

Biomedical Waste Management – Importance in a Healthcare Setting

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ABSTRACT

Biomedical wastes, are those potential hazardous waste materials that consist of solid, liquid, sharps and laboratory wastes which pose grave danger to the health of humans as well as other living organisms. And in some cases, it may be lethal too. It is of extreme importance that this waste must be properly managed and disposed off safely so as to prevent outbreak of infections to general public and disturb the health care setting in a society. It is essential to understand what biomedical waste is, there classification and management accordingly. In this paper, a concise effort is undertaken so as depict biomedical waste substances generated, their origin and the method to deal with them effectively.

Keywords:*Biomedical waste management, Infection, Hospital, Hazardous Waste.*

INTRODUCTION

In Health Care Industry, the materials are not utilized fully or after utilization, something remains as left over or has been utilized for the purpose and is discarded, and treated as waste. Modern hospitals are very complex organizations which consume lot of materials for rendering health service to the people. These wastes are generated as a result of diagnostic, therapeutic, immunization, or research activities in the hospitals. These waste materials have potential of transmitting serious diseases to the health care workers, visitors of the hospital including patients as well as the general public. Various terms may be used in relation to the hospital waste like "medical waste", "regulated medical waste" or "hospital waste". In hospital waste management the popular term is bio medical waste. Bio medical waste is defined as "Waste generated during the diagnosis, treatment or immunization of human beings and are contaminated with patients'

body fluids (such as syringes, needles, ampoule, organ and body part placenta, dressing, disposable plastic and microbiological wastes)”.
The average quantity of hospital waste generated in India ranges from 1.5 to 2.2 kg/day/bed whereas in developed countries it is generated 5.24/kg/day/bed. The problem of the hospital waste is more of quality as compared to quantity. 15%to20%of the hospital waste is contagious and require special disposal technique but if this mixes with rest of the waste, then 100%waste become contagious.

Classification of hospital waste:

- **General waste:** the waste generated from office, administrative office kitchen, laundry and stores. This waste is non-hazardous to human beings.
- **Sharps:** Hypodermicsyringes, needles attached to tubing, scalpel blades, razor, nails, broken glass pieces, etc
- **Infected waste:** Equipment and instruments used for diagnostic and therapeutic procedures, waste from surgery like tissues and organs removed and autopsy.
- **Chemical waste:** Formaldehyde used for preserving tissues and organs, fixer and developers used in radiology department. Solvent like Xylene, acetone, ethanol and methanol used in the laboratories.
- **Radioactive waste:** Various radioactive waste generated through the activities of the department like research activity, clinical laboratory and nuclear medicine department.
- **Cytotoxic drugs:** Anti-cancer drugs

Categories of Biomedical waste:

- The ministry of Environment and Forests has drafted certain rules in exercise of powers conferred by section 6, 8 and 25 of the environmental [protection] act 1986.

<u>Waste category</u>	<u>Waste class and description</u>
Category No.1	Human anatomical waste,
Category No.2	Animal wastes, animal tissues, organs, body parts, bleeding parts,

<p>Category No.3</p>	<p>waste generated by veterinary hospital colleges, discharge from hospital, animal house,</p> <p>Microbiology and biotechnology wastes,</p> <p>Wastes from laboratory culture, stocks and specimens of microorganisms, live or attenuated vaccines, human and cell culture used in research and infectious agents from research and industrial laboratories, waste from production of biological toxins, dishes and devices used in transfer for cultures.</p>
<p>Category No.4</p>	<p>Waste sharps</p> <p>Needles syringes, scalpels, blades, glass, etc. that are capable for causing puncture and cuts. That includes both used in unused sharps</p> <p>Discarded medicines and cytotoxic drugs</p>
<p>Category No.5</p>	<p>Wastes comprising of outdated, contaminated and discarded medicines.</p>
<p>Category No.6</p>	<p>Solid wastes</p> <p>Items contaminated with blood, and body fluid including cotton, dressing, soiled plaster casts, linen, bleeding and other material contaminated with blood.</p>
<p>Category No. 7</p>	<p>Solid wastes</p> <p>Wastes generated from disposable items other than the waste sharps, such as tubing's, catheters intravenous sets.</p>
<p>Category No.8</p>	<p>Liquid waste</p> <p>Waste generated from laboratory and washing, cleaning, housekeeping and disinfection activities</p>
<p>Category No.9</p>	<p>Incineration ash</p> <p>Ash from incineration of any biomedical waste.</p>

Category No. 10	Chemical waste Chemical used in the production of biological, chemical used in disinfections, as insecticides.
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OBJECTIVES

- To understand the process of biomedical waste management in a hospital setting.
- To identify the importance of biomedical waste management in health care services.

