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EFFECTS OF CHEMOTHERAPY AND RADIOTHERAPY ON BLOOD COMPONENTS OF BREAST CANCER PATIENTS

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ABSTRACT

Breast cancer is one of the most common malignancies in women worldwide. It can be treated with surgery combined with chemotherapy and radiotherapy.

This study aims to investigate the effects of chemotherapy and radiation therapy on blood cell components of breast cancer patients who survived one of these therapies, in Al-Amal National Hospital for Cancer Management. Numbers of blood cells including white blood cell (WBC), red blood cell (RBC) and lymphocytes, and hemoglobin (HGB) concentration were measured in thirty-two women with eighteen of them treated with chemotherapy and the left treated with radiotherapy.

The results showed that the counts of WBC, RBC and lymphocytes decreased faster in the patients treated with chemotherapy compared to that in the patients treated with radiotherapy, whereas HGB concentrations only slightly changed with both treatments, upon four cycles of each treatment. These results support that radiotherapy may cause less side effects on breast cancer patients compared to chemotherapy.

Keywords: Brest cancer, radiotherapy, chemotherapy, blood components

INTRODUCTION

Breast cancer is the second most common cancer for women in the world, which considered as a health challenge in many countries of the world, as one of the most prevalent cancers in developing or developed countries. Particularly in Iraq it remains one of the most common conditions that frighten women because they are more likely to be infected than men. Breast cancer is divided into two types, malignant cancer and benign cancer which are about ninety percent, and malignant equivalent to 15 percent. It's worth mentioning that some studies indicate that one of each eight women may suffer at some point in her life. The symptoms of breast cancer are bulk in the breast, Inflammation in the lymph node in the armpit [Saunders **(**2009**)**].

Clinical diagnosis: in case breast cancer, there are no two people are exactly alike. Clinically there are series of tests on the tumour and nearby tissues to create a "profile" of how the breast cancer looks and behaves. The most important methods of prevention of breast cancer, according to the report are the periodic medical examinations to detect breast cancer such as breast examination, mammography and mammogram, breast self-examination, knowing that this test does not prevent breast cancer, but may help to know what changes are occurring in the breast, identify any unusual signs, exercise regularly for 30 minutes a day, do not take hormone therapy after menopause without consulting a doctor, maintain healthy weight, avoid fat in food, and avoid daily stress [Morrow 2015, Siu 2016] are many factors that influence treatments such as the size and appearance of the tumour of the cancer, how quickly it grows, any signs of spread to nearby healthy tissues, whether certain things inside the body- such as hormones or genetic mutations (abnormal changes in genes) are factors in the cancer's growth and development. For breast cancer treatment there are different treatment methods depending on stage of the disease and the quality of cancer cells [Geoffre 2000]. Methods of Treatment: Surgery, Radiotherapy, Chemotherapy, Hormonal therapy, Targeted therapy, Immunotherapy, Biologic therapy, Alternative therapy and complementary medicine Alternative medicine & Complementary medicine, Psychotherapy and emotional support. These treatments are either topical or systemic to all cells in the body. The present research focuses on radiotherapy and chemotherapy [Morrow 2015, Eijers-Heijboer 2001, Lyman 2003, George 2014]. The possibility of spreading the cells from the tumor precedes detection, so it is necessary to give treatment up to all regions of the body and, hence, the benefit of chemotherapy, hormonal, and treatment of the major as they reach all the cells of the body [Tuttle (2009)]. Through the blood, what is chemotherapy or chemotherapy? It is the use of some drugs to eliminate cancer cells. In most cases of breast cancer treated by a range of drugs with no need to other kinds of treatments, these drugs are given either orally or intravenously or intramuscular injection. All ways of treatments are chemotherapy because drugs reach all parts of the body through blood stream. It is therefore useful in case of spreading of the disease [Siu 2016]. These

groups of drugs which used in breast cancer are referred to as the first letter of each drug used. These are examples of some of the groups used [NCCN (2017)]:

