

## Nosocomial Infections through Hospital Waste

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### Abstract

The amount of hospital waste being generated is increasing geometrically day by day due to increasing health consciousness. Improper management of the waste also leads nosocomial to infections. In the present article the types of hospital waste generated, the present pattern of its handling and disposal has been discussed. Its consequences and the proposed disposal methods have also been discussed in brief. The ultimate results of hospital waste on air, water and land have also been highlighted.

**Keywords:** Hospital waste; Infectious waste; Incineration; Microbial waste; Nosocomial infections

### Introduction

Nosocomial infections are most common in the developing countries like India. Improper handling and management of the hospital waste is also an important cause of the nosocomial infections. Hospital waste means any solid, fluid, or liquid waste materials including its container and other product generated during short term and long term healthcare consisting observational, diagnostic, therapeutic and rehabilitative services for a person suffering from diseases or injury and during research testing and immunization of human beings. Hospital waste includes garbage, rubbish and biomedical waste. With industrialization and increasing healthcare services voluminous amount of waste generated by hospital, nursing homes and other healthcare institutions [1]. Hospital waste contains body parts, organs, tissues, blood and body fluids along with soiled linen, cotton, bandage, and plaster casts from infected and contaminated areas along with used needles, syringes and other sharps. It contains pathogens in mass, in their invisible forms. Therefore, its proper management is essential to maintain hygienic, aesthetics, cleanliness, and control of environmental pollution. If this substantial amount of waste is not properly managed it can pollute soil, air and water. Further, it can cause deadly diseases, either in endemic, sporadic or epidemic forms [2]. Proper management means proper collection, segregation, storage, transportation and treatment of waste in safer manner to prevent nosocomial or hospital acquired infection. Diseases of modern era like hepatitis-B, AIDS are also drawing attention for proper management of hospital wastes as persons who are in touch of these materials during discharge of their services to mankind are also at the risk. This can be achieved by public awareness about hospital waste hazards and by making mandatory to officials of the institutions to follow the guidelines of Supreme Court (1st March, 1996 and 30th November 1996) and Ministry of Environment Forest, Government of India notification for biomedical waste (Management and Handling) Rules 1998.

With increasing health facilities in society the amount of hospital waste generated is also increasing substantially. This needs its proper disposal and management. Since it is highly infectious in nature, it is

categorized as hazardous waste. Hospital waste is generated during diagnosis, treatment or immunization of human beings or animals or during research activities.

### Types of Hospital Waste

Hospital waste can broadly be classified as-

#### Biodegradable waste

Biodegradable waste is the component which is a biological product This waste which is capable of undergoing anaerobic or aerobic decomposition e.g.- food and kitchen waste, paper and paper board etc. Paper and food waste of hospital because of its nature and composition is similar to biodegradable waste from households. This component of hospital waste can be safely mineralized using the biological system.

#### Non biodegradable waste

Non- biodegradable waste includes all such wastes, which have not been produced through the biological process. These wastes cannot be acted upon by any kind of biological system. Further, their mineralization is highly expensive and it is a useless process. This category of waste can be recycled and reused till the limit of safety. Non-biodegradable wastes include glass bottle, tin, plastics etc.

#### Infectious waste

These are the waste which are infectious in nature and are potent to cause diseases. These waste can neither be subjected to normal degradation processes nor they can be categorized as recyclable. We have to just get rid of them safely. The best thing about it is that, generally it is generate in less quantity and normally it is only 5-10 percent of the total hospital waste generated.

#### Chemicals or medicinal waste

These wastes are the medicines which have crossed their expiry dates or the medicines released due to leakage from containers or the pathological waste. Usually, the amount of this type of waste is very little but their proper disposal is essential. Mostly, the branded firms

take their expired medicines back, however this is not in practice for most of the time. Under this situation the medicines are directly drained into the sewage system. This ultimately, reaches to water bodies causing hazards to surface as well as ground water.

The quantum of hospital waste that is generated in India is about one to two kg per bed per day in hospitals and 600 gram per day per bed in the clinic of general practitioners, so hundred bedded hospitals will generate 100-200 kg waste per day of which only 5-10% is hazardous or infectious which estimates to be at most five to ten kg per day (www. Medwasteind.....). Only this very amount of the total hospital waste is deadly. Its proper handling is necessary because the pathogens can multiply their quantity and potential for infection.

