ORIGINAL ARTICLE

Haematology profiles in patients with essential and reactive thrombocytosis

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ABSTRACT

Background: An elevated platelet count, either primary (such as essential thrombocytosis) or secondary (such as reactive thrombocytosis), is the hallmark of thrombocytosis. These two conditions have different clinical implications and management approaches but are often difficult to distinguish clinically. Routine hematological tests, including platelet count, mean platelet volume, platelet distribution width, leukocyte count, and hemoglobin, have the potential to serve as easily accessible initial parameters to help differentiate between the two conditions. The purpose of this study is to assess how routine hematological indicators can be used to distinguish between essential thrombocytosis and reactive thrombocytosis.

Materials and Methods: A retrospective cross-sectional analytical observational study was conducted at Makassar's Dr. Wahidin Sudirohusodo General Hospital between November 2024 and January 2025. The study subjects were patients with platelet counts ≥450,000/mm³. The diagnosis of essential and reactive thrombocytosis was established based on the evaluation of thrombocytosis persistence and peripheral blood smear findings, with bone marrow aspiration used solely for diagnostic confirmation as documented in medical records.

Results: A total of 90 thrombocytosis patients were analyzed, including 37 patients ET and 53 patients RT. The mean age in ET was 41.1±11.1 years and in RT was 45.2±10.2 years. The mean WBC count was higher in ET than in RT (19.06±14.8 vs. 15.1±6.5 $\times 10^3/\mu L$; p=0.265). ET had significantly higher platelet counts (1,418.3±735.9 vs. 605±126.5 $\times 10^3/\mu L$; p<0.001) and Hb levels (13.06±2.3 vs. 8.7±1.8 g/dL; p<0.001). MPV values were slightly higher in ET (8.9±1.0 vs. 8.79±0.8 fL; p<0.001), while PDW did not differ significantly between the two groups (11.0±3.4 vs. 8.8±1.6 fL; p=0.311).

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Conclusion: Hemoglobin, MPV, and platelet count were all higher in essential thrombocytosis than in reactive thrombocytosis. (www.actabiomedica.it)

Key words: essential thrombocytosis, reactive thrombocytosis, hematology profile, mean platelet volume, platelet distribution width, platelets.

Background

Thrombocytosis is generally defined as a platelet count above the normal range. The most commonly used normal range is less than 450,000/μL. The main medical complications of thrombocytosis are thrombotic events and bleeding, but thrombocytosis often occurs without symptoms. A platelet count greater than 1,500,000/μL may increase the risk of bleeding (1). Thrombocytosis can be classified into two categories: essential thrombocytosis and reactive thrombocytosis. It is important to differentiate between these two types for the evaluation, prognosis, and treatment of the disease. Currently, essential thrombocytosis is one of the most common types of myeloproliferative neoplasms. Its incidence varies from 0.2 to 2.5 per 100,000 people per year, with a prevalence of 38 to 57 cases per 100,000 people (2). A retrospective study involving 801 adult patients with thrombocytosis in a tertiary care hospital found essential thrombocytosis in 5.2% cases. Available data indicate that the annual incidence of essential thrombocytosis in the United States is estimated to be 2.5 cases per 100,000, while in Western countries it is 0.2 to 2.5 cases per 100,000. The average age at diagnosis of essential thrombocytosis is 60 years, with 20% of patients under the age of 41.3 years old (3). Routine hematological tests such as platelet count, Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), White Blood Count (WBC), and Hemoglobin (Hb) have potential diagnostic value to differentiate between both conditions. Several studies have shown that MPV and PDW values in essential thrombocytosis tend to be higher than in reactive thrombocytosis, reflecting increased megakaryocyte activity in the bone marrow. In addition, hemoglobin and leukocyte levels can also be supporting indicators, as essential thrombocytosis is often accompanied by mild leukocytosis and relatively normal Hb levels (4). This study aims to analyze hematological profiles, including PLT, MPV, PDW, WBC, and Hb, in patients with essential thrombocytosis and reactive thrombocytosis. This study is expected to contribute to early diagnosis, assist clinical decision-making, and improve the accuracy of differentiation between primary and secondary thrombocytosis using simple hematological tests.

Materials and methods

Study design and subjects

This study is an analytical observational study with a retrospective cross-sectional design conducted at Dr. Wahidin Sudirohusodo General Hospital in Makassar from November 2024 to January 2025. The study population consisted of all patients with thrombocytosis who underwent examination at Dr. Wahidin Sudirohusodo General Hospital in Makassar. The study subjects were patients with platelet counts ≥450,000/mm^3 who met the inclusion and exclusion criteria. Inclusion criteria included patients with thrombocytosis who were willing to participate in the study and undergo a series of examinations, while exclusion criteria included patients with a diagnosis of leukemia, acute or chronic inflammatory conditions, and the use of drugs that could affect platelet function. Sampling was performed using consecutive sampling until the sample size was met.