AC±T: Adriamycin (chemical name: doxorubicin) with Cytoxan (chemical name: cyclophosphamide) with or without Taxol (chemical name: paclitaxel) or Taxotere (chemical name: docetaxel)

AT: Adriamycin with Taxol or Taxotere

CMF: Cytoxan with methotrexate and fluorouracil (also called 5-FU or 5-fluorouracil)

CAF: Cytoxan, Adriamycin and fluorouracil

FEC: Fluorouracil, epirubicin (trade name: Ellence), and Cytoxan

FAC or CAF: Fluorouracil, Adriamycin and Cytoxan. These drugs are given in a different sequence

All these drugs that used in chemotherapy did not only kill cancer cells, but they also cause damage to some healthy cells leading to side effects [George 2014, Wolff 2014, Hoogstraten et al., 1981].

Radiotherapy: It uses high-energy rays to eliminate cancer cells and prevent them from growing. The radiation is either from external radiation issued from outside of the body or by placing radioactive source in thin plastic tubes directly inside the breast called radiation implantation. The patient sometimes receives two types of treatment [Geoffrey, **2000**]. X-ray or Gamma-ray used for radio-therapy [Geoffrey 2000**)**, Washington and leaver 2009]. The type of radiation used for external radiotherapy is the same type used for radiography, but with much greater doses than one Rad (Rad is the amount used to operate normal chest rays and what is used to treat malignant breast tumors is more than 4,500 rad sometimes used for the term "Gray", which is synonymous with Rad, both are the X-ray unit) [Washington and Leaver 2009]. Before starting external radiotherapy, the radiologist determines the amount of radiation and the way in which the treatment that are given to the patient and then the treatment is divided according to the case situation. If the patient has five thousand units, this high dose cannot be given in one day or one week, but divided to five or six weeks, the patient will give 160 to 200 units every day for five days a week then the patient will give a two-day rest (Thursday and Friday) to resume treatment during the following week until treatment is completed [Barnett et al., 2009, Rosenberg et al., 1982].

MATERIALS AND METHODS

A-Chemotherapy

1-Fifteen samples were carefully selected from women with breast cancer who visit Al-Amal National Hospital for Cancer Management) (weights between 58-65kg and their ages between 48-55 years), chemotherapy doses depend on the weight and age of the patient

2 –Blood samples prepared by withdrawing (3-5 ml) of the venous blood from the patients after 24 hours of chemotherapy treatment dose (Mabthera (Scientific name: Rituximab))

3. All blood components measured (before and after chemotherapy), by using Analyzer (Diagon D-cell5D, serial No.171021655D, media in Hungary: 2011, Department of Laboratory/ Al-Amal National Hospital for Cancer Management), as follows: blood samples shacked for 15 min., in Analyzer shaker, then by press on start an automatically metallic needle will step down inside the tube and draw out about 2µml from a blood sample. After a few seconds, all blood data will appear on Analyzer screen.

4- Haematology Analyzer used to measure WBC, Lymphocytes, RBC and Haemoglobin concentration (for all blood samples) [Haematology Analyzer Diagonal D-cell5D, serial No.171021655D, media in Hungary: 2011].

B- Radiotherapy

Hypo fractionated radiation therapy: In this approach, radiation is given in larger doses using fewer treatments– typically for only 3 weeks.

1- Seventeen samples were carefully selected from women with breast cancer who reserved their radiotherapy in Al-Amal National Hospital for Cancer Management) (weights between 55-67kg and their ages between 45-60 years).
2- The doctor (radiation oncologist) determines the dose required for each case (Total dosage limits). This dose will divide the dose into several sessions (2.5 per session). Linear Accelerator X-ray [primus Mid; Serial No. 3779; Siemens/Germany] used for irradiation. This device present in radiotherapy department) Al-Amal hospital for cancer, designed for therapeutic purposes). The patients under one parallel field with two levels X-ray source. The amount of dose automatically depends on time.
3- Doses are not equal for patients. Some of them do not continue treatment for several reasons, as the death of the patient or change in the treatment schedule. The best doses thus were complied with the integration of the length of treatment (0,2.5, 5and 7.5 Gy), (0Gy) is conceded as control.
4- Measurements are taken as in step 4while chemotherapy is in part A.

