Analysis Of Biomedical Waste In Amravati City (Maharashtra State)

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Abstract
A comprehensive field visit, Interview and questionnaire survey method were implemented to collect information regarding different aspects of biomedical waste management. In the present scenario the management of biomedical waste is becoming a major problem in most of the developing countries. Economic development from last two decades has resulted in environmental pollution and waste generation in huge quantity in India. Today biomedical waste management has become one of the major issue of concern in India taking into account the rate of growth of population. Biomedical waste collection and proper disposal has become a significant concern for both the medical and general community. The objective of this study was to collect data related to biomedical waste generation, segregation and collection, storage, training and education, transportation, disposal, and safety of cleaning personnel. Questionnaire were distributed among the various authorities of government and private hospitals in Amravati. Questionnaire were collected after completion and interaction regarding biomedical waste was carried out. Later data was tabulated and analysed by various statistical methods as per need and result were found out from collected data. The study revealed that the system of biomedical waste management should be improved and their is lack of necessary knowledge and information regarding biomedical waste management system. During study it was observed that waste is not collected at regular interval. The segregation of hospital waste plays the key role in the safe and efficient management of biomedical waste. Improper disposal of infected and hazardous waste from hospital, nursing home and pathological laboratories lead to great risk of spread of disease. Therefore it is important to aware staff about the hazards posed by biomedical waste. The most vital component of the waste management system is to bring about the transformation in the mind sets and develop a system and culture through education, training and persistent motivation of the staff.

Keywords:- Biomedical waste, Questionnaire, Incineration, Autoclaving, Shredding

I. Introduction
In the present scenario the management of biomedical waste is becoming a major problem in most of the developing countries. Biomedical waste contains potential health and safety hazards. In addition to their infectious and toxic characteristics, the highly variable and inconsistent nature of biomedical waste streams has increased public concern about storage, treatment, transportation and ultimate disposal. Inadequate management of biomedical waste can be associated with risks to health care workers, patients, communities and their environment. According to Biomedical Waste rules, 1998 of India, Biomedical waste means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in a research activities pertaining there to, or in the production or testing of biologicals, and including human anatomical waste, animal waste, microbiology and biotechnology waste, sharps, discarded medicines and drugs, soiled waste, solid waste, liquid waste, incineration ash, chemicals used in production of biological, chemicals used in disinfection, as insecticides, etc. Biomedical waste refers to all the waste generated by a health care establishment. It is estimated that 10-25% of
biomedical waste is hazardous, with the potential for creating variety of health problems. Biomedical waste collection and proper disposal has become a significant concern for both the medical and the general community. Due to the implementation of the biomedical waste management and handling rules, 1998, every concerned health personal is expected to have proper knowledge, practice, and capacity to guide others for waste collection and management and proper handling techniques. There is an urgent need to improve upon the biomedical waste management practices in the country based on systematic and scientific planning of medical waste disposal. Awareness regarding biomedical waste management is very less among health care personal. The health care workers play a very important role in biomedical waste management, hence they should have thorough knowledge and practice to provide safety.

A. Objectives of study

Biomedical waste is a special category of waste, which needs to be handled appropriately with precautions because it carries a higher potential for infection and injury than any other type of waste. Currently it is being managed casually. The crux to all of this may be due to a lack of awareness and appreciation amongst medical staff and residents as well as the public, inadequate existing facilities, etc. With a rapid increase in the number of hospitals, clinics and laboratories in our country, the generation of Biomedical waste has been increasing considerably. It is estimated that in India the generation of biomedical waste has been estimated to be 0.5 to 1.0Kg/bed/day in private and government health care establishments, 1.5kg/day in blood bank, 1.0kg/day in diagnostic laboratory, 0.2kg/day in small clinics and 0.25kg/day in veterinary clinics, and managing the same has become a major problem and hence it is important to study about the biomedical waste management.

II. Literature Review

(Saini S, Nagarajan S S, Sarma R K, 2005) conducted a study on knowledge, attitude and practice of biomedical waste management amongst staff of tertiary level hospital in India. The study suggested that intensive training programs at regular time interval should be organized for all the staff with special importance to the new comers. The entire waste management practices should be a part of total hygiene practice of the society rather than confining to hospital and health facility.

(Chandira boss et al, 2009) studied the character and quantity of BMW generation in Government General Hospital (GH) Puducherry. Unhygienic disposal of non segregated BMW in Puducherry poses a serious health hazard to the population and to scavengers. The current practices of handling, transportation, storage, and disposal of BMW generated at GH need to be strict. After the BMW guidelines were explained, observations indicate that proper management of BMW has improved and that the segregation of BMW is much better than before (Agrawal and Singh, 2005).

(Pandit N B et al, 2005) conducted a cross sectional study on management of biomedical waste: awareness and practice in a district of Gujarat. 30 hospitals with minimum 30 beds were randomly selected from Sabarkanth district of Gujarat. Doctors were aware of risk of HIV and Hepatitis B and C, whereas auxiliary staffs had very poor knowledge about it. The findings suggest that there is an immediate and urgent need to train and educate all doctors and staffs to adopt an effective waste management practices.

