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The effect of systemic chemotherapy on hematological profiles in lung cancer patients

Pengaruh Kemoterapi Sistemik terhadap Profil Hematologis pada Pasien Kanker Paru

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ABSTRACT

Background: *Cancer is a disease characterized by uncontrolled cell growth in one or both lungs originating from epithelial cells. In Indonesia, lung cancer ranks fourth among all cancer types and is the second leading cause of death after cardiovascular diseases. Management of lung cancer involves various therapeutic modalities, including surgery, radiotherapy, chemotherapy, and combination therapy. Certain chemotherapeutic agents, such as cisplatin and carboplatin, are known to have a narrow therapeutic index and high toxicity, so inappropriate regimen selection or dosing may result in serious adverse effects or even death. All chemotherapy agents carry the potential for toxicity, including both hematological and non-hematological effects, with hematological toxicities commonly manifesting as anemia, leukopenia, and thrombocytopenia of varying severity.*

Objective: *This study aimed to determine the hematologic profile in patients after chemotherapy.*

Methods: *This study was a descriptive research with a cross-sectional design using a total sampling technique. During the August-December 2023 period, 36 lung cancer patients met the inclusion criteria at Arifin Achmad Hospital, namely lung cancer patients with adenocarcinoma or squamous cell carcinoma who underwent advanced chemotherapy with a cycle of 21 days in the August-December 2023 period.*

Results: *Of the 36 patients, 29 (80.56%) were male. The highest age of patients undergoing chemotherapy was ≥ 40 years (94.44%). Changes in the hematological profile after chemotherapy occurred in 14 patients (38.89%), with the most common hematological profile being anemia.*

Conclusion: *The use of chemotherapy regimens can cause changes in the hematologic profile, including anemia, leukopenia, and thrombocytopenia.*

Keywords: *chemotherapy toxicity, hematological changes, lung cancer*

ABSTRAK

Latar Belakang: Kanker paru adalah penyakit dengan pertumbuhan sel yang tidak terkendali pada satu atau kedua paru yang berasal dari sel epitel. Kanker paru menempati peringkat keempat dari semua jenis kanker di Indonesia dan merupakan penyebab kematian kedua setelah penyakit kardiovaskular. Penatalaksanaan kanker paru dilakukan melalui serangkaian terapi seperti pembedahan, radioterapi, kemoterapi, dan terapi kombinasi. Beberapa agen kemoterapi seperti cisplatin dan carboplatin dikenal memiliki indeks terapeutik yang rendah dan efek toksik yang tinggi, sehingga penggunaan regimen dan dosis yang tidak tepat dapat menyebabkan efek samping serius bahkan kematian. Setiap kemoterapi memiliki potensi toksisitas baik berupa toksisitas hematologis maupun non-hematologis. Toksisitas hematologis yang dapat

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terjadi meliputi anemia, leukopenia, dan trombositopenia dengan derajat keparahan yang bervariasi.
Tujuan: Penelitian ini bertujuan untuk mengetahui profil hematologis pada pasien setelah kemoterapi.
Metode: Penelitian ini merupakan penelitian deskriptif dengan rancangan potong lintang (cross-sectional) menggunakan teknik total sampling. Selama periode Agustus–Desember 2023, terdapat 36 pasien kanker paru yang memenuhi kriteria inklusi di RSUD Arifin Achmad yaitu pasien kanker paru dengan jenis adenokarsinoma atau karsinoma sel skuamosa yang menjalani kemoterapi lanjutan dengan siklus 21 hari pada periode Agustus–Desember 2023.
Hasil: Dari 36 pasien tersebut, 29 pasien (80,56%) adalah laki-laki. Usia terbanyak pada pasien yang menjalani kemoterapi adalah ≥ 40 tahun (94,44%). Perubahan profil hematologis setelah kemoterapi terjadi pada 14 pasien (38,89%), dengan profil hematologis yang paling sering ditemukan adalah anemia.
Kesimpulan: Penggunaan regimen kemoterapi dapat menyebabkan perubahan profil hematologis, termasuk anemia, leukopenia, dan trombositopenia.

Kata kunci: kanker paru, perubahan hematologis, toksisitas kemoterapi

INTRODUCTION

Lung cancer remains a significant global health challenge, with Non-Small Cell Lung Cancer (NSCLC) constituting approximately 80–85% of all cases[1]. The NSCLC is often diagnosed at an advanced stage due to the lack of early symptoms, resulting in poor survival outcomes. According to the Global Cancer Observatory (GLOBOCAN), lung cancer was responsible for approximately 1.8 million deaths globally in 2020, ranking it as the leading cause of cancer mortality[2]. Prognostically, the 5-year survival rate for non-small cell lung cancer (NSCLC) is strongly stage-dependent, approximately 68% in localized disease, 35% in regional spread, and 8% in distant metastasis, highlighting the clinical importance of optimizing treatment effectiveness while closely monitoring therapy-related toxicities to maintain treatment continuity and improve survival outcomes [3].