RESULTS

In this study, 15 patients with breast cancer received chemotherapy, and 17 patients reserved their radiotherapy measurements taken after 24 hours of each session. The results in each kind of treatment compared with the same factor:

A-WBC: Comparison in WBC X10^9/L accounts between Chemo and Radio therapy shows the difference in WBC account in chemotherapy and radiotherapy. The results have indicated that WBC account decreases after every session (decreasing of WBC with increase of chemotherapy doses), but in radiotherapy WBCslightly decreases after every session (increase of radiation doses), but nearly stabilizes at last two doses. This is not observed in chemotherapy WBC continuously decreasing with increased doses, as shown in fig. 1.

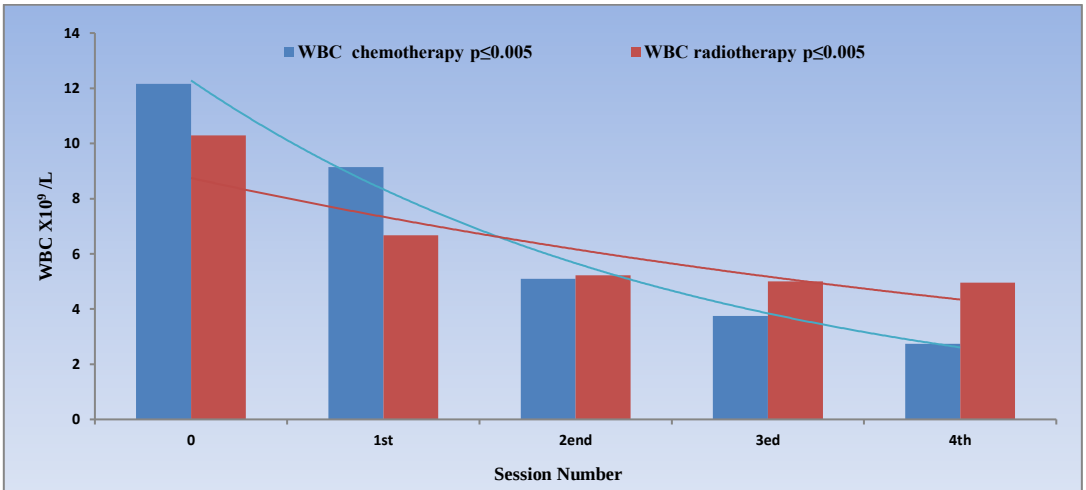

Fig. 1: Comparison in between WBC X10^9/L accounts betweenChemo and Radio therapy

b- RBC accounts: as in WBC RBC account decrease with increasing both radiotherapy and chemotherapy sessions, but as shown in fig. 2, it's clear that RBC account decreased by chemotherapy more than in radiotherapy in breast cancer patients.

