



Study on Role of In-patient Pharmacist in Prescribed Drug Handling, Mixing, Infusing and Spillage Handling of Chemotherapeutic Drug-Cisplatin in a Tertiary Hospital Pharmacy

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The in-patient pharmacist in a cancer hospital plays a major role in patient care especially in patient taking chemotherapy and other narrow indexed drugs as a part of cancer treatment. The pharmacist works as one of the members of cancer treatment team along with physician, oncologist, nurse and other medical professionals. An oncology pharmacist has major role in chemotherapeutic drug handling, mixing, infusing and spillage handling in a disciplined manner. In order to get hands on training about "oncology-pharmacy", it is a mandatory novel pharmaceutical department where a hospital pharmacist who works in oncology will have to get training in handling of chemotherapeutic drugs. The pharmacists who are interested in cancer care will involve in various facets cancer care; from chemotherapeutic drug regimen preparation, mixing of dosage regimen, infusing and finally spillage handling. Hence, it is a mandatory criterion for a graduate pharmacist to get hands on training in specialty Centre to take the responsibility as oncology in-

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patient pharmacist. The inpatient pharmacist can also be a clinical investigator for various clinical trials involving chemotherapeutic medication usage in patients with cancer. Current study shows that an inpatient pharmacist can play a major role in handling, mixing, infusing and spillage handling of chemotherapeutic drugs in a cancer care centre. The pharmacists are also responsible for reducing drug waste, dealing with drug shortages and reducing exposure to hazardous cytotoxic drugs. The current study suggests that the pharmacist in a cancer care hospital should specially be trained for the handling of chemotherapeutic drugs, mixing and infusion, spillage handling and wastage handling in order to provide accurate treatment for patient and to avoid untoward damage to the person who is handling.

Keywords: In-patient pharmacist; oncology pharmacist; chemotherapeutic drugs; anticancer drugs; chemotherapy; oncology pharmacy; drug handling; spillage management.

1. INTRODUCTION

Cancer is the disease of uncontrolled multiplication and spread of abnormal forms of normal human cell. Since, cancer cells adhere to any part of the body and seize upon in obstinate manner like how the crab lives. In case of cancer, if the body cell does not divide and spread to other tissues and cells, they are called benign tumors. But if the tumor is malignant, they spread to other sides or tissues of the body. Till date, researchers have studied about more than two hundred different types of cancers [1]. Cancer can be caused both in men and women [2]. The cancer cells can manifest to larger numbers with distinguished properties compared to normal cells. The cancer cells are invasive and metastatic and can proliferate uncontrollably, differentiate and lose their function. The pathological causes of cancer include the occurrence, epidemiological spread, and the characteristics of specific cancer cells. Sometimes, other demographic factors such as age, gender, race, genetic makeup and exposure to environmental carcinogens may determine the behavior of cancer cells. Particularly, exposure to ionizing radiations have been well known risk factor that cause various types of cancers, especially thyroid carcinoma, acute leukemia, breast cancer [3], lung carcinoma, soft tissue sarcoma, and basal cell skin cancers. Other causative agents of cancer in humans and animals. are grouped as chemical carcinogens that include cigarette smoking, use of azo-dyes, aflatoxins, asbestos, benzene, and radon. In most cancers, pathological virus such as hepatitis are the causative agents in human [4, 5]. The virus-induced cancer can express in human. Cancers are pathologically classified as carcinoma, melanoma, sarcoma, osteogenic sarcoma and leukemia. Carcinoma is malignant tumour that arises from epithelial cell. Melanoma is defined as the abnormal growth of

melanocytes in skin. Sarcoma is the type of cancer that affect the muscle cell or connective tissue. The osteosarcoma is the frequently occurring cancer type that destroys normal bone tissue. Leukemia is characterized by rapid growth of abnormal leucocytes [6]. Cancer is diagnosed by histological methods and electron microscopic method by finding the presence and type of cell junctions, surface of the cell, shape of the cell and nucleus, nuclear membrane, nucleoli, number of cytoplasmic organelles, and any other secretory product in the cytoplasm such as melanosomes in melanoma and membrane-bound granules in endocrine tumors [7]. There are few tumour markers for diagnosing cancers such as circulating tumor markers and tissue tumor markers. The circulating tumor markers are found in the body fluids such as blood, urine, stool, pleural effusion, cerebrospinal fluid and sputum from the cancer patients. These markers are used to determine the prognosis of disease, to find out the remaining cancer cells after treatment or cancer relapse, to assess the response to the treatment and to monitor drug resistance. Tissue tumor markers are found in the tumors and can be detected by taking biopsy sample. Tumor markers are used for the diagnosis of cancer, stage of cancer disease, type of cancer, and for the disease prognosis and for selection of appropriate therapy. A biopsy procedure will confirm the presence of cancer. For this, a tiny piece of the suspicious area is taken out and is tested in the lab.

