

BIO MEDICAL WASTE DISPOSAL

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Abstract- Our country has seen exponential growth in the field of healthcare in the past two decades. However, the waste generated from medical activities pose a grave problem of our environment. Therefore, proper treatment of such waste is of paramount importance for reaping full benefits of development of infrastructure in the healthcare sector. The Government of India has issued guidelines for biomedical waste Management Handling, for all persons or institutions that generate, collect, receive, store, transport, treat, dispose or handle biomedical waste in any form so that any adverse effect to human health and the environment can be minimized. This includes the various spheres beginning with suggestion measures for waste minimization, segregation and collection of bio-medical waste, transportation and treatment of such waste, training of associated personnel right up to management and administration of the sources of such waste generation. The actual status regarding compliance of these guidelines at the field level is a matter of further investigation.

KEYWORDS: Bio-medical Waste, Medical waste, Hospital waste

INTRODUCTION-

India has a glorious history in the field of medical sciences. *Dhanwantari* and *Sushrut* were well known practitioners who have become immortals on account of their contribution in their respective fields. Even today Indian doctors are reputed as among the bests in the world. Today, India boasts of an enviable infrastructure in the field of medical sciences, which, together with presence of competent doctors and relatively cheaper cost of treatment, are attracting large number of patients from foreign lands for treatment. The phenomenon has been fancifully termed “medical tourism” as it is increasingly becoming an important foreign exchange earner. Today even the average domestic patients have access to quality medical facilities within his reach due to availability of specialty hospitals together with various health insurance plans offered by insurance companies. However, in the flip side, the waste

generated from medical activities pose a grave problem for the living world in general and the human beings in particular. Every day, large quantity of potentially infectious and hazardous waste is generated in the health care hospitals and facilities. Indiscriminate disposal of these hospital waste and exposure to such waste poses serious threat to environment and to human health. Therefore, such hospital waste requires specific treatment and management prior to its final disposal.

Hypothesis

Although progress in medical sciences is supposed to bring well being in the society, it can become counterproductive unless adequate safety measures are adopted by the concerned organizations and related persons.

Objective of the Study

To identify the problem areas such as type of hazardous materials generated in the process of healthcare, quantum of such materials generated their possible adverse effects as also desirable methods of treatment of such materials for mitigation of their adverse effects and Government guidelines on such matters. The paper is expected to alert the public in general and hospitals administrators in particular about the problems and the precautions to be adopted for reaping the full benefits of the healthcare sector.

Methodology

Analysis of information and data from various secondary sources.

Bio-Medical Waste

Biomedical waste (BMW), a part of which is contributed by hospital waste, is defined as waste that is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological products for humans & animals and the animal waste from slaughter houses or any other similar establishment. In hospitals it generally comprises of around 15% of total hospital waste. According to World Health Organization (WHO) estimates, 85% of hospital waste is actually non-hazardous and around 10% is infectious while the remaining 5% is non-infectious but consists of hazardous chemicals. From the

treatment point of view, waste can be broadly classified into two categories - biodegradable and non biodegradable waste. Biodegradable waste means any waste that is capable of undergoing anaerobic or aerobic decomposition by micro organisms, such as organic material, food, paper and paperboard etc. On the other hand non biodegradable waste is the waste that cannot be decomposed by bacteria within a short period e.g. plastics, bottles and tins.

Classification of Bio-medical Waste General Waste:

Largely composed of domestic or house hold type waste e.g. kitchen waste, packaging material, paper, wrappers, plastics.

Pathological Waste:

Consists of tissue, organ, body part, human foetuses, blood and body fluid. It is hazardous waste.

Infectious Waste:

The waste which contain pathogens in sufficient concentration or quantity that could cause diseases. It is hazardous e.g. culture and stocks of infectious agents from laboratories, waste from surgery, waste originating from infectious patients.

Sharps:

Waste materials which could cause the person handling it, a cut or puncture of skin such as needles, broken glass, saws, nail, blades, scalpels etc.

Pharmaceutical Waste:

This includes pharmaceutical products, drugs, and chemicals that have been returned from wards, have been spilled, or that are outdated or contaminated.

Chemical Waste:

This comprises discarded solid, liquid and gaseous chemicals e.g. cleaning, housekeeping and disinfecting product. **Radioactive Waste:**

It includes solid, liquid, and gaseous waste that is contaminated with radio-active materials generated from in-vitro analysis of body tissues and fluid, in-vivo body organ imaging and tumour localization and therapeutic procedures. An estimate pegs the quantum of waste that is generated in India to the order of 1-2 kg per bed per day in a hospital and 600 gm per day per bed in a general doctor's clinic which means that a 100 bedded hospital will generate 100 – 200 kg of hospital waste/day. It is estimated that about 15% of this comprises of hazardous/infectious waste (15 – 30 kgs/day).

