Reviews of Literature
Impact Factor : 1.4716 (UIF)
Volume 2 , Issue 3 / Oct 2014 ISSN:-2347-2723

CHALLENGES OF BIO-MEDICAL WASTE ACCUMULATION AND MANAGEMENT IN URBAN AREAS: A STUDY OF ITANAGAR TOWN OF ARUNACHAL PRADESH

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Abstract:

Biomedical waste can be defined as a hazardous waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities in these fields. The biomedical waste means any waste which is generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining thereto or in the production or testing of biological materials. Biomedical Wastes include anatomical waste, pathological waste, infectious waste, hazardous waste and other wastes generated in hospitals and medical laboratories, which require special handling. These wastes are highly infectious and can be a serious threat to human health if not managed in scientific manner. It has been roughly estimated that of 4 kg of waste generated in a hospital at least 1 kg could infectious. The Institutions which generate biomedical wastes include a hospital, nursing home, clinic, dispensary, veterinary institutions, animal home, pathological laboratory, blood banks etc. It has been found that the amount of hospital wastes generated by U.S.A is 4.5 kg/bed/day, U.K. 2.5 kg/bed/day and India 1.5 kg/bed/day. The total quantity of hospital wastes generated in Arunachal Pradesh is approximately 60 kg/day and 0.092 kg/bed/day. The present study examines the volume of hospital wastes accumulation and its management in the Itanagar town on the basis of primary data.

Key words: *Bio-medical waste, hazardous, infectious*.

INTRODUCTION

Biomedical waste is defined as a hazardous waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities in these fields. It means any waste which is generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining thereto or in the production or testing of biological materials. A huge amount of potentially infectious and hazardous wastes are produced every day in different health care hospitals facilities around the world (Cole, 1995). A special concern focuses on effective management of biomedical waste incorporating an appropriate waste reduction and neutralization component (Diaz and Savage, 2003). Among other waste

management, the bio-medical waste management is process which helps to ensure proper hospital hygiene and safety of health care workers and communities. With this indication a proper and systematic approach of biomedical waste management is essential as without proper supervision, the hazardous medical waste management may compromise the quality of patient caretaking.

Hospital waste is now a burning issue due to the recent awareness in public regarding various ailments like HIV, AIDS, and Hepatitis B and exposure to discarded needles, syringes and other medical waste from Municipal Garbage Bins and disposable sites. There are several rag pickers who collect the discarded materials and sell them to earn livelihood. They are exposed to the risk of injuries from infected needles and other sharp objects.

Biomedical Wastes (BMW) include anatomical waste, pathological waste, infectious waste , hazardous waste and other wastes generated in hospitals and medical laboratories , which require special handling (Banerjee and Bagchi, 1999). These wastes are highly infectious and can be a serious threat to human health if it is not managed in scientific manner. It has been roughly estimated that of 4 kg of waste generated in a hospital at least 1 kg could be infectious. Improper practice of hospital medical wastes disposal affects the Para-medical staffs, rag pickers, and the citizen in general besides the medical people who directly come in contact with these wastes.

A substantial part of the total biomedical waste generated by hospitals is potentially hazardous due to infectious nature (USEPA, 1978, 1986). So, proper and protected waste disposal practices will lead to the reduction in medical expenditures, which is a burden of the society, unsightly scene at various communal disposal bins and dump sites. The Institution which generates biomedical wastes includes a hospital, nursing home, clinic, dispensary, veterinary institutions, animal home, pathological laboratory, blood banks etc.

Ministry of Environment and Forest, Government of India has laid down guidelines for handling of Biomedical Waste (Management & Handling) Rules 1998. These guidelines have highlighted segregation, storage, treatment and disposal of bio-medical wastes. Besides, the types of containers colour coding and labels to be used are defined. It is the duty of every biomedical waste generator to dispose of the biomedical wastes safely.

