

Original Article

# Uniform infection screening allowed safe head and neck surgery during the coronavirus disease 2019 pandemic in Japan

Akiko Ito<sup>1</sup>, Kenya Kobayashi<sup>1,\*</sup>, Mika Shiotsuka<sup>2</sup>, Tetsufumi Sato<sup>3</sup>,  
Go Omura<sup>1</sup>, Yoshifumi Matsumoto<sup>1</sup>, Atsuo Ikeda<sup>1</sup>, Azusa Sakai<sup>1</sup>,  
Kohtaro Eguchi<sup>1</sup>, Tomonari Takano<sup>1</sup>, Fumihiko Matsumoto<sup>1</sup>,  
Osamu Kobayashi<sup>2</sup>, Satoshi Iwata<sup>2</sup> and Seiichi Yoshimoto<sup>1</sup>

<sup>1</sup>Department of Head and Neck Surgery, National Cancer Center Hospital, Tokyo, <sup>2</sup>Department of Infection Disease, National Cancer Center Hospital, Tokyo and <sup>3</sup>Department of Anesthesia and Intensive care, National Cancer Center Hospital, Tokyo, Japan

\*For reprints and all correspondence: Kenya Kobayashi, Department of Head and Neck Surgery, National Cancer Center Hospital, 5-1-1 Tsukiji, Chuo-ku, Tokyo 104-0045, Japan. E-mail: kenyajp@hotmail.com

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## Abstract

**Background:** The purpose of this study was to determine whether a uniform infection screening protocol could be used to safely perform head and neck cancer surgery during the coronavirus disease 2019 pandemic and clarify how surgical treatment changed compared with the pre-pandemic period.

**Materials and methods:** During the unprecedented coronavirus disease 2019 pandemic in Tokyo, we continued providing head and neck cancer care, guided by our own uniform screening protocol. In this study, medical records of 208 patients with head and neck malignancy, who underwent surgical treatment at our hospital during the first and second wave of pandemic for each 2-month period (first wave: 30 March 2020–30 May 2020, second wave: 14 July 2020–14 September 2020) and the 2-month pre-pandemic period (30 October 2019–30 December 2020), were analysed.

**Results:** A total of 133 patients were admitted for surgical treatment and all, except six patients with emergency tracheostomy, were screened according to the protocol. As a result, all 127 patients received surgical treatment as planned, and all 1247 medical staff members involved in the surgeries were uninfected by severe acute respiratory syndrome coronavirus 2. During the first wave of pandemic, 20% reduction of head and neck surgery was required; however, restrictions of surgery were not necessary during the second wave. Surgical procedure, length of hospitalization, postoperative complications and number of medical staff were unchanged compared with pre-pandemic period.

**Conclusion:** Our data indicate that continuation of head and neck anticancer surgical treatment in an epidemic area during the coronavirus disease 2019 pandemic were safe and feasible, if adequate and strict preventive measures are vigorously and successfully carried out.

**Key words:** COVID-19, head and neck surgery, infection screening, pandemic, SARS-CoV-2

## Introduction

The coronavirus disease 2019 (COVID-19), the novel infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has spread quickly around the world. In March 2020, the World Health Organization officially declared a pandemic. In response, a drastic and unprecedented change has been required for head and neck clinical practice. Because the highly concentrated SARS-CoV-2 viral particles have been reported in the nasal cavity, nasopharynx and oropharynx, there is concern for intraoperative transmission by aerosolization of the viral particles during head and neck surgery (1). Inhalation of the virus in the form of aerosols in the air originating from the nasopharyngeal mucosa is regarded as a high infection risk during surgical procedures, especially with use of a high-speed drill for resecting bone, which generates significant airborne aerosols (2). Several head and neck surgeries require mandibular, maxillary and nasal bone osteotomies using a drill and are therefore considered SARS-CoV-2 high-risk exposure surgeries for medical staff. In addition, it has been suggested that patients with SARS-CoV-2 infection have higher rate of 30-day mortality and pulmonary complications after surgery (3).

Against this background, delayed elective head and neck surgery has been permitted to promote safety of medical staff and patients. However, the justification for postponing surgery in cancer patients is not clear as any delay in cancer treatment might affect prognosis. There were several data on surgical management and outcome or clinical guideline of patients with head and neck cancer during the COVID-19 pandemic (4–8), although the available guideline is not specific and strict due to varying infection rates between the countries and regions. Moreover, the COVID-19 pandemic is likely to continue for some time. Hence, we are faced with difficult decisions on how to safely perform elective surgery in various pandemic situations.

The purpose of this study was therefore to determine whether a uniform infection screening protocol could be used to safely perform head and neck cancer surgery during the COVID-19 pandemic and clarify how surgical treatment changed compared with the pre-pandemic period. The inclusion of the infection background in the analysis was an original study, unlike previous reports.

