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Biomedical Waste Management in COVID-19

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ABSTRACT

Background: COVID-19 brought many negative consequences with itself and one of it is increasing biomedical waste especially plastic origin biomedical waste. These can include single use protective gears such as PPE kits, facial masks, gloves, shoe and head cover.

Summary: The issue of biomedical waste was already a burning topic prior to the arrival of COVID-19 as there was lack of proper incinerator and safe disposal facilities which is an important component of biomedical waste management. After the pandemic struck, the exponential rise in demand in the protective gear was justified as the nature of the novel Coronavirus causing disease was extremely contagious. But parallel system for the unsustainable disposable of the biomedical waste disposal was overlooked and hence current facilities were overburdened further increasing the problem of biomedical waste being thrown away in open spaces. Biomedical waste reduction campaign can ensure the reduction in protective gear which may harm the nature in the long run.

Conclusion: COVID-19 is not going anywhere in near future as various news from across the world reporting the resurgence in cases of it. Therefore the demand of the protective gear such as hand gloves, PPE kits, facial masks, head and foot cover will remain high. Proper assessment from each hospital must be done to highlight the grave danger that biomedical waste possess to the environment and humanity as whole. Training of staff which disposes of the biomedical waste is the key factor along with reduction in use of single use plastic origin protective medial gear.

Key Words: COVID-19, PPE kits, Biomedical waste, Masks, Incinerators, Health care workers

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INTRODUCTION

Coronavirus disease 2019 or COVID-19 is the disease which highly contagious in nature and known for its ability to create clinical complications in the patients which are infected and makes it difficult to manage. It is caused by the latest member of Coronaviridae family known as novel Coronavirus or SARS-CoV-2 [1]. The first cases was observed in Wuhan city of Hubei province in China and it was spread supposedly through t5 he wet market where live animals are traded. Owing to is zoonotic nature, it is said that it is spilled over from the bats which are natural harbor of many virus. Since its inception, millions of people have been infected and more than five million people lost their lives owing to complications arising out of COVID-19. Till November 22, 2021, 257,570,349 infection cases has been recorded worldwide and 5,151,177 case fatalities were registered across more than 190 territories [2]. The vaccination drive has been gearing up and till date 7,392,637,775 dosages has been administered providing a shield against the virus [3]. The pandemic came and brought many negative impacts among which rising biomedical waste is a major one. Biomedical waste saw a huge increase in its numbers as the usage of protective gear rose exponentially due to high contagious nature of the virus. The pathophysiology of the novel Coronavirus mandates the donning of proper protective gear otherwise the treatment of the infected patients would be extremely dangerous and life threatening especially for doctors and nurses along with allied health care professionals [4]. More innovative method is needed to replace the single use nature of protective gear as it will drastically reduce the biomedical waste which is becoming major problem day by day. The staffs are often ill trained and therefore do not know the hazards associated with the biomedical waste. Standard operating procedures should be followed strictly so that it can serve as the proper guideline to deal with the biomedical waste. Biomedical waste reduction campaign can ensure the reduction in protective gear which may harm the nature in the long run [5].

