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RESEARCH ARTICLE

A STUDY OF HOSPITAL WASTE AT G.B PANTH CANTONMENT HOSPITAL IN SRINAGAR (EVALUATION AND MANAGEMENT)

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ABSTRACT

Improper management of hospital waste has serious implications on public health and the general environment. The present study was carried at G.B Panth cantonment hospital which provides treatment for children and is attached to Government Medical College (G.M.C) Srinagar, Kashmir to study existing system of hospital waste management and evaluation of waste produced ward wise. A questionnaire developed by Central Pollution Control board, Ministry of Environment and Forests, India was used for collection of data. Special Training was given to health workers. Observations were made regarding the evaluation and prevailing systems of hospital waste collection, segregation, transportation and disposal at G.B Panth cantonment hospital. Collection and weighing of wastes was carried out with the help of a weighing machine daily three times i.e, morning, afternoon and in late evening hours for ten consecutive days. It was found that there was no proper segregation of the waste starting from the generation to disposal; there was a separate committee for the management of the hospital waste and most of the waste was incinerated. Total infectious waste produced by G.B Panth cantonment hospital was 34.20 kg/pt/day and the non-infectious waste was 128.30 kg /pt/day. Also, G.B Panth cantonment hospital produced around 4.835 kg/pt/day of waste on average.

INTRODUCTION

Biomedical Waste (BMW) is a big problem but it can be minimised if its proper management is planned. Srinagar city is a developed city with moderate facilities. Due to fast increase in population and urbanization there is a constant increase in hospital waste. Some more hospitals and nursing homes are in the offing which may add to the menace of hospital waste. In the present work G.B Panth cantonment hospital which provides treatment for children has been studied taking in to consideration various aspects of hospital waste. The present study has been conducted only to reveal (1) The study existing system for collection, segregation, storage, transportation and disposal of hospital waste at G.B Panth cantonment hospital, (2) the amount of hospital waste (Infectious/Non-infectious) generated per patient per day ward wise.In the waste management processes, segregation and storage are not properly followed in these hospitals. However, collection and transportation activities to final disposal are being practiced. The policy of quality control system in waste management needs to be improved. Birpinar *et al.,* (2009) analyzed the medical waste management in the light of medical waste control regulation (MWCR) in Istanbul. They showed that quantity of medical waste from a hospital was about 22 tons per day and the average generation rate was 0.63 kg/bed/day. Recyclable materials were collected separately at the rate of 83%. Separate collection of different types of wastes was practiced. However, 25% of the hospitals still used inappropriate containers for medical waste collection. Since the late 1880's increased attention has been focused on medical waste, its handling and safe disposal. Various public and environment health regulations have been enacted at National and State levels such as Ministry of Environment and Forests, biomedical waste management and handling rules. Healthcare waste generated from diagnosis activities can be broadly categorized as general waste and hazardous waste. This, however, remains true only when proper segregation and separation of waste is practiced according to type at the source. There are different estimates regarding the share of hazardous and non-hazardous constituents of healthcare waste (Khajuria and Kumar, 2007).

MATERIALS AND METHODS

To conduct the study on hospital waste management at G.B Panth cantonment hospital a prior permission was sought from the Medical Superintendent of the hospital. The questionnaire developed by Central pollution Control board, Ministry of Environment and Forests, India was used for collection of data. Before collection of data regarding hospital waste categories and quantity; observations were made regarding the prevailing systems of hospital waste collection, segregation and transportation and disposal at G.B Panth cantonment hospital. Along with the observation on the basis of a pre-structured questionnaire the hospital staffs including administrators,

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supervisors and other workers were interviewed. Besides the hospital staff the workers at the disposal site and the general public were also interviewed and the information and opinions gathered were recorded. Information was obtained about the types of waste with special emphasis on bio-medical waste ("any solid, fluid or liquid waste, including its container and any intermediate product, which is generated during diagnosis, treatment or immunization of human beings or animals, in research pertaining thereto, or in the production or testing of biologicals) and Other waste (Refers to that portion of waste that is other than medical waste and found inside the wards or departments. It includes food items, textile, paper, plastic, metal etc.), and agency involved in collection at primary site, mode of transportation from source to temporary collection point and onwards to the final disposal site. These findings were substantiated by the on the spot observation of the places in the hospital where waste was generated as well as at the final disposal sites or treatment sites. The information regarding the types of incinerators being used and the processes followed before and after incineration were also recorded. The waste treatment site was visited and critically examined in the light of the regulation regarding bio-medical waste management. An important determinant of the study was to know what precautions the management took to avoid the risk of health hazards to the sanitation staff. The deficiencies were identified in the light of BMW Rules. The author visited all the wards of the hospital and recorded the amount of waste produced. In order to obtain the exact quantities of hospital waste from each department, waste was collected from each department three times a day i.e, in the morning, noon and late in evening from already placed containers and collected in polythene bags labeled with name of the department. Sheets made of inert synthetic material were used for easy segregation of hospital waste. Infectious and non-infectious wastes were segregated on these sheets, department wise and put in different colour coded polythene bags. The steps followed for measurement of hospital waste samples were as follows:-