However, chemotherapy remains a cornerstone of treatment, particularly for advanced-stage NSCLC[4]. While chemotherapy improves overall survival, it is associated with considerable systemic toxicities that may limit its efficacy and patient compliance. A retrospective study at Dr. M. Djamil General Hospital in Padang, Indonesia, highlighted the hematological toxicity of platinum-based chemotherapy; however, data on the specific patterns and magnitude of hematological changes following chemotherapy in lung cancer patients, particularly in different clinical settings, remain limited. The combination of carboplatin and paclitaxel was notably linked to high rates of anemia (72.2%), leukopenia, and thrombocytopenia, underlining the regimen's potential to cause myelosuppression[5]. This pattern is consistent with international data, where platinum-doublet chemotherapy has been reported to significantly suppress bone marrow function[6].

Review studies indicate that cisplatin-induced nephrotoxicity is a major and frequently occurring toxic effect, affecting approximately 20–30% of patients despite adequate hydration, particularly among those at higher risk, such as older adults or individuals with pre-existing renal impairment[7]. The World Health Organization (WHO) has developed a standardized toxicity grading scale to classify these adverse effects, emphasizing that treatment should ideally not exceed grade 2 or 3 toxicity for continued use[8].

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Ensuring appropriate chemotherapy administration requires stringent patient selection; however, in routine clinical practice in Indonesia, adherence to these criteria remains challenging due to late patient presentation, limited baseline laboratory optimization, and high patient burden. National lung cancer treatment guidelines recommend chemotherapy only for patients with a Karnofsky Performance Status ≥ 60 or WHO Scale 2 and adequate laboratory parameters (hemoglobin ≥ 10 g/dL, leukocytes ≥ 4,000/mm³, and platelets ≥ 100,000/mm³)[9]. Failure to adhere to these parameters can lead to life-threatening complications, prolonged hospitalization, or early treatment termination.

In this context, toxicity profiling is crucial for clinical decision-making; however, evidence describing the real-world hematological changes experienced by lung cancer patients after chemotherapy, particularly in routine hospital settings, remains limited. Comprehensive baseline laboratory assessment, evaluation of performance status, and individualized dose adjustment are therefore essential not only to reduce adverse events, but also to address this gap and support safer, patient-centered chemotherapy management[10]. Furthermore, real-world studies indicate that pre-treatment nutritional status and renal function significantly influence the risk of hematological toxicity in lung cancer patients receiving platinum-based regimens[11]. The study aimed to determine the effect of systemic chemotherapy on the hematological profile of lung cancer patients at Arifin Achmad Regional Hospital, Riau Province.

METHODS

Study design

This study used a descriptive analytical cross-sectional design, suitable for assessing chemotherapy-induced hematological toxicity and analyzing its relationship with hematological profiles at a single point in time. The research was conducted from August to December 2023 at Arifin Achmad Regional General Hospital, Riau Province.

Data Source and Sampling Procedure

The study population consisted of all lung cancer patients with a prior history of chemotherapy at Arifin Achmad Hospital during the period of August to December 2023, totaling 36 individuals. The sample included all lung cancer patients scheduled to undergo subsequent chemotherapy cycles at the same hospital during the same period, comprising 36 respondents. The sampling technique used was total sampling. Inclusion criteria included patients undergoing subsequent chemotherapy cycles during the August–December 2023 period with a 21-day cycle interval, and patients diagnosed with adenocarcinoma or squamous cell carcinoma types of lung cancer. Exclusion criteria included patients with a history of chemotherapy outside Arifin Achmad Regional General Hospital or those who received treatment prior to laboratory examination.

Variables of the study

The independent variables were chemotherapy characteristics and patient clinical factors, while the dependent variable was hematological toxicity reflected in hematological profile parameters.

Data Collection

Data were obtained from the Electronic Data Processing (EDP) system of Arifin Achmad Regional General Hospital, concerning lung cancer patients scheduled for continued chemotherapy during the study period.

Ethical Considerations

This study received ethical approval with clearance number: B/019/UN19.5.1.1.8/UEPKK/2024.

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Data Analysis

Data were analyzed using SPSS version 26. Univariate analysis was conducted to describe the frequency distribution of each variable. Bivariate analysis was performed using the Chi-Square test to determine associations between variables and to calculate the Odds Ratio (OR). Statistical significance was set at $p < 0.05$. An OR value of 4.87 indicated a significant relationship between the independent and dependent variables.

RESULT

Univariate Analysis

Table 1. Distribution of Patients

Respondent Characteristics	n	(%)
Sex		
Male	29	80,56
Female	7	19,44
Total	36	100.00
Age		
< 40 years	2	5,56
≥ 40 years	34	94,44
Total	36	100.00
Body Mass Index (BMI)		
Underweight	28	77,78
Normal weight	8	22,22
Obesity Class I	0	0
Obesity Class II	0	0
Total	36	100.00
Smoking Status		
Non-Smoker	10	27,78
Light Smoker	2	5,56
Moderate Smoker	4	11,11
Heavy Smoker	20	55,56
Total	36	100.00
Type of Lung Cancer		
Adenocarcinoma	21	58,3
Squamous Cell Carcinoma	15	41,7
Total	36	100.00
Chemotherapy Cycle		
≤ 6 cycles	28	77,78
>6 cycles	8	22,22
Total	36	100.00
Chemotherapy Regimen		
Pemetrexed+Cisplatin	13	36,1
Carboplatin+Paclitaxel	15	41,7
Pemetrexed (monotherapy)	3	8,33
Docetaxel (monotherapy)	5	13,89
Total	36	100.00
Treatment Outcome		
No improvement in general condition	22	61,11
Improved general condition	14	38,89
Discharged Against Medical Advice(DAMA)	0	0
Death	0	0
Total	36	100.00

