Original Research Report

DIFFERENCES IN PLATELET COUNTS AND INsDICES PRE- AND POST-THERAPY IN CHILDREN WITH IMMUNE THROMBOCYTOPENIC PURPURA

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ABSTRACT

Immune thrombocytopenic purpura (ITP) is an autoimmune disorder triggered by antiplatelet autoantibodies. ITP patients who do not receive appropriate or optimal treatment face a heightened risk of morbidity and mortality related to bleeding complications with worsening condition, potentially resulting in fatal consequences. In ITP patients, platelet counts decrease, accompanied by abnormal shifts in platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), platelet large cell ratio (P-LCR), and plateletcrit (PCT). Thus, therapeutic responses in ITP patients can be evaluated through increased platelet counts and the normalization of platelet indices. This study aimed to assess therapeutic responses in pediatric ITP patients by comparing pre- and post-therapy platelet counts and indices across diffferent categories of ITP, medication types, and the specific medication used within each category. This retrospective study included 35 ITP patients under 18 years old and was conducted from September 2023 to March 2024 at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The patients' disorder was categorized into three phases: newly diagnosed ITP, persistent ITP, and chronic ITP. The platelet counts and indices pre- and post-therapy were analyzed using the paired t-test for normally distributed data and the Wilcoxon test for non-normally distributed data, with significance set at $p<0.05$. There were notable changes between the pre- and post-therapy levels of platelet, MPV, PDW, P-LCR, and PCT in each ITP category and all therapies. The platelet counts and PCT levels increased, while the MPV, PDW, and P-LCR decreased. Patients treated with prednisone exhibited the most favorable therapeutic response. Among the different categories analyzed, newly diagnosed ITP demonstrated the most optimal therapeutic response. In summary, ITP therapy exhibits significant differences between pre- and post-therapy outcomes, marked by an increase in platelet counts and the normalization of platelet indices.

Keywords: Immune thrombocytopenic purpura (ITP); therapy response; platelet; child health; health risk

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Highlights:
1. This study was the first to analyze the therapy response in children with immune thrombocytopenic purpura (ITP) at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.
2. The analysis of therapy responses focused on platelet counts and alterations in platelet indices, which provide a more comprehensive perspective on therapeutic effectiveness in children with ITP.
3. This study offers new insights into the most effective treatment options for children with ITP, utilizing diverse therapeutic approaches according to various categories of the disorder.

INTRODUCTION

Immune thrombocytopenic purpura (ITP) is an autoimmune condition marked by the generation of autoantibodies against platelets. This autoimmune disorder can lead to a decrease in platelet counts and bleeding, manifesting as reddish skin patches (Pietras et al. 2025). Antiplatelet autoantibodies increase platelet destruction, disrupting hemostasis and resulting in bleeding, thrombocytopenia, and blood imbalances. ITP can arise due to viral infections, tumor malignancies, and other autoimmune or immunodeficiency conditions. According to the 2018 data from the World Health Organization (WHO), there were approximately 66 ITP cases per 1,000,000 people annually, with a higher incidence in females and an increase associated with age. The Maryland Health Care Commission reported that the prevalence of ITP per 100,000 children in the United States is 9.5 cases for ages 1–5 years, 7.3 cases for ages 6–10 years, and 4.1 cases for ages 11–14 years. In Northern Europe, the annual incidence is 2.68 cases per 100,000 people (Wijaya 2019). Although exact data on the incidence of ITP in Indonesia are not available, Sari (2018) revealed an estimate of the annual incidence ranging from two to six cases per 100,000 individuals. ITP is typically divided into three categories according to its clinical phases: newly diagnosed ITP, persistent ITP, and chronic ITP. Each category indicated varying durations of the condition and potential differences in therapeutic implications. Newly diagnosed ITP may resolve within three months, while persistent ITP persists for 3–12 months. Chronic ITP is diagnosed if the symptoms last beyond 12 months.

