

Original Research paper

Bacteriological Profile of Biomedical Waste: Management Guidelines

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Abstract

Biomedical waste (BMW) is generated in hospitals, research institutions, health care teaching institutes, clinics, laboratories, blood banks, animal houses and veterinary institutes. Hospital waste management has been brought into focus in India recently, particularly with the notification of the BMW (Management and Handling) Rules, 1998. This study was conducted in Sharda hospital, Greater Noida with the aim to find out bacteriological profile of BMW with study of practices being followed in management and disposal of this waste with standard procedure. Total 500 cases of biomedical waste samples were taken in the study for bacterial culture, 136 samples of biomedical waste showed growth of bacterias. Pseudomonas species was the predominant bacteria isolated from these cultures. This study also suggests about the optimum practice which is to be followed in management of biomedical waste.

Key Words: Biomedical Waste, Bacteriological Profile, Management

Introduction:

Biomedical waste is represented by solids, liquids, sharps and laboratory waste, which is generated as the result of healthcare activities for both human beings and animals.

It is dangerous due to its high harmful potential, not only for people, but also for the environment, if it is not properly managed. For this reason, medical waste sterilization is an important process to eliminate risks associated with handling and transport. This important advancement moreover provides a guarantee to hospital administrations that are responsible for such waste for as long as it presents a danger. Biomedical waste can be classified into four big categories: clinical waste, laboratory waste, non-clinical waste and kitchen waste.

Infectious or hazardous hospital waste represents only a small part of the total medical waste; yet, because of ethical questions and potential health risks, it is a focal point of public interest. Most hazardous and toxic waste is coming from clinical and hospital. Only a small amount is from domestic or industrial sources.

Among all these types, the first two categories at least should represent a serious concern for everyone who is implicated in healthcare activities. For this reason, all medical units should have proper medical waste treatment equipment. If not, all kind of accidents can happen and healthy people can become ill, just because they were not careful enough and they mishandled medical wastes. In this way, infections and pollutants can spread easily and affect a large number of people.

In the 1980s and 1990s, concerns about exposure to HIV and Hepatitis B Virus (HBV) led to questions about potential risks inherent in medical waste. Thus hospital waste generation has become a prime concern due to its multidimensional ramifications as a risk factor to the health of patients, hospital staff and extending beyond the boundaries of the medical establishment to the general population. [1, 2]

Hospital waste refers to all waste, biologic or non biologic that is discarded and not intended for further use. Medical waste is a subset of hospital waste; it refers to the material generated as a result of diagnosis, treatment or immunization of patients and associated biomedical research. [3] BMW is generated in hospitals, research institutions, health care teaching institutes, clinics, laboratories, blood banks, animal houses and veterinary institutes. Hospital waste management has been brought into focus in India recently, particularly with the notification of the BMW Rules, 1998, makes it mandatory for the health care establishments to segregate, disinfect and dispose their waste in

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an eco-friendly manner. [4] The issue of indiscriminate BMW management in India has attracted the attention of the highest judicial body at the level of Hon'ble Supreme Court of India, from time to time issued instructions regarding management of Bio-Medical Waste.[5] In persuasion to the directive of the Court, the Ministry of Environment and Forests, Government of India notified the Bio-Medical Waste (Management and Handling) Rules on 27th July 1998; Accordingly all the hospitals in the public and private sector are now bound to follow these rules to evade legal actions. [6]

Material and Methods:

In the present study bacteriological profile of the samples like pus from used dressing material, IVline, catheters, urine are some of the biomedical waste material from patients admitted in the different wards in Sharda Hospital; Greater Noida from Jan-2010 till Dec-2010 was studied retrospectively. The 500 bacterial isolates from patients admitted in ICU, Gynecology & Obstetric, Surgery, Orthopaedics, were taken in account. The samples taken for study were transported immediately to the Microbiology Laboratory for culture of the sample on routine culture media and incubation at 37°C for overnight [7]. Any micro organism grown on culture was also taken in account of bacteriological profile of biomedical waste.