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Respondent Characteristics	n	(%)
Duration of Treatment		
Length of Stay < 4 days	21	58,33
Length of Stay ≥ 4 days	15	41,67
Total	36	100.00
Hemoglobin Level		
< 10 mg/dl	11	30,56
≥ 10 mg/dl	35	69,44
Total	36	100.00
Leukocyte Count		
< 4000 µl	2	5,56
≥ 4000 µl	34	94,44
Total	36	100.00
Platelet Count		
< 100.000 mm^3	3	8,33
≥ 100.000 mm^3	33	91,67
Total	36	100.00

Based on Table 1, most lung cancer patients undergoing chemotherapy were male and aged ≥40 years, with a predominance of underweight nutritional status. A high Brinkman Index was common, and adenocarcinoma was the most frequent histopathological type. The majority received ≤6 chemotherapy cycles, most commonly with the Carboplatin–Paclitaxel regimen. Clinically, most patients showed no improvement in general condition, and longer hospital stays were often associated with infectious comorbidities. Hemoglobin, leukocyte, and platelet levels were generally within acceptable clinical ranges.

Table 2 presents the bivariate analysis of hemoglobin levels in relation to demographic characteristics, clinical factors, and treatment outcomes. The statistical analysis showed a significant association between hemoglobin levels and type of lung cancer (p = 0.048; OR = 4.87; 95% CI: 0.87–27.26), treatment outcome (p = 0.01), and length of stay (p < 0.01; OR = 0.025; 95% CI: 0.003–0.224).

Bivariate Analysis

Table 2. Bivariate Analysis of Hemoglobin Levels in Relation to Variables and Outcomes

Variabel dan Luaran	Hemoglobin Level		p-value	OR (95% CI)
	< 10 mg/dl	≥ 10 mg/dl		
Age				
< 40 years	1	1	0,539	2,4 (0,13-3,74)
≥ 40 years	10	24		
Sex				
Male	9	20	0,899	1,12 (0,18-1,93)
Female	3	4		
Body Mass Index (BMI)				
Underweight	5	23	0,678	0,667 (0,13-1,24)
Normal weight	1	7		
Obesity Class I	0	0		
Obesity Class II	0	0		
Smoking Status				
Non-smoker	1	9	0,541	-
Light smoker	0	2		
Moderate smoker	0	4		
Heavy smoker	3	17		
Type of Lung Cancer			0,048	4,87
Adenocarcinoma	9	12		

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Squamous Cell Carcinoma	2	13		(0,87-27,26)
Chemotherapy Cycle				
≤ 6 cycles	9	19	0,699	1,42 (0,23-8,47)
>6 cycles	1	7		
Chemotherapy Regimen				
Pemetrexed+Cisplatin	3	12		
Carboplatin+Paclitaxel	6	7	0,201	
Pemetrexed (monotherapy)	1	4		-
Docetaxel (monotherapy)	0	3		
Treatment Outcome				
No improvement in general condition	0	25		
Improved general condition	11	0	<0,01	
Discharged Against Medical Advice(DAMA)	0	0		-
Death	0	0		
Length of Stay				
< 4 days	1	20	<0,01	0,025 (0,003-0,224)
≥ 4 days	10	5		

Table 3. Bivariate Analysis of Leukocyte Levels in Relation to Variables and Outcomes

Variable	Leukocyte Level		p value	OR (95% CI)
	< 4000 µl	≥ 4000 µl		
Age				
< 40 years	2	0	0,724	-
≥ 40 years	0	34		
Sex				
Male	2	27	0,475	-
Female	0	7		
Body Mass Index (BMI)				
Underweight	2	26		
Normal weight	0	8	0,437	-
Obesity Class I	0	0		
Obesity Class II	0	0		
Smoking Status				
Non-smoker	0	10		
Light smoker	0	2	0,638	-
Moderate smoker	1	3		
Heavy smoker	0	20		
Type of Lung Cancer				
Adenocarcinoma	1	20	0,806	0,70 (0,04-12,15)
Squamous Cell Carcinoma	1	14		
Chemotherapy Cycle				
≤ 6 cycles	1	27	0,331	0,25 (0,14-4,68)
6 cycles	1	7		
Chemotherapy Regimen				
Pemetrexed+Cisplatin	1	14		
Carboplatin+Paclitaxel	0	13	0,138	-
Pemetrexed (monotherapy)	0	5		
Docetaxel (monotherapy)	1	2		

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Variable	Leukocyte Level		p value	OR (95% CI)
	< 4000 µl	≥ 4000 µl		
Treatment Outcome				
No improvement in general condition	34	0		
Improved general condition	2	0	0,047	-
Discharged Against Medical Advice(DAMA)	0	0		
Death	0	0		
Length of Stay				
< 4 days	1	2	0,806	0,71
≥ 4 days	20	13		(0,40-12,51)

Table 3, presents the bivariate analysis of leukocyte levels in relation to demographic data variables, associated influencing factors, and study outcomes. The statistical results indicate a significant association between leukocyte levels and treatment status (p-value = 0.047).