1.1 Cancer Treatment

Cancer can be treated by single or combined treatments of active surveillance, surgery, radiotherapy and chemotherapy.

1.2 Active Surveillance

It is otherwise called as watchful waiting because some of the cancer cells can grow slowly without

causing any signs and symptoms for prolonged period after diagnosis. Hence, the patient may not necessarily take any kind of treatment but periodic screening and monitoring by the oncologist is necessary. So, the oncologist will closely monitor the patient for any abnormal signs and symptoms and can initiate appropriate at right time.

1.3 Surgery

Surgical removal of cancer tumor in the operation theatre. If the cancer growth is specific to one area or organ and do not spread, then the cancer is removed by the surgery. Surgery is done to remove the lymph nodes that are affected by the cancer. Surgery is posted to remove cancer tumor that has spread to other organs of the body which is very uncommon. The type of surgery will be suggested based on the cancer affected region in the body, size and position of the tumours.

1.4 Radiotherapy

Radiotherapy is the exclusive method of treating cancer with high energy X-rays. These X-rays are capable of destroying cancer cells without causing significant harm to normal cells. Radiotherapy is carefully planned to target the cancer affected area in the human body. The most common side effect of radiotherapy is fatigue and is based on the part or organ of the body that is being treated.

1.5 Chemotherapy

Most of the cancer treatment include use of chemotherapeutic or anticancer drugs to damage the cancer cells. As of now, fifty or more different chemotherapy drugs are available currently in the market. Most of the chemotherapy drugs are intravenously infused into vein and few are given orally as tablets or capsules. The drugs circulate in the blood and can destroy cancer cells in the human body. A combination of two or more chemotherapeutic drugs with different mechanism of action are always used [8].

Most of the chemotherapeutic drugs cause side effects. These side effects can be controlled or prevented by various methods.

1.6 Chemotherapeutic Drugs for Treating Cancer

The anticancer drugs are classified as below with their detailed mechanism of action.

- Alkylating agents: These drugs act by forming covalent bond with DNA of cancer cells and delaying or stopping DNA replication. The alkylating agents are cyclophosphamide, mechlorethamine, melphalan, thiotepa, cisplatin etc.
- Antimetabolites are drugs which block or disrupt the metabolic pathway for synthesis of DNA. The antimetabolite drugs are methotrexate, Mercaptopurine, etc.
- Cytotoxic antibiotics are derived from microorganisms that prevent the mammalian cell division. Example: Daunorubicin, Doxorubicin, mitamycin, Biliomycin, etc.
- Chemotherapeutic cytotoxic drugs that are derived from plants are vinca alkaloids, taxanes, and camptothecins. These drugs specially affect microtubule function of cancer cells and affect the formation of the mitotic spindle. Example: Vinblastine, Etoposide, Vincristine, etc., [9].

This study included the use of cisplatin in the in-patient pharmacy of a cancer care centre.

1.7 Cisplatin

TRADE NAME: Platinol®, Platinol®-AQ, CDDP

Cisplatin is an antineoplastic chemotherapy drugs from the group of alkylating agents. Cisplatin is the drug of choice for different cancers such as advanced bladder cancer, metastatic ovarian cancer and metastatic testicular cancer. Cisplatin is administered in inactive form. The drug is activated after entering into the cancer cells. The mechanism of action of this drug is by displacing the water molecules by the chloride atoms in the cytoplasm of the cancer cell. The modified product can react with any nucleophilic compounds inside the cell such a DNA and RNA. Cisplatin binds to the N7 reactive center on purine residues of DNA and cause damage to DNA of the cancer cells. This damage blocks cell division causing cell apoptosis. Many publications published from research laboratories have mentioned DNA as a critical target for cytotoxic effect of cisplatin and the enlightening evidence is both prokaryotic and eukaryotic cells show hypersensitivity to cisplatin by deficient in DNA repair.

