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Pharmaceutical Waste

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1. Objective

The article aims to provide a background the importance and significance of proper disposal of waste, describe the correct methods to dispose off unwanted waste material and expired medications.

2. Method

The information about methods of proper disposal as well as consequence of improper disposal was collected by extensive literature survey of all available resources.

The pharmaceutical waste includes expired products, dispensed drugs that are unwanted or discontinued and contaminated medications. When drugs are prescribed prophylactically or in response to an acute or chronic illness, only a portion of the active ingredient of the drug is metabolized. The non - metabolized parent compound as well as the metabolized enters the natural aquatic environment through waste discharges into receiving streams which may pollute lakes or even the intakes of drinking water treatment plants.

Pharmaceutical compounds are designed to have biochemical activity in target organism at relatively low concentrations. Therefore at the low part per - trillion levels, there is concern that some of these compounds, could have an ecological and human health effect. Although physical and biological processes occurring in aquatic environments may cause attenuation of many pharmaceutical compounds, trace concentrations of human and veterinary pharmaceutical compounds and metabolites have been detected in surface water, ground water and drinking water.

An active pharmaceutical ingredient (API) is a chemical constituent having pharmacological activity and useful effect in the diagnosis, cure, mitigation, treatment or prevention of disease or one that affects the structure or function of the body.

The question to us is what is a waste? Waste are unwanted or unusable materials. Waste is any substance which is discarded after use or is worthless, defective and of no use. When we are taking a broad spectrum look, Pharmaceutical waste can result from many activities and locations in a healthcare facility. Waste pharmaceuticals can pose a special treatment and management challenge. Smaller quantities at households can often be thrown away in the Municipal waste stream, larger quantities kept at Pharmacies, distribution centers, hospitals etc. can be managed to minimize the risk of release or to exposure to workers and the public.

The category of waste includes expired unused ad contaminated pharmaceutical products including vaccines and biological products used for therapy. Prescription and over the counter drugs end up as pharmaceutical waste as used in pharmacies: gloves, masks, bottles, etc. There are different medicines that are made through biotechnology which are referred as biopharmaceuticals or biologics. But when, the management of pharmaceutical waste comes into picture, the health care facilities would routinely flush waste pharmaceuticals down the drain. But as a society we didn't know how hazardous or detrimental these drugs would be to the environment, and as of now different biologists have found residual pharmaceuticals in fish and other aquatic organisms and slowly we are understanding how bad the untreated disposal of any drug or chemical waste would be. So as a responsible citizens and waste managers, we need to understand the precautionary principle for the same.

Pharmaceuticals are ideally disposed off by high temperature (i. e. above 1, 200^0 C) incineration. Such incineration facilities, equipped with adequate emission control are mainly to be found in the industrialized world. Waste disposal methods are as under;

i) Recycling – Incineration
ii) Other thermal treatment plants: Chemical, Physical and biological treatment.
iii) Landfills.

Pharmaceutical waste includes medicines, biological products (blood, serum, vaccine) which are expired, incompletely used, damaged and spilled, rejected medicinal products.

3. Principle and General Requirements

1) Regardless of the quantity, proper treatment and disposal is necessary owing to wide range of chemicals present which have inherent health risk and environmental hazards.
2) Persons handling the hazardous pharmaceutical waste right from segregation to disposal should be equipped with protective gears such as hand gloves, mask.

1) Packaging Materials

Segregation at source

2) Hazardous Waste
3) Non Hazardous Waste
   a) Non hazardous pharmaceutical waste – liquid waste
   b) Non hazardous pharmaceutical waste – solid waste
   c) The used ampoules and vials (but not cytotoxic drugs) to be collected into sharp container/bins.

4) Transportation to Collection Store: 1) storage before disposal
5) Transportation to disposal site: Transportation to disposal site
   All waste bag seals should be in Place and intact at the end of Transportation.

6) Disposal Methods: a) Hazardous Waste: Encapsulation & Landfill
   a) Non hazardous solid waste: Landfill
   b) Non - hazardous liquid solid waste – sewer

4. Procedure

1) Segregation at source.

a) Packaging Materials: The Secondary packaging should be removed and disposed as general dry waste as per the method under the medical waste guidelines. The contaminated packaging materials with medicinal products should be treated as 'Pharmaceutical Waste'.

b) Hazardous Waste:
- Segregate the pharmaceuticals waste into hazardous according to the hazardous list as per the table (hazardous list).
- Discard the hazardous waste into the leak proof containers and labeled as "Hazardous Pharmaceuticals waste" with the name of place where produced.
- Biological and vaccines should be treated as infectious waste and disposed accordingly.

c) Non-Hazardous Waste:
- Pharmaceuticals not listed on the hazardous list should be considered as non - hazardous and should be further segregated into liquid and solid/ semi solid dosage forms.
- The non-hazardous pharmaceuticals waste should be discarded into the green bags or containers and labeled as 'Non - Hazardous Pharmaceuticals Waste' Liquid Waste or Non Hazardous Pharmaceuticals Waste, Solid Waste and name of place where produced.
- The used ampoules or vials ampoules which contained non - hazardous pharmaceuticals waste should be crushed, on a hard, impermeable surface and disposed off as 'sharps'.

2) Transportation to Collection Store:

a) Storage before disposal -
- In the health facilities, pharmaceuticals waste in hospital wards or departments should be returned to the pharmacy store for disposal wit a duly filled waste generation record.
- For the private pharmacies, the waste should be stored separately prior to disposal.

3) Transportation to Disposal Site:

All waste bag seals should be in place and intact at the end of the transportation.