Table 4. Bivariate Analysis of Platelet Levels in Relation to Variables and Outcomes

Variable	Platelet level		p-value	OR (95% CI)
	< 10^5 mm^3	≥ 10^5 mm^3		
Age				
< 40 years	0	2	0,661	-
≥ 40 years	3	31		
Sex				
Male	3	26	0,526	0,44
Female	1	6		(0,3-5,73)
Body Mass Index (BMI)				
Underweight	3	22		
Normal weight	0	8	0,334	-
Obesity Class I	0	0		
Obesity Class II	0	0		
Smoking Status				
Non-smoker	0	10		
Light smoker	0	2	0,884	-
Moderate smoker	0	4		
Heavy smoker	3	17		
Type of Lung Cancer				
Adenocarcinoma	0	21	0,032	-
Squamous Cell Carcinoma	3	12		
Chemotherapy Cycle				
≤ 6 cycles	3	25	0,334	-
6 cycles	0	8		
Chemotherapy Regimen				
Pemetrexed+Cisplatin	3	12		
Carboplatin+Paclitaxel	0	13	0,205	-
Pemetrexed (monotherapy)	0	5		
Docetaxel (monotherapy)	0	3		
Treatment Outcome				
No improvement in general condition	0	33		
Improved general condition	3	0	0,023	-
Discharged Against Medical Advice(DAMA)	0	0		
Death	0	0		
Length of Stay			0,359	
< 4 days	1	20		0,325

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Variable	Platelet level		p-value	OR (95% CI)
	< 10^5 mm^3	≥ 10^5 mm^3		
≥ 4 days	2	13		(0,027-3,959)

Table 4 presents the bivariate analysis of platelet levels in relation to demographic data variables, associated influencing factors, and study outcomes. The statistical results indicate a significant association between platelet levels and the type of lung cancer (p-value = 0.032) as well as treatment status (p-value = 0.023).

DISCUSSION

The predominance of male and older lung cancer patients in this study is consistent with previous findings and likely reflects higher smoking exposure and cumulative risk with age, while the frequent occurrence of anemia after chemotherapy aligns with the known myelosuppressive effects of treatment, with minor differences from other studies possibly due to variations in therapy, treatment duration, and baseline patient conditions. This finding is consistent with the study conducted by Yori Yulindra et al., which reported that 68.2% of patients were male. The higher incidence of lung cancer in men is closely related to smoking habits and occupational factors[5].

In addition, a study by Yaakov Tolwin et al. indicated that during the past two decades (2004–2012), there was a shift in the gender ratio of lung cancer incidence, becoming relatively balanced at 53% in males and 47% in females. The study explained that women are increasingly susceptible to lung cancer due to the rising prevalence of smoking among women and the increasing involvement of women in traditionally male-dominated occupations[12].

Statistical analysis showed no significant association between sex and hematological changes (Hb p=0.899; leukocytes p=0.475; platelets p=0.526), with only a small risk contribution (1.12-fold for hemoglobin and 0.44-fold for platelets). Although most patients were male, sex was not a significant predictor. The predominance of males may relate to smoking, occupational exposure, and lifestyle factors, along with socioeconomic conditions and limited awareness of cancer risks. Most patients (94.44%) were aged ≥40 years, consistent with findings by Yori Yulindra et al., which reported a similar age distribution[5]. This finding is consistent with the study by Yang et al. (2025), which reported that most lung cancer cases occur from the age of forty years onward, and that extending screening to this age group would capture nearly all patients who are currently missed by a higher age threshold[13]. Another study by Salsabila Syifa reported that lung cancer most commonly occurred in individuals aged ≥40 years (96.4%). Furthermore, data from the National Comprehensive Cancer Network (NCCN) stated that individuals aged ≥50 years are at high risk of developing lung cancer. This is because increasing age is associated with prolonged exposure to carcinogenic risk factors, along with declining immune function and physiological capabilities[14],[15].

However, the statistical analysis in this study showed no significant association between age and hematological changes, including hemoglobin (p-value = 0.539), leukocytes (p-value = 0.724), and platelets (p-value = 0.661). Further interpretation indicated that age contributed to a 2.4-fold increase in the risk of hemoglobin reduction. Thus, it can be concluded that, proportionally, individuals aged ≥40 years are at risk of developing lung cancer and are more likely to experience a decrease in hemoglobin levels.

The high incidence of lung cancer correlates with the severity of chemotherapy side effects related to aging. The aging process is physiologically marked by a decline in cellular and immune function. From an epidemiological perspective, lung cancer patients

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are often diagnosed with poor clinical manifestations at stage III or IV. This reflects a delay in lung cancer diagnosis, which contrasts with early detection and screening efforts. Moreover, public education on smoking cessation and its role in lung cancer prevention remains insufficient.