(Rasheed S. et al, 2004) conducted a cross sectional study on hospital waste management in 8 teaching hospitals of Karachi to evaluate the current practices of segregation approaches, arrangements and collection and disposal system in the teaching hospitals of Karachi. The findings suggest that there should be proper training and management regarding awareness and practices of waste disposal. Research must be undertaken to seal existing gaps in the knowledge about hospital waste management.

(Mostafa GMA et al, 2007) conducted cross sectional study at Almansoura university hospital, Egypt on the development of a waste management protocol based on knowledge and practice of health care personnel in surgical departments. 200 samples were taken for the study and data collection was done using a self administered questionnaire for nurses and doctors and an oral questionnaire for house keepers. Based on the findings, a protocol for healthcare waste management was developed and validated. It is
recommended to implement the developed waste management protocol for the surgical departments in the designed hospital, with establishment of waste management audits.

III. Methodology

Biomedical Waste Management involves an array of activities starting from estimation of waste generation to the final disposal of the wastes. The Flow chart for the present study is as follows

1. Selection of study area
2. Preparation of Questionnaire
3. Visits to concerned private and government hospitals in Amravati city
4. Study of existing storage, collection, transportation and disposal facilities
5. Tabulation and analysis of the collected data

Fig.1. Methodology of Study

- Selection of study area

Amravati is a city in the state of Maharashtra, India and the seventh most populous metropolitan area in Maharashtra. Amravati city is located at 20.93°N 77.75°E. It has an average elevation of 343 meters. It lies 156 km west of Nagpur, and serves as the administrative center of Amravati District and of Amravati Division.

- Preparation Of Questionnaire

A questionnaire was prepared and used for data collection during the course of this project. Questionnaire contains questions regarding general information, handling, segregation, disposal and a health hazard of biomedical waste was prepared. Questionnaires were distributed amongst the various authorities of government and private hospitals in Amravati. They were collected after completion and interaction regarding biomedical waste was carried out. Responses to the questionnaire were coded and entered into Excel Sheet. Later data was tabulated and analyzed by various statistical methods as per need. Along with the Questionnaire survey, the participants were also asked about the other obstacles they faced, coordination problems within the various departments and suggestions to improve the biomedical waste management in Amravati city.

- Visits To Concerned Private And Government Hospitals In Amravati City

A questionnaire was designed after discussion with a group of doctors and was distributed to 30 private and government hospitals in Amravati city. Site visits were carried out to the chosen hospitals and clinics to obtain the relevant information regarding the biomedical waste management system. Field observation, informal interviews, filming and photo shots were other techniques used on the field. With the site visits and interviews done in the selected hospital, ways of improving the biomedical waste management system can be proposed. Informal interviews were done with concern doctors, hospital staff and waste management teams. Most of the interviews were done by an open discussion so that the interviewees have a chance to tell the interviewer more about their expectation in respect to improving the quality of the existing biomedical waste management system, as well as other matters. The major issues which were discussed during the interviews were basic system for the management of biomedical waste, rule and regulation, segregation, colour coding, storage areas, methods of treatment, incineration and landfill.

- Study Of Existing Storage, Collection, Transportation and Disposal
To study the existing storage, collection, transportation, processing and disposal facilities a site visit to the common biomedical waste management facility at Amravati city was done which was run by “Global Eco Save System”. During the site visit information related to storage, collection, transportation, processing and disposal was collected.

- **Tabulation And Analysis Of The Collected Data**

Questionnaires were collected back from the government and private hospitals and the Responses to the questionnaire were coded and compiled into Microsoft Excel. Analysis of the questionnaires was done to produce comments, figures and tables. The entered data were checked for accuracy by re-examining all entries twice. Later data was tabulated and Microsoft Excel was utilized to build the graphs, pie charts, etc.

IV. **Detail About Plant And Machinery**

1) Daily Collection of waste – 1700kg/day to 1800Kg/day
2) Capacity of the plant – 3000kg/day
3) Incinerator - 1 Unit with capacity of 200kg/hr, 1 Unit with capacity of 100kg/hr (Stand by unit)
4) Autoclave - 1 Unit with capacity of 100kg/hr
5) Shredder - 1 Unit with capacity of 50kg/hr

V. **Category Of Biomedical Waste**

The waste generated from Hospitals is toxic waste and if proper treatment and disposal will is not carried as per Biomedical waste (management and handling) rule1998, it may be harmful to the human being in specific and to the overall environment in general. The waste generated from Hospitals are segregated and then transported to the biomedical plant and its treatment is done by various processes. Under Biomedical waste management rules following guidelines are also given,

1) Biomedical waste (BMW) shall not be mixed with other waste.
2) BMW shall be segregate into container according to their categories.
3) BMW shall not be stored for more than 48 hours.
4) Every occupier is required to setup a requisite treatment facilities.
5) Every occupier shall make an application to then prescribe authority (Maharashtra pollution control Board) for grant of authorization.
6) Every occupier shall maintain records related to generation, collection, reception, storage, transportation, treatment and disposal of biomedical waste.

