

Management of Biomedical Waste: A Review

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ABSTRACT

Lots of the problem can be fenced if the Biomedical waste management is properly executed. The activities that are usually performed as part of health care waste management involve segregation, storage, collection, transportation and disposal of biomedical waste. It includes organizational, planning, administrative, financial, engineering aspects, legal, and human resource development and their management involves interdisciplinary relationships. Management of biomedical waste requires commitment at all the levels from healthcare providers. A system that is managed by irresponsible and untrained staff, the risks and the importance of their “contribution” is dreaded. Awareness regarding rules of disposal of biomedical waste needs to be taught even among qualified medical personnel, including hospital administrators, private and governmental institutes, hospitals and colleges. Knowledge regarding the significance of biomedical waste, its relationship with the ecosystem, the environmental toxins used in health care industry and the impact of callousness on public health, remain very minimal. For better result we need to increase the level of training and education regarding biomedical waste and environment-friendly health care with optimum priority, under rules and legislation.

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INTRODUCTION

Biomedical waste is “Any solid and/or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human beings or animals”. Common producers of biomedical waste contain hospitals, nursing homes, clinics, laboratories, offices of physicians, dental, and veterinarians, house health care, and funeral homes. It must be properly managed to avoid the harm for the general public, specifically healthcare and sanitation workers who are continuously uncovered to biomedical waste as an occupational hazard.¹ So that very little infection transmission from medical waste has been studied. American Dental Association and Centre for Disease Control notified that medical waste disposal must be carried out in harmony with guidelines. Appropriate handling, treatment and disposal of wastes are essential elements of health care management programme. Correct method helps protect health care personnel, patients and the local society.²

CLASSIFICATION OF BIOMEDICAL WASTE

Non-hazardous waste: The wastes generated by health care centres are basically non-hazardous wastes which comprise about 85% .it constitutes food remnants, paper cartons, packaging material, fruit peels, wash water etc.

Hazardous waste

A) Potentially contagious waste, over the years different times for infectious waste continuously used in the scientific literature, guideline manuals and standards. These include infective medical waste, hazardous, red bag and contaminated, regulated and non-regulated medical waste. All these terms signify basically the same type of waste; although the terms used in regulations are usually depended more precisely. It adds up to 10% of the total waste which includes:

- 1) Dressings and swabs infected with blood, pus and body fluids.
- 2) Laboratory waste including laboratory culture stocks of infectious agents
 - 3) Potentially infected material: Excised tumours and organs, placenta.
 - 4) Potentially infected animals used in diagnostic and research studies.
 - 5) Sharps, which include needle, syringes, blades etc.
- 6) Blood and blood products.

B) Potentially toxic waste

- 1) Radioactive waste: It includes waste contaminated with radionuclide; it may wastes generated from *in vitro* analysis of body fluids and tissue.
- 2) Chemical waste: It includes disinfectants, X-ray processing solutions, monomers and associated reagents, base metal debris (dental amalgam in extracted teeth).
- 3) Pharmaceutical waste: It includes anaesthetics, sedatives, antibiotics, analgesics etc.²

B.M.W has been brought in India, with the notification of the B.M.W (Management and Handling) Rules, 1998. The law makes it obligatory for the health care improvement to segregate, sanitize and dispose their waste in an ecological manner.²

CATEGORIES OF BIOMEDICAL WASTE

Various categories of Bio-Medical wastes has been enlisted in **TABLE NO .1³**

Category	Waste Content	Components	Method of treatment and disposal
No. 1	Human Anatomical Waste	Human tissues, organs, body parts	Incineration /deep burial
No. 2	Animal Waste	All types of Animal tissues, organs, body parts carcasses, bleeding parts etc generated by different health sectors	Incineration /deep burial
No. 3	Microbiology & Biotechnology Waste	Wastes from laboratory cultures, stocks or specimens of micro- organisms used in research	Local autoclaving/ micro waving/incineration
No. 4	Waste sharps	Needles, syringes, scalpels, blades, glass etc	Disinfections chemical treatment
No. 5	Discarded Medicines and Cytotoxic drugs	Out-dated, contaminated and discarded medicines	Incineration/Destruction and disposal of drugs in landfills
No. 6	Solid Waste	Blood contaminated cotton, dressings, soiled plaster casts, lines etc	Incineration , autoclaving/ micro waving
No. 7	Solid Waste	tubing's, catheters, intravenous sets etc	Disinfections chemical treatment
No. 8	Liquid Waste	Waste generated from laboratory and washing, cleaning, house-keeping and disinfecting activities	Disinfections by chemical treatment and discharge into drains
No. 9	Incineration Ash	Ash from incineration of any bio-medical waste	Disposal in municipal landfill
No. 10	Chemical Waste	Chemicals used in production of biological	Chemical treatment and discharges into drains

