Study of Changes in Blood Cell Counts before and After Chemotherapy in Leukemia Patients

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ABSTRACT

Leukemia is the most common type of blood cancer. Leukemia grows from the cells in the bone marrow that give rise to white blood cells. The effects of chemotherapy were examined in 150 leukemia patients. The blood counts of many of the patients were above the normal range before chemotherapy. By chemotherapy treatment it was observed that blood cell counts came to normal values in most of the leukemia patients while somewhere deviations were also observed. Statistical analysis of the data showed chemotherapy to be effective for Leukemia patients. Side effects of chemotherapy like nausea, vomiting, hair loss and fever were also noted in patients being treated.

Keywords: *Leukemia, blood cancer, bone marrow, chemotherapy, blood cell counts*

INTRODUCTION

Leukemia is the disease of white blood cells. Leukemia rises when white blood cells become cancerous (Greek word 'leukos' means white and 'hamia' means blood). In fact leukemia differs from cancers of bone marrow which originate from cells forming the bone itself. From special parent cells in the bone marrow these cells are fed into the blood which continuously divide and increase in number of red and white blood cells (1). There exist several kinds of white blood cells so different types of leukemia occurred (2). Leukemia is present in children in abundance. Leukemias and lymphomas account for 40% of the cases compared to other types of cancers (3).

Four major subtypes of leukemia are known; chronic lymphoid leukemia (CLL), chronic myeloid leukemia (CML), acute lymphoid leukemia (ALL) and acute myeloid leukemia (AML). These entire four subtypes can differentiated on the basis of linage commitment and differences in maturation stages. On the basis of genetic variations these four subtypes can be further be subdivided into good, intermediate and poor risk groups.

Acute Leukemias are a heterogeneous group of malignant diseases that originate in the bone marrow of hematopoietic precursor cells. Acute leukemias have been sub classified on the basis of morphological, immunological, and cytogenetic differences. The differentiation between acute lymphoblastic (ALL) and acute myeloblastic (AML) leukaemia has demonstrated to the development of different treatment strategies using different antileukaemie agents (4). Due to have high incidence and often poor survival in the modern society, Leukemia is playing an emotive role in people (5). According to World Health Organization leukemia is listed in top 15 most founding types of blood cancer (6) (7). Organ infiltration, lymphadenopathy, splenomegaly and hepatomegaly are the clinical characteristics of chronic leukemia.

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MATERIALS AND METHODS

Enrollment of Patients

150 patients of Leukemia were enrolled who visited BINO Cancer Hospital Bahawalpur during years 2010 to 2012. By name files of all patients were made with collaboration of BINO Cancer Hospital Bahawalpur to sure the completion of data of patients in consistent manner. Patients belonged to Southern Punjab Districts; Bahawalpur, Lodhran, Vehari, Rajanpur, Muzafargarh and Rahim Yar Khan. These patients were divided into four groups according to leukemia types. (1) AML, (2) ALL, (3) CLL, (4) CML. They were subdivided in further groups according to gender and age. By age they were divided in two categories before 30 years of age and above 30 years of age.

Collection of Blood Samples

About 1.5ml of blood was collected from each patient. Blood samples were collected aseptically into tri-potassium ethylene diamine tetra acetic acid anticoagulant containing tubes. Blood sample was well mixed by a gentle inversion of tubes several times.

Analysis of Blood Samples

The analysis of different parameters of leukemia blood samples was done by using hematology auto analyzer Sysmex KX-21 N. The automated analysis was done following the manufacturer's operational guidelines. Four parameters; WBCs, RBCs, Hb and PLTs were examined. All blood samples of leukemia patient were analyzed within 30 minutes of collection. Variations in blood cells count after consecutive chemotherapies were examined. Chemotherapy results after consecutive four chemotherapies were analyzed. Effects on blood counts before and after chemotherapy were recorded.

Place of work

The study of blood samples of leukemia patients were conducted in a routine pathology laboratory at the BINO cancer hospital, Bahawalpur Pakistan.

RESULTS

The study shows the usefulness of chemotherapy in leukemia patients. The results of chemotherapy in different groups of Leukemia patients are given below.