Results and Discussion:

Total 136 cases shows isolates of bacterias from biomedical waste culture, out of these 40(29.4 %) isolates were of Pseudomonas sp., 31(22.79 %) cases of Escherichia coli, 25(18.38 %)cases of Staphylococcus aureus, 12(08.82 %) cases of coagulase negative Staphylococcus, 12(08.82%)cases of Klebsiella sp., 08 (5.88 %)cases of Proteus vulgaris, 05(3.67%) cases of Enterococci, 03(2.20%) cases of Citrobacter species(**Table:-1**).

Bacteria isolated from biomedical waste also included resistant strains of variety of bacterias. It is required that bacterias isolated should be disposed of properly to prevent spread of infection in other patients and community.

Potential Implication of Biomedical Waste:

Biomedical waste causes risk to healthcare workers, waste handlers and Public. Improperly contained contaminated sharps pose greatest infectious risk associated with hospital waste. There is also theoretical health risk to medical waste handlers from pathogens that may be aerosolized during the compacting,

grinding or shredding process that is associated with certain medical waste management or treatment practices. Physical (injury) and health hazards are also associated with the high operating temperatures of incinerators and steam sterilizers and with toxic gases vented into the atmosphere after waste treatment. There may be increased risk of nosocomial infections in patients due to poor waste management. Improper waste management can lead to change in microbial ecology and spread of antibiotic resistance.

Non-Hazardous Waste:

This constitutes about 85% of the waste generated in most healthcare set-ups. This includes waste comprising of food remnants, fruit peels, wash water, paper cartons, packaging material etc. [10]

Provisions of the Law:

Safe disposal of biomedical waste is now a legal requirement in India. In accordance with BMW Management and Handling rules, it is the duty of every "occupier" i.e. a person who has the control over the institution or its premises, to take all steps to ensure that waste generated is handled without any adverse effect to human health and environment. The hospitals, nursing homes, clinics, dispensaries, pathological laboratories etc., are therefore required to set in place the biological waste treatment facilities.

It is however not incumbent that every institution has to have its own waste treatment facility. The rule also envisages that common facility or any other facilities can be used for waste treatment. However it is incumbent on the occupier to ensure that the waste is treated within a period of 48 hours. This rule have six schedules as briefed in **Table: 2**. [6]

Hazardous Waste:

Potentially Infectious Waste:

Over the years different terms for infectious waste have been used in the scientific literature, in regulation and in the guidance manuals and standards. These include infectious, infective, medical, biomedical, hazardous, red bag, contaminated, medical infectious, regulated and regulated medical waste. All these terms indicate basically the same type of waste, although the terms used in regulations are usually defined more specifically. [12] It constitutes 10% of the total waste which includes:

1. Dressings and swabs contaminated 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 removed during surgery, extracted teeth etc.
4. Potentially infected animals used in diagnostic and research studies.
5. Sharps, which include needle, syringes, blades etc.
6. Blood and blood products. [10] **(Table: 3, 4)**

Steps in Waste Management

1. Washing of hands with soap and warm water after handling BMW. Also, washing of all areas of body with soap and water that you may have come into contact with biomedical waste, even if we are not sure that body actually touched the biomedical waste.
2. Keeping all sores and cuts covered. Immediately replace wet bandages with clean, dry bandages.
3. Wear disposable latex gloves when handling BMW. Discard the gloves immediately after use.
4. Wear an apron or another type of cover to protect clothes from contact with the waste. If clothes become soiled, put on fresh clothes, and take a shower, if possible. Launder or throw away clothes soiled with biomedical waste.
5. Promptly clean and disinfect soiled, hard-surfaced floors by using a germicidal or bleach solution and mopping up with paper towels.
6. Clean soiled carpets. First blot up as much of the spill as possible with paper towels and put the soiled paper towels in a plastic lined, leak-proof container. Then try one of the following:
Steams clean the carpet with an extraction method. Scrub the carpet with germicidal rug shampoo and a brush. Let the carpet dry, and then vacuum it.
7. Never handle syringes, needles, or lancets with hands. Use a towel, shovel, and/or broom and a dustpan to pick up these sharp objects. Dispose of them in a plastic soda pop bottle with a cap. Tape down the bottle cap. Then throw the bottle in the trash.

