



## RESEARCH ARTICLE

# Clinical Prediction of Blood Parameters Associated with Breast, Colon, Thyroid, Ovarian, and Prostate Cancer: Diagnostic Studies

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## ABSTRACT

Cancer is a cellular change caused by uncontrolled cell growth and division. This disease develops from the growth of abnormal cells that have the potential to invade or spread to other parts of the body. This study's goal was to determine how blood parameters, such as mean corpuscular volume, mean corpuscular hemoglobin (MCH), and MCH concentration, relate to one another. White, red blood cells, hemoglobin and other kind of cancer. Breast cancer, thyroid gland cancer, ovarian cancer, testicular cancer, brain tumors as well as other types of cancer are based on the cell of the tissue found on or in the body. Each of these cancers is accompanied by different health problems that put the patient's life at risk. To perform a complete blood count (CBC) before and after cancer diagnosis, as abnormalities in the body can cause an increase or decrease in blood components, depending on the cancer type, the patient's physiological mechanisms, and the structural component. Since the CBC test belongs to hematology, drawing a blood sample and putting it into the anticoagulant tube for testing were preferred. In this study, the blood components of almost all patients were normal except for a few of them which may be due to other medical and biological factors. The aim of the study was to see if there is a significant relationship between blood parameters and cancer types.

**Keywords:** Complete blood count, breast cancer, thyroid gland cancer, testicular cancer, ovarian cancer, blood parameters

## INTRODUCTION

Cancer is a disease that causes deaths worldwide. The increasing risk of cancer disease can be accounted for by elements such as a longer life expectancy and social, economic, and population growth.<sup>[1,2]</sup> Breast cancer originates from the breast tissue, typically from the lining or lobules of milk ducts.<sup>[3]</sup> Thyroid cancer is a type of cancer that affects the endocrine system.<sup>[4]</sup> There are two different forms of thyroid cancer. Papillary thyroid cancer and follicular thyroid cancer are both differentiated thyroid cancer that arise from thyroid follicle cells. Medullary thyroid cancer the third form of thyroid cancer, develops from parafollicular C-cells. The last type of thyroid cancer, which is anaplastic thyroid cancer, is a lethal form of the disease that can distinguish over time and occurs from *de novo*.<sup>[5]</sup> Epithelial ovarian cancer causes gynecological cancer-associated deaths.<sup>[6]</sup> Ovarian carcinoma can develop in one of three ways which include the surface of the ovary, the fallopian tube that connects the uterus to the

fallopian, and the peritoneal cavity lined by mesothelium,<sup>[7]</sup> whereas colon cancer develops when malignant tumors form in the colon tissue. It is one of the most commonly diagnosed cancers and one of the main causes of death.<sup>[8]</sup> Prostate cancer is the second most commonly diagnosed cancer in men after

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lung cancer.<sup>[9]</sup> Brain tumor is the most terrible type of cancer. It caused many deaths among children and adults during the past years.<sup>[10]</sup> The tumor affects and damages the healthy tissues of the brain or intensifies intracranial pressure.<sup>[11]</sup> Testicular cancer is the most common solid tumor in men over the age of 15–40 years. It is extremely aneuploidy, with the iso-chromosome 12p being the most common chromosomal abnormality.<sup>[12]</sup> Ewing’s sarcoma, a small round cell tumor, usually develops in the bones of children and teenagers but may also occur in soft tissue. Ewing’s disease develops quickly, and within a few weeks, the skeletal lesion transforms into massive tumors that develop in soft tissue.<sup>[14]</sup>

**MATERIALS AND METHODS**

After diagnosing patients with cancer, a complete blood count (CBC) examination is required for further diagnoses of diseases, such as leukemia, anemia, and other hematological diseases.<sup>[15]</sup> There were two stages of the CBC test such as the phlebotomy technique followed using the blood sample in the CBC instruments. Phlebotomy, in a so-called venipuncture, a blood sample is taken by puncturing a vein and collected in EDTA tube. This was the medical procedure to withdraw the blood sample. This study involved collecting data about a hundred patients diagnosed with cancer. The patients consisted of those with cancer of various types such as breast (30 samples), colon (15 samples), thyroid gland (15 Samples), ovarian (20 samples), and prostate cancer (20 samples). They received treatments at Kalar Hospital in Sulaimaniyah, Kurdistan Region, Iraq. Data for each patient for this study were collected by an oncologist at the above hospital statistics department.

