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Long-Term Outcomes of Partial Splenic Embolization as a Therapeutic Intervention for Steroid-Resistant Immune Thrombocytopenia

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ABSTRACT

Background: Primary immune thrombocytopenia (ITP) patients who don't respond to steroid therapy have limited treatment options. One alternative intervention is partial splenic embolization (PSE). **Objective:** This study aimed to assess the effectiveness and safety of PSE in cases with steroid resistant ITP.

Patients and Methods: The current study included 24 adult cases with ITP who underwent PSE after failing to respond to steroid treatment. Analysis of platelet counts, changes in spleen diameter, complications, and failure free survival before and up to 12 months after PSE was done.

Results: Early response rates were favorable, with complete responses observed in 25% and partial responses in 58.3% of patients. Over time, the overall response rate increased to 79.1%, with 45.8% achieving complete responses. Complications were mainly post-embolization syndrome, and infrequent occurrences of bleeding, pleural effusion, and splenic abscess were reported, with no procedure-related deaths. Platelet counts significantly increased after PSE, and spleen size reductions were observed. Subgroup analysis revealed associations between platelet counts, spleen size, and late response. Patients with PLT counts at 1 month $<73 \times 10^9$/L were more likely to experience treatment failure.

Conclusions: PSE proves to be an intervention for ITP patients who do not respond to steroids providing long lasting platelet responses with significant reducing spleen volume in many cases. These results contribute to understanding predictive factors for treatment response and the potential role of PSE in managing steroid resistant ITP

Keywords: Immune thrombocytopenia (ITP), Partial splenic embolization, Splenectomy, Steroid

INTRODUCTION

Primary immune thrombocytopenia is a disorder distinguished by a reduction in platelet count with elevated possibility of bleeding [(1)]. Corticosteroids are commonly used as the line of therapy. However, 20% of adults don't respond well to steroids or other medical treatments and considered as steroid resistant [(2)].

A significant series indicates that 20 :45% of resistant patients may require a splenectomy [(3)]. steroid resistant patients have consistently low platelet levels and are at high risk of bleeding, 60: 70% of these patients experience a response after undergoing splenectomy [(4)]. Total splenectomy carries some risks, including operative infections, thrombosis and bleeding. The mortality rate associated with this procedure is 2% [(5)].

Partial splenic embolization is less invasive compared to total splenectomy; it involves blocking a segment of the artery through radiology techniques leading to splenic infarction [(6)].

When comparing PSE with splenectomy it is observed that PSE offers advantages, including decreased trauma, shorter hospital stays and a lower occurrence of complications. Additionally, PSE effectively boosts counts well as white blood cell counts and hemoglobin levels [(7)].

The main objective of this study is to evaluate the effectiveness, safety, potential complications and long-term response of platelets and spleen diameter to PSE treatment. This will help establish its role as an alternative to splenectomy, for steroid resistant ITP cases.

PATIENTS AND METHODS

Study Design

The current prospective research was performed at Clinical Hematology Unit, Internal Medicine Department, Assiut University Hospital, Assiut, Egypt over a duration of six months, from May to October 2023. The study included 38 steroid resistant ITP patients. Their ages ranged from 28 to 46 years and were predominantly females (58.3%).

Inclusion criteria:

1. Adults aged 18 years or older
2. Diagnosis of ITP according to established guidelines, including a low platelet count and normal or increased megakaryocytes observed through bone marrow biopsy.
3. Resistance to steroid as platelet levels did not improve adequately after receiving high dose corticosteroids for at least four weeks.

Exclusion criteria:

1. Secondary ITP (systemic lupus erythematosus, lymphoproliferative disorders, HCV, HIV infection)

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2. Prior splenectomy
3. Pregnant patients
4. Having conditions that contraindicate sequestration enhancement (PSE) such, as severe liver disease or pulmonary hypertension.

Definitions of Treatment Response

This study utilized the standard criteria for defining treatment response in ITP patients as outlined in two key publications; the international consensus report published by **Rodeghiero *et al.*** [8], and the evidence-based practice guideline from the American Society of Hematology by **Neunert *et al.*** [9] Using widely accepted definitions allows for standardized categorization of outcomes and enables comparison of results to other studies assessing interventions for ITP. Adopting these published guidelines for classifying the degree of platelet response and overall efficacy facilitates interpretation within the appropriate context in the ITP literature. Complete response was defined as a platelet count of at least 100 x 10^9/L on two occasions more than seven days apart. Partial response was a platelet count of 30-100 x 10^9/L that was more than double the baseline, again on two measurements at least 7 days apart, along with resolution of bleeding symptoms. No response was any platelet count under 30 x 10^9/L or less than double baseline. Treatment failure was classified as loss of complete or partial response during follow-up, or need for additional ITP therapy after PSE. The 1-month platelet count was the value closest to 1-month post-PSE.