1.8 Infusion of Cisplatin

- The drug is infused intravenously (no tablet form of cisplatin is available).

- The drug is an irritant which cause inflammation of the vein through which the drug is administered.
- Cisplatin can cause tissue damage when escape from the vein. Only trained personnel like oncology nurse should administer the drug. The oncology nurse or the oncologist should be alerted immediately about the pain, redness or swelling at the injection site by the patient.
- Additional IV fluids must be given to patient before or after the cisplatin infusion. The patient should be hydrated adequately with additional IV fluids prior to, during and after cisplatin administration, to protect the kidney function.
- The dose of cisplatin should be calculated based on type of cancer, height, weight, kidney function, and liver function and comorbid conditions [10].

1.9 Role of Hospital Pharmacist in Clinical Oncology

- DRUG HANDLING
- DRUG SELECTION
- PRESCRIBING AND DOSING
- DRUG PROCUREMENT
- DRUG STORAGE
- DRUG PREPARATION
- DISPENSING
- INFUSION HANDLING
- SPILLAGE HANDLING OF CHEMO DRUGS
- WASTAGE HANDLING OF BIOSOLID WASTAGES [11]

1.10 Drug Handling

Oncology pharmacists (OPS) ensure safety in compounding, preparing, and dispensing chemotherapy. The inpatient pharmacist posted in oncology ward should be responsible for reducing wastage of drug, dealing with shortage of drugs and minimizing the exposure to hazardous drugs. The oncology in-patient pharmacist should be expert in handling anticancer chemotherapeutic drugs and its mechanism of action. The OPSs also work as cytotoxic drug therapy experts and get trained in various responsibilities including drug selection, procurement of drugs, drug storage, chemotherapeutic drug preparation, drug dispensing, drug prescription, drug dosing based on individual patients, getting clarification with oncologist, drug administration at bed side, patient monitoring, evaluating drug effect, side

effects and monitoring adverse drug reactions [12].

1.11 Drug Selection

The oncological pharmacists can help the oncologist in the fields like suitable drug selection and offering information about drug, like pharmacology, dosing of drugs based on the vital function tests to avoid any kind of side effects or adverse drug reaction. OPS have specific skills related to drug-information that include utilization of relevant internet search engines and to scrutinize the published and ongoing clinical trials, review the study design, and evaluate the evidence-based guidelines and correctness of biostatistical values. There is also certain work included for the OPS by regularly reviewing the current literatures that documented the use of anticancer drugs for off-label use. The obtained information can be predominantly helpful to justify the possible treatment outcome and prognosis of the disease state. OPS can prepare history of drugs both current and prior medications taken by the patients to clarify the drug tolerance. This information can help the oncologist to appropriate drug selection for the current treatment [13].

1.12 Prescribing and Dosing

The oncological pharmacists have an important function in the designing of complexity of chemotherapy drug prescription and auditing the chemotherapy drug regimens. Chemotherapy drug prescribing or procuring the drugs are solely depend on the oncologist and the pharmacist combined effort based on the medication order. The chemotherapy regiments are prescribed based on the disease state, signs and symptoms and availability. The dosing calculations of the cancer patient are done using body surface area (BSA) with respect to setting the drug doses and changing the drug administration on following or non-following days. The cancer care treatment basically include diagnosis of disease, height and weight of the patient, calculation of body surface area, calculation of dosage (mg/m^2), calculation of final dose of drug, starting date and time of therapy, number of days of therapy, solution diluents to be used and infusion volume, infusion drip rate per minute, choosing the intravenous route whether by bolus or infusion, infusion duration, frequency of drug administration, and number of scheduled doses to be administered. The height and weight of the patient should be documented which help the oncology pharmacist

and bedside nurse to cross or double check the dosage calculations based on body surface area and final dose to be administered [14]. The demographic properties of patients also affect the pharmacokinetics properties of drugs such as absorption of administered drug, drug distribution, drug metabolism, and drug elimination changes especially age factor. A unique challenge in pediatric dosing of cytotoxic drugs is faced by the oncology pharmacist is the differences in drug disposition, changes in the gastrointestinal function that includes pH of stomach, intestine and blood, drug movement, and production of bile, or activity of enzyme activity which alter the amount of drug absorbed after administration.

1.13 Dose Calculation

The dosage for anticancer chemotherapeutic drugs is calculated considering below criteria.

