Review of Physicochemical Analysis of Solid Biomedical Waste Management at Different Hospital of Metrocities

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Abstract: **Medical waste is unwanted biological products that are highly infectious in nature. It has to be disposed properly otherwise it poses a health and environmental danger. Biomedical waste management is receiving greater attention due to recent regulations of the Biomedical Waste. Inadequate management of biomedical waste can be associated with risks to healthcare workers, patients, communities and their environment. The present study was conducted to assess the quantities and proportions of different constituents of wastes, their handling, treatment and disposal methods in different health-care settings. Various health care units were surveyed using a modified survey questionnaire for waste management. This questionnaire was obtained from the World Health Organization (WHO), with the aim of assessing the processing systems for biomedical waste disposal. Hazards associated with poor biomedical waste management and shortcomings in the existing system were identified. The development of waste management policies, plans, and protocols are recommended, in addition to establishing training programs on proper waste management for all healthcare workers.**

Keywords— **Medical Waste, Biomedical Waste, Environment, Physicochemical**

I. INTRODUCTION

Bio-medical waste' means any strong and additionally fluid waste including its holder and any transitional item, which is created amid the finding, treatment or vaccination of people or creatures or in look into relating thereto or in the generation or testing thereof. The physico-compound and organic nature of these parts, their lethality and potential peril are extraordinary, requiring diverse strategies/alternatives for their treatment/transfer. Doctor's facility squander alludes to all waste created, disposed of and not proposed for additionally use in the healing center. Shameful treatment of this waste influences not just therapeutic faculty, specialists who interacted with restorative waste, yet in addition Nurses, Para-medicinal staff, Ward Boy, Workers, Waste pickers and natives on the loose. Solids squander created from therapeutic organizations should be taken care of precisely as these squanders may contain irresistible material. India produces an immense amount of Biomedical Waste (BMW) consistently. Before, numerous clinics basically dumped every single waste stream together, from gathering region junk to working room squander, and consumed them in incinerators — and this is as yet regular practice in numerous nations. A few healing facilities and centers in the creating scene dispose of restorative waste with normal junk and hazard the spread of sicknesses among scrounger populaces. Disposed of needles and syringes may bring about the spread of blood borne pathogens, for example, HIV and hepatitis. Others consume their loss in open fields or in little incinerators without contamination control, presenting groups to harmful results and conceivably perilous slag. Medicinal waste cremation is a main wellspring of dioxin, mercury, lead and different risky poisons that undermine human wellbeing and nature. As wellbeing programs grow, the issue of restorative waste treatment and transfer in rustic regions ends up noticeably basic.

II. RELATED WORK

Hospitals are those institutions which have existed since time immemorial in one form or the other and have become more complex in the present time frequented by people from every walk of life without any distinction between sex, age, caste

and religion. Recently, there is a significant increase in the dental and medical teaching hospitals and correspondingly there has been tremendous increase in the amount of biomedical waste generated by the hospitals. Biomedical waste [BMW] can be defined as "any solid, fluid or liquid waste, including its container and any intermediate product, which is generated during its diagnosis, treatment or immunisation of human beings or animals, in research pertaining thereto, or in the, production or testing of biological and the animal wastes from slaughter houses or any other like establishments." Hospital waste is sub-divided into health care general waste (HCGW) and health care risk waste (HCRW). The health system is under pressure to dispose of health care waste in such a way as to avoid unnecessarily high levels of environmental degradation. The aim of health care facilities worldwide is beginning to subscribe to the social goals of a cleaner and safer environment. To manage health care waste optimally, health care providers should consider all stages or whole life cycle of the medical product by looking at the medical product's upstream and down-stream activities (Kaiser et al. 2001).

Biomedical waste is any waste in the form of solid or liquid, including its containers and any product, which are generated during the treatment, diagnosis and immunization of human beings and animals in research. Basically health care wastes refer to all wastes produced which are discarded and not intended for any further use in hospitals (BAN & HCWH, 1999). Many synonyms to medical waste exist and they are currently used interchangeably in different parts of the world and in different scientific journals. According to Moritz (1995) some of the easily come across synonyms are clinical waste, hospital waste and bio-medical waste. The WHO uses the term "healthcare waste" in reports and other official publications.