## Materials and methods

### Setting and study population

The National Cancer Center Hospital of Japan is located in the centre of Tokyo. During the unprecedented COVID-19 pandemic in Tokyo, we continued providing head and neck cancer care. In this retrospective cross-sectional study, we analysed medical records of patients with head and neck malignancy who underwent surgical treatment at our hospital during the first and second wave of COVID-19 pandemic for each 2-month period (first wave: 30 March 2020–30 May 2020, second wave: 14 July 2020–14 September 2020) and the 2-month pre-pandemic period (30 October 2019–30 December 2020).

In our department, 475 surgical cases (general anaesthesia: 418 cases, local anaesthesia: 57 cases) were performed between 1 January 2019 and 31 December 2019, with 79 surgical cases performed per 2 months. As the control for the COVID-19 pandemic period, we randomly sampled 2 months in 2019: 30 October 2019–30 December 2019. Patients characteristics, primary site, clinical stage, surgery, use of drilling system, operation time, blood loss, cumulative total number of medical staff, intensive care unit hospitalization, length of hospitalization and postoperative complications were evaluated.

Head and neck surgery was classified as follows: maxillectomy/mandibulectomy, glossectomy/other oral surgery, partial pharyngectomy, transoral videolaryngoscopic surgery, total laryngectomy/total laryngopharyngectomy, skull base surgery, endoscopic sinus surgery, emergency tracheostomy and other neck surgery (thyroidectomy, parotidectomy and neck dissection). Postoperative complications were defined as adverse events needing any medical intervention or prolonging the length of hospital stay. Medical staff included all individuals who participated in a surgery for >10 min. Medical staff consisted of head and neck surgeons, plastic surgeons, general surgeons, anaesthesiologists and operating room nurses. The eighth edition of the TNM classification from the UICC was adopted for clinical staging (9). Ethical approval for this retrospective study was obtained from our ethics committee (approved number 2018-179).

### COVID-19 infection prevention and control measures

**General measures.** After the start of the epidemic in Tokyo, the Tokyo governor requested the public to stay home unless necessary, on 26 March 2020. Because the infection got out of control, the Prime Minister declared a state of emergency between 7 April 2020 and 25 May 2020. Contrary to lockdowns in the West, our state of emergency is not legally binding, but relies on voluntary co-operation of the public. The resulting infection trends in Tokyo are shown in Fig. 1, from official Tokyo data (10).

**Specific hospital measures.** Thermography was set up in front of the hospital entrance, and all incoming persons were triaged by this system. Detailed instructions about hand hygiene, cough and sneeze hygiene, as well as disinfecting agents were provided. The hospital also denied access to visitors except families receiving informed consent. In addition, wearing medical face masks became mandatory for all medical staff.

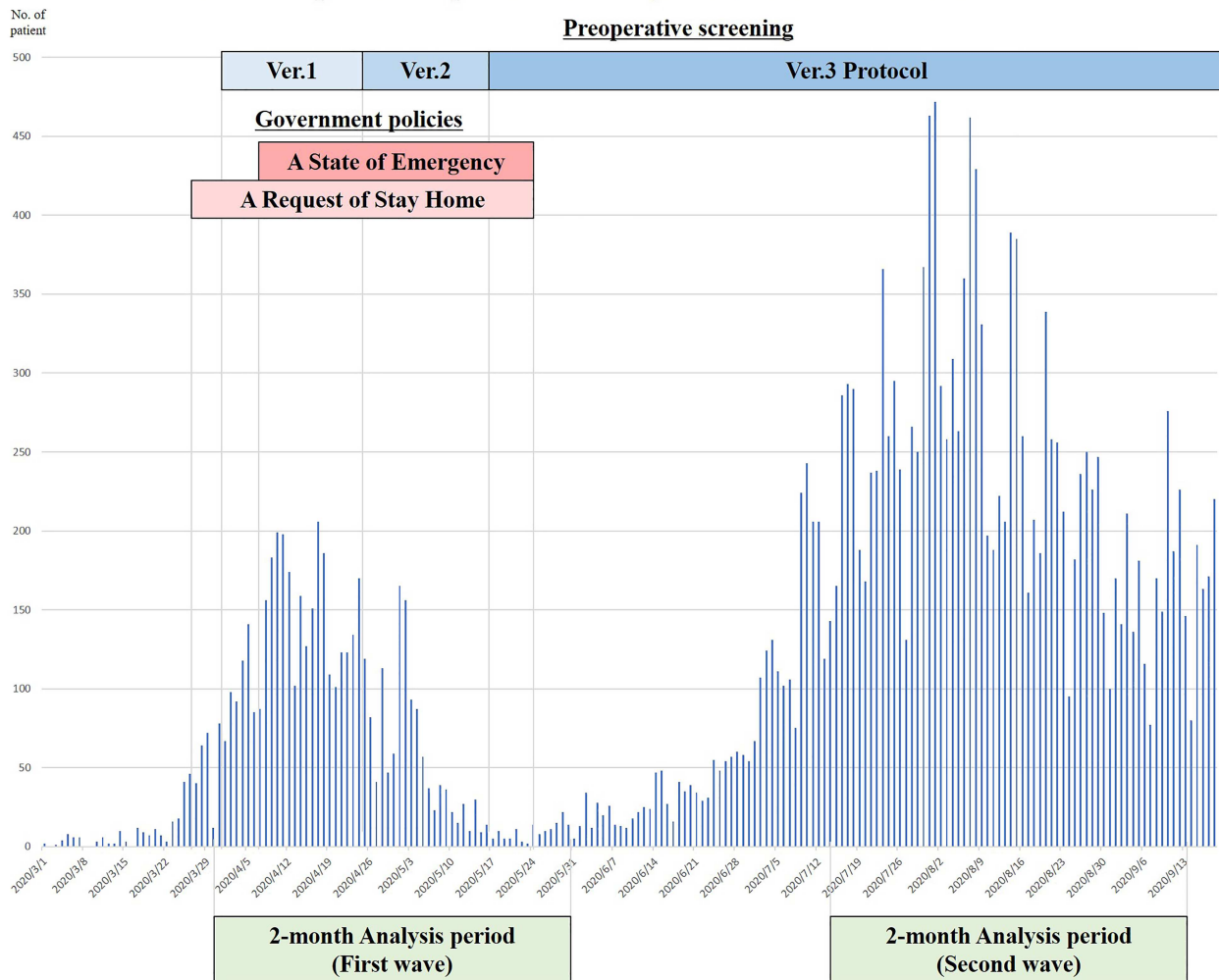
**Specific measures at department of head and neck surgery.** Oto-Rhino-Laryngological Society of Japan provided useful screening protocol guidelines based on region and facilities (11). We also developed our own protocols while adhering to the guidelines. The COVID-19 preoperative screening protocol is shown in Fig. 2.

