

A Review of Biomedical Waste

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Abstract:- The management of biomedical waste is subject of important concern for public and also infection control specialist. As everyone knows that several types of health care activities produces various types of hazardous and contagious materials. Although we all know that in some manner it is harmful to public health, yet very recently people and government became aware about its proper management and disposal in India. Unscientific disposal of biomedical waste may cause transmission of communicable disease spreading through air, water and direct human contact by means of blood and infectious body fluids. These can be responsible for spread of hepatitis B, C and E and even AIDS within a community. Hence, proper handling, treatment and disposal of biomedical waste are important parts of healthcare infection control program. Appropriate management of biomedical waste is thus an important part of environmental health protection and it should become an integral feature of health care services. This review paper discuss about how to treat and dispose the biomedical waste.

Keywords:- Bio-medical waste, solid waste management, handling of bio medical waste, treatment of biomedical waste.

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I. INTRODUCTION

Biomedical wastes are generated in different departments of hospitals, research institutions, healthcare institutes, clinics and nursing homes, laboratories, blood banks animal houses etc. the waste produced in healthcare activities possess a higher potential for infection and injury than any other types of waste. As the population is increasing, requirement of hospitals and medical facilities are also increasing which is further increasing the production of biomedical waste. Biomedical wastes are defined as per Biomedical Waste (Management and Handling) rules, 1998 of India “Any waste which is generated during the diagnosis, treatment and immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals”. The government of India specifies that Hospital Waste Management is part of hospital hygiene and maintenance activities. This involves management of many activities like collection, transportation, operation/treatment of processing systems and disposal of waste. Before the Biomedical waste rules, biomedical wastes were responsibility of municipal or government authorities but now hospitals and laboratories have to dispose solid waste as per law. There are 1.6 million health care workers at approximately 27500 health care facilities in India (Shah et al., 2001). Health risks are very high for these workers alone. In healthcare wastes, about 85% of the waste generated is non-hazardous and 15% is hazardous of which 10% is infectious and 5% is non-infectious. If infectious waste gets mixed with any non-infectious waste then, whole mass becomes infectious. So, if we do not learn the new methods of disposal of biomedical waste, then it will cause the number of diseases. And very purpose of medical inventions and scientific research will become useless.

II. SOURCE AND CLASSIFICATION

Wherever is people, there will be sources of biomedical waste. Its quality and quantity may vary depending upon the source and level of facilities available. Out of the total biomedical waste produced, 80 percent are general health care waste which can be dealt with normal urban and domestic waste management system, 15 percent are pathological and infectious waste, 1 percent are sharp waste, 3 percent are chemical and pharmacological waste and less than 1 percent are special waste like radioactive or cytotoxic waste etc. Sources may be classified as:

Major Sources: These includes biomedical waste emerging from

- Govt. hospitals/private hospitals/nursing homes/ dispensaries
- Primary health centres
- Medical colleges and research centres/paramedic services
- Veterinary colleges and animal research centres.

- Blood banks/mortuaries/autopsy centres.
- Biotechnology institutions.
- Production units.

Minor Sources: These sources includes waste emerging from

- Physicians/ dentists' clinics
- Animal houses/slaughter houses
- Blood donation camps
- Vaccination centres
- Acupuncturists/psychiatric clinics/cosmetic piercing
- Funeral services
- Institutions for disabled persons

III. STORAGE AND TRANSPORTATION OF BIOMEDICAL WASTE

For effective minimization and management of biomedical waste, there should be daily collection of waste by sorting in colour coded plastic bags or container in accordance with rules and then, identification and segregation, mutilation, disinfection, storage and safe transportation of waste to off-site treatment facility for final disposal with suitable technology.

Table 3.1: Colour coding and type of container for disposal of biomedical waste

Colour Coding	Type of container	Waste category
Yellow	Plastic bag	Cat 1, Cat 2, Cat 3 and Cat 6
Red	Plastic bag/ Disinfected container	Cat 3, Cat 6 and Cat 7
Blue/ White	Plastic bag/ Puncture	Cat 4
Translucent	Proof container	Cat 7
Black	Plastic bag	Cat 5, Cat 9 and Cat 10

These waste categories are explained as under as given below.

Table 3.2: Waste category and their descriptions

Waste category	Description
Category 1	Human Anatomical Waste
Category 2	Animal Waste
Category 3	Microbiology & Biotechnology Wastes
Category 4	Waste sharps
Category 5	Discarded Medicines and Cytotoxic drugs
Category 6	Soiled Waste
Category 7	Solid Waste
Category 8	Liquid Waste
Category 9	Incineration Ash
Category 10	Chemical Waste

Waste can be stored temporarily in storage area for not more than 48 hours and subsequently transported once or twice in a day depending upon the quantity of biomedical waste produced. During transportation, a great care must be taken. Containers having biomedical waste should properly clean and labelled and properly placed at its position. Container should be disinfected once the bag is removed. Transportation from hospital to site of disposal should be in a closed vehicle which can prevent the spillage of waste and that vehicle must have symbol of 'Bio-Hazard'.

