

**A Review on Biomedical Waste Management**Chetna Sharma¹, Raj Kumari Sharma¹, Purna²¹Biomedical Engineering, Deenbandhu Chhotu Ram University of Science and Technology, Murthal²Cygnus J.K Hindu Hospital, Sonipat

Abstract — Developing trends and facilities in healthcare are playing a key role in better hospital management. This has also become a driver for more biomedical waste generation. The waste produced in the course of healthcare activities needs to be handled in an efficient way as inadequate and inappropriate knowledge of management of biomedical waste may lead to serious consequences to patients, doctors, other persons involved and the environment. Every day, relatively large amount of waste is generated in the health care hospitals and facilities around the world which need proper biomedical waste management. The present article presents the basic issues as definition, categories, sources of biomedical waste and procedure of handling and disposal technologies of Biomedical Waste Management. It also intends to create awareness amongst the personnel for the effective waste management in healthcare units.

Keywords- Biomedical Waste, Hospital Management, healthcare, patient safety, hazardous, disposable

I. INTRODUCTION

Health care is one of the basic and significant needs for the life. With the advancement in medical sciences, solutions to various health issues have been found out which earlier were very difficult to deal with for the health care practitioners. This could not be possible only with the advances in medical sciences but the development of various medical devices has added to the better hospitality being imparted to the patients. Such enhancement of engineering principles applied in medical field has increased per capita per patient generation of biomedical wastes in health care units. As a foreseen result, the need for the management of biomedical waste is very crucial not only to the hospitals, nursing home authorities but also for the environment. The biomedical waste, produced in hospitals rely on a number of factors like the waste management methods, types of healthcare units, occupancy of healthcare units, specialization of healthcare units, ration of reusable items in use, availability of infrastructure and resource[1].

II. DEFINITION

Biomedical waste, also known as, the infectious waste or the medical waste is defined as “any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in the health camps”[2].

The Government of India (notification, 2016) specifies that the Biomedical Waste Management is an integral part in cleanliness of hospital and the maintenance activities. This can be only possible by administrating a wide number of activities such as the collection, segregation, processing, treatment and disposal of the medical waste in an environmentally sound management thereby, reducing the biomedical waste generation and its impact on the environment. Today, one of the biggest challenges that India faces is to change the attitudes of the operators of the medical care providers to incorporate good Health Care Waste management practises in their day to day routine. World Health Organisation (WHO) states that 85% of hospital wastes are actually non-hazardous, whereas 10% are infectious and 5% are non-infectious but they are included in hazardous wastes. This range is dependent on the total amount of waste generated [3].

III. TYPES OF BIOMEDICAL WASTE

According to the Biomedical Waste Management Rules 2016, the different types of biomedical waste are as follows:

Types of Biomedical Waste	Description
Human Anatomical Waste	Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of Pregnancy Act 1971, amended from time to time).
Animal Anatomical Waste	Experimental animal carcasses, body parts, organs, tissues, including the waste generated from the animals used in experiments or testing in veterinary hospitals or colleges or animal houses.
Solid waste	Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.
Expired or Discarded Medicines	Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.
Chemical Waste	Chemicals used in production of biological and used or discarded disinfectants.
Chemical Liquid Waste	Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, housekeeping and disinfecting activities etc.
Microbiology, Biotechnology and other clinical laboratory waste	Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, Human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures.
Contaminated Waste (Recyclable)	Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes(without needles and fixed needle syringes) and vacutainers with their needles cut) and gloves.
Waste sharps including Metals	Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades or any other contaminated sharp object that may cause puncture and cuts. This includes used, discarded and contaminated metal sharps.
Glassware and Metal Body Implants	Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.

