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A study on the characterization and management of biomedical wastes in Kapurthala and its adjoining areas

Sukhpreet Kaur[1], Manpreet Kaur Saini[2] and Dr. Jatinderpal Singh[3]*

[1]M.Phil. Scholar, Department of Zoology, Baring Union Christian College, Batala-143505, Punjab, India
[2]Ph. D. Scholar, Department of Zoology, School of Bioengineering and Biosciences, Lovely Professional University, Phagwara, 144411, Punjab, India
[3]Associate Professor & Head, Department of Zoology, Baring Union Christian College, Batala-143505, Punjab, India
*Corresponding author Email id: jpsbucc@gmail.com |contact : +91-9915311947

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Abstract

This study delves into the characterization and management of biomedical wastes in Kapurthala and its neighbouring areas, focusing on three civil hospitals and seven primary health centres. The investigation highlights a substantial generation of biomedical waste in these healthcare facilities, with notable variations in waste management practices between civil hospitals and primary health centres. While civil hospitals demonstrate effective waste segregation and disposal methods, primary health centres exhibit shortcomings in infrastructure and segregation practices. The study emphasizes the critical need to standardize infrastructural requirements for proper biomedical waste management across all healthcare establishments, underscoring the shared responsibility to adhere to regulations. Challenges such as lack of awareness and cost factors are identified, prompting a call for increased education on proper waste disposal. The findings stress the importance of reducing daily waste generation in healthcare operations to ease the burden on disposal systems, emphasizing the role of healthcare providers in ensuring safe and efficient biological waste management.

Keywords: Civil hospitals, Primary health centres, Waste disposal, Environmental responsibility

1. Introduction

"Any solid and/or liquid waste, including its container and any intermediate product, which is generated during the diagnosis, treatment, or immunization of humans or animals" is what is known as biomedical waste. The garbage may consist of items such as sharps, anatomical waste, expired medications, chemical waste, dirty waste, and disposable materials. The aforementioned items consist of cotton swabs, single-use syringes, adhesive strips, bodily fluids, and human refuse [1].

The issue about it has recently escalated into a significant concern, extending beyond hospitals and nursing homes to encompass environmental, law enforcement, media, and public spheres. Unlike a few large private hospitals in metropolitan areas, smaller healthcare facilities lack effective systems for the safe disposal of their waste. Many of these establishments irresponsibly dump waste into local municipal bins or even open areas, fostering unauthorized reuse by rag pickers. The negligent handling of medical waste by Indian hospitals, coupled with the sale of waste as scrap or abandonment for municipal authorities to address, has contributed to a surge in HIV and hepatitis cases, prompting a warning from the World Health Organization [2].

India now faces a critical juncture, with infectious and communicable diseases posing substantial public health challenges. Most hospitals in the country lack the necessary infrastructure, such as shredders, to destroy the hazardous solid medical waste generated daily, despite directives from the Supreme Court. Handling, segregation, mutilation, disinfection, storage, transport-tation, and final disposal are crucial steps in the safe and scientific management of biomedical waste in any healthcare establishment. Several workers have studied the generation and average composition of biomedical wastes in different parts of the world. This is a serious situation that could lead to outbreaks of epidemics. Various workers [3-7] studied different aspects of biomedical waste. The basic step relating to biomedical waste, i.e. different categories of biomedical waste, principals of handling and disposal of biomedical waste were discussed in detail by Singh et al. [8]. Hospital trash that has been contaminated by chemicals utilized within healthcare facilities is classified as hazardous. The substances referenced are formaldehyde and phenols, both of which find application as disinfectants, as well as mercury, which is utilized in thermometers and blood pressure measuring devices. The majority of hospitals in India lack adequate disposal facilities for this deadly waste. The handling of biomedical waste poses a significant challenge, not only in India but globally. Effectively managing highly contaminated and pathological waste is a significant challenge in the pursuit of environmental protection. The Government has implemented regulations and legislation to facilitate the management and disposal of biological waste. An imperative requirement at present is the meticulous and rigorous enforcement of these rules. Kishore et al. [9] reported that biological waste has become a significant worry for hospitals, nursing homes, environmental law enforcement agencies, and the general public. All types of healthcare facilities generate a waste stream varied in its composition. Indian hospitals produce an average of 1.45 kg of garbage per patient each day, but the amount is far greater in advanced nations. Based on Western data, around 15-20 percent of the overall garbage is considered hazardous, which includes contaminated waste [10]. The prevalence of this issue is significantly greater in India due to the absence of appropriate trash segregation. The Ministry of Environment and Forests oversees the management and handling of biomedical waste. The Rules of 1998 were established per the stipulations of the Environment (Protection) Act of 1986. According to these regulations, all healthcare facilities, regardless of their size, are required to establish measures to handle and manage such waste in a manner that does not cause any negative health impacts on humans or the environment. The many classifications of biomedical waste were outlined in Schedule 1 of the Biomedical Waste (Management and Handling) Rule 1998. The accurate categorization of biological waste at the moment of waste creation. It is the duty of all doctors and nurses to rectify the categorization of trash and facilitate the appropriate segregation of waste. Rule 8 (I) of the Biomedical Waste (Management and Handling) Rule 1998 stipulates that authorization must be obtained from the designated authority, known as the Board, prior to engaging in the generation, collection, reception, storage, transportation, treatment, disposal, or handling of biomedical waste [11], except clinics, dispensaries, pathological laboratories, and blood banks that serve fewer than one thousand patients per month).Clinics, dispensaries, pathological laboratories, and blood banks catering to a patient population of fewer than one thousand per month are also required to adhere to the aforementioned regulations for the proper handling and disposal of biological waste. The Punjab Pollution Control Board

