



RESEARCH ARTICLE

A STUDY ON QUANTUM OF BIOMEDICAL WASTE GENERATED IN A TERTIARY CARE TEACHING HOSPITAL OF SOUTH INDIA

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Abstract

Introduction: Management of biomedical waste (BMW) has become a very serious health problem in developing countries. Every day, in the health care hospitals and in various facilities large amount of hazardous and potentially infectious wastes is generated. Inappropriate waste management and chaotic disposal of biomedical waste that occur in hospital cause various types of health effect on society.

Objectives: To estimate the quantity of BMW generated by various departments of a hospital and to determine their compliance with BMW norms.

Materials and methods: With regards to quantum of BMW generated a retrospective study was conducted for a period of 3 years from January 2019 to December 2021, and with regards to compliance of bio-medical waste management an observational study was conducted for a period of 3 months from July 2021 to September 2021. Selected areas of hospital were included in the study. Area wise waste collected, segregated and disposed off was observed and recorded on checklist designed on existing BMW management rules 2016.

Results: The quantum of BMW generated during 3 years is in 20-19-106563 kg/year, 2020-98353 kg/year, and 2021-75951 kg/year. Yellow waste constituted the maximum of all during all 3 years(52%). Overall compliance with BMW rules 2016 was 85%.

Conclusions: The quantum of biomedical waste generated is high as per permitted norms by local regulatory body. All the concerned staff should be frequently trained in this regard to avoid excess wastage, in order to bring down biomedical waste generated.

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Introduction:-

Health care waste generated is classified into biomedical waste, general waste and other wastes. Percentage of biomedical waste is around 10 to 15% from total health care waste. According to Biomedical waste management (BMW) rules 2016 guidelines, biomedical waste is defined as “any waste which is generated during the diagnosis, treatment or immunization of human beings or animal or research activities pertaining thereto or in the production or testing of biological or in health camps”.^[1]

Previously there were ten categories of biomedical waste as per BMW rules 1998 which were then revised into only four categories based on the segregation pathway & colour code as per BMW rules 2016 which included yellow, red, white and blue category. Yellow category includes human & animal anatomical waste, soiled waste, discarded or expired medicines, chemical waste, chemical liquid waste and clinical laboratory waste. Red category includes waste generated from disposable items such as tubing, bottles. White category included waste sharps including metals and blue category includes broken or discarded and contaminated glass.^[2-5]

Approximately 774 tonnes of biomedical waste is generated in India as per the annual report on biomedical waste management for the year 2020. With the advent of Corona virus disease 2019 (COVID-19) pandemic, use of Personal protective equipment (PPE) including masks and other biomedical waste generation from treatment aspects and vaccination stupendously increased adding to the already over burdened aspect of biomedical waste management especially in India due to the huge population and vast health care sector providing services against COVID-19.^[6,7]

The health care facilities are responsible for the bio medical waste management which necessarily includes five steps i.e. segregation, collection, pre treatment, intramural transportation and storage of the waste before such waste is collected by Common Biomedical waste treatment facilities (CBWTF). The guidelines have been framed and developed under biomedical waste management rules for effective following the give steps of its management. These guidelines have been revised and amended time to time according to the need of the hour; the latest been during the COVID 19 pandemic in 2020 “Guidelines for handling, treatment and disposal of waste generated during treatment/diagnosis/quarantine of COVID 19 patients” under Central Pollution Control Board (CPCB), Ministry of Environment, Forest & Climate change, Government of India.^[8]

Management of biomedical waste has become a very serious health problem in developing countries. Every day, in the health care hospitals and in various facilities large amount of hazardous and potentially infectious wastes is generated. Insufficient waste management and chaotic disposal of biomedical waste that occur in hospital cause various types of health effect on human society, the employees associated with the health care facilities and on environment; possess serious danger to health of human and the surrounding environment and for that; it requires a particular treatment and management before its final disposal.^[9,10]

Objectives:-

1. To estimate the quantity of biomedical waste generated by various departments of a tertiary care teaching hospital.
2. To determine the compliance of BMW norms by various departments.

