International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol.1, Issue 1, April 2014, pp. 39-46
***Available Online* at www.ijgsr.com**

Research Paper

Determination of hospital waste composition and their disposal methods in Shivpuri town: Case study

Anand Kumar Mishra* and Mohit Arya
Department of Zoology, Govt. P.G. College, Shivpuri-473551, MP, India
Department of Zoology, Govt. K.R.G. P.G. College, Gwalior-474004, MP, India
*Corresponding author, Email: anand81795@gmail.com

Received: 18/04/2014
Revised: 19/04/2014
Accepted: 22/04/2014

Abstract: Bio-Medical Waste, (BMW), consists of solids, liquids, sharps and laboratory waste that are either putrescible or potentially infectious. BMW may also include waste associated with the generation of waste that visually appears to be of medical or laboratory origin (e.g., packaging, unused bandages, etc.), as well research laboratory waste containing biomolecules or organisms that are restricted from environmental release. The fundamental information for selecting and designing the most efficient treatment method of hospital waste is obtained by means of waste composition analysis. Therefore, the aim of this study was to evaluate the physical and elemental composition of waste in hospitals in Shivpuri town M.P. There is one district government hospital and associated T.B. hospital having 198 and 20 beds respectively. 07 nursing homes and 21 clinics cater the needs of the patients. The 07 nursing homes collectively have only 108 beds. The study reveals poor waste management practices in hospitals and suggests measures to dispose harmful waste matter not environment pollution and health risk.

Keywords: Bio-Medical Waste, Hospitals, Health, Management, Shivpuri Town.

Abbreviations: Bio-Medical Waste (BMW), Immunodeficiency virus (HIV), Hepatitis B virus (HBV).

INTRODUCTION

Hospital waste consists of mainly three types of group wastes: medical waste, infectious waste and domestic waste. “Medical waste” refers to the materials accumulated as a result of patient diagnosis, treatment or immunization of human beings (Ministry of Environment 1998, B.L.Wadhera v/s Union of India and others, 1996). “Infectious waste” refers to the portion of medical waste that is in contact with a patient who has infectious disease and it is capable of producing an infectious disease. Most of the time, medical waste is considered to be infectious waste, if medical

waste and other waste are not collected separately. Traditionally, hospital wastes are disposed of with the municipal wastes in landfills. However, since late 1980's, the spreading trend of immunodeficiency virus (HIV), hepatitis B virus (HBV) and other agents associated with blood bone diseases has raised public awareness and concerns of the disposition of medical waste. As a result, medical waste is required to be treated in a special way and not to be mixed with municipal waste. Proper medical waste management requires special treatment of medical waste such as incineration of hazardous waste landfill facilities. Former studies have shown that the best available technology for disposing of medical waste is incineration (The Bio Medical Waste (Management and Handling) Rules, 1998, Report of High Power Committee on urban Solid Waste Management, Planning Commission, Govt. of India, 1995, Gravers P. D. Management of Hospital Wastes- An overview1998). The proper collection of hospital waste will reduce the volume of infectious wastes and consequently the cost of treatment.

MATERIALS AND METHODS

In order to determine the total daily rate and characteristics of wastes from hospitals and nursing homes, each unit of hospitals was visited every month for a period of two years. During these visits, the total medical waste of each unit was weighed. Then, the waste was separated into groups according to type of waste such as paper, textiles, plastic, glass, etc. and waste groups were weighed again. Samples were taken from each group and transported to the laboratory in order to determine moisture content for which the samples were first In order to determine moisture content of waste the samples first were weighed, then dried at 105^0C for 24-hours and weighed again. The ratio of dried weight to weight before drying multiplied by 100 gave the moisture content as a percentage (%). In order to estimate the hospital waste generation rate as kg/bed/day, kitchen waste of each unit was also added to each unit waste. The number of overnight patients was has also recorded. Then, the waste generation rate was calculated by the following equation.

$$Wday = (Wmed + Wkit) / Np$$

Where,
Wday- waste rate (kg /bed/day-unit)
Wmed- total medical waste (kg/day-unit)
Wkit- total kitchen waste (kg/day-unit)
Np- the number of overnight patients

RESULT AND DISCUSSION

There is one district government hospital and associated T.B. hospital having 198 and 20 beds respectively. 07 nursing homes and 21 clinics cater the needs of the patients. The 07 nursing homes collectively have only 108 beds. The details of waste material produced from hospitals, nursing homes and clinics are depicted in Table 1. A study of the government hospital waste disposal strategies showed that an incinerator is available in the premises of the hospital but it is not in use since last three years. The incinerator had damaged exhaust pipe. Waste generated from hospital is mostly thrown in the municipal nala traversing through the campus of the hospital. Plasters, bandages and blood soaked cotton can be seen littered in the nala which is sometime collected and burned. The government hospital also has two landfill sites on the campus but they have been filled and therefore closed. All the debris collected from the hospital wards and other areas of hospital is directly dumped in to the nala.