PSE PROCEDURE

Prior to undergoing partial splenic embolization, all patients had received treatment with corticosteroids (methylprednisolone) and other immunosuppressive medications. To prevent procedure-related infections, patients were administered antibiotic prophylaxis with ciprofloxacin 500 milligram twice daily for seven days, beginning on the day of the embolization procedure. PSE has been performed under local anesthesia. Angiography via a 4F catheter showed normal splenic morphology. Branches of the splenic artery supplying the lower pole were accessed using a microcatheter and embolized with 300–500-micron polyvinyl alcohol (PVA) particles and Geofoam. PVA was the main embolic agent used, with Gelfoam additionally placed in some cases to further occlude the parent artery after PVA injection in a cost-saving measure. The endpoint of the embolization procedure was determined when contrast stasis was visualized for three cardiac cycles during angiography. Post-procedure angiograms demonstrated approximately 70-75% decrease in splenic parenchymal perfusion, with slowed flow in the embolized blood vessels. On average, 60-75% of the spleen volume underwent embolization. Mean hospital stay was 3 days followed by outpatient follow-up. Treatment response was evaluated based on platelet count at final follow-up.

Statistical analysis

The primary endpoint was failure-free survival (FFS) of steroid resistant ITP patients in the study cohort. Data management and analysis were conducted using SPSS version 27.0. The patients were categorised into three distinct groups based on their utilizing response status, namely complete, partial, and no response groups. The normality test (Kolmogorov-Smirnov) was initially applied to the quantitative variables. The study utilised median (interquartile range) to present continuous variables, and the Kruskal–Wallis's test and Mann-Whitney U test were employed to evaluate any potential differences between them. The categorical variables were presented in numerical form as percentages and subjected to statistical comparison using both the chi-square and Monte Carlo tests. Friedmen test was utilized to compare platelet counts, splenic span by ultrasound before and after PSE. FFS was defined as the time from PSE until death from any cause or loss of platelet response. FFS was analyzed using Kaplan-Meier methods and the log-rank test. A landmark survival analysis was conducted with the landmark set at one month following PSE.

Ethical considerations

The protocol of the current research was reviewed and approved by the Medical Ethics Committee of Faculty of Medicine, Assiut University, Egypt, (approval No. 04-2023-300252, dated 25/5/2023. An informed written consent in Arabic language (the native language of the study participants) was obtained from each subject involved in the current study before enrollment, ensuring compliance with the ethical guidelines. To protect the privacy of the participants, all information and photographs were anonymized, and their privacy rights were duly respected. The Helsinki Declaration was followed throughout the study's conduct.

RESULTS

I- **Analysis Of Data of The Study Participants.**

DEMOGRAPHIC, PRE- AND POST- PSE DATA

Table 1 describes the characteristics of the 24 ITP patients included in the study. The patients had a median age of 37.5 years and were predominantly female (58.3%). At baseline, most patients had severe thrombocytopenia with platelet counts below 30 x 10^9/L (70.8%). The median time to response following PSE was 15 days, with a median hospital stay of 3 days. Each individual in the study had exhibited resistance to corticosteroids. All enrolled patients completed the study without withdrawals.

Response

Early response rates were favorable, with complete responses in 25% and partial responses in 58.3% of patients. By late follow-up, the overall response had increased to 79.1% (Complete response; 45.8% **(Table 1)**.

Complications

All patients had post-embolization syndrome. Other complications, like bleeding, pleural effusion, and splenic abscess, occurred infrequently. There were no procedure-related deaths **(Table 1)**.

Table 1: Characteristics of the Study Participants.

