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Research article

Anti-breast cancer therapy may affect blood and liver cells

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Abstract

Chemotherapy and radiations for breast cancer destroy constantly dividing breast cancer cells. However, these treatments can also affect healthy cells of the patient. Stages of breast cancer range from early cure of metastatic breast cancer, with a variety of treatments. Chemotherapy affects normal, healthy cells as well as breast cancer cells; because of this reason, it may cause hair loss, anemia, and diarrhea. Our study shows the risk of developing anemia, leukemia and liver disease after radiation therapy or chemotherapy to treat early-stage breast cancer, A total of 90 blood samples from control and cancer patients were collected and analyzed for RBCs, WBCs, Platelets, absolute indices and liver function test. Hematological analyzer Sysmex KX-21N used for hematological studies and commercial kits for Pioneer Diagnostics is used for liver function tests. It was concluded that anti-cancer treatments such can affect in RBCs, WBCs, platelets, absolute indices and liver function test. Low levels of these cells can result in the immunocompromised body of the cancer patient.

Key word: Breast cancer, chemotherapy, radiotherapy, liver.

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Introduction

Breast cancer is the second most common malignant disease in women, worldwide [1]. It is metastases at distant sites that are the main reason of mortality. Recently, the rates of metastasis and death in patients with breast cancer have reduced as a result of early diagnosis by screening and the use of systemic adjuvant therapy. However, chemotherapy has a wide range of acute and chronic side effects that substantially affect the patient's quality of life. As it is not possible to truly predict the risk of metastasis development in individual patients. Now a day's more than 80% of them receive adjuvant chemotherapy, while only about 40% of the patients relapse and ultimately die of metastatic breast cancer. Therefore, women who would be cured by local treatment alone, such as surgery and radiotherapy, will be treated and experience the deadly side effects of chemotherapy [5, 6].

In chemotherapy, various drugs, i.e. doxorubicin, bevacizumab, sorafenib etc. are being used to destroy the cancer cells without damaging healthy surrounding tissues [7-9].However, besides the desired therapeutic effects they also exert numerous adverse effects [10, 11]. Many chemotherapeutic agents are substrates for liver uptake, metabolism, excretion and dysfunction of the liver can result in result of toxic drug effects. Preexisting liver impairment is thought to have only modest effects on the elimination and toxic effects of drugs [12]. Nevertheless, a typical patient presents with several variable causes of liver impairment, including direct hepatic involvement by their disease, effects of cancer-induced inflammatory cytokines, co-morbidities, and concurrent medications.

Patients with aberrant chemotherapy drug metabolism have a substantial risk of severe hematological and non-hematological toxic effects: caution must be exercised with specific chemotherapy drugs. However, substantial dose reductions might reduce therapeutic effectiveness. Our study suggests that this risk is twice as high as has been reported

Materials and methods

A study was undertaken in Institute of Biochemistry, University of Sindh, Jamshoro, Sindh, Pakistan. Breast Cancer patients and their data were obtained from Nuclear Institute of Medicine and Radiotherapy (NIMRA), Jamshoro, Pakistan. Total ninety samples were processed in this study, out of them; fifty were

breast cancer patients and forty were healthy persons as control. The age group of all samples was between 30-60 years.

The demographic data were obtained either by interviewing the patients or from hospital record at the time of sampling. The detailed questionnaire was prepared before data collection. Questionnaire includes patient's age, gender, marital status, family history, type stage and duration of breast cancer, diagnostic tests, topographic side any other treatment taken for the disease previously, and the type of therapy (chemo, radio and surgery) in this study.

Blood Sampling

Blood samples (5ml) were collected via intravenous using 22 gauge standard needle syringe. 2ml blood was stored in EDTA containing tubes for hematological analysis and 3ml blood in plain bottles for serum bilirubin, Alanine transaminase (ALT), Aspartate transaminase (AST), further processing. All the sampling was done after the consent of the patients and healthy volunteers.

Clinical test determination

The hematological parameters including RBCs count, WBCs count, platelet count, differential count (neutrophils, eosinophils, basophiles, lymphocytes, monocytes) were analyzed by Hematological analyzer Sysmex KX-21N, Japan. This instrument was capable of measuring up to twenty blood parameters. Blood waste metabolites (Creatinine, Total Billirubin, and Urea (BUN) enzymes (ALT or SGPT, AST or SGOT) were analyzed by kit. Serum Bilirubin: Serum bilirubin was estimated by diazotized sulfanilic acid test. In this method bilirubin is converted to colored azobilirubin by diazotized sulfanilic acid and is measured photometrically. Commercially available kits of Linear Chemical prepared and supplied by Joaquim Costa Barcelona (Spain) were used. Photometric investigation was performed by using Microlab 200 (Merk).

