

Comparison of Hematological Profile Changes in Pre- and Post-Chemotherapy Treatment of Cancer Patients

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ABSTRACT

Background: Cancer being the principle cause of death in both developed and developing countries; the problem is more likely to increase around the globe due to rapid population growth and aging. The aim of this study was to find the effect of chemotherapy on hemoglobin, total leucocytes count, and platelets level.

Materials and Methods: A cross-sectional study was conducted and through convenient sampling technique, blood samples from cancer patients were studied in a pathology lab at the INOR cancer hospital in Abbottabad, KPK, Pakistan. During the months of September to December 2017, 200 cancer patients visited INOR Cancer Hospital Abbottabad. The haematology analyzer Mindray BC 5000 was used to analyse various parameters of cancer blood samples. The effects of chemotherapy on blood counts were documented in Microsoft Excel 2007.

Results: A total of two hundreds cancer patients were recruited in the study. Among total, 44% (n=88) were male patients and 46% (n=112) were female patients. All hematological parameters including hemoglobin, total leucocytes count, and platelets level were decrease after chemotherapy.

Conclusion: Chemotherapy is the most effective method of treating cancer patients. It progressively restores normal levels of WBCs, RBCs, Hb, and PLTs. It is beneficial in order to reduce the blood cells burden on patients. Moreover, it is determined that blood cells become normal after chemotherapy.

Keywords: Hematological parameters, Blood cancer, Chemotherapy, Bone marrow, Tumor, Cancer patients

INTRODUCTION

Tumor or neoplasm undergoes irregular growth of cells to form lumps or irregular mass with wide distribution¹. The cancer survivor's statistics continues to increase in the United States even with decrease in incidence rates in males and constant rates in females². The risk of cancer increases in less developed countries by adopting behaviors in lifestyle like smoking, imbalance diet, lack of exercise and reproduction changes like first birth at late age³. Cancer being a major health concern around the world and is the second major cause of death in the United States^{4,5}.

These are cancer of blood cells. Leukemia is found mainly in children accounting for about 30% cancer in children. However, lymphoma mostly develops in adults. Cancers originating in connective tissues like bone, cartilage, nerve and fats, which develops from cells mesenchymal cells outside the bone marrow⁶. New therapeutic strategies are developing with the advancement in understanding of cancer biology to increase the quality of life⁷.

Chemotherapy is a group of treatment for cancer which uses one or more anticancer drugs as standardized chemotherapy plan. Chemotherapy may be given for cure, or to prolong the life or to reduce symptoms. Chemotherapy is specifically dedicated to pharmacotherapy of cancer and is one of the major class of medical discipline called medical oncology⁸. Newly developed therapies like inhibition of specific molecular or genetic targets, which inhibit growth-enhancing signals coming from endocrine hormones (e.g. androgens for prostate cancer and estrogens for breast cancer) are called hormonal therapies, while targeted therapy is the inhibition of other growth-promoting like those associated with receptor tyrosine kinases⁹. Chemotherapeutic drugs have effect on lymphocytes due to which they can be used in conditions where harmful reactions occur due to over reactivity of immune system like rheumatoid arthritis, multiple sclerosis, systemic lupus erythematosus and vasculitis^{8,9}.

The average volume of the red cells, measured in femtolitres. Anemia may be macrocytic or microcytic if the MCV value is below or above the normal range; while normal MCV is an indicator of normocytic anemia. The MCV value changes during certain diseases like reticulocytosis, thalassemia, chemotherapy, alcoholism, Vitamin B12 or folic acid deficiency. The average

amount of hemoglobin per red blood cell in pictograms¹⁰. Total white blood cells and differential leukocyte as a percentage and absolute number per unit of volume are determined. A high WBC is an indicator of infection in the body. Neutrophils, indicate a bacterial infection but are also raised in viral infections. Neutrophils are referred as "segs" due to their segmental appearance of nucleus and appears as rod like or band shaped at the early stage when the nucleus is not segmented¹¹. Platelet numbers, as well as information about their size and the range of sizes in the blood are determined. Mean platelet volume is a measurement of the average size of platelets¹². Leukemia is playing an emotional part in people's lives because of its high prevalence and frequently poor survival in modern culture. The aim of this study was to find the effect of chemotherapy on hemoglobin, total leucocytes count, and platelets level.

