Biomedical Waste Management Systems for Urban Hospital

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Abstract—Hospitals produces waste, which are a special category of toxic and hazardous waste. Hospital waste generation is increasing over the years in its type and quantity. This bio-medical waste requires a systematic and scientific approach for their disposal to render it as hygienically and economically as possible, there by minimizing risk to health and environment. Biomedical waste management system includes segregation, storage, handling, collection, transportation and disposal of biomedical waste which are generated from hospitals and health care activities. This paper presents study of biomedical waste management system of an urban hospital. In present study data were collected to study and estimate the total amount of waste generated in hospital, and also to study the difference in waste generation and to determine overall waste generated per patient per day.

Index Terms—Biomedical waste, collection, waste generation, waste management.

I. INTRODUCTION

Hospitals have traditionally been regarded as places where sick people go to shed off their disease, infections, disabilities, depressions and worries and come out as healthy glowing people. Because of such yeomen services being rendered by hospitals they have always been worshiped or, have been held in high esteem in the minds of the general populace. However studies have painted a very different picture of hospitals. It has been documented that hospitals not only treat diseases and infections but also DO serve as places for the transmission and acquisition of infections.

Large majority of wastes generated as consequences of activities related to patients and hence such waste can be infectious. Hospital waste are a special category of toxic and hazardous wastes which require a systematic and scientific approach for their disposal, so that they might be disposed of as hygienically and economically as possible there by minimizing the risk to health and environment. The public health sequels of contact of hospital waste with man are manifest and manifold. In addition to the health risks to the patients and personnel, the impact of health care waste on human health and environment outside health care establishment cannot be ignored. It has now become necessary that every hospital should evolve proper techniques to collect, transport, store and dispose hospital waste safely so as to cause any harm to the general community.

Injudicious and unhygienic disposal of hospital wastes may, besides posing aesthetic problems, also be responsible for a number of other hazard like

1. Transmission of infections.
2. Increased morbidity and ill health in the community.
3. Pollution of both surface and subsurface water into which waste water and other hospital waste are discharged.
4. The risk of contaminating land and food crops, and of infecting animals as a result of the discharge or reuse of waste/ waste water.
5. Pollution of air from incinerator emissions.
6. Pollution of general environment from collection of non-biodegradable plastics.
7. Interference with water and waste water treatment processes because of presence of various types of chemicals and drugs in hospital wastes.

II. DEFINITION & CLASSIFICATION

The legal definition of biomedical wastes given by Ministry of environment and forest is as follows: “Biomedical Wastes” means solid, fluid or liquid waste including its container and any intermediate product, which is generated during the diagnosis, treatment or immunization of human being or animal in research pertaining there to or in the production or testing biologicals and the animal waste from slaughter house or any other like establishment including the waste listed in schedule I [1]

The ‘hospital wastes’ may be defined as discarded, unwanted residual matter arised from health care establishment [2]

It has been shown that around 85% of the hospital wastes are actually non-hazardous wastes, around 10 % are infectious waste and around 5% non infectious but hazardous waste [4].

Based on properties, hospital waste may be classified as : Classification by World Health Organisation working group:

1. General Waste
2. Pathological Waste
3. Radioactive Waste
4. Chemical Waste
5. Infectious Waste
6. Sharps
7. Pharmaceutical Waste
8. Pressurized containers

Classification according to Ministry of Environment and Forests, Government of India [1], Schedule I (Categories of Bio-medical wastes)
Waste Category | Waste Class
---|---
Category 1 | Human Anatomical waste
Category 2 | Animal Waste
Category 3 | Microbiology
Category 4 | Waste sharps
Category 5 | Highly infectious wastes
Category 6 | Isolated waste
Category 7 | Discarded medicine
Category 8 | Discarded glassware
Category 9 | Soiled waste
Category 10 | Disposable
Category 11 | Liquid Wastes
Category 12 | Bio-technology wastes
Category 13 | Slaughter house wastes
Category 14 | Incineration wastes.

### III. AIM AND OBJECTIVE OF PAPER

The housekeeping department, in modern healthcare institutions, is a non-revenue producing service department, and as such, it is often tempting to underestimate its vital role in the various facilities provided by the hospital. Improper management of hospital waste can be catastrophic to the health situation in the community and also can cause hazardous to environment. Looking into the serious, health implication of improper disposal of hospital wastes, the present study was undertaken with following aims and objectives.

1. To study and analyze the waste management policy in an urban hospital with tertiary care facilities.
2. To study and analyze the waste disposal chain in the studied hospital by on-spot observations.
3. To study and estimate the total amount of waste generated in hospital, and also to study the difference in waste generation and to determine overall waste generated per patient per day. To compare the amount of waste generated from different sections of the hospital.
4. To study the final disposal of hospital wastes.
5. To suggest corrective measures for any observed deficiencies in the hospital waste management.

### IV. METHODOLOGY ADOPTED

Paper focuses on the study which was conducted at a teaching hospital situated in an urban area. The hospital under study is a multidisciplinary 1319 bedded government hospital. In the study an attempt was made to observe and assess the waste disposal pattern in the hospital, where in the term ‘waste’ was defined as “any discarded, unwanted matter arising from the hospital or activities related to the hospital” and the term ‘disposal’ referred to “the total process of handling packaging, storage, transportation and final treatment of wastes”.

