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Short Communication

Biomedical Waste Management in a Charitable Hospital: A Case Study of Jindal Institute of Medical Science, Hisar District, India

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Abstract

Disposal of hospital biomedical waste is a process of paramount importance because of its infectious and hazardous nature. The Government of India promulgated the Bio-medical Waste (Management & Handling) Rules, 1998 and it is mandatory for all hospitals to follow the rules and the standards laid down under statutory regulations. In the present study the Jindal Institute of Medical Sciences, Hisar, India having 110 bedded hospital has been chosen for case study and its compliance with Regulatory Notifications for Bio-medical Waste (Management and Handling) Rules, 1998, under the Environment (Protection Act 1986), Ministry of Environment and Forestry. The study of non infectious and infectious waste generated in different months was performed. The conclusions were: (i) Adequate education, awareness of preventive measure and training is required for technical and non technical staff so that the compliance of standard and regulation of waste management could be maintained in a better and efficient manner. (ii) The compliance of standard is to be maintained while performing processes like segregation, collection, transport, storage, and final disposal of biomedical wastes.

Key words: Biomedical Waste management; Incineration; Hospital.

Introduction

Bio-medical waste is defined as waste that is generated during the diagnosis, treatment or immunisation of human beings and are contaminated with patients' body fluids (such as syringes, needles, ampoules, organs and body parts, placenta, dressings, disposables plastics and microbiological wastes) (Das *et al*., 2001). Hospitals are complex institutions which are frequented by people from every walk of life without any distinction between age, sex, race and religion. Hospitals produce waste which is increasing in quantity and diversity due to advances in science and

technology. The hospital waste, in addition to the risk for patients and personnel who handle these wastes, poses a threat to public health and environment (Singh *et al,* 1996). Keeping in view inappropriate biomedical waste management, the Ministry of Environment and Forests notified the Bio-medical Waste (Management & Handling) Rules, 1998. In accordance with these Rules (Rule 4), it is the duty of every "occupier" i.e a person who has the control over the institution and or its premises, to take all steps to ensure that waste generated is handled without any adverse effect to human health and environment (Notification: BMWM Rules, 1998). Hospitals, nursing homes, clinic, dispensary, animal house, pathological lab etc., are therefore required to set in place biological waste treatment facilities. It is however not incumbent that every institution has its own waste treatment facility. The rules also envisage that common facility or any other facilities can be used for waste treatment. However it is incumbent on the occupier to ensure that the waste is treated within a period of 48 hours (Manohar *et al*., 1998; Baveja *et al.*, 2000; Rao *et al*., 2004 Verma *et al.,* 2008).

One of best and biggest hospital, Jindal Institute of Medical Sciences (JIMS), has been selected for present investigation, which includes two division of N.C Jindal institute of Medical Care and Research and O.P Jindal Institute of Cancer and Research. JIMS is a multispecialty, upgraded secondary level charitable hospital managed by O.P Jindal Group, and is located in Hisar city with 15 acres of land having state of the art infrastructure. At present JIMS has 50 doctors, about 700 paramedical and supporting staff, a turnover of 3.65 lacs outpatients, 31,000 inpatients and 15,000 surgeries and procedures per year. The hospital has 110 beds at present and is the biggest referral hospital in south Haryana and neighbouring Rajasthan and Punjab, covering a population of about 70 lacs. JIMS is a common man's all facility, clean environment health centre. JIMS has 9 operation theatres with facilities for all kind of surgeries like Laproscopy, Arthroscopy, Nasal Endoscopy, and Microsurgery. For serious patient hospital has Intensive Care Unit (ICU), High Dependency Unit (HDU), Emergency ward and Nursery for Neonatal, Ventilators Monitor, Defibrillator, Continuous Renal Replacement Therapy (CRRU), and Pulse Oxymeters other facilities include CO_2 Laser Surgery, Terror Management Therapy (TMU), Echocardiogram (ECHO), Electro Cardiography (ECG), Ultrasound ,Colour Doppler, Digital Audiometery. Its facilities can be divided in four headings:

1. **Center for excellence** which consists of (a) Management of all types of cancer with surgery and chemotherapy; (b) radiotherapy for cancer patients (Equinox 80 Tele cobalt) and (c) 30 channel advanced (High Dose Rate) HDR, Microselectron Brachytherapy unit with Oncentra Treatment Planning System.
2. **Diagnostic facilities** which consists of (a) Spiral Computed Tomography Scan (C.T Scan); (b) Computerized X Ray; (c) Ultrasonography; (d) Colour Doppler; (e) Flourescien Angiography; (f) Perimetry; (g) Mammography; (h) Digital Audiometry; (i) Echocardiography; (j) Tread Mill Test; (k) Video Endoscopy; (l) Colonoscopy and (m) Lab investigation
3. **Therapeutic Facilities** which consists of (a) Centrally Air Conditioned, fully equipped, 9 Operation Theaters for various specialties; (b) State of the art Intensive Care unit with advanced Ventilators, managed round the clock by intensivisits and skilled staff; (c) Neonatal ICU with dedicated Neonatal Ventilators, Phototherapy Units and pulse oxymeters; (d) Lithotripsy

procedure for the treatment of kidney stones and (e) Nd:Yag Laser, Double Frequency Green Laser.

Table 1 Categories of Bio-Medical Waste

Category	**Waste Category**	**Treatment & Disposal**
1	Human Anatomical Waste (human tissues, organs, body parts)	Incineration /deep burial
2	**Animal Waste** (animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal)	Incineration/ deep burial
3	**Microbiology & Biotechnology Waste** (wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	local autoclaving / micro-waving / incineration
4	**Waste sharps** (needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	disinfection (chemical treatment 01/autoclaving / micro-waving and mutilation/ shredding
5	**Discarded Medicines and Cytotoxic drugs** (wastes comprising of outdated, contaminated and discarded medicines)	Incineration /destruct ion and drugs disposal in secured landfills drugs disposal in secured
6	**Solid Waste** (Items contaminated with blood, and body fluids including cotton dressings, soiled plaster casts, lines, beddings, other material contaminated with blood)	Incineration autoclaving / micro-waving
7	**Solid Waste** (wastes generated from disposable items other than the waste shapers such as tubings, catheters, intravenous sets etc)	disinfection by chemical treatment autoclaving/micro-waving and mutilation
8	**Liquid Waste** (waste generated from laboratory and washing, cleaning, house- keeping and disinfecting activities)	disinfection by chemical treatment and discharge into drains.
9	**Incineration Ash** (ash from incineration of any bio-medical waste)	disposal in municipal landfill
10	Chemical Waste (chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc.)	chemical treatment and discharge into drains for liquids and secured land filled for solids

4 **Patient friendly services** which consists of (a) Multiple lush green, landscaped lawns and pollution free environment; (b) Spacious Hospital Parking; (c) Play area for children with well maintained Aquarium, Toys and

Children friendly décor; (d) Advanced Life support Mobile ICU Ambulance supported by Oxygen, Ventilator, Defibrillator, Monitor managed by skilled technicians and (e) 24 hour In-house Pharmacy Store with facilities of bed side supply of medicine.

Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of biomedical waste in any establishment. The key to minimisation and effective management of biomedical waste is segregation (separation) and identification of the waste as shown in Table 1. The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into colour coded plastic bags or containers. The details are given in Table 2. Biomedical wastes should be segregated into containers/ bags at the point of generation in accordance with Schedule II of Biomedical Waste (management and handling) Rules 1998 (Notification: BMWM Rules, 1998).

Table 2 Colour coding and type of container for disposal of biomedical wastes in Jindal Hospitals

Colour Conding	**Type of Container -I**	**Waste Category**	**Treatment options as per Schedule I**
Yellow	Plastic bag	Cat. 1, Cat. 2, and Cat. 3, Cat. 6.	Incineration/deep burial
Red	Disinfected container/plastic bag	Cat. 3, Cat. 6, Cat.7.	Autoclaving/Microwaving/ Chemical Treatment
Blue/White Translucent	Plastic bag/puncture proof Container	Cat. 4, Cat. 7.	Autoclaving/Microwaving/ Chemical Treatment and destruction/shredding
Black	Plastic bag	Cat. 5 and Cat. 9 and Cat. 10. (solid)	Disposal in secured landfill

1. Colour coding of waste categories with multiple treatment options as defined in Schedule I, shall be selected depending on treatment option chosen, which shall be as specified in Schedule I.
2. Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics.
3. Categories 8 and 10 (liquid) do not require containers/bags.
4. Category 3 if disinfected locally need not be put in containers/bags. (Notification: BMWM Rules, 1998).