In terms of Body Mass Index (BMI), this study found that the most common BMI category was underweight, affecting 28 patients (77.78%), while 8 patients (22.22%) had a normal BMI. No patients were categorized as Obesity I or II. This is consistent with the findings of Nie et al. (2024), who reported that this multicenter cohort study involved 7,021 patients with advanced NSCLC and categorized patients based on body mass index, including the underweight category, to assess its association with clinical outcomes following first-line systemic therapy[16]. Statistical analysis showed no significant association between BMI and hematological changes, including hemoglobin ($p=0.678$), leukocytes ($p=0.437$), and platelets ($p=0.334$). According to Ku and Ko, this may be due to the multifactorial nature of hematological regulation in cancer patients. BMI reflects overall body mass but does not capture key factors such as metabolic status, inflammation, or bone marrow function, which more directly influence hematological parameters. In heterogeneous cancer populations, variables such as disease severity, systemic inflammation, treatment exposure, nutritional status, and individual biological differences play a greater role. As a result, the independent effect of BMI may be weakened and become statistically non-significant[17].

The high proportion of underweight patients may be due to disease progression, chemotherapy side effects, and psychological factors that reduce appetite, contributing to malnutrition and increasing the risk of hematological changes. Most patients had a heavy Brinkman Index (55.56%), but smoking status was not significantly associated with hematological parameters ($p>0.05$), although it remains a major lung cancer risk factor.

Adenocarcinoma was the most common type (58.3%) and was significantly associated with hemoglobin ($p=0.048$) and platelet levels ($p=0.032$), increasing the risk of hemoglobin reduction by 4.87 times. This is consistent with Zhang et al., which identified adenocarcinoma as the most prevalent subtype globally[18]. Similarly, research by Salsabila Syifa found that adenocarcinoma was the most common type of lung cancer, accounting for 60.4%[14]. Another study by Muhammad Rudy Chairudin et al. reported that adenocarcinoma was the most frequently diagnosed lung cancer type (81%)[15]. This may be related to the use of cigarette filters, which cause smoke inhalation to reach deeper into the lungs. Through this mechanism, nicotine and other harmful substances are more likely to be deposited in the peripheral areas of the lungs, which are the common sites for adenocarcinoma[14],[15].

Most patients (77.78%) had received ≤6 chemotherapy cycles, while 22.22% had >6 cycles. Statistical analysis showed no significant association between the number of cycles and hematological changes (Hb $p=0.699$; leukocytes $p=0.331$; platelets $p=0.334$). However, further analysis indicated a 1.42-fold risk of hemoglobin reduction and a 0.25-fold risk of leukocyte reduction. Proportionally, patients with ≤6 cycles were more likely to experience changes, likely because most had just begun early treatment cycles following recent diagnosis.

The most common regimen was carboplatin–paclitaxel (41.7%). No significant association was found between chemotherapy regimen and hematological parameters (Hb $p=0.201$; leukocytes $p=0.138$; platelets $p=0.205$). This is consistent with Sharif et al., which reported that although this regimen can cause myelosuppression, its effects are

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often transient and influenced by treatment cycles, supportive care, dose adjustments, and individual variability.[19].

Carboplatin–paclitaxel is a first-line regimen for NSCLC, while pemetrexed–cisplatin is primarily used for adenocarcinoma. Second-line therapy is typically administered as single-agent chemotherapy (e.g., docetaxel or pemetrexed). In this study, chemotherapy selection was not strictly based on cancer type, and carboplatin–paclitaxel was also used in some adenocarcinoma cases. Regarding treatment outcomes, 38.89% of patients required clinical condition optimization before chemotherapy based on hematological thresholds, while 61.11% met criteria without prior optimization. No deaths occurred during the study. Treatment outcomes were significantly associated with hematological changes, particularly hemoglobin ($p < 0.01$), leukocytes ($p = 0.047$), and platelets ($p = 0.023$), indicating that post-chemotherapy hematological status influences eligibility for continued treatment.

For length of stay, 51.83% of patients were hospitalized for <4 days and 41.67% for ≥4 days. Length of stay was significantly associated with hemoglobin changes ($p < 0.01$), but not with leukocyte or platelet counts. Decreased hemoglobin was associated with prolonged hospitalization, with a mean stay of 7.67 ± 4.19 days. Evidence suggests that hemoglobin, particularly within prognostic indices such as the HALP score, has stronger prognostic value than leukocyte or platelet counts alone[20].

Leukocyte reduction (<4000/µL) occurred in 5.56% of patients, with no significant associations identified in the bivariate analysis. Nevertheless, leukopenia affected treatment status. Potential bias may exist, as some patients with leukocyte counts ≥4000/µL had secondary infections (e.g., pneumonia, dental caries, and pulmonary tuberculosis), which may have masked underlying hematologic suppression.

Platelet reduction (<100,000/mm^3) occurred in 8.33% of patients and was significantly associated with cancer type, also influencing treatment status. Confounding factors such as acute bleeding, organ metastasis, and secondary infections may have contributed to thrombocytopenia. The study by Kong et al. (2025) demonstrated that thrombocytopenia in cancer patients is multifactorial, influenced by age, comorbidities, clinical symptoms, and laboratory parameters, with severe complications such as pulmonary embolism and systemic infections further contributing to platelet decline beyond the direct effects of therapy[21].