Variables		ITP patients (N=24)
Demographic data		
Age (years)		37.50 (28.50 - 46.00)
Gender	Male	10 (41.7%)
	Female	14 (58.3%)
Pre-PSE data		
PLT count categories before PSE ($\times 10^9$/L)	<10	9 (37.5%)
	10-30	8 (33.3%)
	>30	7 (29.2%)
Post-PSE data		
Time to response (days)		15.00 (8.00 - 30.00)
Average Length of Stay in Hospital (days)		3.00 (2.00 - 6.00)
Response		
Early response	Complete response	6 (25.0%)
	Partial response	14 (58.3%)
	No response	4 (16.7%)
Late response	Complete response	11 (45.8%)
	Partial response	8 (33.3%)
	No response	5 (20.8%)
Complications		
Post-embolization syndrome		24 (100.0%)
Bleeding at puncture site		2 (8.3%)
Pleural effusion		1 (4.2%)
Splenic abscess		1 (4.2%)
Procedure related mortality		0 (0.0%)

Abbreviations: ITP= immune thrombocytopenia; PSE= partial splenic embolization; PLT= platelet count. Data represent the median (interquartile range) or Number (%)

PLATELET COUNT (10^9/L)

Comparison of the medians platelet count at the pre-PSE laboratory was 13.00 x 10^9/L, then corrected to 84.00 x 10^9/L at 1 week, and 92.50 x 10^9/L at 1 month follow-up period, and then there were some fluctuations at 3-, 6-, and 12-month follow-up periods; most outcomes were ranking in the figure of around 101 × 103 with P value (< 0.001) (Figure 1).

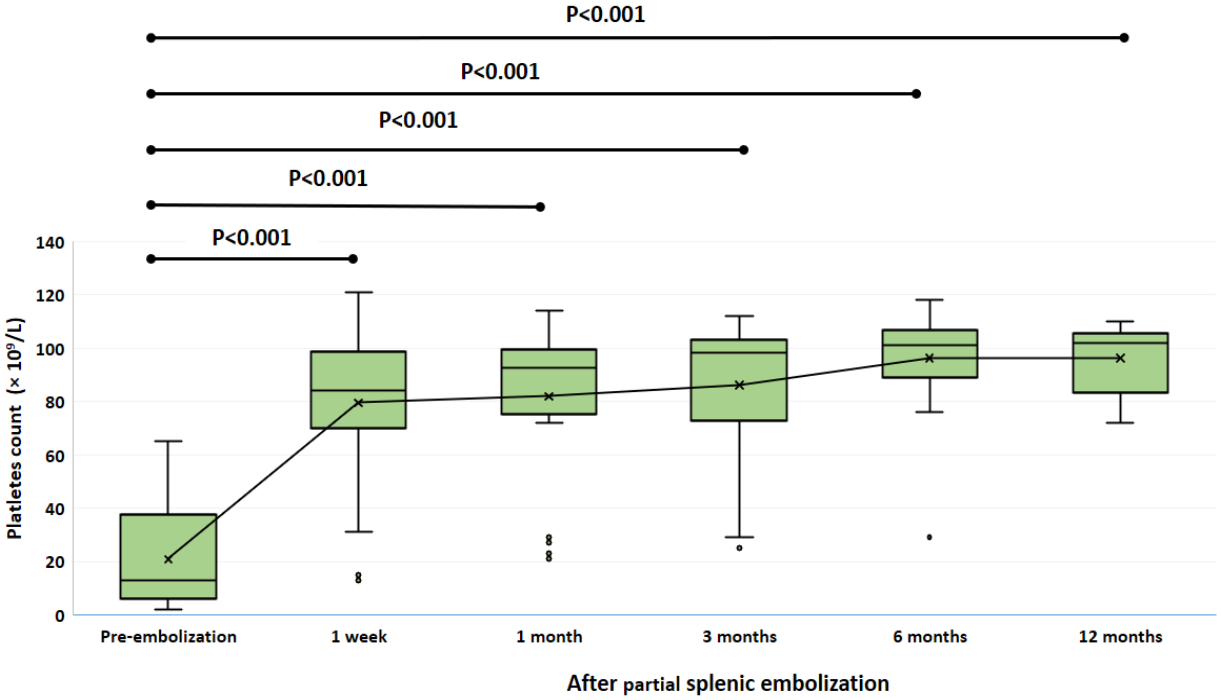

Figure 1: Partial splenic embolization (PSE) led to a lasting response in terms of platelet count. The platelet counts at the 1week, 1-, 3-, 6-, and 12-month intervals following PSE were significantly elevated compared to those prior to the procedure.