COVID-19 and it's pathophysiology

COVID-19 or Coronavirus disease 2019 is viral and contagious disease caused by severe acute respiratory syndrome Coronavirus 2 or SARS-COV-2 of the Coronaviridae family of the viruses. After due consideration of the devastating impact of the COVID-19 it was termed as pandemic. It is caused due to novel Coronavirus and is a zoonotic disease emerging mainly from bats. Novel Coronavirus mainly affects lungs and respiratory system but have ability to affect each and every part of the human being. The angiotensin converting enzyme 2 or ACE-2 receptors which are present on every vital organ system of the human being acts as gateway for the novel Coronavirus. The virus is a type of microorganism which is a quasi-living organism and it needs host to survive and reproduce. In case of the novel Coronavirus humans act as host for the virus. The size of the viruses is extremely small and it is less than a size of the human cell. Novel Coronavirus after entering into the human body through bodily openings like mouth, nose, and eyes and so on takes control of the cell and starts multiplying inside the human cell and proliferate further. This damage the human cell and it can lead to organ failure and multi organ failure. Primarily lungs are affected and then it gets transmitted to other organ system like heart, liver, kidney and so on through connective tissue called blood. Viral load decides the patient's clinical outcome [6]. The more is the viral load, greater is the chance of patient becoming critically ill. It also depends upon patient's pre COVID-19 condition. If patient is comorbid that is if they are already suffering from another chronic disease then the clinical management of the said patient becomes extremely difficult. The high mortalities around the world have been attributed to comorbidity. The reason behind high case infections and fatalities is the high rate of spread from one person to another. The transmissibility is extremely high in case of COVID-19 and therefore makes even more difficult to curb the spread. The virus transmits through nasal and oral pathway, through stool of the infected person. It is also an airborne virus which makes it to be suspended in air for long time. It can enter through mouth, nose or eyes and can rapidly multiply itself. The incubation period for the novel Coronavirus is 4 to 12 days in which symptoms starts to appear. The symptoms are cough, cold and fever which are basic symptoms and it can raging from diarrhea, vomiting to dyspnea and dysgeusia. The symptoms can vary according to person and so does the incubation period. Reverse Transcription Polymerase Chain Reaction (RT-PCR) test needs to be done to conform the viral presence in the person's body. The nasal and oral swabs also tell the viral load through the Critical Threshold (CT) value. Lower the CT value higher is the viral load and vice versa [7]. After more than one and half year has been passed, certain inferences have been made regarding the behavior of the virus. A section of people which are most affected are called vulnerable section of population. These include comorbid, elderlies and pregnant women and so on. These section of population needs to be protected from the viral spread as the clinical manifestation of the COVID-19 in the said population is difficult to manage and can result into fatal clinical outcome. Many complications also have been reported in the said section of the population also called vulnerable section. The main reason behind the level of destruction is the high rate of transmission or transmissibility and capacity to cause high degree of damage as innate immune response is unable to identify the virus from its memory due to novelty of the disease. The spreading capacity is the key element and hence we need to counter this fact [8].

Preventive measure for COVID-19

Due to unavailability of the medicine and any treatment course owing to the novelty of the disease. Various measures were suggested by the World Health Organization (WHO) and other research institutes which were found to be effective. Preventive measures such as wearing masks, maintaining physical distancing of appropriate measure, wearing personal and protective equipment's if necessary, wearing gloves when at public places or all the times were some of the measures issued by the highest health authorities from all across the globe [9]. There is some merit to these measures as these measures were followed in the previous outbreaks such as Severer Acute Respiratory Syndrome (SARS), Middle Eastern Respiratory Syndrome (MERS), Ebola and similar contagious outbreaks. In fact the containment procedures were becoming effective post usage of the masks and the case fatality rate dropped drastically when patients were easily detected easily and health care workers were at ease to go far flung infected areas in case of Ebola outbreak. Initially health care workers were themselves were the victim of the Ebola. They got infected while tracing the immediate contacts of another infected person. When masks and gloves were introduce in fight against Ebola, it gave huge impetus to the same and Ebola infection figures were controlled rapidly and successfully. In SARS and MERS also, the efficacy of masks and gloves along with personal and protective equipment's kit has been proven time and again. They were highly effective in controlling the viral spread. The major success rate in the Japan and South Korea in the initial days of the pandemic was due to the habit of wearing of masks when on public commute which was instilled during the outbreak of SARS. In case of swine flu (H_1N_1) which is also contagious, masks and PPE kits made the life of health care professionals safe as the transmission was greatly reduced due to the usage of this available measure. The drop in the figure after the start of the usage of this measure can be seen from statistics. Therefore it was also suggested to curb the Coronavirus disease 2019 or COVID-19, which was is also contagious in nature [10].