AML

In southern Punjab the occurrence of acute myeloid leukemia is equivalent in the male and female patients and the ratio of patients of age before 30 were observed more than the patients of above 30 years. In some of the AML patients count of WBCs was less than normal and came to the normal range after chemotherapy. In some other the patients it was observed that WBCs count were more than the normal started decreasing by the application of chemotherapy but at some deviations were also observed. RBCs and HGB count also observed decreasing in AML patient and become normal. The count of platelet were also observed decreasing in AML patients and by chemotherapy it started increasing but chemotherapy has little effects at platelet count. For these patients hormonal therapy like PDGF was done to normalize the count of platelet. In female patients blood count did not vary in a huge quantity as compared to male patients. Except Platelets which varied greater in AML female patients that become normal count by chemotherapy. In male patients of age above to 30 the count of WBCs increases in a huge amount that becomes normal count by chemotherapy.

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In statistical analysis in AML patients (Figure 1) P value was more significant. Like in case of WBCs before to 1st chemotherapy, P value was 6.82517E-28 & 2nd to 1st chemotherapy P value was 1.04309E-18 & 3rd to 2nd chemotherapy P value was 1.0165E-102. The P value of 3rd to 2nd chemotherapy is less as compared to previous values. It is more significant. It shows patients are improving their health. Both males and females had the same situation. The P value was less of 3rd to 2nd chemotherapy as compared to previous P values. This P value is highly significant of 3rd to 2nd chemotherapy. While at the mid it is less significant because it is higher than 1st to before chemotherapy. While at the end its P value is least as compared to previous values. So it is much more significant. It shows chemotherapy is effective for patients as their health was improving.

