



Review Article

Biomedical waste management – A review

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How to cite: Indumathy M, Mukesh S. Biomedical waste management – A review. *Int J Soc Rehab* 2021; 6 (2) :1-9.
<https://doi.org/10.56501/intjsocrehab.v6i2.425>

Received: 02-05-2021

Accepted: 20-06-2021

Web Published:16-07-2021

Abstract

Various national and international agencies have shown their concern toward proper handling, treatment and disposal of biomedical waste, as they may cause serious infectious diseases such as hepatitis, tuberculosis, and HIV/AIDS. Most of the hospitals do not have effective disposalsystem leading to complex problem of hygiene and sanitation in hospitals. The use of disposable items has reduced the rate of infection but at the same time has increased the volume of the waste which needs to be disposed properly. Effective waste disposal can be achieved only by considering the various components of the waste management system and this should be made an integral part of hospital planning and designing.

Keywords: Biomedical waste; Environment; Pollution

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INTRODUCTION

The environment is significantly responsible for a man's health, and much of his ill health may be linked back to negative environmental variables such as pollution. Through industrialization and urbanization, human has frequently been the source of pollution in his own surroundings. As a result, environmental contamination is becoming a source of concern for the planet's future life.

Sanitarians and public health engineers are now primarily responsible for waste disposal. However, health practitioners should have a basic understanding of the matter because inappropriate waste disposal is a health danger. Furthermore, when there is a disruption or breakdown of community health services due to natural catastrophes, the health professional may be called upon to provide assistance in some unique scenarios, such as camp cleanliness or dealing with waste disposal issues.[1]

Waste management practices can be broadly classified into two main types:

- I. Medical waste management
- II. Residential waste management

Medical Waste Disposal It's paradoxical that we, as dental practitioners, who provide dental treatment in hospitals and clinics to help the sick, can contribute considerably to environmental pollution and cause a health danger owing to inappropriate waste management in hospitals and clinics. Dental care delivery is a multidisciplinary system that necessitates a large number of things.

Many improved materials have emerged in recent years as a result of advances in research and technology. However, many chemicals such as esters of acrylic acid, impression materials, and mercury used for filling purposes may have potential environmental and human health consequences if not handled properly.[2]

Because of the increased need for dental treatment, the number of dental clinics and hospitals has increased dramatically in recent years, resulting in an increase in the amount of trash generated by these facilities. This has resulted in an increase in the incidence of nosocomial infections (hospital-acquired illnesses), Hepatitis B, HIV, and transfusion-transmitted disease, as well as increasing land and water pollution, which has resulted in an increase in the risk of numerous diseases.

Under the Environment (Protection) Act, the Ministry of Environment and Forest of the Government of India issued a notification on Biomedical Waste (Management and Handling) Rules 1998 to safeguard the environment and the community from these dangers. As a result, it will be the responsibility of every occupier of a facility that generates biomedical waste to take all reasonable means to ensure that such waste is managed in a manner that is safe for human health and the environment.[3]

CLASSIFICATION

Classification Of Health Care Waste WHO Classification

According to the World Health Organization, health-care waste is divided into nine categories, each of which implies a different level of risk of infectious disease transmission or poor health effects from human exposure to the waste.

1. Pathogenic waste – Garbage suspected of containing pathogens, such as laboratory cultures, waste from isolation wards, tissues, materials, or equipment that have come into contact with diseased people, and excreta
2. Pathological waste – Human tissues or fluids, such as body parts, blood, and other bodily fluids, and fetuses
3. Sharps include needles, infusion sets, scalpels, knives, blades, and broken glass
4. Pharmaceutical trash –Waste containing pharmaceuticals, such as expired or no longer needed pharmaceuticals, as well as goods contaminated with or containing pharmaceuticals
 1. Genotoxic waste – Waste containing substances with genotoxic properties, e.g., waste containing cytostatic drugs and genotoxic chemicals
 2. Chemical waste – Waste containing chemical substances, for example, – laboratory reagents; film developers; disinfectants that are no longer needed; solvents
 3. Wastes with high content of heavy metals – Batteries; broken thermometers; blood pressure gauges
 4. Pressurized containers – Gas cylinders and gas cartridges
 5. Radioactive waste –Waste containing radioactive substances, for example, unused liquids from radiotherapy or laboratory research; contaminated glassware; packages or absorbent paper; urine and excreta from patients treated or tested with unsealed radionuclides.

US Classification

The USA uses a separate classification laid down by Center for Disease Control, Atlanta;[4] which is enunciated below;

1. Microbiological waste: This includes cultures and stocks of infectious diseases
2. Sharps: Which include needles, syringes, scalpels, blades, etc.,
3. Human blood, blood products, and body fluids
4. Animal wastes
5. Pathological wastes – tissues, sections, organs, and supply specimens
6. Cytotoxic wastes
7. Radioactive wastes
8. Communicable disease isolation wastes which includes certain highly communicable waste such as Marburg, Lossa, and Ebola viruses.