HOSPITAL WASTES CLASSIFICATION

Hospital wastes include different types of wastes, which are produced by different branches in a hospital. These may be generated from general office wastes which include human resources, public relations, gift shops, receiving and shipping and security. Hospital Wastes also generates from housekeeping, laundry processing, which are completely reusable wastes. Similarly, hospital kitchens also produce some wastes like wasted foods and vegetables remaining which are solid wastes by nature. The wastes generated from clinical areas like wards, laboratory, radiology, pharmacy, OT. , ICCU, post mortem cell etc. are generally infectious (about 15%) and hazardous (about 5%) wastes.

Table 1
Different Categories of Bio-medical Wastes

Sl.No.	Category of Wastes	Type of Wastes includes
I	Pathological Waste	Human tissue such as limbs, organs, foetuses, blood and other body fluids. Animal carcasses and tissues from laboratories. Related swabs and dressings.
II	Infectious	Soiled surgical dressing, swabs Material which has been in contact with persons or animals suffering from infectious diseases. Waste from isolation wards. Cultures or stocks of infectious agents from laboratory. Dialysis equipments, apparatus and disposable gowns, aprons, gloves, towels etc.
III	Sharps	Any item that can cut or puncture such as Needles, Scalpels, Blades, Saws, Nails, Broken Glass etc.
IV	Pharmaceutical Waste	Drugs, Vaccines, Cytotoxic drugs and Chemical returned from wards. Out dated drugs etc.
V	Chemical Waste	Any discarded solid, liquid or gaseous chemicals from laboratories, cleaning, disinfection etc. These wastes may be hazardous or non- hazardous. Hazardous chemicals are those that are corrosive, flammable, reactive genotoxic. Non-hazardous chemical wastes do not Exhibit the above properties such as Inorganic salts, buffer chemicals, amino acids, sugars, etc.
VI	Aerosols and Pressurized Containers	Containers
VII	Radioactive Waste	Solids, liquids and gases from in vitro analysis of body tissue and fluid.

Source: Ministry of Environment and Forests Notification 20th July, 1998.

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Improper hospital waste management and uncontrolled dumping of these wastes causes a threat to the surrounding environment. Proper collection and disposal of hospital wastes is very essential for the overall health of the people. The hospitals and nursing homes can also be termed as healthcare units (Akhtar et. al, 2002; Acharhulu, M.S., 2001).

This study will give an insight regarding the appropriate amount of biomedical solid waste generated and disposal practices adopted by the different hospitals and nursing homes in Itanagar town. The total quantity of hospital wastes generated in Arunachal Pradesh is approximately 60 kg/day and 0.092 kg/bed/day as per the report by the SPCB, 2009.

There are three sections in this paper. The first section deals with the methodology. The second section deals the results and discussion of the study and to finish the conclusion follows.

SECTION-I

METHODOLOGY

The present study is based on a primary survey of bio-medical wastes in the capital city of Arunachal Pradesh. A random sample survey of four hospitals was conducted in Itanagar town in order to examine the extent and composition of bio-medical wastes generated by different types of hospitals and nursing homes of Itanagar town. The table 2 shows that total four hospitals were surveyed, among which one government hospital, one NGO run hospital and two private hospitals.

Table 2
Types of Hospitals Surveyed in the Study Area

Types of Hospitals	No. of Hospitals & Nursing Homes
1.Government Hospitals	1
2.NGO Run Hospitals	1
3.Private Hospitals	2
Total	**4**

Source: Field survey, 2012

The survey was conducted in different types of hospitals like government run hospitals, NGO run hospitals and privately run hospitals so that the individual information regarding biomedical generation and its management can be observed along with the overall information of the same in the town as whole.

SECTION-II

RESULTS AND DISCUSSION

The survey results show that biomedical waste generation per day in Itanagar town was found to be 577.805 kg and 1.35 kg per day per bed which was much higher than the estimate of around 60 kg per day and 0.092 kg per day per bed in Arunachal Pradesh as whole as per the report of the State Pollution Control Board (SPCB), 2009. However there are little variations of different types of bio-medical wastes generated as shown in the table 3.