1. Dose calculated based on body surface area is accurate. But consider other parameters along with BSA for appropriateness.
2. The extreme data of body surface area should not be used for calculation of doses (example: <1.5 and >2.0). Because, muscle wastage and obesity of the patients may affect the therapeutic dose and the drug effect.
3. The body surface area value is used as a distinctive absolute dosage range of drugs for a particular dosage regimen protocol (example, doxorubicin dose is 80-120mg and not 60mg/m²). The appropriate dose is likely to be in the specified range and do not depend on the body surface area.
4. The calculated dose should be in exact numerical value without any fractional dose size, for e.g., if the calculated dosage of doxorubicin is 120mg, then the prepared dose should be 100 mg of doxorubicin. If the calculated dose of methotrexate is 67mg, then the prepared dose should be 70 mg of methotrexate.
5. The other parameters such as comorbid conditions, liver function and kidney function should be considered along with the body surface area during calculation of drug dosage for a particular patient.
6. The elimination of drug should be known by the pharmacist and oncologist before calculating the dosage. The dosage should be adjusted based on the blood investigation report of the patient, for

example, serum levels of creatinine, bilirubin and transaminase, or genotyping and phenotyping results.

7. The drug-drug interaction should be monitored with chemotherapeutic drugs and other drugs that may inhibit or enhance the elimination of chemotherapeutic drugs.
8. The other parameters that affect drugs disposition e.g., serum albumin, presence of ascites, cachexia, obesity, and performance status, should be checked before calculating the dosage.
9. The correctness of the calculated dosage should be checked to avoid over dosage and under dosage.
10. A biological end point such as myelosuppressant should be checked for the administered dose and the subsequent dosage should be adjusted up or down, according to the neutrophil count (1.5*10⁹/L).
11. The calculated dosage should be cross checked by another person like co-pharmacist or a nurse [15].

1.14 Dose Calculating Formula

The chemotherapy drug dosage for each patient is calculated based on Du Bois Formula.

Du Bois formula:

$$BSA = 0.0071848 \times \text{height (meter)}^{0.725} \times \text{weight (kg)}^{0.425}$$

1.15 Procurement

The anticancer therapy should be optimized by making the drug available to the patient by procuring at the time of need. The duty of oncology pharmacist is to spend quality time to procure antineoplastic drugs in spite of hurdles like manufacturing shortages. Contamination (43%), delay during manufacturing, closure of manufacturing plant, discontinuation of drug manufacture due to raw material unavailability and due to increased demand of the specific chemotherapeutic drug.

1.16 Storage

Chemotherapeutic or cytotoxic drugs should be stored properly under appropriate lighting, ventilation and temperature in order to sustain chemical integrity and to warrant 100 % activity of the chemotherapeutic property of anti-

neoplastic drugs. It is very difficult to maintain certain chemotherapy drugs which are similar in look and sound. This factor may also impact on improper storage and improper dispensing.

1.17 Preparation of Chemotherapeutic Regimen

It is a complexed step to reconstitute and prepare anticancer drugs is complex process. So, accurate compounding and preparation of chemotherapeutic drugs are necessary. There should be standardized charts for quantity of dilution of drugs, type of carrier solutions, volume of diluted drugs, proper containers to be used such as glass, polyvinyl chloride and plastic, rate of infusion, and expiration dates. This chart should be prepared by the pharmacist and approved by the Pharmacy and Therapeutics Committee. The pharmacist should maintain worksheets for compounded drugs that contain information about chemotherapy drug used during each cycle, serial numbers in case of recall, calculation of cumulative doses of certain drugs, number of chemotherapy treatment and their dates, simultaneously with columns for double checking by the technicians and pharmacists. This can help to maintain a record of patient's course of therapy over time [16].

1.18 Dispensing

The pharmacist in a cancer care centre will also focus on appropriate drug delivery and writing policies and dispensing procedures for appropriate transport. Precaution should be taken for transporting breakable and expensive drugs in protein carriers. The pharmacist should be expert in writing policies and dispensing procedures that explain restriction during spillages or leakage situations and ensure suitable disposal of intravenous, oral or topical dosage forms. The pharmacist should be capable of dispense the exact cytotoxic drugs.

