

Novel Technique of Tracheostomy in the Era of Novel Coronavirus

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Abstract

➤ *Background:*

WHO declared COVID-19 outbreak as pandemic in March, 2020. During this pandemic, nobody is immune of being infected with novel coronavirus or being asymptomatic carrier of it. Tracheostomy is an ancient lifesaving surgical procedure. In our region, carcinoma larynx or other head neck cancer is the most common indication of tracheostomy. In a resource constraint country- like Bangladesh, patient presents to the hospitals at advanced stage usually with stridor. In our context, emergency tracheostomy is quite common, especially in our centre, at Dhaka Medical College Hospital.

Tracheostomy is an aerosol generating procedure. Sometimes situation is unfavourable for doing any investigation, like RT-PCR, CT scan of chest or even chest X-ray for detection of COVID-19 status prior to tracheostomy. So, health care professionals should take maximum protection for their own safety, seeming every patient as a COVID-19 patient. Some simple, but novel and very effective measures will be discussed for protection of all HCP.

➤ *Method/ Material*

In our setting, placement of a transparent, sterile polythene which acts as an interface between patient and surgeons and all other HCPs is the change maker. Meanwhile, use of Povidone Iodine mouthwash for gargling and nasal application either by spray or nasal irrigation or drop will reduce viral load from nose and mouth of patient, and thus reduce the chance of transmissibility of novel coronavirus. HCPs should use PVP-I prophylactically also. This technique was innovated by the corresponding author and applied in Dhaka Medical College Hospital in two (2) cases.

➤ *Conclusion*

As tracheostomy is an aerosol generating procedure, and novel coronavirus is highly contagious, so higher level of protection is required. A simple and cheap polythene sheet as barrier drape as well as rational and novel use of Povidone Iodine can significantly reduce the chance of corona virus transmission among the health care professionals working in the operation theatre.

Keywords:- Novel Coronavirus; Tracheostomy; Novel Technique; Polythene; Povidone-Iodine.

➤ *Abbreviations:-*

HCP: Health care professional, PVP-I: Povidone Iodine

I. INTRODUCTION

WHO declared COVID-19 outbreak as pandemic in March, 2020, which was started from Wuhan of china. During this pandemic, (every person or patient has chance of being infected with corona virus,) nobody is immune of being infected with coronavirus or being asymptomatic career of this 1.

Tracheostomy is an ancient lifesaving surgical procedure in which the trachea is surgically opened in its anterior wall and a stoma is created and maintained to facilitate ventilation 2, 3, 4. In our country or South East Asia region, carcinoma larynx or other head neck cancer is the most common indication of tracheostomy still now 5,6. In a resource constraint country- like Bangladesh, patient presents to the hospitals at advanced stage usually with stridor. Upper airway obstruction due to trauma to larynx (by road traffic accident, cut throat injury, hanging) or foreign body, laryngeal papilloma, prolonged mechanical ventilation are some other common indications of tracheostomy 5,6. In our context, emergency tracheostomy is not uncommon/ quite common, especially in our centre, at Dhaka Medical College Hospital 7.

Tracheostomy is an aerosol generating procedure. If a patient of COVID-19, either confirmed, suspected or asymptomatic career, requires tracheostomy for any of those indications, it's a critical and alarming issue for the health care professionals, including doctor, nurse, other HCPs for the highly contagious nature of this virus 8.

In current situation prior to any (routine) surgery report of RT-PCR test for coronavirus is mandatory. In a developing country- like Bangladesh, patient presents to the hospitals at advanced stage usually with stridor. Most of the time, surgeon has no (waiting) time for tracheostomy, so confirmation of COVID-19 by RT-PCR test can't be done instantly. Prior to surgery it's recommended to do a CT scan of chest 8, if not possible at least Chest X-ray to find clue regarding COVID-19. But sometimes situation is unfavourable for doing any of them. Few minutes or even seconds are demarcating line between life and death. For this reason health care professionals should take maximum protections for their own safety within lots of limitation, seeming every patient as a COVID-19 patient.

Though the government, local authorities, personally all HCPs are trying to provide or collect adequate personal protective equipment (PPE) or other measures, throughout the world there is deficiency of it. In a resource constraint country, like us, we need to have cheap, affordable, easily available measures for protection.