1. Studied the bio-medical waste regulation 1998 and examined the rules, procedures and regulations set by the hospital to be followed by the personal regarding the management of bio-medical waste generated at the hospital.
2. In order to determine the total daily rate and characteristics of wastes from targeted hospital,. Waste was collected from each ward of the hospital in the morning, noon and late in the evening.

i. Determination of the weight of polythene bags.
ii. Picking the wastes on the sheet for segregation so as to collect infectious and non-infectious wastes and transferred them to polythene bags.
iii. Determination of gross weight of infectious and non-infectious waste separately using a spring balance.
iv. While segregating the waste, gloves, face masks and special clothes were used for personal protection.

The author made use of both primary and secondary data. Primary data was collected from questionnaire administration and interviews with authorities of the hospital, health workers and personnel in charge of waste management (Sanitary Inspector) at the hospitals. Secondary data was obtained from the documents of hospitals and State Pollution Control Board. Information was also obtained from books, journals, newsletters, news papers, periodicals, articles and the Internet. The daily waste output per patient in a ward was determined by the following formulae:-

$$Wday = (Wmed + Woth) / Np$$

where;
Wday - waste rate (kg /bed/day-unit)
Wmed - total medical waste (kg/day-unit)
Woth - total other waste (kg/day-unit)
Np - the number of patients

RESULTS

1. Observations regarding the waste management (prevailing methods of collection, transportation and disposal of hospital wastes).
2. Evaluation of waste ward wise.

Collection of hospital waste

The method of collection was more or less similar in wards. The author visited all the wards of the hospital and recorded the amount of waste produced .In order to obtain the exact quantities of hospital waste from each department, waste was collected from each department three times a day i.e, in the morning, noon and evening from already placed colour coded containers and collected in polythene bags labeled with name of the department and date of collection. The number of patients present in wards was also recorded.

Onsite Transport and Temporary Storage

In G.B Panth cantonment hospital, the waste collected in different bins is transferred to polythene bags of different colours by the sanitary staff of hospital and then the bags are loaded on wheeled trolleys in order to transport it to the back yard of hospital. It was observed that the workers involved in transport of waste have overall gowns, gloves but not suitable gum boots which showed that the personals involved in this type of work have to some extent proper understanding about using protective equipments. This is alarming that the personals are exposed to serious danger of being exposed to the contaminated waste. The hospital does not maintain any record of amount of production of waste and its disposal. The area demarcated for temporary storage of waste is on the extreme back of the main building of hospital. However, no signs of proper bio-medical waste management were observed as the bags containing waste were placed against the wall in open. Both infectious and non infectious wastes were stored temporarily in the same area.

Off Site Transport of Medical Waste

Off site transport of hospital waste of G.B Panth cantonment hospital has been leased to private company known as Kashmir Health Care System (KHCS) at Lassipora, Pulwama which is responsible for transport of the waste. As observed by investigator in the present study, proper segregated waste was not received. In fact colour coding was not observed in waste as HIV syringes and bags were not labeled. There was no sharp differentiation between different categories of wastes. There are two incinerators that are double chambered. Ist chamber of incinerator is attached with water scrubber that controls particulates of matter. For treatment of contaminated water there is effluent treatment plant and treated water is mixed with urea, DAP, cow dung cakes. This nutrient rich or treated water is used for plantation purpose. Cyclones are attached in chimney that control particulate matter. Height of Chimney is 100 feet. Management unit covers a confined land of 8 kanals. All workers of this unit are non local and a non local lady Mehmooda engages freash faction of workers every year from outside valley from last two years.