METHODOLOGY

This is a descriptive study based on secondary data and has included abstracts, reviews, Bio Medical Waste Management and Handling Rules – 2016 and contents from books on Biomedical Waste Management Techniques.

DISCUSSION & FINDINGS:

Hospital waste management:

The hospital waste management is done on the following steps.

- **Generation and segregation of waste**
 - **Generation of waste:** In hospitals waste is generated from almost all the areas and at all levels starting from group 'D' employees to highly educated and trained professional.
 - **Sources of waste:**

The Health Care organization generating biomedical waste can be categorized as follows:

 - ***Hospital and its departments:***
 - a. Hospitals of all categories like General, Specialist hospitals, Private sector as well as Public sector hospitals.

b. Departments like surgery, Gynecology and Obstetrics, Paediatric, Oncology, Orthopedics, Burn and Trauma, Neurosurgery etc.

- ***Clinics:***

a. Physicians, dentists, maternity clinics, immunization clinics, dialysis center and Endoscopists

b. Dispensaries of state or governments

- ***Health care Organizations:***

a) Polyclinics

b) Nursing homes

c) Geriatric homes

d) Home for mentally retarded asylums.

- ***Support services:***

a) Blood bank, pharmacy, mortuary, CSSD, laundry, technical services, laboratories

b) Other health centers

c) Veterinary hospitals, clinics and laboratories.

▪ **Segregation of waste:**

As per the Bio Medical Waste (management and handling) rules 2016 segregation is defined as “separation of different type of waste by sorting”. In fact, this step is the key to the success of the waste management program. The methodology is to be designed for identification of the different type waste, categorization of the waste into different categories and segregation the waste into different categories and segregation of the waste into different type right at the point of origin. All the health care worker at all levels need active teaching and training in this aspect. This is a matter of changing the attitude and behavior of all the Health care workers. The segregation of waste will depend upon the following factors:

- Size and type of the hospital, availability of super specialty facility in the hospital.
- Training level of all the health care workers particularly those who are responsible for generation of the waste.
- Motivation of the health care worker for the waste management program.
- Hospital policy for waste management and support of the top-level management.

- Standard operative procedure (SOP) for the procedures.
- Availability of the treatment options for Hospital waste.

▪ **Collection and storage of waste**

This process starts after the segregation of the waste. The pre-requisites of the collection and storage of the waste are follows.

- Safe water supply
- Facilities for sanitation in respect of toilet, urinals etc.
- Good housekeeping service on patient care areas of the hospital.
- Zoning particularly in operations theatres

▪ **Color coding criteria for segregation:**

Color coding criteria as recommended for developing country by WHO

Sr. No.	Category of waste.	Recommended color code
1.	General non hazardous waste	Black color bag
2.	Sharps(whether infected or not)	Yellow color bag
3.	Infected waste (not containing sharps)	Yellow color beg
4.	Chemical and pharmaceutical (other than cytotoxic drugs, radioactive waste,high pressure containers)	Red color beg
5.	Clinical waste that requires autoclaving	Blue color

▪ **Storage of Wastes:**

As per the biomedical waste (Handling and management) Rules 2016, the storage may be defined as “The holding of biomedical waste for such period of time, at the end of which waste is treated and disposed of”. This is the time duration from the point of generation to the point of disposal of waste. under the provision of biomedical waste (Handling and management) Rules2016, the storage of waste will be done as per the guidelines &the authorized persons handling the biomedical wastes shall ensure that:

1. No untreated biomedical waste shall be stored beyond a period of 48 hours.

2.If for any reason, it becomes necessary to store the waste beyond such period, the authorized person must take permission of the prescribed authority and take measures to ensure that the waste does not adversely affect human health environment.

Characteristics of waste storage containers:

The containers being used to store the biomedical waste must have the following characteristics:

1. It should be made of hard plastic/metal, sturdy and proof.
2. It should be appropriate size according to the quantum of waste generated.
3. It should be remained closed.
4. It should be puncture proof.
5. The containers should be of appropriated colors for easy identification.

▪ **Transportation of wastes**

In case of transportation of the hazardous waste due care is to be taken, neither the operator nor the general public should be exposed to the risk of infection or hazardous of biomedical wastes.

* ***Type of transportation***

The transportation can be broadly divided into to types:

1. Intramural transportation: It is transportation inside the hospital. The intramural transportation is done with the help of:
 - a. The push cart
 - b. Waste trolleys
 - c. Wheel Barrow
2. Extramural transportation: Transportation of the wastes outside the hospital called extramural transportation. It is done with the help of:
 - a. Rickshaw
 - b. Van/Lorry

The untreated wastes must be transported only in such vehicle which may be authorized by competent authority for the purpose. It is the duty of the authorized person handling the biomedical waste to segregate it prior to its storage, transport, treatment and disposal.