MATERIALS AND METHODS

A cross-sectional study was carried out and blood samples were collected through convenient blood sampling technique from cancer patients were studied in a pathology lab at the INOR cancer hospital in Abbottabad, KPK, Pakistan. During the months of September to December 2017, 200 cancer patients attended INOR Cancer Hospital Abbottabad. With the participation of INOR Cancer Hospital Abbottabad, by name files of all patients were created to ensure the consistency of patient data completion. Patients came from various parts of Pakistan. These patients were separated into cancer-specific groups. They were placed into groups based on gender and age. They were sorted into two groups based on their age: those under 30 and those over 30.

Each patient had 1.5ml of blood drawn from them. Blood samples were collected aseptically into tubes containing the anticoagulant tri-potassium ethylene diamine tetraacetic acid. The blood sample was well mixed by gently inverting the tubes several times. The haematology analyzer Mindray BC 5000 was used to examine several parameters of cancer blood samples. The automated analysis was carried out in accordance with the manufacturer's operational instructions. WBCs, RBCs, Hb, and PLTs were the four parameters studied. All cancer patients' blood samples were examined within 10 minutes of being collected. The variations in blood cell count following many chemotherapies were

investigated. Chemotherapy outcomes after four successive chemotherapies were examined. The effects of chemotherapy on blood counts were documented in Microsoft Excel 2007.

RESULTS

A total of two hundreds cancer patients were recruited in the study. Among total, 44% (n=88) were male patients and 46% (n=112) were female patients (Table 1).

Table 1: Gender-wise distribution of cancer patients

Gender	Frequency	Percentage
Male	88	44%
Female	112	46%
Total	200	100%

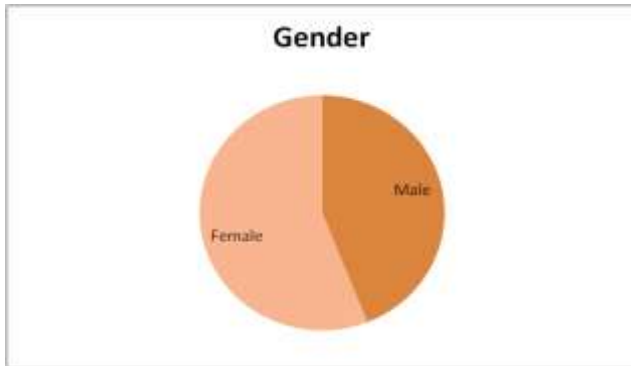


Figure 1: Gender-wise distribution of cancer patients

All diagnosed patients was on chemotherapy. Blood samples were obtained from patients before and after chemotherapy. The hemoglobin level were found 13.5 before chemotherapy and 12.1 hemoglobin level after chemotherapy. Similarly, level of total leucocytes count were found 103860 before chemotherapy and 62920 level of TLC after chemotherapy. Likewise, the platelets count were found 303652 before chemotherapy and 176208 platelets count after chemotherapy. Overall, all hematological parameters including hemoglobin, total leucocytes count, and platelets level were decrease after chemotherapy (Table).

Table 2: Comparison of pre-chemotherapy and post-chemotherapy hematological parameters

Parameters	Pre-chemotherapy	Post-chemotherapy
Hb (g/dL)	13.5	12.1
Total Leucocytes count ($10^3/\mu\text{l}$)	103860	62920
Platelets ($10^3/\mu\text{l}$)	303652	176208

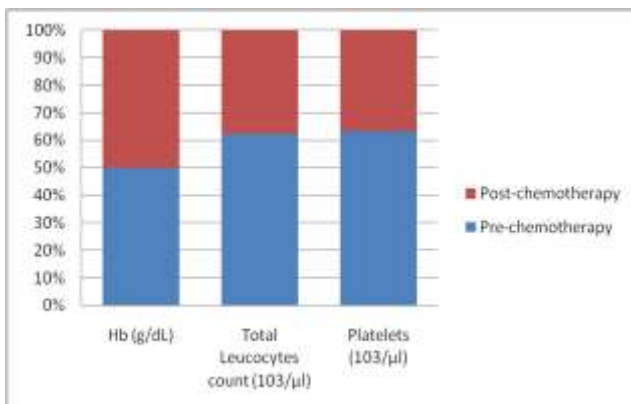


Figure 2: Comparison of pre-chemotherapy and post-chemotherapy hematological parameters