Table 1 Waste Generation at G.B Panth Cantonment Hospital (Average Values)

Services	Medical waste (kg)	Other waste (kg)	Total hospital waste (kg)	No. of patients	W/day (kg)
OPD	11.0 ± 0.15	14.0 ± 0.5	25.0 ± 1.52	37.5 ± 1.30	0.667
Casualty	2.5 ± 0.50	7.50 ± 0.62	10.0 ± 1.02	20.5 ± 0.68	0.488
Gastroenterology	17.5 ± 1.27	18.5 ± 0.95	36.0 ± 1.32	34.0 ± 0.98	1.059
Medicine	18.0 ± 0.95	22.0 ± 1.30	40.0 ± 1.46	40.5 ± 1.02	0.988
Immunization	2.25 ± 0.75	2.25 ± 0.55	4.50 ± 0.25	10.5 ± 0.15	0.429
Neonatology	16.0 ± 0.95	21.0 ± 1.32	37.0 ± 1.52	39.0 ± 1.50	0.949
Labs	3.6 ± 0.40	6.40 ± 0.82	10.0 ± 0.63	39.0 ± 1.29	0.256
TOTAL	70.85	91.65	162.5	221.0	4.835

Table 2 Total infectious and Non- infectious waste at G.B PANTH CANTONMENT HOSPITAL Hospital during (Average values)

WARDS	No. of Patients	Total Waste (kg)	Infectious Waste (kg)	Infectious Waste/ patient/ day (kg)	Non-Infectious Waste (kg)	Non-Infectious Waste/ patient/ day (kg)
OPD	37.5 ± 1.30	25.0 ± 1.52	5.5 ± 0.55	0.147	19.5 ± 1.54	0.520
Casualty	20.5 ± 0.68	10.0 ± 1.02	3.1 ± 0.31	0.151	6.9 ± 072	0.337
Gastroenterology	34.0 ± 0.98	36.0 ± 1.32	5.0 ± 0.82	0.147	31.0 ± 1.73	0.912
Medicine	40.5 ± 1.02	40.0 ± 1.46	6.1 ± 1.04	0.151	33.9 ± 1.48	0.837
Immunization	10.5 ± 0.15	4.50 ± 0.25	1.5 ± 0.87	0.143	3.0 ± 0.72	0.286
Neonatology	39.0 ± 1.50	37.0 ± 1.52	06 ± 0.71	0.154	31.0 ± 1.21	0.795
Labs	39.0 ± 1.29	10.0 ± 0.63	7.0 ± 0.56	0.179	3.0 ± 0.87	0.077
TOTAL	221.0	162.5	34.20	1.072	128.30	3.763

No special training is given to workers regarding safe collection, transportation, segregation and management of bio medical waste but almost all protective equipments like simple gloves, masks, gum boots, aprons etc are given but not up to the recommended .Workers are given monthly stipend of Rs. 6000 each. Mostly health condition of workers was good. These companies use small pick up vans. Care is taken so that the waste does not spill on the road or in hospital premises because wastes such as body parts, blood and other fluids are dangerous as many of these harbor microorganisms that cause mostly airborne bacterial infections like Tuberculosis, MRSA (Methicillin-resistant Staphylococcus aureus – a powerful staph infection) and other infections such as tetanus, a microbial poison. It is recommended by W.H.O that the vehicle carrying hospital waste should not have any nooks and corners where contaminated waste can be collected, rather the inner of transport vehicle should be smooth and without any corners so that it can be cleaned completely. The vehicle is recommended to be a bit slanting so that washing can be done effectively. The vehicles used by these companies for transport of hospital waste do not have any such features and therefore, chances of contaminated hospital waste accumulating in the corners are always there.

Treatment and Disposal

In many developing countries the more common treatment and disposal method utilized in management of hospital waste are autoclaves, microwave disinfection system, chemical disinfectants, combustion (low, medium and high technology) and land disposal. If the infectious waste is not properly treated it may expose both humans and the environment to microbes and toxins and will lead to illness. So all pathogenic materials used in research activity must be destroyed by heat or chemical treatment before its disposal as bio-medical waste.

Chemical Disinfection

Decontamination is defined as the reduction of microorganisms to an acceptable level which includes disinfection by using anti microbial chemical such as sodium hypochlorite, chlorine dioxide, iodine, hydrogen peroxide vapour etc.

The author in the present study found that chemical disinfection system is found not only in all waste treatment sites but also in temporary storage sites of hospitals. During prolonged strike periods in Srinagar city, it becomes impossible for vehicles of waste treatment plants to ply on the roads daily due to intense curfew and frequent curbs, chemical disinfectants are used during such periods so that contamination, foul smell and culture of pathogens can be controlled to a great extent.

