Biomedical Waste Management in India-A Review

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Abstract

Biomedical waste is any kind of waste either solid or liquid containing infectious, potentially infectious materials of medical, laboratory or research origin from activities such as diagnosis, prevention & treatment of diseases. Bio-medical waste has a higher potential of infection and injury to the healthcare worker, patient and the surrounding community. It consists of human anatomical waste, animal waste, microbiology & biotechnology waste, waste sharps, discarded medicines & cytotoxic drugs, soiled waste, liquid waste, incineration ash & chemical wastes. Common generators of biomedical waste include hospitals, clinics, medical & veterinary colleges, blood banks, mortuaries, autopsy centers, biotechnology institutions, research laboratories, home health care & funeral homes. Hazardous chemicals & radioactive waste though non-infectious require proper disposal. World Health Organization states that 10% of hospital waste are infectious & 5% are non-infectious but hazardous waste. World Health Organisation has classified medical waste into 8 categories which include general, pathological, radioactive, chemical, infectious, sharps, pharmaceuticals & pressurized wastes. In India, Biomedical waste (Management & Handling) Rules 1998 along with further amendments regulate biomedical waste management. It consists of 6 schedules which includes Category of Biomedical waste, Colour coding & type of container, Label for Biomedical waste containers or bags which should be non-washable & prominently visible, Label for transport of Biomedical waste containers or bags, Standard for treatment & disposal, Schedule for waste treatment facilities like Incinerator, Autoclave, Microwave System. Operating Standards like combustion efficiency & Emission Standards are defined. The present review article focused on basic issues as definition, categories, problems relating to biomedical waste and procedure of handling and disposal method of Biomedical Waste Management.

Keywords: *Biomedical waste, Health care, Colour-coding, Segregation*

Hospital is one of the complex institutions which is frequented by people from every walk of life in the society without any distinction between age, sex, race and religion. This is over and above the normal inhabitants of hospital i.e patients and staff. All of them produce waste which is increasing in its amount and type due to advances in scientific knowledge and is creating its impact. [1]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. Biomedical waste (BMW) is any waste produced during the diagnosis, treatment, or immunization of human or animal research activities pertaining thereto or in the production or testing of biological or in health camps. It follows the cradle to grave approach which is characterization, quantification, segregation, storage, transport, and treatment of BMW. The basic principle of good BMW practice is based on the concept of 3Rs, namely, reduce, recycle, and reuse.[2]Due to the increase in the procedures that are carried out at the various health care setups, excessive amounts of waste have been generated at the centers of care. India approximately generates 2

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kg/bed/ day and this biomedical waste encompasses wastes like anatomical waste, cytotoxic wastes, sharps, which when inadequately segregated could cause different kinds of deadly infectious diseases like Human immunodeficiency virus(HIV) hepatitis C and B infections, etc, and also cause disruptions in the environment, and adverse impact on ecological balance.

Biomedical waste (BMW) is a major issue of concern in modern times.[3,4] As per WHO 15 -25% of the waste generated in the hospital is dangerous and hazardous to health as it poses a risk to health of individual .As per estimates 32% of new Hepatitis B infection, 40 % of Hepatitis C infections and 5 % of new HIV infections occur every year due to contaminated sharps and syringes.[5] Health care waste consists of solid, liquid and gaseous waste contaminated with organic and inorganic substance including pathogenic radionuclide generated from in vitro analysis of body microorganisms. Hospital waste possesses serious tissues and fluid. WHO (1999) reported that, about 85% of health hazard to the health workers, public and air hospital waste is non-hazardous, 10% infective and 5% flora on the area not infective but hazardous.[6] The Government of India (notification, 1998) specifies that Hospital Waste Management is a part of hospital hygiene and maintenance activities. This involves management of range of activities, which are mainly engineering functions, such as collection, transportation, operation or treatment of processing systems, and disposal of wastes.[7]

Classification of Bio-Medical Waste according to World Health Organization

The World Health Organization (WHO) has classified medical waste into eight categories: ´

1. General Waste
2. Pathological
3. Radioactive
4. Chemical
5. Infectious to potentially infectious waste
6. Sharps
7. Pharmaceuticals
8. Pressurized containers

Major Sources of bio-medical waste.

· Govt. hospitals/private hospitals/nursing homes/ dispensaries.

· Primary health centers.

· Medical colleges and research centers/ paramedic services.

· Veterinary colleges and animal research centers.