First, as ‘basic screening’, we asked about fever ( $\geq 37.5^\circ\text{C}$ ), olfactory dysfunction, contact with COVID-19 patients or close contact and travel history on admission. As objective findings, we also checked chest computed tomography (CT) and  $\text{SpO}_2$  ( $<95\%$ ) to check for symptomatic/asymptomatic pneumonia. A positive basic screening would lead to postponement of surgery at that point and examination for COVID-19 infection.

If basic screening was negative, we proceeded to ‘advanced screening’. Advanced screening was performed using a real-time reverse transcription polymerase chain reaction (RT-PCR) on respiratory samples from nasopharyngeal and trachea stomal swab. We asked our patients to admit 1 or 2 days before the surgeries, and the patients were required not to go out during the hospitalizations.

During the pandemic, especially in the first wave, the medical system was disrupted and medical supplies became limited. In particular, the efficient use of N95 masks and RT-PCR tests were required. We overcome this problem by performing surgery at 80% of the conventional rate and by gradually expanding the indication for PCR test according to the COVID-19 exposure risk from head and neck surgery. The range of indications for PCR testing was expanded in three stages every 3 weeks, according to our capacity of in-hospital examination. The changes in the protocol over time

### Landscape of new patients in Tokyo and COVID-19 measures



**Figure 1.** Landscape of new patients in Tokyo and COVID-19 measures. The vertical axis shows the number of new COVID-19 cases in Tokyo. The top columns show duration of the national policy and the evolution of the infection screening protocol. Ver., Version; No. of patients, number of patients; COVID-19, coronavirus disease 2019.

and COVID-19 exposure risk classification of surgeries are shown in Figs 1 and 3, respectively. In Version (Ver) 1 protocol (1 April 2020–24 April 2020), high exposure risk surgery such as skull base surgery, sinonasal surgery, surgery using drilling system, surgery with massive haemorrhage and difficult intubation cases were eligible for PCR. In Ver.2 protocol (24 April 2020–17 May 2020), in addition to high exposure risk surgery, intermediate exposure risk surgery such as surgery with free flap or pedicle flap reconstruction and surgery (oral cavity/pharynx/larynx) lasting >2 h without reconstruction (e.g. total laryngectomy, partial pharyngectomy) were eligible for PCR. In final Ver.3 protocol (18 May 2020–), in addition to the previous two risk groups, low exposure risk surgery (oral cavity/pharynx/larynx) lasting <2 h without reconstruction (e.g. glossectomy, transoral video surgery) were eligible for PCR. Finally, it was possible to perform PCR testing for all but neck surgery (neck dissection only, thyroidectomy and parotidectomy) that did not involve the oral or nasal cavity, with negligible exposure risk.

Finally, if preoperative screening was negative, surgery was performed as scheduled. Medical staff wore normal personal protect equipment (PPE), including surgical mask and level-3 gown. In

high-risk surgery, we set the transparent screen around the surgeon to protect the anaesthesiologist. For emergency tracheostomy, the medical staff operated with full PPE (N95 respirator, goggles, level-3 gown) because there was no time to perform PCR testing.