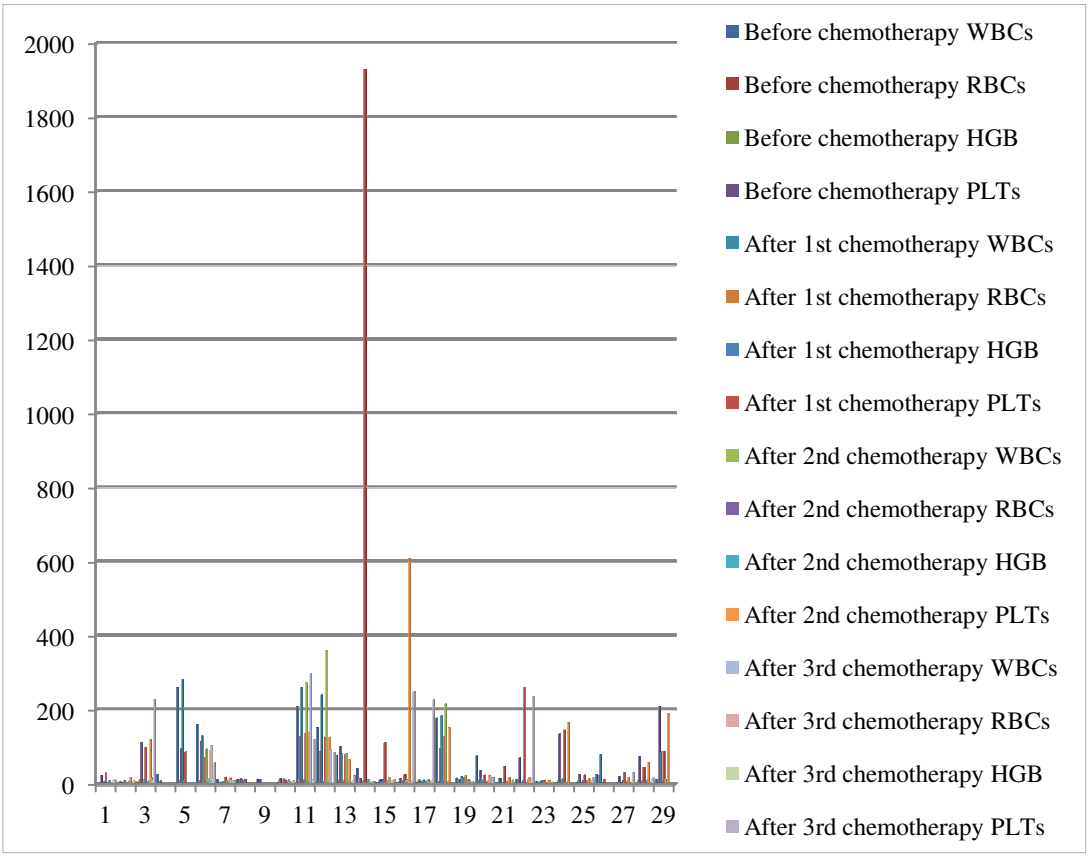

Figure 1. Graphical presentation CBC results of AML patients

CCL

The enrolled male patients of CLL were above the age of 30 years. This mean CLL is found in older people. No patient of CLL was seen below to 30 years. In CLL patients only WBCs counts were affected and were above the normal values. The other parameters were not significantly disturbed in CCL patients. Chemotherapy resulted to normalize the count of WBCs in CLL patients. Whether other parameters were little bit affected in CLL patients.

The statistical analysis in CCL patients (Figure 2) showed P value to be continuously decreasing. The P value of 1st to before chemotherapy is greater than 2nd to 1st chemotherapy. And the P value of 2nd to 1st chemotherapy is greater than P value of 3rd to 2nd chemotherapy. So the last value is more significant as compared to previous values. The values are decreasing continuously so it shows patients are improving their health gradually by the application of chemotherapy.

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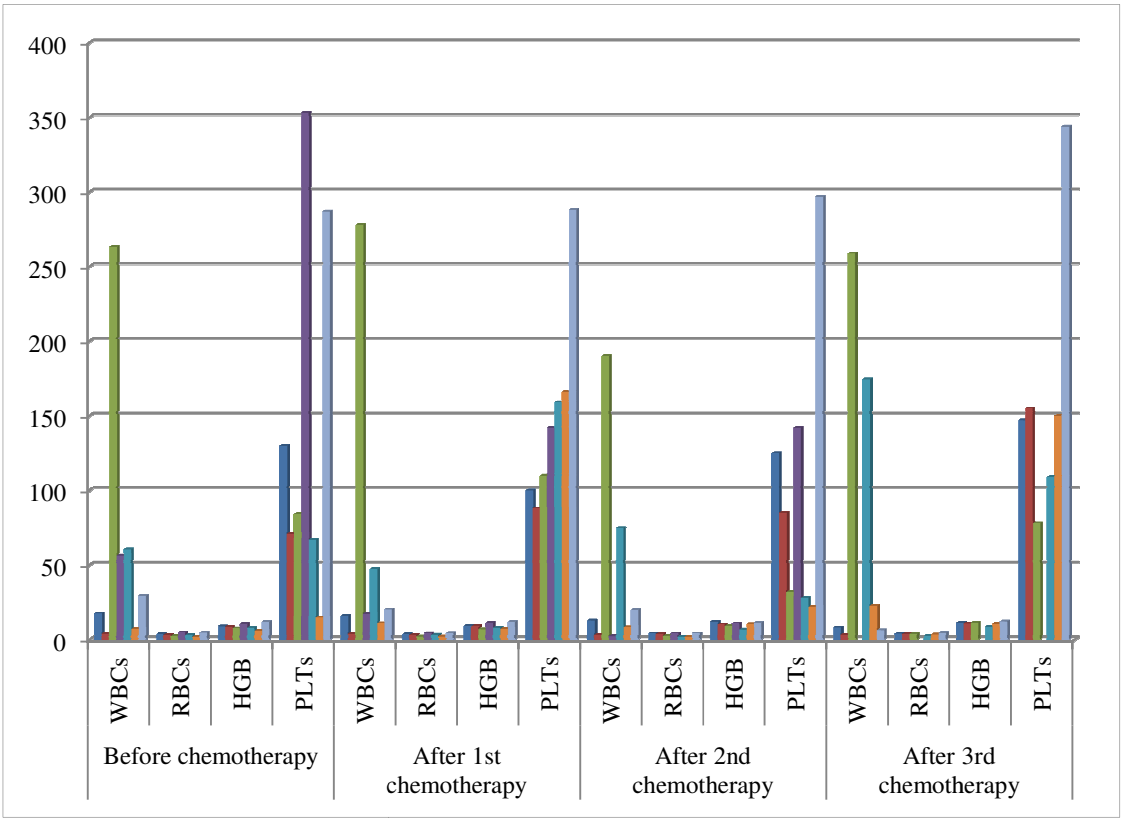