In the total amount of municipal waste a city generates, only 1 to 1.5% is hospital waste, of which only 10-15% is considered infectious. However, in absolute terms the quantum is large enough to attract attention. It is estimated that a city like New Delhi

with about 40,000 beds generates about 60 metric tons of hospital waste per day. But whatever the quantity of hospital waste there be, it proves to be harmful to the community. The disposal of hospital waste becomes very hazardous particularly when hazardous waste is not segregated at the source of generation itself and gets mixed with municipal solid waste which is dumped in uncontrolled or illegal landfills such as vacant plots in neighboring residential areas and slums. In this process 100% of the waste becomes hazardous which can lead to a higher degree of environmental pollution, apart from posing serious public health risks such as AIDS, Hepatitis, plague, cholera, etc.

The number of health care centers in the country are ever increasing. In a mid-sized city like Kanpur alone, the total number of private hospitals as on 01.06.2014, found in an internet search, was 88 apart from various Government hospitals. Even smaller towns in the country have large number of health care units. Therefore, the total quantum of such harmful wastes generated and the magnanimity of the problem of their safe disposal can be imagined.

Quantity and Composition of Hospital Waste Generated:

Table. No. 1- Comparison of Quantity of Hospital Waste in Some Selected Countries

Country	Quantity (kg/bed/day)
U. K.	2.5
U.S.A.	4.5
France	2.5
Spain	3.0
India	1.5

Table No. 2- Hazardous/non-hazardous hospital wastes

Hazardous	15%
a) Hazardous but non-infective	5%
b) Hazardous and infective	10%
Non-hazardous	85%

Hospital waste management is a part of hospital hygiene and maintenance activities. Proper disposal of biomedical waste is of paramount importance because of its infectious and hazardous

characteristics. Improper disposal can result in the following:

- Organic portion ferments and promotes breeding of harmful organisms such as fly.
- Injuries from sharp objects to all categories of health care personnel and waste handlers. One of the main concerns in this area is the transmission of HIV and Hepatitis B or C viruses. In this context, syringes and needles have the highest disease transmission potential.
- Increased risk of infections to medical, nursing and other hospital staff.
- Poor infection control can lead to infections in patients particularly HIV, Hepatitis B & C
- Increase in risk associated with hazardous chemicals and drugs being handled by persons handling wastes including those outside hospitals such as waste handlers and scavengers and at times, general public living in the vicinity of hospitals.
- Poor waste management encourages unscrupulous persons to recycle disposables and disposed drugs for repacking and reselling.
- Development of resistant strains of microorganisms.
- Risk of air, water and soil pollution directly due to waste, or due to defective incineration emissions and ash.

Depending upon the activity, the persons at risk and mode of transmission in some common medical procedures are Table no. 3

Legislative Provisions

The Government of India has published a Gazette notification on 20 Jul 1998 - Biomedical Waste (Management and Handling) Rules 1998, making responsible all such persons who generate, collect, receive, store, transport, treat, dispose or handle biomedical waste in any form, for handling the medical waste without any adverse effect to human health and the environment. This includes hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories and blood banks. The rules came into effect in the beginning of Dec 1999, and all hospitals were to implement these rules not later than December 2002 depending upon the bed strength of the hospital. However even at the end of the mandated period proper healthcare waste management at the hospitals

and other healthcare facilities is yet to be established to the complete satisfaction of the formulated rules.

It is made mandatory for such institutions to:

- Set up biomedical waste treatment facilities like incinerators, autoclave and microwave systems for treatment of the wastes.
- Make an application to the concerned authorities for grant of authorization.
- Submit a report regarding information about the categories and quantities of biomedical wastes handled during the preceding year by 31 Jan every year.
- Maintain records about the generation, collection, reception, storage, transportation, treatment, disposal and/or any form of handling bio medical waste.
- Report immediately any accident to the prescribed authority.

Since Hospital Waste Management will be a perpetual problem in future, it was felt that there should be an all India Organization/Society comprising of experts/specialists from various disciplines involved in Hospital Waste Management. This Society will provide conceptual guidance and oversee scientific research for further development. With this in mind, Indian Society of Hospital Waste Management (ISHWM) was formed on the 10 Apr 2000, and registered under Societies Registration Act XXI of 1860.(Table No. 4)

Bio-medical Waste (Management and Handling) Rules 1998, notified under the Environment Protection Act by the Ministry of Environment and Forest (Government of India) has spelled out the Table No. 5.

