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Biomedical Waste and its Management

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Abstract: Medical wastes include all infectious waste, hazardous (including low-level radioactive) wastes, and any other wastes that are generated from all types of health care institutions, including hospitals, clinics, doctor (including dental and veterinary) offices, and medical laboratories. The concern for hospital waste management has been felt globally with the rise in infectious diseases and indiscriminate disposal of waste. Medical waste has been identified by US Environmental Agency as the third largest known source of dioxin air emission and contributor of about 10% of mercury emissions to the environment from human activities. This paper will sensitize the reader about the impacts of improper waste management. The main bottleneck to sound hospital waste management is lack of training and appropriate skills, insufficient resource allocation and lack of adequate equipment. This paper has been developed to create awareness about Bio-medical waste management and the processes involved in Bio Medical waste management.

Keywords: Bio Medical Waste, Infectious.

I. INTRODUCTION

'Bio-medical waste' means any waste generated during diagnosis, treatment or immunization of human beings or animals. Management of healthcare waste is an integral part of infection control and hygiene programs in healthcare settings. Health-care waste contains potentially harmful microorganisms which can infect hospital patients, health-care workers and the general public. Health-care waste includes all the waste generated by health-care establishments, research facilities, and laboratories. In addition, it includes the waste originating from "minor" or "scattered" sources--such as that produced in the course of health care undertaken in the home (dialysis, insulin injections, etc.)

Infectious waste is material suspected to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. This category includes waste contaminated with blood or other body fluids, cultures and stocks of infectious agents from laboratory work, waste from infected patients in isolation wards; dressings, bandages and other material contaminated with blood or other body fluids which is Infectious because it contains bacteria, viruses, parasites or fungi. Pathological waste contains human tissues, organs or fluids, body parts, unused blood products. Chemical Waste containing chemical substances (e.g. laboratory reagents; film developer, disinfectants that are expired or no longer needed, solvents, waste with high content of heavy metals, e.g. batteries, broken thermometers and blood pressure gauges). Pharmaceuticals that are expired or no longer needed, items contaminated by or containing pharmaceuticals, cytotoxic waste containing substances with genotoxic properties waste containing cytostatic drugs (often used in cancer therapy).Radioactive Waste containing radioactive substances (e.g. unused liquids from radiotherapy or laboratory research contaminated glassware, packages, or absorbent paper, urine and excreta from patients treated or tested with unsealed radionuclide's, sealed sources.
Generation of waste depends on numerous factors such as type of healthcare facility, specialization, proportion of reusable items employed in hospital, and proportion of patients treated on a day-care basis. Hospitals and clinics are the only one source of infectious waste generation which is heterogeneous mixtures composed of general refuse, laboratory and pharmaceutical chemicals and their containers, and pathological wastes. As a result, some infectious wastes do not separate from general waste and may pose a threat to the environment.

II. SOURCES OF BIOMEDICAL WASTE

Wherever there are people, there is medical waste. It is generated in small quantities in many locations. The WHO estimated 16 billion injections are done worldwide every year. This gives an idea of scope of generation sites. Hospitals produce waste, which is increasing over the years in its amount and type. The hospital waste, in addition to the risk for patients and personnel who handle them also poses a threat to public health and environment.

Major Sources

- Govt. hospitals/private hospitals/nursing homes/ dispensaries.
- Primary health centers.

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- Medical colleges and research centers/ paramedic services.
- Veterinary colleges and animal research centers.
- Blood banks/mortuaries/autopsy centers.
- Biotechnology institutions.
- Production units.

Minor Sources

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

III. CLASSIFICATION OF BIOMEDICAL WASTE

Approximately 75-90% of the biomedical waste is nonhazardous and as harmless as any other municipal waste .The remaining 10-25% is hazardous and can be injurious to humans or animals and deleterious to environment. Medical waste can be identified by following different categories:

Table No. 1 Classification of Biomedical Waste

Category	Components
Infectious waste	• Lab Culture • Waste from isolation wards • Tissues (swabs) • Material / equipment's of infected patients.
Pathological lab	• Excreta • Human tissues / fluids • Blood or body fluids
Sharp Waste	• Needles • Infusion sets • Scalpels • Knives Blades • Broken Glass
Pharmaceutical waste	• Expired phaurmaceuticals • Contaimineted Pharmaceuticals • Banned pharmaceuticals
Genotoxic waste	• Waste Containing Cytotoxic Drugs (Often used in cancer theraphy) • Genotoxic Chemicals
Chemical waste	• Lab reagents • Film developer • Expired disinfectant • Expired solvent
Waste with high content of heavy metals	• Waste with high content of heavy metal • Batteries • Broken thermometers • Blood pressure gauges
Pressurised Container	• Gas cylinder • Gas cartridges • Aerosol cans
Radioactive waste	• Radiotherapy / lab research liquids • Contaminated glass wares , packages , absorbent papers