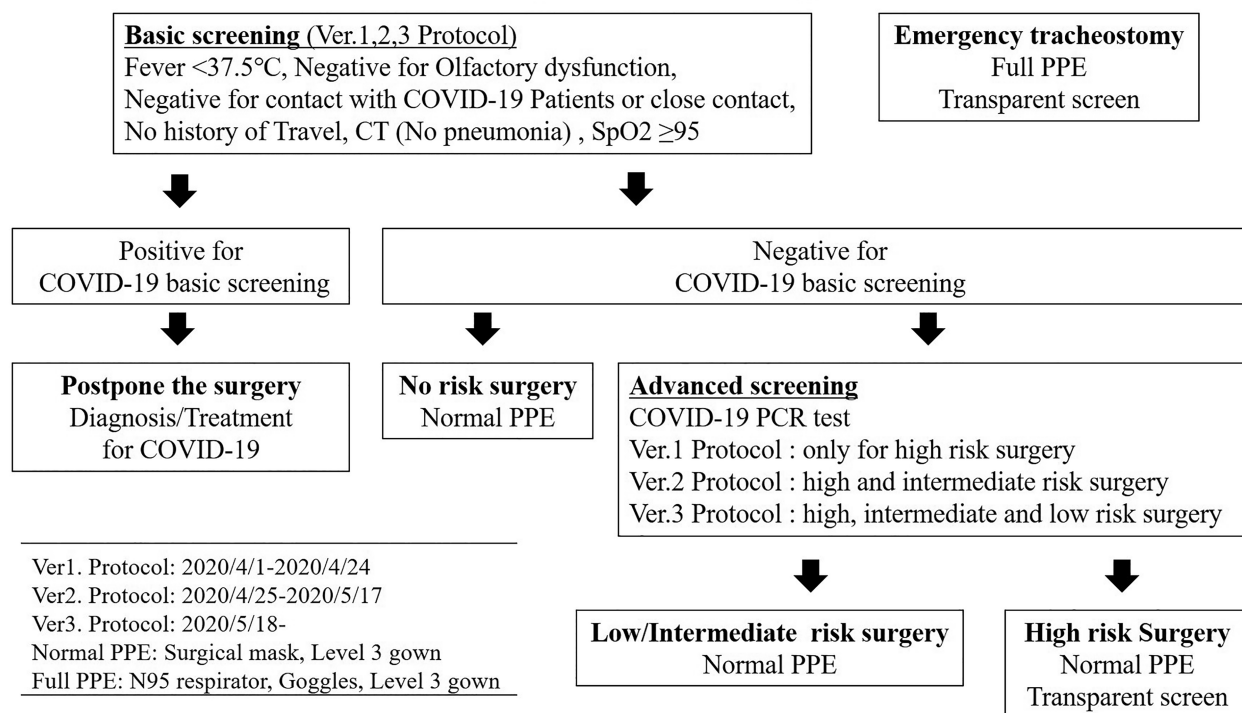
During the second wave of the pandemic, there were few shortages of medical supplies because of the experience of the first wave; PCR testing was adequate because of the expanded testing capacity; however, the N95 respirator was still inadequate. Hence, the restrictions on surgery were removed while adhering to the screening protocol.

We overcome this problem by performing surgery at 80% of the conventional rate and by gradually expanding the indication for PCR test according to the COVID-19 exposure risk from head and neck surgery.

Postoperative management was carried out as before in accordance with standard precautions.

**Population and COVID-19 infections in Tokyo.** The population of Tokyo and the cumulative number of COVID-19 cases were calculated from the public database of Tokyo Metropolitan Government

## COVID-19 Preoperative Screening Protocol



**Figure 2.** COVID-19 preoperative screening protocol. The preoperative screening protocol is shown, which consists of two steps: basic screening and advanced screening. Due to the shortage of medical supplies during the pandemic, the indication for PCR testing was gradually expanded based on the SARS-CoV-2 exposure risk. Emergency surgery was performed with full PPE because there was no time for screening. PCR, polymerase chain reaction; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; CT, computed tomography; PPE, personal protective equipment.

(10). The cumulative number of infected persons per 10 000 population was calculated and used as an indicator of infection in Tokyo.

### Statistical analysis

Difference between any two groups were analysed using Fisher's exact test or Wilcoxon signed-rank test. Statistical analysis was performed using SPSS Statistics software (version 22.0.0, IBM, Armonk, NY, USA). The level of significance was set at  $P < 0.05$ .

## Results

### COVID-19 infections in Tokyo

According to our public database, the population of Tokyo in 2020 was estimated at 13.98 million. A total of 448 persons were infected with COVID-19 at the beginning of this study (30 March 2020), representing 0.32 infections per 10 000. At the end of the first wave (5 June 2020), the total number of infected persons had risen to 5338, or 3.8 infections per 10 000. At the end of this study during the second wave (14 September 2020), the total number of infected persons had risen to 23 274, or 16.6 infections per 10 000.

### Protocol adherence and screening

A total of 133 patients (first wave: 62 patients, second wave: 71 patients) were admitted for surgical treatment and all, except six patients (first wave: four patients, second wave: two patients) for emergency tracheostomy, were screened according to the protocol

(Table 1). Ver.1 protocol, Ver.2 protocol and Ver.3 protocol were adapted for 21, 15 and 91 patients, respectively. All 127 patients were negative for COVID-19 on preoperative screening. None of their chest CTs detected pneumonia. Selection of 81 patients (first wave: 29 patients, second wave: 52 patients) were tested for RT-PCR and returned negative result. As a result, all 127 patients (first wave: 58 patients, second wave: 69 patients) received surgical treatment as planned.