has authorized specific shared waste treatment facilities to oversee the management, transportation, treatment, and disposal of biomedical waste in all hospitals across the state. As per the announcement on Biomedical Waste Management Handling Rules 1998, it is forbidden to retain any untreated biomedical waste for a period exceeding 48 hours. Combining biological waste with any other type of garbage is strictly forbidden [12]. In industrialized nations, trash collection entails the methodical transportation of garbage from different points of origin (such as patient areas, surgical rooms, and laboratories) to initial storage sites inside each unit of a hospital. Certain hospitals implement environmental friendly measures, such as planting trees at garbage disposal places and establishing green spaces around them, to improve the sustainability of waste management. An immediate and crucial focus is needed to tackle the present lenient attitude towards biomedical waste in India, highlighting the need to follow established procedures for the welfare of public health and the environment. The government ought to initiate a comprehensive awareness campaign utilizing both electronic and print media platforms. The ultimate solution to this problem lies in the education, training, and promotion of ecologically sustainable and economically efficient technologies.

2. Methodology

A study was carried out to analyze and handle biological waste in Kapurthala and its surrounding region. The Kapurthala district is situated in the northern area of the state of Punjab. This district is adjacent to Gurdaspur district in the North, Amritsar district in the West, and Hoshiarpur and Jalandhar district in the East. To the south, it is next to the Firozepur and Jalandhar districts. To conduct the study on the production of various types of biological waste, three civil hospitals and seven primary health centres were chosen. Multiple approaches were employed to gather data on the generation of different categories of biomedical waste. Concurrently, an analysis was conducted on the present management practices being utilized. The survey was done through regular visits to hospitals and basic health centres. The study was undertaken in primary health centres and hospitals to collect data on the production of several categories of biomedical waste, including anatomical waste, soiled waste, waste sharps, and solid trash. Data on the daily and monthly production of these wastes was gathered.

Table 1: List of Civil Hospitals and Primary Health Centres of Kapurthala District of Punjab Selected for the Study

S. No.	Name of Hospital / Primary Health Centre
1	Civil Hospital, Kapurthala
2	Civil Hospital, Phagwara
3	Civil Hospital, Sultanpur Lodhi
4	Primary Health Centre, Kalasanghian
5	Primary Health Centre, Dhilwan
6	Primary Health Centre, Panchhat
7	Primary Health Centre, Begowal
8	Primary Health Centre, Bholath
9	Primary Health Centre, Tibba
10	Town Dispensary, Kapurthala

The personnel at all primary health centres and hospitals were cooperative in facilitating the survey by supplying the needed data and allocating suitable time for interviews. The present study also examined many hospitals to evaluate the diverse techniques employed in the collection, segregation, storage, transportation, and treatment of biological waste. Data pertaining to the utilization of personnel safety devices, cleaning devices, and storage devices was also gathered. Direct observation was employed to examine the techniques employed for storing and separating materials at the ward/department level, as well as for transporting them internally, storing them at the curb, transporting them outside, and disposing of them on-site or off-site in all ten hospitals. An analysis was conducted on the local infrastructure dedicated to the ultimate disposal of infectious waste. The locations where the garbage was disposed of were frequently inspected.