VI. **Working Of Plant Flow Chart**

![Flowchart for Biomedical Waste Management in Amravati](Fig.2)

Plant contains two incineration chamber (Primary and secondary). The burner in incinerators takes 1 hr. to heat out completely. The LDO (Light Diesel oil) is used in incinerator. The quantity LDO required for 1 hour is 25 liters. The yellow bags are
directly placed into primary incinerator for burning at 8500 C whereas the red bags are manual segregated. Ash coming out of the primary incinerator are send to secondary incinerator were the ash is again burned at 10500 C. During incineration the chimney releases the harmful gases. Wetted packed towers are the simplest and most commonly used approaches to gas scrubbing. The principal of this type of scrubber is remove contaminants from the gas stream by pissing the stream through a packed structure which provides a large wetted surface area to induce intimate contact bed and the scrubbing liquor. The contaminant is absorbed into or reacted with the scribing into or reacted with the scrubbing liquor. Wet scrubber are effective air pollution control devices for removing particulars and gases from industrial exhaust streams wet scrubbers are common in many industrial applications including pollutant reduction at petroleum refineries, chemical process acid, manufacturing plants, and steel making. The remaining ash is collected from the secondary chamber and disposed in the land and the waste water coming out of the wet scrubber is then send to the effluent treatment plant. The treated water from the effluent treatment plant is than recycled and reused.

VII. Observations

Following observations are done with the help of questionnaire

- **Best Method of Disposing Biomedical Waste**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Best Method Of Disposing Biomedical Waste</th>
<th>Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Autoclaving Shredding And Then Land Filling</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Incinerator</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Incinerator With Energy Recovery</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>Microwave And Shredding</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Chemical Disinfection And Shredding</td>
<td>1</td>
</tr>
</tbody>
</table>

**TABLE 2. General Constituents of Biomedical Waste**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>General Constituents of Biomedical Waste</th>
<th>Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paper cotton boxes</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>dressing cotton boxes</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>Chemicals</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Radioactive materials</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Pathology materials</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>Pharmaceuticals</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>Body fluids</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>pressurised container</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>unused medicines</td>
<td>20</td>
</tr>
</tbody>
</table>

VIII. Results

The findings of the present study showed that majority of Doctors in the study sample
were Highly concerned (90%) about Biomedical waste. It was observed that 16 (53.33%) of Hospital were having Waste Management Team. The Quantity of Biomedical Waste Generated per bed per day in the Hospital of Amravati city was found to be 0.5 kg/bed/day in 11 (38%), 1 kg/bed/day in 9 (31%), 1.5 kg/bed/day in 1 (4%), 2 kg/bed/day in 7 (24%), and 3 kg/bed/day in 1 (3%). In 27 (90%) Hospitals the Waste is segregated and in 27 (90%) Hospitals colour coding is used in segregation of Waste.

Fig.3. shows that 16 (53%) Doctors think that Incineration is the best treatment for disposal of Medical Waste. 8 (27%) doctors think that Incineration with Energy Recovery is the best treatment. Autoclaving Shredding and then Land Filling is the best disposal treatment according to 5 (17%) Doctors. Only 1(3%) Doctor thinks that Chemical Disinfection and Shredding is best treatment for disposal of Biomedical Waste.

Fig.4. represents that 16(53.33%) of the Doctors quoted that the waste coming out of their hospital also contains general waste such as paper, cartons, boxes, etc. whereas 29(96.67%) of doctors quoted that biomedical waste contains Dressings cotton and plasters. 25 (83.33%) responded that medical waste contains harmful chemicals and 20(67.67%) said that Radioactive materials may be the part of biomedical waste. 26(86.67%) replied that biomedical waste form their hospitals contains Pathological materials and 25(83.33%) said that it contains Pharmaceuticals. Most of the Doctors quoted that medical waste from their hospital contains body fluid, pressurized container and Unused medicines 30(100%), 18(60%) and 20 (67.67%) respectively.

IX. Conclusion

In the present study the assessment of biomedical waste management in Amravati city was done. To identify the components of biomedical waste, segregation practices and its disposal methods a questionnaire survey was used and interview sessions were conducted with doctors to achieve the objective of the study. Also a visit of the common biomedical waste management facility at Amravati city was carried out for studying the disposal method and practices. Following conclusions are drawn from the present study:

1) The Segregation of hospital waste plays the key role in the safe and efficient management of biomedical waste.

2) Improper disposal of infected and hazardous waste from hospitals, nursing homes and pathological laboratories leads to great risk of spreading the diseases from highly contagious material and it also leads to significant degradation of environment.

3) The most vital component of the waste management system is to bring about a transformation regarding awareness of biomedical waste management and develop a system through education, training and persistent motivation of the staff.

4) The challenge before the environmental engineers is to scientifically manage growing quantities of biomedical waste. If we want to protect our environment and health of community we must sensitize ourselves to this important issue not only in the interest of health managers but also in the interest of community.

Acknowledgment

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References


