Jurnal Kesehatan Lingkungan

Vol. 12 No. 1 Special Issue
DOI: 10.20473/jkl.v12i1si.2020.38-44
ISSN: 1829 - 7285
E-ISSN: 2040 - 881X

Journal Home Page:
https://e-journal.unair.ac.id/JKL

ORIGINAL RESEARCH Open Access

SPECIAL ISSUE

# MANAGEMENT OF SOLID MEDICAL WASTE ON ONE OF THE COVID19 REFERRAL HOSPITALS IN SURABAYA, EAST JAVA

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***Article Info***

Submitted : 25 July 2020
In reviewed : 6 September 2020
Accepted : 22 September 2020
Available Online : 30 September 2020

***Keywords :*** *Covid19, Covid19 referral hospitals; solid medical waste, Infectious solid medical waste*

***Published by*** *Fakultas Kesehatan Masyarakat Universitas Airlangga*

***Abstract***

***Introduction:*** *The Covid19 virus has an outer lipid sheath that is not tolerant towards disinfectants, but this virus can quickly infect humans with a fairly high mortality rate. The increasing Covid19 patients directly proportional the amount of solid medical waste production in hospitals. This study aims to identify the health protocol in solid medical waste management in one of the Covid19 patient referral hospitals in Surabaya, East Java.* ***Method:*** *We used descriptive observational research with secondary data for the data compiling method. The obtained data were then compared with the 2020 Guidebook on Waste Management in Referral Hospitals, Emergency Hospitals, and Public Health Centers that Handles Covid19 Patients, issued by the Ministry of Health of the Republic of Indonesia.* ***Result and Discussion:*** *Research results showed that the management of all solid medical waste yielded from the Covid19 Special Isolation Room is directly infectious, went through the incineration process using an incinerator with the primary burner set at 800°C and the secondary burner set at minus 1.000°C. The usage of Personal Protective Equipment (PPE) by medical waste trolley carriers was inappropriate. The officers only used surgical masks, head caps, gloves, shirt, and work shoes, without using any apron.* ***Conclusion:*** *Health protocol for medical waste management in one of the Covid19 patient referral hospitals in Surabaya, East Java has been implemented, but the usage of PPE by medical waste trolley carriers was still inappropriate.*

## INTRODUCTION

Covid19 is a respiratory infection caused by SARS-CoV-2 or the Covid19 virus (1). The Covid19 virus became widespread globally in early 2020, to the extent that the WHO declared it as a Public Health Emergency of International Concern (PHEIC). This is a virus capable of infecting humans very rapidly with a fairly high mortality rate (2).

As many as 65 countries contracted the coronavirus. Around 93% of the total global population stood still as many countries implemented movement restrictions and quarantines at home (3) such as physical distancing, implementing online mechanisms for schools and workplaces, and the implementation of Large-Scale Social Distancing (LSSD) in many regions in Indonesia). These policies were made as an effort to terminate the chain of the Covid19 transmission. Fomites as the main medium in the spread of viruses that were transmitted to humans during an outbreak (4). Transmission occurred through physical contact on an infected surface (skin-to-skin, touch of an infected inanimate object) which was then made to touch the mouth, nose, or eyes (5) . The world had adapt to behavioral and social changes in facing the risks of Covid19. This pandemic is different from any previous pandemics in history. Covid19 presents a global crisis. The effects of Covid19 have brought several industries to the brink of collapse(6). From a total of 12.166.688 cases, the highest amount of positive cases, as of July 9$^{th}$ 2020, is in the USA with 3,158,932 cases (7). Indonesia also suffers a fairly high amount of cases with 68.709 cases per July 9$^{th}$ 2020. The highest contributor to positive cases is the East Java region, particularly Surabaya (8).

As a health services facility, hospitals provide comprehensive, curative, and preventive health services to the public and they are expected to be able to treat Covid19 patients (9). One of the Covid19 referral hospitals in Surabaya, East Java, is a hospital with classification a that has a bed capacity of over 2,050 beds. Operating hospital activities can bring about both positive and negative effects. The positive effect is the restoration of public health, particularly Covid19 patients. Whereas the negative effect is the environmental issue with the arising general waste, medical waste, liquid waste, and the decline of air quality in the hospital environment (10). The surgical mask could only be worn in one day. The Covid19 outbreak had led to the use of one or more masks every day, disposable gloves (11).