## Consequences

Usually, in most of the developing and under developed cities in India, no proper norms are in practice for proper management of hospital waste. Hospital waste, as well as the surgical wastes can be seen flowing smoothly through open drainage system even in the exteriors of metropolitan cities [3]. In addition to a cause of the nosocomial infection, following are some of the hazards, which can be caused by improper management of hospital waste –

- Injuries from sharps to all categories of personnel and waste handlers.
- Increase risk of infection to medical, nursing and other hospital staff.
- Improper and poor infection control can lead to super infection in patients having poor immunity level (HIV, hepatitis B).
- Persons handling wastes may be exposed to the hazard of chemicals and drugs.
- Improper waste management encourages unscrupulous persons to recycle disposables for repacking and reselling, which is deadly.
- Resistant strains of microorganisms may develop.
- Organic portion of the biomedical waste ferments and provide good media for flies breeding.

In light of the above, the proper disposal and management of biomedical wastes is of paramount importance. In order to combat the hazards of improper disposal of hospital waste certain guidelines have been recommended. Further, the hazardous hospital waste has been divided into various categories, such that each category should contain different type of waste, also requiring different treatment procedures, according to nature of component [3]. The categories are discussed below -

**Category 1:** This category includes anatomical wastes such as Human tissues, organs, body parts etc., their treatment and disposal options available presently are incineration or deep burial.

**Category 2** Category 2 includes, animal wastes such as Animal tissues, organs, body parts carcasses, bleeding parts, blood and experimental animals used in research etc. Their treatment and disposal options are also incineration or deep burial like category 1.

**Category 3** Microbiological and biotechnological wastes, such as waste from laboratory culture, specimens from microorganisms, vaccines, cell cultures, toxins, dishes, devices used to transfer cultures are included under the category 3. Their treatment and disposal options are- local autoclaving or micro waving or incineration.

**Category 4** This includes, waste sharps such as Needles, Syringes, scalpels, blades, glass, which are treated by chemical disinfection, autoclaving, micro waving or mutilation and shredding.

**Category 5** Category 5 includes discarded medicines and cytotoxic drugs such as outdated, contaminated, discarded drugs, their treatment and disposal options are- incineration, destruction or by disposal in landfills.

**Category 6** This includes soiled wastes, contaminated with blood and body fluids including cotton, dressing, soiled plasters, linen etc. Their treatment and disposal options are- autoclaving, micro waving or incineration.

**Category 7** This category of hospital waste consists of solid wastes such as tubes, catheters, IV sets etc. Their recommended disposal is by means of chemical disinfection, autoclaving, micro waving, mutilation and shredding.

**Category 8** Category 8 includes liquid wastes such as waste generated from laboratory and washing, cleaning, disinfection etc. Their treatment and disposal options being followed presently are disinfection by chemical treatment and / or discharge into the drains.

**Category 9** This includes incineration ash, and presently their disposal is only through land fillings.

**Category 10** Now in the last, category 10 includes chemical wastes which are treated either by another chemical or discharge of directly into the drains.

To ease the separation of hazardous waste and to facilitate their separation and disposal, certain colour codes have been recommended (www.edugreen . teri.....). Such that, plastic bags or puncture proof plastic container of different colours be used for keeping the different category of hospital waste separately. The colour codes are as follows –

### Yellow container

Yellow coloured bags be used for the disposal of human and animal wastes, microbial and biological wastes and the soiled wastes. Waste of category 1, 2, 3 and 6 are to be kept together in yellow container.

### Red container

Red coloured disinfected containers or bags be used for the disposal of microbial and biological wastes and the soiled wastes. Waste of category 3, 6 and 7 are to be kept together in red container.

Blue, white and transparent containers

Blue, white or transparent bags, puncture proof containers be used for the disposal of waste sharps and the solid wastes. Waste of category 4 and 7 are to be kept together in blue, white or transparent containers.

### Black container

Black coloured bags be used for the disposal of discarded medicines, cytotoxic drugs, incineration ashes and the chemical wastes. Waste of category 5, 9 and 10 are to be kept together in black container.

### Green container

Green coloured containers be used for the disposal of general wastes such as office wastes, food wastes and garden wastes.