Segregation of Waste:

Segregation is the essence of waste management and should be done at the source of generation of Bio-medical waste e.g. all patient care activity areas, diagnostic services areas, operation theatres, labour rooms, treatment rooms etc. The responsibility of segregation should be with the generator of biomedical waste i.e. doctors, nurses, technicians etc. (medical and paramedical personnel). The biomedical waste should be segregated as per categories mentioned in the rules.

Collection of Bio-Medical Waste :

Collection of bio-medical waste should be done as per Bio-medical waste (Management and Handling) Rules. At ordinary room temperature the collected waste should not be stored for more than 24 hours.

Transportation

With in hospital, waste routes must be designated to avoid the passage of waste through patient care areas. Separate time should be earmarked for transportation of bio-medical waste to reduce chances of it's mixing with general waste. Desiccated wheeled containers, trolleys or carts should be used to transport the waste/plastic bags to the site of storage/ treatment. Trolleys or carts should be thoroughly cleaned and disinfected in the event of any spillage. The wheeled containers should be so designed that the waste can be easily loaded, remains secured during transportation, does not have any sharp edges and is easy to clean and disinfect. Hazardous biomedical waste needing transport to a long distance should be kept in containers and should have proper labels. The transport is done through desiccated vehicles specially constructed for the purpose having fully enclosed body, lined internally with stainless steel or aluminium to provide smooth and impervious surface which can be cleaned. The drivers compartment should be separated from the load compartment with a bulkhead. The load compartment should be provided with roof vents for ventilation.

Treatment of Hospital Waste

Treatment of waste is required -

1. to disinfect the waste so that it is no longer the source of infection.
2. to reduce the volume of the waste.
3. make waste unrecognizable for aesthetic reasons.
4. make recycled items unusable.

General Waste

The 85% of the waste generated in the hospital belongs to this category. The, safe disposal of this waste is the responsibility of the local authority.

Bio-medical waste: (Constituting 15% of Hospital Waste) Deep burial:

The waste under category 1 and 2 only can be accorded deep burial and only in cities having less than 5 lakh population.

Autoclave and Microwave Treatment

Standards for the autoclaving and microwaving are also mentioned in the Biomedical waste

(Management and Handling) Rules 1998. All equipment installed/shared should meet these specifications. The waste under category 3,4,6,7 can be treated by these techniques. Standards for the autoclaving are also laid down.

Shredding: The plastic (IV bottles, IV sets, syringes, catheters etc.), sharps (needles, blades, glass etc) should be shredded but only after chemical treatment/microwaving/autoclaving. Needle destroyers can be used for disposal of needles directly without chemical treatment.

Secured landfill:

The incinerator ash, discarded medicines, cytotoxic substances and solid chemical waste should be treated by this option.

Incineration:

The incinerator should be installed and made operational as per specification under the BMW rules 1998 and a certificate may be taken from CPCB/State Pollution Control Board and emission levels etc should be defined. In case of small hospitals, facilities can be shared. The waste under category 1,2,3,5,6 can be incinerated depending upon the local policies of the hospital and feasibility. The polythene bags made of chlorinated plastics should not be incinerated. It may be noted that there are various options available for disposal of certain category of waste. The individual hospital can choose the best option depending upon the facilities available and its financial resources. However, it may be noted that depending upon the option chosen, correct colour of the bag needs to be used.

Safety Measures

All the generators of bio--medical waste should adopt universal precautions and appropriate safety measures while doing therapeutic and diagnostic activities and also while handling the bio-medical waste. It should be ensured that:

1. drivers, collectors and other handlers are aware of the nature and risk of the waste.
2. written instructions, provided regarding the procedures to be adopted in the event of spillage/ accidents.
3. protective gears provided and instructions regarding their use are given.
4. workers are protected by vaccination against tetanus and hepatitis B.

Training

- Each and every hospital must have well planned awareness and training programme for all category of personnel including administrators (medical, paramedical and administrative).
- All the medical professionals must be made aware of Bio-medical Waste (Management and Handling) Rules 1998.
- To institute awards for safe hospital waste management and universal precaution practices.
- Training should be conducted to all categories of staff in appropriate language/medium and in an acceptable manner.

Management and administration

Heads of each hospital will have to take authorization for generation of waste from appropriate authorities as notified by the concerned State/U.T. Government, well in time and to get it renewed as per time schedule laid down in the rules. Each hospital should constitute a hospital waste management committee, chaired by the head of the Institute and having wide representation from all major departments. This committee should be responsible for making Hospital specific action plan for hospital waste management and its supervision, monitoring and implementation. The annual reports, accident reports, as required under BMW rules should be submitted to the concerned authorities as per BMW rules format.