TECHNOLOGIES FOR WASTE TREATMENT

Hospitals generate between 8 to 45 pounds of waste per bed per day in the form of general trash, infectious (red bag) waste, hazardous waste, and low-level radioactive waste. Infectious waste is estimated to be about 15% or less of the overall waste.
Four basic processes are used in medical waste treatment:

Thermal; Chemical; Irradiative; Biological treatment.

THERMAL PROCESSES uses heat to decontaminate instruments and equipment and the temperatures in this process may rise to extremely high levels. Most of the microbes are destroyed at temperatures below 100°C (Mathur et al, 2012). It includes Autoclave; Hydroclave; Incinerator; Microwave. They can be further classified as low-heat thermal processes (operating below 350°F or 177°C), medium-heat thermal processes (between 350 to about 700°F), and high-heat thermal processes (operating from around 1000°F to over 15,000°F). The low-heat processes utilize moist heat (usually steam) or dry heat. High-heat processes involve major chemical and physical changes that result in the total destruction of the waste.

CHEMICAL PROCESSES employ disinfectants to destroy pathogens or chemicals to react with the waste. Safety and occupational exposures should be monitored when using any chemical technology. Chemicals are added to waste to kill or inactivate the pathogens it contains; this treatment usually results in disinfection rather than sterilization. The types of chemicals used for disinfection of health-care waste are mostly aldehydes, chlorine compounds, ammonium salts, and phenolic compounds. Powerful disinfectants are often hazardous and toxic; many are harmful to skin and mucous membranes.

IRRADIATION PROCESSES involves ionizing radiation to destroy microorganisms while **BIOLOGICAL PROCESSES** use enzymes to decompose organic matter. Mechanical processes, such as shredders, mixing arms, or compactors, are added as supplementary processes to render the waste unrecognizable, improve heat or mass transfer, or reduce the volume of treated waste.

SOURCES OF BIOMEDICAL WASTE

Hospital is a place, where an individual is examined by the doctors, diagnosis is made and an appropriate treatment plan is worked out. Depending upon the extent or the intensity of illness, the patients are either treated in

outpatient department (OPD) or are admitted in the hospital for treatment and follows up. In both the cases, greater amount of waste is generated during this procedure. The quantum of waste thus generated varies according to the site and the nature of treatment.

For example, in the minor operation theatres (OT), the amount of waste would be less than in the major OT. Similarly, the amount of infectious waste is more in the maternity hospitals than in a general hospital. In orthopedic specialties, this amount is much less. Thus the amount of waste will vary depending upon the nature of treatment. At individual ward level also, waste is generated show in figure 1.1.