TABLE 1: Types of Biomedical Waste

IV. SOURCES OF BIOMEDICAL WASTE

The various sources of Biomedical Waste are:

Major Sources	Minor Sources
Production Units	Physicians / dentists' clinics
Biotechnology institutions	Animal houses/ slaughter houses
Blood banks / mortuaries/ autopsy centres	Blood donation camps
Veterinary colleges and animal research centres/ paramedic services	Vaccination centres
Primary health centres	Acupuncturists/ psychiatric clinics/ cosmetic piercing
Government hospitals/ private hospitals/ nursing homes/ dispensaries	Funeral services
	Institutions for disabled persons

TABLE 2: Sources of Biomedical Waste [4]

V. NEED FOR THE MANAGEMENT OF BIOMEDICAL WASTE

There is a great need to manage the biomedical waste due to many reasons. Although, there is an increased global awareness among health professionals about the hazards and also appropriate management techniques, but the level of awareness in India is found to be unsatisfactory [5]. First of all, injuries from sharps lead to infection to all health care providers. There are many infections that may arise in the patients from improper management of medical wastes. The management of biomedical waste has also become vital when it comes to hygiene [6]. There are many risks associated with improper disposing off the waste which can make the life of the people involved in taking and giving health care facilities miserable [7]. "Disposable" being repacked without even washing and sold by fraudulent elements also pointed the demand for the management of biomedical waste [8]. Similarly, there are certain drugs which have been disposed off are being repacked and sold off by monks to fulfil their selfish greed. Further the exposure of harmful pollutants from various types of pollution caused due to the poor management of biomedical waste marks the necessity for the proper management of biomedical waste [9]. The absence of proper waste management, lack of awareness about the health hazards from biomedical wastes, insufficient financial and human resources, and poor control of waste disposal are the most critical problems connected with healthcare waste that makes the need of biomedical waste management a necessity[10].

Inadequate Biomedical waste management, thus, will cause environmental pollution, unpleasant smell, growth and multiplication of vectors like insects, rodents and worms and may lead to the transmission of diseases like typhoid, cholera, hepatitis and AIDS through injuries from syringes and needles contaminated with human [11]. So, there is a high need for the management of biomedical waste.

VI. MANAGEMENT OF BIOMEDICAL WASTES

The key steps that are used in the management of the biomedical waste are Waste minimization, Segregation, Collection, Storage, Transportation, Treatment and Disposal. Apart from these, non-infectious wastes should be segregated as a separate category and these wastes shall not be mixed with other categories.

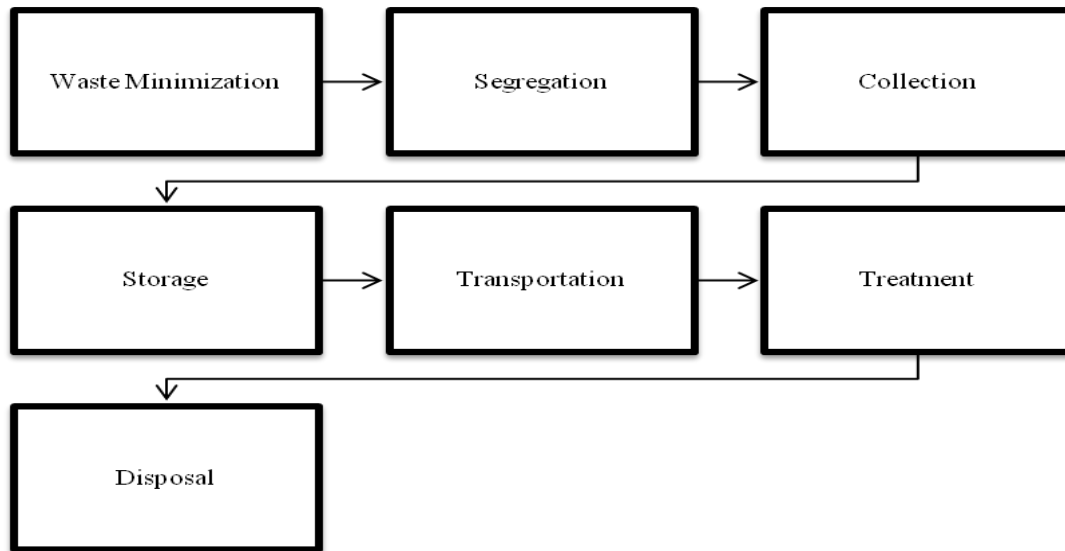


FIGURE: Steps of Biomedical Waste Management [12]