3. Results and Discussion

In the Primary Health Centre of Kalasanghian, the quantity of waste generated was 185 kg (human anatomical waste), 6155 kg (waste sharps), 45 kg (soiled waste) 340 kg (solid waste/ microbiology and biotech-

nology wastes). In the Primary Health Centre of Dhilwan, the amount of waste produced was 203 kg, 5232 kg, 41 kg, and 380 kg for human anatomical waste, waste sharps, soiled waste and solid waste (microbiology and biotechnology wastes) respectively. In the Primary Health Centre of Panchhat, the quantity of waste produced was 142 kg, 5154 kg, 31 kg241kg for human anatomical waste, waste sharps, soiled waste solid waste (microbiology and biotechnology wastes) respectively.In the Primary Health Centre of Begowal, the dispensary amount of waste produced was 169 kg (human anatomical waste), 5157 kg (waste sharps), 31 kg (soiled waste) and 285 kg (solid waste/ microbiology and biotechnology wastes). In the Primary Health Centre of Bholath, the quantity of generation of human anatomical waste, waste sharps, soiled waste and solid waste was about 151 kg, 4279 kg, 29 kg and 229 kg respectively. In the Primary Health Centre of Tibba, the quantity of production of human anatomical waste, waste sharps, soiled waste and solid waste (microbiology and biotechnology waste was about 155 kg, 4572 kg, 30 kg, and168 kg respectively. Similarly in the Town Dispensary of Kapurthala 130 kg (human anatomical waste), 3617 kg (waste sharps),144 kg (soiled waste) 212 kg (solid waste/ microbiology and biotechnology wastes) was produced. In Civil Hospital Kapurthala, the generation of biomedical waste was 2711 kg (human anatomical waste), 1,30,675 kg (waste sharps), 254 kg (soiled waste) 669 kg (solid waste/ microbiology and biotechnology wastes). In Civil Hospital Phagwara, the generation of biomedical waste was 2757 kg (Human anatomical waste),1,29,935 kg (waste sharps), 239 kg (soiled waste) 667 kg (solid waste/ microbiology and biotechnology wastes) In Civil Hospital Sultanpur Lodhi, the quantity of generation of human anatomical waste, waste sharps, soiled waste and solid waste was about 2137 kg, 58087 kg, 250kg and 512 kg respectively.

The collection of biological waste entails the utilization of diverse containers sourced from numerous locations such as operation theatres, laboratories, ward corridors, and others. The bins/ containers should be strategically positioned to ensure a 100% collection rate. Sharps should be consistently stored in puncture-resistant containers to prevent harm and infection to the workers who handle them. After the collection process, the biomedical waste is kept in an appropriate location. Various types of garbage must be sorted and placed in clearly distinguishable containers. In large hospitals, the storage time should not exceed 8-10 hours, whereas in nursing homes it should not exceed 24 hours. Every container must be conspicuously labelled with the name of the ward or a caution symbol. The most widely used method for distinguishing between various classifications of biomedical waste is to sort the material into containers or sacks that are colour-coded. Schedule II of biomedical waste management also describes the use of four types of bags for the segregation of biomedical waste. For the disposal of human anatomical waste, animal waste, microbiological waste, and soiled refuse, yellow plastic bags or containers should be utilized. The anatomical waste consists of every variety of human organs, tissues, and body parts. Solid refuse, soiled waste, and microbiology and biotechnology waste are all appropriately categorized in red bags. The waste produced during the processing of biologicals, toxins, and devices utilized for transferring cultures, in addition to human and animal cell cultures utilized in research and infectious agents derived from weakened vaccines or laboratory stocks, as well as human and animal cell cultures utilized in research. Soiled waste comprises various materials that have been in contact with bodily secretions, including but not limited to cotton, dressings, soiled plaster casts, linen, and bedding. Solid waste encompasses the trash produced from non-reusable objects, excluding waste sharps like tubing, catheters, and intravenous sets. The recommended bags for disposing of sharp and solid trash are puncture-proof bags in blue and white. The trash sharps consist of items such as needles, blades, syringes, glass and scalpels that have the potential to inflict punctures and cuts. It is recommended to utilize black plastic bags for the disposal of pharmaceutical and cytotoxic medications, incinerator ash, and chemical waste [13].