Figure 2. Graphical presentation of CBC results of CLL patients

ALL

The enrolled patients of ALL were more males that indicate occurrence of ALL is more in males as compared to females in southern Punjab. Most of the patients of ALL were below the age of 30 years. In majority of patients platelets were observed in least amounts. And in some patients WBCs were observed in greater amount than normal values. In some patients HGB value was below normal but in majority of patients HGB remained stable in a normal limit. In some of the patients a relationship was observed between platelet and WBCs count. The patients in which count of WBCs were observed above normal, the Platelet count were observed in a least number. The patients having WBCs count in a normal range also had Platelets count in normal range. While in some of the patients both were below normal range. During chemotherapy in ALL patients randomization was observed. Sudden increase or decrease was observed in ALL patients. While in majority of male patients it was observed that chemotherapy had little effects in ALL patients. So combination or adjuvant therapy would have better effects in ALL patients. While in females more betterment was observed during chemotherapy treatment. Platelets started to increase in amount and WBCs started to become normal during chemotherapy treatment.

In case of ALL patients, P value of 3^{rd} to 2^{nd} chemotherapy is also less significant as compared to previous with a least difference. Because the P value of 3^{rd} to 2^{nd} chemotherapy is greater than 2^{nd} to 1^{st} chemotherapy while less than 1^{st} to before chemotherapy. Because there exists some deviations due to which P value is less significant. In females Patients P value of 3^{rd} to 2^{nd} chemotherapy is less than previous P values so in females it's more significant as compared to male patients. These results are shown in figure 3.

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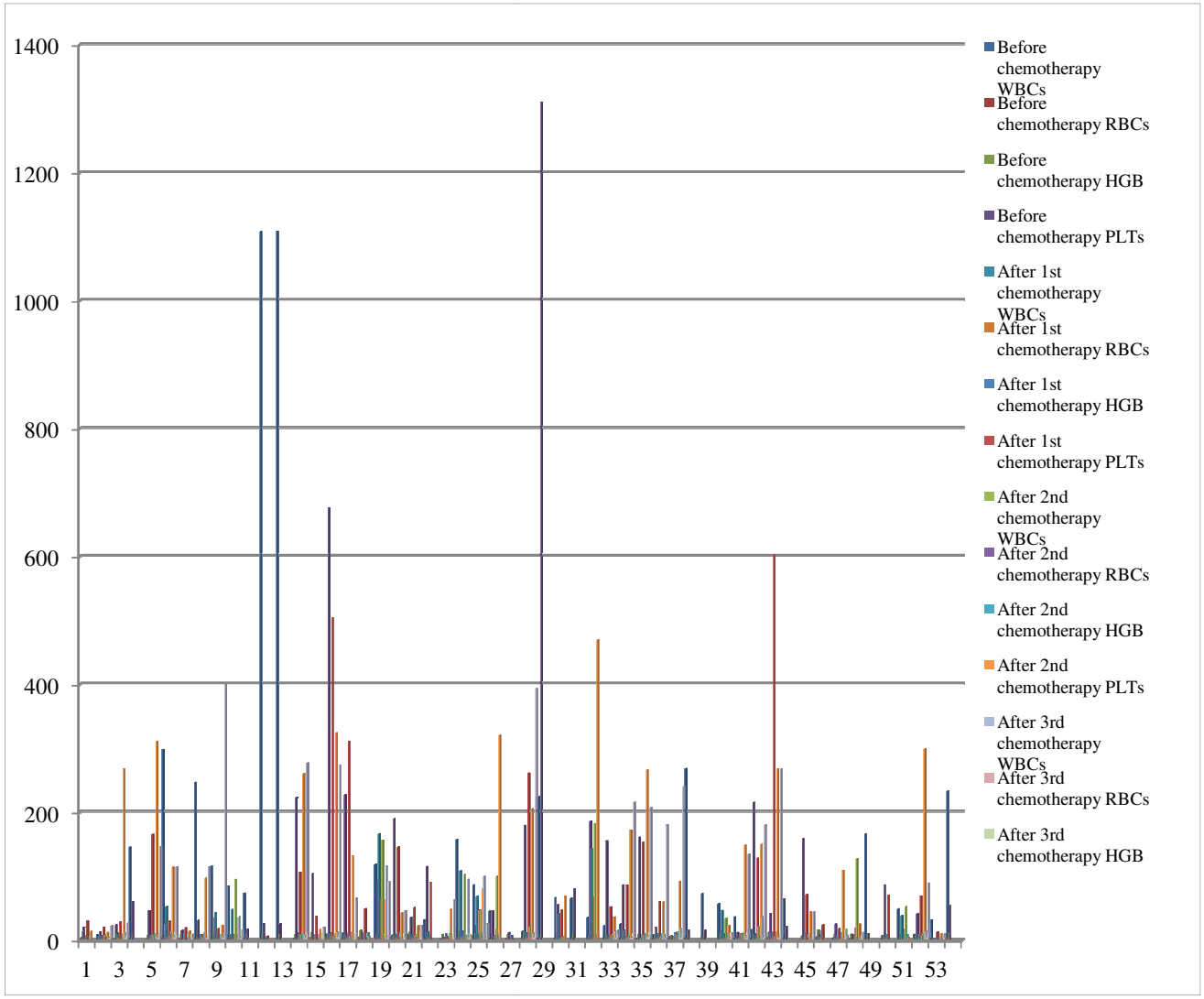