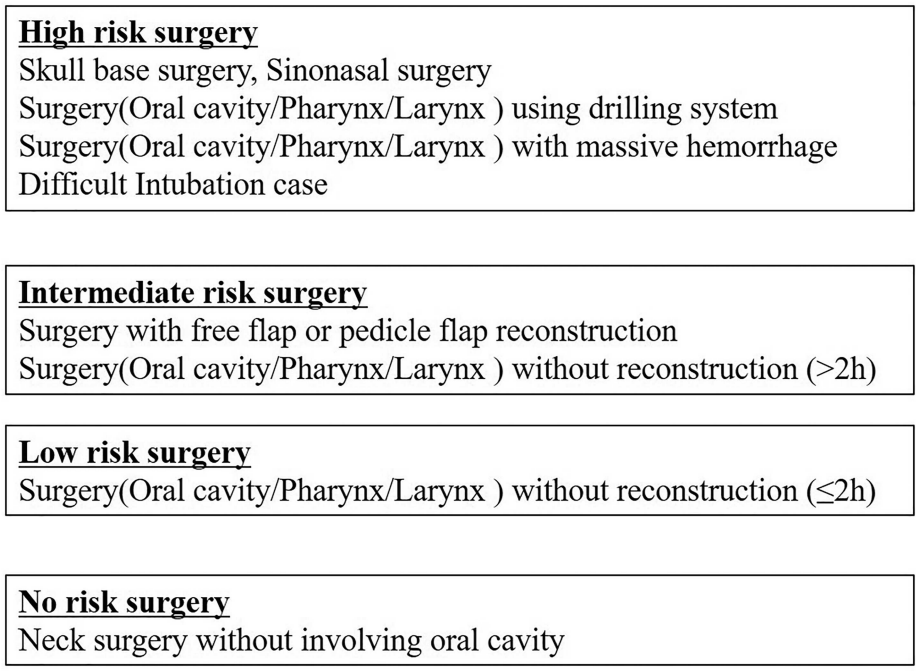
A total of 1247 medical staffs were involved in the surgeries over the 4-month pandemic period. This included 439 head and neck surgeons, 135 plastic or general surgeons, 230 anaesthesiologists and 453 operating room nurses. No medical staff was infected with COVID-19.

### Comparison between pandemic and control period

The number of surgeries during the first and second wave of pandemic each period and control period was 62, 71 and 75, respectively. The number of surgeries decreased by 20% in the first wave period, while it decreased by only 5% in the second wave period.

Table 2 shows the changes between each pandemic and control periods. There was no significant difference in age, sex, primary site, stage, surgical procedure and operation time. We aimed to improve the efficiency of the number of medical staff involved in the surgeries, but, in fact, there was no significant difference between pandemic and control period. Postoperatively, there was no difference in length of hospital stay or complication rate between groups. Therefore, apart

# COVID-19 Exposure Risk Classification of Head and Neck Surgery



**Figure 3.** COVID-19 exposure risk classification of head and neck surgery. The risk of exposure was classified into four levels, taking into account the aerosol generation risk of the surgery and the number of medical staff involved in the surgery.

**Table 1.** Result of COVID-19 preoperative screening

Protocol	Number of patients
	Total (first wave/second wave)
Ver.1	21 (21/0)
Ver.2	15 (15/0)
Ver.3	91 (22/69)
Emergency	6 (4/2)
Characteristics	Median (range)
BT (°C)	36.5 (35.1–37.2)
SpO <sub>2</sub> (%)	97 (95–100)
Characteristics	Number of patients
	Total (first wave/second wave)
CT screening	
Negative	129 (60/69)
Positive	0 (0/0)
PCR screening	
Negative	81 (29/52)
Positive	0 (0/0)

COVID-19, coronavirus disease 2019; Ver., Version; BT, body temperature; CT, computed tomography; PCR, polymerase chain reaction.

from the ~20% reduction in surgery during the first wave pandemic period, other parameters did not differ significantly from the control period.

## Discussion

In this study, during the COVID-19 pandemic in Tokyo, we provided safe and efficient head and neck cancer care using our own screening protocol. A total of 564 medical staffs were involved in the surgeries, and no medical staff was infected with SARS-CoV-2. With an infection background of 16.6 infections per 10 000, this protocol was considered useful.

Our institution is located in Tokyo, Japan. Tokyo has a population of 13.95 million, >10% of the total population of Japan. As of the first wave (5 June 2020) and the second wave (14 September 2020), 81 596 and 447 471 individuals were tested for COVID-19 in Tokyo, with registration of 5338 and 23 274 laboratory-confirmed COVID-19-positive cases, representing a 6.5 and 5.2% positivity rate, respectively (10). According to the report by Fong et al. (12) in northern Italy, they tested 219 cancer outpatients by RT-PCR screening and the positivity rate was 1.8%. A cumulative total of 3075 persons were tested by RT-PCR in their healthcare district over the same period and 200 (6.5%) were positive.