Methods:-

A hospital based observational study was conducted in a tertiary care teaching hospital in Hyderabad from July 2021 to September 2021 with regards to compliance of biomedical waste management and with regards to quantity of waste generated a retrospective observational study was conducted, taking into account the data of last 3 years ie (2019-2021). Data collection method: The information regarding quantity of waste generated, was collected from hospital records year wise and month wise over the past three years i.e., from January 2019 to December 2021. Other aspect on compliance regarding BWM; area wise waste collected, segregated and disposed off was observed and recorded on checklist designed as per existing BMW management rules 2016 over a duration of 3 months from July 2021 to September 2021. Data was collected and analysed with the help of MS Excel and Epi Info software version 7. Data was presented in percentages and proportions. Numerical data was expressed in mean and standard deviation wherever required.

Results:-

The present hospital based study on biomedical waste management on the aspects of quantity and processing of biomedical waste showed that the majority of anatomical waste is generated in operating rooms, followed by cath-ward, EMD, nephrology wards, Oncology etc. Data was collected over the past three years from 2019 to 2021 with regards to quantity of biomedical waste from the hospital records. It showed that highest quantity of total waste was generated in the year 2019 (1,05,563 kg per annum) followed by 2020 (98,353 kg per annum) and lowest in 2021 (75,951 kg per annum). The same was evident with individual category of biomedical waste. [Table 1]

Table 1:- Year wise distribution of biomedical waste generated in Hospital.

Type of Waste category	2019	2020	2021
Yellow	57,499 kg/annum	50,604 kg/ annum	38,001 kg/ annum
Red	40,898 kg/ annum	40,585 kg/ annum	31,466 kg/ annum
Blue	4,527 kg/ annum	4,106 kg/ annum	3,782 kg/ annum
White (Translucent)	3,639 kg/ annum	3,058 kg/ annum	2,702 kg/ annum
Total	1,06,563 kg/ annum	98,353 kg/ annum	75,951 kg/ annum

With regards to percentage distribution according to type of biomedical waste category; half the proportion of waste belonged to yellow category in all the three years followed by red category. White (translucent) category was the least among the four categories. [Figure 1]

Figure 1:- Distribution of various category of biomedical waste.

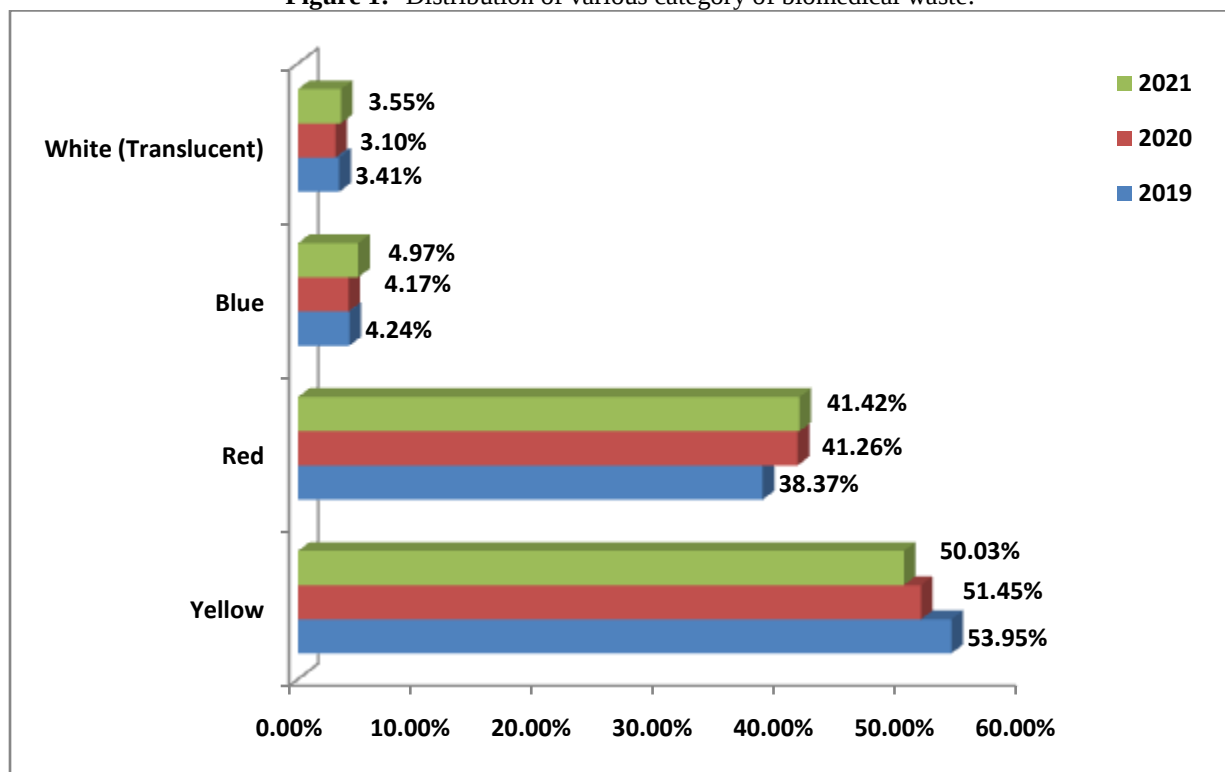


Table 2:- Average weight of biomedical waste generated per month.