Figure 3. Graphical presentation of CBC results of ALL patients

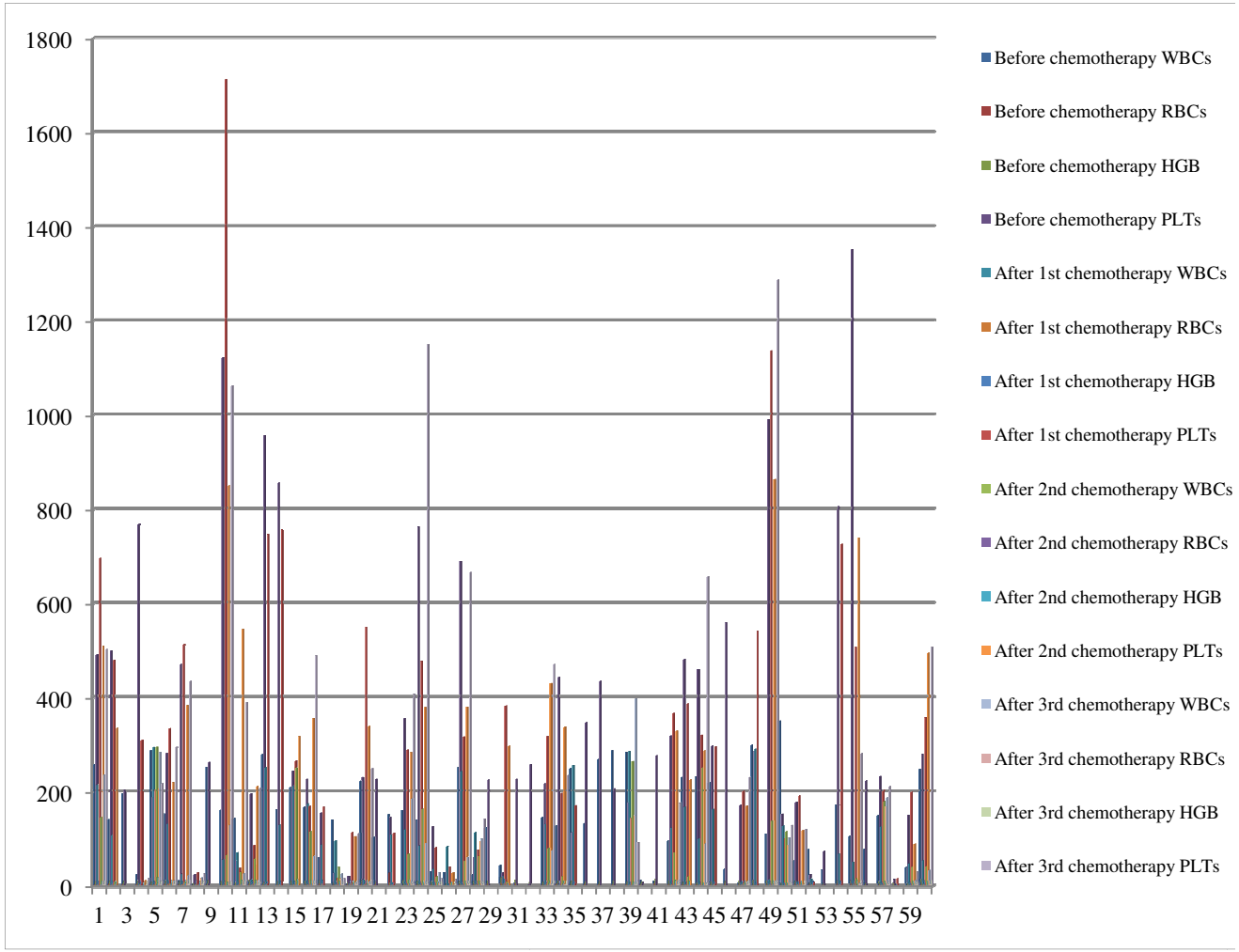

Figure 4. Graphical