· laboratories and research centres

· mortuary and autopsy centres

· animal research and testing laboratories

· blood banks and collection services

· nursing homes for the elderly

· Biotechnology institutions.

· Production units.

Minor Sources of bio-medical waste.

• Physicians/ dentists' clinics

• Animal houses/slaughter houses.

• Blood donation camps.

• Vaccination centers.

• Acupuncturists/psychiatric clinics/cosmetic piercing.

• Funeral services.

• Institutions for disabled persons

Need of biomedical waste management in hospitals

The reasons due to which there is great need of management of hospitals waste such as:

1. Injuries from sharps leading to infection to all categories of hospital personnel and waste handler

2. Nosocomial infections in patients from poor infection control practices and poor waste management.

3. Risk of infection outside hospital for waste handlers and scavengers and at time general public living in the vicinity of hospitals.

4. Risk associated with hazardous chemicals, drugs to persons handling wastes at all levels.

5. Disposable being repacked and sold by unscrupulous elements without even being washed.

6. Drugs which have been disposed of, being repacked and sold off to unsuspecting buyers.

7. Risk of air, water and soil pollution directly due to waste, or due to defective incineration emissions and ash.[8]

Benefits of Biomedical Waste Management

1. Cleaner and healthier surroundings.

2. Reduction in the incidence of hospital acquired and general infections.

3. Reduction in the cost of infection control within the hospital.

4. Reduction in the possibility of disease and death due to reuse and repackaging of infectious disposables.

5. Low incidence of community and occupational health hazards.

6. Reduction in the cost of waste management and generation of revenue through appropriate treatment and disposal of waste.

7. Improved image of the healthcare establishment and increase the quality of life.

Biomedical Waste Management Process

Mismanagement of hospital waste implies a combination of improper handling of waste during generation, collection, storage, transport and treatment. Improper handling comprises several unsafe actions, such as handling without personal protective equipment (PPE), poor storage (e.g. high temperature conditions combined with prolonged storage times before treatment), manual transport for longer distances, use of uncovered containers instead of closed plastic bags, etc. Other examples include exposure times beyond acceptable limits, lack of worker and equipment decontamination procedures, etc., all of which affect hospital workers in different ways. There is a big network of Health Care Institutions in India. The hospital waste like body parts, organs, tissues, blood and body fluids along with soiled linen, cotton, bandage and plaster casts from infected and contaminated areas are very essential to be properly collected, segregated, stored, transported, treated and disposed of in safe manner to prevent nosocomial or hospital acquired infection.

Six steps of Bio medical waste Management

1. Waste collection

2. Segregation

3. Transportation and storage

4. Treatment & Disposal

5. Transport to final disposal site

6. Final disposal

Safeguarding the health care workforce against occupational health risks arising from hospital-waste management calls for effective infectious waste control measures. In addition to protecting workers health, such control measures protect public health and the environment from the hazards posed by hospital waste. Proper management ensures that infectious waste is handled in accordance with established and acceptable procedures from the time of generation through treatment of the waste and its ultimate disposal.

Salient Features of Biomedical Waste Rules 2016

1. The scope of the rules have been expanded to include various health camps such as vaccination camps, blood donation camps, and surgical camps[9]

2. Duties of the occupier of HCFs have been revised. Occupier is the person having administrative control over the HCF that is generating BMW[10]

a. Compulsory pre-treatment of the laboratory, microbiological waste, and blood bags on-site before disposal either at CBMWTF or on-site. The method of sterilization/disinfection should be in accordance with National AIDS Control Organization (NACO) or WHO

b. The use of chlorinated plastic bags, gloves, blood bags, etc. should be gradually stopped and this phasing out should be within 2 years from the date of notification of these rules

c. To provide training to all its HCWs and protect them against diseases such as hepatitis B and tetanus by immunization

d. Liquid waste to be separated at source by pretreatment before mixing with other liquid waste

e. To set up a barcode system for BMW containing that is to be sent out of the premises for treatment and disposal

f. All major accidents including accidents caused by fire hazards, blasts, during handling of BMW, and remedial action taken by the prescribed authority should be reported

g. The existing incinerator should be upgraded/ modified to achieve the new standard within 2 years from the date of this notification

h. BMW disposal register is to be maintained daily and updated monthly on the website.