Table 3
Different Types of Total Hospital Wastes generated per day *(in kg)*

Sl. No	Types of Hospital Wastes	Total Amount of Wastes (kg)	Average Waste Generated per Hospitals (kg)
1	**Non-Infectious Waste:**	**157**	**39.25**
a)	General Office Waste	112 (71.33)	28.00
b)	Kitchen Waste	45 (28.66)	11.25
2	**Infectious Wastes**	**432**	**108**
a)	Sharps	32 (7.41)	8
b)	Pathological Wastes	134 (31.02)	33.5
c)	Infectious Plastic	245 (56.71)	61.25
d)	Cytotoxic Drugs and Chemical Solid Wastes	21 (4.86)	5.25

Source: Field survey, 2012

Note: Figures in parentheses indicate the respective percentages of Total.

The table shows that a total of approx. 157 kg of non-infectious wastes generated per day which includes general office wastes 112 kg (71.33 percent of the total) followed by kitchen wastes 45 kg (28.66 percent). Average general office wastes generated is 39.25 kg per day. A total of 432 kg infectious wastes generated per day in the capital city which includes sharps 32 kg (7.41 percent), pathological wastes 134 kg (31.02 percent), and infectious plastic 245 kg (56.71 percent), cytotoxic drugs and chemical solid wastes 21 kg (4.86 percent). The average general office wastes are found to be 28 kg per hospitals. Although average infectious plastic is found to be the highest among other types of average wastes per hospital which is 61.25 kg followed by average pathological wastes which is 33.5 kg and the quantity of average cytotoxic drugs and chemical solid wastes is found to be the lowest (5.25) kg per hospital among other wastes. The Table 4 explains the number of hospital beds, average waste generated per day per bed by different types of hospitals.

Table 4
Number of Hospital Beds, Average Waste generated Per Day and Per Bed by Different Types of Hospitals.

Sl.No	Types of Hospitals	No of Beds	Waste Generated Per Day (in kg)	Average Waste Generated Per Bed
1	Government Hospitals	150	380.805	2.54
2	NGO Run Hospitals	222	88	0.396
3	Private Hospitals	57	109	1.91

Source: Field survey, 2012

Table 4 shows that a government run hospitals in capital town of Itanagar has 150 beds and it generates approx. 380.805 kg of biomedical wastes in day and the average waste generated per bed per day is found to be 2.54 kg. It is observed that the NGO run hospital has 222 numbers of beds which generates about 88 kg of wastes per day and per day per bed waste generated is 0.396 kg which is quite lower than the figure of any other types of hospitals in the town. The total waste generated per day by the private hospitals is found to 109 kg and the average waste generated per day per bed is found to 1.91 kg which higher than that of NGO run hospitals but less than that of government run hospitals. It shows that NGO run hospital manage waste products more efficiently then that of Government run and private hospitals. For more details an attempt was made to examine the method and management of waste products of surveyed hospitals which is given in Table 5.

Table 5
Type of the Management of Hospital Wastes among surveyed Hospitals.

Sl.No	Collection and Disposal Activity	No of Hospitals	Percentage of Hospitals
1	**Use for Waste Collection**		
1.1	Closed container	03	75
1.2	Open uncovered container	-	-
1.3	Colour coded container	03	75
1.4	Both open and closed container	03	75
2	**Following Segregation Process**		
2.1	General Office Waste	04	100
2.2	Kitchen Waste	04	100
2.3	Sharp Waste	04	100
2.4	Pathological Waste	04	100
2.5	Infectious Plastic	04	100
2.6	Cytotoxic drugs and Chemical solid waste	04	100
3	**Following disinfection process:**		
3.1	Chemical disinfection	01	25
3.2	Autoclaving method for sterilization of infectious and sharp waste)	-	-
4	**Use of incinerator**		
4.1	Indigenous incinerator	01	25

4.2	One chambered incinerator	-	-
4.3	One chambered incinerator	-	-
5	**Dispose into municipal dustbin**		
5.1	General office waste	03	75
5.2	Kitchen waste	01	25
5.3	Sharp waste	-	-
5.4	Infectious pathological waste	-	-
5.5	Cytotoxic drugs & chemical solid waste	-	-
5.6	Deep burial	01	25

Source: Field survey, 2012

The table 5 shows that almost all hospitals (about 75 percent) hospitals in the town follow a proper method of hospital wastes management. They collect the wastes either in closed colour coded container or in open container, but not in uncovered open container. Besides, they follow the proper segregation processes for all types of biomedical wastes including general wastes, pathological wastes, kitchen wastes, infectious plastics etc. But the process of following disinfection is found to be very poor. For example, 25 percent of the surveyed hospitals are following the chemical disinfection. The processes of autoclaving method for sterilization of infectious and sharp waste are not found in the study. Regarding incinerator it is found that none of the hospitals are using incinerator except an indigenous incinerator by a hospital. Most of the hospitals are throwing their general office wastes and kitchen wastes in the municipal dustbins although some of them follow the deep burials of their wastes.