A field survey of JIMS was done to identify whether the BMWM fulfilment in accordance with the standard norms and Procedures as per the Bio-Medical Waste Management Rules 1998.

Waste determination: For collecting and examining biomedical waste management in hospital the following steps are adopted:

1. Extensive discussion was made with the staffs of each ward, department, and laboratory about the nature of assessment and their role in supporting the study.

2. To assist in determination of waste generation for data collection, the staff was given coded stickers to paste on all of the colour-coded, high-density, polyethylene bags etc.
3. The infectious and non infectious solid wastes were monitored inside and outside the incinerator room for waste management.
4. The infectious and non infectious solid wastes were measured with the help of staff and then recorded. This recording was done for both infectious and non infectious waste each day for a period of 12 months.

Role of Municipality The Municipal body of the area shall continue to pick up and transport segregated non bio-medical waste generated in hospitals, medical institutes and nursing homes, as well as duly treated bio-medical wastes for disposal at municipal dump sites.

Common Regional Facility for Final Disposal of Infectious Biomedical waste Hospitals, private practitioners, emergency care centres though aware of the rules do not have the time or resources to arrange satisfactory disposal of biomedical waste. Self contained on site treatment methods may be desirable and feasible for large healthcare facilities. They will not be practical or economical for smaller institutes. An acceptable common system should be in place which will provide free supply of colour coded bags, daily collection of infectious waste, and safe transportation of waste to offsite treatment facility and final disposal with suitable technology.

Operating parameters Handling, segregation, mutilation, disinfection, storage, transportation and final disposal are vital steps for safe and scientific management of biomedical waste. The key to minimisation and effective management of biomedical waste is segregation (separation) with identification of the category of waste. The most appropriate way of identifying the categories of biomedical waste is by sorting the waste into colour coded plastic bags or containers. Biomedical waste should be segregated into containers/ bags at the point of generation in accordance with Schedule II of Biomedical Waste (management and handling) Rules 1998 (Notification: BMWM Rules, 1998).

Segregation The segregation of Bio-Medical waste is the key to successful Bio-Medical waste management. This aspect is taken care by capturing information regarding the waste material like solid waste, sharp waste, chemical waste etc, collected from various locations in the hospital at the waste generation point itself. Weighing machines are made available by the staff to weigh the waste bags properly for correctness of data. A digital weighing machine with direct interface to the system is also used for this. A trend analysis of the waste generation based on the reports generated by the BMWM module helps the hospitals in arriving at an approximate amount of waste, category wise at various points. This approximation is then used to ascertain the correctness of the quantity of actual waste collected (category wise) in different areas and entering it into the online BMWM system.

The weight approximation trends also help in gradually developing the judgement of the hospital staff and guide them to tie the bags once they are filled ¾ of its capacity. The system ensures the segregation of waste bags at the point of generation in accordance with Schedule I of Bio-Medical Waste rules (Pokhrel and Patil 2004).

Packaging Puncture proof containers were used to pack sharp edged objects which include syringes, needles, scalpels, blades, pipettes, broken glasses. Shredding methods were employed for needle tips followed by disinfection and incineration. Packaging biomedical waste is vital in view of protecting & preventing public health hazards.