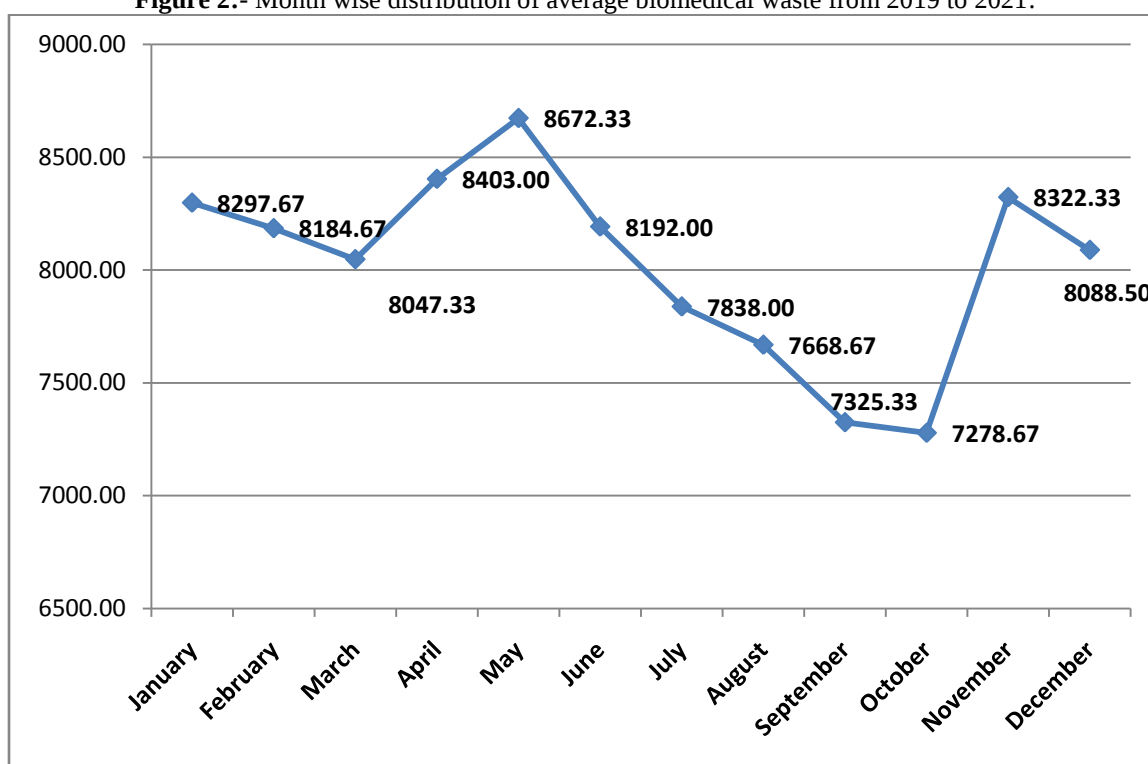
Type of Waste category	Quantity permitted for handling	Average Biomedical waste generated per month
Yellow	5610 kg/month	Approx. 8500 kg/month
Red	1785 kg/month	Approx. 6200 kg/month
White (Translucent)	127.5 kg/month	Approx. 500 kg/month

Blue	127.5 kg/month	Approx. 1000 kg/month
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Average weight of biomedical waste generated per month under different categories in comparison to orders issued by pollution control board. In the present study, quantity of biomedical waste generated in all four categories was higher than the quantity permitted for handling by the pollution control board [Table 2]. Quantity generated under yellow category is approximately 8500 kg per month against the permitted for handling yellow category which is 5610 kg per month. Hence it is imperative to take appropriate measurement to reduce unnecessary waste generation.