**RESULTS**

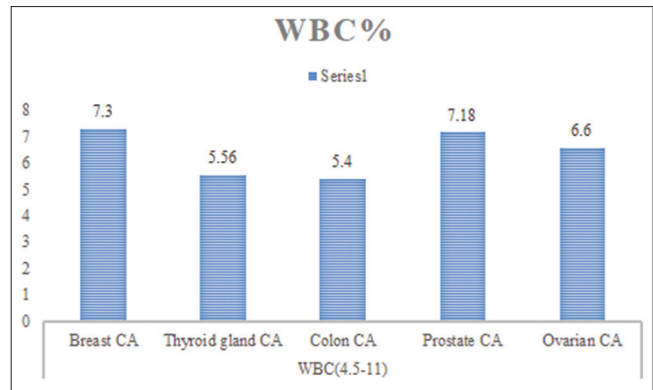
The variations in blood parameters of patients with cancer of various types are illustrated in the following figures.

The highest mean white blood cell (WBC) count was seen in patients with breast cancer 7.3, prostate cancer 7.18, and ovarian cancer 6.6. The mean WBC count was lower (5.4) in patients with colon cancer compared to 5.56 in patients with thyroid gland cancer. However, the standard rate was 4.5–11 (Fig. 1).

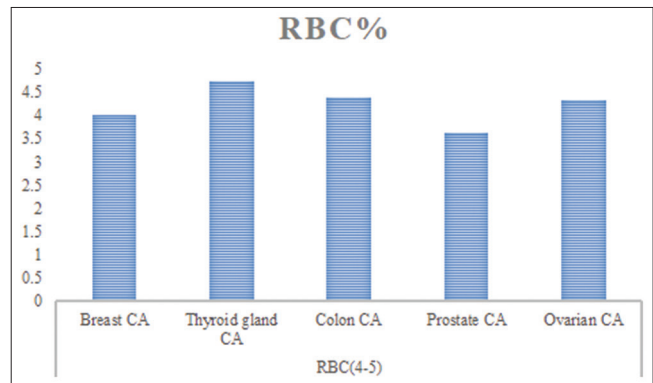
The highest and lowest mean red blood cell (RBC) counts were observed in patients with thyroid gland cancer (5) and prostate cancer (3.5), respectively. The same mean (4.5) RBC count was shown in patients with colon cancer and ovarian cancer. The mean RBC count in patients with breast cancer was 4, which was slightly higher than that of patients with prostate cancer. However, the standard rate was 4–5 (Fig. 2).

The highest mean hemoglobin (HGB) count (14) was in patients with thyroid gland cancer and ovarian cancer, followed by 13 and 11 in patients with colon cancer and breast cancer, respectively. Patients with prostate cancer had the lowest mean HGB count (10). The standard rate was 12–15.5 (Fig. 3).