SPLENIC SPAN BY ULTRASOUND, (CM)

Pre-PSE splenic size ranged from 16.45 to 20.00 cm with the median 17.95 cm. After the embolization (PSE) procedure there was a significant reduction, in the size of the spleen as found through ultrasound. At 1 month the median spleen span measured 15.50 (IQR 13.45 - 17.40) cm. One month after PSE the median spleen span decreased by 2.50 (IQR 3.15 - 2.10) cm compared to before the procedure. By the end of 12 months following PSE there was a reduction in spleen size, with a median span of 14.10 (IQR 12.15 - 15.50) cm presenting a decrease of 4.30 (4.70 - 3.60) cm when compared to its initial measurement (Figure 2).

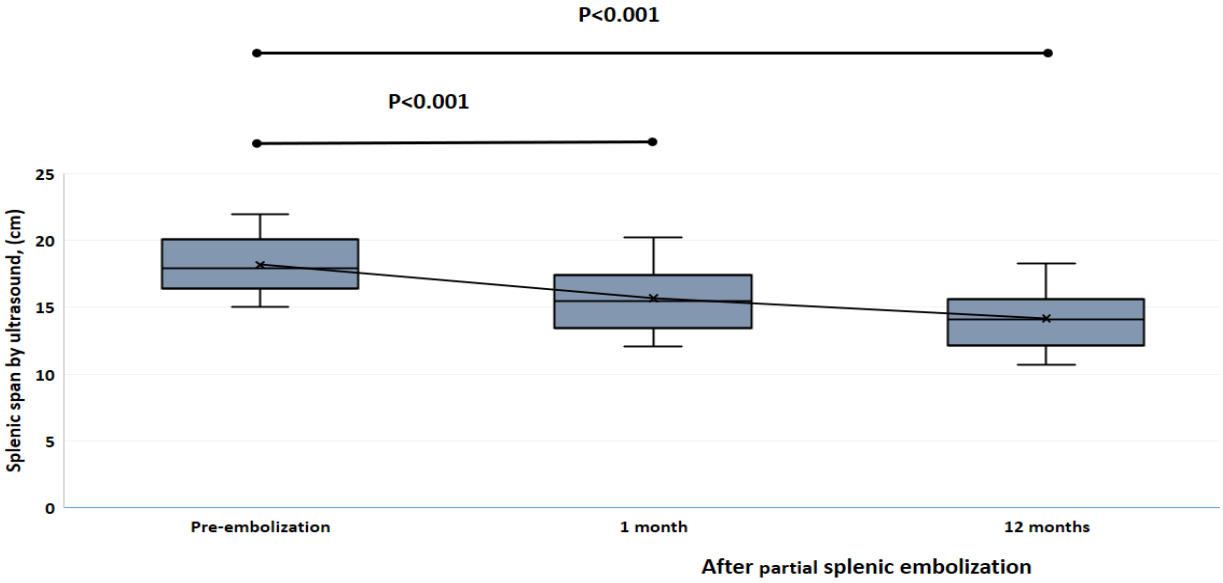

Figure 2: After partial splenic embolization (PSE), the splenic span, as measured in centimeters by ultrasound, showed a significant decrease at the 1 and 12-month marks post-procedure compared to the measurements taken prior to PSE.

II- Analysis of Data between Three Study Groups Regarding Late Response

DEMOGRAPHIC, PRE- AND POST- PSE DATA

There were insignificant differences between response groups in terms of age and gender. In addition, no complete responders had baseline platelet counts <10 x 10^9/L, while 75% of partial responders and 60% of non-responders had platelet counts in this very low range prior to PSE. Time to response and length of hospital stay were similar between groups (Table 2).

RESPONSE

The early response to treatment was significantly associated with the late response. Among patients with a complete late response, 81.8% had a partial early response. No patients in this group had no early response. In the partial late response group, 50.0% had complete early response and 50.0% had a partial early response. In the no response group, 80.0% had no early response. Interestingly, no cases in this group had a complete early response (Table 2).

COMPLICATIONS

Post-embolization syndrome affected 100% of patients in all three groups. The group differences were not statistically significant regarding bleeding at puncture site, pleural effusion, splenic abscess. No procedure-related deaths occurred in any group (Table 2).

Table 2: Analysis of patient characteristics concerning treatment late response.