No disinfectant like lime is applied to the waste. Likewise the nursing homes also do not have proper mechanism for the disposal of solid and liquid medical waste. They also dispose off their waste by burning and throwing in to the nala. Surprisingly the nala is a part of city's sewage system and through Jadhav Sagar Lake and Karbala stream, the water of the nala reaches Madhav Lake through Sakhya Sagar Lake from where treated drinking water is supplied to the city. In this way disposal of waste from hospitals is in measurable condition and is a threat to the health of the people.

Table1. Hospital waste generation in Govt. and private hospitals of Shivpuri town (kg./day).

S. No.	Waste type	In Govt. hospitals	In nursing home/ clinics	Required treatment
1	Human anatomical waste	4.10 ± 0.62	1.02 ± 0.20	Infected wastes to be disposed through incinerator and non infected waste through deep burial
2	Laboratory samples and other subsidiary products.	4.11 ± 0.51	2.11 ± 0.22	Disinfection, autoclaving and shredding
3	Disposal syringes, needles, blades, glass and other wastes	2.12 ± 0.42	1.00 ± 0.24	Disinfection, glass and metals separated and dumped
4	Infected garbage, bands, plasters, cotton, beddings, packaging, blood stain cotton and other products.	8.75 ± 1.12	2.03 ± 0.20	Incinerator/ autoclaving
5	Ash originates through incineration of different wastes	Non functional	Not available	In landfill

The issue of indiscriminate Bio-Medical Waste management in India has attracted the attention of the highest judicial body at the level of Hon'ble Supreme Court of India and Apex Court has, from time to time issued instructions regarding management of BMW. In this background 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; under the provision of Environment Protection Act 1986. Accordingly all the hospitals in the public and private sector are now bound to follow these rules to evade legal action. Patil and Pokhrul (2005) suggested that even though there are rules stipulating the method of safe disposal of biomedical waste (BMW) generated by the Government hospitals is sometimes collected along with general waste. According to WHO (2004), the human element is more important than the technology alone. Almost every system requires treatment and disposal that is operated by well trained and well-motivated

staff, provides more protection for staff, patients and the community, than an expensive and sophisticated system that is managed by staff who do not understand the risks and the importance of their contribution (WHO, 2004). Sandhu and Singh (2003) emphasized that biomedical waste management is a special case where the hazards and risks are not for the generator and operators but also for the general community. Dwivedi *et al*., (2009) on the basis of "self-assessment audit form" which consisted of 122 parameters divided into 32 broad categories found that infections components of hospital waste are very little. However, in most of the cases it was not being disposed as per the norms. Altin *et al*., (2003) studied the daily waste generation rate of four hospitals which was 985 kg/day, projected to be 1267 kg./day in 2015. Pandey and Chaplot (2005) reported that even in the metropolitan cities only a few hospitals strictly comply with biomedical waste rules (1998). On the basis of their study on 22 hospitals they reported land burial to be the main approach of biomedical waste in Udaipur city. According to a WHO report, around 85% of the hospital wastes are actually non-hazardous, 10% are infective (hence, hazardous), and the remaining 5% are non-infectious but hazardous (chemical, pharmaceutical and radioactive).

Health Hazards from Indiscriminate Management of Bio-Medical Waste

There are many examples and ample evidences that indiscriminate management of BMW could cause serious hazards to health and environment.

There are many harmful agents in the BMW. The most important are biological agents, which pollute water and food and cause alimentary infections like cholera, typhoid, dysentery, infective hepatitis, polio, hook worm diseasesand ascariasis etc.

Wastes breed vermin and pests. Examples are:

a. Mosquitoes that transmit insect borne diseases like malaria and filaria.

b. Common house flies which transmit infections mechanically.

c. Many other insects and worms that cause nuisance e.g. cockroaches, ants, dog, Rats thriving on refuse. Dust may harbour *Tubercle Bacilli* and other germs, which cause diseases if inhaled. Soil polluted by night soil may be rich in *Tetanus spores*.

Who are at more risk?

