ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Management of Infectious Bio-medical Waste of Ujjain City

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Manuscript Info

Manuscript History:

Received: 16 March 2013
Final Accepted: 29 March 2013
Published Online: April 2013

Key words:
Ujjain, BMW,
Indore Bio-medical waste,
Bio-medical waste Management.

Abstract

Bio-medical waste (BMW) is generated mainly by health care establishments. The management of Bio-medical waste is still infant all across the world. It consists of Bio-medical waste as well as chemical waste with a portion of solid waste. The MoEF notified Bio-medical waste and handling rules 1998 in July 1998. According to it every hospital generating Bio-medical waste needs to set a requisite treatment facility nearby to ensure degradation of Bio-medical waste as the untreated Bio-medical waste should not be kept beyond 48 hours. In this research we try to elaborate the effects of Bio-medical waste and will also discuss its treatment techniques w.r.t. Ujjain city.

A detailed study of major hospitals of Ujjain city is carried out to assess the structure and amount of Bio-medical waste generated and its management.

The study depicts that there is no proper management of Bio-medical waste. In the main Government hospital an electric incinerator is situated but is in between of densely populated area of city causing air pollution health problems. Another disposal method is that various companies of Indore (a city 54 Kms Southwest) send their vehicles to take Bio-medical waste for disposal but the Bio-medical waste taken by them is only 15-20% of the total generated the rest is been pumped directly in municipal waste collecting box or direct open burning.

After analysis of this study it is concluded that there is a very urgent need for Bio-medical waste disposal facilities in Ujjain city.

Introduction

Bio-medical waste is defined as waste that is generated during the diagnosis, treatment or immunization of human beings or animals or research activities it includes sharps, solid waste, disposables, anatomical wastes, cultures, discarded material and is contaminated with patients body fluids (such as syringes, needles, ampoules, organs, body parts, placenta, dressings, disposable plastics and microbiological wastes). Bio-medical waste is generated from health care establishments and also some small sources as blood banks, laboratories and research institutes. Bio-medical waste contaminated by chemicals becomes hazardous these chemicals include formaldehydes and phenols (used as disinfectants), mercury etc.

Amount and Consumption of Bio-Medical Waste Generated

Bio-medical waste in Ujjain amounts to 0.5% of total waste generated in the city every day**.** Quantities of waste are sent to different companies of Indore for incineration by all their member hospitals a brief data is in table below

Table 1 – Quantity of waste generated in Ujjain

S. no.	Type of institution	No. of institutions		No of beds		Quantity Kg/month
		Government	Private	Government	Private	
1.	Hospitals beds>400	1	1	685	525	1380
2.	Hosp. beds 100-399	1	7	300	1800	2280
3.	Hosp beds 50-100	1	13	70	216	1890
4.	Hosp < 50 beds	2	20	50	875	1990
5.	Others – clinics, non-bedded health care's, Lab, Blood banks, dispensaries, medical centers etc					170
6.	Total					7710

But the total waste generation of city is 51400* Kgs (according to our survey) so we divide it on Percentage wise distribution –

i. Hazardous

1. Hazardous but non infective
2. Hazardous and infective

ii. Non-Hazardous

1. Combustible
2. Non-Combustible

The study shows that only hazardous waste is send to Indore for incineration by major hospitals of Ujjain which is only 15% of total Bio-medical waste generated. All other wastes like kitchen waste, packaging material, paper, wrappers, plastics, needles, broken glass, saws, nails, screws, blades, scalpels, syringes and bandages consist of rest 85%.

Existing Waste Management

Hospitals and public healthcare units are supposed to safeguard the health of the community. However the waste produced by the medical care centers if disposed of improperly, can possess a greater threat than the original disease themselves. Ujjain is facing such a problem as here is no proper management of Bio-medical waste. Study of many hospitals is made to collect information of waste generation and existing practices for its management. The study shows that there is no systematic approach to Bio-medical waste disposal. Almost all hospitals have membership of common waste disposal facility of two different companies situated at industrial area in Indore (54 Kms from Ujjain). Daily 1 – 2 maruti vans of each company come to collect the waste but there is no safety measure for transportation. Each van consists of four drums of 100 lit. Capacity and a weighing scale as they charge the hospitals on per Kg basis so all hospitals send only hazardous waste and that too in a limited quantity. Rest all material is mixed with municipal waste and put in municipal bins present at roadsides. Only the District hospital has incinerator but it's situated in middle of the city resulting in air pollution for surroundings and is not in working condition presently. Sharps and syringes are not disposed of properly at home also we don't know how to dispose them so we just throw them in bins causing damage to life and environment.