We tested 81 asymptomatic cancer patients based on our protocol of preoperative screening and none of them were positive by PCR. Asymptomatic cancer patients might have significantly lower positivity rate compared with their healthcare district's rate because generally PCR testing was performed on symptomatic patients or their close contacts. Another reason may be that patients scheduled for cancer surgery are educated on proper infection

**Table 2.** Patients characteristics

Characteristics	Pre-pandemic period	Pandemic period	P value Pre vs first	Pandemic period	P value Pre vs second
	n=75	First wave n=62		Second wave n=71	
Sex, No. (%)					
Male	43 (57%)	43 (69%)	0.1016	41 (58%)	0.5466
Female	32 (43%)	19 (31%)		30 (42%)	
Age, median (range), years	66 (12–85)	67 (20–91)	0.7088	65 (28–86)	0.4845
Primary tumour site, No. (%)					
Oral cavity	25 (33%)	25 (40%)	0.0714	21 (30%)	0.6447
Pharynx	20 (27%)	17 (27%)		23 (32%)	
Thyroid/salivary gland	17 (23%)	6 (10%)		13 (18%)	
Nasal cavity	5 (7%)	4 (6%)		6 (8%)	
Larynx	5 (7%)	1 (2%)		2 (3%)	
Others	3 (4%)	9 (15%)		6 (8%)	
Clinical TNM stage, No. (%)					
I	21 (28%)	16 (26%)	0.2844	21 (30%)	0.2622
II	17 (23%)	16 (26%)		9 (13%)	
III	12 (16%)	3 (5%)		7 (10%)	
IV	17 (23%)	19 (31%)		25 (35%)	
N.A.	8 (11%)	8 (13%)		9 (13%)	
Anaesthesia, No. (%)					
General	73 (97%)	58 (94%)	0.2549	69 (97%)	0.6691
Local	2 (3%)	4 (6%)		2 (3%)	
Surgical procedure, No. (%)					
Maxillectomy/mandibulectomy	10 (13%)	12 (19%)	0.8011	9 (13%)	0.9795
Glossectomy/other oral surgery	15 (20%)	10 (16%)		12 (17%)	
Partial pharyngectomy	8 (11%)	6 (10%)		7 (10%)	
TOVS	6 (8%)	6 (10%)		10 (14%)	
TL/TPL	8 (11%)	4 (6%)		7 (10%)	
Skull base surgery	4 (5%)	2 (3%)		3 (4%)	
Endoscopic sinus surgery	0 (0%)	1 (2%)		0 (0%)	
Emergency tracheostomy	2 (3%)	4 (6%)		2 (3%)	
Neck surgery	22 (29%)	17 (27%)		21 (30%)	
Tracheostomy, No. (%)					
Positive	24 (32%)	18 (29%)	0.4261	22 (31%)	0.5187
Negative	51 (68%)	44 (71%)		49 (69%)	
Free flap reconstruction, No. (%)					
Positive	18 (25%)	13 (21%)	0.4156	19 (27%)	0.4233
Negative	57 (75%)	49 (79%)		52 (73%)	
Use of drill system, No. (%)					
Positive	18 (24%)	18 (29%)	0.3181	18 (25%)	0.5007
Negative	57 (76%)	44 (71%)		53 (75%)	
Operating time, median (range), min	205 (11–697)	190.5 (13–721)	0.1887	203 (21–857)	0.7764
Bleeding, median (range), ml	82 (0–1580)	79 (0–3333)	0.7878	91 (0–3638)	0.9347
Medical staff, median (CM), No.					
Head and neck surgeon	3 (250)	3 (203)	0.6378	3 (236)	0.5404
Other surgeon	0 (73)	0 (57)	0.4663	0 (78)	0.7959
Anaesthesiologist	2 (135)	2 (108)	0.7539	2 (112)	0.0683
Nurse	3 (250)	2 (196)	0.4043	3 (257)	0.5763
Length of hospital stay, median (range), days	9 (4–63)	9 (4–39)	0.2182	13 (4–40)	0.5180
Hospitalize in an ICU, No. (%)					
Positive	21 (28%)	15 (24%)	0.2566	20 (28%)	0.5638
Negative	54 (72%)	47 (76%)		51 (72%)	
Postoperative complication, No. (%)					
Positive	7 (9%)	9 (15%)	0.2499	7 (10%)	0.5676
Negative	68 (91%)	53 (85%)		64 (90%)	
Re-operation, No. (%)					
Positive	0 (0%)	3 (5%)	0.0902	0 (0%)	N.A.
Negative	75 (100%)	59 (95%)		71 (100%)	

No., number of patients. Neck surgery thyroidectomy, parotidectomy, neck dissection; TOVS, transoral videolaryngoscopic surgery; TL, total laryngectomy; TPL, total laryngopharyngectomy; CM, cumulative total; ICU, intensive care unit; N.A., not applicable.



prevention and tend to avoid behaviours that put them at risk for infection.

On the other hand, in a retrospective study on 1524 patients with cancer, Yu et al. (13) estimated an infectious rate of 0.79% (12/1524) compared with 0.37% within the general population. This study suggested that cancer patients have high risk of SARS-CoV-2 infection because of immunocompromised status or highly invasive surgery. Therefore, screening protocols are needed to protect patients and medical staff.

