

Biomedical waste management during Covid-19 Pandemic

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ABSTRACT

The progressing COVID-19 pandemic has transformed the globe into state of chaos and killing many lives due to its infectious nature. In an urban populated by millions, many problems arise in this distressing and fast spreading nature of the disease, a major one includes improper management of medical waste. Improper management of biomedical waste emanating from the healthcare establishments have given rise to many environmental and health problems. A safe and effective management of waste is not only a legal necessity but also a social responsibility. Lack of concern, motivation, awareness and cost factor are some of the problems faced in the proper hospital waste management. Clearly there is a need for education as to the hazards associated with improper waste disposal. Lack of apathy to the concept of waste management is a major stymie to the practice of waste disposal. In order to find suitable articles, the following electronic databases were searched in PubMed, EMBASE, google scholar, and the electronic archives of the journals. The search terms for papers associated with biomedical waste management and COVID-19 were considered. Subsequently, the resulting literature reports were from searched databases. The present review covers response by India in COVID-19 pandemic, various treatment and disposal options of biomedical wastes for hospitals, Measures to ensure safety of employee in hospitals and sustainability approach to biomedical waste management during the pandemic

Key words : Biomedical waste, Coronavirus, COVID-19, Pandemic, SARS-CoV-2 virus

Key Messages: If the enormous amount of bio medical waste cannot be managed through sustaining proper and acceptable guidelines, probabilities of community-based spreading of COVID-19 can surpass the limit and take more lives in the future days.

Response by India in COVID-19 pandemic

Corona viruses are from massive family of viruses which have the capacity to inflict disease with mul-

tiple severities. Emerged in Wuhan, China during December 2019, the novel SARS-CoV-2 has spread to 190 countries and regions and resulted in pandemic. Biomedical waste generated in such pandemic can host potential virus particles; therefore, they are hazardous, which can stay beneath human tissues, blood contaminated items like needles, syringes, blood bags, other sharp objects, body fluids contaminated items like cotton swabs, beddings, dressings, and plaster casts. Experts state that medi-

cal waste unlike other wastes from household or industrial can infect people by direct contact of skin or by ingestion and inhalation through objects such as inhalers or ventilating pipes. Hospitals and other health-care establishments have a "duty of care" for the environment and for public health, and have particular responsibilities in relation to the wastes they produce. It is ironical that the very hospital that brings relief to the sick can create health hazard for hospital staff, patients as well as the community at large². Biomedical waste management is a crucial component of health service in securing the safety of patients, caregivers, hospital staff, general public and environment from this new health hazard¹.

The Bio-medical Waste Management Rules, 2016 as well as the Bio-medical Waste Management (Amendment) Rules, 2018, state that wastes are to be segregated at the place of generation, collected, stored at healthcare facilities then transported, treated and disposed by the Common Bio-medical Waste Treatment Facilities (CBWTFs).

The Central Pollution Control Board (CPCB) came up with extra guidelines, along with Bio-medical Waste Management Rules, 2016 to make sure safe disposal of waste generated during patient's diagnosis, treatment and quarantine from coronavirus disease. This guideline issued numerous procedures for safe disposal of waste generated in hospital, isolation wards, testing centers, laboratories, quarantine facilities and homes of patients suspected of the disease. On 19th March 2020, the first version was published. Later, Revision-1 was issued on 25th March 2020 and the following Revision-2 on 18th April 2020.

In isolation wards for COVID-19 patients, the guidelines highlighted that double-layered bag (two bags) are to be used for adequate strength and leak-proof as a precaution in collecting waste. Moreover, to collect and store separately before passing over the wastes to Common Bio-medical Waste Treatment Facility (CBWTF). Use a specific bin labelled as "COVID-19" to store wastes and keep them separate in a temporary storage room before giving to the authorized staff of CBWTF. Waste collected can also be transferred directly from isolation ward to CBWTF collection van while searching for a separate record of waste generated.