1.19 Infusion of Chemotherapeutic Drugs

Chemotherapy is most often administered intravenously by infusion. The drug can be administered intravenously or through chest cannula. Some of the chemotherapy drug taken in pill or capsule form. Before mixing of chemotherapy drugs, the pharmacist should check the height and weight of the patient, and should also check the lab investigation values to ensure the safety of treatment. The pharmacy

technician should collect all gathers all supplies like needle, protective kit, goggles, gloves, and containers necessary for preparing each single dosage of drug. Then, the pharmacist should mix the calculated dosage of drugs one by one. An oncology pharmacist should supervise the above works done by the technician. Pharmacy technicians should be expertise in mixing of chemotherapeutic drugs. The dosage should be prepared in strict sterile and germ-free area. Pharmacists should also take additional measures to recheck the order to make sure the right medication in the right dose, given through the right route of administration at the right time. The oncology pharmacists should also focus on medication safety profiles using innovative technology [17]. The prescribed medications should be checked for potential drug interactions. An ultimate goal is to provide a sterile and timely treatment for patient. The pharmacy team is available to discuss the needs of patient with co-pharmacists.

1.20 Preparation of Chemotherapy Drugs for Infusion

The following conditions must be followed while preparing chemotherapy drugs [12]. The preparing chemotherapy medication should be sterile, accurate and timely administered. The physician and the pharmacist should get collaborated for chemotherapy administration during treatment [16].

1.21 Steps Involved in Preparation

- Physician orders patient's chemotherapy
- The pharmacist reviews the order for accuracy and completeness
- Infusion nurse notifies the pharmacy when all assessments and parameters are cleared.

1.22 Spillage Handling of Chemotherapy Drugs [18]

Chemical spillage of chemotherapy drugs is defined as the spilling of cytotoxic hazardous drugs in solid, liquid or gaseous form. Preparation room should be checked properly to reduce spillage and should be planned for responding to chemical drugs spillage is necessary irrespective of the type or the quantity of hazardous cytotoxic drugs. Safety equipment for spillages should be kept ready and the

technicians should know about the emergency procedures for removal of spillages.

1.23 Spillage Management Procedure for Chemotherapeutic Drugs

The cytotoxic spillage should be handled with the spill kit. The workers should be notified about the spillage. The spillage kit should be opened and the warning signage should be displayed at the isolated spillage area. The spreading of spillage should be prevented. The worker should wear the cytotoxic gown, booties, overshoes, gloves and masks with isolation gown. A set of pre-mix cleaning detergent should be obtained and 5% decon90 solutions should be prepared. Any broken glass pieces and any other sharp items should be removed from the spillage area and put into the sharp bin. Gauge should be used to clean up the spillage using 5% decon90 solutions as necessary. The cleaning procedure should be repeated several times and the gauges and wastes should be disposed into first cytotoxic waste bag. The area should be cleaned in an order of least contamination to the greatest contamination with deacon90 solutions to remove all spillage residues and the area should be rinsed with distilled water. The cleaned area should be allowed to dry. The contaminated area should be cleaned repeatedly at least two times. The contaminated equipment, gauze used to clean and the unused cleaning solution must be discarded into the first cytotoxic waste bag. Remove shoes cover and outer layer latex

gloves, isolation gown and discard into the first cytotoxic waste bag. The first cytotoxic waste bag should be sealed and tightly tied. The first bag should be placed inside the second waste bag. The cytotoxic gown, masks and remaining gloves are discarded into the second cytotoxic waste bag. Then the second waste bag should be sealed tightly. The workers should wash their hands thoroughly. The supervisor should be notified about the spillage. The supervisor should prepare an incident report about the spillage of cytotoxic drugs, cleaning procedures and the removal of used materials. A replacement spill kit should be obtained from pharmacy services [19].

1.24 Wastage Disposal of Cytotoxic Chemotherapeutic Drugs and Biosolid Medical Wastes

The policy for waste disposal of cytotoxic drug should be established as per the existing National biomedical waste management rules. The cytotoxic waste is any material or equipment that comes in contact with cytotoxic drugs during drug storage, drug handling, dosage preparation, drug administration, and waste disposal. These materials included packaging material, protective equipment, preparation supplies, syringes and needles, administration tubes, drug bags, and incontinence inner wears of cancer patients who received cytotoxic drugs, hood prefilters and high efficiency particulate air (HEPA) filters [20, 21]. The cytotoxic waste should be placed in an airtight container and "cytotoxic" Hazard symbol