IV. PROBLEMS ASSOCIATED WITH BIOMEDICAL WASTE

- Several health hazards are associated with poor management of BMW like injury from sharps to staff and waste handlers associated with the health care establishments, Hospital Acquired Infection (HAI) of patients due to

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spread of infection. Occupational risk associated with hazardous chemicals, drugs, unauthorized repackaging and sale of disposable items and unused/date expired drugs. Bacterial contamination represents the highest and most immediate health risk and water is the main carrier medium. Infection due to unsafe injection practice infects 8-16 millions with Hepatitis B, 2-45 millions with Hepatitis C, 75000 to 150000 from HIV/AIDS (WHO and Health Care Waste Management Cell, 2000). The comprehensive rule covers various aspects of dealing with waste, specifying the duty of the occupier of an institution generating BMW as to ensure safe handling, on segregation, packing, transportation and storage specifics, submission of annual report to Pollution Control Board of categories and waste generated, maintenance of records on generation, collection, reception, storage, transportation, treatment and disposal, type of waste to be incinerated and colour coding for segregation. The occupier of an institution generating BMW is required to take all steps to ensure that such waste is handled without any adverse effect on human health and the environment. The environmental considerations must form an integral part of all development efforts and be supplemented by mechanisms to see that environmental safeguards proposed are actually implemented together with systematic monitoring to assess the effectiveness of such precautions in protecting the environment.

V. TREATMENT AND DISPOSAL TECHNIQUES FOR BIOMEDICAL WASTE

The primary methods of treatment and disposal of medical waste are:

- Incineration
- Autoclaving
- Thermal inactivation
- Gas sterilization
- Microwave Irradiation

Incineration

Incineration is the controlled burning of the medical waste in a dedicated medical waste incinerator. Among industry professionals, these units are often referred to as hospital/medical/infectious waste incinerators (HMIWIs). Incineration is an old technology and was widely used in the past for all sorts of waste. Individual buildings had their own waste incinerators in many cases. Incinerators got a bad reputation because of the air pollution they created and because the bottom ash, or sinter, was hard to keep under control. Lay members of the public unfortunately still have negative associations with incinerators. Today's incineration units are typically much cleaner.

Autoclaving

Autoclaves are closed chambers that apply both heat and pressure, and sometimes steam, over a period of time to sterilize medical equipment. Autoclaves have been used for a century to sterilize medical instruments for re-use. Surgical knives and clamps, for instance, are put in autoclaves for sterilization. For medical waste that will be disposed of, autoclaves are a heat treatment are used to destroy microorganisms that may be present in medical waste before disposal in a traditional landfill.

Autoclaves are best for wastes that are unlikely to produce combustion or substantial off-gas. While incinerations can be built with pollution abatement systems, autoclaves are smaller and it is not economical to unit make a treatment system for vapors emitting from the unit. Autoclaved medical waste is usually compacted after it cools down. Compacting involves compression to reduce volume and the compaction process may include shredding before the compression. The compaction process reduces the volume of the treated waste significantly.

After treatment and compaction, the treated waste can be combined with general waste and disposed of in traditional manners. Waste that is treated using an autoclave is still recognizable after treatment, and therefore must be shredded to allow for disposal with general waste.

Thermal inactivation

Thermal inactivation involves the treatment of waste with high temperatures to eliminate infectious agents. This method is usually used for large volumes. Liquid waste is collected in vessel and heated by heat exchangers or a steam jacket surrounds the vessel. The types of pathogens in the waste determine the temperature and duration of treatment. This method requires higher temperatures and longer treatment cycles than steam treatment.

Gas sterilization

Gas sterilization by means of a bactericidal gas, frequently used for items that are heat and moisture sensitive. Ethylene oxide is the gas most often used; it is highly explosive and flammable in the presence of air, but these hazards are reduced by diluting it with carbon dioxide or fluorinated hydrocarbons. Gas sterilization is a chemical process resulting

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from reaction of chemical groups in the bacterial cell with the gas. Factors influencing gas sterilization include time of exposure, gas concentration, penetration of the gas, and temperature and humidity in the sterilizing chamber. Automatically controlled ethylene oxide sterilizers are usually heated to a temperature of 54°C (130°F). A humidity level of 35 to 70 per cent is recommended.