Urban Local Bodies are in charge to make sure waste collection and disposal are safe and if gathered from quarantine-camps, quarantine-home, home-care for patients are to be corresponding to

CBWTFs. The guidelines also stressed that bags/containers used in the waste collection from wards, labelled as COVID-19 for easy identification, priority treatment and immediate disposal in CBWTFs. Additionally, the guidelines recommend that the surface of containers, bins, trolleys used for waste storage in isolation wards to be disinfected regularly. CPCB proposed same steps to be followed in sample collection centres and laboratories. Any launching or starting of COVID-19 wards, sample collection centres and laboratories should be made known to SPCBs. In addition, services and staff associated to CBWTFs for collection, transportation, treatment and disposal of biomedical waste are considerably an essential part of health infrastructure. Although less quantity of waste generated at quarantine facilities and home-care, strict steps are to be followed as in the guidelines to ensure safe waste handling and disposal.

Furthermore, the guidelines said that operators of CBWTF will ensure workers involved in handling and collecting waste to be provided with adequate personal protective equipment such as three-layered masks, splash proof aprons/gowns, nitrile gloves, gumboots and safety goggles. It addressed facilities to use dedicated vehicles to collect wastes from wards and to sanitize them after each trip. In revision-2, there is guidelines for management of wastewater from home-care facilities and isolation wards. This revision is to include precise requirements and duty of sewage treatment plant operators at healthcare facilities and to refine on general waste management from quarantine-homes and masks/gloves from another household.

Hon. National Green Tribunal (NGT) on 21st April 2020 has directed the State Pollution Control Board (SPCB) and Pollution Control Committee (PCC) to implement serious efforts to reduce the possible risk of improper disposal of the biomedical waste from handling the COVID-19 disease. This showed the need to revise the guidelines so that all scopes of scientific disposal of liquid and solid waste management are handled well at individual and institution level for example the disposal of used personal protective equipment, used bags, gloves, goggles without getting mingled with other municipal solid waste causing contamination. It also showed the need to review the effectiveness of tracking mechanism which includes procuring information by ways of electronic manifest system from waste handlers and online reporting by SPCBs

or PCCs through developing certain software ¹

Treatment and disposal of biomedical wastes for hospitals in India during COVID-19 pandemic³

Under 2016 Rules, the hospitals are to provide a safe place within the premise for a spill/pilferage free storage of segregated biomedical waste in labelled/coloured bags or containers and operator duty is to transport the stored wastes from hospital to CBWTF.

Hospitals are used to deal with segregation, storage and management of biomedical waste but when contagious COVID-19 arrived and hospitals are flooded with active cases, the Ministry of Health and Family Welfare (MoHFW) and CPCB issued several guidelines for waste generated from the facilities.

CPCB specifically issued Revision 1 to the guidelines on 25th March 2020 for Handling, Treatment and Disposal of Waste Generated during Treatment/Diagnosis/Quarantine of COVID-19 Patients (CPCB Guidelines)⁴. The guidelines inter-alia requires the hospitals to designate special biomedical waste sanitation workers to isolation wards, record all waste generated in the wards and to collect, to store in leakproof colour-coded double-layered bag, bins or containers labelled as 'COVID-19 waste' according to 1998 Rules and the Guidelines.

Measures to ensure safety of employee (doctors, nurses, other staff and healthcare personnel) from diseases like COVID-19 in hospitals³

Healthcare personnel have a high chance of infecting COVID-19. Though hospitals are trying to stop infection from spreading, it is challenging because viruses are infectious and can be transmitted easily in a populated environment. Firstly, to control the spreading of virus is personal protective equipment (two-layered fluid-resistant apron) and essential items such as N-95 masks, face shield, full cover gowns and sanitizers, however this is ineffective if quality of these equipment are not up to standard.

It is stressed that adequate training and awareness of healthcare personnel in proper use and disposal of equipment after used. Fast spreading of virus from asymptomatic patients coming into hospitals thus require to formulate a COVID-19 protocol nationally.

The MoHFW in its specified revised guidelines of clinical management of COVID-19 dated 31st March 2020 (Clinical Management Guidelines)⁵ expressed

strict compliance of Infection Prevention Control (IPC) protocol in hospitals as well as prevention and management for hospital staffs. This protocol includes standard precautions like hand hygiene, PPE usage to avoid direct contact with blood, body fluids, any secretions from patients and non-intact skin, prevention of needle-stick or any sharps injury, proper waste management, disinfection of equipment and environment around COVID-19 patients.