Contents of spill kits

Contents:



One tyvek cytotoxic gown



one isolation gown



One pair shoe cover



one surgical mask, one respirator mask

Fig. 1. Content of spill kit for handling spilled chemotherapeutic drug



One protective eye goggles



two pair latex gloves



Two cytotoxic waste bags,
Plastic ties with label



one sharps bin

Fig. 2. Represent the package consisting of eye goggles for protection, two pairs of rubber or latex gloves, two waste bags for cytotoxic substances, labelled plastic ties and a bin for collecting sharp broken items



One pack gauze



one spill management procedure

Fig. 3. Represents the waste package consisting of gauze and a spill management procedure

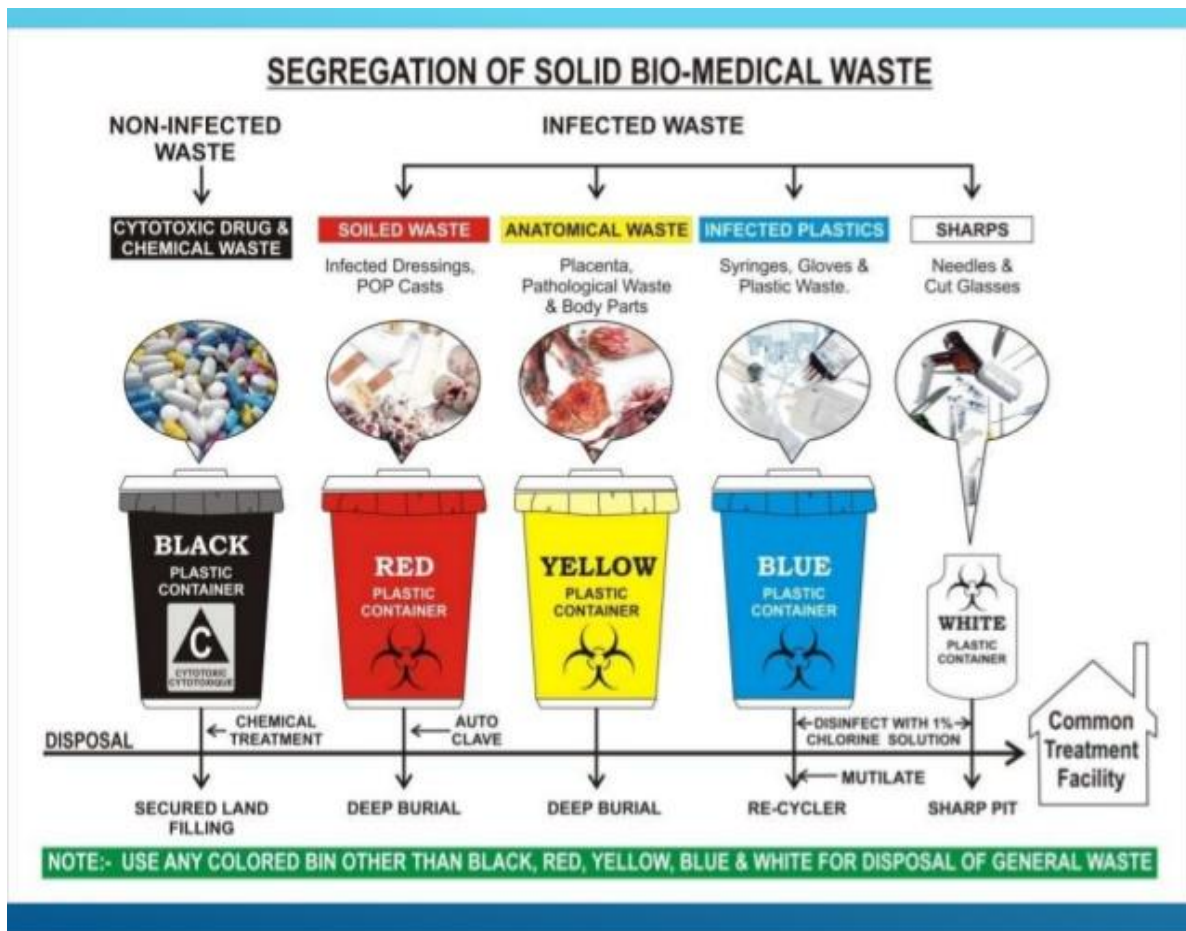


Fig. 4. The poster that has to be displayed in the cytotoxic waste disposal management facilities in any institution or hospital