These findings are consistent with Yori Yulindra et al., who reported that common hematological toxicities include anemia, leukopenia, and thrombocytopenia, mostly at grades 1–3 severity [5]. Anemia is particularly prevalent in cancer patients (30–90%) and is mainly caused by chemotherapy-induced suppression of hematopoiesis and cytokine function. Chemotherapeutic agents disrupt erythropoiesis by damaging red blood cell precursors in the bone marrow. Additionally, platinum-based drugs can reduce erythropoietin production due to nephrotoxic effects, further worsening anemia. Thus, platinum-containing regimens are strongly associated with anemia through their toxic impact on both bone marrow and kidney function [22].

These findings are consistent with research conducted by Yori Yulindra et al., which reported that the most common hematological toxicities during chemotherapy included anemia, leukopenia, and thrombocytopenia, with severity ranging from grades 1 to 3[5]. Anemia is a common condition in cancer patients, with incidence rates ranging from 30% to 90%. Chemotherapy-induced anemia occurs due to inhibition of hematopoiesis and erythropoietin production, particularly from the nephrotoxic effects of platinum-based agents, which impair both bone marrow and kidney function[22].

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Thrombocytopenia is another frequent hematological complication associated with chemotherapy, especially with gemcitabine and platinum-based regimens. Different agents induce thrombocytopenia through various mechanisms, including damage to hematopoietic stem cells, suppression of megakaryocyte progenitors, and increased platelet apoptosis[22]. In conclusion, this study found that cancer type was a potential risk factor for hematological changes in hemoglobin, leukocyte, and platelet levels. These hematological changes significantly impacted patient outcomes, particularly treatment status. Based on these findings, it is recommended that patient education about post-chemotherapy hematological effects, nutritional enhancement, and stress management be further strengthened.

The effect of systemic chemotherapy on hematologic profiles in 36 lung cancer patients (29 males, 7 females; 80.6% vs. 19.4%). This gender distribution parallels Yulindra et al. (2023), who reported 68.2% male participants[5]. The predominance of male patients is largely attributable to higher smoking prevalence and occupational exposures[23]. Tolwin et al. (2024) found that the male-to-female lung cancer ratio approached parity (53% vs. 47%), attributing this shift to increased female tobacco exposure and occupational hazards[24]

In this study, sex was not significantly associated with changes in hemoglobin, leukocyte, or platelet levels ($p = 0.899$, 0.475, and 0.526, respectively). The estimated risks were 1.12-fold for hemoglobin reduction and 0.44-fold for platelet reduction. Although males predominated in this chemotherapy cohort, sex was not a significant predictor of hematological changes. Age analysis showed that 94.4% of patients were aged ≥40 years, consistent with previous studies reporting similar proportions in this age group[5]. NCCN guidelines also underscore increased lung cancer risk among individuals ≥50 years, due to cumulative carcinogenic exposure and age-related immune decline[14], [15]. Age was not significantly associated with hematological changes ($p = 0.539$, 0.724, and 0.661); however, it was associated with a 2.4-fold increased risk of hemoglobin reduction.

Regarding body mass index (BMI), 77.8% of patients were underweight, and 22.2% had normal BMI, with no cases of obesity. Previous findings have similarly reported a high proportion of underweight patients among those undergoing chemotherapy for NSCLC. BMI was not significantly associated with hematological parameters ($p > 0.33$), although underweight status showed a 0.67-fold risk of hemoglobin reduction.

Based on the Brinkman Index, 55.6% of patients were heavy smokers (BI > 600), 11.1% moderate smokers, 5.6% light smokers, and 27.8% non-smokers, who were likely exposed to passive smoking[25]. Statistical analysis showed no significant hematologic differences by smoking status ($p > .54$); however, heavy smokers predominated. The strong link between smoking and lung cancer, via carcinogenic inhalation and epithelial damage, is well-established[26].

Clinicopathologically, adenocarcinoma (58.3%) was more prevalent than squamous cell carcinoma (41.7%). Cancer type was significantly associated with hemoglobin ($p = 0.048$) and platelet levels ($p = 0.032$), with a 4.87-fold risk of hemoglobin decline. Previous studies have also reported a predominance of adenocarcinoma, which is often attributed to deeper peripheral deposition of cigarette smoke, particularly among filtered-cigarette smokers[27], [28], [29].

Most patients (77.8%) received ≤6 chemotherapy cycles, which were not significantly associated with hematological changes, although they showed a 1.42-fold risk of hemoglobin reduction. The most common regimen was carboplatin–paclitaxel (41.7%), with no significant association with hematologic toxicity ($p>0.13$), despite known effects

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of platinum-based drugs in suppressing erythropoiesis and platelet production. Hospitalization outcomes showed significant associations with hemoglobin ($p<0.01$), leukocytes ($p=0.047$), and platelets ($p=0.023$), indicating their role in chemotherapy eligibility. Patients hospitalized ≥4 days (41.7%) had significant hemoglobin changes, while leukocyte and platelet changes were not significantly related to length of stay. The mean hospitalization duration was 7.7 ± 4.2 days.

In this cohort, 30.6% had hemoglobin <10 g/dL, 5.6% developed leukopenia, and 8.3% thrombocytopenia. Previous studies report higher rates of severe anemia, neutropenia, and thrombocytopenia in patients receiving carboplatin–paclitaxel, with myelosuppression as the main dose-limiting toxicity. The addition of immune checkpoint inhibitors may further increase the risk of severe hematologic toxicity[32].