Rules and Regulations Governing the Disposal of Biomedical Waste:

I. Biomedical waste Storage and Containment:

Sort and separate BMW from other waste at the point where the waste is created. Keep it away from direct contact with humans, animals, insects, and environmental elements, such as rain and wind. Limit access only to

people who are trained and authorized to handle this waste.

Sharps must be contained in leak-proof, rigid, puncture-resistant, break-resistant containers which are labelled and tightly lidded during storage, handling, and transport.

For BMW, excluding sharps, dispose of the waste in leak-proof plastic bags strong enough to prevent ripping, tearing, breaking, or bursting under normal conditions of use. Rigid plastic, single-use, or approved multiple-use marked containers may also be used. BMW that is held in plastic bags should additionally be placed in another leak-proof container such as disposable or reusable pails, drums, or bins during storage or transport. Secure bags or containers to prevent leakage or expulsion during storage.

The container holding the BMW should be conspicuously labelled with the international biohazard symbol and the words "Biomedical Waste" (or words that clearly denote BMW).

II. Disposal:

- BMW must not be compacted or placed into the regular garbage before it is decontaminated.
- Trash chutes must not be used to transfer BMW.
- BMW, except sharps, must be treated or delivered to a BMW storage/treatment operator within fourteen (14) days, unless otherwise approved by the health officer.
- Sharps waste must be disposed of or be transported to a storage treatment facility within ninety (90) days starting from the time the sharps container is sealed.

Expenditure in Biomedical Waste Management:

The cost of construction, operation and maintenance of system for managing waste represents a significant part of overall budget of a hospital, if the BMW handling rules have to be implemented in their true spirit. Self-contained on-site treatment methods may be desirable and feasible for large healthcare facilities, but not be practical or economical for smaller institutes.

An acceptable common system should be in place which will provide regular supply of color coded bags, daily collection of infectious waste, and safe transportation of waste to offsite treatment facility and final disposal with suitable technology.

Conclusion:

Safe and effective management of waste is not only a legal necessity but also a social responsibility. Lack of concern, motivation, awareness and cost factor are some of the

problems faced in the proper hospital waste management. Clearly there is a need for education as to the hazards associated with improper waste disposal. Lack of apathy to the concept of waste management is a major stymie to the practice of waste disposal.

An effective communication strategy is imperative keeping in view the low awareness level among different category of staff in the health care establishments regarding BMW management.

Proper collection and segregation of BMW are important. At the same time, the quantity of waste generated is equally important. A lesser amount of BMW means a lesser burden on waste disposal work, cost-saving and a more efficient waste disposal system. Hence, health care providers should always try to reduce the waste generation in day-to-day work in the clinic or at the hospital.

References:

- Gordon JG, Rein Hardt PA, Denys G. A.. Medical waste management. In: Mayhall CG Hospital epidemiology and infection control, 2004 (3rded.). Lippincott Williams and Wilkins publication. Pg: 1773-85.
- Rao SK, Ranyal RK, Bhatia SS, Sharma VR. Biomedical waste management: An infrastructural survey of hospitals, MJAFI, 2004; Vol. 60(4).
- Rutala WA, Weber DJ. Disinfection, sterilization and control of hospital waste. In: Mandell, Douglas and Bennett's Principles and practice of infectious diseases 2005; (6th Ed.). Elsevier Churchill Livingstone Publication. Pg: 3331-47.
- Sharma M. Hospital waste management and its monitoring, 2002; (1st Ed.), Jaypee Brothers Medical Publication.
- B.L.Wadhwa v/s Union of India and others; Judgment Today 1996 (3) SC: 38-51.