should be prominently mentioned on the container. The other cytotoxic wastes such as administration tubing and protective equipment should also be kept in a leak-proof and tear-proof containers with the cytotoxic hazard symbol. All cytotoxic waste should be packed in rigid leak-proof containers with cytotoxic hazard symbol and scheduled for final transport outside the institution. The remaining unused fluid from the cytotoxic drug preparation should be disposed in a sealed container and placed in a rigid container. The base of the rigid disposal container should be covered with absorbent pads. This rigid container should be handled and disposed like other cytotoxic waste. Disposable incontinence diapers and inner wears used by the cancer patients should be packed in a cytotoxic waste container. The cytotoxic waste containing spills and other things should be incinerated at 120°C or above. The cytotoxic waste receiving containers or incinerators should remain closed and opened only during waste deposition. Waste bins with foot pedal and lids is

recommended for minimal exposure during disposal of cytotoxic waste [22, 23]. The people who work in the cytotoxic disposal area must also know the disposal procedure to avoid contamination of outer side of the receptacle when depositing waste. The workers should be trained for proper transportation of cytotoxic waste receptacles. Only the assigned and trained person should handle the receptacles. The trained workers should wear gloves and protective goggles and also should have an individual spill kit during disposal. The cytotoxic waste container should not be removed through public care units and canteen [24, 25].

2. MATERIALS AND METHODS

The study was done at the Erode Cancer Centre, Erode for a period of six months from February 2019 to July 2019. The patient's data was collected from patient's prescription chart and inpatient pharmacy where the drugs are dispensed and prepared. The chemotherapy

prescriptions were collected from the hospital. Data of drugs prescribed, routes of administration and dosing regimen were analyzed from the collected chemotherapy prescription. The information about chemotherapy drug regimen preparation, dosing, infusion, spillage handling and wastage disposal of chemotherapy drugs at the in-patient pharmacy and chemotherapy drugs preparation room was observed. Procedure for handling chemotherapy drugs after dispensing was given mentioned below. The pharmacist received the prescription from the nursing station. Then the prescription was cross checked and verified by the pharmacist with the physician. The pharmacist after getting confirmation about the prescription from the physician and proceeded to the dose calculation. The dose calculation was based on the BSA by using Du Bois formula. All chemotherapy drugs were administered through the intravenous route. Pre dose calculation was prepared to the infusion. The infusion preparation was carried out using saline solution. The selection of saline solution was based on the type of the chemotherapy drug. The prepared infusion drug was filled into the sterile syringe with accurate dose. Then the filled syringe was hand over to the respective nursing person. Remaining drugs after infusion were disposed by the pharmacist as per the guidelines.

3. RESULT AND DISCUSSION

We have collected 59 prescriptions which contain both single (cisplatin alone) and combined drugs therapy. From that, 42 prescriptions contain singles drugs therapy and 17 contain combined drug therapy. Among those prescriptions, cisplatin is the most commonly used drug for single dose chemotherapy treatment. The current study dealt with the exploration of role of oncology pharmacists for ensuring the safety during compounding, preparing, and dispensing the chemotherapeutic drugs. The pharmacists should be responsible for minimizing drug waste, managing drug shortages, and for decreasing exposure to hazardous drugs. So, we planned to do the study by choosing inpatient pharmacy at Erode Cancer Centre, located at Thindal, Erode. We have been posted in inpatient pharmacy and chemotherapy drugs preparation room for one month. We learnt about prescription handling of chemotherapy drugs, preparation, infusion handling and spillage handling of cytotoxic drugs step by step with the help of medical care team consisting of pharmacist, nurses and oncologist.

4. CONCLUSION

To conclude, the study suggested that the pharmacist in a cancer care hospital should specially be trained for the handling of chemotherapeutic drugs, mixing and infusion, spillage handling and wastage handling in order to provide accurate treatment for patient and to avoid untoward damage to the person who is handling. The pharmacist should be involved in educating co-pharmacists and health care providers about the chemotherapy order writing, dosage calculation, infusion techniques and mixing and spillage handling of drugs in order to provide accurate treatment to patient, safety handling of cytotoxic drugs before administration, wastage and spillage handling after the administration in a tertiary care hospital.

CONSENT

The patient's informed consent was obtained before the case facts were published.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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