This study is strengthened by the use of primary and secondary medical record data, comprehensive variable analysis, and comparison with existing literature, enhancing the validity of findings, especially in identifying cancer types associated with hematological changes. However, limitations include a small sample size, short study duration, uncontrolled confounders, and a cross-sectional design that limits causal inference.These findings highlight the importance of routine hematological monitoring in lung cancer patients undergoing chemotherapy, support patient education and clinical protocol development, and emphasize the need for further research with larger samples and stronger study designs.

CONCLUSION

The administration of systemic chemotherapy affects the hematological profile of lung cancer patients. Hematological changes were observed in 38.89% of patients after chemotherapy, with anemia being the most common manifestation of hematological toxicity, followed by leukopenia and thrombocytopenia in smaller proportions.

REFERENCES

[1] American Cancer Society, ‘Treating non-small cell lung cancer’, https://www.cancer.org/content/dam/CRC/PDF/Public/8706.00.pdf.
[2] WHO, ‘Lung cancer’, https://www.who.int/news-room/fact-sheets/detail/lung-cancer.
[3] National Cancer Institute, ‘SEER Cancer Stat Facts: Lung and Bronchus Cancer’, https://seer.cancer.gov/statfacts/html/lungb.html.
[4] N. H. Hanna *et al.*, ‘Therapy for Stage IV Non–Small-Cell Lung Cancer Without Driver Alterations: ASCO and OH (CCO) Joint Guideline Update’, *Journal of Clinical Oncology*, vol. 38, no. 14, pp. 1608–1632, May 2020, doi: 10.1200/JCO.19.03022.
[5] Y. Yulindra, N. Hansen, E. Sabrina, S. Lilik, and A. Dian, ‘Hematologic Toxicities of Chemotherapy in Lung Cancer Patient: A Retrospective Study in DR. M. Djamil Hospital Padang, Indonesia’, *Toksisitas Hematologis Akibat Kemoterapi pada Pasien Kanker Paru*, vol. 8, 2019. doi: https://doi.org/10.15416/ijcp.2019.8.2.129
[6] P. Gargiulo *et al.*, ‘Chemotherapy-induced neutropenia and treatment efficacy in advanced non-small-cell lung cancer: a pooled analysis of 6 randomized trials’, *BMC Cancer*, vol. 21, no. 1, p. 549, Dec. 2021, doi: 10.1186/s12885-021-08323-4.
[7] M. Raza and A. M. Gowda, ‘Platinum Hypersensitivity and Toxicity’, StatPearls https://www.ncbi.nlm.nih.gov/books/NBK617056/?utm.
[8] WHO, ‘Cancer control: Diagnosis and treatment’, https://www.who.int/publications-detail-redirect/cancer-control-diagnosis-and-treatment.
[9] Kemenkes RI, *Panduan Penatalaksanaan Kanker Paru*. Jakarta: Kemenkes RI, 2022.
[10] X. Guo *et al.*, ‘Genetic variants in genes of tricarboxylic acid cycle key enzymes are associated with prognosis of patients with non-small cell lung cancer’, *Lung Cancer*, vol. 87, no. 2, pp. 162–168, Feb. 2015, doi: 10.1016/j.lungcan.2014.12.005.