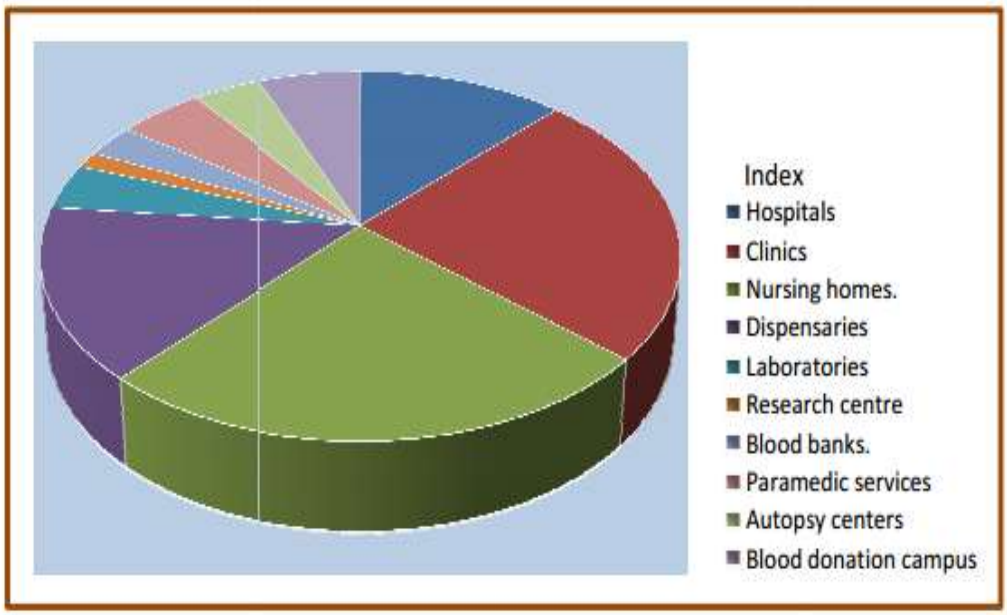

Figure 1.1 Biomedical Wastes in Various Sources

RESULT AND DISCUSSION

Biomedical waste management is one of the biggest challenges of the present day times. It has a direct impact on the health of the citizen of that city. It is hazardous in nature. It's safe and proper disposal is extremely important. As in many developing countries the generation of biomedical waste has increased significantly over the last few decades, management of this kind of waste continues to be a major challenge. Biomedical waste is generated in hospitals, research institutions, health care teaching institutes, clinics, laboratories, blood banks, animal houses and veterinary institutes. For proper management of bio-medical waste the Ministry of Environment and Forests has promulgated the Bio-Medical Waste (Management and Handling) Rules, 1998. Purpose of study was to highlight certain aspects of hospital waste management status. Not only Delhi there is some other states also whose metro cities produce a lot of biomedical wastes. One of such estimation for Uttar Pradesh has also been done. Following table and diagram show the observation of over a period of five months from January 2016 to May 2016 in ChhatrapatiShivajiSubharti Hospital, Meerut by the Infection Control Team (ICT). Assessment of knowledge was carried out by asking set of questions individually and practice regarding awareness of BMW Management among the Health Care Personnel (HCP) was carried out by direct observation in the workplace. Further, the total BMW generated from the present setup in kilogram per bed per day was calculated by dividing the mean waste generated per day by the number of occupied beds.

During the study period the total waste generated (infectious + non-infectious) from the hospital was 57912 kgs. Out of which, 15% (8686.8 kg) was infectious waste and 85% (49225.2 kg) was non-infectious waste. This is summarized in the following figure 1.2:

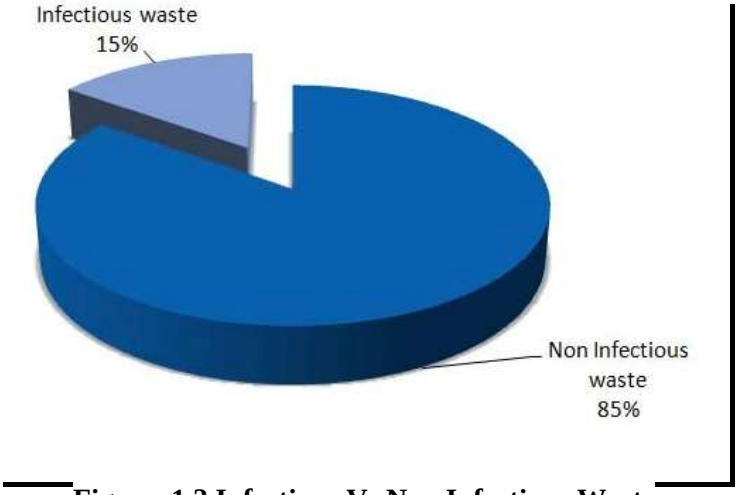

Figure .1.2 Infectious Vs Non Infectious Waste

The average infectious waste generated from hospital per day was calculated as 289.56 kg. Owing to the number of occupied beds (n=850), the average infectious waste generated per bed per day was found to be 0.341kg as shown in the following table 1:

Table 1 Average Infectious Waste Generated From Hospital per Day Calculation

Health Care Facility	Total No of Occupied Beds	Infectious waste Generated /Month	Infectious waste Generated/Day	Infectious waste Generated /Bed/Day
CSS Hospital	**850**	**8686.8Kg**	**289 kg**	**0.341 kg**

Distribution of various category of infectious waste (that is waste collected in red bag, yellow bag, and puncture proof container is elaborated in the following table 2. The maximum waste generated from our hospital was soiled infectious waste in yellow bag (6954.4kg/month and 231.81kg/day) followed by solid infectious waste in red bag (928.0kg/month and 30.93kg/day) and sharp waste in translucent puncture proof container (804.4kg/month and 26.81kg/day).