DISCUSSION

Issue of accumulation of biomedical waste due to COVID-19

Personal protective equipment's are the shielding gear intended in such a method so as to guard and defend the health care workers by decreasing the contact to the various agents in atmosphere or virus like novel Coronavirus. It is the preventive measure so as to guard oneself and the person nearby oneself. PPE kits assists in stopping in getting in contact with a contagious substances and material, thus by making a hindrance between the possibly infected material and the health care worker. PPE is basically a gear or material which is being donned so as to protect from getting ill by harmful or infected agents. Novel Coronavirus causing COVID-19 have several adverse impacts on environment and surrounding in terms curtailment of the practice of recycling and using less plastic derived products [11]. Due to lack of availability of the medication for treatment for COVID-19, preventing the disease itself from happening was the most feasible option available and this has prompted the usage of masks and physical distancing along with personal and protective equipment's. There was release of guidelines as soon as the contagious nature of the virus came in to light that all the health care worker, doctors, allied health acre staffs, ambulance driver and all others who working in the vicinity of the COVID-19 care facility must don the PPE kit and that too throughout the duty hours. Before that person must sanitize itself from sanitization tunnel or similar equipment's and pairs were designated so that third party is barred from entering the room as donning PPE kits is a tedious task. Millions of health workers and associated people started using PPE kits and masks for their safety but this has given rise to the accumulation of biomedical waste. Post pandemic the biomedical; waste figures shot up exponentially. The PPE kits and surgical masks which doctors, nurses and health care workers use are of non-reusable category. Once wore cannot be donned again. PPE kit contains whole body suit made out of plastic which is non-biodegradable material. Masks especially surgical mask should be discarded after each exposure to patient. By this way, one health care worker needs more than one mask in his or her duty hours. This also gets thrown away as no recycling or disposing of facility could be work owing to the non-pharmacological interventions like lockdown. Garbage trucks were plying near hospitals several times a day in order to dump the biomedical thrash away from the hospital premises [12]. One study conducted found out that Coronavirus disease 2019 or COVID-19 alone generated more than 8 million tons of waste that is mostly non-biodegradable plastic, around the world. This plastic is not being treated and recycled and more than twenty five thousand tons of the waste which is mostly plastic will be entering into oceans. Several sustained goals have been designed to reduce the net plastic footprint of the humans to live sustainably have been not followed as rapid increase in biomedical waste was seen. The rapid increase in the demand of single use plastic which is the main culprit behind the plastic pollution as it does not get recycled or decompose, which is used in manufacturing the safety products such as PPE kits, surgical masks, face shield, show cover etc. The load and stress on the waste management system was so increased that it was difficult to manage the huge waste coming from hospitals and COVID-19 care facilities. Improper vigilance, lack of personnel's, resource diversion in the containment of procedures culminated into plastic waste and biomedical waste getting dumped anywhere from which it flowed down thorough river streams and oceans. Single use plastic was already creating menace prior to the arrival of the pandemic and now it is being intensified by more and more biomedical waste containing mostly single use plastic [13]. This cohort study which was conducted internationally with the help of available data, it was found out that most of the plastic was coming from Asian countries as the population density and spread of the disease was extremely high among these countries. The waste generated by an individual was surpassed by biomedical waste due to increased consumption of the plastic based products. Prior to the arrival of COVID-19 approximately 2 billion people were unable to access proper waste collection services and 3 billion people lacked disposal of waste in controlled environment. After the pandemic arrived, the situation becomes grimmer. At the start of the pandemic owing to the dangerous situation which can negatively affects health care professionals and others, World Health Organization (WHO) itself recommended the industry to make medical and protective gear for all at rapid pace as the requirement will approximately increase by 40 percent post pandemic. The shortages of this protective gear will plague the fight against COVID-19 considering its high transmissibility and contagious nature. With doctors and nurses along with medical allied staff equipped with all the protective gear will give impetus to the fight against COVID-19. The lockdown induced supply chain disruptions around the world and closure of facilities and lack of personnel working in the factories has made the supply shortage but it was cleared out and massive product started to ensure there is no supply demand mismatch. But this was not complemented with the facilities that will dispose of this humungous waste which is non-biodegradable and non-recyclable. The who estimated stated that 89 million makes, 76 million gloves, 1.6 million hand gloves will be required per month to deal with the highly contagious pandemic. Naturally all these will be made from single use plastic as it is easy to manufacture and cheap and therefore cost of product remains low. But appropriate facilities weren't created to dispose of such quantity of plastic. An Indian study points out that over 2 lakh kilograms of plastic waste which is categorized as biomedical waste is being collected that too per day from hospital's only post pandemic [14]. Massive surge of more than 50 percent can be seen in the biomedical plastic waste collection in the initial months of April and May. There was already a massive gap between the amount of biomedical waste and management measures like incinerators, trained professionals and rampant use of plastic oriented

