

## Biomedical Waste Disposal System in a Hospital

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**Abstract:** Medical wastes are highly infectious which may carry the germs of various diseases like HIV/AIDS, hepatitis B and C (jaundice). Biomedical waste management is receiving greater attention nowadays. The improper disposal of Medical waste in the hospitals poses a high health risks to healthcare workers, patients, communities and the whole environment. The present study was conducted to identify different constituents of wastes, their handling, treatment and disposal methods in a secondary health care hospital. This study was based on the interview sessions with the various level health care workers in the hospital. This paper focuses on the current scenario with respect to disposal of hospital wastes. It is clear that even though there is some lag in following all the principles of WHO regarding waste disposal, it can be corrected by providing proper training to health care workers in the hospital.

**Keywords:** Biomedical waste, Waste disposal, Infectious waste, secondary health care unit, Hazards.

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### I. Introduction

Waste generated in the process of providing health care to the population are composed of variety of wastes including hypodermic needles, scalpels, blades, surgical cottons, gloves, bandages, clothes, discarded medicine, body fluids, human tissues and organs, chemicals etc., Other wastes generated in healthcare settings include radioactive wastes, mercury containing instruments, PVC plastics etc. All these medical wastes are capable of causing diseases and illnesses to people, either through direct contact or indirectly by contaminating soil, groundwater, surface water and air. Medical waste therefore, poses high risk to individuals, communities, and the environment if not carefully handled. These are the most environmentally sensitive healthcare byproducts and needs a greater attention which has to be monitored carefully.

### II. Definition:

According to Biomedical Waste (Management and Handling) Rules, 1998 of India "Any waste which 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 is defined as the biological wastes. 85% of the waste produced by health-care providers is non-risk or "general" health-care waste, comparable to domestic waste. This type of waste usually comes from the administrative and housekeeping functions of health-care establishments and may also include waste generated during maintenance of health-care premises. The remaining 10-15% of health-care waste is regarded as hazardous and may create a variety of health risks (WHO, 1999).

### Objectives of the Study:

The objectives of this study were-

- To assess the different types of medical wastes which are generating from the Secondary care hospital.
- To assess the waste disposal practice.
- To assess the impacts of medical waste on environment as well as on human health.

### Profile of the Study Unit:

A secondary health care hospital in Chennai district of Tamil Nadu has been selected as the study area to assess the various methods of medical waste disposal, its fate and to develop a management system. It is a 50 bedded hospital where patients having different types of disease get admission and in the course of treatment dispose a large amount of wastes carrying infectious agents. This hospital runs various departments like general medicine, surgery, pediatrics, obstetrics and gynecology, orthopedics, radiology, etc. A large amount of wastes have been produced from these departments and also from the laboratories, labour ward, pharmacy wastes, etc. Consent has been obtained from the proprietor of the hospital to undergo this study in their premises. Detailed explanation regarding the purpose of the study, mode of the study, research analysis and the results has been discussed with the proprietor.

### **III. Data Collection**

The data regarding different types of waste generation and their mode of disposal have been collected from the hospital workers including the housekeeping services, nurses, ward attenders and the laboratory workers. An interview has been made with each worker regarding the various waste generation and its disposal methods. Various places in the hospital have been visited like the waste segregation area, dumping area and the waste collection units of the hospital. The hospital strictly follows the WHO criteria in segregating the hospital wastes and its disposal.

### **IV. Materials And Method:**

The methodology for this study includes empirical field observation and field level data collection through questionnaire survey and interviews in formal and non-formal ways. The presented study was carried out for a period of 3 months from JAN 2017 to MAR 2017. The work was divided into several sections to achieve precise result.

**Field observations:** Field observations were made at each location, using a checklist that focused on potential problems posed by disposal of Medical waste. Waste generation sites (ward, laboratory), laboratory (sample collection site, place of analysis, washing basin), and waste disposal sites (dustbin, dumping site, drainage system, wastewater flow) were observed. Current waste management system and the safety measures taken in the pathological laboratory and clinics were also observed.