In ITP, platelet depletion occurs as antiplatelet autoantibodies target the glycoprotein IIb/IIIa (GPIIb/IIIa) on platelet surfaces, facilitating their destruction through interaction with Fc receptors on macrophages within the reticuloendothelial system (RES) of the spleen. Additionally, these autoantibodies attach to the glycoprotein Ib-IX-V (GPIb-IX-V) on megakaryocytes, thereby reducing platelet production (Saeidi et al. 2014, Perera & Garrido 2017). In response, the body enhances thrombopoiesis by the bone marrow, resulting in increased immature platelets with a giant morphology. This causes an increase in several parameters, including the mean platelet volume (MPV), which measures average platelet size; platelet distribution width (PDW), which quantifies variability in platelet size and reflects morphological heterogeneity; and platelet large cell ratio (P-LCR), which evaluates the proportion of larger circulating platelets and serves to assess platelet activity by determining the ratio of larger platelets to the total platelet count. Conversely, plateletcrit (PCT), as a parameter that detects the proportion of the total blood volume occupied by platelets, decreases due to platelet destruction (Subramaniam et al. 2014, Saran et al. 2022). Since platelet counts and indices are interrelated, effective ITP therapy should ideally normalize both parameters.

The management of ITP requires appropriate and effective therapy for each category. In patients with ITP who do not receive appropriate treatment, the risk of both morbidity and mortality due to bleeding is significantly elevated. Bleeding may occur at various sites, including the skin, mucosal membranes, gastrointestinal tract, and intracranial regions. Intracranial hemorrhage is considered the most severe complication of ITP, affecting approximately 1% of patients with severe thrombocytopenia. The mortality rate associated with bleeding in ITP patients is estimated to be around 1% in children and 5% in adults (Hallan et al. 2022).

The management of ITP generally aims to prevent serious bleeding during the thrombocytopenic period, which is phase-dependent. In patients with newly diagnosed ITP, the treatment option may include high doses of corticosteroids, such as prednisone and methylprednisolone. Another option may include a single dose of intravenous therapy using immunoglobulin (IVIg) or anti-D immunoglobulin (IV Anti-D). In contrast, treatment for persistent and chronic ITP may involve corticosteroids such as prednisone and methylprednisolone, thrombopoietin receptor agonists (TPO-RA) such as romiplostim and eltrombopag, as well as other agents such as rituximab and mycophenolate mofetil (MMF) (Provan et al. 2019).

Effective management of ITP not only improves survival rates but also enhances the quality of life for patients. However, thus far, no research has compared platelet counts and indices across varying therapy types and ITP categories. This research aimed to determine the effectiveness of therapies administered to ITP patients across different categories and medications, as well as the specific medication used for each category, by analyzing the differences in pre- and post-therapy platelet counts and indices, including MPV, PDW, P-LCR, and PCT. These parameters serve as indicators of therapeutic efficacy, assessed by both parametric and non-parametric statistical techniques. The findings of this study are expected to provide an overview of the most effective treatment options for ITP patients, with the goal of preventing bleeding complications and reducing mortality rates.

MATERIALS AND METHODS

This study employed an analytical, retrospective cohort design and was performed at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from September 2023 to March 2024. The subjects were 35 pediatric patients with immune thrombocytopenic purpura (ITP) who received treatment in both the outpatient and inpatient departments of the hospital from 2019 to 2023. Patients aged under 18 years old who were diagnosed with ITP and had no history of other autoimmune diseases were enlisted as the research subjects. Patients with inconsistent treatment or incomplete medical records were excluded from this study. The patients were categorized into three different groups: newly diagnosed ITP for symptoms that disappear within three months, persistent ITP for symptoms lasting 3–12 months, and chronic ITP for symptoms persisting more than 12 months (Sari 2018).

The collected data included pre- and post-therapy levels of platelet, MPV, PDW, P-LCR, and PCT. These parameters were measured by the complete blood count (CBC) of the patients (Saran et al. 2022). Pre-therapy levels were recorded during the patients' initial visit, while post-therapy levels were obtained from the latest CBC. The data were classified by component types, ITP categories, and therapy types and subsequently analyzed using IBM SPSS Statistics for macOS, version 29.0 (IBM Corp., Armonk, N.Y., USA). The Shapiro-Wilk test was employed to assess the normality of the data. For the comparison between pre- and post-therapy levels, the paired t-test was used for normally distributed data, whereas the Wilcoxon test was used for non-normally distributed data, with statistical significance set at $p<0.05$. The ethical approval for this study was obtained from the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, under reference No. 1419/LOE/301.4.2/VIII/2023 dated 18/8/2023.