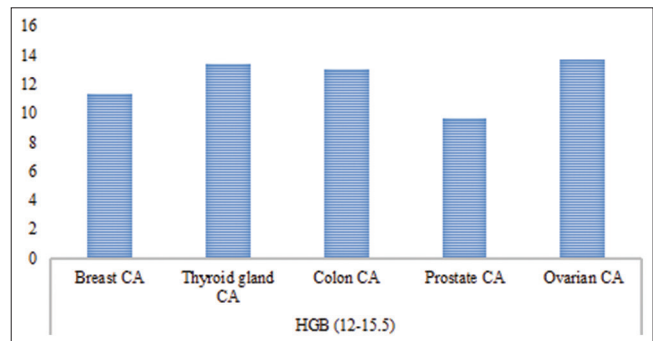
Patients with ovarian cancer, colon cancer, thyroid gland cancer, and breast cancer presented normal mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and MCH concentration (MCHC) rates, indicating these types of cancer normally do not affect MCV, MCH, and MCHC (Fig. 4)



**Figure 1:** The mean white blood cell count in patients with cancer of various types



**Figure 2:** The mean red blood cell count in patients with cancer of various types



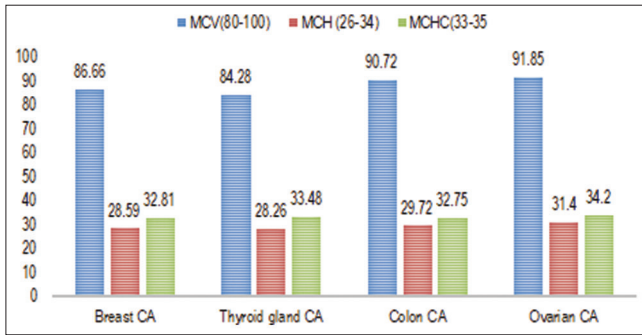
**Figure 3:** The mean hemoglobin count in patients with cancer of various types

The WBC, RBC, and HGB rates were normal in all patients with ovarian cancer, colon cancer, thyroid gland cancer, and breast cancer. This finding indicates these types of cancer do not normally affect WBC, RBC, and HGB (Fig. 5).

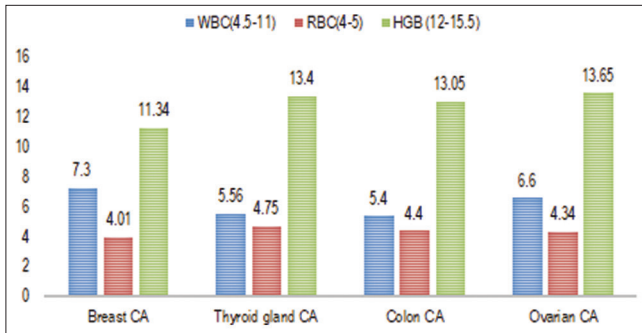
Each of the patients with ovarian cancer, breast cancer, and thyroid cancer had normal levels of platelets. On the other hand, patients with colon cancer had the lowest levels of platelets in comparison to patients with other types of cancer (Fig. 6).

**DISCUSSION**

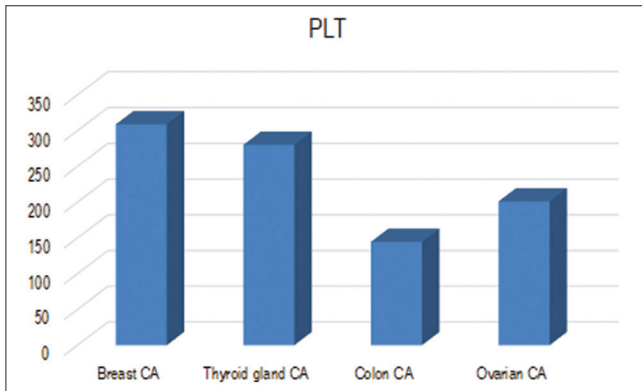
Early prognosis of tumors in the body, especially in relation to early detection of oncological diseases, is a popular issue.



