World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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The difference between hemoglobin, erythrocytes, leukocytes, and thrombocytes before and after cisplatin chemotherapy in stage III B cervical cancer patients at Oncology Clinic of Dr. Soetomo General Hospital

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World Journal of Advanced Research and Reviews, 2026, 29(01), 469-472

Publication history: Received on 28 November 2025; revised on 04 January 2026; accepted on 07 January 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.29.1.0017

Abstract

This study aimed to evaluate the differences in hemoglobin, erythrocyte, leukocyte, and thrombocyte levels before and after neoadjuvant cisplatin chemotherapy and radiotherapy in stage IIIB cervical cancer patients at Oncology Clinic of Dr. Soetomo General Hospital, Surabaya. The data were obtained from secondary sources and analyzed using a paired t-test. The majority patients were aged 40-59 years and originated from outside Surabaya. The most common parity was three, and abnormal vaginal bleeding was the most frequently reported symptom.

The mean hemoglobin level decreased from 10.94 ± 2.21 g/dL to 10.61 ± 1.66 g/dL (p = 0.281), but the change was not clinically significant. Similarly, the mean erythrocyte levels decreased from 4.09 ± 0.06 x 10^6/ µL to 3.36 ± 0.58 x 10^6/µL (p = 0.001), with no significant effect observed. The mean leukocyte levels showed a significant decrease from 11.17 ± 4.73 x 10^3/dL to 9.62 ± 4.56 x 10^3/µL (p = 0.029), indicating leukopenia as a notable side effect of chemoradiation. The mean thrombocyte levels also decreased from 385.98 ± 133.85 x 10^3/µL to 342.08 ± 118.24 x 10^3/µL (p = 0.023), without significant difference.

The findings suggest that cisplatin-based chemoradiotherapy has a significant impact on leukocyte levels, whereas changes in hemoglobin, erythrocytes, and thrombocytes were not statistically significant. These results are consistent with previous studies that emphasize leukopenia as a major hematological toxicity from chemoradiation. Monitoring blood cell parameters is essential in the management of cervical cancer patients undergoing this therapy.

Keywords: Cervical cancer; Cisplatin; Chemotherapy; Leukocytes; Hemoglobin

1. Introduction

Cervical cancer is one of the leading causes of cancer-related morbidity and mortality among women worldwide, particularly in developing countries. In Indonesia, cervical cancer remains highly prevalent and is often diagnosed at an advanced stage, such as stage IIIB. Standard treatment for this case includes neoadjuvant chemotherapy followed by radiotherapy, with cisplatin being the most commonly used chemotherapeutic agent.

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Cisplatin-based chemoradiotherapy is known for its effectiveness in tumor suppression; however, it is also associated with hematologic toxicity, including anemia, leukopenia, and thrombocytopenia. Monitoring hematologic parameter such as hemoglobin, erythrocytes, leukocytes, and thrombocytes before and after therapy is essential to evaluate the treatment's impact on patients' overall condition and to guide supportive care decisions.

Although previous studies have explored the side effects of its treatment, limited data are available regarding its specific effects on these blood components among stage IIIB cervical cancer patients in Indonesia. Understanding these effects can provide insights into patient management during treatment.

This study aims to evaluate the differences in hemoglobin, erythrocyte, leukocyte, and thrombocyte levels before and after neoadjuvant cisplatin chemotherapy and radiotherapy in stage IIIB cervical cancer patients at Dr. Soetomo General Hospital, Surabaya. The hypothesis of this study is that significant changes, particularly decreases, occur in hematologic parameters as a result of cisplatin-based therapy, which may affect the patient's clinical outcomes.

2. Material and methods

This study is an analytic retrospective study. It was conducted at the medical records department at Oncology Clinic Dr. Soetomo General Hospital Surabaya. The subject in this study included all patients diagnosed with stage IIIB cervical cancer who underwent neoadjuvant 4 times cisplatin chemotherapy and radiotherapy. Data were analyzed by using paired t-test to assess the comparison of hemoglobin, erythrocyte, leukocyte, and thrombocytes levels before and after cisplatin chemotherapy. Statistical analysis used was paired t test with significance level $\propto < 0,05$.

3. Result and Discussion

Stage III B cervical cancer patients who received chemotherapy with cisplatin 4 times are 86 patients. Based on paired t test method analysis statistic before and after chemotherapy showed that there is no significant difference in decreasing of hemoglobin level (p=0,281), significant difference in decreasing of erythrocyte level (p=0,001), significant difference in decreasing of leucocyte level (p=0,029), dan significant difference in thrombocyte level (0,023).