RESULTS

A total of 35 datasets were obtained from children with ITP who received treatment in the Outpatient and Inpatient Departments of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, between 2019 and 2023. Table 1 displays the distribution of the ITP patients' characteristics. Most of the patients diagnosed with ITP were female (54.3%). The data indicated that the predominant age group for children diagnosed with ITP was 1–5 years (45.7%). Chronic ITP was the most common category among the pediatric patients (51.4%). A total of 68.6% of the patients exhibited bleeding manifestations of varying severity, with the most common being a single manifestation (20%). Additionally, almost all patients did not experience complications associated with ITP (82.8%). The majority of the patients received prednisone as part of their treatment (60%).

Table 1. Characteristics of the immune thrombocytopenic purpura patients (n=35).

Characteristics	n (%)
Sex	
Male	16 (45.7)
Female	19 (54.3)
Age (y.o.)	
<1	2 (5.7)
1–5	16 (45.7)
6–10	6 (17.1)
11–14	10 (28.6)
15–17	1 (2.9)
ITP categories	
Newly diagnosed	12 (34.3)
Persistent	5 (14.3)
Chronic	18 (51.4)
Bleeding manifestation	
1	7 (20)
2	6 (17.1)
3	4 (11.4)
4	5 (14.3)
6	1 (2.9)
7	1 (2.9)
None	11 (31.4)
Complications	
Hepatosplenomegaly	1 (2.9)
Anemia	5 (14.3)
None	29 (82.8)
Therapies	
Prednisone	21 (60)
Methylprednisolone	5 (14.3)
Eltrombopag	4 (11.4)
Switch from prednisone to eltrombopag	5 (14.3)

Legends: y.o=years old; ITP= immune thrombocytopenic purpura.

Table 2. Comparison between pre- and post-therapy platelet counts and indices.

Components	n	Pre-therapy		Post-therapy		p
		Mean±SD	Median (min–max)	Mean±SD	Median (min–max)	
Platelet	35	27.5±25.83		236.22±145.89		<0.001**
MPV	26	11.67±2.63		9.65±2.12		<0.001**
PDW*	25		17.1 (8.5–24.9)		10.6 (7.6–24.71)	<0.001**
P-LCR	19	36.14±11.11		23.44±9.27		<0.001**

PCT	12	0.08±0.06	0.2±0.1	0.002**

Legends: SD=standard deviation; MPV=mean platelet volume; PDW=platelet distribution width; P-LCR=platelet large cell ratio; PCT=plateletcrit. An asterisk (*) denotes a non-normal data distribution. Two asterisks (**) indicate a statistical significance (p<0.05).

Table 2 shows the comparisons between pre- and post-therapy platelet counts and indices. The results indicated an increase in platelet counts and PCT levels, along with a decrease in MPV, PDW, and P-LCR levels. The statistical analysis using paired t-tests and Wilcoxon tests revealed significant changes in platelet, MPV, PDW, and P-LCR levels (p<0.001), as well as a significant alteration in PCT levels (p=0.002).

Table 3 presents the analysis of pre- and post-therapy platelet counts and indices across different ITP categories. In the analysis of post-therapy levels, each category exhibits an increase in platelet counts and PCT levels, accompanied by a reduction in MPV, PDW, and P-LCR levels. Furthermore, the statistical analysis indicated significant differences across all components in each ITP category (p<0.05), except for PCT levels in persistent ITP (p=0.056) and chronic ITP (p=0.172).

Table 4 displays the comparative analysis of pre- and post-therapy platelet counts and indices according to the therapies administered. The post-therapy analysis revealed that all therapies led to an increase in platelet levels, with a decrease in MPV and PDW levels. However, the P-LCR and PCT levels could not be analyzed due to incomplete data. The statistical analysis indicated significant differences in platelet levels across all therapies (p<0.05), except for the therapy with a switch from prednisone to eltrombopag (p=0.122). The MPV and PDW levels demonstrated significant changes only with prednisone therapy (p<0.001).

Table 3. Comparisons between pre- and post-therapy platelet counts and indices by each ITP category.