Measures for Waste Minimization

As far as possible, purchase of reusable items made of glass and metal should be encouraged. Select non PVC plastic items. Adopt procedures and policies for proper management of waste generated, the mainstay

of which is segregation to reduce the quantity of waste to be treated. Establish effective and sound recycling policy for plastic recycling and get in touch with authorized manufactures.

Coordination between Hospitals and Outside Agencies

Municipal authority : As quite a large percentage of waste (in India up to 85%), generated in Indian hospitals, belong to general category (non-toxic and non-hazardous), hospital should have constant interaction with municipal authorities so that this category of waste is regularly taken out of the hospital premises for land fill or other treatment. **Pollution Control Boards:** Search for better methods technology, provision of facilities for testing, approval of certain models for hospital use in conformity with standards laid down. **Industries involved with bio-medical technology:** To search for cost effective and environmental friendly technology for treatment of bio-medical and hazardous waste. Also, to search for suitable materials to be used as containers for bio-medical waste requiring incineration/autoclaving/ microwaving. Development of non-PVC plastics as a substitute for plastic which is currently used in the manufacture of disposable items.

Suggested Studies

The actual compliance level of these standards at different hospitals and institutions and their comparison for field level improvement is a matter of further level study.

Table NO. 3. The activity, the persons at risk and mode of transmission in some common medical procedures

Activity	Person at risk	Mode of Transmission
Collection of blood samples	Patient Health worker	Contaminated needle, gloves, Skin puncture by needle or container, contamination of hands by blood
Transfer of specimens (within laboratory)	Laboratory personnel	Contamination of exterior of specimen container, broken container, plash of specimen
HIV serology and virology	Laboratory personnel	Skin puncture, splash of specimen, Broken specimen container, Perforated gloves
Cleaning and Maintenance	Laboratory Personnel Supporting staff	Skin puncture or contamination, Splashes, Contaminated work surface

Waste Disposal	Laboratory Personnel Support Staff Transport worker	Contact with contaminated waste Puncture wounds and cuts
Shipment of specimens	Transport worker Postal worker	Broker or leaking specimen, containers and packages

Table No. 4- Different BMW Categories and their Treatment/ Disposal Options

Category	Type of Waste	Treatment and Disposal Options
Category 1	Human Anatomical Waste (Human tissues, organs, body parts)	Incineration/Deep Burial
Category 2	Animal waste (Animal tissues, organs, body parts, carcasses, bleeding parts, blood and experimental animals used in research)	Incineration/Deep Burial
Category 3	Microbiology and biotechnology waste(waste from lab culture, specimens from microorganisms, vaccines, cell cultures, toxins, dishes, devices used to transfer cultures)	Local Autoclaving/ Microwaving/ Incineration
Category 4	Waste Sharps (Needles, Syringes, scalpels, blades, glass)	Chemical Disinfection Autoclaving/ Microwaving, Mutilation and Shredding
Category 5	Discarded medicines and cytotoxic drugs (outdated, contaminated, discarded drugs)	Incineration/Destruction and disposal in land fills
Category 6	Soiled waste (contaminated with blood and body fluids including cotton, dressings, soiled plasters, linen)	Autoclaving/ Microwaving/ Incineration
Category 7	Solid waste (tubes, catheters, IV sets)	Chemical Disinfection/Autoclaving/ Microwaving, Mutilation and Shredding
Category 8	Liquid waste (Waste generated from laboratory and washing, cleaning, disinfection)	Disinfection by chemical treatment and discharge into the drains
Category 9	Incineration ash	Land fills
Category 10	Chemical waste	Chemical disinfection and discharge into the drains

Table No. 5 - Type of container and Colour Code for Collection of Bio-Medical Waste.

Category	Waste class	Type of container	Colour
1.	Human anatomical waste	Plastic	Yellow
2.	Animal waste	-do-	-do-
3.	Microbiology and Biotechnology waste	-do-	Yellow/Red
4.	Waste sharp	Plastic bag puncture proof containers	Blue/White Translucent
5.	Discarded medicines and Cytotoxic waste	Plastic bags	Black
6.	Solid (biomedical waste)	-do-	Yellow
7.	Solid (plastic)	Plastic bag puncture proof containers	Blue/ White Translucent
8.	Incineration waste	Plastic bag	Black
9.	Chemical waste (solid)	-do-	-do-

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