Serum ALT

Serum ALT or SGPT was measured using commercial kits of Pioneer Diagnostics, manufactured and supplied by Pioneer Diagnostics New York USA. The assay is based upon the principle that alanine aminotransferase catalyses the reversible transfer of an amino group from alanine to α-ketoglutrate forming glutamate and piruvate. The piruvate so produced is reduced to lactate by lactate dehydrogenase and NADH. The rate of reduction in concentration of NADH measured photo-electrically is proportional to the catalytic concentration of ALT present in the sample. Photometric analysis was performed using Microlab 200 (Merk).

Serum AST

Serum AST or SGOT was measured using commercial kits of Pioneer Diagnostics, manufactured and supplied by Pioneer Diagnostics New York, USA. The assay is based upon the principle that AST catalyses the reversible transfer of an amino group from alanine to a-ketoglutrate forming glutamate and oxaloacetate. Oxaloacetate produced is reduced to melate by melate dehydrogenase and NADH. The rate of decrease in concentration of NADH measured photo-electrically is proportional to the catalytic concentration of AST present in the sample. Photometric study was also performed using Microlab 200 (Merk). Data were analyzed statistically by the using software SPSS version 18 and T test was performed.

Results and Discussion

Our results showed that the female is explored to highest level from breast cancer mostly older age females. Kapp et al also reported older patients have a higher risk of cancer. We also observed significant changes in blood parameters in breast cancer patients. The hemoglobin concentration was found below normal range. Red blood cell and white blood cell value were normal in range which was in accordance with the findings of Shin et al [14]. Hematocrit and platelet count were found below the normal range as shown in Figure 2.

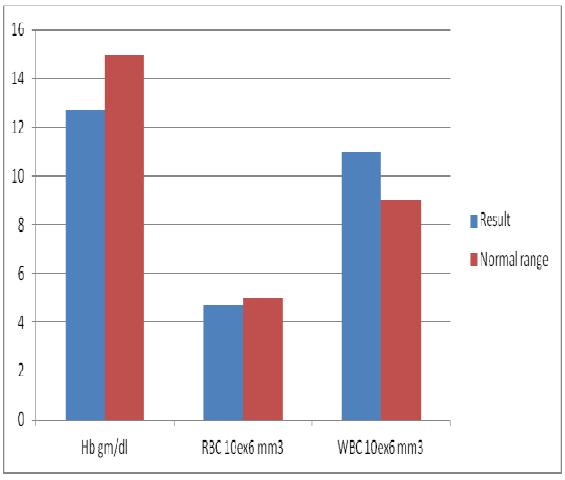

Figure 1: Difference b/w the patient and control hemoglobin (Hb) RBC and WBC counts

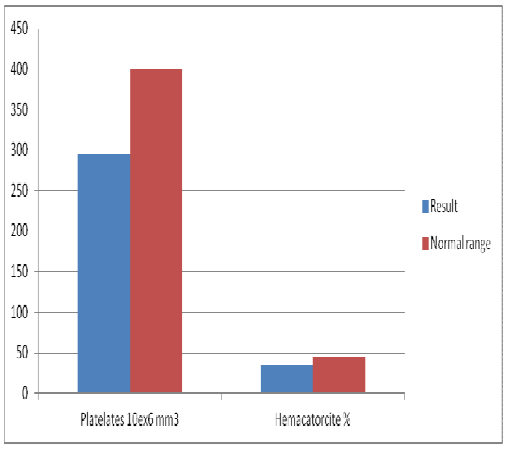

Figure 2: Difference b/w the patient and control platelets and hematocrite counts.

Figure 3 showed the differential count, including neutrophil, basophils, monocytes, eosinophils and leukocytes were found to be normal in breast cancer patient. Lymphocytes and monocytes have no significant change, while neutrophil and basophile count increase in patients. Andrew also reported an increase of differential counts in patients during chemotherapy [15]. Concentration of absolute indices parameter including MCV, MCH and MCHC were reduced concentration absolutes indices during radiotherapy of breast cancer patients shown in Fig. 4 [16]. The waste metabolite levels slightly increases and decreases were mostly within the normal range. Urea (BUN) concentration was in normal range, and creatinine slightly increased in patients. Bilirubin concentration was decreased in patients as shown in Figure 5. Figure 6 showed that the alanine transaminase increase in patients while alkaline phosphates was in the normal range during radiotherapy patients.