Components	ITP categories	n	Pre-therapy		Post-therapy		p
			Mean±SD	Median (min–max)	Mean±SD	Median (min–max)	
Platelet	Newly diagnosed	12	27.75±25.41		346.04±88.51		<0.001**
	Persistent	5	43.4±34.03		199.2±92.02		0.024**
	Chronic*	18		10.23 (1–63)		111 (15–576)	<0.001**
MPV	Newly diagnosed	9	10.39±2.55		8.08±1.76		0.004**
	Persistent	5	11.08±1.41		9.68±0.64		0.045**
	Chronic	12	12.89±2.68		10.83±2.08		0.001**
PDW	Newly diagnosed	8	17.96±5.89		11.78±4.49		0.010**
	Persistent	5	15.3±3.78		10.16±1.19		0.033**
	Chronic*	12		18.45 (8.5–24.9)		12.05 (7.6–24.71)	0.003**
P-LCR	Newly diagnosed	5	34.56±14.49		16.84±5.86		0.040**
	Persistent	5	36.42±11.43		22.44±5.25		0.016**
	Chronic	9	36.86±10.27		27.67±10.7		0.001**
PCT	Newly diagnosed	4	0.10±0.09		0.31±0.049		0.049**
	Persistent	4	0.06±0.047		0.18±0.095		0.056
	Chronic	4	0.08±0.049		0.13±0.069		0.172

Legends: SD=standard deviation; MPV=mean platelet volume; PDW=platelet distribution width; P-LCR=platelet large cell ratio; PCT=plateletcrit. An asterisk (*) denotes a non-normal data distribution. Two asterisks (**) indicate a statistical significance (p<0.05).

Table 4. Comparative analysis between pre- and post-therapy platelet counts and indices across different therapies.

Components	Therapies	n	Delta ($10^3/\mu L$)	Pre-therapy		Post-therapy		P
				Mean±SD	Median (min–max)	Mean±SD	Median (min–max)	
Platelet	Prednisone	21	237.22	33.48±27.64		270.71±123.36		<0.001**
	Methylprednisolone	5	224.6	38.4±22.49		263±135.34		0.020**
	Eltrombopag	4	67.41	5.33±3.49		72.75±40.31		0.046**
	Switch from prednisone to eltrombopag	5	186.2	9.2±9.49		195.4±222.12		0.122
MPV	Prednisone	19	2.02	11.43±2.59		9.40±1.97		<0.001**
	Methylprednisolone	3	3.2	12.96±1.7		9.76±2.71		0.058
	Eltrombopag*	2	1.4		13.39 (9.6–17.19)		11.99 (9.2–14.78)	0.180
	Switch from prednisone to eltrombopag*	2	0.8		10.4 (9.4–11.4)		9.6 (9.3–9.9)	0.180
PDW	Prednisone	18	5.62	17.69±5.19		12.07±4.06		<0.001**
	Methylprednisolone	3	8.89	20.99±5.62		12.1±6.35		0.105
	Eltrombopag*	2	0.02		16.63 (8.5–24.76)		16.6 (8.5–24.71)	0.317
	Switch from prednisone to eltrombopag*	2	3.3		13.1 (13.1–13.1)		9.8 (9.6–10)	0.180

Legends: SD=standard deviation; MPV=mean platelet volume; PDW=platelet distribution width. An asterisk (*) denotes a non-normal data distribution. Two asterisks (**) indicate a statistical significance (p<0.05).

Table 5. Comparison between pre- and post-therapy platelet counts and indices according to the administered therapies for each category.