DISCUSSION

This study was conducted at the INOR Cancer Hospital in Abbottabad. A total of 200 cancer patients' full blood counts were gathered. There was a difference in the CBC of cancer patients before and after chemotherapy. Cancer incidence is about equal in men and women. Chemotherapy is the most effective technique to treat cancer aggressively. The core idea of combination chemotherapy is the employment of multiple medicines with diverse modes of action. With rising age, the likelihood of developing acute cancer rises¹³. He revealed that the median age of cancer patients was 62-64 years old, with almost 60% being over 60. Similarly, the proportion of cancer patients grows with age in many nations. The care of senior cancer patients is becoming more important for clinical haematologists as the number of elderly cancer patients increases. However, as compared to senior people, clinical analysis for cancer in younger populations is still poor. Chemotherapy is sometimes ineffective in elderly adults because to their poor overall health. Secondary cancer caused by radiation and/or anticancer medicines is also more prevalent in the elderly¹⁴. Cancer has a lower incidence rate in Asian populations¹⁵. Cancer is more frequent in the elderly¹⁶.

The latest study's findings are similar in that all of the participants were elderly, with only one afflicted individual being under the age of 40, indicating that cancer is more frequent among the elderly. Male cancer patients above the age of 30 years were monitored. This means that cancer is more common in elderly persons. There were no cancer patients under the age of 30. Only the WBC count was abnormal and above normal in cancer patients. Chemotherapy restored normal WBC counts in cancer patients. Whether or not other parameters were impacted in cancer patients. Cancer incidence rises with age and is uncommon in children. The median age of cancer patients at diagnosis was observed to be around 65 years old. There was also a masculine preponderance. Cancer incidence is low in the Asian population¹⁷. Platelets were found in low concentrations in the majority of individuals. WBCs were also found in higher concentrations in certain cases. Cancer patients were not significantly more upset than normal. HGB was found in decreasing amounts in certain cases. While HGB remained steady in the majority of individuals within normal limits. The number of platelets and WBCs was shown to be related in some cases. Patients with a higher number of WBCs had a lower platelet count. And in individuals whose WBCs were within normal limits, platelets were likewise within normal limits. While in some individuals, both were seen to be in a declining posture. Randomization was detected in cancer patients undergoing treatment. Cancer patients had a sudden spike or reduction. Chemotherapy has been shown to have no effect on cancer patients in the majority of male patients. As a result, combination or adjuvant therapy will have a greater impact on cancer patients. During chemotherapy treatment, ladies improved more than males. During chemotherapy, platelets began to rise in number and WBCs began to return to normal. It is differentiated by the malignant growth of lymphoblasts that affects and destroys the normal process of cell maturation and differentiation in the bone marrow, resulting in the replacement of cancerous cells with normal cells¹⁸.

Cancer occurs at the highest rate in the first five years of life, at roughly 5.7 per 100 000 people each year¹⁹. Cancer was once thought to be a guaranteed death sentence. However, children cancer survival rates have grown during the last five decades²⁰. Treatment procedures of 2-3 years of combined chemotherapy have a significant impact on cancer patients' survival²¹. Cancer sufferers now have a better chance of surviving. However, patients must endure lengthy therapy, which disrupts the patient's entire family, and there may be some potential adverse effects. Chemotherapy is sometimes ineffective in elderly adults because to their poor overall health. Secondary leukaemia caused by radiation and/or anticancer medicines is also more prevalent in the elderly²². The majority of long-term survival of older cancer patients received standard treatment. A reduction in dosage had no effect on

long-term survival. Chemotherapy has been shown to be effective in the treatment of cancer in older persons in prior research.

CONCLUSION

Chemotherapy is the best technique to treat cancer patients. It gradually brings the amounts of white blood cells, Hemoglobin and Platelets to normal amount. Moreover, majority were male cancer patients as compared to female patients.