Variables		Late response			*p value*
		Complete response (N=11)	**Partial response (N=8)**	**No response (N=5)**	
Demographic data					
Age (years)		36.00 (31.00-46.00)	36.50 (28.50-45.00)	29.00 (21.00-52.00)	0.982
Gender	male	4 (36.4%)	4 (50.0%)	2 (40.0%)	0.869
	female	7 (63.6%)	4 (50.0%)	3 (60.0%)	
Pre-PSE data					
PLT count categories before PSE (× 10^9/L)	<10	0 (0.0%)	6 (75.0%)	3 (60.0%)	**0.014***
	10-30	6 (54.5%)	1 (12.5%)	1 (20.0%)	
	>30	5 (45.5%)	1 (12.5%)	1 (20.0%)	
Post-PSE data					
Time to response (day)		13.00 (7.00-33.00)	17.50 (13.00-31.00)	----------	0.351
Average Length of Stay in Hospital (days)		2.00 (2.00-6.00)	3 (2.00-6.00)	3.6.00 (2.00-6.00)	0.052
Response					
Early response	Complete response	2 (18.2%)	4 (50.0%)	0 (0.0%)	**<0.001***
	Partial response	9 (81.8%)	4 (50.0%)	1 (20.0%)	
	No response	0 (0.0%)	0 (0.0%)	4 (80.0%)	
Complication					
Post-embolization syndrome		11 (100.0%)	8 (100.0%)	5 (100.0%)	
Bleeding at puncture site		1 (9.1%)	1 (12.5%)	0 (0.0%)	1.000
Pleural effusion		1 (9.1%)	0 (0.0%)	0 (0.0%)	1.000
Splenic abscess		0 (0.0%)	1 (12.5%)	0 (0.0%)	0.535
Procedure related mortality		0 (0.0%)	0 (0.0%)	0 (0.0%)	

PSE; partial splenic embolization. Data represent the Median (interquartile range) or Number (%).*: Statistically significant at $p \leq 0.05$

PLATELET COUNT (10^9/L)

Significant differences are observed in the platelet count (× 10^9/L) pre-embolization between the three groups, with median platelet counts of 28. 00, 7. 50, and 4. 00 (× 10^9/L) for the complete response, partial response, and no response groups, correspondingly. On week post-embolization, the differences in platelet count between the groups weren't statistically significant. However, significant differences were observed at 1 month, 3 months, 6 months, and 12 months post-embolization. In terms of repeated measures (changes in platelet count over time within each group), there were significant changes in all groups (Table 3).

Table 3: Comparison of pre- and post-treatment PSE points of platelet count (× 10^9/L) within treatment late response groups.

Variables	Late response			*p value*
	Complete response (N=11)	Partial response (N=8)	No response (N=5)	
Platelet count (× 10^9/L)				
Pre-embolization	28.00 (16.00-65.00)	7.50 (6.00-36.00)	4.00 (3.00-38.00)	**0.003***
1 week post-embolization	86.00 (79.00-104.00)	92.50 (73.00-121.00)	31.00 (15.00-120.00)	0.106
1 month post-embolization	93.00 (82.00-112.00)	99.00 (87.50-114.00)	27.00 (23.00-98.00)	**0.023***
3 months post-embolization	98.00 (88.00-112.00)	101.50 (86.00-104.00)	29.00 (25.00-29.00)	**0.022***
6 months post-embolization	107.00 (104.00-118.00)	89.00 (79.00-98.00)	29.00 (29.00-29.00)	**0.011***
12 months post-embolization	104.00 (102.50-110.00)	82.00 (80.00-95.00)	----------	**0.002***
Repeated measures *p value*	**<0.001***	**<0.001***	**<0.001***	

PSE; partial splenic embolization. Data represent the Median (interquartile range) or Number (%).
*: Statistically significant at $p \leq 0.05$

SPLENIC SPAN BY ULTRASOUND, (CM)

Pre-embolization, the groups did not significantly differ in terms of splenic span by ultrasound. However, 1-month post-embolization, significant differences in span were found between the groups. At 12 months post-embolization, the variance wasn't statistically significant between complete and partial response. In terms of the change (Δ) in splenic span after 1 month and 12 months, significant differences were observed between the groups. For repeated measures (changes in splenic span over time within each group), there were significant changes in all groups (Table 4).