Components	ITP category	Therapies	n	Pre-therapy		Post-therapy		p
				Mean±SD	Median (min–max)	Mean±SD	Median (min–max)	
Platelet	Newly diagnosed	Prednisone	8	25.24±28.2		367.93±67.83		<0.001**
		Methylprednisolone	4	32.75±21.48		302.25±118.97		0.014**
	Persistent	Prednisone	5	43.4±34.03		199.2±92.02		0.024**
	Chronic	Prednisone	8	35.53±23.93		218.18±128.19		0.006**
		Metilprednisolone	1	61		106		-
		Eltrombopag	4	5.33±3.49		72.75±40.31		0.046**
		Switch from prednisone to eltrombopag	5	9.2±9.49		195.4±222.12		0.122
MPV		Prednisone	7	9.9±2.68		8.05±2.03		0.025**

	Newly diagnosed	Methylprednisolone*	2		12.09 (11.3–12.89)		8.2 (8.1–8.3)	0.180
	Persistent	Prednisone	5	11.08±1.41		9.68±0.64		0.045**
	Chronic	Prednisone	7	13.2±2.28		10.55±1.89		0.009**
		Eltrombopag*	2		13.39 (9.6–17.19)		11.99 (9.2–14.78)	0.180
		Switch from prednisone to eltrombopag*	2		10.4 (9.4–11.4)		9.6 (9.3–9.9)	0.180
PDW	Newly diagnosed	Prednisone	6	17.51±6.18		12.89±4.71		0.038**
		Methylprednisolone*	2		19.34 (14.5–24.18)		8.45 (7.8–9.1)	0.180
	Persistent	Prednisone	5	15.3±3.78		10.16±1.19		0.033**
	Chronic	Prednisone	7	19.57±5.09		12.73±4.8		0.016**
		Eltrombopag*	2		16.63 (8.5–24.76)		16.6 (8.5–24.71)	0.317
		Switch from prednisone to eltrombopag*	2		13.1 (13.1–13.1)		9.8 (9.6–10)	0.180
P-LCR	Newly diagnosed	Prednisone	3	40±13.71		20.3±4.67		0.124
		Methylprednisolone*	2		26.4 (15.4–37.4)		11.65 (10.2–13.1)	0.180
	Persistent	Prednisone	5	36.42±11.43		22.44±5.25		0.016**
	Chronic	Prednisone	5	39.86±9.04		28.02±9.54		0.001**

Legends: SD=standard deviation; MPV=mean platelet volume; PDW=platelet distribution width; P-LCR=platelet large cell ratio. An asterisk (*) denotes a non-normal data distribution. Two asterisks (**) indicate a statistical significance ($p<0.05$).

Table 5 shows the comparison between pre- and post-therapy platelet counts and indices across each ITP category according to the therapies administered. All therapies administered for each ITP category demonstrated an increase in post-therapy platelet counts, accompanied by a decrease in MPV, PDW, and P-LCR levels. The PCT levels were excluded from this analysis due to incomplete data. The statistical analysis of each therapy revealed significant differences in platelet counts ($p<0.05$), except for the therapy that included a transition from prednisone to eltrombopag in chronic ITP ($p=0.122$). The MPV, PDW, and P-LCR levels indicated significant changes solely with prednisone therapy ($p<0.001$), with the exception of newly diagnosed ITP patients receiving prednisone ($p=0.124$).

DISCUSSION

Characteristics of children with immune thrombocytopenic purpura

This study found that female children were more likely to be diagnosed with ITP during the period of 2019 to 2023, with a male-to-female ratio of 1:1.2. This aligns with the findings of a study conducted by Al-Suheel et al. (2014), indicating a higher prevalence of ITP in female children compared to males. This is likely because females are more susceptible to autoimmune diseases in comparison to their male counterparts. This disparity is associated with various factors, including immunological, hormonal, and chromosomal differences (Kronzer et al. 2021). However, the findings of this study differ from those reported by Alwadi et al. (2020), who investigated 95 pediatric ITP cases in Riyadh, Saudi Arabia. In their study, a higher number of ITP cases was observed in male children compared to female children.

This study revealed that the majority of the pediatric ITP patients were within the age range of 1–5 years, accounting for 45.7% of the cases. The findings of this study are consistent with those of research conducted by Friedman & Beck (2019), who found

that ITP cases most commonly occur in children aged 2–5 years because their immune systems are still developing, leading to an exaggerated response to an antigen or platelet. This is particularly relevant as ITP in children is often triggered by viral or bacterial infections or immunization. Furthermore, the majority of the population in this study experienced chronic ITP (51.4%). This might be due to the fact that many cases of newly diagnosed ITP or persistent ITP progress to chronic ITP. It is estimated that 20–25% of pediatric ITP cases develop into chronic ITP over time (Lee 2023).