“Bio-medical waste” is defined as any waste generated during the diagnosis, treatment, or immunization of humans or animals, or during related research activities, or in the manufacture or testing of biologicals, as defined by the Bio Medical Waste (Management and Handling) Rules, 1998 of India.

Nonrisk or general health care waste accounts for 75%–90% of the garbage produced by health-care providers, which is comparable to household waste. It primarily stems from the administrative and housekeeping functions of health-care facilities, although it may also include trash generated during facility maintenance. The remaining 10%–25% of health-care waste is considered toxic, posing a variety of health risks.

Sources of Health Care Waste

- The institutions involved in the generation of bio-medical waste are government hospitals
 - Private hospitals nursing homes
 - Physicians' offices/clinics dentists' office/clinics dispensaries
 - Primary health-care centers
 - Medical research and training establishments
 - Mortuaries
 - Blood banks and collection centers animal houses
 - Slaughter houses laboratories
 - Research organizations vaccination centers.
 - Bio-technology institutions/production units

All these health care establishments generate waste and are therefore covered under bio-medical waste rules.

Composition Of Hospital Waste

The amount of waste generated per bed varies with the type of hospital; however, on an average; 1–5 kg of waste per bed per day is generated. The type of waste generated is;

- a. Nonhazardous – 85%
- b. Hazardous – 15% hazardous but not infective 5% hazardous but infective 10%.

Health Care Waste Generation Several surveys have shown that typical health-care waste creation varies not only from nation to country but even within countries. Numerous variables influence waste generation, including waste management techniques that have been in use for a long time types of health-care facilities specializations in hospitals. The percentage of reusable products is used in health care. The percentage of patients who are treated on a day-to-day basis.

Health-care waste generation is lower in middle- and low-income countries than in high-income countries. The following estimates for an average distribution of health-care wastes are useful for preliminary waste management planning in developing nations that have not conducted their own surveys of health care waste.[5]

Eighty percentage of general health-care waste can be handled by standard home and urban waste management systems. Pathological and infectious trash account for 15% of total waste. One percentage of garbage is sharp. Three percentage waste from the chemical and pharmaceutical industries. Special waste, such as radioactive or cytotoxic waste, pressurized containers, broken thermometers, and used batteries, account for < 1% of total wastage.

According to a survey conducted in Bangalore, the amount of solid waste produced in hospitals and nursing homes varies between 12 and 4 kg per bed per day in government hospitals, 12–2 kg/bed per day in private hospitals, and 12–1 kg/day in nursing homes. In Bangalore, hospital waste is created at a rate of roughly 40 tons

each day. Nearly 45%–50% of this is contagious. In approximately 30% of hospitals, infectious waste is separated from noninfectious waste.[6]

There is currently no thorough data on the amount of trash created in dental facilities and clinics. A survey conducted in Davangere in 2006 in both dental colleges and private clinics in Davangere city regarding the awareness and practice of dental health care waste management in Davangere city revealed a significant lack of awareness of dental health-care waste management and lack of segregation of the dental health care waste generated, as well as the fact that most practitioners were unaware of bio-medical waste management and handling rules and even color coding.[7]

Rationale for Waste Disposal

- a. To prevent nosocomial infection or hospital-acquired infection
- b. To protect health-care providers
- c. To prevent risk to general population (when hospital waste is thrown in open area without proper treatment, it is hazardous)
- d. To protect environment.[8]

Health Hazards of Health Care Waste

1. Pathogens in infectious waste and sharps can enter the human body by a puncture, abrasion, or cut in the skin, through mucous membranes by inhalation, or by ingestion. Infection with HIV and hepatitis B and C, for which there is substantial evidence of transmission via health-care waste, is of special concern
2. Chemical and pharmaceutical waste poses a threat since many chemicals and drugs used in health-care facilities are poisonous, genotoxic, corrosive, flammable, reactive, explosive, or shock-sensitive. Even though they are present in little amounts, they can induce intoxication and damage, including burns, when exposed to them either acutely or chronically. Disinfectants are among the most important members of this category. Reactive chemicals can create very dangerous secondary products when employed in large quantities and are often caustic
3. Genotoxic waste hazards – the severity of the hazards for health-care workers handling or disposing of genotoxic waste is determined by a combination of the toxicity of the substance and the degree and duration of exposure. Exposure can also happen during the manufacturing or treatment of a medicine or chemical. Inhalation of dust or aerosols, skin absorption, and consumption of food contaminated with cytotoxic medications, chemicals, or water are the most common routes of exposure
4. Radioactive waste hazards – the kind and extent of exposure determine the type of disease produced by radioactive waste. It might be anything from a headache to dizziness to vomiting to far more serious issues. It may harm genetic material since it is genotoxic
5. Public sensitivity – Aside from health risks, the general public is extremely sensitive to the visual impact of medical waste, particularly anatomical waste.