3. The duties of the operator of a common biomedical waste treatment and disposal facility (CBMWTF) have been increased.[9] They should assist in training of HCW from where the waste is being collected. Furthermore, there should be barcoding and global positioning system established for handling of BMW within 1 year. Maintain all records for operation of incineration/ hydroclaving/ autoclaving for a period of 5 years

4. The segregation, packaging, transportation, and storage of BMW have been improved. Biomedical waste has been classified into four categories based on color code-type of waste and treatment options. In addition, untreated human anatomical waste, animal anatomical waste, soiled waste, and biotechnology waste should not be stored beyond a period of 48 h. In case, there is a need to store beyond 48 h, the occupier should take all appropriate measures to ensure that the waste does not adversely affect human health and the environment.[9]

5. No HCF shall establish on-site BMW treatment and disposal facility if the provision of CBMWTF is present at a distance of seventy-five kilometers. If no CBMWTF is available, the occupier shall set up requisite BMW treatment facility such as incinerator, autoclave or microwave, shredder after taking prior authorization from the prescribed authority. After confirming treatment of plastics and glassware by autoclaving or microwaving followed by mutilation/shredding, these recyclables should be given to authorized recyclers

6. Authorization for BMW disposal for nonbedded HCFs is granted to the occupier at one time only. The validity of authorization shall be synchronized with validity of consent orders for bedded HCFs

7. Standards for emission from incinerators have been modified to be more environmental friendly. These are permissible limit for SPM-50 mg/nm3 ; residence time in secondary chamber of incinerator – two seconds; standard for dioxin and furans – 0.1 ng TEQ/Nm3

8. Ministry of Environment, Forest, and Climate change will monitor the implementation of rules yearly. The responsibility of each state to check for compliance will be done by setting up district-level committee under the chairpersonship of District Collector or District Magistrate or Additional District Magistrate. In addition, every 6 months, this committee shall submit its report to the State Pollution Control Board.

Table- Colour coding of BMW

Category	Types of Waste	Colour and type of Container
Yellow	Human Anatomical waste Animal Anatomical waste Soiled waste Discarded or expired medicine Laboratory waste Chemical waste Chemical liquid waste	Yellow colour non chlorinated plastic bags having thickness equal to more than 50microns or containers.
Red	Contaminated waste (Recyclable)	Red colour non chlorinated plastic bags having thickness equal to more than 50microns or containers.
White	Waste sharps including metals	White colour translucent, puncture proof, leak proof, temper proof containers.
Blue	Glassware Metallic body implants	Cardboard boxes with blue coloured marking or blue coloured puncture proof, temper proof containers.

Suggestions

The following solutions to remove obstacles to make progress in hospital waste management are recommended:

1. Calculate and monitor economical benefits from waste minimization in hospital.

2. More accurate monitoring and controlling of hospital waste separation process by the ministry of health and medical education and environmental protection agency.

3. Materials management in a way that the 3 primary criteria of using less, reusing and recycling to be considered.

4. Review reasonably related laws to facilitate the process of reducing the danger of hospital waste and removing their problems.

5. Review the laws in the process of the hospital waste separation at source and related definitions to prevent from confusion of officials responsible for hospital waste separation.

6. Participation of private sector's specialists in the process of hospital waste management.

7. Domestic and foreign investment to import modern technology in the country by public and private sector.

8. Meetings with managers and officials for a closer relationship and familiarity with available scientific and practical solutions.

9. Helping of the University to improve the implementation of the plans and suggests new scientific recommendations.

10. Advertising extensively by the public media for more awareness of the public.

11. Using new technology capable of reducing waste in different parts of the hospital, especially areas with potential of production of hazardous wastes.

Conclusion

Training programs need to focus on empowering the healthcare professionals on biomedical waste

management with broad scope and practical knowledge in all aspects. Training the staff with checklists and regular inspections can bring about accountability in the staff. Improper Biomedical waste management leads to environmental pollution, multiplication of vectors like insects, rodents & worms leading to transmission of diseases like typhoid, cholera, plague, hepatitis & AIDS. Recycling of disposable syringes, needles, intravenous sets, and glass bottles without proper sterilization leads to hepatitis, tetanus, HIV & viral diseases. Benefits of biomedical waste management include healthy surroundings, reduction in hospital acquired infections & cost of infection control, reduction in reuse of infectious disposables & prevention of occupational health hazards. Awareness about hazards of biomedical waste & its proper disposal is required for a safe & healthy future. All health care professionals regardless of their designation, experience and qualification , designation must be included in these interventions, so that it can avoid cross infections among the professionals and patients in the health care sector.

Conflict of Interest- Nil

Ethical Clearance- Nil

Acknowledgment- Nil

Source of Funding - Nil

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