Presentation of CBC results of CML patients

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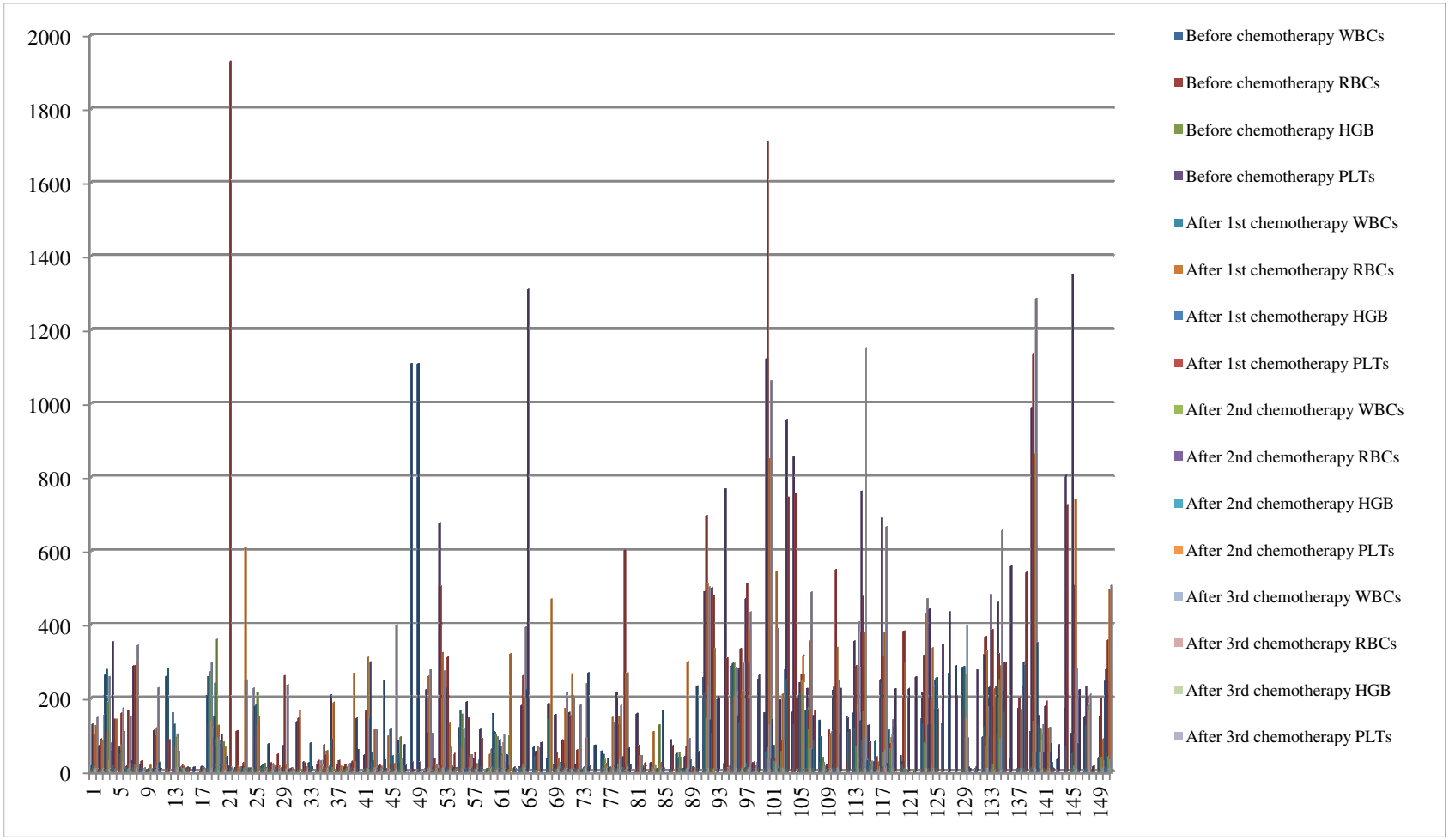

