An Innovative Three-in-One Face Protective Gear (FPG): A Feasibility Study in a Neonatal Unit in Times of Pandemic!

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Abstract

Background: Healthcare workers (HCWs) are at greatest risk of acquiring infection in times of global pandemic of COVID-19 disease. There is an unprecedented demand of several forms of personal protective equipment (PPE) for HCWs leading to possible acute shortage of these equipment. This has paved way for development of local innovative PPEs.

Objective: To test feasibility of a low cost, indigenous three-in-one face protective gear (FPG) in HCWs of a neonatal unit of a tertiary care institute in northern India.

Methodology: A three-in-one FPG was developed using the commonly available items in a ward or intensive care and few trash items. Items used were sterile surgical sheet, cling wrap piece/transparency sheet, cover of umbilical catheter/any sterile hollow plastic pipe, or straw and adhesive tape. The FPG was tested in 17 HCWs regarding its ease to use, comfort, and feasibility with the help of questionnaire.

Results: A total of 17 HCWs participated in this study. Majority (10, 58.8%) were doctors. Eight (47%) participants have never used any form of PPE previously. Thirteen (76.4%) participants found the FPG comfortable to wear; 12 (70.5%) found it comfortable to wear up to 8 h. Three HCWs found it difficult to work when wear the FPG; 1 out of 3 found it suffocating.

Conclusion: Three-in-one FPG is an indigenous, low cost, and may be a feasible alternative in low-risk situations when there is scarcity of conventional protective equipment.

Keywords

Face protective gear, PPE, COVID19

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Introduction

COVID-19, the disease caused by novel corona virus SARS CoV-2, has led to an unparalleled global contagion involving more than 200 countries and still dispersing speedily. The virus seems to affect people of all age groups with varying severity. Clinical illnesses range from asymptomatic viral shedding, to mild sickness resembling the common cold, to severe influenza-like disease and viral pneumonia. Amongst the worst affected are elderly persons and those with risk factors. Healthcare workers (HCWs) due to nature of their job are at greatest risk of COVID-19 transmission. Droplet transmission can occur during any of the aerosol-generating procedures like endotracheal intubation, suctioning, and surgical procedures of upper airways. The solitary tool which may prevent transmission from affected patients to HCWs is appropriate use of personal protective equipment (PPE). Quality of care provided will also suffer in the unfortunate event of loss of manpower in the healthcare sector. Hence, HCWs should wear tested N95 respirators and protective suits, goggles, and face shields.¹ Face shields and masks are partial PPE which are absolutely essential especially in this pandemic which primarily spreads via droplet spread. The utility is mainly in non-Covid areas of hospital where full PPE for all is not practical. With increasing number of affected patients, there is likely shortage of these kits thereby compromising on availability of preventive tools for doctors. Local innovations are needed to meet the shortage of protective tools. This has led to design a low-cost reusable three-in-one face protective gear (FPG) which comprise of mask, cap, and face shield using locally available items.
Material and Methods

The three-in-one FPG was developed using the commonly available items in a ward or intensive care and few trash items. Items used were sterile surgical sheet, transparent plastic/transparency sheet, cover of umbilical catheter/any sterile hollow plastic pipe, or straw and adhesive tape. A rectangular piece of surgical sheet is cut according to an average adult head size and is folded once. Both the sides are stitched or firmly stuck with adhesive tape. A rectangular window for eyes is made in front part. The upper part will act as cap and the lower part will serve the purpose of mask. Three more pieces are cut from the surgical sheet which is attached to lower part to make it a three-layered mask. Four strings are made from the same surgical sheet and 2 are attached on the back side and 2 are attached on the lower part of long edge as mask strings. The umbilical catheter holder/sterile hollow plastic pipe/straw are attached to the cap part of the front side in a slight curved. The cling wrap/transparency sheet which will act as a face shield is attached to this pipe or holder (Figures 1 and 2). The FPG was tested in 17 HCWs of a neonatal unit over period of 2 weeks regarding its ease to use, comfort, and feasibility with the help of questionnaire. A pre-demonstration questionnaire was given to the participants assessing their experience levels, their knowledge, and experience regarding use of PPE. Following this, they were asked to wear the FPG for 1 h and asked to fill a post-demonstration questionnaire.

Results

A total of 17 HCWs participated in this study. The basic demographic details and level of experience of the participating HCWs are being given in Table 1.

The pre- and post-demonstration responses from participants are shown in Tables 2 and 3. Eight (47%) participants have never used any form of PPE previously. Thirteen (76.4%) participants found the FPG comfortable to wear; 12 (70.5%) found it comfortable to wear up to 8 h. Three (76.4%) participants found it difficult to work when wear the FPG; 1 out of 3 found it suffocating. The total cost of making FPG was ₹ 94 (Table 4).

Discussion

With increasing number of cases, there is expected shortage of supplies of PPE which in turn makes the HCWs prone to infection. Innovative indigenous solutions are helpful in finding out ways to create personal protective gear with locally available materials and use them judiciously. The three-in-one FPG is made up of locally available materials and may serve as a useful tool during this pandemic crisis. Cost of manufacture is minimal and this protective gear can even be reused. Majority of participants agree that indigenous PPE can be made and thus reduce economic burden on the country. The survey showed that HCWs have substantial knowledge...
of how to make innovative knowledge and believe that local solutions for local problems are feasible. Difficulty in using PPE is well known and spans across various designs and types. In previously published studies, healthcare personnel believed that PPE was hot, difficult to breathe through, interfered with patient communication.2-4 Till date, no PPE is completely comfortable and research is going on to form effective strategies for sustaining PPE. The findings were similar with our FPG as well.

The limitations of study were single department use and less number of participants. The participants are from a tertiary care unit with attitude toward innovations, access to knowledge, and opportunity for development. We did not study the efficiency in terms of prevention of transmission of microbes.

**Conclusion**

Three-in-one FPG is an indigenous, low cost, and may be a feasible alternative in situations of scarcity of conventional protective equipment. More local solutions should be encouraged keeping in line with nation’s policy of “vocal for local.” Efficiency of this FPG needs to be further evaluated.

**Declaration of Conflicting Interests**

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