The high number of contaminated Personal Protective Equipment (PPE) from treating Covid19 patients will end up as waste, and if not properly managed, they can potentially threaten the surrounding health and environment (6,12). Effective measures for waste treatment were becoming increasingly irreplaceable(13).

The increase of Covid19 positive patients being treated in hospitals is directly proportional to the increase in waste volume, particularly medical waste. An average of 206 tons of medical waste was produced due to Covid19 per day in Dhaka (14). All types of outcomes from patient care activities that are potentially contaminated by substances that are infectious or in contact with patients and/or health workers who treat Covid19 patients are classified as medical waste (15). Medical waste can include used facemasks, used gloves, used bandages, used syringes, used infusion set, used PPEs, and other items that derive from patient care activities in the Emergency Department (ED), special isolation room (SIR), Intensive Care Unit (ICU), treatment room, and other service rooms (16).

Patient care or any other health services activities can yield various dangerous waste (17). Hospitals, as a health services facility, are required to manage solid medical waste, from waste reduction, solid medical waste sorting, solid medical waste storage, solid medical waste transport, solid medical waste processing, solid medical waste burial, to solid medical waste landfill (18).

This study aims to identify the health protocol in solid medical waste management in a Covid19 referral hospital in Surabaya, East Java, and assess its appropriateness in accordance with the guidebook issued by the Ministry of Health of the Republic of Indonesia.

## METHOD

We used descriptive observational research as the researcher did not intervene in any way with the research variable. The researcher only provided the obtained description of the phenomenon. This research took the form of a survey, which is a research activity conducted by collecting and compiling data.

This research was conducted in one of the hospitals that had been assigned by the Ministry of Health of the Republic of Indonesia as a Covid19 referral hospital tasked in handling the Covid19 virus. The hospital was located in Surabaya, East Java. The research was conducted from April to June 2020.

The reference used in this research is the guidebook titled Waste Management in Referral Hospitals, Emergency Hospitals, and Public Health Centers that Handles Covid19 Patients, issued by the Ministry of Health of the Republic of Indonesia.

## RESULT

Surabaya is a city located in East Java, Indonesia. Since March 26, 2020 until today, on June 10, confirmed positive cases of Covid19 have increased. Record of an increase in solid medical waste is also increased at this referral hospital for Covid19.

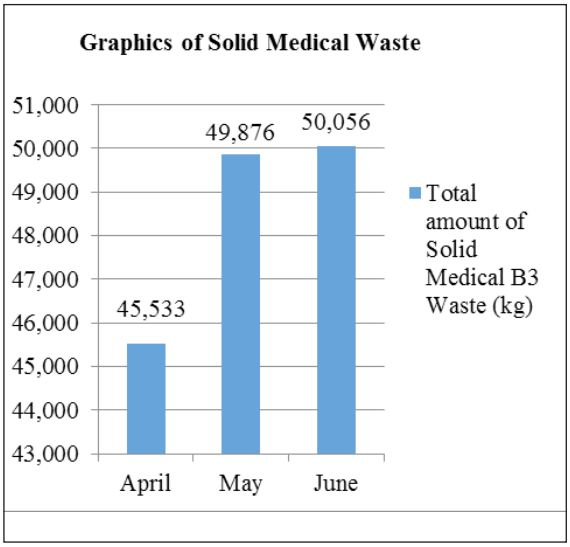


**Figure 1. Amount of Solid Medical Waste from April to June 2020**

The referral hospital for handling the emerging Covid19 infectious disease has a prominent task, one of which is to increase the capacity of the resources needed in the management of suspected cases that have the potential for an extraordinary impact of emerging Covid19 infectious disease (9). The potential impact due to the outbreaks of emerging Covid19 infectious diseases put additional work to the health workers aligned with solid medical waste generated from the care of Covid19 patients. There is no exception for one of these Covid19 referral hospitals. It is known that Solid Medical waste in the referral hospital has significant increases in April - June 2020.