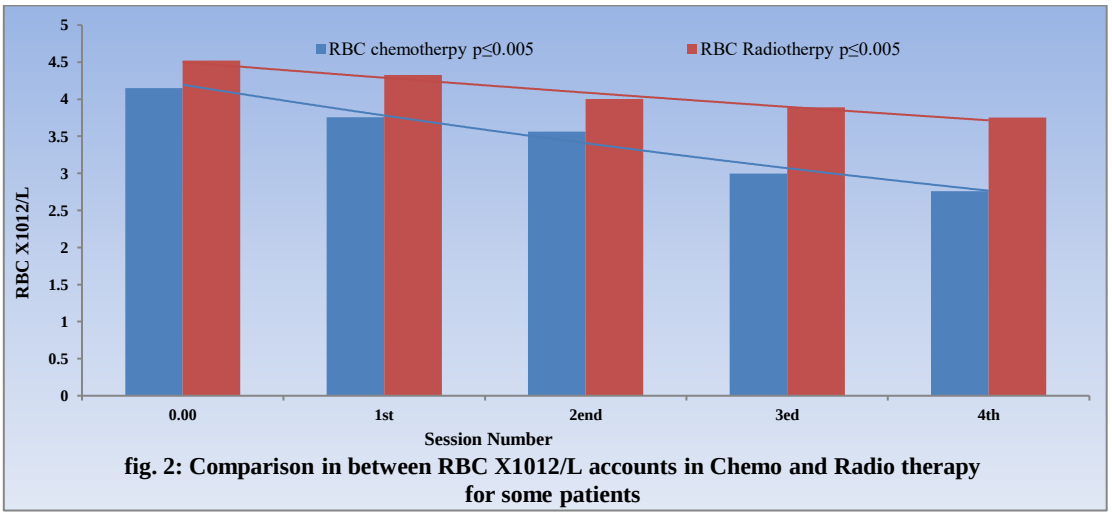

fig. 2: Comparison in between RBC X1012/L accounts in Chemo and Radio therapy for some patients

c- Lymphocytes: the results showedthatchemo therapy and radiotherapy have nearly the same effect on lymphocytes account more than radiotherapy as shown in fig. 3.

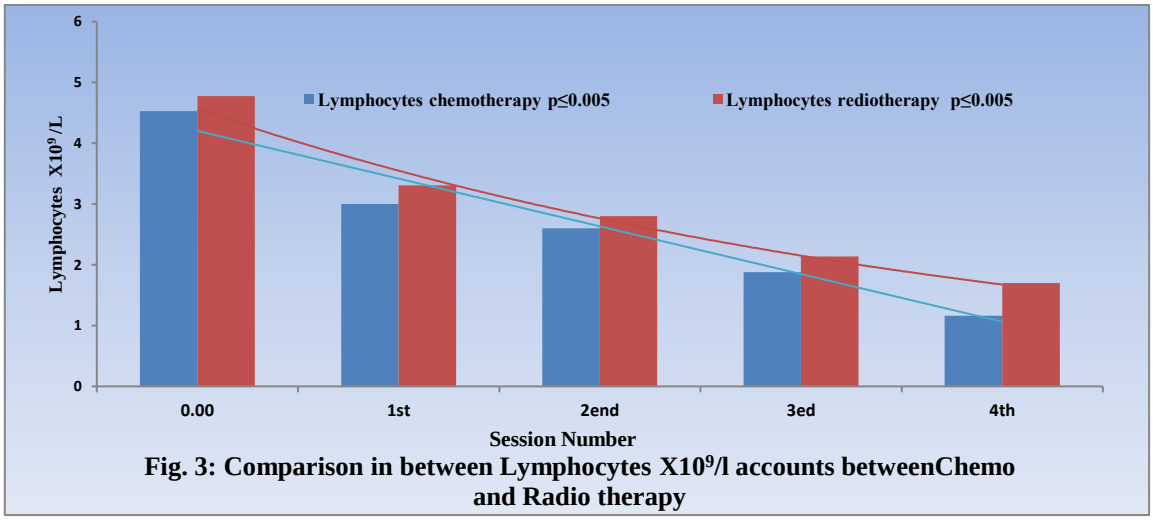

Fig. 3: Comparison in between Lymphocytes X10^9/l accounts betweenChemo and Radio therapy

d- Haemoglobin Concentration HGB: Haemoglobin decreases slightly session's progress in both radiotherapy and chemotherapy as in fig. 4.