The pattern of average biomedical waste generated month in combined three years from 2019 to 2021 showed that the highest waste was generated in the month of May with mean biomedical waste being 8672.33 kg followed by April month (8403 kg). Lowest biomedical waste was generated in the month of November (7278.76 kg). This pattern of waste generated probably might help in proper planning to tackle the biomedical waste in hospitals. [Figure 2]

Figure 2:- Month wise distribution of average biomedical waste from 2019 to 2021.



It is observed that around 85% of hospital has been using colour coded bins. Rest of the areas have bins but colours were not as per the guidelines and few bins are without lids. In few wards, blue bins were not maintained. It is observed that proper segregation of biomedical waste was 85%.

Discussion:-

For any health care system to effectively work, biomedical waste disposal management is extremely essential and integral part of it. And also due to infectious and hazardous nature which will have undesirable effects on humans and the environment, henceforth biomedical waste management is of great importance.

In the present study, majority of anatomical waste is generated in operating rooms, followed by cath-ward, EMD, nephrology wards and Oncology departments. These findings were similar to findings by Bhaskar NL et al (2020)^[11] where majority of waste is generated in operating rooms.

With regards to quantum of biomedical waste generated over the past three years from 2019 to 2021, the COVID 19 pandemic had a definite impact on the health care systems throughout globally. The present study found that

quantity of biomedical waste was higher in 2019 year compared to next two consecutive years i.e. 2020 and 2021. This is in contrary to the belief that COVID 19 management methods generated more biomedical waste. Because though COVID 19 emerged in December 2019, World Health Organization (WHO) declared it has pandemic in 2020 and subsequently the phases of lock down and different waves of COVID 19 have been witnessed. The possible explanation might be due to the fact that, during the 1st wave of COVID 19, Government imposed lockdown and many health care institutes were converted into exclusive COVID care centres. Hence many patients found it difficult to reach hospitals for non COVID services either due to difficulty to reach or fear of contracting COVID 19 in hospitals. And apart from this, many elective surgeries and OPD services for non COVID cases were postponed to cater services for COVID patients.

Distribution of various categories biomedical waste showed that half the proportion of waste belonged to yellow category followed by red category. These findings were in concurrence with Anita Pandey et al (2016)^[12] where the maximum waste generated was soiled infectious waste in yellow bag followed by solid infectious waste in red bag and sharp waste in translucent puncture proof container.

With regards to compliance of biomedical waste management norms, it was observed in the present study that around 85% of hospital has been using colour coded bins. Rest of the areas have bins but colours were not as per the guidelines and few bins are without lids which need to be rectified. It is observed that proper segregation of biomedical waste is shown as approximately 85%. All five steps of biomedical waste management including segregation, collection, pre treatment, intramural transportation and storage of the waste are pivotal in proper handling and disposal of biomedical waste. In comparison to present study finding, study by Lohani N & Dixit S (2017)^[13] on biomedical waste management practices found that the mean segregation score was 77% and mutilation of recyclable waste score was 88%. Though there were some practice such as presence of posters but there were identified deficiencies in practices.

In contrast to present study findings, study by Kalia et al (2015)^[14] showed that all the wards and laboratories had properly positioned dustbins and also that colour coding was followed but the records of waste management were not maintained in any of the laboratories or wards.

An analysis of Health Workers' Perceptions on Medical Waste Management in Tanzanian Hospitals by Kagonji, I.S. and Manyele, S.V from Tanzania found few main issues hindering effective biomedical waste management including lack of facilities or infrastructure and lack of skills and knowledge among health care workers in handling the same.^[15]

The advent of COVID 19 pandemic definitely made the situation of biomedical waste management more difficult to manage. And with more emerging infections such as NIPAH virus requiring use of personal protective equipment (PPE), the quantity of biomedical waste will be proportionately higher in the near future also. Hence it is imperative to develop capacity building and training of hospitals and staff to manage biomedical waste effectively as per the guidelines given by the Government of India.

Conclusions And Recommendations:-

The quantum of biomedical waste generated is high as per permitted norms by local regulatory body. All the concerned staff should be frequently educated or trained in this regard to avoid excess wastage, in order to bring down biomedical waste generated. It was found that segregation of BMW as per norms was low and training of Health care workers is required. More emphasis needs to be laid for mutilation of recyclable waste and disinfection. Frequent monitoring by hospital authorities and reviewing the situation on specific designated calendar dated and monitoring will go long way to decrease and for safe disposal of biomedical waste.

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