**Figure 4:** The mean corpuscular volume, mean corpuscular hemoglobin (MCH), and MCH concentration counts in patients with cancer of various types



**Figure 5:** The mean white blood cell, red blood cell, and haemoglobin counts in patients with cancer of various types



**Figure 6:** The results of the platelet count test for patients with cancer of various types

The CBC test was administered to patients diagnosed with cancer of various types (e.g., prostate cancer, ovarian cancer, thyroid cancer, colon cancer, and breast cancer). The results of this study displayed average WBC rates in all patients with cancer of various types, with the exception of one breast cancer patient who had a high rate of WBC. These results are consistent with previous study findings.<sup>[13,14]</sup> Other studies showed that, using the CBC profiles to measure a patient’s risk of health outcomes may indicate different infections or leukemia.<sup>[16]</sup> The rates of RBC were normal in all patients with cancer of various types except one breast cancer patient who had a very low rate of RBC, which indicate some vitamin deficiency or anemia. According to prior studies conducted

in 2020, patients are rated based on quantitative changes in blood parameters related to the body’s response to stress caused by malignant tumors.<sup>[17]</sup> The results of this study also demonstrated that the rates of HGB were almost normal, and there was no association between bleeding and cancer type. These results are in line with the findings of the previous study.<sup>[18,19]</sup> However, some patients had low rates which may signify anemia. In addition, MCHC rates were normal in all patients with cancer of various types.<sup>[20,21]</sup>

**CONCLUSION**

CBC is a well-known laboratory technique that measures the levels of various blood parameters to predict and diagnose a wide range of disorders and infections. Cancer is a lethal disease caused by irregular cell division and development. The findings of this study revealed that all patients with ovarian cancer, thyroid cancer, breast cancer, and colon cancer had normal levels of WBCs, RBCs, and HGB. Furthermore, the MCV, MCH, and MCHC rates were normal in all patients with cancer of the same type. The platelet levels were also normal in breast cancer, thyroid gland cancer, and ovarian cancer patients. On the other hand, colon cancer patients exhibited low platelet levels. Based on the results of this study, it was suggested that the CBC test does not accurately diagnose cancer.

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**ETHICS COMMITTEE APPROVAL AND CONSENT FOR PUBLICATION**

The oncologist gathered information from the Kalar Hospital’s Statistics Department in Sulaimaniyah, Iraq’s Kurdistan Region. Medical ethics application was not applicable, as this study did not involve patients.

**REFERENCES**

1. World Health Organization. *Cancer Fact Sheets*. World Health Organization, Geneva, 2020. Available from: <https://gco.iarc.fr/today/fact-sheets-cancers> [Last accessed on 2023 Jan 29].
2. G. Salcedo-Villanueva, A. A. Medina-Andrade, D. Moreno-Paramo, M. F. Golzarri, E. Moreno-Paramo, G. Y. Ortiz-Ramirez, U. Martinez-Aguilar, U. De Dios-Cuadras, M. Jimenez-Rodriguez, I. Espinosa-Soto, X. Mira-Lorenzo, J. Guzman-Cerda, A. Orozco-Moguel, C. Becerra-Revollo, L. P. Orozco-Gomez and E. Fulda. Primary cancer sites and clinical features of choroidal metastasis in Mexican patients. *Clinical Ophthalmology*, vol. 15, pp. 201-209, 2021.
3. G. N. Sharma, R. Dave, J. Sanadya, P. Sharma and K. K. Sharma. Various types and management of breast cancer: An overview. *Journal of Advanced Pharmaceutical Technology and Research*, vol. 1, no. 2, pp. 109-126, 2010.
4. M. Xing. Molecular pathogenesis and mechanisms of thyroid cancer. *Nature Reviews Cancer*, vol. 13, pp. 184-199, 2013.
5. D. F. Schneider and H. Chen. New developments in the diagnosis and treatment of thyroid cancer. *CA: A Cancer Journal for Clinicians*, vol. 63, no. 6, pp. 373-394, 2013.