IV. TREATMENT AND DISPOSAL OF SOLID WASTE

Biomedical waste are treated and disposed on the basis of their category. It is given in the table given below.

Table 4.1: Category of biomedical waste, their treatment and disposal methods

Category	Waste type	Treatment and disposal methods
1	Human Anatomical Waste	Incineration/ Deep burial
2	Animal Waste	Incineration/ Deep burial
3	Microbiology & Biotechnology Wastes	Autoclave/Microwave/ Incineration
4	Waste sharps	Disinfection/ Autoclave/ Microwave/ Mutilation Shredding
5	Discarded Medicines and Cytotoxic drugs	Incineration/ Drug disposal in secured landfills
6	Soiled Waste/ Contaminated	Incineration/ autoclave/ Microwave

	solid waste	
7	Solid Waste	Disinfection/ Autoclave/ Microwave
8	Liquid Waste	Disinfection and discharge into drains
9	Incineration Ash	Disposal in municipal landfill
10	Chemical Waste	Chemical treatment and discharge into drain for liquids and secured landfill for solids

Incineration is used for those biomedical wastes which cannot be reused, recycled or disposed in a landfill site. But problem is that, medical incinerators emit toxic air pollutants and toxic ash residues which are major source of dioxins in environment. Dioxin is a carcinogenic chemical. Pressurized gas container, silver salts and radioactive waste etc. are those biomedical wastes which cannot be incinerated. Disinfection method is used for liquid pathological waste to neutralize it before flushing it into sewers. Chemicals used for disinfection are phenol and related compounds like lysol, cresol, chlorhexidine etc., quaternary ammonium compounds like cetrimide-cetavolon, halogens and their compounds like bleaching powder, sodium hypochlorite and alcohol. Autoclave with steam, moisture, heat and pressure is used in order to inactivate the micro-organisms, and to sterilize the medical devices and for medical wastes treatment. When we use gravity autoclave, a medical waste is subjected to a minimum temperature of 121⁰C and pressure of 15 pounds per square inch (psi) for an autoclave residence time of not less than 60 minutes or a minimum temperature of 135⁰C and pressure of 31 psi for an autoclave residence time of not less than 45 minutes or a temperature not less than 149⁰C and a pressure of 52 psi for an autoclave with minimum residence time of 30 minutes. When using a vacuum autoclave, medical waste is first subjected to a minimum of one pre-vacuum autoclave to remove the autoclave of all air. The waste is then subjected to either a minimum temperature of 121⁰C and pressure of 15 psi for an autoclave residence time of not less than 45 minutes or a minimum temperature of 135⁰C and pressure of 31 psi for an autoclave residence time of not less than 30 minutes. Microwave is suitable for most of the infectious waste except human organs, animal carcasses and metals etc. The waste is heated to a temperature of 97-100⁰C and it makes possible treatment of waste at site without the requirement of shredding. Liquid chemical and pathological waste should be treated before their disposal. Effluent generated from hospital waste should follow these limits.

Table 4.2: Liquid waste parameters and their permissible limits

Parameters	Permissible Limit
pH	6.5-9.0
Suspended solids	100 mg/L
Oil and grease	10 mg/L
BOD	30 mg/L
COD	250 mg/L
Bio-assay test	90% survival of fish after 96 hours in 100% effluent

For deep burial purpose, a pit should be dug about 2 meters deep. It should be half filled with waste, and then covered within 50 cm of the surface, before filling the rest of the pit with soil. Whenever wastes are added to the pit, a layer of 10 cm of soil shall be added to cover the waste. Deep burial site should be almost impermeable and no ground water source should be around pit as it may cause contamination in those water sources.

V. CONCLUSION

Management of biomedical waste is one of the major social and ethical responsibilities of healthcare professionals to control the process of treatment and disposal of dangerous waste of healthcare sector. General public should also be educated and aware regarding health hazards related to biomedical waste. Hospital wastes are risk to the patients and personnel who handle these wastes and also a threat to the public life and environment. Safe and effective management of biomedical waste is also a legal necessity. Lack of concern and awareness are the problems faced in the proper hospital waste management. There should be proper collection and segregation of biomedical waste. The most important component of waste management plan is to develop a system and culture through education, training and persistent motivation of the hospital staff.

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