Figure 5. Graphical Presentation of CBC results of all enrolled patients

CML

The enrollment of CML patient was is more than other leukemia. Male patients were more than females. The occurrence of CML is more in older people than in younger people. The patients of CML were observed more above to 30 years than before 30 years. In CML patients WBCs were observed above normal while RBCs, HGB and Platelets counts were observed in normal limit. In some patients these parameters were observed in lower limit than normal. In some patients WBCs were also observed below to normal range. During chemotherapy treatment it was observed that WBCs come to normal limit from upper limit. And other little bit disturbing parameters RBCs, HGB and platelets were also observed coming to normal limit. During chemotherapy treatment ups and downs in values were observed. But in most of patients they come to normal range at the end. At some places deviations were also observed.

The P value of 3rd to 2nd chemotherapy in CML patients is also less significant as compared to previous values respecting to WBCs, RBCs & HGB. While in case of PLTs the P value of 3rd to 2nd chemotherapy is more significant as compared to previous values. The P value of 3rd to 2nd chemotherapy is less significant as compared to previous values as shown in figure 4.

Graphical Presentation of CBC results of all enrolled e patients (Figure 5) shows P value of 3rd to 2nd chemotherapy is less than 2nd to 1st chemotherapy and 1st to before chemotherapy. P value of 3rd to 2nd chemotherapy is more significant as compared to previous values. So collectively Patients are improving their health.

DISCUSSION

Lukemia is the most common type of cancer. Occurrence of leukemia is almost equal in males and females. Chemotherapy is the best way to treat ALL intensively. Multiple drugs with different mechanisms of action are used in combination chemotherapy and it's the fundamental principle. The incidence of occurrence of acute myeloid leukemia (AML) increases with the increasing age (8). He demonstrated that the median age of AML patients was 62–64 years old, and approximately 60% were over 60 years old. Likewise, with increasing age the proportion of AML patients increases in many countries. Due to increase of elderly AML patients, management of elderly AML patients is getting importance for clinical hematologists. However, clinical analysis for AML in the younger populations is still insufficient compared with the elderly populations. Chemotherapy occasionally cannot be applied to elder patients due to poor general condition. Secondary leukemia due to Radiation and; or anticancer drugs is also more common among the elderly (9).

The incidence rate of CCL is less in Asian population (10) and same is showing in our study as out of 150 patients, only 7 were having CCL. CLL is more common in elderly patients (11). In the current study the results are same as all of individuals were elder and only one affected individual had age less than 40 which is showing CCL is more common in elderly people. The male Patients of CLL were observed of the age of above 30 years. This mean CLL is found in older people. No patient of CLL was seen below to 30 years. In CLL patients only WBCs count were disturbed and above normal. Chemotherapy normalized the count of WBCs in CLL patients. Whether other parameters were little bit affected in CLL patients. CLL incidence increases with age and is rare at young age. Approximately 65 years age at diagnosis was reported as a median age of patients with CLL. The male predominance was also observed. A low incidence of CLL is observed in Asian population (12). The current results also show the occurrence of CLL is less in Southern Punjab. Acute lymphoblastic leukemia (ALL) is the most common type of cancer occurring in children and accounts for more than 75% of childhood cancer (13). In southern Punjab occurrence of ALL is more in