STEPS FOR EFFECTIVE B.M.W MANAGEMENT

Waste Survey:

It is an important component of the waste management method. A survey helps in assessment of both the type and amount of waste generated.^{1,4-8,10}

Waste survey is valuable in the aspect of:

- make a distinction of types of waste.
- enumerate the waste generated.
- conclude the points of generation & type of waste generated at each point.

- Determine the altitude of generation & disinfection within the hospital.
- To trace out the type of disposal carried out.

Segregation:

- Segregation refers to the primary division of different categories of waste generated at basis and thereby dipping the risks as well as cost of handling and disposal.
- Segregation is the most essential step in bio-medical waste management. Effective segregation only can ensure useful bio-medical waste management.

- The BMWs have to be segregated in harmony to guidelines laid down under schedule 1 of BMW Rules, 1998.

This consists of placing different kinds of wastes in different containers or coded bags at the point of generation. It helps to decrease the

bulk of infectious waste and treatment costs. Segregation also helps to hold the spread infection and reduces the probability of infecting other health care personnel. **Table .2** describes the various colour coding.

TABLE NO.2: Color coded containers for waste³

Colour coding	Type of container	Waste category
Yellow	Plastic bag	Cat 1 , 2 ,3 , 6 (human anatomical waste, animal waste, microbiology & biotechnology waste , solid waste)
Red	Disinfected container / Plastic bag	Cat 3,6,7 (microbiology & biotechnology waste ,solid waste)
Blue/white tranlucent	Plasic bag/puncture proof container	Cat 4,7 (waste sharps ,solid waste)
Black	Plastic bag	Cat 5,9,10 (discarded medicine and cytotoxic drugs, incineration ash,chemicals)

Storage & Accumulation of Biomedical Waste:

Waste accumulation and storage is basically done in the areas and steps between the point of waste generation and location of waste treatment and disposal. Though accumulation refers to the temporary holding of small quantities of waste near the point of generation, storage of waste is categorized by longer holding periods and large waste volume. Storage areas are generally located near where the waste is treated. Any offsite holding of waste is also considered storage.

- Different types of containers are used for collection of waste.
- The containers or bins should be positioned in such a way that 100 % gathering is achieved.
- Sharps must be kept in puncture-proof containers to keep away injuries and

infection to the employees handling them.

- Once collection has done, then biomedical waste is stored in a appropriate place.
- Segregated wastes of dissimilar categories need to be collected in individual containers or bins.
- The period of storage should not more than 8-10 hrs in big hospital and 24 hrs in nursing homes.
- Each container or bin should be clearly labelled to show the ward or room where it is kept. The reason for this labelling is that it may be required to trace the waste back to its source.
- Besides this, storage site should be noticeable with a caution sign.

Transportation of waste:

Transportation of Bio-Medical wastes can be done by Carts and containers that are not used for any other function. The trolleys have to be cleaned each day. Offsite carrying vehicle should be marked with the name and address of transporter. Biohazard sign should be dyed. Appropriate system for securing the weight during transport should be ensured. Such a means of transport should be easily cleanable with rounded corners. All disposable plastic should be subjected to shredding before disposing off to vendor. No unprocessed bio-medical waste store more than 48 hours.^{9,10}

Treatment of waste:

Treatment refers to the method that modifies the waste in some way before it is get to its ultimate resting place. It is mainly necessary to disinfect or decontaminate the waste, right at source so that it is no longer the source of pathogenic organisms. After such treatment, the remains can be handled safely, transported and store up.