### Solid Medical Waste Sorting and Packing

Sorting and packing process of solid medical waste at the Covid19 referral hospital are implemented by distinguishing solid medical waste that is being placed into a container or bin coated with a yellow plastic bag with the symbol “biohazard” and later on by making sure that the container was tightly bound. These solid medical wastes contain residual goods or leftover materials, from activities, that are contaminated by infectious substances or exposed with patients’ direct contact and/or officers at this referral hospital during the handling process of Covid19 patients. The medical waste produced was divided into two types, there are soft medical waste which later will be disposed into a yellow plastic bag in a yellow thrash can and sharp medical waste using a yellow plastic bag in yellow thrash can. In the sorting and packing stages there are keeping, labeling, cleaning, and process collecting. Keeping, that is to say the activities of storing solid medical waste into a container according to its type, binding the plastic bag and lining the container, if the solid medical waste is full then a replacement with a new plastic bag should be conducted. The next procedure is labeling, which is to say the activity of lining the container with the appropriate plastic bag. There are two sizes of plastic bag being used, small size of 60 cm x 60 cm and a large size of 75 cm x 100 cm. The next procedure is cleaning the solid medical waste container after it is emptied and accommodating the generated solid medical waste in a bound yellow plastic bag, from a small size solid medical waste container into a larger container.

### Solid Medical Waste Transport

The solid medical waste transport process carried out using a special yellow trolley with a tight yellow cover. There ware sign “infectious waste” written on the trolley. The volume of solid medical waste stored in the container or collecting bag is more than ¾ of the container volume. In the carrying process, officers disinfect the materials with disinfectant liquid using $H_2O_2$ 0.5 % before it is delivered to the incineration site. When conducting their duties, officers who carry solid medical waste have to wear long work clothes, work shoes, PPE consisting of surgical masks, head caps, and gloves. This carrying process is conducted 4 times a day, specifically at 05.00 A.M, 09.00 A.M, 01.00 P.M, and 04.00 P.M. Spraying of disinfectants were also conducted when the container or bin has been used, using $H_2O_2$ 0.5%.

### Solid Medical Waste Storage

The process is carried out using a special yellow trolley with a tight yellow cover. There were signs “infectious waste” written on the trolly. The volume of solid medical waste stored in the container or collecting bag was more than ¾ of the container volume. In the carrying process, officers disinfect the materials with disinfectant liquid using $H_2O_2$ 0.5 % before it is delivered to the incineration site. When conducting their duties, officers who carry solid medical waste have to wear long work clothes, work shoes, PPE consisting of surgical masks, head caps, and gloves. This carrying process conducted 4 times a day, specifically at 05.00 A.M, 09.00 A.M, 01.00 P.M, and 04.00 P.M. Spraying of disinfectants also conducted when the container or bin has been used, using $H_2O_2$ 0.5%.

The storage duration of solid medical waste from the Covid19 referral hospital was no more than 24 hours or 2 days. The solid medical waste were taken from post-service activities leftover items in the Emergency Room, Covid19 special isolation room, Intensive Care Unit (ICU), treatment rooms, and other service rooms such as PPE that was to say hazmat, apron, surgical masks and N95, handscones, bandages, ampoules, needles, and the others that were relatively large so that there was no accumulation of solid medical waste expected. Officers were also conduct a disinfection process with disinfectant hydrogen peroxide ($H_2O_2$) with a percentage of 0.5% in the whole landfill area.

### Solid Medical Waste Processing and Elimination

The handling of solid medical waste was carried out by using an incineration. The minimum temperature of this incinerator primary burner is 800 °C and the secondary burner is min 1000°C. The Covid19 referral hospital has 4 incinerators.