Disposal

Disposal of waste was by incineration and land disposal. When the pickup vans reached the disposal site the waste from the van was emptied on the ground. Then the sanitary workers transferred the specific categories of waste into incinerator and remaining categories for land disposal. No attempt was made to evaluate whether the incineration was complete or not. During incineration the door of the incinerator is sporadically opened and the waste material is turned upside down for absolute incineration. The author made observations during the waste treatment processes and the questions were asked to the working staff in charge of taking care of treating wastes. The explanation given by staff of every treatment site was that they are unaware of bio-hazardous materials. The author found that specific categories of both medical and other wastes are taken to the landfill sites and are treated there. Landfill sites are generally selected in the premises of waste treatment sites where large pits are available, may be due to quarrying or gravel, sand or brick clay extraction so that the disposal is at minimum cost without looking into future problems. It is fenced so that cattle do not approach the site and in which soil cover is used over the waste. The drainage is controlled and basic records are maintained W.H.O (2000). Such landfills are covered with vegetation when they are filled.

Observations Regarding Evaluation of Hospital Waste

Table no. 1 depicts that on average in G.B Panth cantonment hospital, maximum hospital waste was produced in the Medicine department i.e, 40.0 kg and minimum hospital waste was produced by Immunization department i.e, 4.50 kg. Maximum Other waste was also produced in Medicine department i.e, 22.0 kg while as minimum other waste was also produced in

Immunization department i.e, 2.25 kg. Maximum per capita waste was generated by Gastroentrology i.e, 1.059 kg while as minimum per capita waste was produced in Labs i.e, 0.256 kg.

Observations regarding evaluation of infectious and non-infectious hospital waste

Table no. 2 depicts that on average in G.B Panth cantonment hospital, maximum infectious waste was produced in the Labs i.e, 7.0 kg and minimum infectious waste was produced by Immunization department i.e, 1.5 kg. Maximum Non-infectious waste was produced in Medicine i.e, 33.9 kg while as minimum non-infectious waste was produced in Immunization and labs equally i.e, 3.0 kg. Maximum per capita infectious waste was generated by Labs. i.e, 0.179 kg while as minimum per capita infectious waste was produced in Immunization department i.e, 0.143 kg. Maximum per capita non- infectious waste was generated by Gastroentrology i.e, 0.912 kg while as minimum per capita non- infectious waste was produced in Immunization department i.e, 0.286 kg.

DISCUSSION

Managing waste has two vital parts: firstly management of hazardous waste of different types generated from different sources, which involves careful segregation, collection, transportation and final disposal and secondly effective training and supervision of various categories of personnel involved in whole waste management system. For streamlining the process wastes have been classified and are to be stored in different colour coded containers or bags so that staff is able to distinguish the appropriate container for each particular type of waste. Segregation is an important pre-requisite in the entire process of waste management as it allows unique interest to the reasonably small quantities of infectious and hazardous waste, only domestic waste is being collected to separate containers, which also gets mixed with bio-medical waste. No proper segregation is practised. Different colour coded bags are present in wards but not used for different types of wastes. No labeling or marking, viz hazardous/infectious waste is being practised. The general waste is collected in common container in the wards which also contains part of bio-medical waste. It is documented that such a practice of non segregation may increase the costs of final disposal of waste because the infective and non infective wastes get mixed up and hence the wastes that could be disposed off by land-fill need incineration also thus reducing risks and costs of waste management. According to Kulkarni (2011), North America produces 7-10 kg bio-medical waste/ bed/day where as South America produces 3 kg of waste/bed/day. Similarly Western Europe produces 3-6 kg, where as Eastern Europe yields 1.4-2 kg waste/bed/day. In Asia richer countries produce 2.5 kg/bed/day and poorer countries 1.8-2 kg/ bed/day. It shows that health care waste generation is proportional to the level of economic development of the region. Due to economic development the developed nation's life style demands consumption of high amount of goods which generate higher amount of waste. It is also is the fact that more of disposable materials are being used than the reusable ones. It leads to more of packaging materials at the health care centers.