6. G. C. Jayson, E. C. Kohn, H. C. Kitchener and J. A. Ledermann. Ovarian cancer. *Lancet*, vol. 384, no. 9951, pp. 1376-1388, 2014.
7. E. Lengyel. Ovarian cancer development and metastasis. *The American Journal of Pathology*, vol. 177, no. 3, pp. 1053-1064, 2010.
8. T. Hu, Z. Li, C. Y. Gao and C. H. Cho. Mechanisms of drug resistance in colon cancer and its therapeutic strategies. *World Journal of Gastroenterology*, vol. 22, no. 30, pp. 6876-6889, 2016.
9. P. Rawla. Epidemiology of prostate cancer. *World Journal of Oncology*, vol. 10, no. 2, pp. 63-89, 2019.
10. A. Rehman, M. A. Khan, T. Saba, Z. Mehmood, U. Tariq and N. Ayesha. Microscopic brain tumor detection and classification using 3D CNN and feature selection architecture. *Microscopy Research and Technique*, vol. 84, no. 1, pp. 133-149, 2020.
11. T. Saba, A. S. Mohamed, M. El-Affendi, J. Amin and M. Sharif. Brain tumor detection using fusion of hand crafted and deep learning features. *Cognitive Systems Research*, vol. 59, pp. 221-230, 2020.
12. G. de Vries, X. Rosas-Plaza, M. A. T. M. van Vugt, J. A. Gietema and S. de Jong. Testicular cancer: Determinants of cisplatin sensitivity and novel therapeutic opportunities. *Cancer Treatment Reviews*, vol. 88, p. 102054, 2020.
13. Y. Iwamoto. Diagnosis and treatment of Ewing's sarcoma. *Japanese Journal of Clinical Oncology*, vol. 37, no. 2, pp. 79-89, 2007.
14. J. J. Noh, M. C. Lim, M. H. Kim, Y. H. Kim, E. S. Song, S. J. Seong, D. H. Suh, J. M. Lee, C. Lee and C. H. Choi. The prognostic model of pre-treatment complete blood count (CBC) for recurrence in early cervical cancer. *Journal of Clinical Medicine*, vol. 9, no. 9, p. 2960, 2020.
15. N. H. Mahmood, P. C. Lim, S. M. Mazalan and M. A. A. Razak. Blood cells extraction using color based segmentation technique. *International Journal of Life Sciences Biotechnology and Pharma Research*, vol. 2, no. 2, pp. 2250-3137, 2013.
16. D. K. Kur, D. Thøgersen, L. Kjeldsen and L. Friis-Hansen. The HemoScreen hematology point-of-care device is suitable for rapid evaluation of acute leukemia patients. *International Journal of Laboratory Hematology*, vol. 43, no. 1, pp. 52-60, 2021.
17. M. G. Sadovsky, A. A. Feller, E. A. Martynova, D. V. Chernyaev, E. V. Semenov, E. V. Slepov and R. A. Zukov. CBC effectively stratifies the patients with different types of malignant tumors. *Journal of Physics: Conference Series*, vol. 1679, p. 042019, 2020.
18. S. Yousefian, A. Moafi and M. Khalilian. The relation between end of induction minimal residual disease and different risk factors in patients with acute lymphoblastic leukemia. *Iranian Journal of Pediatric Hematology and Oncology*, vol. 9, no. 4, pp. 211-218, 2019.
19. N. Michels, C. van Aart, J. Morisse, A. Mullee and I. Huybrechts. Chronic inflammation towards cancer incidence: A systematic review and meta-analysis of epidemiological studies. *Critical Reviews in Oncology Hematology*, vol. 157, p. 103177, 2021.
20. A. M. Hussein, Z. B. Taha, A. G. Malek, K. A. Rasul, D. Q. Hazim, R. J. Ahmed and U. B. Mohamed. D- dimer and serum ferritin as an independent risk factor for severity in COVID-19 patients. *Materials Today: Proceedings*, 2021.
21. T. S. Salih and S. N. R. Darogha. Incidence of B-cell leukemia among Kurdish people in Erbil City. *Cihan University-Erbil Scientific Journal*, vol. 2, p. 2, 2017.