products. Often the ill trained staff dumps the biomedical truck anywhere in the open ground or in the rivers or lake as they were overburdened due to massive plastic waste generation. This has caused pollution levels to increase affecting humans as well as marine and wildlife. Many animals were seen eating such plastic waste as it got mixed up with food items resulting in accumulation of plastics in various bovine animals like cows and buffaloes. Human's to bore the brunt of the rise of increased biomedical waste getting accumulated in their vicinity as it caused more spread of the virus as the used PPE kits harbors virus long after being discarded [15].

Possible solution on the issue of increasing biomedical waste due to COVID-19

The issue of accumulation and increasing biomedical waste is becoming day by day as plastic derived biomedical waste stays for very long time in atmosphere, ecosystem and so on. The issue of micro plastic was the burning one in the recent years as these plastics are so small that they cannot be differentiated and one can easily consume it unknowingly creating accumulation of micro plastic problem inside the human body. The manufacturing industry of the PPE kits, face mask, gloves and other products related to the medical industry must come up with innovative method such as reusable PPE kits and so on. This will drastically reduce the burden on the waste management system [16]. It is important that one must reduce the use of plastic especially use od single use plastic along with waste collection measures in order to successfully curb the menace of the plastic pollution. As the pandemic is still not going anywhere owing to the instances of resurgences after some time, the need of protective gear will remain high and therefore a sustainable way is needed to ensure safe way to deal with the problem. Masks can be reused mostly of N95 category and that should be preferred so as to prevent the spread. In no case one time use mask must be repeated as it can jeopardize the health of the health care professionals. Also the number of incinerators and disposable facilities which are suitable must be increased as more quantity of biomedical waste is being generated after each passing days. The standard operating procedure regarding the disposal of the biomedical waste and various laws associated with it must be followed and it must be ensured that it not getting flouted. The spread of infection of COVID-19 through biomedical waste is a serious issue as one must be caution enough to report any biomedical waste being dumped near the habitable area. The staff of the waste management especially biomedical waste management must be trained proficiently so that they can understand all the guidelines, rules and laws regarding it [17].

CONCLUSION

COVID-19 is not going anywhere in near future as various news from across the world reporting the resurgence in cases of it. Therefore the demand of the protective gear such as hand gloves, PPE kits, facial masks, head and foot cover will remain high. The production facility must ensure that the plastic being used in the manufacturing of the said product is of high quality and is recyclable. The limits of certain threshold micron below which there should be ban on production of such products. The staff of the biomedical waste management system must be trained professionally so that their can do their job efficiently. Dumping of biomedical waste anywhere should be a punishable offense as it can jeopardize the health of the population in the vicinity of that area. Also the ecosystem of the marine animals is getting disturbed and it is proven by various research studies. Therefor appropriate measures must be employed in order to curb the effects which are negative in nature.

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