- Syringe nozzle and needles should be shredded in syringe cutters and needle destroyers.
- Broken glass /Scalpel blades/ Lancet/ should be keep in separate containers with bleach, transferred to plastic/ cardboard boxes; sealed to prevent spillage and transported to incubators.
- Glassware must be disinfected, sterilized and cleaned.
- Culture plates with possible culture must be autoclaved; media are placed in suitable bags and disposed off. The plates can be reused after sterilization.
- Gloves should be cut / shredded / mutilated before disposal.
- Swabs should be chemically sterilized followed by incineration. If they have only a small quantity of blood that does not drip, they could be placed in the garbage.

- Disposable objects should be dipped in freshly prepared 1% sodium hypochlorite for 30mis to 1 hour, after that mutilation is required before disposal should be the policy adopted for such items.
- Heat should be used for disposal of amalgam, under no circumstances. It will cause mercury to volatize and be discharged to the environment. So, teeth filled with amalgam should be treated by immersion in high-level disinfectants (e.g. Glutraldehyde) for 30 min.
- Liquid waste produced by the laboratory is either pathological or chemical. Non-infectious waste should be defused with reagents.
- Liquid contaminated waste should be treated with a chemical decontaminator and then defused.

Minimization of waste:

Whereas regular solid and liquid waste requires no treatment before disposal, virtually all contagious waste should first be treated. The cost for disposal of infectious waste may be ten times more than cost for disposal of ordinary waste. Any methods that reduce the quantity of infectious waste produced will at the same time decrease the cost of infectious waste disposal.¹¹

MANAGEMENT OF PLASTIC IN HEALTHCARE

Disposable syringes, blood, bottles and urine bags, surgical gloves, catheters, etc. are some of the examples of plastic practise in health care. Plastic has been related with deduction in sperm count, genital abnormalities and a rise in the occurrence of breast cancer. Burning of plastics discharge carcinogens like dioxin and furan.

Plastic is now a severe environmental and health concern, basically because of its non Bio degradable nature .The nature of plastic waste disposal is environmentally friendly, Long-term, land filling or recycling. All disposable plastic should be subjected to shredding before disposing off to vendor. Designing eco-friendly, biodegradable plastics are the need of the hour. Minimizing the production of plastic waste is also very essential.²

LEGISLATION IN RELATION TO BIOMEDICAL WASTE

Various governmental legislation related to BMW in India are following:

- The water Act, 1974 (prevention and control of pollution).
- The Air Act, 1981 (prevention and control of pollution).
- The Environment Act, 1986 (Protection).
- The hazardous waste rules, 1998 (management and handling).
- The Biomedical waste rules, 1998 (management and handling).
- Municipal Solid waste rules, 2000 (management and handling)
- The Biomedical waste rules Amendment, 2000 and 2003 (management and handling).
- The Biomedical Waste Rules, 2011(Management and Handling) [Draft].

It might be kept in mind that any individual can complain any suspected negligence in Management and Handling of BMW to the responsible authority.¹²

CONCLUSION

Biomedical waste management is as important as treatment plan for medical professionals. Awareness programmes should be conducted for all health care personnel and auxiliary personnel of various health care institutes to keep side by side with the current knowledge of scientific biomedical waste management system and its importance and benefits to the patients, staff and the community as an entire. On-going education and training, continuing medical education and update should be held at regular intervals. For the successful initiatives in health care waste management a sound legal/ regulatory framework has to be used in conjunction with scientific judgment. Periodic monitoring of the safe management of health care waste systems is recommended. Occupational health and safety of the health care personnel should assume importance since it is the health care personnel who are at immediate risk if waste were mismanaged. For strict and transparent enforcement of the notification of biomedical waste (handling and management) rules, 1998, individual health care centres/ units should evolve and adopt a system that suits them best. Every member of the community has the right to be informed about harmful effects of health care waste. Hence the public has to be educated in a comprehensive manner using mass media. To achieve quality in disposal of health care waste of the health care centres/units should have a transparent holistic approach in medical services. This should include management of their waste in an environmentally friendly manner.

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