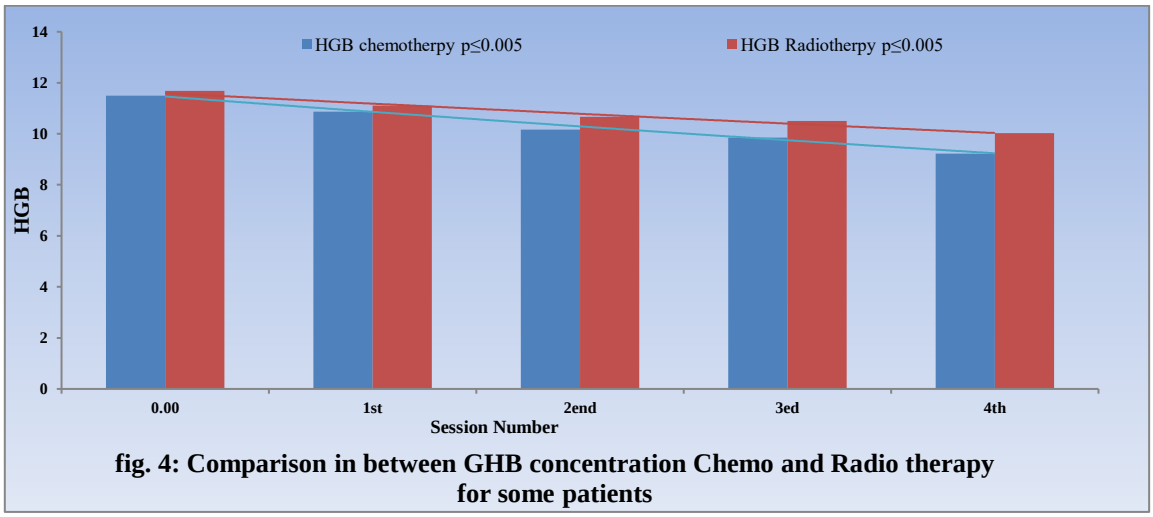

fig. 4: Comparison in between GHB concentration Chemo and Radio therapy for some patients

DISCUSSION

The results in figures 1 and 2 show that the effect of radiotherapy with increasing of doses by accumulation of sessions effects on the number WBC and RBC but less than the effect of chemical therapy. This is since chemotherapy is transmitted intravenously throughout all over the body, including the bone marrow, which is stem cells generator, ccertain chemotherapy drugs that can damage bone marrow- the spongy material found in the bones. Bone marrow makes blood cells, which grow rapidly, making them very sensitive to the effects of chemotherapy. Chemotherapy kills many of the cells in bone marrow that will reduce WBC and RBC, in case of radiotherapy. Therefore, the effect is limited just near bone marrow from the irradiation zone. The blood vessels located close to the irradiated tumour area, WBC and RBC will be affected if the radiotherapy receives to large areas of your body and especially to the large bones that contain the most bone marrow, such as your pelvis, legs and torso. It may reach low levels of red and white blood cells.

The results of lymphocytes cleared that the effect of radiotherapy is like the effect of chemotherapy; because the effect of radiation directly affects the lymphocytes near the tumor. This causes reduction in lymphocytes with the effect of radiotherapy as in chemotherapy.

The results of hemoglobin in figure 3 have clearly shown that the hemoglobin is the least effect in blood component. The HGB (hemoglobin concentration), chemotherapy and radiotherapy change hemoglobin into Methamoglobin [Washington and Leaver 2009, Saunders 200)]. Furthermore, the body can reconvert to hemoglobin [Barnett and Wilkinson 2009, Fisher 2002, Geoffrey 2000].

Generally, the effect of chemotherapy spreads with blood throughout all over the body but the effects of radiation depend mainly on which part of the body is exposed [EBCTCG 2000].

Conclusion

1- The effect of radiotherapy is less than the effect of chemotherapy on both WBC and RBC in the blood of patients with breast cancer.
2- Radiotherapy and chemotherapy have nearly the same effect on Lymphocytes in breast cancer patients.
3- HGB is the lowest factor in the blood affected by radiotherapy and chemotherapy.

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