Title:
Care of the laryngectomy patients during the COVID-19 pandemic

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List of Abbreviations: ENT: Ear, nose and throat; PPE: Personal protection equipment; SARS: Severe acute respiratory syndrome; HME: Heat moister exchanger.
Abstract:

Laryngectomy patients are at increased risk for droplet-transmitted diseases, and therefore the COVID-19, which has now caused a worldwide pandemic. Adaptive measures to protect laryngectomy patients and their families were designed and implemented in the Hong Kong SAR (HK). Driven by the fear of Severe Acute Respiratory Syndrome in HK 2003, the hospitals in HK have modified infection control routines since to adapt and prevent a repeat public health nightmare. To face the COVID-19 caused by SARS-CoV-2, we have adapted with guidelines for our laryngectomy patients. Contact precautions, droplet precautions with physical barriers, hand and equipment hygiene are our mainstays of prevention against the COVID-19, and sharing these routines is the aim of writing this paper. The COVID-19 pandemic is still roaring ahead. Awareness and precautions for laryngectomy patients who may be at higher risk are outlined here and should be maintained during the current pandemic.
Introduction

This global pandemic of COVID-19 caused by the SARS-CoV-2 virus had yet to reach its peak. At the time of writing, three million four hundred eighty thousand people were infected in over 210 countries, resulting in more than two hundred forty thousand deaths worldwide according to the World Health Organisation (WHO) data. Medical professionals and citizens alike are still adjusting to this major public health issue.

HK had faced SARS in 2003. It was an outbreak from the SARS-CoV-1 imported from mainland China that infected 1750 Hong Kong citizens, resulting in 286 deaths. Learning from the past, our medical routines were revised to adapt to the threat of COVID-19. Some were measures to protect our health care workers (HCW) and preserve previous medical resources in anticipation of a lengthy fight.

Within our specialty of Otorhinolaryngology, Head and Neck surgery, there have been broad guidelines evaluating tracheostomy and surgical precautions during the current pandemic. Unlike patients with an intact upper aerodigestive tract, laryngectomy patients have an intact nasal cavity and nasopharynx that has the potential to be infected or harbour a high viral load, in addition to a stoma that lacks a filter for the virus. This additional orifice adds an additional route for contracting COVID-19 during this pandemic. In this paper, we will discuss some details of adaptations and precautions we have prepared for our laryngectomy patients in HK.
Experience of SARS in HK

In 2003, the index case in HK had landed at our hospital, the Prince of Wales Hospital of HK. At least 88 HCW and 18 medical students were infected. Since the etiology was not known at the time, cases were triaged to be suspicious of SARS based on clinical symptoms or history of close contact. Suspected cases were handled with airborne precautions. Eye protection had also been worn in some units. Even then, severe outbreak in the public hospitals was unavoidable. This might be due to the use of nebulised bronchodilator in the index patient, creating infectious aerosols. Procedures thought to increase the risk of disease transmission included other aerosol generating procedures such as airway suctioning, bronchoscopy, and endotracheal intubation.

SARS was predominantly transmitted through close person-to-person contact, via respiratory droplets produced when an infected person coughs or sneezes. It was also postulated that the SARS virus might have spread by airborne transmission according to Center for Disease Control and Prevention (CDC). Therefore, patients had to wear N-95 masks once symptoms developed and were placed immediately in isolation negative pressure rooms. Healthcare workers had worn N-95 masks together with head covers, goggles, waterproof gowns, and gloves when caring for the suspected or confirmed cases of SARS. There had been daily and terminal disinfection that was described to be thorough, with emphasis on careful washing and disinfection of the beds, handrails, bedside tables, floor, and equipment with hypochlorite solution (1000 parts per million). Closed suction system was employed in intubated patients to avoid air leak releasing of infectious aerosols. Healthcare workers had to present themselves to hospitals if suspicious symptoms developed rather than putting the whole family at risk. It was advised for doctors in the community to wear a N-95 mask in when seeing any patient with respiratory symptoms. Positive contacts of SARS patients should
isolate themselves until the incubation period was over. Hand hygiene was emphasized after contact with patients with respiratory symptoms.\textsuperscript{4}

In a laryngectomy patient, the stoma multiplied the risk of infection due to an additional exposed respiratory tract mucosal membrane. Virus travelling by droplets could land directly into the trachea and lower respiratory tract through the stoma. There have been suggestions for post-operative care for head and neck cancer patients, however there is no current protocol for care of post-laryngectomy patients.