## Environmental hazards

Poor and improper management of biomedical waste, besides a great risk for hospital personnels and supporting staff, can cause serious environmental problems through air, water and land pollution. Environmental problem can arise due to generation of biomedical waste and through the process of handling, treatment and disposal. The extent of environmental degradation by hospital waste is discussed below, briefly -

### Air pollution

Air polluted by biomedical waste can be biological, chemical, as well as radioactive in nature. Biological waste can pollute both indoor and outdoor environment [1].

**Indoor air pollution:** Polluted air especially in indoors contains pathogens in the form of spores or pathogen itself which are present in contaminated waste, may live long. The patients and their attendants may acquire infection by these pathogens or their spores (Nosocomial infection), (<http://kspcb.kar.gov.in>). Very little statistical data is available in this field. Research in this area is needed. Indoor air pollution can also be caused by poor ventilation, use of chemicals for disinfection, fumigation etc. which gives out acidic or noxious gases.

**Outdoor air pollution:** Outdoor air pollution can be caused by pathogens which infect through water, food stuffs, soil etc. when waste is not pretreated or dumped openly outside the institution. It can be reduced by proper waste management practices. Chemical pollution of outdoor could be due to open burning of biomedical waste. The plastics and hazardous material in waste will generate harmful gases such as- oxides of sulphur, nitrogen and carbon etc. Gases like dioxins and furans which are generated during open burning as well as also during incineration are carcinogenic. It is necessary that open burning should be avoided. The laid down guidelines in this connection should be practiced as per prescribed standard.

**Radioactive air pollution:** Use of <sup>85</sup>Kr and <sup>133</sup>Xe is the principal source of gaseous radioactive waste in hospitals. In the absence of special exhaust system an activated carbon trapping device may be used to keep away the emitting gases from polluting the air.

### Water pollution

The biomedical waste dumped into low lying areas, lakes and water bodies can cause severe water pollution. Liquid waste if not treated and let into sewers can also lead to water pollution. Water pollution can also be caused due to biological, chemical and radioactive substances. Leaching out of pathogens can pollute the water and may cause diseases. Heavy metals present in the chemical waste can also cause water pollution. They can enter into biological systems through the process of biological magnification. Pollution of water bodies can alter parameters such as, pH, BOD, DO, COD etc. and may further become toxic for the flora and fauna of the water body. Proper waste management can reduce water pollution markedly [2].

Radioactive material shipment is mostly in the form of liquid. Principal part of radioactive waste is of the residue of this shipment.

Radioactive substances are found in the urine of patients and scintillation liquids used in radioimmunoassay (<http://kspcb.kar.gov.in>).

### Land pollution

Land pollution by biomedical waste is inevitable as the final disposal of all biomedical waste including treated liquid effluent, is on the land. However through proper treatment it can be minimized. Soil pollution from biomedical waste is due to infectious waste discarded medicines, chemical used during treatment processes. Heavy metals present in the waste get enter into the ecosystem by being absorbed by plants, contaminating the food chain [3]. Trace nutrient elements if present in considerable amount, are harmful to crops, animals and also to the human beings ultimately.

Radioactive waste which causes soil pollution includes, cadavers, protective clothing, absorbent paper, used in nuclear medicine imaging laboratory etc. Proper treatment and minimum generation of this kind of pollutant is the only way to reduce this kind of pollution.

### Rules and Regulations

In most of the cities in India, only a few large hospitals can be spared, but most of other smaller hospitals and nursing homes have no any effective system to safely dispose off their wastes. Even government and municipal hospitals are no better than these private nursing homes and hospitals regarding disposal of their wastes. Thus, an unauthorized reuse of medical wastes by rag pickers, is being promoted by irresponsible dumping of these dangerous waste in open bins.

Biomedical waste, because of its infectious nature and serious health hazards need care for its proper collection, segregation and disposal to minimize the pollution of air, water and soil. For this, government of India has laid down certain rules which should be enforced by government and should be strictly followed by institutions and clinics in the welfare of mankind and animals.

Central Pollution Control Board and the State Pollution Control Boards, the agencies responsible to enforce these rules in hospitals, are on one hand lacking adequate power and on the other hand there is no commitment, as a result most of the large hospitals have not complied with these rules even after expiry of new deadlines. In such situation NGO's and voluntary bodies have to come forward and compel the hospitals and nursing homes to fall in the line with the rules.

Thus, in order to prevent the nosocomial infections, proper understanding of the waste generated in hospitals is essential, in addition to adopting their proper disposal and management practices.

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