The Health Impacts of Bio-Medical Waste

a. Persons at risk – All individual exposed to Bio-medical waste are potentially at risk including those within the health care establishments that generate hazardous waste and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management. The main groups at risk are the following

i. medical doctors, nurses, health-care auxiliaries and hospital maintenance personnel
ii. patients in health-care establishments or receiving home care
iii. Visitors to health-care establishments.
iv. Workers in support services allied to health care establishments such as laundries, waste handling and transportation.
v. workers in waste disposal facilities (such as landfills or incinerators), including scavengers The hazards associated with scattered, small sources of health care waste should not be over looked; waste from these sources includes that generated by home-based health- care, such as dialysis and that generated by illicit drug use.

b. **Hazards from Infectious Waste & Sharps –** Infectious waste may contain any of a great

variety of pathogen micro-organisms. Pathogens in infectious waste may enter the human body by a number of routes:

i. through a puncture, abrasion or in the skin
ii. through the mucous membranes
iii. by inhalation
iv. by ingestion

c. Types of Hazards

i. **Health hazards –** According to the WHO. The global life expectancy is increasing year after year. However, deaths due to infectious disease are increasing. A study conducted by the WHO in 1996. Reveals that more than 50.000 people die every day from infectious diseases. One of the causes for the increase in infectious diseases is improper waste management. Blood, body fluids and body secretions which are constituents of bio-medical waste harbor most of the viruses, bacteria and parasites that cause infection. This passes via a number of human contacts, all of whom are potential 'recipients' of the infection. Human Immunodeficiency Virus (HIV) and hepatitis viruses spearhead an extensive list of infections and diseases documented to have spread through bio-medical waste. Tuberculosis, pneumonia, diarrhea diseases, tetanus, whooping cough etc., are other common diseases spread due to improper waste management.

ii. **Occupational health hazards –** The health hazards due to improper waste management can not only affect the occupants in institutions, but also spread in the vicinity of the institutions. Occupational health concerns exist for janitorial arid laundry workers, nurses, emergency medical personnel, and refuse workers. Injuries from sharps and exposure to harmful chemical waste and radioactive waste also cause health hazards to employees in institutions generating bio-medical waste. The problem of occupational health hazards due to bio-medical waste is not publicized as there is lack of information. Hence, the Bio-Medical Waste (Management and Handling) Rules. 2000 prescribe a form under schedule VI to report such incidences in order to develop a database. There is plenty of scope for research in this field. Proper management of waste can solve the problem of occupational hazards to a large extent.

iii. **Hazards to the general public –** The general public's health can also be adversely affected by biomedical waste. Improper practices such as dumping of bio-medical waste in municipal dustbins, open spaces, water bodies etc... Leads to the spread of diseases. Emissions from incinerators and open burning also lead to exposure to harmful gases which can cause cancer and respiratory diseases. Exposure to radioactive waste in the waste stream can also cause serious health hazards. An often- ignored area is the increase of in-home healthcare activities. An increase in the number of diabetics who inject themselves with insulin, home nurses taking care of terminally ill patients etc... All generate bio-medical waste which can cause health hazards. Bio-medical waste can cause health hazards to animals and birds. Plastic waste can choke animals which scavenge on openly dumped waste. Injuries from sharps are a common feature affecting animals. Harmful chemicals such as dioxins and furans can cause serious health hazards to animals and birds. Certain he heavy metals can affect the reproductive health of the animals,

d. **Impacts of Infectious Waste and Sharps –** For serious virus infections such as HIV/AIDS and hepatitis B and C. hospital workers-particularly nurse-are at greatest risk of infection through injuries from contaminated sharps (largely hypodermic needles). Other hospital workers and waste management operators outside hospitals are also at significant risk, as are individuals who scavenge on waste disposal sites (although these risks are not well documented).The risk of this type infection among patients and the public is much lower. Certain infections spread through other media or caused by more resilient agents may pose a significant risk to the general public and to hospital patients. Individual cases of accidents and subsequent infections caused by the Bio-medical Waste are well documented. E.g. a hospital housekeeper in the USA developed staphylococcal bacteriaemia and endocarditic after a needle injury. France in 1992 eight cases of HIV infection was recognized as occupational infection. Two of these cases, involving transmission through wounds, occurred in waste-handlers. USA In June 1994, 39 cases of HIV infection were recognized by the Centers for Disease Control and Prevention as occupational infections, with the following pathways of transmission:

i. 32 from hypodermic needle injuries
ii. 1 from blade injury
iii. 1 from glass injury (broken glass from a tube containing infected blood)
iv. 1 from contact with non-sharp infectious item
v. 4 from exposure of skin or mucous membranes to infected blood By June 1996. The cumulative recognized cases of occupational HIV infection had risen of 51.