Data collection

Research data were obtained from patients' medical records. Routine hematological parameters collected included platelet count, MPV, PDW, WBC, and Hb. The

diagnosis of essential and reactive thrombocytosis was based on the persistence of thrombocytosis for at least two weeks and peripheral blood smear examination, with bone marrow aspiration performed as part of work-up to confirm essential thrombocytosis. As this study used secondary data, the bone marrow aspiration procedure was not conducted as a primary research intervention and was not described in detail; its findings were used solely for diagnostic confirmation and were not included as analytical variables. Demographic data, including age and sex, were recorded as baseline characteristics.

Statistical analysis

Data analysis was performed using SPSS statistical software version 25.0. Numerical data were presented as mean and standard deviation or median and interquartile range according to data distribution. Normality testing was performed using the Shapiro–Wilk test. Comparison of hematological parameters between the ET and RT groups was analyzed using the Mann–Whitney test according to the data distribution. p-value <0.05 was considered statistically significant.

Result

This study involved 90 patients with thrombocytosis. Patients were grouped into 37 patients with ET and 53 patients with RT. The average age of patients with ET was 41.1 years, while the average age of patients with RT was 45.2 years. WBC was higher in the ET group than in the RT group (19.06 $\times 10^3/\mu L$ vs. 15.1 $\times 10^3/\mu L$). Hb levels were also higher in ET than in RT (13.06 g/dL vs. 8.7 g/dL). The most striking difference was seen in platelet count, where the ET group had an average of 1418.3 $\times 10^3/\mu L$, much higher than RT, which was only 605 $\times 10^3/\mu L$. MPV values were relatively similar between the two groups, at 8.9 fL for ET and 8.79 fL for RT. Meanwhile, PDW in ET averaged 11.0 fL, slightly higher than RT at 8.8 fL (Table 1).

Based on a comparative analysis of hematological profiles between ET and RT, there were no significant differences in WBC count (19.06 ± 14.8 vs. 15.1 ± 6.5 $\times 10^3/\mu L$; p=0.265) or PDW values (11.0 ± 3.4 vs. 8.8 ± 1.6 fL; p=0.311). In contrast, hemoglobin levels were significantly higher in the ET group compared to RT (13.06 ± 2.3 vs. 8.7 ± 1.8 g/dL; p<0.001). Platelet count also showed a significant difference, with a much higher mean value in ET compared to RT (1,418.3 ± 735.9 vs. 605 ± 126.5 $\times 10^3/\mu L$; p<0.001). In addition, the MPV value in ET was significantly higher than in RT (8.9 ± 1.0 vs. 8.79 ± 0.8 fL; p<0.001), indicating a difference in platelet size characteristics between the two groups (Table 2).

Discussion

Thrombocytosis is a condition in which the number of platelets in the blood increases, generally above 450 × $10^3/\mu L$. Based on its etiology, thrombocytosis is categorized into primary or clonal ET and RT,

Table 1. Research Characteristics

Variable	Essential Thrombocytosis (n =37)			Reactive Thrombocytosis (n =53)		
	Mean	SD	Min-Max	Mean	SD	Min-Max
Age (years)	41.1	11.1	25-59	45.2	10.2	21-60
WBC (10^3/uL)	19.06	14.8	7.3-91	15.1	6.5	6.5-28.9
Hb (g/dL)	13.06	2.3	6.9-17.6	8.7	1.8	4.1-12.4
Plt (10^3/uL)	1418.3	735.9	617-3.493	605	126.5	459-1123
MPV (fL)	8.9	1,0	7.4-13	8.79	0.8	7.6-10.8
PDW (fL)	11,0	3.4	7.4-21.5	8.8	1.6	6.5-14

Abbreviations: WBC: White Blood Test; Hb: Hemoglobin; Plt: Platelet; MPV: Mean Platelet Volume; PDW: Platelet Distribution Width

Table 2. Comparison of routine blood test results between patients with essential and reactive thrombocytosis

Variable	Thrombocytosis	N	Mean	Standard Deviation	Min	Max	p
WBC (10^3/uL)	Essential	37	19.06	14.8	7.3	91	0.265
	Reactive	53	15.1	6.5	6.5	28.9	
Hb (g/dL)	Essential	37	13.06	2.3	6.9	17.6	<0.001
	Reactive	53	8.7	1.8	4.1	12.4	
Plt (10^3/uL)	Essential	37	1.418.3	735.9	617	3.493	<0.001
	Reactive	53	605	126.5	459	1.123	
MPV (fL)	Essential	37	8.9	1.0	7.4	13	<0.001
	Reactive	53	8.79	0.8	7.6	10.8	
PDW (fL)	Essential	37	11,0	3.4	7.4	21.5	0.311
	Reactive	53	8.8	1.6	6.5	14	