Here, some simple, but novel and very effective measures will be discussed for protection of all HCPs in this highly aerosol generating procedure. Polythene and Povidone Iodine are the change maker in this novel technique of tracheostomy, mentioned in this article.

II. METHOD/ MATERIAL

In our setting, placement of a transparent, sterile polythene which acts as an interface between patient and surgeons and all other HCPs is the change maker. Meanwhile, rational use of Povidone Iodine mouthwash for gargling and nasal application either by spray or nasal irrigation or drop will reduce viral load from nose and mouth, as well as covering the face with a mask or face shield of the patient to reduce the chance of transmissibility of COVID-19 patient. Thus, transmission of COVID-19 will be reduced. This technique was innovated by the corresponding author and applied in Dhaka Medical College Hospital in two (2) cases.

A. Povidone Iodine :

In 1955 Povidone-iodine (iodine with water-soluble polymer polyvinylpyrrolidone, PVP-I) was invented 9. The active moiety, non PVP-bound (free) iodine is released into solution from the PVP-I complex. PVP delivers the free iodine to target cell membranes. Free iodine that mediates the basic mechanism of action (oxidation of amino acids and nucleic acids in biological structures), which is difficult to counteract. This basic mechanism of action leads to strong microbicidal activity expressed by multiple modes of action that include the disruption of microbial metabolic pathways, as well as destabilisation of the structural components of cell membranes, causing irreversible damage to the pathogen. Consumed free iodine is then replaced by PVP-bound iodine. The concentration of free iodine is the determining factor of the microbicidal action of PVP-I. In a study investigating the virucidal activity of different disinfectants, Electron micrographic study revealed that, exposure of iodine led to destruction of nucleoproteins of viral particle – which is the main mechanism of action 10,11. However, disruption of surface proteins essential for the spread of enveloped viruses has also been noted 10,12. Furthermore, Iodine is a scavenger of free radical oxygen species, contributing to anti-inflammatory properties 10, 13. This interaction ultimately results in microbial death.

B. Virucidal activity of PVP-I

Povidone-iodine has been reported as having the highest virucidal activity profile among several antiseptics such as CHG, benzalkonium chloride (BAC), BEC and alkyldiaminoethyl-glycine hydrochloride (AEG) 10, 14.

PVP-I has been shown to be active in vitro against the coronaviruses that have caused epidemics in the last two decades, namely SARS-CoV causing the severe acute respiratory syndrome (SARS) epidemic of 2002–3 and MERS-CoV the agent responsible for causing the Middle East respiratory syndrome (MERS) epidemic of 2012–13. SARS-CoV-2 is highly homologous with SARS-CoV, and as such it is considered a close relative of SARS-CoV1015. In his study Egger et al suggests that, upto 0.23% concentration of PVP-I is virucidal 12, 13. Kariwa showed that treatment in vitro of SARS-CoV with various preparations of PVP-I for 2 minutes was enough to reduce viral activity to undetectable levels14. The lowest

concentration used was 0.23%, found in an over the counter throat spray 13. Recent studies conclude that SARS-CoV-2 should behave similarly 15

C. Plastic/Polythene:

Modern healthcare would not be possible without the use of plastic materials.

From the casing of an open MRI machine to the smallest tubing, plastics have made health care simpler and less painful. Fibers and resins used in medical applications include polyvinyl chloride (PVC), polypropylene (PP), polyethylene (PE), polystyrene (PS) as well as nylon, polyethylene terephthalate (PET), polyimide (PA), polycarbonate (PC), acrylonitrile butadiene (ABS), polyetheretherketone (PEEK) and polyurethane (PU). The most widely used plastic material in medical applications is PVC followed by polythene or PE, PP, PS and PET.

Polythene is popular for its greater flexibility, comfort and mobility. Polythene, with its exceptional barrier properties, light weight, low cost, durability, biocompatibility and transparency, is ideal for medical applications.

Today's most innovative medical procedures are dependent on plastics 16.