▪ **Treatment of wastes**

As per the biomedical (management and handling) Rules, 2016 the treatment is defined as "A method technique or process designed to change the physical chemical or biological characteristics or composition of any biomedical waste so as to render such waste non-hazardous to health and environment ". The waste treatment method is classified into the following broad group:

a) Chemical method

In this method, the main method of waste treatment is disinfection. The disinfection can be defined as " the process by which most of the pathogens are destroyed from any inanimate object, surface or material". When this process is done by the chemical, its called chemical infection. The articles which are disinfected by the chemical method are as follows:

- a. Instruments and equipment that come in contact with skin and mucous membrane with skin and mucous membrane.
- b. Sharpe like needle, scalpel, syringes.
- c. contaminated floor, surfaces like trolley tops, table, trays, clothing, bleeding etc.
- d. Wards, operation theatre, ICU, etc.

Common chemical used for disinfection

1. Bleaching powder for toilet, washroom, urinals,
2. 1% solution of bleach.
3. Alcohol 70% for hand Wash.
4. Savlon 1% for thermometer, cheatles forceps etc.

b) Thermal method

These processes are used to decontaminate or destroy medical waste. Most of the microbes are destroyed at a temperature of 100C. For treatment of biomedical waste, following two techniques are used.

- Low heat systems: this is done by operating at a temperature of 150'c.
- High heat system: this is done by operating at a very high temperature to the tune of more than 5500°c.

Autoclave

This is dependent open low heat system. The different types of autoclaves are used for the purpose are:

Gravity type autoclave

Pre-vacuum autoclave

Retort type autoclave

Hydroclave

This is also dependent upon the low heat system. It allows total dehydration of the product, so that the final volume is considerably reduced.

Microwave

This is also a low heat system based equipment for waste treatment.

Incinerators

This is dependent upon high heat system. These incinerators use high temperature and controlled conditions and convert the waste into inert mineral residue and gases. It uses stages combustion concept. The final volume of the waste is reduced considerably.

c) Mechanical method

These methods are used to change the physical properties of waste, to convert the waste materials to such a stage where it becomes easier to handle it. The method may be used in conjunction with this method. The following types of the method are used

a. Compaction: This method is used to reduce the volume of the waste, generally a hydraulic ram used for this purpose.

b. The biomedical waste is converted into more homogeneous form.

d) Irradiation method: this method use ultraviolet or ionizing radiation for treatment of the wastes. A processing utilising cobalt 60 and electron beam accelerator unit or electronic bean gun for irradiation the hospital waste has been developed. this is very effective method for treatment of waste but at the same time very costly.

e) Biological method:A method of using biological enzyme for treatment of biomedical waste has been developed. It destroys all the organic components of the wastes.

Biomedical waste management rules

Waste category	Waste class	Treatment & Disposal
Category No. 1 waste	Human anatomical waste	Incineration\ deep burial
Category No. 2	Animal waste	Incineration\ deep burial

Category No. 3	Microbiology & biotechnology waste	Local autoclaving \ micro waving \ Incineration
Category No. 4	Sharp	Disinfection (chemical treatment \ autoclaving micro waving and mutilation \ shredding
Category No. 5	Discarded medicine and cytotoxic drugs	Incineration\destruct ion and drug disposal in secured landfills
Category No. 6	Solid waste	Incineration\autoclaving micro waving
Category No. 7	Solid waste	Disinfection by chemical treatment \ autoclaving\ micro waving and mutilation \ shredding
Category No. 8	Liquid waste	Disinfection by discharge and drains
Category No. 9	Incineration Ash	Disposal in municipal landfill
Category No. 10	Chemical waste	chemical treatment and discharge into drains for liquid and secured landfill for solid

Importance of biomedical waste management

Biomedicalwaste management plays vital role in preventing any outbreak of infectious diseases and protecting the society from transmission of these diseases. Here are few benefits that biomedical waste management programs provide:

- Hygienic and healthy environment in medical center
- Low incidence of community and occupational health hazard
- Low impact on ecological system
- Potential epidemics are prevented
- Improved public health and cleaner environment

- Improve image of the healthcare establishment and increased quality of life

CONCLUSION

Biomedical waste should be safely and efficiently identified, segregated, stored, transported and disposal after appropriate treatment. Its effective implementation in our community is of prime importance to protect public health and environment. With growing population, biomedical waste is also growing in quantity in our country. Management of this waste is a rising concern in India. Segregation of biomedical waste at its origin is the key to the efficiency of waste management. Following regulations and scientifically managing biomedical waste is in the best interest of the public as well as the environment.

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