A total of 68.6% of the patients experienced bleeding manifestations, with the majority having a single bleeding manifestation (20%). The most common initial manifestations of ITP, as indicated by the signs and symptoms, are petechiae, ecchymosis, epistaxis, gum bleeding, and genital tract bleeding (Omar et al. 2018). Bleeding manifestations experienced by the 35 patients included ecchymosis (15), petechiae (13), oral mucosal bleeding (8), epistaxis (6), hematemesis (4), menometrorrhagia/abnormal uterine bleeding (2), hematoma (2), subconjunctival hemorrhage (1), hematuria (1), and purpura (1). These findings align with a prior study, which demonstrated that most ITP patients exhibit a range of bleeding manifestations (Neunert et al. 2015). According to Frelinger et al. (2015), platelet counts affect the amount and severity of bleeding, with diminished platelet counts associated with increased bleeding frequency, thereby impacting the disease severity. Therapeutic interventions for pediatric patients with ITP involve the administration of two classes of medications: corticosteroids and thrombopoietin receptor agonists (TPO-RA). Corticosteroid medications, including prednisone and methylprednisolone, were administered to 60% and 14.3% of the patients, respectively. TPO-RA medications, such as eltrombopag, were prescribed to 11.4% of the patients. Meanwhile, another 14.3% of the patients switched from prednisone to eltrombopag at different intervals. This treatment approach is consistent with both the international consensus from the American Society of Hematology and the National Clinical Practice Guidelines for ITP patients at Dr. Soetomo General Academic Hospital Surabaya, Indonesia, which recommend corticosteroids as the first-line therapy and TPO-RA as the second-line therapy for ITP (Provan et al. 2019).

Comparison between pre- and post-therapy platelet counts and indices

In this study, the effectiveness of therapy was evaluated by analyzing changes in platelet counts and indices toward normal ranges. Generally, effective therapy is associated with an increase in platelet counts and the normalization of platelet indices, characterized by a decrease in MPV, PDW, and P-LCR levels, as well as an increase in PCT levels. This is consistent with the findings of this study, which demonstrated an overall increase in platelet counts among the 35 patients following therapy, with a statistically significant difference ($p<0.05$). These findings suggest that the administered therapy effectively inhibited platelet destruction and stimulated platelet production through various mechanisms, leading to a positive therapeutic response, as evidenced by the increase in mature circulating platelets (Negash et al. 2016).

This study analyzed 26 patients for MPV, 25 for PDW, 19 for P-LCR, and 12 for PCT levels. The results showed a decrease in MPV, PDW, and P-LCR levels as well as an increase in PCT levels post-therapy. The analysis indicated a significant difference between pre- and post-therapy levels of each parameter ($p<0.05$), with platelet counts, MPV, PDW, and P-LCR showing the most notable differences. Similar to the findings of Frelinger et al. (2015), this study demonstrated that ITP treatment leads to an increase in platelet counts and the normalization of platelet indices. These effects are attributed to the reduction in platelet destruction and the controlled increase in platelet production, resulting in a greater, more balanced proportion of mature platelets, which tend to be smaller in size, and fewer immature or giant platelets. This stabilization and reduced variability in platelet size contributed to the concurrent decreases in MPV, PDW, and P-LCR. Moreover, increased platelet production results in a higher blood volume proportion occupied by platelets, as reflected in the higher PCT levels, indicating an increased platelet count in circulation post-therapy (Walle et al. 2023).

Comparison between pre- and post-therapy platelet counts and indices according to immune thrombocytopenic purpura categories

The analysis revealed that all three ITP categories started with low mean platelet counts, which significantly increased post-therapy ($p<0.05$), especially in the newly diagnosed and chronic ITP categories. This indicated effective responses to therapy, characterized by elevated mature platelet production and more stable platelet counts. The highest mean platelet increase was seen in newly diagnosed ITP, with a delta of 318.89 x $10^3/\mu L$. The statistical analysis revealed significant differences in MPV, PDW, and P-LCR levels pre- and post-therapy across all categories ($p<0.05$), with chronic ITP showing the most pronounced differences. The findings suggest that each ITP category responded well to therapy, as evidenced by a reduction in MPV, PDW, and P-LCR levels toward normal ranges. These changes might stem from reduced platelet

destruction and increased production of small, mature platelets, resulting in a more homogenous and orderly platelet distribution in the blood (Xu et al. 2023). In addition, PCT levels showed an increase during the post-therapy analysis. The statistical analysis presented a meaningful distinction between pre- and post-therapy levels in newly diagnosed ITP ($p<0.05$), but not in persistent and chronic ITP ($p>0.05$).