**Interview:** Interviews were conducted with people involved in providing medical services and handling and disposing medical waste. Supervisors of different wards, doctors and nurses, laboratory technicians, cleaners, and garbage dwellers were interviewed. Generally questions were geared towards the basic understanding of the respondents.

**Analysis relating to Objective I:** To assess the different types of medical wastes which are generated from the Secondary care hospital.

The various types of hospital wastes that have been generated here are,

#### **1. Pathological Waste:**

This waste includes:

- Tissues
- Organs
- Body parts
- Fetuses (Unborn Vertebrates)
- Blood and body fluids

#### **2. Sharps**

Sharps include the following whether infected or not

- Needles
- Syringes
- Scalpels (A thin straight surgical knife used in dissection and surgery)
- Infusion sets
- Saws and knives
- Surgical blades
- Broken glass
- Any other items that can cut and puncture

#### **3. Pharmaceutical Waste:**

These include

- Expired or unused pharmaceutical products.
- Spilled or contaminated pharmaceutical products.
- Surplus drugs, vaccines or sera.
- Discarded items used in handling pharmaceutical, for example bottles, gloves, masks and tubes.

#### **4. Genotoxic Waste:**

These wastes include:

- Cytotoxic drugs and outdated material.

- Vomiting, feces or urine from patients treated with cytotoxic drugs or chemicals.
- Contaminated materials from the preparation and administration of the drugs such as syringes, vials (A bottle that contains a drug (especially a sealed sterile container for injection by needle))

#### **5. Chemical Waste:**

- Chemical waste can include the following;
- Chemicals from diagnostic and experiment work
- Cleaning processes
- Housekeeping and disinfecting procedures.
- Mercury waste such as from broken clinical equipment spillage.
- Cadmium waste, mainly from discarded batteries.

#### **6. Radioactive Waste:**

These wastes include Liquid, solid or gaseous waste contaminated with radio nuclides generated from invitro (outside) analysis of body tissue/fluid, in vivo (body organ imaging) and tumor localizations and investigations and therapeutic procedures.

#### **Non-Risk Waste:**

Non-risk waste is that, which is comparable to normal domestic garbage and presents no greater risk, therefore, than waste from a normal home. This general waste is generated by almost everybody in the hospital, i.e., administration, patient's risk, cafeterias rooms, cafeterias and nursing station. Such waste may include:

- Paper and cardboard.
- Packaging.
- Food waste, i. e., leftover food, fruit and vegetable peelings.
- Aerosols.(spray)

#### **Analysis relating to Objective II:**

To assess the waste disposal practice. Health care workers collect the medical wastes in a separate colour coded plastic bags placed in particular colour coded containers. All wards, laboratories, operation theatres, outpatient departments have four colour coded plastic containers .wastes are been collected in these containers. Then these wastes are segregated ,packed ,labeled and disposed off. Four colour coded bins are used for disposal of medical wastes here. They are,

**Yellow bags-** Human tissues, organs, body parts, items contaminated blood and body fluids, soiled cotton and dressing, soiled plaster casts, etc.

**Red bags-** Catheters, tubes, cannula, syringes, plastic IV bottles and sets, used gloves, infected plastics, specimen containers, lab waste, microbiology cultures, used or discarded bags of blood / blood products, vaccines, etc.

**Blue bags-** Glass items, needles, syringes, scalpels, blades, used and unused sharps, etc.

**Black bags-** Discarded medicines, discarded cytotoxic drugs, etc.

Medical waste containers help healthcare workers correctly dispose of waste by labeling and can make removal of waste a more simplified and streamlined process. Various container types are available for different needs, for example, sharps containers, which are used for needles and other sharp objects that may tear through a bag.