Table 4: Comparison of pre- and post-treatment PSE points of splenic span by ultrasound, (cm) within treatment late response groups.

Variables	Late response			*p value*
	Complete response (N=11)	Partial response (N=8)	No response (N=5)	
Splenic span by ultrasound, (cm)				
Pre-embolization	18.50 (16.40-22.00)	17.20 (15.60-20.40)	19.80 (19.00-21.00)	0.089
1 month post-embolization	15.40 (13.40-18.70)	14.80 (13.30-18.40)	18.20 (17.30-20.20)	**0.027***
12 months post-embolization	14.00 (12.00-17.30)	13.45 (12.00-15.70)	----------	0.840
change (Δ) after 1 months	-3.20 (-3.30--2.90)	-2.25 (-2.45--2.00)	-1.40 (-1.60--.80)	**<0.001***
change (Δ) after 12 months	-4.70 (-4.90--4.30)	-3.65 (-3.85--3.40)	----------	**0.001***
Repeated measures *p value*	**<0.001***	**<0.001***	**0.042***	

PSE; partial splenic embolization. Data represent the Median (interquartile range) or Number (%). *: Statistically significant at $p \leq 0.05$

III- FALIURE-FREE SURVIVAL

Over a median 10-month follow-up period after PSE, 5 out of 24 patients (20.8%) who initially achieved a platelet response eventually experienced treatment failure evidenced by decreasing platelet counts necessitating additional therapy. ROC analysis was utilized to determine the optimal 1-month platelet count cut-off value for comparing FFS. The area under the curve (AUC) for 1-month platelet counts was 0.884. The optimal cut-off was 73 × 10^9/L, which had a specificity of 80.0% and a sensitivity of 94.7% for predicting FFS.

KAPLAN–MEIER CURVES OF PLT COUNTS (× 10^9/L) AT 1 MONTH TO DETERMINE THE FALIURE-FREE SURVIVAL OF ITP PATIENTS

We estimated the mean FFS time according to PLT counts at 1 month (estimated mean time until failure is 11.57 months for PLT counts at 1 month ≥73 × 10^9/L and 3.80 months for PLT counts at 1 month <73 × 10^9/L). So, it is obvious that those patients with PLT counts at 1 month <73 × 10^9/L are more likely to failure response after PSE (Figure 3).