The analysis of pre- and post-therapy platelet counts and indices showed that the patients with newly diagnosed ITP exhibited significant differences in all blood parameters. Compared to the patients with other ITP categories, those with persistent and chronic ITP exhibited significant differences in most blood components, except for PCT levels. In particular, the chronic ITP patients frequently demonstrated notable changes across all blood components, with the exception of PCT levels. These findings suggest that patients with newly diagnosed ITP respond positively to treatment, achieving increased platelet levels and the normalization of platelet indices. In cases of persistent and chronic ITP, therapy improves platelet indices but may not sufficiently increase blood volume platelet proportion, as reflected in PCT levels. The effectiveness of treatment for different ITP categories can vary depending on several factors, such as the specific therapy used, the duration of therapy, and patient adherence. A prior study indicated that newly diagnosed and persistent ITP patients often show better responses due to an active immune phase, while chronic ITP patients may respond less effectively due to immune modulation and reduced activity (Liu et al. 2023). Furthermore, Yao et al. (2016) found that among 85 pediatric patients, those with chronic ITP tend to have elevated T follicular helper (Tfh) cells, enhancing B-cell differentiation and antiplatelet antibody production. This study observed favorable responses in chronic ITP patients concerning platelet levels and the normalization of MPV, PDW, and P-LCR, despite previous data indicating a generally reduced therapeutic response in this population. The variations in findings might be attributable to the limited sample size of only 35 cases.

Comparison between pre- and post-therapy platelet counts and indices according to the administered therapies

The study results indicated a meaningful distinction in platelet counts before and after therapy across all medication types, with platelet counts increasing post-therapy. The statistical analysis revealed significant differences in platelet counts before and after therapy in patients treated with prednisone, methylprednisolone, and eltrombopag ($p<0.05$), with the most pronounced changes observed in the prednisone group. The administration of prednisone demonstrated the highest platelet delta, at 237.22 x $10^3/\mu L$. However, patients undergoing a transition from prednisone to eltrombopag did not show a meaningful distinction in platelet counts ($p>0.05$). This suggests that prednisone, methylprednisolone, and eltrombopag produced a favorable therapeutic response by reducing platelet destruction and enhancing controlled platelet production, with prednisone showing the greatest average platelet increase. The lack of statistical significance in the transition from prednisone therapy to eltrombopag therapy could be associated with the limited sample and high variability in the data. Additionally, the short duration of eltrombopag administration in some patients might have affected the results, as eltrombopag typically increases platelet levels within a period of 2–24 weeks (Kim et al. 2018).

The study also showed a decrease in MPV and PDW post-therapy, in line with the expected therapeutic response. Notable differences in MPV and PDW before and after therapy were detected in patients treated with prednisone ($p<0.05$), although no significant differences were established in patients receiving methylprednisolone, eltrombopag, or prednisone switched to eltrombopag ($p>0.05$). The varying effects might correspond to the limited sample in this analysis. The corticosteroid group showed the highest delta values for MPV and PDW, indicating that prednisone and methylprednisolone effectively reduced platelet destruction and promoted more homogenous platelet production in terms of size and morphology (Negash et al. 2016).

The results of this study imply that corticosteroids, specifically prednisone, provide a favorable therapeutic response in children with ITP. A study conducted by Mazzucconi et al. (2024) similarly concluded that the administration of prednisone as a therapeutic approach can increase platelet counts, restore platelet indices to normal levels, and maintain these levels over an extended period. Prednisone works through multiple mechanisms as an immunosuppressant. It inhibits platelet destruction by autoantibodies, reduces antiplatelet antibody production, enhances platelet production, and decreases structural changes in the endothelium. The beneficial effects of prednisone medication include a reduction in bleeding and platelet consumption (Kim & Despotovic 2021).