Table 2 Various Category of Infectious Waste

Colour code	Waste	Amount in Kg.
Yellow	Total waste generated /month	6954.4
	Total waste generated /day	231.81
Red	Total waste generated /month	928.0
	Total waste generated /day	30.93
White (translucent) / Blue (sharp)	Total waste generated /month	804.4
	Total waste generated /day	26.81

Study had few limitations: the study design itself was an overview of management of infectious waste from the waste storage area and individual category of waste generated from different units in the hospitals was not looked for, therefore, to pinpoint the unit of the hospital from which maximum amount of infectious waste was generated is not possible.

The safe and effective management of health care biomedical waste has received much attention for improper and inadequate management is associated with an increase in the incidence of health risks to the healthcare workers, the patients, and their environment and to the community at large. Against this the biomedical waste may need more systems,

since it includes body parts, human and animal tissues, radioactive waste, gauze, cotton, plastics, plaster-of-paris casts, infected liquid waste, blood and laboratory wastes. Medical waste generated at different health care facilities presents environmental and public health risks

Conclusion

Medical wastes should be classified according to their source, typology and risk factors associated with their handling, storage and ultimate disposal. The segregation of waste at source is the key step and reduction, reuse and recycling should be considered in proper perspectives. We need to consider innovative and radical measures to clean up the distressing picture of lack of civic concern on the part of hospitals and slackness in government implementation of bare minimum of rules, as waste generation particularly biomedical waste imposes increasing direct and indirect costs on society. The challenge before us, therefore, is to scientifically manage growing quantities of biomedical waste that go beyond past practices. 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. Healthcare is an essential aspect of life; these activities generate a large amount of waste called biomedical waste. This waste generated by healthcare activities can be hazardous or toxic or something deadly as it is contaminated by disease carrying pathogens which can infect patients, healthcare workers and other public present near there. Increase in the healthcare facilities and the rising trend of using disposal material has increased the amount of biomedical waste significantly and hence creating serious threats to health of society and environment also. Biomedical waste can contain cotton, needles, vials, specimen, human organs etc. and proper disposal of different types of biomedical waste differently is essential.

REFERENCES

1. Ram Kumar Srivastava et al., (2014), Evaluation of Hazards of Waste Materials in Clinics and Hospitals: A Research, NUJHS, Vol. 4, No.3, pp. 11-14.
2. RitikaSemwal et al., (2016), Environmental Concern and Threat Investigation due to Malpractices in Biomedical Waste Management: A Review, Proceedings of IRF International Conference.
3. Varsha U Lomate et al., (2013), Effects of Biomedical Waste Generation and Disposal on Environmental Status of Amravati City, International Journal of Engineering Science and Innovative Technology, vol. 2, no. 2.
4. Shailendra Kumar Mandal(2009), Integrated Bio-Medical Waste Management Plan for Patna City, Institute of Town Planners, India Journal, vol. 6, no. 2, pp. 01-25.
5. Patan S et al., (2015), Assessment of biomedical waste management in government hospital of Ajmer city - a study, International Journal of Research in Pharmacy and Science, vol. 5, no. 1, pp. 6-11.
6. Hasina Quari et al., (2013), To Study The Solid Waste Generated Per Bed Per Day at District Hospital Kargil A Remote High Altitude Area, Journal of Pharmacy, vol. 3, no. 6, pp. 61-65.
7. Vijai Krishna et al., (2014), Bio Medical Waste Management in Varanasi City, (U.P.), India, International Journal of Engineering Research and Development, vol. 10, no. 8, pp. 12-18.
8. VN Kalpana et al., (2016), Biomedical waste and its management, Journal of Chemical and Pharmaceutical Research, vol. 8, no. 4, pp. 670-676.
9. Ekta Madan (2012), Environmental Auditing As A Management Tool For Evaluation of Category Wise Biomedical Waste [BMW Rules, 1998] And Its Practices In Hospitals In India, International Journal of Engineering Research & Technology, vol. 1.
10. B. Sowbhagya Lakshmi et al., (2012), Awareness About Bio-medical Waste Management Among Health Care Personnel of Some Important Medical Centers In Agra, International Journal of Engineering Research & Technology, vol. 1, no. 7.
11. Venkatarama et al., (2013), Assessment of Bio-Medical Wastes Disposal and Management in Some Major Hospitals of Mysore City, Karnataka, International Journal of Engineering Research & Technology, vol. 2.
12. Aravindan et al., (2015), Case study Exploration of Biomedical Waste inMultispecialty Hospital in Madurai, International Journal of Applied Environmental Sciences, ISSN 0973-6077, vol. 10, no. 1, pp. 347-363.
13. D. Shreedevi(2002) Hazardous Waste Management at Healthcare Facilities, International Journal of Engineering Sciences & Research Technology, vol. 5, no. 9, pp. 452-459.
14. Dhruv P. Hirani et al., (2014), Biomedical Waste: An Introduction to its Management, International Journal of Innovative Research in Advanced Engineering, vol. 1, no. 8, pp. 82-87.