The doctors, nurses, technicians, washer mans, sweepers, hospital visitors, patients, rag pickers and their relatives are exposed routinely to Bio-Medical Waste and are at more risk from the many fatal infections due to indiscriminate management.

Why Bio-Medical Waste needs Management?

It is needed due to health, Environmental, legal and aesthetic reasons in addition to Ethical reasons.

Ethical aspect

The ethical aspect related to the social responsibilities, which the health professions have, as a result of their status, knowledge and skills and an obligation to alert those who are at risk. This is reflected by the compulsory notification of infectious and notifiable diseases as a measure of public welfare. As regards Bio-Medical Waste management health professionals, bear a responsibility to act in such a way to prevent exposure to various health hazards and exposures to dioxins'. As Bio-Medical Waste are the major source of dioxins production during incineration, which are generally cause of incurable cancers, the Medical ethics dictate that prevention must

be carried out as we all are bound by Hippocratic oath.

Reasons for indiscriminate management and handling of Bio-Medical Waste

•Lack of priority in policy on BMW and funds on the issue.
•Lack of managerial skill and Training of Bio-Medical Waste Management.
•Lack of appropriate technologies for treatment and disposal of Bio-Medical Waste.
•Lack of Strict implementation of infection control measures like sterilization and disinfectant techniques.
•Lack of awareness among medical personal, patients, attendants and people at large.
•Lack of coordination between municipality, Pollution Control Board and hospital authorities.
•Lack of accountability of persons involved in the management of Bio-Medical Waste.

Management of Bio-Medical Waste:

Segregation of Bio-Medical Waste

Segregation means "separation of different types of wastes by sorting or the systematic separation of Bio-Medical Waste into designated categorized.

Significance

It is the most important step in the entire process of BMW management. It needs special attention to be given to the relatively small quantities of infectious and hazardous waste, thereby reducing not only the risks but the cost of handling, treatment and disposal. For example if general waste gets mixed with infectious waste, the whole waste has to be incinerated which may prove to be costly.

Who are responsible for segregation?

It is universally accepted fact that segregation of Bio-Medical Waste is and should be the responsibility of the generator of the waste. The generators of the waste may include doctors, nurses, paramedical staff, patients, and their attendants. These Medical persons who are educated and trained surprisingly they are least bothered about the amount, quantity and type of waste they generate and the way it is disposed.

Why Emphasis on sharps?

During segregation special emphasis should be given to infectious, hazardous and sharp wastes. From amongst all categories of waste, the "sharps" which include syringes, needles, guide wires, broken glassware's, scalpel, blades etc. have the highest disease transmission potential. Almost 85% of sharp injuries are caused between their usage and subsequent disposal and more than 20% of those handle them encounter "stick" injuries. The emphasis should be on safe handling, rather than on the various treatment and disposal options, however, use of needle cutter or needle malter is of great help. The staff involved in BMW Bio-Medical Waste handling should be given all personal protection measures such as caps, masks, gum boots, gloves etc. They should also bevaccinated for Tetanus and Hepatitis B and should follow health check up along with keeping record of their health status.

Solution

Till the doctors do not wake up to this problem, the ground reality will not improve in any way. Thus it can be very well said that "sensitizing" the generators of waste to properly segregate the waste at the source of generation is the "Key" to the successful implementation of Bio-Medical Waste (M&H) Rules 1998.

Containers

The dustbin should be light with a cover and size enough to be carried by a person. Inner plastic bag is also used to facilitate the lifting of waste content for transferring coloured bags/dustbins should be placed in

different parts of the hospital. Labeled with instructions in regional language, Segregation and collection both can be considered as being complementary to each other.

Keep Focused On Reduction

Hospitals in the Third World generate significantly less volumes of waste than U.S. hospitals. In part this is a result of a decision to maintain a system that relies on reprocessing and reuse of materials. Establishing clear guidelines for product purchasing that emphasized waste reduction will keep waste management problems in focus. New emphasis needs to be put on waste reduction of hazardous materials. For example, hospital waste management would benefit from a policy of a phase out of mercury-based products and technologies. Digital and electronic technology is available to replace mercury-based diagnostic tools. This is a purchasing and investment decision. Since there is no capacity in most countries to safely manage mercury wastes, this reduction policy will make a serious contribution to cleaning up the hospital waste stream. This is one example of reduction strategies which could be identified and implemented in all countries. Practicing pollution prevention is the most cost effective way of securing public health.