#### **Sealing of Containers:**

Containers of clinical wastes in this hospital are not filled above the warning line indicated between 70% and 80% of their maximum volume before sealing. The packaging and sealing is done with care to ensure that there is no clinical waste that adheres to the external surface of the containers. Sharps containers are properly sealed with proprietary closure/tape. Plastic bags are sealed by tying the neck securely to prevent spillage. Staples or unprotected metallic wires are not used for sealing or tagging of plastic bags with clinical waste, so that there is no injury to waste handlers and damage to other bags. Metallic wire tie fully wrapped with plastic is acceptable for use in sealing plastic bags. If the clinical waste contains liquids, thermal sealing of the plastic bags is recommended to prevent spillage.

#### **Labeling and Packaging:**

Different types of medical waste also require different labeling and packaging, so they can be handled and disposed of differently. Pathology waste, infectious waste, chemotherapy waste, and bio hazardous waste all require different labels, and should all be handled differently. In addition, all sharp objects, such as needles, should be in puncture resistant packaging before being put into a medical waste bag for shipping, to prevent any injury during transport. All waste bags or containers should be labeled with basic information of their content and on the waste producer:

Waste category

Date of collection

Place in hospital where it is produced.

Waste destination.

Two different types of packaging are used for healthcare risk waste, bags or sacks, and rigid containers in the form of bins or sharps boxes. The bags are made of plastic film or, sometimes, plastic or wax-coated paper. Rigid containers are generally made from plastic but corrugated cardboard is also used. The bags are used to hold soft materials that do not contain sharp objects or liquids. Rigid containers are used for other forms of waste and for waste containing small amounts of free liquids. Rigid containers are also used for infectious substances and other risk wastes, such as used sharps, pharmaceuticals/ cytotoxic material etc. which may be inherently hazardous. Identifiable anatomical material, such as organs, recognizable body parts placentas and other such wastes containing liquid, must be packaged in robust rigid leak-proof containers that contain sufficient absorbent material to prevent leakage. To meet the aim of protecting personnel the packaging shall conform to an appropriate specification satisfying minimum requirements for leak resistance, strength, penetration and tear resistance. There may also be special demands on packaging which are dependent on the treatment and disposal method used. Under no circumstances should healthcare risk waste be compacted, either manually or mechanically. Packaging requirements are directly related to the classification of the waste.

**Medical wastes from this hospital is been disposed off by GJ multiclave(India) pvt.Ltd.**

Waste No.	Category (type)	Treatment & Disposal
1	Human anatomical waste: (Human tissues,organs,body parts)	Incineration/Deep burial
2	Animal waste: (Animal tissues, organs, body parts, carcasses, bleeding parts , fluids, blood, experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal houses).	Incineration/Deep burial
3	Microbiology & Biotechnology waste: ( waste from laboratory cultures, stocks or specimens of micro-organisms, live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, waste from production of biological, toxins, dishes and devices used for transfer of cultures).	Local autoclaving/ Incineration and microwaving.
4	Waste sharps:(Needles, scalpels, blades, glass broken and unbroken,etc) thstmsy cause punctures and cuts.	Disinfection by chemical syringes,treatment/ autoclaving, microwaving.
5	Discarded medicines and cytotoxic drugs:( Wastes comprising of outdated medicines,contaminated drugs and discarded medicines).	Incineration/ destruction disposal in secured landfills.
6	Soiled waste:(Items contaminated with blood and body fluids including cotton ,dressing, soiled plaster casts, linens, bedding,other materials contaminated with blood).	Incineration/autoclaving/microwaving
7	Solid waste:(waste generated from disposable items other than treatment, waste sharps such as catheters, intravenous sets,etc.)	Disinfection- chemical autoclaving/ microwaving and mutilation/shredding
8	Liquid waste:( waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities).	Disinfection by chemical treatment and discharge into drain.
9	Incineration Ash:(Ash from incinerationof any bio-medical	Disposal by chemical treatment and discharge into drain.

	waste).	
10	Chemical waste: ( chemicals used in production biological, chemicals used in Disinfectants, as insecticides,etc.	Chemical treatment / discharges into drains for liquids and of secured landfills for solids.