The method employed for collection of observations and data consisted of pre-structured interviews with the hospital administrator, supervisors, contractor and worker involved at all level of the waste disposal chain. These findings were substantiated by on-spot observations by the investigator at all the places in the hospitals where wastes are generated or likely to be generated. The system of transportation of wastes (both internal as well as external transportation) was also observed. The structure of the interim storage facility was studied. The incinerator and other methods of final disposal of wastes, if any, were identified in the light of guidelines/ideals requirements laid down by the World Health Organization and/or other International Health agencies.

In order to assess the amount of waste generated from various sections of the hospitals, the total wastes generated in that section were collected and weighed the next day morning. This procedure was followed for 18 days. The rationale for studying the generation of hospital waste in two phases during different months was to determine the influence of seasonal variations on the generation of hospital waste.

### V. OBSERVATIONS

It was observed that the hospital did not have a documented waste management policy when survey was done. The job of collection of all waste generated as a result of hospital activities, with in the sections and department was entrusted to housekeeping department.

The study for quantities of waste generated in the hospital was conducted for 18 days. The study period was divided in 12 days and 6 days of different months to take into account seasonal variations in waste generations. During the study period the total amount of waste generated was 10240 kilograms. This included waste collected within the hospital buildings, and from all department and sections of the hospitals. During the period of study the total number of indoor and outdoor patients treated in the hospital was 20603 and 12467 respectively. Waste generated by indoor patient per day was observed to be 428.6 grams. While waste generated by outdoor patient was observed to be 113 grams per patient per day. Ward wise details are reflected in fig.2. The normal waste from the hospitals was usually stored, collected and disposed off together with all other types of waste without any segregation. It is freely accessible to rag pickers, scavengers and stray animals at storage and disposal points.

No pharmaceutical wastes were produced from hospital. Replacement of radioactive substance used for external radiation treatment at radiotherapy unit was done by representative from B.A.R.C. X-ray films and empty disposable plastic bottles were periodically sold to prospective buyers under hospital rules. The disposal of biological/pathological wastes, in general, left much to be desired. Disposable needles and plastic syringes were discarded with other general waste and are ultimately dumped in the enclosure, for intermediate storage. Blood and other body fluids and secretion from patients are routinely washed down the drained without any pretreatment. Old and used surgical dressings, pads, cotton and gauze pieces, discarded tissues and organs from operation theaters are disposed off carelessly with general wastes.

The hospital has open masonry enclosure for intermediate storage of waste, where all the wastes were stored and piled.
up together without segregation. From here hospital wastes were transported to its ultimate disposal place by tractors. The hospital has an incinerator manufactured for burning of type 3 wastes, which does not include pathological waste. Wastes transported from storage facility are dumped on open ground near incinerator unit. In absence of any policy or guidelines regarding the type of waste to be incinerated, anything which is brought to the incinerator unit is incinerated. Residual ash were thrown open ground near incinerator.

The amount of waste generated per bed in studied hospital was quite less as compared to other places. Studies from various part of the world have documented that the amount of waste generated per bed per day varies from 1 kg to 10 kg. During the last decade there has been an increasing trends towards the use of disposable products or single purpose items, which now accounted for more than one half of the total hospital wastes generated. Some disposable products in developing countries, used to be sterilized and reused have been replaced with one time use, throw away articles by developed countries.[3]

**VI. RESULTS AND DISCUSSIONS**

On basis of the observations, to improve waste management system, modifications/ alterations is required to render waste non-hazardous and non-infectious to community. From fig. 1 it is clear that waste generation is most in surgical ward, followed by OPD, Orthopedics ward and Medicine ward. This is because of total number of patient is more in respective ward, which is depicted in fig. 3. However total number of patient treated in Gynecology ward is more but per patient generation is less. Per patient per day generation is most in Operation Theater followed by Orthopedics and Surgical wards. The following points need attention for proper and efficient waste management.

A well defined waste management policy should be formulated and implemented. To economize collection, to offset cost of disposals, container of various types can be followed for different categories of waste, waste may be segregated/sorted in different containers of different colours right at the source so as to clearly differentiate between infectious and non-infectious wastes. Containers and colour coding should be used which are recommended by ministry of Environment and Forest, Government of India. Orientation programme for doctors, nurses, paramedical workers, staff from house keeping department and personnel involved at different stages of waste management cycle, should be arranged and they should be well versed about colour coding of waste container.
The average waste generation can be worked out on basis of sorted wastes categorically which helps in determining the size and numbers of collecting bins to be provided in each ward. This also helps in determining the crew size required for collection and disposal of such wastes.

The enclosure, for intermediate storage of wastes requires some modifications such as: It should have roofing arrangement. Flooring should be paved with cement concrete. Flooring should also be slopped to facilitate periodical washing/cleaning.

VII. CONCLUSIONS

Present studies outline rate of generation of hospital waste is very low compared to hospitals in developing countries. There is a gap between Biomedical waste rules and inadequate state of waste management. Safe and effective management of waste is not only a legal necessity but also a social responsibility

VIII. REFERENCES