Comparison between pre- and post-therapy platelet counts and indices by the administration of therapies in each category

All medications administered to the patients across different ITP categories resulted in an elevation of

platelet counts post-therapy. The analysis revealed significant differences in platelet counts before and after therapy for the administration of prednisone and methylprednisolone in newly diagnosed ITP ($p<0.05$), with prednisone indicating the most significant effect. In persistent ITP, significant differences were also observed in platelet counts before and after prednisone therapy ($p<0.05$). In chronic ITP patients, meaningful distinctions in platelet counts were noted before and after therapy with both prednisone and eltrombopag ($p<0.05$), with prednisone showing the most pronounced effect. However, patients with chronic ITP, who transitioned from prednisone to eltrombopag medication, exhibited a tendency for increased platelet counts. However, no meaningful distinctions were found in the pre- and post-therapy platelet counts ($p>0.05$). This could be associated with the limited sample size and high data variability, as reflected in the standard deviation. All medication types administered across different ITP categories resulted in a decrease in both MPV and PDW parameters, demonstrating statistically significant differences before and after therapy ($p<0.05$). This suggests that prednisone therapy provides a favorable response by gradually increasing platelet counts and ensuring that the circulating platelets are predominantly mature, resulting in a decrease in mean platelet volume and size variation (Mazzucconi et al. 2024).

In this study, a decrease in P-LCR was observed following therapy. The newly diagnosed ITP patients showed no significant differences in P-LCR before and after treatment using prednisone or methylprednisolone ($p>0.05$). However, in the persistent and chronic ITP patients, significant differences in P-LCR were observed after prednisone therapy ($p<0.05$). In contrast, the switch from prednisone to eltrombopag medication did not result in significant differences ($p>0.05$). This indicated that prednisone therapy effectively controls platelet production in persistent and chronic ITP patients, leading to a higher number of smaller and mature platelets compared to immature platelets, hence reducing P-LCR (Kuter 2021). The absence of significant differences in some variables might be influenced by the small sample size, limiting the findings from fully representing the therapeutic response throughout the entire population.

The results of this study indicated that in all three ITP categories, prednisone demonstrated higher effectiveness compared to other medications in providing a favorable therapeutic response in children. Prednisone elicits a therapeutic response through multiple mechanisms of action, including reducing platelet destruction, rapidly altering endothelial cell integrity to facilitate primary hemostasis, modulating cytokine production and inflammatory processes, as well as reducing bleeding and bruising (Yan et al. 2023). Additionally, the duration of therapy and patient adherence significantly affect the effectiveness of treatment.

Strength and limitations

This study presents the effectiveness of each therapy by providing a comparison of pre- and post-therapy platelet counts and indices across the three ITP categories and various therapeutic interventions. The results of this study may provide a valuable foundation for future research and guide the selection of therapies for ITP patients. However, the small sample size and inadequate medical record data resulted in the inability to analyze certain platelet indices and other parameters, such as immature platelet fraction (IPF), hence constraining the comprehensive assessment of the therapeutic response. Furthermore, other important factors that might affect the study outcomes, such as the duration of treatment, patient adherence to medication, patient immunity, disease onset, and disease recurrence, could not be analyzed due to data limitations.

CONCLUSION

This study demonstrates the effectiveness of immune thrombocytopenic purpura (ITP) treatment in producing favorable outcomes, namely an increase in platelet counts and the normalization of platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), platelet large cell ratio (P-LCR), and plateletcrit (PCT). This is evidenced by notable differences in pre- and post-therapy platelet counts and indices, which correspond to an increase in platelet counts and PCT levels, alongside a decrease in MPV, PDW, and P-LCR. Among the three ITP categories (i.e., newly diagnosed, persistent, and chronic) and diverse therapeutic interventions, patients treated with prednisone demonstrate the most favorable therapeutic response compared to those receiving other medications. Similarly, patients with newly diagnosed ITP exhibit good response to the therapy.

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Conflict of interest

None.

Ethical consideration

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Author contribution

RRCK, MRA, YH, and PZR contributed to the conception and design of the study, the analysis and interpretation of the data, the drafting of the article, and the critical revision of the article for important intellectual content.

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