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Biomedical Waste Management, Meaning, Methods of Disposal, and Scope by Handling Rules: A Review

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ABSTRACT

The modern mankind lives in an environment which is greatly polluted mostly because of their own torturous activities on the environment and the pollution created by the mankind is again a threat to themselves. The industrialization has already enlightened the rate of pollution and therefore waste management emerges as a concern of the hour. They release solid, liquid or gaseous substances which disturb the environmental and ecological balance. Such substances are possible intimidation to the living beings and also to the environment. Along with now a day's Biomedical waste is also taking an unsafe and extremely hazardous position which can provide rise to serious diseases that may be deadly; therefore it is a subject of worldwide concern. Biomedical waste management is of immense importance to reduce the severe health implications. This article deals with the basic issues of biomedical waste disposal and management of biomedical waste. The purpose of this paper is to spread knowledge among the human resources concerned in health care services to prevent transmission of the diseases in the society and to protect physical condition of public and the surroundings.

Introduction

Any type of waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining there to or in production or testing of biological and other activities by hospitals, pathological practices and health camps etc. Concerning healthcare facilities either solid or liquid containing harmful materials called biomedical wastes [1]. Only about 10%–25% of BMW is hazardous, and the remaining 75%–95% is nonhazardous. The hazardous part of the waste presents physical, chemical, and/or microbiological risk to the general population and health-care workers associated with handling, treatment, and disposal of waste[2]. These wastes consists of mainly human tissues, infected blood, body parts, cadaver fluids, useless and residuals of medicines, drugs, unhygienic cotton, dressings, and sharps like glasses, needles, blades, scalpels, lancets [3]. Collection and disposal of biomedical waste has greatest risk to healthcare, cleanliness workers and the general community. The hazardous biomedical waste without proper sterilization leads to various infective diseases for example Hepatitis B & C, Acquired Immune Deficiency Syndrome (AIDS), Severe Acute Respiratory Syndrome (SARS), Tetanus, Psychosocial distress etc [4].

Requirement of Biomedical Waste Management

Improper management of waste generated in health care services causes a direct health hazards on the society, the health care workers and on the surroundings and environment. There is a requirement for the management and supervision of biomedical waste to minimize the risk of contamination outside the hospital for waste handlers, scavengers and those living in the vicinity of

hospitals. Biomedical waste Management is also needed due to the risk of air, water, and soil pollution, or due to improper incineration emissions and ash. It plays an important role in disposal of the discarded drugs that can be repacked and sold off [5]. The government is committed to protect the environment and health of the population. Biomedical waste management is very essential to control and disposal of hazardous and solid wastes. These are regulated under the Environment (protection) Act, 1986. Rules for management, regulation, handling and disposal of hazardous wastes and solid waste have been framed by the central government as per the provisions of the Environment (protection) Act, 1986.

The Central Government exercising the powers as conferred in the sections 6, 8 and 25 of the Environmental (Protection) Act, 1986 has enacted the Bio-Medical waste (Management and Handling) Rules 1998. They laid out 14 different rules and 6 schedules which were made effective from July 27, 1998 and saw additional amendment in 2016. These Rules mostly focal point to apply a licensing system followed by a reporting mechanism on bio-medical waste generated by hospitals and other health care organization. All persons and organizations that generate, collect, receive, store, transport, treat, dispose or handle and take all steps to ensure that such waste is properly channeled bio-medical waste in any form come under of these rules.

Various methods to be adopted for disposal of bio-medical wastes are: -

a) Incineration

b) Deep burial

c) local autoclaves

d) Micro-waving

e) Mutilation

f) Disposal in landfills

g) Disinfection

h) Chemical treatment

The methods of disposal of wastes mainly depend on the nature of the category. Segregation, storage and safe disposal of the waste is the key to the effective management of biomedical waste in a workplace [6,7].

Steps and Methods of Biomedical Waste Management

Segregation: Segregation of waste is very important and plays a major role for improved biomedical waste management. It is important to reduce the volume of infectious waste otherwise the quantum of waste will go beyond the control of management [8]. As per Rule 6, different colored plastic bags have to be used for collection of bio medical wastes and labeled. Such wastes shall be transported only on authorized vehicles. Rule 6 further requires that no untreated bio-medical waste shall be kept beyond 48 hours without the permission of the competent authority.

a. **Red Bag**: Recyclable contaminated waste such as bottles, intravenous tubes, catheters, urine bags, syringes and gloves.

b. **Yellow Bag**: Human and animal anatomical waste, soiled waste including items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs, expired or discarded medicines, chemical waste (liquid), discarded linen, mattresses, beddings contaminated with blood or body fluid, microbiology, biotechnology and other clinical laboratory waste.

c. **Black Bag**: Incineration ash and chemical waste (solid).

d. White bag: Waste sharps including needles, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts.

e. **Blue Bag**: Metallic body implants and glassware such as medicine vials, ampoules.

As per the Rule the institution/ hospital generating such wastes shall be duty bound to maintain a proper record regarding the generation collection, reception, storage, transportation, treatment and disposal of bio-medical waste.

Storage: Healthcare services must provide a sufficient storage area for medical waste until it is collected for treatment and disposal. Storage area should be selected carefully which is unapproachable to the general public and must exhibit warning symbols & signs. It should be stored in a dry and secured area before being transported. The area must be protected from water, wind, rodents, insects and animals. Hazardous biomedical waste should not be stored for more than 3 months [9].