REFERENCES

- Ewing J. Neoplastic diseases: a text-book on tumors. WB Saunders company; 1919.
- Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. CA: a cancer journal for clinicians. 2019 Jan;69(1):7-34.
- Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. CA: a cancer journal for clinicians. 2015 Mar;65(2):87-108.
- Chen W, Zheng R, Baade PD, Zhang S, Zeng H, Bray F, Jemal A, Yu XQ, He J. Cancer statistics in China, 2015. CA: a cancer journal for clinicians. 2016 Mar;66(2):115-32.
- Weaver KE, Forsythe LP, Reeve BB, Alfano CM, Rodriguez JL, Sabatino SA, Hawkins NA, Rowland JH. Mental and Physical Health-Related Quality of Life among US Cancer Survivors: Population Estimates from the 2010 National Health Interview Survey. Health-Related Quality of Life among US Cancer Survivors. Cancer Epidemiology, Biomarkers & Prevention. 2012 Nov 1;21(11):2108-17.
- Amin MB. American Cancer Society. AJCC cancer staging manual. Eight edition/editor-in-chief, Mahul B. Amin, MD, FACP. 2017:1024.
- Patel JD, Krilov L, Adams S, Aghajanian C, Basch E, Brose MS, Carroll WL, De Lima M, Gilbert MR, Kris MG, Marshall JL. Clinical cancer advances 2013: annual report on progress against cancer from the American Society of Clinical Oncology. Journal of clinical oncology. 2014 Jan 10;32(2):129-60.
- Armstrong DK, Bundy B, Wenzel L, Huang HQ, Baergen R, Lele S, Copeland LJ, Walker JL, Burger RA. Intraperitoneal cisplatin and paclitaxel in ovarian cancer. New England Journal of Medicine. 2006 Jan 5;354(1):34-43.
- Cheung-Ong K, Giaeffer G, Nislow C. DNA-damaging agents in cancer chemotherapy: serendipity and chemical biology. Chemistry & biology. 2013 May 23;20(5):648-59.
- Dimeo F, Schwartz S, Fietz T, Wanjura T, Böning D, Thiel E. Effects of endurance training on the physical performance of patients with hematological malignancies during chemotherapy. Supportive Care in Cancer. 2003 Oct;11(10):623-8.
- MacDonald V. Chemotherapy: managing side effects and safe handling. The Canadian Veterinary Journal. 2009 Jun;50(6):665.
- Bertomeu MC, Gallo S, Lauri D, Levine MN, Orr FW, Buchanan MR. Chemotherapy enhances endothelial cell reactivity to platelets. Clinical & Experimental Metastasis. 1990 Nov;8(6):511-8.
- Kantarjian HM, Keating MJ, Walters RS, Smith TL, Cork A, McCreddie KB, Freireich EJ. Therapy-related leukemia and myelodysplastic syndrome: clinical, cytogenetic, and prognostic features. Journal of Clinical Oncology. 1986 Dec;4(12):1748-57.
- Dighiero G, Travade P, Chevret S, Fenaux P, Chastang C, Binet JL. B-cell chronic lymphocytic leukemia: present status and future directions. French Cooperative Group on CLL.
- Plasschaert SL, Kamps WA, Vellenga E, de Vries EG, de Bont ES. Prognosis in childhood and adult acute lymphoblastic leukaemia: a question of maturation?. Cancer treatment reviews. 2004 Feb 1;30(1):37-51.
- Coebergh JW, Reedijk AM, de Vries E, Martos C, Jakab Z, Steliarova-Foucher E, Kamps WA. 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. 2006 Sep 1;42(13):2019-36.
- Degos L. John Hughes Bennett, Rudolph Virchow... and Alfred Donne: the first description of leukemia. The hematology journal: the official journal of the European Haematology Association. 2001;2(1):1.
- Lichtman MA. Battling the hematological malignancies: the 200 years' war. The Oncologist. 2008 Feb;13(2):126-38.
- Otten J, Philippe N, Suci S, Béhar C, Babin-Boilletot A, Thyss A, Ferster A, Vilmer E. The Children Leukemia Group: 30 years of research and achievements. European Journal of Cancer. 2002 Mar 1;38:44-9.
- Hoelzer D. Change in treatment strategies for adult acute lymphoblastic leukemia (ALL) according to prognostic factors and minimal residual disease. Bone Marrow Transplantation. 1990 Jul 1;6:66-70.
- Beutler E. The treatment of acute leukemia: past, present, and future. Leukemia. 2001 Apr;15(4):658-61.
- Geary CG. The story of chronic myeloid leukaemia: Historical review. British journal of haematology. 2000 Jul;110(1):2-11.