All chemotherapy regimens can cause immune suppression and myelosuppression by impairing bone marrow function which leads to a decrease in erythrocyte production and subsequently affects hemoglobin level [1]. From the total study sample, 47 patients (33.33%) received ferrous sulphate supplementation, 33 patients (23.40%) received folic acid supplement 24 patients (17.02%) underwent PRC transfusion, 5 patients (3.55%) received vitamin B complex, and 15 patients (10.64%) did not receive any additional supplements or vitamins. The nonsignificant decrease observed may be attributed to the effect of supplemental administration, which play an essential role in hemoglobin synthesis. The bone marrow needs some material for hemoglobin formation include metals (iron, manganese, cobalt, zinc, copper), vitamins (B12, B6, C, E, folic acid, thiamine, riboflavin), proteins, and hormones (erythropoietin, androgens, thyroxine) [2]. Ferrous sulphate supplementation can improve cellular oxygenation, enhance metabolism, and optimize nutrient absorption within cells [3]. These findings indicate that cisplatin-based chemotherapy has a substantial suppressive effect on erythropoiesis, supporting the study hypothesis. This is consistent with previous reports showing that up to 50% of patients develop post-chemotherapy anemia [4]. Chemotherapy-induced anemia is primarily attributed to bone marrow suppression, as well as bleeding, hemolysis, renal dysfunction, nutritional deficiencies, and anemia of chronic disease [5]. In the present study, transfusion of packed red cells (PRC), with or without iron and folic acid supplementation was administered to maintain hemoglobin stability, whereas patients who did not receive transfusion or supplementation experienced a more pronounced decline in erythrocyte levels, further highlighting the role of myelosuppression in cisplatin-related hematologic toxicity [5,6].

There is a significant decrease in leukocyte levels in patients with stage IIIB cervical cancer following four cycles of cisplatin chemotherapy. Mean leukocyte counts decline from $11.17 \pm 4.73 \times 10^3/\mu L$ after treatment, with a statistically significant difference ($p = 0.029$). These findings indicate that cisplatin-based chemotherapy exerts a meaningful suppressive effect on leukopoiesis, thereby supporting the study hypothesis. Chemotherapy-induced leukopenia is primarily attributable to bone marrow suppression, as most chemotherapeutic agents impair hematopoietic function and immune competence [4]. This is consistent with previous describing myelosuppression, neutropenia, and increased susceptibility to infection as common adverse effects of chemotherapy [7]. Reduced leukocyte production compromises immune defense mechanisms, rendering patients with cervical cancer more vulnerable to bacterial and viral infections, as previously reported in similar populations [8].

This study demonstrated a significant reduction in platelet counts in patients with stage IIIB cervical cancer after four cycles of cisplatin chemotherapy. The mean platelet level decreased from 385.98 ± 133.85 × 10^3/µL before treatment to 342.08 ± 118.24 × 10^3/µL after treatment, with a statistically significant difference (p = 0.023), supporting the study hypothesis. Cisplatin-induced thrombocytopenia is primarily attributed to chemotherapy-related myelosuppression, which leads to hematologic toxicities including anemia, leukopenia, neutropenia, and thrombocytopenia [9]. Thrombocytopenia increases bleeding risk, whereas thrombocytosis has been associated with poor prognosis in cervical cancer due to tumor cell–induced platelet aggregation (TCIPA), which facilitates tumor immune evasion, angiogenesis, and metastasis [10]. n the present study, the observed decline in platelet counts suggests effective suppression of tumor-associated thrombocytosis, potentially indicating a favorable prognostic impact. Although some patients received adjunctive therapy such as vitamin K and tranexamic acid to manage bleeding risk, no significant difference in platelet levels was observed between supplemented and non-supplemented groups, likely due to the limited number of subjects receiving these agents. Vitamin K supports coagulation factor synthesis, while tranexamic acid, an antifibrinolytic agent, reduces bleeding by inhibiting plasminogen activation [11].

4. Conclusion

Cisplatin-based chemotherapy administered for four cycles in patients with stage IIIB cervical cancer resulted in significant reductions in erythrocyte, leukocyte, and thrombocyte levels, reflecting chemotherapy-induced bone marrow suppression. In contrast, hemoglobin levels did not show a significant decline, likely due to the use of supportive interventions during treatment. These findings demonstrate that cisplatin has a substantial impact on hematopoietic function, emphasizing the need for careful hematological monitoring throughout chemotherapy. Early identification and appropriate management of hematologic changes are essential to reduce the risk of anemia, infection, and bleeding, thereby improving treatment safety and clinical outcomes in patients with advanced cervical cancer.

Compliance with ethical standards

Acknowledgments

The authors would like to thank the medical record unit of Dr. Soetomo General Hospital for their assistance in data collection. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclosure of conflict of interest

All authors declare that they have no competing financial or non-financial interests, including affiliations with institutions, products, or organizations that could influence or be perceived to influence the outcomes of this study.

Statement of ethical approval

This study was approved by the Health Research Ethics Committee of Dr. Soetomo General Hospital (Ethical Clearance No: 25/Panke.KKE/I/2017).

Statement of informed consent

Written informed consent was waived due to the retrospective nature of the study.

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