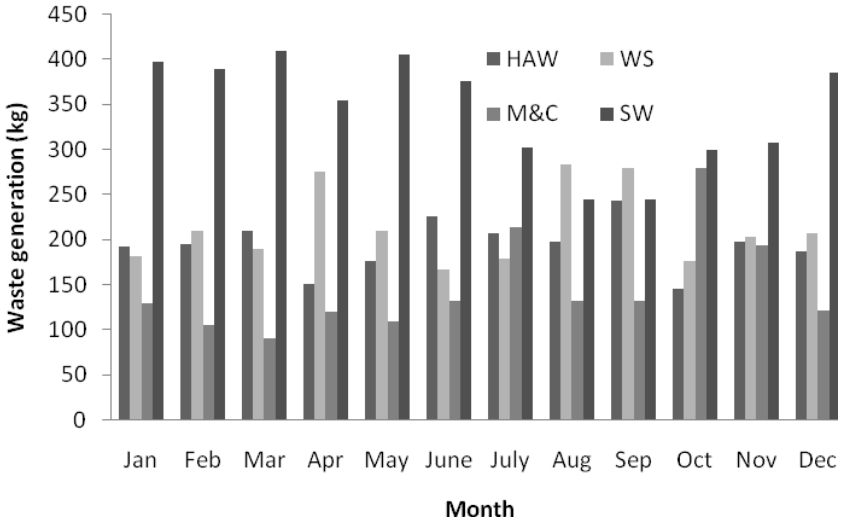
Storage Any injury to working staff during biomedical waste handling should be reported to the higher officials for necessary actions. The biomedical wastes were treated within 18 hours of its generation.

Compilation, Substitution & Shipping The compilation of biomedical wastes was undertaken by two teams of five members each, one for pulling the cart and distributing empty polyethylene bags and the other member for sealing the bags, putting the bags into the cart and replacing the bins with polyethylene bags. The staffs were aware of the potential hazards of the material they were handling and were found to take requisite protective measures. They wore impervious gloves and masks during collection of infectious waste, segregation of various colour-coded containers and transporting waste in the designated cart, taking adequate precaution to prevent any spillage from the plastic bags. Upon questioning, it was found that the staff had been instructed to report any injury during material handling to the medical authorities in charge.

An average of 0.07 kg biomedical waste per day per bed generates in JIMS (official estimation in JIMS). The standard approximation of the Jindal hospital is of 30 kg per day. These biomedical wastes were treated in four categories (Table 3) by Synergy Waste Management (P) Ltd. Figure1 depicted as Waste generation (KG) by JIMS Hospital during year 2009.

Table 3 Approximately average waste generation in (KG) in JIMS per day (Standard Approximation)

Category	Description	Kg (Approx) per day
1	Human Anatomical	6
2	Waste Sharps	6
3	Discarded Medicines and Cytotoxins	4
4	Solid waste	14
	Total	30



HAW- *Human Anatomical*, WS- *Waste Sharp*,
M&C- *Medicine & Cytotoxins*, SW- *Solid Waste*

Figure 1 Waste generation (KG) by JIMS Hospital during year 2009

Conclusions

The hospital under study (JIMS) confirmed to "Biomedical Waste (management and handling) Rules, 1998" in July 1998. JIMS produces a total of solid infectious and non-infectious waste of approximately 30kg/day and the waste is disposed through Synergy Waste Management Pvt. Ltd. which collects wastes from different hospitals and clinics. The study proposes the following measures should be taken to reduce the risk of infection, to control the cost of disposal specifically and to aware the public in general.

- Capacity building of staff (technical and non technical) through short term training programme should be conducted for proper documentation and implementation of the policies.
- The cost of disposal significantly affects the implementation of biomedical waste management policies in any hospital so waste management needs a careful evaluation.
- To create the budget of BMWM a fund is suggested to be created by imposing a mandatory Rupee one charge on every patient in OPD and this fund must be expensed on biomedical waste disposal and short term training programme and the annual expenditure report must be submitted to Ministry of Health for annual publication.
- To create awareness regarding risk to human health from hospital waste among general public and institution seminar/conference/training an awareness programme should be conducted regularly.
- JIMS needs to prepare a proper policy and display it to the public thus serving the dual needs of public awareness and transparency.

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Authors' Contribution: ***Ms. Shivani Jaiswal*** *(Asst. Professor), wrote the manuscript and also corresponding author of manuscript;* ***Mr Atul Kumar Singh*** *(Asst. Professor), performed survey and data collection from the hospital;* ***Mr. MD. Koushik Chowdhury*** *(Asst. Professor), performed calutation of data and editing of manuscript; and* ***Mr. Ravish Garg*** *(Asst. Professor), performed final editing of manuscript and helped in getting necessary formal application for collection of data from the hospital.*

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