According to a report from Hong Kong, with their initial measures in surgery management, which reduced elective surgeries by 80% and infection control, no medical staff developed nosocomial infection (14). Morrison et al. (15) reported that they stratified surgical cases and saw a 55% reduction in surgical volume during 18 March–18 April 2020 in AL, USA. Brar et al. (16) in London, UK, reported their 47 elective head and neck surgeries from 23 March to 20 May 2020 and concluded that careful preoperative screening and postoperative care in a COVID-19 clear ward allowed head and neck surgeries to proceed safely during the epidemic.

We used unified COVID-19 screening protocol and control measures and performed 133 head and neck surgeries during extracted 4 months of the COVID-19 pandemic. Our hospital specializes in cancer treatment and performs highly invasive surgeries including skull base surgery, radical surgery with massive haemorrhage and reconstructive surgery requiring a large number of medical staff and long operation time. Such surgical procedures are considered SARS-CoV-2 high risk. Because the screening protocol was effective, we performed all surgeries safely without any infection to the medical staff. The decrease in surgeries was restrained to 20% in first wave and only 5% in second wave, and surgical procedures, postoperative course and other parameters were similar to the pre-pandemic period in 2019.

At the beginning of the outbreak, it was found that while most COVID-19 patients rarely infected others, there were clusters suspected of contracting COVID-19 from specific patients (17). In Japan, infection preventive measures by tracking such clusters were adopted at the early stage of the epidemic. And it was concluded that the risk of occurrence of clusters is particularly high when the ‘Three Cs’ overlap: close spacing with insufficient ventilation, crowded conditions with other people and conversation over short distances (18,19). As operation rooms meet these conditions to some extent, we should minimize the number of medical staff entering the operation room. However, in fact, there was no significant difference in number of medical staff involved in surgeries between pandemic and control period in this study.

The most common reported symptoms of COVID-19 include fever and cough, leading to dyspnea and fatigue (20). Sore throat, sputum production, olfactory and taste disorder are also identified as symptoms (20,21). Therefore, we checked these symptoms at the point of hospitalization. The difficulty in managing COVID-19 is due to the high number of asymptomatic persons infected with the disease. Some studies showed that >50% of patients were asymptomatic at the time of testing (22). In order to expose asymptomatic patients, CT scans and SpO<sub>2</sub> screening were used as routine objective tests. It is reported that chest CT abnormality is found in 86.2% of COVID-19 patients, whereas chest X-ray abnormality is found in 59.1% (20). Moreover, asymptomatic patients could have CT changes before symptom onset (23). In addition, we used nasopharyngeal swabs and tracheal stomal swabs for RT-PCR, as ‘advanced screening’. The detection rate of nasal swabs was reported to be 63% (24), implying around 40% false negatives. We expected chest CTs to augment

RT-PCR results. However, no matter how accurate the screening protocol, it is difficult to completely eliminate false negatives. Infection screening is not perfect, so medical staff continue to wear normal PPE. In high-risk surgeries, we set the transparent screen around the surgeon to protect the anaesthesiologist. Furthermore, any delays to performing emergency surgeries can be life threatening, and therefore a full screening on patients prior to the surgery may not be practical. In order to mitigate the risk of infection from those patients, (1) all patients are subject to screening on admission and (2) medical staff involved in emergency surgeries is equipped with full PPE. In this study, all six patients of emergency tracheostomy had tested negative during screening on admission and therefore they did not proceed to receive chest CT or RT-PCR. Screening on admission involves looking for symptoms such as fever (37.5°C) or olfactory dysfunction, any history of contact with COVID-19 patients, as well as travel history. If a patient tests positive during screening on admission, our policy is to perform the necessary emergency surgery with full PPE, followed by private room management and PCR testing until it is confirmed that the patient tests negative for COVID-19. Screening on admission helps us mitigate the risk of post-hospitalization horizontal transmission of COVID-19.

Our study suggested that proper infection screening and protection through the first and second wave of the COVID-19 pandemic may allow head and neck surgery to be performed safely without restriction. Because SARS-CoV-2 is silent and persistent virus, long-term measures considering the infection situation in surrounding healthcare district are required. Further research is needed in the future.

The major limitation of this study was selection bias due to the retrospective setting with a limited number of cases. Also, the lack of PCR-positive patients is a weakness in terms of demonstrating the usefulness of infection screening. However, during a pandemic, it is difficult to conduct clinical studies, and the fact that a large number of head and neck cancer surgeries continued to be performed with a unified infection screening is very valuable information.

## Conclusion

In conclusion, we performed uniform COVID-19 screening of 133 preoperative head and neck cancer patients and implemented safe perioperative management for both patients and medical staff. Although medical supplies were scarce during the pandemic, surgeries could be performed safely by expanding the screening indications in stages. Our screening protocol was considered valid for the infection background of 16.6 infections per 10 000 persons. During the first wave of pandemic, 20% reduction of head and neck surgery was required; however, restrictions of surgery were not necessary during the second wave. The nature of surgery, length of hospital stay, postoperative complications and number of medical staff were unchanged compared with the pre-pandemic period.