Ensure Worker Safety through Education, Training and Proper Personal Protective Equipment

Workers who handle hospital wastes are at greatest risk from exposure to the potentially infectious wastes and chemical hazardous wastes. This process starts with the clinical workers who generate the wastes without proper knowledge of the exposure risks or access to necessary protective gear, and includes the workers who collect and transport the wastes through the hospital, the staff who operates a hospital incinerator or who take the waste to municipal bins, the municipal workers who collect wastes at the municipal bins and transport it to city dumping sites, and the rag pickers, who represent the informal waste management sector, but play an important role in reducing the amount of waste destined for ultimate disposal. Whether rag pickers are considered as part of the formal system or not, they are integrally involved in waste management and their unique role and personal safety and health needs must be considered. Proper education and training must be offered to all workers from doctors to ward boys, to laborers and rag pickers to ensure an understanding of the risks that wastes pose, how to protect themselves, and how to manage wastes (especially how to properly segregate). Education and training programs must be developed which speak to each population in a way that will best meet the needs and build understanding and change behavior in that population. There is no “one” way to educate all workers.

Provide Secure Collection and Transportation

If the benefits of segregation are to be realized then there must be secure internal and external collection and transportation systems for waste. If waste is segregated at the point of generation only to be mixed together by laborers as they collect it, or if a hospital has segregated its waste and secured it in separate containers for ultimate disposal only to have municipal workers mix it together upon a single collection, then the ultimate value is lost. While worker safety may have been enhanced, the ultimate cost to the environment and the general public is still the same. In addition the very real concern of hospital administrators and municipal officials to prevent their use of medical devices, containers and equipment

after disposal should be taken into account in any management scheme. In addition, the practice of cleaning and reselling, syringes, needles, medicine vials and bottles, is not well documented but appears to have enough informal evidence to indicate that it is a serious concern. Items that could potentially be reused illegitimately must be either rendered unusable after their use (cutting needles, puncturing IV bags, etc.) or secured for legitimate recycling by avendor or system that can be monitored for compliance.

Require Plans and Policies

To ensure continuity and clarity in these management practices, health care institutions should develop clear plans and policies for the proper management and disposal of wastes. They need to be integrated into routine employee training, continuing education, and hospital management evaluation processes for systems and personnel.

Conclusion

Shivpuri town currently is facing a biomedical waste dilemma, for which all elements of the society are responsible. The community sensitization and public awareness is low. There is no system of segregation in hospital level. It is universally accepted fact that segregation of BMW is and should be the responsibility of the generator of the waste. The generators of the waste may include doctors, nurses, paramedical staff, patients, and their attendants. These Medical persons who are educated and trained surprisingly they are least bothered about the amount, quantity and type of waste they generate and the way it is disposed. There is an adequate legal framework existing in the country to address hospital waste management. What is lacking is its implementation. In spite of a stringent legislation, open dumping is the most wide spread form of waste disposal. The possible reasons for poor implementation could be a combination of social, technical, institutional and financial issues. Public awareness, political will and public participation is essential for the successful implementation of the legal provisions and to have an integrated approach towards sustainable management of BMW in the Shivpuri town.

REFERENCES

Wadhera B L (1996) v/s Union of India and others, Judgment today (3) SC: 38-51.

Practitioner J K (1998) The Bio Medical Waste (Management and Handling) Rules, 8(4), 2001, 281.

Gravers P D (1998) Management of Hospital Wastes- An overview. Proceedings of National workshop on Management of, Govt. Of India, (1995). Hospital Waste Management: 35-47.

Patil G V and Pokhrel K (2005) Biomedical solid waste management in an Indian hospital a case study. Waste Management. 25: 592-599.

WHO (2004) World Health Report WHO, Geneva.

Sandhu T S and Singh N (2003) A Hazard Going Unnoticed – Biological Waste is a Threat to the Community at Large, The Tribune, Online edition, Chandigarh, India, Monday, June 30.

Dwivedi A K, Pandey S and Shashi (2009) Fate of hospital waste in India. Biol. Medic., 1(3), 25-32.

Altin S, Altin A, Elevli B and Cerit O (2003) Determination of hospital waste composition and disposal methods: A case study. Polish. J. Environ. Stud., 12(2), 251-255.

Pandey J and Chaplot K (2005) Environmental status Evaluation of Bio-medical waste at Udaipur. Ind. J. Environ. Prot., 25(11), 1016-1020.

Ministry of Environment (1998) Waste characterization and quantification; "Parivesh" Newsletter on Hospital Waste l.4 (IV) March, CPCB. Ministry of Environment 6c Forest, Govt. of India, New Delhi: 3-4. Report of High Power Committee on urban Solid Waste Management, Planning Commission.