Microwave Irradiation

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. This heat generated from within kills all pathogens. n microwaving, microbial inactivation occurs as a result of the thermal effect of electromagnetic radiation spectrum lying between the frequencies 300 and 300,000 MHz. Microwave heating is an inter-molecular heating process.

The heating occurs inside the waste material in the presence of steam. Most microorganisms are destroyed by the action of microwaves of a frequency of about 2450 MHz and a wavelength of 12.24 cm. The microwaves rapidly heat the water contained within the waves and the infectious components are destroyed by heat conduction.

VI. DISPOSAL OF BIO MEDICAL WASTE

Medical waste and its proper disposal remain a major concern. Infectious waste that has been effectively treated is no longer biologically hazardous and may be mixed with thedisposed of as ordinary solid waste, and disposal of this waste are done in same manner.

EPA recommends:

- Contacting state and local governments to identify approved disposal options.
- Discharge of treated liquids and pathological wastes (after grinding) to the sanitary sewer system.
- Approval of the local sewer authority must be obtained.

VII. CHALLENGES OF BIOMEDICAL WASTE IN INDIA

Surveys carried out by various agencies show that health care establishments in India are not giving due attention to their waste management. The need for treating BMW was not taken up as a serious issue till the late 90's. However, the initiatives taken up led to the formulation of the 'Bio-medical Waste – Handling and Management Rules – 1998' which was amended in 2000 by the MoEF and taken forward by the Central Pollution Control Board.

After the notification of the Bio-medical Waste (Handling and Management) Rules, 1998,these establishments are gradually streamlining the process of waste segregation, collection, treatment, and disposal.

Many of the larger non hospitals management. have either installed the treatment facilities or in the process of doing so while entrepreneurs have set up centralized waste treatment facilities. Despite these rules and initiations, a lot of challenges to health care waste management practices are faced by Indian health care sector.

- Lack of Segregation Practices
- Lack of Proper Operational Strategy
- Poor Regulative Measures
- Lack of Top Management Commitment
- Lack of Adequate Facilities
- Inadequate Pressure from Societies

VIII. CONCLUSION

Health care units produce large amount of waste in the process of providing services to mankind. Many efforts have been made by environmental regulatory agencies and waste generators to better manage the waste from healthcare facilities in recent years but still these are not sufficient enough to prevent environmental hazards and associated health hazards caused by health care waste. So there is an urgent need for raising awareness and education on medical waste issues. This study has made an attempt to identify various challenges faced by Indian health care units for managing their waste properly and ensuring health and environmental safety.

Health care unit authorities should also provide health education and training of everyone involved in the management and handling of Bio-Medical Waste. Last but not the least is effective implementation of rules by surprise visits and inspection by appropriate authorities And fixing the accountability of each and every person involved in management

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of Bio-Medical Waste. If Hospital Management wants to protect our environment and health of community Hospital Management must sense us to this important issue not only in the interest of health managers but also in the interest of community.

REFERENCES

[1] Mostafa GM, Shazly MM, Sherief WI. "Development of a waste management protocol based on assessment of knowledge and practice of healthcare personnel in surgical departments." Waste Manag 2009; 29 : 430-9.
[2] Gupta S, Boojh R, Mishra A, Chandra H. "Rules and management of biomedical waste at Vivekananda Polyclinic: a case study." Waste Manag 2009; 29 : 812-9.
[3] Hossain S.M. ,Rahman N., Balakrishnan V., PuvanesuaranR.V., Sarker M.Z.I. ,Kadir M.O.A.2013 "Infectious Risk Assessment of Unsafe Handling Practices and Management of Clinical Solid Waste" Int. J. Environ. Res. Public Health 10, 556-567
[4] L.Joseph, and H Paul, Biomedical Waste Management: Study on the awareness and practice among healthcare workers in a tertiary teaching hospital, Indian Journal of Medical Microbiology, 33(1), 2015, 129-131.
[5] Anjali Acharya, VashudhaAshutoshGokhale, and Deepa Joshi, "Impact of Biomedical waste on city Environment: Case Study of Pune India," IOSR Journal of Applied Chemistry (IOSR-JAC), e-ISSN: 2278-5736, 6(6), 2014, 21-27.