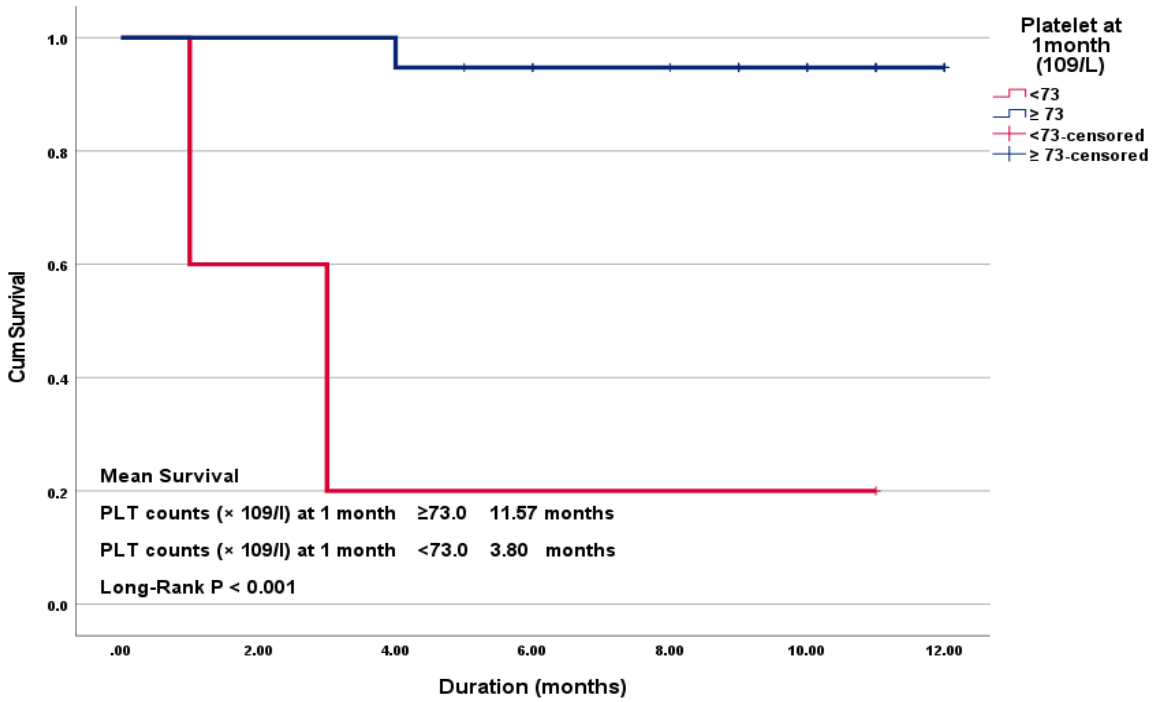

Figure 3: The survival rate without any recorded failures for patients who demonstrated platelet reactions, based on their platelet counts one month following a partial splenic embolization, is significant. It was seen that patients who had platelet counts above 73 × 10^9/L (n = 19) one month following undergoing partial splenic embolization consistently maintained a higher failure-free survival rate. This was in comparison to those patients whose platelet counts were below 73 × 10^9/L following PSE (n = 5) (P < 0.001, log-rank test).

DISCUSSION

To present, few published research supports prescribing a PSE in patients of steroid resistant ITP despite the fact that this treatment significantly improve response [(7)].

Our research examined how PSE affected 24 patients diagnosed with steroid resistant ITP. Our main focus was, on studying the changes in platelet count and spleen size following PSE. The participants had a median age of 37.5 years with a distribution of 41.7% males and 58.3% females. After undergoing PSE there were increases in platelet counts rising from a level of 13.00 x 10^9/L to 92.50 x 10^9/L after one month. Concurrently spleen size showed a reduction with the median span decreasing from 17.95 cm before PSE, to 14.10 cm twelve months post embolization. In the beginning the response rates were quite positive. 25.0% of patients achieved a complete response while 58.3% experienced a partial response after undergoing PSE. As time went on 45.8% of patients showed a platelet complete response. It was expected that all patients would experience post syndrome but other complications such, as bleeding and splenic abscess were rare occurrences. Fortunately, there were no deaths related to the procedure.

A case series-pilot study by **Thomas *et al.*** examined the effectiveness and safety of a PSE in six patients diagnosed with ITP that did not respond to steroid treatment. The average age was 35 years and their platelet count, before undergoing PSE was recorded at 10.50 x 10^9/L. Following the PSE procedure there was a rise in the platelet count to 48.33 x 10^9/L indicating significant improvement in their blood related condition. Additionally, the size of the spleen decreased from an average of 15.00 cm to 12.00 cm suggesting a reduction in the spleens ability to sequester platelets. The overall response rate for this treatment was found to be 100% with all six patients achieving complete response. Importantly no major complications were observed during or after the procedure [(10)].

This finding pass in accordance with **Togasaki *et al.*** [(11)], who reported that the effectiveness and safety of PSE were evaluated in a group of 91 patients diagnosed with ITP. The average age was 45.7 years. Their initial platelet count, before undergoing PSE was recorded as 20.00 x 10^9/L. Following the procedure there was an improvement in the patients' hematological condition as indicated by an increase in the mean platelet count to 133.00 x 10^9/L. Additionally, it was observed that the size of the spleen decreased from a measurement of 16.00 cm to 12.00 cm indicating a reduction in sequestration of platelets. The overall response rate among the patients was found to be 84% (76 out of 91) with 46% (34 out of 76) achieving

response and around 38% (28 out of 76) experiencing partial response. No major complications were reported either during or, after the procedure.

A case report studied a case of a 69-year man who had a recurring grade invasive urothelial bladder carcinoma and was also diagnosed with ITP. Due to his platelet count the patient couldn't undergo chemotherapy, so PSE was considered as an alternative treatment. Fortunately, the procedure went well and within 48 hours the patient's platelet count rose to 251 x 10^9/l. Notably there were no complications during or, after the procedure [(12)].

A study performed by **Kimura *et al.*** [(13)] found that PSE showed a response rate of 51%, in treating ITP when initial partial embolization was performed. The study authors concluded that PSE, whether accompanied by repeat embolization or not is an effective alternative to splenectomy for patients, with ITP [(13)].

