GAAREIP: Indian Innovation of Caps and Personal Protective Equipment

Aakash Pandita1 and Girish Gupta1

Abstract

The world has recently been hit by a pandemic caused by the novel Coronavirus infection. The infection is highly contagious and possesses a significant risk for health care workers caring for the infected patients. With more than 200 countries being affected and around 3,00,000 deaths across the globe, the essential supply of masks and personal protective equipment has been falling short of the ever increasing need. In such crisis there is a need for innovating and designing endogenous masks and equipment to avoid compromise in care of the effected patients and for safeguarding the health of health care workers.

Keywords

Death and dying, neonatal and infant nursing, neonatology/perinatology, corona, COVID-19, PPE, mask

Introduction

Recently, the world has been fighting the pandemic caused by the novel Coronavirus also known as COVID-19, which was first identified as the cause of a cluster of pneumonia cases in Wuhan city of China. It spread rapidly throughout the world. More than 6 million confirmed cases of COVID-19 have been reported across the world.1 Person-to-person spread occurs mainly through respiratory droplets during coughing, sneezing, or talking. Spread of infection has also been reported through infected surface/fomites by gaining entry through eyes, nose, or mouth. Droplets can travel up to 6 feet.2 The incubation period varies from 5 to 14 days.3-5 In the absence of specific and effective treatment, prevention seems the best option to keep away the COVID-19. Health care workers treating COVID-19 patients are at highest risk of infection. During the severe acute respiratory disease (SARS) pandemic in 2003, health care workers made up 21% (1706/8096) of the global cases.6 According to a case series of 138 hospitalized patients from China, 29% (40/138) of the patients were health care workers that had been infected in hospitals.7 The current recommendations to protect health care workers against COVID-19 are conflicting for nonaerosol-generating routine care of patients.8-11 For example, European Centre for Disease and Prevention (ECDC) and the US Centers for Disease Control and Prevention (CDC) recommend the N95 mask/respirator, while the Public Health Agency of Canada and the World Health Organization (WHO) recommend medical masks.10,11 Because of huge burden of disease there has been a shortage of surgical masks, N95 masks, and personal protective equipment throughout the globe.12 This is especially concerning for the medical staff engaged in managing the COVID-infected patients.1

In view of increasing cases across the globe including India there is shortage of masks and personal protective equipment. Therefore, we aimed to make low cost indigenous masks of different types that could serve the purpose during management of nonaerosol-generating patient care activities.

Material and Methods

The different masks were developed with the help of common things available in most of the homes and neonatal intensive care units (NICUs).

Giri Aakash Respiratory Eye Infection Preventer: GAAREIP

Five different masks were designed, type 1 to 5 (Figures 1 and 2).

1 Department of Neonatology, SGPGIMS, Lucknow, Uttar Pradesh, India

Corresponding author:
Aakash Pandita, Consultant Neonatology, SGPGIMS, Lucknow, Uttar Pradesh 226014, India.
E-mail: aakash.pandita@gmail.com
Type 1: Type 1 GAAREIPs were made with the help of a pant type diaper of varying sizes ranging from small to XXL as per the head size of individuals, which are commonly available in all NICUs, and cling wraps. A cling wrap is commonly used in neonatal care to protect neonates from hypothermia. The diaper is worn over head and the two openings are placed in front and back. The diaper covers the whole of the head, face, nose, and mouth. The eyes are not covered by the diaper. The eyes are covered by a layer of cling wrap going around the head. The cling wrap is used to cover the top over the diaper. After each use the layer of cling wrap can be discarded and a new layer can be put across for reuse along with the same diaper (Figure 1). The cost for each use is approximately 5 INR. Most of the items used for type 1 category are commonly available and biodegradable (Figure 3). The model was tested in 5 adults for 4 to 5 hours to see for any difficulty in breathing and vision. All the 5 volunteers were blinded for this study and none of the 5 adults reported discomfort or any difficulty in vision with the model.

Types 2 to 5: GAAREIP Types 2 to 5 were made with the help of cotton cloth, soft tissue paper, and rubber bands. The cost was approximately 3 INR for each mask. The different masks were made by increasing layers ranging from 1 to 4 for types 2 to 5, respectively. Masks with more number of layers were likely to be safer and could be similarly used in increasing risk scenarios. Two rubber bands were stapled at the ends to help in fixing the mask. Each mask fits snugly covering the nose and mouth. The masks were tested on 5 healthy participants who were blinded to study and its outcomes, and they did not report any discomfort after 4 to 5 hours of use.

Discussion

We have tried to provide a solution to the shortage of personal protective equipment and masks by developing indigenous mask sand face-shield-cum-mask models. These are made from material that is easily available in most of the NICUs or at home. The cost of each unit is less than 5 INR and some can even be reused. Limited availability of masks and personal protective equipment has jeopardized medical care of patients...
and health of medical staff, in the present era of COVID-19 pandemic. According to the CDC, there is cancelation of nonurgent procedures or visits that would warrant the use of PPE, prioritization of the use of PPE for the high-risk situations, and cautious reuse of PPE. Furthermore, CDC has mentioned 3 methods for decontamination of N95 masks when supplies are critically low during a crisis. These include the use of UV light, hydrogen peroxide vapor, and moist heat. There has hardly been any innovation because of lack of time and initiative, and if there has been any, it has not been published to the best of our knowledge.

Limitations

Our model lacks clinical testing because of lack of time and ever-increasing numbers of infected patients.