- The Bio Medical Waste (Management and Handling) Rules, 1998
- Duguid J.P. Laboratory strategy in the diagnosis of infective Syndromes UTI; In Practical Medical Microbiology; edited by Collee J.G., Marmion B.P., Fraser A.G., Simmons A; 14th Ed, Elsevier, New Delhi; Pg: 84-90, 1996.
- Environment management for control of hospital infections: Proceedings of 7th conference of hospital infection society - India, CME- 9 January 2003. CMC, Vellore.
- Manual for control of hospital associated infection: Standard operative procedures (1999). National AIDS control organization. Delhi. Pg: 50-66.
- Laboratory diagnosis, bio safety and quality control. National institute of communicable diseases and national AIDS control organization, Delhi. Pg- 26-41.
- Seymour Block S. Disinfection, sterilization and preservation, 2001: 5th ed., Lippincott Williams and Wilkins publication.

Table-1: Bacteriological Profile of Biomedical Waste:

Bacteriological Profile	No. of cases (%) (n=136)
Coagulase negative staphylococci	12(8.82)
Enterococci	05(3.67)
Escherichia coli	31(22.79)
Staphylococcus aureus	25(18.38)
Klebsiella sp.	12(8.82)
Pseudomonas sp.	40(29.4)
Proteus Vulgaris	08(5.88)
Citrobacter sp.	03(2.20)

Table 2:

Schedule	Contents
Schedule I	Classification of biological waste in various categories (Table 3).
Schedule II	Color coding and types of containers to be used for each category of biomedical waste (Table 4)
Schedule III	Proforma of the label to be used on container / bag
Schedule IV	Proforma of the label for transport of waste container / bag
Schedule V	Standards for treatment and disposal of wastes
Schedule VI	Deadline for creation of waste treatment facilities

Table 3: Categories of Biomedical Wastes & Methods of their Disposal:

Category	Waste Type	Treatment and Disposal Method
Category 1	Human Wastes (Tissues, organs, body parts)	Incineration @/ deep burial *
Category 2	Animal Waste	Incineration @/ deep burial *
Category 3	Microbiology and Biotechnology waste	Autoclave/microwave/incineration@
Category 4	Sharps	Disinfection (chemical treatment)+autoclaving/microwaving and mutilation shredding**
Category 5	Discarded Medicines and Cytotoxic Drugs	Incineration@/ destruction and drugs disposal in secured landfills
Category 6	Contaminated solid waste	Incineration@/autoclaving / microwaving
Category 7	Solid waste (disposable items other than sharps)	Disinfection by chemical treatment+ microwaving/autoclaving & mutilation shredding*
Category 8	Liquid waste (generated from laboratory washing, cleaning, housekeeping and disinfecting activity)	Disinfection by chemical treatment+ and discharge into the drains
Category 9	Incineration ash	Disposal in municipal landfill
Category 10	Chemical Wastes	Chemical Treatment + and discharge in to drain for liquids and secured landfill for solids

@ There will be no chemical treatment before incineration. Chlorinated plastic shall not be incinerated.

* Deep burial shall be an option available only in towns with population less than 5 lakhs and in rural areas.

+ Chemical treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection. ** Mutilation/shredding must be such, so as to prevent unauthorized reuse.

Table 4: Colour Coding of Bags of Waste Management System:

Color Coding	Type of Container	Waste Category	Treatment Option
Yellow	Plastic Bag	Cat 1,2,3,6	Incineration / deep burial
Red	Disinfected container / plastic bag	Cat 3,6,7	Autoclave/microwave/chemical treatment
Blue/white,translucent	Plastic bag/ Puncture proof	Cat 4,7	Autoclave/microwave/chemical treatment and destructing shredding
Black	Plastic bag	Cat 5,9,10	Disposal in secure landfill