Each ward of health facilities should have at least two coloured containers and other coloured containers can be placed at centralized places. All the items should be made non-reusable before they can be taken out of the hospital. For disfigurement of needles and syringes, all hospitals should provide an adequate number of needle destroyers and syringes cutters at appropriate locations such as Nursing desk, OT, blood bank, etc. [13]. The needles after disinfections/ destruction shall be collected in a puncture proof container and the container may be buried. A detailed study should be carried out for the treatment of liquid effluent generated at the hospital. This may be carried out through a recognized institutions/ consultants. An inventory of various hazardous chemicals used in medical treatment shall be prepared. The possibilities of recycling of such hazardous chemicals should also be looked into. Infectious waste has to be kept separately in lidded bins lined with polyethylene bags wherever needed. Under no circumstances should the infectious waste be mixed with non infectious bags. The bag lining the bin should be only three fourth full to ensure that the waste does not spill out. While carrying the bag containing infectious waste, it has to be sealed. Bags containing infectious waste have to be disposed off through incineration, autoclaving, or micro waving as per recommendations. Properly labelled waste containers should be of prescribed colour and labelled properly. Blood bags, syringes and sharps should be handled with extreme care. The doctor supervisor should ensure that such items are either out or disfigured before disinfecting it. All the employees working in the hospital or otherwise coming in contact with waste must be vaccinated against hepatitis B. All the workers should put on gloves while dealing with the infectious waste especially sharps. Sharps should not be left casually counter tops, food trays, on beds or on the floor as grievous injuries can result. Segregation of hospital waste is the key to ensure that 90% of the waste which is non infectious is treated easily. At no stage should infectious waste come in contact with non infectious waste. If mixed, with the infectious waste, non infectious waste has to be treated as infectious waste. A system should be worked out to develop a common treatment facility for the biomedical waste. The municipal authorities in large cities to set up common hospital waste treatment facilities, so that small nursing homes and clinics can make use of such facilities. Household clinical waste can also be sent to such facilities for necessary treatment [14].

VII. TREATMENT AND DISPOSAL TECHNOLOGIES OF BIOMEDICAL WASTE

The various technologies employed for treatment and disposal of biomedical waste are:

Incineration

This method is used to be the first choice for most hazardous biomedical waste and is still used widely. Incineration is a high temperature, dry oxidation process, which reduces organic and combustible waste to inorganic incombustible matter and results in a very significant reduction of waste volume and weight. This process is usually selected to treat waste that cannot be recycled, reused or disposed off in a land fill site. The advantages of incinerator include good disinfection efficiency and drastic reduction of weight and volume of waste [15].

Autoclaving

The autoclave should be dedicated for the purposes of disinfecting and treating biomedical waste. It operates on the principle of a pressure cooker. This process involves steam at a high temperature. The autoclave should completely and consistently kill the approved biological indicator at the maximum design capacity of each autoclave unit.

Microwaving

The microwave is based on the principle of generation of high frequency waves. These waves cause the particles within the waste material to vibrate, generating heat. Most microorganisms are destroyed by the action of about 2450 MHz and a wavelength of 12.24cm. The water contained within the waste is rapidly heated by the microwaves and the infectious components are destroyed by heat conduction. The efficiency of the microwave disinfection should be checked routinely through bacteriological and virological tests [16].

VIII. CONCLUSION

With advances in medical facilities, demand for handling biomedical waste has come into light. There is a crucial need for effective Biomedical Waste Management in health care hospitals to prevent its consequences on personnel involved and the environment. Medical waste should be categorised according to their source, typology and risk factors associated with their handling, storage and disposal. The key steps in the management of the biomedical waste are Waste minimization, Segregation, Collection, Storage, Transportation, Treatment and Disposal. Therefore, segregation of wastes is a key step in the process of handling of biomedical waste. Appropriate measures should be implemented in healthcare hospitals and related units to cope up with the distressing effects of waste generation. The absence of proper waste management, lack of awareness about the health hazards from biomedical wastes, insufficient financial and human resources, and poor control of waste disposal are the most critical problems connected with healthcare waste that makes the need of biomedical waste management a necessity.

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