4) Disposal Methods: -

a) Hazardous Waste: Encapsulation and Landfill
- It should be immobilized or encapsulated prior to disposal into land fill as per the encapsulation method below: -

b) If the waste is with their secondary packages, remove materials from their package but not from the primary packaging (strips/blisters/bottles/sachets).

c) Fill a steel/plastic drum up to 75% capacity with pharmaceutical waste.

d) Fill the remaining space with the following at approximate ratios by weight.
- Cement 15%
- Lime 15%
- Water 5% or more to obtain required consistency

e) Close the lids of the drum and place the drum at the base of landfill and cover with soil.

f) Once the waste are encapsulated, it may be disposed off with the municipal waste or ordinary landfill.
- Incineration of hazardous pharmaceutical waste is an option.

5) Incinerators:

a) The incinerators should be set according to the environment control strategies of the National Environment Commission (NEC).

b) The incinerators should have the following specifications: -
Type – Rotary Kin incinerators
Chambers – Two
Min Temperature – 1100^0 C
Capacity Range – Depending on the waste generated data.

c) Pressurized containers should not be incinerated as it may explode during incineration and cause damage to the equipment.

d) Waste with heavy metal content (eg. Lead, cadmium, mercury) should not be incinerated as it will cause emission of toxic metals into the atmosphere.

e) Hazardous pharmaceutical waste including waste containing more than 1% halogenated compounds should be incinerated in rotary kin incinerators with a minimum temperature of 11000 C.

f) The waste should be mixed with cardboard and possibly with other combustible material for incineration.

g) The residues of incineration should be land - filled.

A) **Non- Hazardous Solid Waste:** LANDFILL

Non hazardous pharmaceutical wastes should be disposed off in a solid landfill as identified by the local Health Administration Head or local Municipality.

B) Non- Hazardous Liquid Solid Waste:

a) Non Hazardous pharmaceutical liquid dosage from waste such as large volume parental fluids (salts, amino acids, lipids, glucose), vitamins and eye drops (but not antibiotics or cyto toxic drugs can be diluted) (dilution factor water in 1: 3 ratio) and flushed into the sewers in small quantities.

b) ii) Fast flowing water sources should be used to flush the diluted liquid pharmaceutical waste.

c) Do not discharge even small quantities of pharmaceutical waste into slow moving or stagnant water bodies.

d) Non hazardous, liquid waste other than large volume parental fluids (salts, amino - acids, lipids, glucose) vitamins & eye – drops should be land filled as it is.

C) Recording and Reporting of Medical Waste:

Recording and reporting of medical waste is important for the future planning on infrastructure, logistics and manpower. It will also serve the purpose of monitoring the compliance to the medical waste management guidelines.

Waste generated from all units and taken to the storage facility should be individually weighed and reported as per the recording and reporting form.

1) Weighing of Waste:

a) Equipment:

- Approximate personnel protective equipments.
- Appropriate weighing machine

b) Methods to Weigh Waste: -

- The total waste generated from the facility should be weighed at the common storage site and recorded on the register/form.
- The waste should be weighed without opening the plastic bags.

2) Responsible Persons:

- The designated personal for the intended purpose should be responsible for weighing and recording.
- The focal person for infection control and medical waste management or the competent person should compile the total waste generated.

Recycling of Waste

It is a process which involves the treatment of substance that can be recycled to its original form or to its intermediate form. It includes recycling of organic wastes but excludes energy recovery. Recycling definitely benefits the environment by use of raw materials and an be saved for sustainable development. It is said that Recycle today, for better tomorrow.

Role of Pharmacist

A Pharmacist is the best person who knows and can identify the worthlessness of most medicines. He should accept the degree of responsibility for changing the entire medication use process, finding the cure and most important minimizing the toxic effects of pharmaceuticals on environment. Any Pharmacist is involved with the entire process of prescribing, advising, dispensing, pharmaceutical care, disposal of expired medicines and ultimately reduction in metabolic waste discharge into the environment. The Pharmacist practitioner has the opportunity which will definitely influence more rational prescribing that would reduce the amount of leftover medicines. This would decrease potential risks to the environment.

All the different issues of prudent drug disposal methods to end users of drugs are being handled by the pharmacists. They are the medication experts and most knowledgeable health care professionals, which can provide valuable education to people on how to dispose the unwanted waste in an effective manner. Drug disposal programs and pharmaceutical collection events serve not only as resources to the community for safely disposing off unused or unwanted medications but also as a platform, for examining the different causes of medication waste.

And last but not the least pharmacists provide information regarding proper disposal of medicines, drug abuse and several drug managing programs and can be the part of several NGOs for environmental protection.

5. Conclusion

In today's scenario with the growing life style the need of pharmaceutical compounds is also increasing and they are with environment in extremely large quantity and the system present is not able to control the untreated or partially pharmaceutical waste. Therefore pharmaceutical waste management continues to be new frontier for health care facilities.

New waste classification is observed which increasing the complexity of management of waste, so the new techniques of disposal are developing regularly to make surrounding eco - friendly. But one thing we should be particular that the technique should be cost effective with better treatment facilities.

And if the entry of different drugs or any pharmaceutical waste into eco - system, biotic, a biotic factors causing severe side - effects, we should sincerely investigate to control them and definitely all should work in coordination to make more and more awareness to professional and well as consumers to in turn reduce the burden of unused and expired medicines on ecosystem.

So we should take care of our mother, environment is also our second mother. We should be equally concerned about it as it is the only source of life i. e. power, oxygen and water. So 'Conserve more' and protect our environment.