According to 2016 Rules, hospitals have to train and immunize their healthcare workers and all staffs handling biomedical waste as per National Immunization Policy⁶ to ensure their safety and protection against diseases transmittable from the wastes. Moreover, hospitals have to provide proper and adequate personal protective equipment (PPE), perform health checkup during induction and maintain records at least once per year for these to ensure occupational safety for all healthcare workers and others handling biomedical wastes.

Sustainability approach to biomedical waste management during pandemic

With inclining number of cases every day, increase the need of PPE usage and therefore lead to heaps of biomedical wastes to be disposed later. This is evident in New Delhi where two CBWTFs are struggling with wastes overload now that number of cases kept rising. The incinerator burns 13 tons of biomedical wastes each day compared to 6 tones before pandemic. It operates between 90 and 110 percent capacity from add in COVID-19 wastes which increase the possibility of shutting down. Efforts are to be made to relieve these burdens from such facilities to prevent machine meltdown which will halt in wastes disposal process in the future, because the machines do need rest⁷. In fact, the revision of the guidelines aims to decrease burden on treatment facilities at the same time not compromising safe disposal of the wastes⁸.

Then, we should look into ways to reduce overall wastes in hospital and not just through the scope of COVID-19. World Health Organization (WHO) revealed that 85 percent of hospital wastes are non-hazardous while remaining 10 percent are infectious and another 5 percent are non-infectious yet they are marked as hazardous wastes⁹. If hospitals priorities to lessen biomedical wastes for example in reusing PPE kits while this may serve as an opportunity to focus on managing COVID-19 wastes¹⁰.

Tips to reduce hospital wastes include use of hand dryer machine instead of paper towels in bathrooms, use of reusable items instead of disposable items such as bed pans and water pitchers, use of washable items in wards such as gowns and bed linen and use of washable cups, plates and cutlery in cafeteria¹¹.

Besides, waste treatment should be sorted out to other facilities or treatment and not just through incinerator even if it means to explore other alternatives. For example, University of Petroleum and Energy Studies (UPES) in Uttarakhand demonstrated that through pyrolysis disposable PPE materials can be converted into biofuels, which are at par with fossil fuels, from its polypropylene (plastic) state. This process is one of the most promising and sustainable ways to recycle in comparison to incineration and landfill, according to researchers¹².

Another solution to plastic disposal includes use of enzymes. By linking two separate enzymes a super enzyme was engineered, both were found in plastic eating bug at Japanese waste site in 2016. Then, researchers showed version of first enzyme engineered in 2018, can break down plastic in days. However, the super enzyme works faster by six times. This super enzyme is derived from bacteria which naturally evolved the ability to eat plastic and enables full recycling¹³.

There should be a national protocol linking The Bio-medical Waste Management Rules, 2016 with newly released guidelines on 'extended producer responsibility' (EPR) for plastic producers by Ministry of Environment, Forests and Climate Change. The policy which published on 26th June 2020 however do not refer to pandemic but suggest on how producers of plastic should fund the urban local bodies in recycling wastes¹⁴.

Impacts to the environment are also to be considered here. Single use plastics and non-biodegradables materials are already an environmental challenge to the world on their own on top of this arising problem in disposing masks, gloves and PPE amid COVID-19 crisis. Environmentalists expressed that PPEs, masks and gloves are plastic made and cannot biodegrade or be recycled. Even though they are burned in incinerators through systematic disposal, they released two very toxic carcinogenic gases, Dioxin and Furan, and most hospitals incinerators do not possess specialized filters to eliminate them. Consequently, this creates an invisible and silent health hazards to many people living

around these incinerators who may develop cancer or other disease later in life. Thus, the governing healthcare authority and industry must quickly take actions to ensure a green recovery that incentivizes sustainability by installing toxic gas absorbing filters and to dispose loads of biomedical wastes safely¹⁵.

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