https://doi.org/10.34011/jmp2k.v36i1.3610

Vol 36 No 1, Maret 2026
e-ISSN: 2579-8103
p-ISSN:1979-8253

[11] S. Neesanun, 'Risk factors predicting chemotherapy-induced severe neutropenia and outcome in advanced stage non-small cell lung cancer: Data from the limited resource in Thailand', *Asian Pacific Journal of Cancer Care*, vol. 7, no. 2, pp. 285–293, 2022.
[12] Y. Tolwin, R. Gillis, and N. Peled, 'Gender and lung cancer—SEER-based analysis', *Ann Epidemiol*, vol. 46, pp. 14–19, 2020, doi: 10.1016/j.annepidem.2020.05.008.
[13] H. C. Yang *et al.*, 'Age-Based Screening for Lung Cancer Surveillance in the US', *JAMA Netw Open*, vol. 8, no. 11, p. e2546222, Nov. 2025, doi: 10.1001/jamanetworkopen.2025.46222.
[14] S. Salsabila, 'Gambaran tipe sel kanker paru berdasarkan usia, jenis kelamin, dan paparan rokokdi RSUP Dr. M. Djamil Padang tahun 2018-2020', *JIKESI*, vol. 4, no. 4, pp. 281–288, Dec. 2023.
[15] M. C. Rudy, I. A. Marhana, and D. Erawati, 'Profil pasien kanker paru primer yang dirawat inap dan rawat jalan di RSUD Dr. Soetomo Surabaya', *Jurnal Respirasi*, vol. 5, no. 3, pp. 65-71, 2019.
[16] W. Nie *et al.*, 'Obesity and survival in advanced non-small cell lung cancer patients treated with chemotherapy, immunotherapy, or chemoimmunotherapy: a multicenter cohort study', *BMC Med*, vol. 22, no. 1, p. 463, Oct. 2024, doi: 10.1186/s12916-024-03688-2.
[17] I. H. Ku and S. Ko, 'Health-related characteristics of Cancer survivors according to body mass index: a secondary data analysis', *BMC Cancer*, vol. 25, no. 1, p. 865, May 2025, doi: 10.1186/s12885-025-13871-0.
[18] Y. Zhang *et al.*, 'Global variations in lung cancer incidence by histological subtype in 2020: a population-based study', *Lancet Oncol*, vol. 24, no. 11, pp. 1206–1218, Nov. 2023, doi: 10.1016/S1470-2045(23)00444-8.
[19] Md. R. Bin Sharif, A. M. M. S. Alam, H. M. N. Iqbal, S. B. A. Ayub, and M. Habibur Rahaman, 'Comparative Efficacy and Cycle-Wise Toxicity of Paclitaxel-Carboplatin Versus Gemcitabine-Cisplatin in Stage IV Non-small Cell Lung Cancer (NSCLC): A Quasi-experimental Study in Bangladesh', *Cureus*, Sep. 2025, doi: 10.7759/cureus.93093.
[20] M. Zhang, C. Xie, S. Liu, H. Fan, Z. Li, and X. Tong, 'The Prognostic Value of the Hemoglobin, Albumin, Lymphocyte, and Platelet (HALP) Score in Lung Cancer: A Systematic Review and Meta-Analysis', *J Clin Med*, vol. 14, no. 16, p. 5701, Aug. 2025, doi: 10.3390/jcm14165701.
[21] H. Kong *et al.*, 'Characteristics and risk factors for thrombocytopenia in malignancy patients with pulmonary embolism: a case control study', *BMC Pulm Med*, vol. 25, no. 1, p. 483, Oct. 2025, doi: 10.1186/s12890-025-03946-w.
[22] A. Febriani and Y. Rahmawati, 'Efek samping hematologi akibat kemoterapi dan tatalaksananya', *Jurnal Respirasi*, vol. 5, no. 1, pp. 22-28, 2019.
[23] Aribowo and Sari, 'Hematological side effects management of paclitaxel carboplatin chemotherapy in lung cancer', *Magna Medika: Berkala Ilmiah Kedokteran dan Kesehatan*, vol. 10, no. 1, pp. 129–140, 2023.
[24] Y. Tolwin, R. Gillis, and N. Peled, 'Gender and lung cancer—SEER-based analysis', *Ann Epidemiol*, vol. 46, pp. 14–19, Jun. 2020, doi: 10.1016/j.annepidem.2020.04.003.
[25] Y. Sari and W. Aniwidyaningsih, 'Perubahan Indeks Massa Tubuh, persentase otot rangka, dan kadar albumin pada pasien kanker paru KPKBSK sebelum dan setelah kemoterapi', *J Respir Indo*, vol. 36 no. 2, pp. 73-82, April 2016
[26] D. Arumsari, K. D. Artanti, S. Martini, and S. Widati, 'The description of smoking degree based on Brinkman Index in patients with lung cancer', *Jurnal Berkala Epidemiologi*, vol. 7, no. 3, p. 249, Sep. 2019, doi: 10.20473/jbe.V7I32019.250-257.
[27] F. Ramadhaniah, D. Khairina, D. T. Sinulingga, E. Suzanna, and A. M. Jayusman, 'Distribution of Lung Cancer Patients in Dharmais Cancer Hospital Year 2008-2012',

https://doi.org/10.34011/jmp2k.v36i1.3610

Vol 36 No 1, Maret 2026
e-ISSN: 2579-8103
p-ISSN:1979-8253

Jurnal Respirologi Indonesia, vol. 39, no. 1, pp. 31–36, Jan. 2019, doi: 10.36497/jri.v39i1.1.

[28] Noorwati Sutandyo and Eddy Suratman, 'Non-Small-Cell Lung Carcinoma in Women: A Retrospective Cohort Study in Indonesia', *Acta Med Indones*, vol. 50, no. 4, pp. 291–298, 2018.

[29] N. Soetandyo, A. R. Hanafi, S. Agustini, and D. T. Sinulingga, 'Prognosis of advanced stage non-small-cell lung cancer patients receiving chemotherapy: adenocarcinoma versus squamous cell carcinoma', *Medical Journal of Indonesia*, vol. 29, no. 1, pp. 26–31, Mar. 2020, doi: 10.13181/mji.oa.203787.

[30] J. Bohlius *et al.*, 'Management of Cancer-Associated Anemia With Erythropoiesis-Stimulating Agents: ASCO/ASH Clinical Practice Guideline Update', *Journal of Clinical Oncology*, vol. 37, no. 15, pp. 1336–1351, May 2019, doi: 10.1200/JCO.18.02142.

[31] F. Casas, D. Muñoz-Guglielmetti, G. Oses, C. Cases, and M. Mollà, 'Hematological Toxicity in Lung Cancer', 2022, pp. 907–923. doi: 10.1007/174_2022_335.

[32] S. Wang *et al.*, 'Grade ≥ 3 hematologic adverse events of immunotherapy in advanced NSCLC patients: a systematic review and meta-analysis', *Eur J Clin Pharmacol*, vol. 81, no. 4, pp. 479–493, Apr. 2025, doi: 10.1007/s00228-025-03803-z.

https://doi.org/10.34011/jmp2k.v36i1.3610