SECTION-III

CONCLUSION AND SUGGESTIONS

From the study it could be concluded that the health units dispose their wastes daily or within 48 hours of generations. Generally the wastes are collected manually (75 percent) and only 25 percent of the hospitals collect their wastes by using push cart.

From the study of the four major health units in the capital city of Itanagar, it is found that 50 percent of the hospitals follow the process of chemical disinfection. But no hospitals found to following autoclaving method for sterilization of their infectious (e.g. blood, urine bags, cotton, gloves, bandage etc) and sharps (e.g., needles, blade, etc), solid waste.

Segregation process was found satisfactory, as 100 percent hospitals in the city are following proper segregation process to segregate their general office wastes, kitchen wastes, sharp wastes, infectious pathological wastes, cytotoxic drugs and chemical solid wastes.

So, far as the availability of incinerator is concerned, no hospitals are found to have this facility in the entire city. Only one of the hospitals is found to be using an indigenous incinerator facility.

For the disposal of general office and kitchen solid wastes, it is found that 75 percent of the hospitals dump these wastes in the municipal dustbin, 25 percent of the hospitals use open burning and deep burial practices.

For the disposal of sharp wastes, 100 percent of the hospitals follow the deep burial method. But for disposal of infectious pathological solid wastes, 50 percent of the hospitals use open burning method of disposal. 25 percent of the hospitals have given the responsibility of waste treatment and disposal practices to a private party on contract basis. Besides, another 25 percent of the hospitals use landfill as the method of disposal.

The use of colour coated bins and bags found satisfactory. More than 75 percent hospitals use different types of wastes generated following the bio-medical rule. About 75 percent hospitals use red and yellow bags for collection of pathological wastes. Besides, 75 percent hospitals use red and white container for collecting infectious wastes. More than 75 percent hospitals use blue and white container for collection of glass, and blue and white container for metal sharps.

The analysis shows that the bio-medical waste management is average in the city. Although it is not alarming, yet there is an urgent need to improve the handling and disposal methods of bio-medical solid wastes. The violation of BMW rules, 1998 indicates that the concerned authorities are not sincere and vigilant. The State Government and the Pollution Control Board and the municipal authorities also should take intensive initiatives in this regard.

The following recommendations can be suggested-

1) The establishment of a common incinerator as per prescribed criteria is an effective alternative for proper method of disposal of infectious wastes in view of high individual cost of incinerator, especially for small healthcare units. Health department should make it

compulsory for the small nursing homes or hospitals to avail the facility of common incinerator as specified by BMW rule.

2) Necessary precautions should be followed as mentioned in the BMW rules during the disposal of toxic wastes by deep burial method to avoid any spillage to the environment.
3) All the hospitals should have incinerator facility.
4) Mixing of bio-medical solid wastes with municipal solid wastes in dustbins provided by the urban department should totally avoid as it may cause unhygienic situation and also aggravate the environmental pollution problems.
5) Intensive awareness and training programme should be conducted at various levels for the healthcare personnel to accelerate the implementation of BMW rules.
6) Heavy penalty should be imposed on those healthcare units, which are not complying with the provisions of BMW rules.
7) The hospitals which carry bio-medical solid wastes to the deep burials place should use only specified air tight vehicle for the purpose.
8) Trained personnel may be entrusted for collection of the wastes in the specified containers from the health units, for better disposal of bio-medical solid wastes.
9) The process of segregation of wastes at the point of generation should be implemented in all the hospitals in a move effective way so as to prevent spread of infection like hepatitis, drug resistant infection etc.

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