CATEGORIES OF WASTE GENERATED IN DIFFERENT DEPARTMENT OF DENTAL HOSPITAL

Oral medicine

Rubber gloves, exposed X-ray films, lead foils, covers of the X-ray films, developer solution, and fixer solution.

Oral surgery/periodontics

Needles and syringes, scalpels and blades, extracted tooth, excised tissues, items contaminated with blood and body fluids including cotton, dressing, bedding contaminated with blood, waste comprising of outdated contaminated and discarded medicines, condemned instruments.

Conservative and endodontics/community dentistry

Amalgam and mercury, outdated contaminated filling materials such as cements, composites, endodontic reamers, files, used cotton, gauze, gloves, and mouth masks.

Prosthodontics

Plaster of Paris cast, alginate impression materials, ZOE, impression compounds, acrylic materials, crown and bridges.

Oral pathology

Disinfectants, dyes, reagents, laboratory cultures, specimens of microorganisms, and human cell cultures.

Orthodontics

Orthodontic brackets and wires.

Bio-medical waste management in India

Bio-medical waste (Management and Handling) Rules 1998, prescribed by the Ministry of Environment and Forests, Government of India, came into force on July 28, 1998. This rule applies to those who generate, collect, receive, store, dispose, treat or handle bio-medical waste in any manner; the table shows the categories of bio-medical waste, types of waste and treatment, and disposal options under rule 1998.[9]

Bio-medical waste management in India, 2016

Bio-medical Waste Management Rules, 2016 categorizes the bio-medical waste generated from the health care facility into four categories based on the segregation, pathway, and color code.[10]

1. Yellow category
2. Red category

3. White category
4. Blue category.

Steps in waste disposal

1. Segregation
2. Decontamination
3. Deformation/destruction
4. Containment/label/transport
5. Disposal.

Segregation – Separate collection of different categories of waste reduces the chances of injury and reduces the quantity of hazardous waste.

The key to minimization and effective management of health care waste is segregation (separation) and identification of the waste appropriate handling; treatment and disposal of waste by type reduce casts and do much to protect public health. Segregation should always be the responsibility of the waste producer, should take place as close as possible to when the waste is generated and should be so maintained in storage areas and during transport.[11]

The same system of segregation should be in force throughout the country. The most appropriate way of identifying the categories of health-care waste is by sorting the waste into color-coded plastic bags/containers. The recommended segregation and color coding as per central pollution control board regulations and used on convenient disposal methods as follows.[12]

Yellow; human anatomical waste-all removed parts from the body during operation (placenta, aborted fetus, biopsy pieces of tumor, etc.).

Red: Solid infectious waste-cotton, gauze, bandage, adhesive plasters, etc., which are soaked/in contact with blood, pus-urine or any other body fluids including removed Plaster of Paris cast.[13]

Blue: Plastic and rubber disposables: IV sets, syringes, nasogastric tube, separation tube, rubber drain, and unused glass vials.[14]

Decontamination – Disinfection reduces chances of infection.

Deformation – Prevents misuse of the needles, syringes, and gloves.

Containment – Use a heavy duty puncture proof narrow mouthed plastic container to collect the waste sharps. A narrow mouthed container facilitates collection, minimizes/obstructs unnecessary handling and removal. Syringes, Plaster of Paris casts, metals, need to be contained in appropriate containers.[15].

A storage location for health-care waste should be designated inside the health-care establishment or research facility. The waste in bags or containers should be stored in a separate area, room or building of a size appropriate to the quantities of waste produced. Unless a refrigerated storage room is available, storage times for health care waste should not exceed the following.[16]

Recommendations of storage facilities for health-care waste are as follows:

1. The storage area should have an impermeable, hard standing floor (with good drainage), it should be easy to clean and disinfect
2. There should be a water supply for cleaning purposes
3. The storage areas should afford easy access for staff in charge of handling the waste
4. It should be possible to lock the store to prevent access by unauthorized persons
5. Easy access for waste collection vehicles is essential
6. There should be protection from the sun
7. The storage area should be inaccessible to animals, insects, and birds
8. The storage area should not be situated in the proximity of fresh food stores or food preparation areas.

CONCLUSION

Recent studies have shown wide variation in the practice of Dental Health-care waste Management, waste generated can be detrimental to the environment, if not properly managed. We have to address this issue in a practical and meaningful manner. In western countries, they have a take back program for all types of waste. This is not true for our country, but we can always believe setting up our own solutions to manage wastes. What is needed is a meaningful commitment to environmental protection in our own area. Our commitment and voluntary measures will be much more effective to preserve our earth for the future generation. All we need to do is to develop very simple effective and economic procedures that are sustainable.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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