Given the increased risk of COVID-19 infection especially in post-laryngectomy patients, it would be extremely important to emphasize an infection control protocol for them. A video on post-laryngectomy care was made in conjunction with the New Voice Club of Hong Kong in order to educate these patients on COVID-19. (Supplementary video 1)

Protocol for care of laryngectomy stoma in COVID-19

Social distancing:

Social distancing and maintaining high level of hygiene will not only protect the patients but also their families. According to a study done in 2012 with 45 healthy non-smokers on cough aerosols, droplets smaller than ten-microns account for up to 99\% of the total number of droplets that are expelled as a bioaerosol during coughing.\textsuperscript{8} The WHO recommended staying at least 1 meter (3 feet) while CDC suggested staying at least 2 meters (6 feet) from other people. Mass gatherings and exposure in crowded places should be avoided.\textsuperscript{1,9}

Hand hygiene:

Hand hygiene is known to be an important intervention measure as a part of standard
precautions for pandemic crisis such as SARS and avian influenza in the general public, general ward, as well as in the intensive care setting. A meta-analysis of 30 studies in a community setting suggested that the use of non-antibacterial soap with hand-hygiene education interventions is efficacious in preventing both gastrointestinal and respiratory illnesses. The indications for hand hygiene in the health care setting include before and after touching the patient; before handling an invasive device for patient care, regardless of whether or not gloves are used; after contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings; while moving from a contaminated body site or another body site during care of the same patient; after contact with inanimate surfaces and objects in the immediate vicinity of the patient; and after removing sterile or non-sterile gloves. Therefore, additional attention to hand hygiene must be paid by laryngectomy patients, their home carers, and HCW in otorhinolaryngology during stoma care. The 7 steps in hand washing include rubbing palms together; rubbing the back of both hands; rubbing hands together with fingers interfaced; rubbing the back of fingers of both hands with interlocked fingers; rubbing thumb in a rotating manner followed by the area between index finger & thumb; rubbing fingertips on palm for both hands; and finally rubbing both wrists in a rotating manner. The whole process should last for at least 20 seconds before rinsing hands under running water till clean. Use the elbow or a paper towel to turn off the tap and then dry the hands thoroughly with a single-use towel. Alcohol-based handrubs with optimal antimicrobial efficacy usually contain 75% to 85% ethanol, isopropanol or n-propanol, or a combination of these products. The WHO recommended formulations containing either 75% volume per volume (v/v) isopropanol or 80% v/v ethanol, when water and soap were not available.
Physical barriers:

A face mask should be worn when going out. It should be worn even when socializing indoors if possible when away from home. It is recommended to wear a face mask with hydrophobic and droplet filtering properties such as the classic three-ply mask. When wearing a face mask, the metal wire should be fitted to the nasal bridge and moulded until it seals the contour of the nasal bridge completely. Patients should be vigilant in avoiding to touch the external surface of the mask after putting it on or during its removal, and to perform hand hygiene after disposal of the mask.

Stoma hygiene is the basic daily routine in laryngectomy patients. The technique is learned by the patients and their relatives before discharge, which should not be overlooked. In addition, wearing a laryngectomy apron, stoma filter with microporous adhesive or heat & moisture exchanger (HME) helps reduce contact and contamination of the stoma. A multicentre study published in 2003 concluded that patients being compliant to HMEs reported a decrease in respiratory symptoms, including 68% less coughing; 73% less sputum reduction; 60% less forced expectoration; and 52% need for stoma cleaning. Some newer HMEs that filter bacteria, viruses and small particles are recommended if affordable by patients. A summary of stoma hygiene is given in table 1.

Voice rehabilitation devices:

Apart from hand hygiene, it was crucial to ensure hygiene of the voice rehabilitation devices in preventing COVID-19 transmission as most devices require frequent contact between the neck, stoma, and hand of the patient or carer. Each of the voice rehabilitation devices also requires unique precautions, and a brief outline is given in table 2.
i. **Electrolarynx**

The electrolarynx was placed over the neck or cheek for phonation. It should be wiped with alcohol swabs or wipes thoroughly after use to prevent contact contamination.