Proposed **Steps** of Tracheostomy (under local anaesthesia) in COVID-19 pandemic

- **Consent-** written informed consent is mandatory with double risk bond
- **Preparation of patient**
 - Prior to surgery, patient is to gargle with 10-15 ml PVP-I 1% (undiluted) or 20-30 ml 0.5% (diluted with same amount of water) mouthwash solution
 - Nasal irrigation with PVP-I (0.5%) is to be given, in case of difficulty or inconvenience of patient PVP-I nasal spray or drop should be applied.
 - Patients' nose and mouth is to cover with face shield or face mask (optional).
- **Preparation of members of surgical team**
 - Sterile surgical gown should be put over impermeable gown or protective apron.
 - FFP3 or FFP2 or N95 mask or PAPR on face
 - Eye protective goggles
 - Hood cap is preferable than simple cap forehead protection.
 - Head light or top light both can be used. If head light is used, it should be protected with head cap.
 - Double gloves is preferable.
 - All health care professionals are proposed to use PVP-I for gargling and applying in nose in same manner as proposed for patient for protection as adjunct to PPE before or after tracheostomy.

- **Positioning** of the patient: A sand bag is to place under the patient's shoulders for neck extension.
- **Skin** should be **prepared** with PVP-I 10% solution from chin to mid chest.
- **Draping** is to be done properly.
- Infiltration of **local anaesthesia** with Lignocaine with adrenaline.
- A vertical **incision** (usually) is made in the midline of neck, extending from the lower part of cricoid cartilage to just above the suprasternal notch.

(Vertical incision is mostly used in our centre for emergency tracheostomy for rapid access, minimum bleeding and minimum tissue dissection.

In our centre, emergency tracheostomy is performed more than elective one in 3:1 ratio.)

- Tissues are to **dissect** in the midline
- Strap muscles are to separate in the midline and to retract laterally.
- Thyroid isthmus is to displace upwards or to divide between the clamps and suture.
- Few ml of Lignocaine is to inject into the trachea to suppress the cough following tracheostomy.
- Prior to opening of the trachea an additional, transparent, sterile polythene sheet is to place over the operative field, like an extra drapping sheet.

Hands of surgeons, tracheostomy tube and all necessary instruments kept inside the polythene sheet.

- Trachea is to open with a vertical incision to make a fenestra, in between 2nd and 3rd or 3rd and 4th rings, which can be converted into a circular or quadrangular opening. Sparing 1st tracheal ring is mandatory to prevent subglottic stenosis.
- Tracheostomy tube is to insert and is to secure by tapes or suture.
- Gauze dressing is to place between skin and flange of the tube around the stoma 17,18.

D. Preparation of application of Povidone Iodine or PVP-I prior to surgery:

- For gargling and mouthwash :
 - For fully conscious patient-
 - PVP-I 1% solution (undiluted) 10 ml for 30 sec to 1 minute or 0.5% solution (diluted by mixing same amount of water, i.e. 10 ml PVP-I with 10 ml water) 20 ml for 1-2 minutes.
 - For patient with altered consciousness –
 - A sponge swab or similar is soaked in 2-5 ml of 1% PVP-I and this is carefully wiped around all oral mucosal surface
 - For nasal application:
 - Nasal spray: 2 puff in each nostril with a standard atomizing devise with 0.5% solution of PVP-I or
 - Nasal irrigation: Irrigate or wash through both nostril with 50 to 200 ml of 0.5% PVP-I solution or

- Nasal drop: If nasal spray or irrigation facility is not available apply nasal drop 3-4 drops in each nostril 19, 20, 21.

E. Face mask or face shield of patient

It is optional. As in our setting patient presents mostly (as emergency condition) with severe respiratory distress, patient can't allow or tolerate a facemask always. But, if patient can tolerate a face mask, at least face shield can be advocated or used.

Face shield is an alternative option. It can also serve the purpose of preventing transmission of virus partially.

Polythene: Simple, transparent polythene.

The plastic / polythene sheet allows good mobility of the hands of the surgeon's. In spite of being transparent or translucent, there may have some degree of glare.

One should keep two (2) polythene sheet in the trolley. Sometimes it can be soiled with respiratory secretion mixed with blood; so visibility can be compromised. Then surgeon or assistant can change or remove it under cover of another fresh polythene sheet. Otherwise, it is better to take a big polythene sheet which can be folded or moved a little, any side.

Several modifications can be done. Some ports in polythene sheet like microscope drape, for entry of surgeon and assistant's hand can be made.

Our focus is on the simplest method. Any positive modification is appreciable.

Microscope drape is an alternative, but not available everywhere and relatively expensive 22.