Conclusion

Indigenously made, low-cost masks and personal protective equipment GAAREIP from type 1 to 5 are very practical and easy to make. They have full potential to adequately address the current and future preventive needs of health care professionals during COVID-19 and future such epidemics. Most importantly, this will induce confidence and positivity in health care workers and facilitate them to discharge their responsibilities effectively.

Acknowledgments

To our little stars, parents, faculty, residents, nursing staff, and other workers working in NICU. Special thanks to Dr Shivani Bajpai.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Aakash Pandita https://orcid.org/0000-0001-5890-0974

References

1. World Health Organization. Director-General’s remarks at the media briefing on 2019-nCoV on 11 February 2020. 2020. https://www.who.int/dg/speeches/detail/who-director-general-s-remarks-at-the-media-briefing-on-2019-nCoV-on-11-february-2020

2. 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(13):1199-1207. doi: 10.1056/NEJMc2004973.

3. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel Coronavirus-infected pneumonia. N Engl J Med. 2020;382(13):1199-1207. doi: 10.1056/NEJMoa2001316.

4. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of Coronavirus disease 2019 in China. N Engl J Med. 2020. doi:10.1056/NEJMoa2002302.

5. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel Coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020;395:514.

6. Johnston LB, Conly JM. Severe acute respiratory syndrome: what have we learned two years later? Can J Infect Dis Med Microbiol. 2004;15(6): 309-312.

7. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel Coronavirus-infected pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-1069. doi:10.1001/jama.2020.1585.

8. Centers for Disease Control and Prevention (CDC). Interim infection prevention and control recommendations for patients with suspected or confirmed Coronavirus disease 2019 (COVID-19) in healthcare settings. 2020, 10 March. https://www.cdc.gov/Coronavirus/2019-ncov/infection-control/control-recommendations.html

9. European Centre for Disease Prevention and Control. Guidance for wearing and removing personal protective equipment in healthcare settings for the care of patients with suspected or confirmed COVID-19. 2020. https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-guidancewearing-and-removing-personal-protective-equipment-healthcare-settingsupdated.pdf Accessed 11 April, 2020.

10. World Health Organization (WHO). Rational use of personal protective equipment for Coronavirus disease 2019 (COVID-19). 2020, 27 February. https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPE-use-2020.1-eng.pdf. Accessed 11 April, 2020.

11. Public Health Agency of Canada (PHAC). Coronavirus disease (COVID-19): for health professionals. 2020, 18 March. https://www.canada.ca/en/public-health/services/diseases/2019-novelCoronavirus-infection/health-professionals.html#i

12. Chan JF, Yuan S, Kok KH, et al. A familial cluster of pneumonia associated with the 2019 novel Coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020;395:514.

13. World Health Organization. Shortage of personal protective equipment endangering health workers worldwide. 2020. https://www.who.int/news-room/detail/03-03-2020-shortage-of-personalprotective-equipment-endangering-health-workers-worldwide. Accessed 11 April, 2020.

14. Lindsley WG, Martin SB Jr, Thewlis RE, et al. Effects of ultraviolet germicidal irradiation (UVGI) on N95 respirator filtration performance and structural integrity. J Occup Environ Hyg. 2015;12:509.
15. Heimbuch BK, Wallace WH, Kinney K, et al. A pandemic influenza preparedness study: use of energetic methods to decontaminate filtering facepiece respirators contaminated with H1N1 aerosols and droplets. *Am J Infect Control*. 2011;39:e1.

16. Mills D, Harnish DA, Lawrence C, et al. Ultraviolet germicidal irradiation of influenza-contaminated N95 filtering facepiece respirators. *Am J Infect Control*. 2018;46:e49.

17. Lowe JJ, Paladino KD, Farke JD, et al. N95 filtering facepiece respirator ultraviolet germicidal irradiation (UVGI) process for decontamination and reuse. https://www.nebraskamed.com/sites/default/files/documents/covid-19/n-95-decon-process.pdf?date=03252020. Accessed March 25, 2020.

18. Holmdahl T, Walder M, Uzcátegui N, et al. Hydrogen peroxide vapor decontamination in a patient room using feline calicivirus and murine norovirus as surrogate markers for human norovirus. *Infect Control Hosp Epidemiol*. 2016;37:561.

19. Rudnick SN, McDevitt JJ, First MW, Spengler JD. Inactivating influenza viruses on surfaces using hydrogen peroxide or triethylene glycol at low vapor concentrations. *Am J Infect Control*. 2009;37:813. https://www.safety.duke.edu/sites/www.safety.duke.edu/files/N95%20Decontamination%20Procedure.pdf. Accessed March 27, 2020.

20. Ostriker R. Boston hospitals getting ‘game changer’ machine that sterilizes 80,000 protective masks a day. Boston Globe. 2020, April 3. https://www.bostonglobe.com/2020/04/02/metro/boston-hospitals-getting-game-changer-machine-that-sterilizes-80000-protective-masks-day/. Accessed April 03, 2020.

21. Kariwa H, Fujii N, Takashima I. Inactivation of SARS Coronavirus by means of povidone-iodine, physical conditions and chemical reagents. *Dermatology*: 2006;212 (Suppl 1):119.

22. Yunoki M, Urayama T, Yamamoto I, et al. Heat sensitivity of a SARS-associated Coronavirus introduced into plasma products. *Vox Sang*. 2004;87:302.

23. Duan SM, Zhao XS, Wen RF, et al. Stability of SARS Coronavirus in human specimens and environment and its sensitivity to heating and UV irradiation. *Biomed Environ Sci*. 2003;16:246.