Another study by **Miyazaki** on PSE for the treatment of chronic ITP in 26 cases illustrated that it brought about a complete response in thirty-three percent, a partial response in thirty-eight percent, and no response in twenty-nine percent. No serious complications had happened in these cases [(14)].

A study, by **Ji *et al.***, PSE in twenty-one cases with chronic ITP observed that the response attained three months following embolization with trans catheter vessel occlusion is comparable to the reported outcomes of splenectomy [(15)]. In addition to the diminished death and morbidity repleted surgical splenectomy, the no infarcted spleen following PSE may continue to provide immunologic functions. Splenectomy can lead to serious complications such as venous thromboembolism and infections, open and laparoscopic splenectomy is related to a death rate of 1 and 0.2%, correspondingly [(16)].

Kaiho *et al.* [(17)], regarding the potential of PSE to predict the effectiveness of splenectomy, observed that the increase in platelet count after PSE was more significant in cases where it proved effective compared to those where it didn't. These findings imply that the response level to PSE could serve as an indicator of whether splenectomy will be successful. Furthermore, the study also highlighted a case where a patient's platelet count increased sufficiently after PSE leading to complete remission. This suggests that PSE can be a treatment for ITP even when splenectomy becomes necessary. However, another patient in the study did not experience an increase, in platelet count after PSE indicating that if PSE is proven to be efficacious, the surgical procedure of splenectomy can potentially induce a state of complete remission. On the other hand, splenectomy might not result in remission if PSE is later shown to be ineffective.

Our current study reveals that age and gender did not show any differences between the response groups. It was also observed that none of the responders had platelet counts below 10 x 109/L before undergoing PSE, whereas 75% of responders and 60% of non responders had platelet counts in this very low range prior to the procedure. Patients who experienced a response typically achieved it within a time frame of 13 days post PSE while partial responders took around 17.5 days. The length of hospital stay was similar among all groups.

Togasaki *et al*. revealed that individuals with platelet counts ($\geq$10 x 10^9/L) before undergoing PSE exhibited significantly better response rates compared to those with lower baseline platelet counts (<10 x 10^9/L) prior to the procedure (90%, vs. 69% p = 0.016). There were no variations, in the gender and age of cases who responded to PSE compared to those who did not [(11)].

From our results, platelets level is important risk factor, which predict outcome response. In this research it was observed that 20.8% of participants experienced treatment failure within a span of 10 months after undergoing PSE. Analyzing the data, we found that a platelet counts of 73 x 10^9/L, at the one-month mark served as the threshold. If the count fell below this threshold there was a 94.7% chance of predicting treatment failure with an 80% specificity rate. On average cases with a platelet count $\geq$73 x 10^9/L had 11.57 months without treatment failure compared to about 3.80 months for those with counts <73 x10^9/L ($p<0.001$).

Similarly, another study by **Togasaki *et al***. identified a cut-off platelet count of around 68 x10^9/L at one month that predicted chances of treatment success without any failures. Patients with counts above this threshold had rates of failure free survival compared to those, below it ($p=0.0061$)[(11)].

STRENGTHS AND LIMITATIONS

The key strengths were the analyses of predictors of failure-free survival and changes in the splenic span alongside platelet counts. However, limitations include the single-center design, lack of comparison to other therapies.

CONCLUSIONS AND RECOMMENDATION

Overall, this study provides useful real-world data supporting PSE as an efficacious intervention for steroid-resistant ITP, with many patients achieving durable platelet responses. Higher pre-PSE platelet levels and 1-month post-PSE counts strongly predicted improved outcomes. PSE was also shown to reduce spleen size and increase platelet count significantly. While complication rates were low, the conclusions were constrained by the prospective nature of the information and limited follow-up duration. Further studies with multicenter participation and more than 12 months follow-up are needed to fully assess the longevity of PSE responses.

Author Contributions

Mohammed M, AbdelHammed M, Mohamed H conceived and designed the research.

Mohammed M and AbdelHammed M recruited patients and collected clinical data.

Mohammed M, AbdelHammed, M, Mohamed H contributed to the interpretation of data for the work.

AbdelHammed M, Muhamad H prepared the original draft of the manuscript.

Mohamed H performed the partial splenic embolization (PSE) procedure.

All authors contributed to information analysis, or revising the article, have agreed on the EJIM to which the article will be submitted, gave final approval of the suitable version to be published, and agree to all aspects of the work.

Declaration of Conflicting Interests:

The author(s) declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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