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## Conflict of Interest

None declared.

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## References

- van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 2020;382:1564–7.
- Workman AD, Jafari A, Welling DB, et al. Airborne aerosol generation during endonasal procedures in the era of COVID-19: risks and recommendations. *Otolaryngol Head Neck Surg* 2020;163:465–70.
- COVIDSurg Collaborative. Mortality and pulmonary complications in patients undergoing surgery with perioperative SARS-CoV-2 infection: an international cohort study. *Lancet* 2020;396:27–38.
- Yuen E, Fote G, Horwich P, et al. Head and cancer care in the COVID-19 pandemic: a brief update. *Oral Oncol* 2020;105:104738.
- Werner MT, Carey RM, Albergotti WG, et al. Impact of the COVID-19 pandemic on the management of head and neck malignancies. *Otolaryngol Head Neck Surg* 2020;162:816–7.
- Galli J, Settini S, Tricarico L, Almadori G, Paludetti G. Clinical and surgical management of patients with head and neck cancer in a COVID-19 dedicated center in Italy. *Head Neck* 2020;42:1466–70.
- Day AT, Sher DJ, Lee RC, et al. Head and neck oncology during the COVID-19 pandemic: reconsidering traditional treatment paradigms in light of new surgical and other multilevel risks. *Oral Oncol* 2020;105:104684.
- Mehanna H, Hardman JC, Shenson JA, et al. Recommendations for head and neck surgical oncology practice in a setting of acute severe resource constraint during the COVID-19 pandemic: an international consensus. *Lancet Oncol* 2020;21:e350–9.
- Brierley JD, Gospodarowicz MK, Wittekind C, editor. *TNM Classification of Malignant Tumours*, 8th edn. Wiley-Blackwell, New jersey USA, 2017; p.17–54, 136–138.
- Tokyo Metropolitan Government. Updates on COVID-19 in Tokyo. <https://stopcovid19.metro.tokyo.lg.jp/en> (20 September 2020, date last accessed).
- The Oto-Rhino-Laryngological Society of Japan, Inc. Information from the Society. [http://www.jibika.or.jp/members/information/info\\_corona.html](http://www.jibika.or.jp/members/information/info_corona.html) (3 April 2020, date last accessed).
- Fong D, Rauch S, Petter C, Haspinger E, Alber M, Mitterer M. Infection rate and clinical management of cancer patients during the COVID-19 pandemic: experience from a tertiary care hospital in northern Italy. *ESMO Open* 2020;5:e000810.
- Yu J, Ouyang W, Chua MLK, Xie C. SARS-CoV-2 transmission in patients with cancer at a tertiary care hospital in Wuhan, China. *JAMA Oncol* 2020;6:1108–10.
- Cho RHW, Yeung ZWC, Ho OYM. Pearls of experience for safe and efficient hospital practices in otorhinolaryngology-head and neck surgery in Hong Kong during the 2019 novel coronavirus disease (COVID-19) pandemic. *J Otolaryngol Head Neck Surg* 2020;49:30.
- Morrison DR, Gentile C, McCammon S, Buczek E. Head and neck oncologic surgery in the COVID-19 pandemic: our experience in a deep south tertiary care center. *Head Neck* 2020;42:1471–6.
- Brar S, Ofo E, Hyde N. Outcomes of elective head and neck confirmed or suspected cancer surgery during the COVID-19 pandemic. *Eur Arch Otorhinolaryngol* 2020;15:1–6.
- Grant K, Metcalf CJE, Lessler J. Dispersion vs. Control. <https://hopkinsiidd.github.io/nCoV-Sandbox/DispersionExploration.html> (25 July 2020, date last accessed).
- Nishiura H, Oshitani H, Kobayashi T, et al. Closed Environments Facilitate Secondary Transmission of Coronavirus Disease 2019 (COVID-19). <https://www.medrxiv.org/content/10.1101/2020.02.28.20029272v2> (25 July 2020, date last accessed).
- Ministry of Health, Labour and Welfare. Message to the People in Japan. [https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/newpage\\_00032.html#message](https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/newpage_00032.html#message) (25 July 2020, date last accessed).
- Guan W-J, Ni Z-Y, Hu Y, et al. China medical treatment expert group for Covid-19: clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020;382:1708–20.
- Sedaghat AR, Gengler I, Speth MM. Olfactory dysfunction: a highly prevalent symptom of COVID-19 with public health significance. *Otolaryngol Head Neck Surg* 2020;163:12–5.
- Huff HV, Singh A. Asymptomatic transmission during the COVID-19 pandemic and implications for public health strategies. *Clin Infect Dis* 2020. doi: 10.1093/cid/ciaa654.
- Lee EYP, Ng M-Y, Khong P-L. COVID-19 pneumonia: what has CT taught us? *Lancet Infect Dis* 2020;20:384–5.
- Wang W, Xu Y, Gao R, et al. Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA* 2020;323:1843–4.