All cases were nurses, medical doctors or laboratory assistants. [Source: Safe Management of waste from health-care activity; WHO. Geneva. 1999]

Health Impacts of BMW on Community of Ujjain City

Exposure to hazardous health-care waste can result in disease or injury. The hazardous nature of health-care waste may be due to one or more of the following characteristics:

- it contains infectious agents
- it is genotoxic
- it contains toxic or hazardous chemicals or pharmaceuticals
- it contains sharps

In spite of high sickness rate among the sanitation staff dealing with health care waste, the awareness regarding the protection of their bodies and manual handling was found to be missing. The common perception is that "everybody else is doing the same so there lays danger in doing it myself. No body was found wearing an\ protective gears, spectacles, shoes and hand gloves even. These items are considered to be a luxury and were thought to hinder the work. Besides they complained that the same are not provided by their employers like hospitals and municipalities. The sanitation staff do understand the relation of waste and diseases but they replied that they have been doing the same for a very long time (ranging from 8-20 years) so they have become immune to many health problems The sanitation staffs working in hospital and health care facilities get free medication from their place of work or from municipal clinics.

They are not provided with gloves while the treatment takes place, which might be infectious to them. They are open to the diseases of the patients, as the public hospitals do not provide them with proper equipment and facility. The nurses, sweepers and cleaners are not aware of taking any precautionary measures while disposing the hazardous hospital/clinical waste. The scavengers outside the hospitals are exposed to the hospital/clinical waste, as the waste is disposed into the UMC dustbin. Studies have not been carried out on the health effects of the community those who are exposed to the hospital/clinical waste in Ujjain. But, short information is given some evidence that exposure to hospital/clinical waste there might be some possibility of health effects in future. Mainly people at risk to hospital/clinical waste in Ujjain City are:

- cleaners
- sweepers
- nurses
- scavengers

Problems faced by the Health Care Institutions.

The problems faced by health care institutions in the management of biomedical wastes are many. Even though the problems faced by health care institutions in the public and private institutions are almost the same there are lots of differences. The problems faced by health care institutions are:

e. **Inadequate space –** The health care institutions are constructed and operate in places where there is no scope for any future expansion. In many cases during the establishment of institutions there was no consideration on the waste management. So now the health care institutions are finding it very difficult to find suitable and adequate space in their hospitals to accommodate the waste treatment and disposal facilities.

f. **Lack of funds –** In general it is felt that there is no scarcity of funds in the private health care institutions. However adequate priority is not given for the biomedical waste management. All are having a notion to install some type of incinerator and incinerate all waste irrespective of its category or type. There is a notion that incineration of waste is the one and only option of waste management. The segregation procedures suggested, which are mandatory, in the rules are mostly not taken into account. However in the case of government hospitals. Finance is the vital problem. At present there is no budgeted allocation of funds. And hence these health care institutions are facing of problem for purchasing biomedical waste containers/bags, making facilities for storage of waste, establishing treatment facilities, disposal of treated waste, etc. Lack of fund allocation specifically for these purposes prevents institutions for going for the management of biomedical waste. Most of the hospitals in the Govt, sector are finding it difficult to mobilize adequate resources for establishing waste treatment and disposal facilities.

g. **Awareness –**The waste management techniques suggested in the Rule is quite new to all and different from which was followed by the institutions till 1998. Health care institutions as per the information available were doing the waste management by dumping in the backyard and in most cases adequate attention was not given to waste management. All institutions try to some or other to avoid the waste. The Rules suggests highly scientific and best biomedical waste management methods so as to avoid all

types of environmental as well as health effects due to mismanagement of waste. The management specifications and suggestions try to avoid all sorts of occupational health problems to workers as well as to the general public. The environmental and health effects of techniques like mixing of waste with other wastes and incineration of waste are also addressed. The true and correct awareness of the scope of the Rule as well as the biomedical waste management is to be imparted to all health workers irrespective of their type of work.

h. **Inadequacy of waste management system –** At present the waste management system is lacking in most health care institutions particularly so in most of the public health care institutions. The lowest level of staff is supposed to manage the waste as per their will and pleasure. This has to be changed and altered drastically. Modern techniques like formation of committees comprising of members representing all category of staff can improve the situation.

i. **Lack of monitoring facilities –** At present there is no monitoring system to assess the waste management facilities available are carried out effectively and as expected. Periodical meeting of waste management committees can improve the system.

j. **Responsibility is not fixed –**The responsibility of waste management and connected matters are not made mandatory to any officer of health care institutions. It is true that the head of institutions is responsible. However the head of institutions has to find out suitable officer under him and give responsibility on these matters along with powers for carrying out the works.

g. **Non-availability of equipments –** There is a problem regarding the non-availability of required instruments, waste containers/bag Etc. of required specification.