**Table 1. Incinerator Data of Surabaya Referral Covid19 Hospital**

| Coordinator Points | Brand | Capacity | Chimney Height |
|---|---|---|---|
| 07°16'07.0"LS 112°45'32.7"BT (licensed incinerator) | CMC SLI-02 | 2m³ | 14m/40 cm |
| 07°16'04.71"LS 112°45'35.81" BT (licensed incinerator) | Hoval | 1m³ | 10,8m/40cm |
| 07°16'04.85"LS 112°45'35.85" BT (licensed incinerator) | CMC | 2m³ | 9m/40cm |
| 07°16'07.0"LS 112°45'32.43" BT (licensed incinerator) | CMC SLI-03 | 3m³ | 14m/40cm |

The results of combustion in the form of ash or residue are placed into a drum with capacity of 200 liters and later on being carried out in the process of solidification using cement as a lid. Ash or residue-containing-drums are sent to the 3rd party who already has the legality of the Republic of Indonesia Ministry of Environment and Forestry for ash incinerator waste management.

## DISCUSSION

An Increased amount of solid medical waste has occured occurred in Wuhan, China. on March 1, solid medical waste went up to 247 tons per day, which was initially only 40 tons per day, this indication of increase reached 6 times of the total amount of the preceding calculations (15). The same thing happened in the cities of Manila, Hanoi, Kuala Lumpur, and Bangkok which undergo increases of the waste volume from 154 to 280 tons per day (16). In many developing countries solid waste is still disposed in the open environment without concerning waste management process. it has the potential as a place of livelihood such as a scavenger. A waste needed special attention which was prioritized by immediate action from the authorities, as it had been identified as one of the three main sources of environmental degradation in Asian countries by the World Bank (19). Solid waste management that was decentralized in a system area and formed as an effort to provide a livable and hygienic environment (20). Strong waste management had developed into one of the main problems in the journey of environmental health. The factors of human civilization advancement and the rate of population growth had made the sources of waste varied and the resulted waste were more complex (21) became a threat and a prolonged environmental safety concern about the dangers of public health due to the environment being infected every day (14).

During the outbreak, an increase in the amount of solid medical waste was generated, including masks, gloves, protective equipment and others that have become infected. The hard surface and plastic SARS-CoV-2 virus could live for several days. Re-criticization was needed to be done to protect cleaner officers from being exposed to potentially contaminated waste. Given the potential role of the environment in the spread of SARS-CoV-2 (14) . Recent reports had been obtained if Covid19 could be transmitted through the air because of this, health workers are required to wear surgical masks in the hospital environment (22). Indonesia also undergoes and increase in the volume of solid medical waste, unfortunately, the availability of health facilities that supports the management process of solid medical waste were still limited. Indonesia only has 20 of Covid19 referral hospitals that provide licensed incinerators out of 132 hospitals. According to the data, out of 2,889 regular hospitals, there are only 112 hospitals with licensed incinerators (23). Some steps of Covid19 solid medical waste management were in forms of sorting/packing, storing, carrying, and processing (24-25).

Solid medical waste is a solid waste consisting of infectious waste, pathological waste, sharps waste, pharmaceutical waste, cytotoxic waste, chemical waste, radioactive waste, pressure container waste, and waste with a high heavy metal content. Infectious solid medical waste itself is a waste that is suspected of containing pathogens such as bacteria, viruses, parasites, or fungus in sufficient concentration or quantity to cause disease transmission to humans (26).

**Solid Medical Waste Sorting And Packing**

The medical waste sorting process is an important point to reduce the volume of hazardous and infectious waste. This sorting is carried out by fully utilizing the container's label/tag to support the effective sorting process. Covid19 referral hospital has been conducted sorting and packing by the guidelines of the Republic of Indonesia Ministry of Health, solid medical waste in the form of liquid is disposed of in the wastewater channel which is directly connected to the Waste Water Treatment Plant (18,24,27). The solid medical waste container has a "biohazard" symbol in the same plastic coated in yellow (27). Solid medical waste was separated and placed in a container according to the color and characteristics that had been determined, this depends on the composition and appropriate treatment such as incineration (28). The addition of several medical waste containers as an effort to prevent the transmission of Covid19 had also been carried out considering the amount of waste that had been increased from April to June 2020. When medical waste related to Covid19 increased, consequently the supply and demand for containers for medical waste were used and needed to be increased so that storage and later transportation could be balanced (29). The disinfection process uses disinfectants to disinfect solid medical waste. The disinfectant used is $H_2O_2$ 0.5 % by accordance with regulations issued by the Ministry of Health (30).