The proportion of clinical waste genereneration depends on several factors like waste management plan, segregation activity at waste generation source. Reports on various countries show that Brazil produces 2.63 kg/bed/day, Bangladesh 1.71 kg/bed/day and China 1.22 kg/bed/day. As per directive of Supreme Court of India medical waste management in India began in 1996, according to which all the hospitals with more 50 beds should have incinerator to dispose off their bio–medical waste. It is estimated that each hospital bed in India generates about 250 grams waste/day which is much lower than most of the countries. In India Delhi generates the highest bio-medical waste at about 1.5 kg/bed/day. On the basis of an average of 250 gram/day/bed it is estimated that India generates about 227 tons per day of bio-medical waste. Maharashtra contributes largest share of bio-medical waste which is about 60% of that of India. In 2001 Kankan division of Maharashtra accounted for 40 % of total bio-medical waste of state while Pune and Nagpur accounted for 18.13% and 11.21% respectively. Nasik accounted for 9.65%, Amravati 7.65% and Aurangabad 7.95% of bio-medical waste. According to 1999 study, Andhra Pradesh produced 18977kg/day, Arunachal Pradesh 6100kg/day, Assam 4000/day, Bihar 44642kg/day, Gujarat 19666/kg/day, Haryana 2860 kg/day, Himachal Pradesh 2329kg/day, Jammu and Kashmir 1378kg/day, Karnataka 141139kg/day, Kearla 2674kg/day, Madhya Pradesh 7181kg/day, Maharashtra 31594 kg/day. In China, Tao and Dawei found that medical waste generation rate changes from 0.5-0.8 kg/bed/day.
At Pravara Rural Hospital the generation of waste from departments under study was found to be 511 gm/pt./day. Similar are the findings in other studies by Patil AD (2001), Basu N (1996)4 and Pruthvish S. et al (1996). Even higher figures of waste generation has been quoted from a study from hospitals in Mumbai to be 1130 gm/pt./day.

Recommendations

In the light of the study made, following recommendations have been framed with the hope of improving the management of bio-medical waste in G.B Panth cantonment hospital. It is important to measure and quantify the amount of medical waste generated in each unit of the hospital periodically to ascertain which unit or department generates the highest and lowest amount of wastes. This could have implications for resource allocation in managing medical waste. There is a need for proper segregation of infectious and non- infectious medical waste. Bags and containers for infectious waste should be marked with Biohazard symbol. Effective waste reduction should be planned. Regular chemical disinfection of waste should be followed. Budget allocation should be increased.

- Medical College students should be trained and given responsibility of supervising the bio-medical waste treatment.
- Medical waste should be transported in suitable dedicated wheeled leak-proof containers.
- Proper training is necessary to develop awareness of health, safety and environmental issues. It is important for workers to know and understand the potential risks associated with healthcare wastes. The hospital should institute regular training and education of all workers, from doctors to ward boys, laborers, rag pickers and also workers of the private waste management company.
- NGO'S should take up work of surveillance of bio-medical waste and should present recommendations periodically.
- Awareness programme should be planned for public including information, education and training.

SUMMARY AND CONCLUSIONS

"Thinking well is wise, planning well is wiser, and doing well is best of all". This study examined the medical waste management practices in G.B Panth cantonment hospital of Srinagar City. From the results of the study, it is evident that medical waste management is not practiced according to W.H.O's recommended standards and BMW Rules. It is imperative for significant investment in the proper management of medical waste in order to reduce the health risk it poses. The author hopes that this study will create awareness regarding the problem of medical waste management in healthcare units and will generate interest for systematic control efforts for effective medical waste management. Hospitals committed to patient care and community health paradoxically defy their own objectives. On one hand they cure patients and on the other they emerge as a source of several diseases by not paying proper attention to the disposal of hospital waste. Improper management of these wastes leads to public health hazards, environmental pollution and impacts aesthetic values. Hospital waste management is important because a lot of infectious waste is generated. All the above points highlight the multifaceted problems of hospitals waste. Formed mind sets, lack of awareness and sensitivity to the subject on the part of the health care staff especially administrators and also little accountability to Government have emerged as vital causative factors. The most vital component of the waste management plans that have been formulated is to bring about a transformation in the mind sets and develop a system and culture through education, training and persistent motivation of the health care staff. It should involve the coordinated working of several departments in a health care establishment i.e. not just the conventional, laundry, kitchen and security besides nursing, medical, surgical, laboratory and administrative departments. The cliché lies in segregation of the waste especially infectious waste from the non-infectious waste resulting in defining and limiting expenditures. No effort should be spared to ensure the scientific management and disposal of all types of health care waste. Medical waste must be separated from municipal waste. Poor management of medical waste has serious health implication to health workers, patients and the public as observed in many other developing countries. Also, due to the toxic nature of medical waste, improper handling may lead to the destruction of natural environment and disturb the balance of the ecosystem.

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