Result & Discussions

Activities for good management practices – Bio-medical Waste Management means the management of waste produced by hospitals using such techniques that will help to check the spread of diseases through it. Handling, segregation, mutilation, disinfect ion, storage, transportation and final disposal are vital steps for safe and scientific management of biomedical waste in any establishment. The key to minimization and effective management of biomedical waste is segregation (separation) and identification of the waste. The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into color coded plastic bags or containers. Biomedical waste should be segregated into containers/ bags at the point of generation in accordance with Schedule II of Biomedical Waste (management and handling) Rules 1998

a) **Segregation** In the process of waste management the segregation of wastes is the most important prerequisite. Segregation allows special attention to be given to the relatively small quantities of infectious wastes and thereby reducing the risks as well as cost of handling and disposal of the otherwise 100% infectious waste. Segregation at the point of generation itself is mandatory. . All personnel generating and handling, waste should be trained in handling different categories of it. The segregation and storage of sharps needs special attention because pathogens can survive for long periods in articles such as needles due to presence of blood. Any cuts in the skins of handlers provide a direct route for pathogens to enter the blood. In institutions, which generate hazardous substances such as radioactive waste, special training should be provided. Every individual in the institute should be aware of the waste quantity generated and the type of waste generated. Waste quantification is also a part of segregation. Details on waste quantification can be obtained from the section on Waste Generation Matrix.

b) **Storage:** Different categories of segregated wastes need to be collected in Color-coded containers as prescribed in the Bio-Medical Waste (Management and Handling) Rules. 2000. Sharps must always be kept in puncture-proof containers to avoid injuries and infection to the workers handling them. Plastic bags for storing the waste must be suspended inside a frame or be placed inside a sturdy container. A lid should be provided to cover the opening of the bag. Laboratories and other functional areas should have containers/bags for the wastes generated there. In all rooms of a hospital, there should be a container for general waste. All wastes from isolation wards should be regarded as infectious and treated as such. Each container must be clearly labeled to show where it comes from because it may be necessary to trace the waste back to its source. For example, if a waste collector is injured by a syringe or blade put into the wrong container, it is possible to determine the origin of the waste and identify the staff member responsible. It may also help in determining the type of infection that may

have been transmitted. The storage time for each category of waste generated should be determined; wastes such as placenta which cannot be stored for long durations should be collected early. Ideally, waste should be collected at least twice a day.

c) **Pre-treatment:** Some pre-treatment should be carried out at the point of waste generation. Syringes and needles should be damaged before putting into the containers so that rag-pickers are dissuaded from collecting them for resale. This saves the needles from getting recycled at a later stage. Sharps should be disinfected at source using chemical disinfectants. Laboratory waste and highly infectious waste such as body parts with ganger or HIV-infected blood should also be pre- treated and disposed immediately. For liquid bio-medical waste, pre-treatment is a must.

d) **Recycling:** Recycling of waste is an important option which needs to be looked at during the pre- treatment stage wherever possible, and should be considered. Recycling of organic waste generated form kitchens and canteens is a very good practice. This could be undertaken at a very low cost within the premises itself. Other substances that could be recycled are paper, plastics and metals. However, the economics of recycling these wastes works only with bulk quantities which require waste to be stored for a longer duration. The environmental hazards or the benefits of recycling should also be considered. The possibility of centralized or common collection system from all the institutions generating it could be established for recycling waste. A schedule could be established for frequency of collection of each type of recyclable.

e) **Internal Transportation:** The transport of bio-medical waste is an important aspect and must be considered as it moves to storage facilities, pre-treatment post-treatment or onsite disposal facilities. The segregated waste should always be collected and transported separately. Mixing the segregated waste should be strictly prohibited. The waste receptacles and equipment used for carting the waste should be used exclusively. This equipment should be cleaned and disinfected routinely. A minimum path for routing the waste within the institution should be maintained to minimize the spread of secondary infections.

f) **Post-treatment:** The waste which is transported to the collection point, ready to be transported elsewhere, could also undergo treatment. An autoclave or microwave technology could be used to treat the infected waste. An incinerator could also be set up to treat certain waste. Pre-treated waste could be shredded or macerated to help reduce its volume. For liquid bio-medical waste post- treatment is a must.