F. Special considerations:

- Number of health care professionals in the OT should be minimum.
- Experienced and skilled surgical team is must.
- If facility and time allows tracheostomy should be done under general anaesthesia in a negative pressure room.
- Before opening of the trachea
 - Intratracheal injection of 3-5 ml Lignocaine is recommended to reduce the cough reflex.
 - ventilation should be stopped (if under general anaesthesia)
- After opening of the trachea
 - electrocauterization by monopolar diathermy should be avoided, otherwise minimized.
 - following insertion of a cannula or endotracheal tube the ventilation circuit is to be connected with that particular one to resume ventilation of the patient (if under general anaesthesia or in ICU) 8.

III. DISCUSSION

In the current COVID-19 situation, healthcare professionals are prone to be infected with SARS-CoV-2/ novel corona virus more than any other people 1. Absentism of HCPs and spread to their family members are big threats on healthcare system at this crisis period 23. Nosocomial transmission of SARS-CoV-2 is common in ENT, dental, ICU or critical care unit, as aerosol generating procedures like- ventilation, intubation, suction, tracheostomy commonly performed here and the bioaerosol may represent more of a potential inoculum than by community transmission 24. Tracheostomy is a highly aerosol generating procedure.

Viruses often bind to receptor proteins on the surface of cells in order to enter in human cells, for example, novel coronavirus binds to ACE2 receptor. ACE2 could be expressed in the oral cavity. Moreover, among different oral sites, ACE2 expression was higher in tongue than buccal and gingival tissues 25. In COVID-19 high viral load is found in saliva (when the saliva of patients was analysed at the time of admission to hospital) 26.

Uniquely in Japan, gargling is generally accepted and strongly recommended as a preventive measure for URTI, in addition to hand washing and the wearing of masks 27. Recent study reveals that the nasopharynx appears to have a higher viral load than that found in the oropharynx 28. So that, nasal administration of PVP-I is as important as gargling with PVP-I mouthwash. Again, PVP-I is the time tested and trusted antiseptic agent, having best possible (99.99%) virucidal effect (even against SARS-CoV2) with only of its 0.23% concentration.

Povidone Iodine is safe for gargling as mouthwash, for inhalation or instillation as nasal spray, drop or vapour. PVP-I Nasal Spray directly attacks viruses by trapping and disabling them in the nasal cavity. The disabled viruses are then expelled with the product after blowing the nose 29, 30, 8.

By destroying/eliminating the culprit virus from its route of entry, risk of transmission of COVID-19 from patient to health care professionals will be reduced in significant amount as well as viral load of COVID-19 infected patients will be minimized. So Patient as well as health care professionals should use Povidone Iodine accordingly.

Wearing face shield or face mask or respirator by the patient, the chance of viral transmission from him/her is reduced. Sometimes patients with upper airway obstruction can't tolerate more obstruction caused by face mask or respirator. For this reason this option is not mandatory always.

In other hand, to protect HCPs of surgical team from being soiled with respiratory secretion and being infected with aerosol, a barrier is much needed. Polythene is a suitable option in a resource constraint country like Bangladesh.

However, modern healthcare would not be possible without the use of plastic materials.

Polythene is popular for its greater flexibility, comfort and mobility. Polythene, with its exceptional barrier properties, light weight, low cost, durability, biocompatibility and transparency, is ideal for medical applications.

Today's most innovative medical procedures are dependent on plastics 6.

It can be sterilized by Glutaraldehyde, Formaldehyde or Ethylene Oxide easily 31.

In this article, we added Polythene barrier and Povidone Iodine for protection for transmission of novel corona virus in addition with existing technique of

tracheostomy. Simple addition will dramatically change the fear of doing this emergency lifesaving procedure and overall outcome.

IV. CONCLUSION

As tracheostomy is an aerosol generating procedure, and novel coronavirus is highly contagious, so higher level of protection is required. A simple and cheap polythene sheet as barrier drape as well as rational and novel use of Povidone Iodine can significantly reduce the chance of corona virus transmission among the health care professionals working in the operation theatre.

➤ Conflict of interest

All authors declared, there is no conflict of interest.

➤ Contributions:

Corresponding author is Arefin MK. He generated the idea of the technique, which was appreciated and accepted by all the authors. Arefin MK prepared the manuscript and submitted. All other authors read, revised and participated in coordination of this article.



Fig 1:- Novel Technique of Tracheostomy

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