15. Anjali Acharyaet al., (2014), Impact of Biomedical Waste on City Environment: Case Study of Pune, India, Journal of Applied Chemistry, vol. 6, no. 6, pp. 21-27.
16. PV Deshmukh et al., (2016), Biomedical Waste Management - A Review, International Journal on Recent and Innovation Trends in Computing and Communication, ISSN: 2321-8169, vol. 4, no. 6, pp. 66-70.
17. Mamta Arora et al., (2013), Hospital Waste: Management & Handling, International Journal of Advancements in Research & Technology, vol. 2, no. 11, pp. 238-213.
18. Asif Chowdhary et al., (2014), Biomedical Waste Management: A Caste Study of Gandhinagar Hospital, Jammu, International Journal of Environmental Research and Development, ISSN 2249-3131, vol. 4, no. 4, pp. 287-290.
19. Rahul Nemade et al., (2014), Need of Enhanced Bio Medical Waste Management, International Journal of Research in Engineering and Applied Sciences, vol. 2, no. 1, pp. 15-18.
20. Manasi S(2017), Challenges in Biomedical Waste Management in Cities: A Ward Level Study of Bangalore. Adv Recycling Waste Manag., vol. 2.
21. SwetaPaney et al., (2016), Nosocomial Infections through Hospital Waste, Int J Waste Resour., vol. 6.
22. B Ramesh Babu et al., (2009), Management of Biomedical Waste in India and Other Countries: A Review, J. Int. Environmental Application& Science, vol. 4, no. 1, pp. 65-78.
23. KVRadha et al., (2009), A Case Study of Biomedical Waste Management in Hospitals, Global Journal of Health Science, pp. 82-88.
24. Nikos E. Mastorakis et al., (2011), Environmental and Health Risks Associated with Biomedical Waste Management, Journal of Development, Energy, Environment, Economics, pp. 287-294.
25. Anita Pandey(2016) Bio-Medical Waste Management in a Tertiary Care Hospital: An Overview, Journal of Clinical & Diagnostic Research, vol. 10, no. 11, pp. DC01-DC03.
26. KokilaSelvaraj et al., (2013), Knowledge and practice of Biomedical Waste (BMW) Management among the medical practitioners of Kanchipuram Town, India, Int.J.Curr.Microbiol.App.Sci , vol. 2, no. 10, pp. 262-267.
27. BE Bassey et al., (2006), Characterization and management of solid medical wastes in the Federal Capital Territory, Abuja Nigeria, African Health Sciences, vol. 6.
28. V Sudhakar et al.,(2008), Dental health care waste disposal among private dental practices in Bangalore City, India, International Dental Journal, vol. 58, pp. 51-54.
29. Anita Rajor et al., (2012), An overview on characterization, utilization and leachate analysis of biomedical waste incinerator ash, Journal of Environmental Management, vol. 108, pp. 36-41.
Rajesh Chudasama et al., (2013), Biomedical Waste Management: A study of knowledge, attitude and practice among health care personnel at tertiary care hospital in Rajkot, Journal of Research in Medical and Dental Science, vol.1,no 1.