In all the primary health centres, there was proper identification and segregation of waste in colour-coded plastic bags or containers. However, the sharps were not collected in puncture-proof containers. A single variety

of container was utilized to collect all waste materials, and these containers lacked the biohazard symbol. The current investigation noted that primary health centres employed plastic containers for the purpose of sorting biological refuse. These buckets were in broken condition. There were the chances that the plastic waste was taken by rag pickers. In all the civil hospitals chosen for the study, the segregation of waste in colour-coded plastic bags or containers was done properly. To eliminate the used needles and syringes, syringe cutter devices and a plastic needle destroyer were utilized. The plastic was destroyed by using the plastic destroyer machines. Bandages, cotton, expired medicines, capsules and vaccines were destroyed by burning. Nevertheless, at the site of generation, the syringe and needle remained undamaged in primary health centres despite the implementation of a needle destroyer and syringe cutter. Instead, they are thrown in cemented pits dug inside the ground which was not the proper method. Additionally, it was discovered that sharp objects, plastic and rubber products, and contaminated linen were not disinfected at the point of production. Biomedical refuse ought to be conveyed using covered wheelbarrows or trolleys. Whenever possible, labour-intensive manual loading should be avoided. Before transportation, the sacks or containers containing biomedical waste must be fastened securely. Before being transferred, the container containing biomedical waste must be accompanied by a duly signed document that specifies the date, shift, quantity, and destination, as attested by the nurse or doctor. To prevent transportation operators, scavengers, and the public from accessing and directly contacting the garbage, it is necessary to utilize specialized trucks. The transportation containers must be adequately sealed. It is important to take into account the consequences of traffic accidents during the design process, and the driver should receive training on the appropriate procedures to follow in the event of an accident.

The investigation revealed that rubbish within hospitals was transferred utilizing wheeled trolleys. The containers were placed onto these wheeled trolleys and physically moved from the location where they were created to the sites where they were disposed of. These trucks were specifically designed for the transportation of biological waste and were not utilized for any other function. Special four-wheelers were also utilized for the conveyance of biomedical waste at the public hospital of Kapurthala. The deceased anatomical components are appropriately handled. Initially, the various body parts and organs are segregated into five distinct compartments. The stomach and intestine were put in the first box, the water sample in the second box, the lungs and heart in the third box, the liver, spleen, and kidney in the fourth box and blood samples were placed in the fifth box. All five boxes of separated organs were sent to the Ludhiana laboratory for examination. A separate four-wheeler van was used for this purpose. Sterilization of cloths and bed sheets was done with the help of an electric machine. In all the three civil hospitals surveyed the sharps were collected in puncture-proof containers and marked with biohazard symbols. A needle destroyer and syringe cutter were used to break the used needles. Hospitals locate these instruments near the location where needles and syringes are manufactured. With a minimum contact time of one hour, freshly prepared sodium hypochlorite was used to disinfect vials and gloves. Infectious human anatomical waste was first incinerated and converted into ash. Hanumantha Rao [6] also stated that it is not essential for every institution to possess its waste treatment facilities. Additionally, the regulations allow for the utilization of common facilities or any other facility for waste treatment. Nonetheless, within forty-eight hours, the facility administrator is obligated to ensure that the refuse is appropriately disposed of. The present analysis concludes that hospitals with faulty incineration should be mandated to use a central incineration facility. Hospitals lacking functional or inadequate incineration systems should be permitted to utilize centralized incineration facilities. At civil hospitals, staff were utilizing comprehensive protective gear such as gloves, masks, and footwear. Sodium hypochlorite was present at all the sharp-generating locations across several wards and departments. Nevertheless, in the majority of primary health centres, sanitation personnel frequently neglect to consistently bear gloves, so exposing themselves to a significant likelihood of acquiring infectious diseases. The garments and bed linens were effectively sterilized utilizing an electrical apparatus.

Conflicts of interest: The author stated that no conflicts of interest.

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