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males as compared to females. And younger patients suffered to ALL more than older patients. Most of the patients of ALL that were observed were of the age of before 30 years. In majority of patients platelets were observed in least amounts. And in some patients WBCs were observed in greater amount. Than normal amount were not much more disturbed in ALL patients. In some patients HGB was observed in decreasing amount. While in majority of patients HGB remained stable in a normal limit. In some of the patients a relationship was observed between platelet and WBCs amount. The patients in which count of WBCs were observed in a greater amount the Platelet count were observed in a least amount. And the patients in which WBCs were observed in a normal range Platelets were also observed in normal range. While in some of the patients both were observed in decreasing position. During chemotherapy in ALL patients randomization was observed. Sudden increase or decrease was observed in ALL patients. While in majority of males' patients it was observed that chemotherapy has little effects at ALL patients. So combination or adjuvant therapy will have better effects at ALL patients. While in females more betterment was observed during chemotherapy treatment. Platelets started to increase in amount and WBCs started to become normal during chemotherapy treatment. It is distinguished by the malignant proliferation of lymphoblast affecting and destroying the normal process of maturation and differentiation of cells in the bone marrow, which causes the substitution of cancerous cells with normal cells (14). The chances of occurring ALL at highest rate in the age of first five years of life at approximately 5.7 per 100 000 persons per annum (15). In the previous days ALL diagnosis was meant a certain fatality. However survival rates for childhood leukemia have increased over the previous five decades (16). Treatment protocols over 2-3 years of combination chemotherapy have great effects in improvements in the survival of patients with ALL (17) and (18) (19) (20). Now the survival rate with ALL patients is increased. But the patients have to face long treatment disrupting the whole family of patient and there may be certain possible side effects.

Chemotherapy occasionally cannot be applied to elder patients due to poor general condition. Secondary leukemia due to Radiation and; or anticancer drugs is also more common among the elderly (21Kantarjian et al., 1986). Standard chemotherapy was given to most of the long term survivors of elderly AML patients. Reduction in dose did not increase the chances of long term survival. Efficacy of chemotherapy was demonstrated in some previous studies for treatment of AML in elderly patients.

CONCLUSION

Chemotherapy is the best technique to treat leukemia patients. It gradually brings the amounts of WBCs, RBCs, Hb and PLTs to normal amounts. There are some side effects of chemotherapy.

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REFERENCES

[1] Degos et al. (2001). The firs description of leukemia. *The Hematology Journal*, 2(1).

[2] Lichtman, M. (2008). Battling the hematological malignancies: the 200 years war. *The Oncologist*, *13*, 126–138.

[3] Otten et al., (2002). The Children Leukemia Group: 30 years of research and achievements. *Eur J Cancer*, *38*(Suppl 4), S44–49.

[4] Hoelzer, D. (1990). Change in treatment strategies for adult acute lymphoblastic leukemia (ALL) according to prognostic factors and minimal residual disease. *Bone Marrow Transplant*, 666-7070.

[5] Beutle, E. (2001). Treatment of acute leukemia: past, present, and future. *Leukemia, 15*, 658–661.

[6] Geary, C. G. (2000). The story of chronic myeloid leukaemia. *Br J Haematol.,* 110(1), 2-11.

[7] Brincker, H. (1985). Estimate of overall treatment results in acute nonlymphocytic leukemia based on age specific rates of incidence and of complete remission. *Cancer Treat Rep, 69*(1), 5-11.

[8] Kantarjian et al. (1986). Therapy-related leukemia and myelodysplastic syndrome: clinical, cytogenetic, and prognostic features. *Journal of Clinical Oncology, 4*(12), 1748-1757.

[9] Dighiero et al. (1991). B-cell chronic lymphocytic leukemia: Present status and future directions. *Blood, 78*, 1901- 1914.

[10] Plasschaert et al. (2004). Prognosis in childhood and adult acute lymphoblastic leukaemia: A question of maturation? *Cancer Treatment Reviews, 30*(1), 37-51.

[11] Coebergh et al. (2006). Leukaemia incidence and survival in children and adolescents in Europe during 1978-1997. Report from the automated childhood cancer information system project. *European Journal of Cancer, 42*, 2019-2036.

[12] Cholby-Graham, M. F., & Chordas, C. (2003). The childhood leukemias. *Journal of Pediatric Nursing, 18*(2), 87-95.

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