Mann-Whitney U ($p<0.05$); *Abbreviations:* WBC: White Blood Test; Hb: Hemoglobin; Plt: Platelet; MPV: Mean Platelet Volume; PDW: Platelet Distribution Width

which is secondary to other processes such as infection, inflammation, tissue damage, hemolysis and malignancies. bleeding, or iron deficiency anemia. ET is included in the group of myeloproliferative neoplasms, characterized by autonomous megakaryocyte proliferation in the bone marrow due to genetic mutations such as JAK2, CALR, and MPL (5). The difference between ET and RT can be identified through routine blood tests, which include parameters such as platelet count, WBC, hemoglobin, MPV, and PDW. In ET, a significantly higher platelet count is generally found, accompanied by an increase in MPV and PDW, reflecting the production of larger and more varied young platelets (6). In addition to platelet count, important differences are also seen in hemoglobin and WBC levels. Patients with ET often have normal to elevated hemoglobin levels and slightly elevated WBC levels due to clonal activation of the myeloid line. In contrast, RT is often accompanied by anemia and elevated WBC levels, which are more likely to be caused by inflammation or physiological stress. Several studies have shown that a combination of platelet count, MPV, PDW, and hemoglobin levels can help distinguish between the two conditions without the need for genetic testing. Therefore, careful interpretation of routine blood parameters has important diagnostic value in hematology clinical practice (7). In Table 2, the results show significant differences in Hb levels, platelet counts, and MPV between patients with ET and RT, while WBC and PDW counts did not show significant differences. These findings are consistent with the study by Shen et al., which reported that patients with ET had higher platelet counts and MPV values compared to RT, indicating increased clonal platelet production and activation. Additionally, higher Hb values in the ET group reflect preserved erythropoietic function compared to RT, which is often associated with inflammation or iron deficiency anemia (8). A study by Hafeez et al. also showed a similar pattern, where MPV were significantly higher in ET than in RT. This is due to platelet size heterogeneity caused by abnormal megakaryocyte proliferation in myeloproliferative disorders. In contrast, reactive thrombocytosis occurs due to temporary stimulation from inflammatory factors such as IL-6, resulting in platelets that are more uniform in size (9).These findings support the results of this study, which found that the difference in MPV was statistically significant ($p < 0.001$). In addition, a study by Ozturk et al. showed that ET is generally accompanied by high WBC and PDW but not statistically significant, which describes the presence of multipotential myeloid proliferation in the bone marrow. Although in this study the difference in WBC was not significant ($p = 0.265$), the tendency for higher WBC values in ET is consistent with the pattern seen in myeloproliferative disorders. The

insignificant PDW values may be due to individual biological variation or differences in laboratory analysis techniques (10). This finding of significantly higher Hb levels in ET ($p < 0.001$) is also supported by a study by Tekin et al. which reported that patients with RT due to iron deficiency anemia tend to have low Hb levels and reactively elevated platelet counts. This suggests that Hb levels can be an additional indicator in distinguishing between primary and secondary thrombocytosis (11). This study has several limitations. First, the relatively small sample size ($n = 37$ for ET and $n = 53$ for RT) may limit the statistical power to detect subtle differences between routine blood parameters. Additionally, this study only used routine blood tests without molecular confirmation (such as detection of JAK2, CALR, or MPL mutations), which are important markers in the diagnosis of ET, potentially leading to misclassification between ET and RT. As this study relied on secondary data retrieved from medical records, follow-up of patients was not available, limiting the assessment of longitudinal outcomes and post-treatment hematological changes. Other factors such as inflammatory status, iron levels, and the presence of comorbidities were also not fully controlled, even though these variables can affect Hb, WBC, and platelet values. Finally, due to the retrospective cross-sectional design, this study could not establish causal relationships.

Conclusion

This study shows that routine hematological parameters, particularly hemoglobin, platelet count, and MPV, have significant differences between essential and reactive thrombocytosis. Essential thrombocytosis is characterized by higher hemoglobin levels, more severe thrombocytosis, and larger MPV compared to reactive thrombocytosis. Conversely, WBC count and PDW did not show significant differences between the two groups. These findings indicate that a combination of routine hematology parameters, particularly hemoglobin, platelet count, and MPV, has the potential to be used as a simple and easily accessible initial tool to distinguish essential thrombocytosis from reactive thrombocytosis in clinical practice.

Ethic approval: The Research Ethics Committee of Hasanuddin University's Faculty of Medicine has authorized this study by issuing an ethics approval letter with the number 203/UN4.6.4.5.31/PP36/2025. Participants' rights and confidentiality are protected by this study's adherence to ethical standards.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Authors contribution: AAP, SS, and FS drafted the manuscript. SS, FS and SB designed and concepted the study. AAP and AAZ collected and analyzed and interpreted the data. TH, AMA, and SB revised manuscript critically for important intellectual content. All authors participated in the final draft preparation, manuscript revision, and critical evaluation of the intellectual contents. All authors have read and approved the content of the manuscript and confirmed the accuracy or integrity of any part of the work

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