ii. **Pneumatic device**

The pneumatic device will be soiled by saliva and sputum during phonation. Rolled tissue strips should be inserted into the tubing to keep it from moisture. It should be soaked in 3% hydrogen peroxide solution for 5-10 minutes every time after use, followed by rinsing with boiled drinking water or normal saline. Hydrogen peroxide works by producing destructive hydroxyl free radicals that can attack membrane lipids, DNA, and other essential cell components, as well as killing off bacteria, yeasts, fungi, viruses, and spores.\(^{16}\)

iii. **Tracheo-esophageal puncture voice prostheses (TEP)**

Phonation with a TEP voice prosthesis requires stoma occlusion with patient’s thumb, and thus increasing the risk of contact and droplet contamination. TEP voice prostheses could be indwelling or non-indwelling, and made with different materials. An in-vitro study on biofilm growth was conducted on various choices of the modern TEP voice prostheses, which concluded that use of silver oxide coating and Teflon as valve flap materials showed significantly less surface biofilm formation.\(^{17}\) It might more effectively protect users against the current pandemic, since viral particles could penetrate into the exopolymeric matrix of mucoid biofilms, and thus to benefit from a protective environment against external aggressions.\(^{18}\) A dedicated brush should be used during cleansing of an indwelling device facing a mirror to prevent colonisation of pathogens with drinking water. This brush should be disinfected with one of the followings methods: 70% ethanol for 10 minutes; 70% isopropylalcohol for 10 minutes; or 3% hydrogen peroxide for 60 minutes.\(^{19}\) As for a non-
indwelling device, it is removed and reinserted by the patient daily after being soaked in disinfectants. Brushing and flushing devices are readily available in commercial kits. However, cleansing of the TEP voice prosthesis could be challenging to patients and carers, where droplets and sputum contamination is common due to cough reflex. Hands-free HMEs were now available in the market which significantly reduces the need of frequent hand-stoma contact during phonation.

Carers:

Family and members providing laryngectomy care should remain vigilant during the battle of COVID-19. Carers should take universal precautions to put on gloves, surgical mask and goggles during laryngectomy care since procedures such as stoma suctioning could be aerosol-generating.

Conclusion

Prevention against the COVID-19 requires concerted effort. Contact precautions, droplet precautions with physical barriers, as well as hand and equipment hygiene should be carried out with high vigilance. Currently, there is no literature regarding standard protocols on laryngectomy care. Nonetheless, no SARS-CoV-2 positive cases have been reported among laryngectomy patients in HK who are in compliance with the routines described in this paper, and we hope that it remains the case. We will continue to adapt to any new condition or information regarding the virus in our medical centres to protect our staff, patients, and the families. May we all endure this.
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Table 1: Routine and specific laryngectomy stoma care during Covid-19 in Prince of Wales Hospital and United Christian Hospital of Hong Kong

<table>
<thead>
<tr>
<th>Routine</th>
<th>Specific care during COVID-19</th>
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<tbody>
<tr>
<td>• Check for secretions at least three times a day.</td>
<td>• Ensure compliance to wearing physical barriers such as laryngectomy apron, stoma filter or heat &amp; moisture exchanger.</td>
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<tr>
<td>• Chest secretions should be coughed up and wiped away with disposable tissue. The use of humidifier can help thin mucus secretions.</td>
<td>• Regular replacement or cleansing of physical barriers</td>
</tr>
<tr>
<td>• During cleaning of the stoma, a table mirror and good light source are required.</td>
<td></td>
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<tr>
<td>• Use wet gauzes or disposable tissues to moisten and wipe away dried crusts.</td>
<td></td>
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<tr>
<td>• Laryngectomy tubes, if worn, should be cleaned daily with soapy water under the tap with or without a brush.</td>
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Table 2: Routine and specific voice prostheses care during Covid-19 in Prince of Wales Hospital and United Christian Hospital of Hong Kong

<table>
<thead>
<tr>
<th></th>
<th>Routine</th>
<th>Specific care during COVID-19</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrolarynx</strong></td>
<td>• Wiping with tissue paper or dry cloth after use</td>
<td>• Wiping with alcohol swabs after use</td>
</tr>
<tr>
<td><strong>Pneumatic device</strong></td>
<td>• Insert rolled tissue strips into the tubing • Rinse the two tips with water daily and leave it to dry • Change tubings regularly</td>
<td>• Soaking in 3% hydrogen peroxide solution for 5-10 minutes every time after use, followed by rinsing with boiled drinking water or normal saline.</td>
</tr>
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</table>
| **TEP voice prosthesis** | **Indwelling** • Brushing after meals using drinking water • Soak the brush in drinking water after use | **Indwelling** • Brushing after meals • Soak the brush in disinfectants after use  
  • 70% ethanol for 10 minutes  
  • 70% isopropylalcohol for 10 minutes  
  • 3% hydrogen peroxide for 60 minutes |
|                   | **Non-indwelling** • Clean with brush or flushing device with drinking water |                                                                 |
This manuscript was accepted for publication in Otolaryngology-Head and Neck Surgery.

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**Video Clip**

New Voice Covid Video Final_Eng_subtitle_Journal.mp4

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