**Analysis relating to Objective III:**

To assess the impacts of medical waste on environment as well as on human health . Medical waste refers to clinical waste materials that are produced from healthcare facilities, such as hospitals, doctor's offices, pharmaceutical manufacturing plants, nursing homes, and research laboratories. Disposal of this waste is an environmental concern. Examples of harmful side effects related to medical waste may include acquired immunodeficiency syndrome (AIDS), hepatitis A, drug abuse, and cancer. Toxins, such as mercury, may be spread through skin contact or inhalation. Also, Escherichia coli bacteria may be spread through eating contaminated foods. Furthermore, infectious diseases may be transmitted through contaminated syringes or potentially cause injury. Medical waste may pollute the air and water. Pollution refers to substances in the natural environment as a result of human activity that might harm humans, animals, or the environment. The WHO suggests that nearly 25% of preventable illnesses are environmentally related. For example, unclean water can transmit bacteria that may cause diseases, such as cholera. It has been suggested that waste from healthcare activities may contribute to environmentally related illnesses. For instance, exhaust from hospital incinerators may cause illness among people living near the incinerator. Exhaust from incinerators has been associated with cancer and developmental problems in children. By minimizing the harmful chemicals in the exhaust, illness may be prevented. One of the first tenets of the Hippocratic Oath (an ethics code for medical doctors) states that harm should not be done onto a patient. However, healthcare workers, community members, and politicians may also have an ethical concern to safely manage medical waste and protect the public's health. Although not bound by the same ethical code as doctors, they may be responsible for waste production and have the power to make changes that will ensure the safety of others. Ongoing efforts to address medical waste management issues and minimize its environmental impact are shared by community members, as well as local, state, national, and international governing agencies.

**V. Summary Of Findings And Conclusion:**

On the basis of the functions of the wards, several types of wastes were found which could be classified as follows-The sharps included syringes and needles, ampoules and vials, saline bags and infusion sets. The waste generation rate of one ward to another ward is different. The difference is because of the characteristics of each ward. Each ward requires a different type of diagnosis and treatment. Some diagnosis and treatment methods produce more waste than others. From this investigation it is found that wastes from hospital such as placenta, syringes, needles, sputum pots, chemical agents are all potential areas of concern for hospital waste management. A hospital cannot operate in isolation but works in close relationship with not only the Government (Central and State) but is strongly influenced by the policy and legal provisions framed by the international apexbodies like WHO and World Bank. The successful implementation of the formulated rules would be possible if the community is involved. A Bottom-Top approach would ensure the active participation of the people living in close proximity of the hospitals. Residents can be encouraged to take the responsibility of managing certain key areas of hospital management. . The study concludes that healthcare waste management should go beyond data compilation, enforcement of regulations and acquisition of better equipment. It should be supported through appropriate education, training and the commitment of the healthcare staff, management and healthcare managers within an effective policy and legislative framework.

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**Questionnaires Used for this Study:**

1) General information about the hospital:

Name of the hospital

Type of hospital

Year of commencement

Number of beds

In/ Out Patients

Other facilities provided

2) What is the present waste management system in the hospital?

Details of the system

How did the present system develop?

Any training imparted

Regular monitoring and record keeping

3) What is the role of different personnel's involved in the system?

4) What is the present sharps management system of the hospital?

At the point of generation, collection and final disposal site.

Money and Manpower required for the same.

Any stand by mechanism for managing sharps at each point

Quantity of sharps generated per day

Frequency of collection of sharps everyday / \_\_\_\_\_ in a week

5) What are the reasons for choosing the present system?

6) Do you use a sharps pit for final disposal?

7) If the unit has a sharps pit, what are the dimensions of the pit and where were the specifications derived from?

8) If Yes, How do you transfer the waste into the sharps pit?

9) Is the method safe?

10) Which company transports waste from this hospital and how they dispose the medical waste?