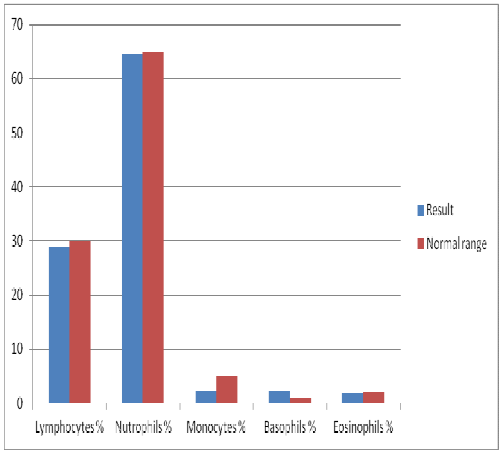

Figure 3: Difference b/w the patient and control leucocytes counts.

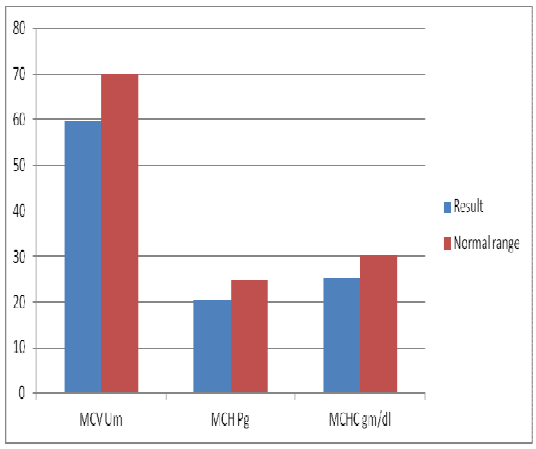

Figure 4: Difference b/w the patient and control concentration of absolute indices**.**

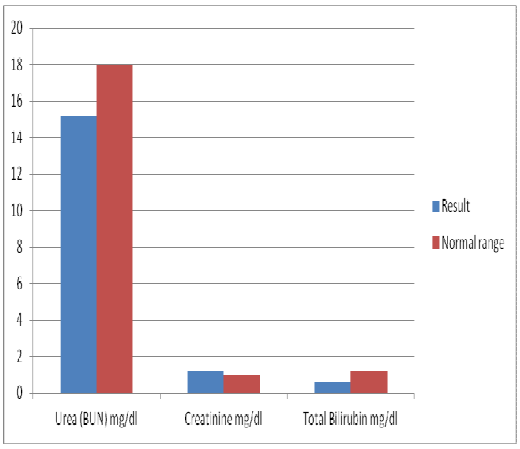

Figure 5: Difference b/w the patient and control concentration of waste metabolites

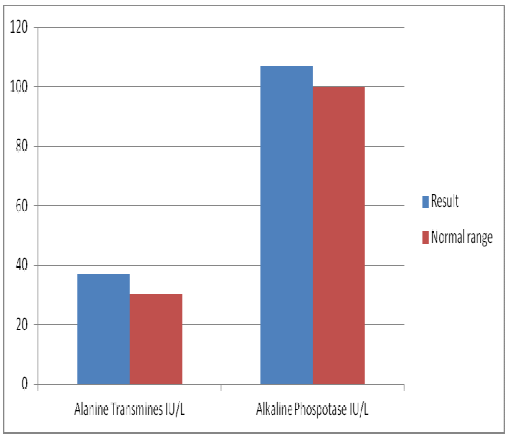

Figure 6: Difference b/w the patient and control enzyme concentration

In Pakistan, intermarriages are very common and thus also becoming the major causes of this type of cancer in women. Due to unawareness and illiteracy, people in Pakistan do not come to doctor in early stages become they do not have a knowledge about cancer. Our study comprises mostly of III and IV stages cancer patients as these people do not understand the problem and do not come to the doctor, the cancer starts to metastasize and cause great damage to that area or organ of the body [16].

Radiotherapy and chemotherapy are the treatments of cancer which are given to the patients. These treatments can be efficient in early stages of cancer but they do not show any significant progress in late stages of cancer. These can only extend the time of death but cannot treat the cancer. Our study reveals that these treatments do not show any significant sign of damage to the liver or kidney but causes some change in the function of these organs. The ratio of the result show that the radiotherapy does not causes any harm to other organ of the body. According to Younis et al chemotherapy and radiotherapy affects blood cells [17].

Conclusively, anti-breast cancer treatments such as chemotherapy and radiation therapy can result in the decrease of RBCs, WBCs, platelets count, absolute indices, and liver function level. Blood loss in result of cancer treatment also can cause worsen anemia. Low RBCs, WBCs, platelets and Hb levels can result in the immune compromise body and quality of life of the cancer patient. Erythropoietin (EPO) can be suggested to the patients during cancer treatment especially in case of chemotherapy and radiotherapy to maintain the RBCs count and Hb levels.

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