Treatment: Biomedical waste treatment refers to the processes to eradicate the toxic effects of the waste. There are several treatment options which maximize safety during handling and disposal of the waste. It also minimizes environmental hazards.

Most common methods used for treatment and decontamination of biomedical waste are.

a) Incineration

b) Autoclaving

c) Irradiation

d) Chemical treatments

e) Disposal of Biomedical Waste

Incineration: It is a treatment process used to convert pathological and pharmaceutical waste into ash, flue gases and heat. Operating temperature for incineration should be in the range of 800-1400°C. It decreases the mass of waste by 90-95% and thus reduces adverse effects on the environment [10].

Autoclaving: It is a process of steam sterilization and is the most common alternative to incineration. Autoclaving requires a temperature of 121oC and pressure of about 15 pounds per square inch (psi) for 20-30 minutes. This treatment is applied to inactivate the transmittable agents and to sanitize the equipment used in medical services. It is less costly and carries no documented health impacts [11].

Chemical Treatment: This action is often used to disinfect liquid waste, so that it can be disposed of locally. It makes use of several techniques such as oxidation, reduction, precipitation and pH neutralization to convert waste into less hazardous substances. Chlorine, Sodium hydroxide or Calcium oxide can be used according to the nature of waste [12].

Irradiation: These systems are currently being used in waste treatment operations which include gamma, electron-beam, ultraviolet and X-rays. Irradiation sterilizes waste in an enclosed chamber by exposing it to a radioactive cobalt-60 which gives out gamma rays that are mortal to micro-organisms. It is very costly as compared to other methods and safety measures must be taken to protect workers from harmful effects of radiations such as cancer, radiation sickness or even death [13].

Disposal: Land disposal is typically used for remediation of waste which is decontaminated by above applicable treatment methods. This method is generally used in developing countries which involves the dumping of waste into a landfill. Land-filling should be done at locations where groundwater level is low and which are far from flooding sources. Radioactive wastes are generally dumped in the oceans far away from human habitations. Every state and local administration has its personal rules and regulations for disposal of germ-free waste [14].

Importance of BMW Management

Planning the waste management and recycling for all of the waste generated in the health care facilities is a crucial task which plays an exceptionally important role in the worldwide cleanliness, public health, conservation of resources and sustainability of the ecosystem. Recycling medical waste minimizes utilization of raw material and reduces the amount of the waste materials that must be disposed in a landfill. It reduces the hazards and risks to the community which can be acquired by hospital. Reduction in the occurrence of HIV/AIDS, sepsis, hepatitis, and other diseases transmitted by infectious medical equipments takes place by proper waste management [15]. Prohibited trading of used syringes, injection needles and medical tools can also be prevented by proper management strategies. Awareness about hazards of biomedical waste and its proper disposal is required for a safe and healthy future [16,17].

Biomedical Waste Management Outside India

A survey by WHO conducted in 2012 in the scenario of BMWM status which included Japan, China, Australia, New Zealand, Philippines etc. (24 countries of West Pacific area). All West Pacific countries fared satisfactory except Micronesia, Nauru, and Kiribati. Only Japan and Republic of Korea use BAT (best available technologies) for BMW logistics and treatment, which were well-maintained and regularly tested [18]. In Canada, there is variation seen in the medical waste. However, Canada's hospital appears to moving away from on-site incinerators toward centralized provincial facilities for BMW sterilization [19].

Biomedical Waste Management in India

In July 1998, first BMW rules were notified by Government of India, by the erstwhile Ministry of Environment and forest [20]. During 2002–2004, International Clinical Epidemiology Network explored the existing BMW practices, setup, and framework in primary, secondary, and tertiary health care facility (HCF) in India across 20 states [21]. New Biomedical Waste Rules formed in 2016. Advantage of new rule: The new rules lays down new criteria for authorization of an HCF and have made the procedure for getting authorization very simple. Bedded hospitals will get automatic authorization and non bedded HCFs will get a one-time authorization. Another improvement in the new rules is in the monitoring sector. The MoEF (Ministry of Environment, Forest, and Climate change) will review HCFs once a year through state health secretaries and the SPCB (State Pollution Control Board). Moreover, according to the new rules, the advisory committee on BMWM is now mandated to meet every 6 months.

Conclusion

Waste generation should be minimized for the protection of environment and general public health. It should be a mutual teamwork with committed government backing, good BMW practices followed by health-care workers continuous monitoring of BMW practices, and strong governing body. It is our fundamental right to live in clean and safe environment. The current BMWM 2016 rules are an improvement over earlier rules in terms of improved segregation, transportation, and disposal methods, to decrease environmental pollution and ensure the safety of the staff, patients, and public. People must be sensitized to the issues related to biomedical waste and should participate in the programs planned

for waste minimization. The medical employees must be trained to create awareness and foster responsibilities for prevention of exposure and unsafe disposal to the waste. Medical personnel should strictly follow all the rules and regulations implemented by concerned governing bodies. Furthermore, more use of non-PVC medical devices and development of newer novel and eco-friendly systems for disposal of BMW should be encouraged. All participants in BMW Management should oath to guarantee a cleaner and greener environment.

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