing severe illness against omicrons is still maintained. The effectiveness in preventing hospitalization was 58% after one dose, 64% at 2–24 weeks after two doses, and 44% at more than 25 weeks after two doses [19]. In our cohort, none of the patients received a third dose of the mRNA vaccine, and 88% of the patients received two doses. The severity of COVID-19 was 36%, 50%, and 14% for mild, moderate, and severe, respectively, and none of the patients had critical illness.

Short distance from patients with SARS-CoV-2 infection increases the risk of infection [20]. The break room in the ward was small and used more by positive cases than by non-positive cases. Therefore, using the break room could be considered an infection risk factor for healthcare workers. As an infection prevention and control measure for COVID-19, we prohibited the use of the break room during the outbreak period and continued to prohibit its use by multiple individuals after the outbreak had converged.

Omicron has been reported to be more than 10 times more infectious than the original variant, and approximately 2.8 times more infectious than the Delta variant [21]. The generation time of Omicron has been reported to be < 2.5 days or less in early reports from the UK [22] and shorter than the Delta strain (4.7 days) [23]. The reduction in the generation time might be one of the factors that accelerated the spread of SARS-CoV-2 in the facility. In our case, the possibility of a tertiary infection being caused during a short period was considered (Case ID 24). Furthermore, rooming with patients with SARS-Cov-2 infection was more common among positive cases than among non-positive cases. Despite the highly contagious nature of Omicron, compliance with universal masking was observed more commonly among non-positive cases than among positive cases, thus emphasizing the importance of universal masking of patients after outbreak convergence.

In the outbreak ward, the possibility of sputum suctioning of patients with SARS-COV-2 infection without the required personal protective equipment suddenly occurred, thus requiring wearing N95 masks and face guards for healthcare workers in the ward. Sputum suctioning is an aerosol generating procedure that requires a higher level of personal protective equipment [17,24]. In our cohort, the proportion of healthcare workers who performed aerosol generating procedures on positive patients was higher in positive cases than in non-positive cases. Sharing rooms with patients with COVID-19 was more common in positive cases than in non-positive cases. Similarly, sharing a room with a positive patient who had a tracheotomy, with a positive patient using a nebulizer, and with a positive patient requiring sputum suctioning were also more common among the positive cases. However, these were considered to be confounded and correlated with each other, and it was not possible to identify specific risk factors due to the small sample size.

The main route of SARS-CoV-2 transmission is droplet infection, and contact transmission is a minor part of the overall transmission [25]. However, during this outbreak, two patients with CRE and MRSA, who were isolated in private rooms under contact infection prevention, developed COVID-19 (Case ID 19 and 20). These cases were considered to be due to inadequate hand disinfection and the use of personal

protective equipment by healthcare workers. Therefore, we re-educated healthcare workers on wearing personal protective equipment and hand hygiene methods to prevent contact transmission and infection.

This study had several limitations. First, we could not perform statistical analysis owing to the small sample size. Second, we did not conduct experimental studies to evaluate droplet and airborne transmission routes and ventilation systems, which are important factors. Finally, we did not obtain genotype data for the SARS-CoV-2 samples collected from healthcare workers and patients. Despite these limitations, the strength of this study is that it provides insights into the Omicron outbreak in the head and neck surgery ward that can be useful to other healthcare institutions, given the rarity of COVID-19 outbreak reports in the head and neck surgery ward.

## 5. Conclusion

In conclusion, we described an outbreak of SARS-CoV-2 infection in a head and neck surgery ward. Notably, there were a high number of positive cases among healthcare workers who performed aerosol generating procedures and patients who shared the room with a patient with COVID-19, who could generate aerosols, providing important insights for strengthening the infection prevention and control measures for Omicron outbreaks in head and neck surgery wards.

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## All authors meet the ICMJE authorship criteria

NI contributed to the study conception and design; NI, NA, DK, and TC collected the data; NI and TK performed data analysis; NI wrote the first draft of the manuscript; and NA, MI, TK, DK, TC, ENK, and NO interpreted the data and assisted in the review of the final manuscript. All authors critically reviewed the draft of the manuscript and read and approved the final manuscript. All authors meet the ICMJE authorship criteria.

## Declarations of competing interest

None.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jiac.2022.08.010>.

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