g) **External transportation:** All medical waste, except general and non-hazardous waste, should be kept separate at all stages from general municipal waste. Special vehicles must be used to prevent access to and direct contact with the waste by transportation operators, scavengers and the public. The containers should be properly enclosed during transport and waste tracking practiced mandatory. It should also be possible to wash the interior of the containers thoroughly. Accidents should be taken into consideration and the driver trained in the procedures to be followed in case of an accidental spillage.

h) **Final Disposal:** Care should be taken to reduce the waste as much as possible before it is finally disposed. Only hazardous substances such as treated incinerator ash should be disposed of after retrieving the recyclable portion. The liquid waste should be disposed of in sewers or septic tanks and the solid waste into landfills

i) **Common Biomedical Waste Treatment and Disposal Facility –** There is strong need of common facilities for Bio-medical Waste disposed in Ujjain. This will have latest technology to minimize environmental problems and to achieve optimum output. A common biomedical waste treatment and disposal facility (CBWTDF) is a set up where biomedical waste, generated from a number of health care facilities, is imparted necessary treatment to reduce all adverse effect that these wastes may pose. The treated waste may finally be sent for land filling or other recycling purposes. Installation of individual treatment facilities by small health care establishments requires comparatively high capital investment. In addition, it requires separate manpower and infrastructure development for the proper operation and maintenance of treatment systems. The concept of CBWTDF not only addresses such problems but also prevents scattering of treatment equipment in a city.

In turn it reduces the monitoring pressure on regulatory agencies. By running the treatment equipment at CBWTDF to its full capacity, per kilogram cost of treatment of waste gets significantly reduced. Its considerable advantages have made CBWTDF popular and proven concept in many developed countries. First step of management waste segregation is accomplished in hospital into following categories.

i. Recyclable
- Metals
- Glass
- Plastics

ii. Not recyclable
- All other waste (which is incinerated)

Then this waste is collected in well managed transporting vehicles & transported lo common disposal unit. In disposal unit different method of disinfection is used for both categories for recyclable waste following step is to be done
- Disinfection by steam autoclaving and
- volume reduction by crushing

k. And for non recyclable
   i. Disinfection by incinerator (electrically operated)
   ii. volume reduction is also done in by incinerator
   iii. disposing off of ash

l. To make good management we will be used waste heat boiler from exit gas of incinerator & Steam produced by this boiler is used for steam autoclaving.

m. To minimizing air pollution we used electrostatic precipitator for removing ash from exit gas of incinerator

n. Collected ash mixed with condensate water from steam autoclaving & by compression small bricks is made from this ash.

o. This small bricks disposed off in safe land filling & this land is used for plantation. Operating cost can be collected by from waste generating hospitals by charging them waste disposal fees.

Conclusion

In conclusion, the following problems have been identified:

a. Lack of definite policies and budget allocation at the provincial and hospital level regarding Bio-medical Waste management.

b. Lack of proper training for different personnel of the hospitals, especially the staff responsible for Bio-medical Waste management regarding the hazards and correct management of Bio-medical Waste.

At present in Ujjain environment pay fees of human health in the form of different pollution by biomedical waste. But different governing authorities must make it change in the favor of environment. This can be achieved by

i. Minimizing the waste production
ii. Making common system for waste disposal

Some steps should be taken for the minimization of Bio-medical Waste. Before any clear improvement can be made in medical waste management, consistent and scientifically based definitions must be established as to what is meant by medical waste and its components, and what the goals are. Plans and policies should be laid down for this purpose. Then the waste should be segregated. Imposing segregated practices within hospitals to separate biological and chemical hazardous waste will result in a clean solid waste stream, which can be recycled easily. If proper segregation is achieved through training, clear standards, and tough enforcement, then resources can be turned to the management of the small portion of the waste stream needing

Reference

http://wvvw.kspcb.kar.nic.in

http://www.ujjain.nic.in

Pollution Control Board, Ujjain

Municipal Corporation ,Ujjain

Pruss, A: Townened. W.K. 'Teacher's Guide: Management of wastes from healthcare activities'. World Health Organization (WHO). Geneva. 1998.

Pruss, A; Giroult, E; Rushbrook. P. 'Safe management of wastes from health-care activities''. World Health Organization (WHO). Geneva. 1999.

Quality Improvement of Juran Institute Inc. USA Compiled by TMDC 1996.

The Quality Pocket Book by Anthony Mitchell. 1997.