**Solid Medical Waste Storage**

Storage process of solid medical waste is already appropriate, that is, it must be done no more than 2x24 hours to the TPS (15). The need for proper planning in the management of solid medical waste because solid medical waste cannot be left full, if container reached its ¾ then the container must be packed in tightly bound and must be transported immediately (24-25,31). In addition, potential hazards can also impact human health (32).

Determination of landfill location was an important consideration of the impact on groundwater because it would had been caused the formation of leachate (33)

**Solid Medical Waste Transport**

Acceleration of medical waste was carried out from the source to the temporary waste processing facility (34). The process of carrying hazardous solid medical waste is carried out using a special infectious waste with a tight cover, so that it is expected to prevent transmission of Covid19 (24). Routes in transportation have been adjusted with the hours outside the busy schedule of visitors so as to avoid crowds of visitors (15). The carrying process of solid medical solid medical waste by officers is carried out by using proper PPE, officers are not allowed to only use surgical masks, gloves, and head caps. The complete use of PPE, that is to say hazmat clothing, goggles, hair caps, surgical masks, gloves, and safety boots is a recommendation given by the Indonesian Ministry of Health (17). Concerning WHO's recommendations namely aprons, surgical masks, gloves, goggles or face shields, and safety boots (27). So it is expected to be able to prevent Covid19 transmission. From the results of monitoring carried out by the researchers from April to June 2020, officers carrying solid medical waste are always carry the waste consistently according to their schedule without being absent. There were no complaints of Covid19 symptoms arising from the officers carrying the solid medical waste up to the current date. There has never been any evidence that the officer handling the solid medical waste could be infected with the Covid19 virus (27). Trolley disinfection is also carried out when solid medical waste has been relegated to a Temporary Disposal Site (TDS). that is in accordance with guidelines which is then placed and dried with the direct sunlight (24,30).

**Solid Medical Waste Processing / Elimination**

Incinerator were used to reduce the volume of waste produced. Waste management using incinerators could protect humans and the environment from hazardous and toxic waste. This incineration could reduce the volume of waste by up to 90% so as to minimize the landfill area (35). Combusting is one of the most widely used annihilation technologies, especially in several developing countries including the technology used by the Covid19 referral hospital (36). Incineration had a major effect on positive impacts, namely on improving the performance of disaster waste management, especially in situations and time constraints (37). Incineration showed the greatest impact on fossil fuels, changes in climate, the effect on breathing because humans will inhale the inorganic substances produced (38).

The appropriate incinerator temperature is at least 800$^{o}$C (24). Incineration temperature needed in a very strict waste reduction procedure which were at 1000$^{o}$C (22). Although the gas produced by the incinerator during the combustion process has an adverse effect on air quality, previous studies have shown that combustion is the most common and effective way to kill virus bacteria, and harmful pathogens, which originate from various infectious medical wastes (39) and can reduce waste volume (32) .

Ash or residue resulted from the incineration process is carried out by storing conducted by a licensed third party according to the construction process issued

by the Minister of Environment and Forestry Regulation number P.56 of 2015 (18,36). Ash resulted from a waste incinerator when a sufficient reduction in the volume of waste had been achieved were safe enough and threatless to the environment and public health (40).

## ACKNOWLEDGEMENT

In this research, warm gratitude are given to journal reviewer who provided input, suggestions and improvements to my manuscript.

## CONCLUSION

The Covid19 referral hospital in Surabaya, East Java had implemented the health protocol on solid medical waste management in accordance with the guidelines for waste management of referral hospitals, emergency hospitals in handling Covid19 patients, namely sorting/ carrying, storing, transporting and processing/destroying infectious waste by incineration. However, the suitability of PPE for medical waste transport officers was still not proper because waste transporters only wore surgical masks, gloves and head caps.

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