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Occurrence of Hematological Diseases in Patients with Intraabdominal Venous Thrombosis and Evaluation of Paroxysmal Nocturnal Hemoglobinuria

İntraabdominal Venöz Trombozlu Hastalarda Hematolojik Hastalıkların Görülme Sıklığı ve Paroxysmal Nocturnal Hemoglobinuria Değerlendirmesi

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ÖZET

Giriş: Bu çalışma, abdominal venöz tromboz (AVT) hastalarının klinik, demografik ve laboratuvar özelliklerini tanımlamayı ve paroksismal noktürnal hemoglobinüri (PNH) klonunun varlığını araştırmayı amaçlamaktadır. AVT; portal, renal, mezenterik ve dalak venlerini etkileyebilen nadir fakat önemli bir tablodur. Hematolojik hastalıkların AVT üzerindeki etkileri ve PNH klonlarının varlığı değerlendirilmektedir.
Gereç ve Yöntemler: Retrospektif olgu serisi olarak planlanan bu çalışmaya, üçüncü basamak bir hastaneye başvuran, intra-abdominal venöz tromboz tanısı alan erişkin hastalar dahil edilmiştir. Yaş, cinsiyet, trombozun yeri, eşlik eden hastalıklar, protrombotik durumlar ve genetik mutasyonlar gibi veriler hastane kayıtlarından toplanmış, PNH klonu akım sitometrisi ile değerlendirilmiştir.
Bulgular: Otuz iki hastanın ortalama yaşı 45 ± 15,6 yıldır. Hastaların %65,6'sında izole portal ven trombozu görülmüş, bazı hastalarda çoklu damar tutulumu saptanmıştır. Siroz, polisitemi vera, Faktör V Leiden mutasyonu ve protein C eksikliği gibi durumlar tespit edilmiştir. Hiçbir hastada malignite öyküsü veya PNH klonu bulunmamıştır.
Sonuç: AVT'nin patogenezinde PNH'nin rolü sınırlı olabilir. Bulguların daha geniş çalışmalarda doğrulanması gerekmektedir.

Anahtar Kelimeler: Tromboz, PNH, Hemoliz

ABSTRACT

Introduction: Introduction: This study aims to describe the clinical, demographic, and laboratory characteristics of patients with abdominal venous thrombosis (AVT) and to investigate the presence of paroxysmal nocturnal hemoglobinuria (PNH) clones.
Material and Methods: This retrospective case series was conducted at a tertiary care research hospital. Adult patients diagnosed and treated for intra-abdominal venous thrombosis were included. Data were collected from hospital records, including age, sex, thrombosis site, comorbidities, prothrombotic conditions, and genetic mutations. PNH clone presence was evaluated by flow cytometry.
Results: The mean age of the 32 patients was 45 ± 15.6 years. Isolated portal vein thrombosis was observed in 65.6% of the patients, and multi-vessel involvement was detected in some cases. Conditions such as cirrhosis, polycythemia vera, Factor V Leiden mutation, and protein C deficiency were identified. None of the patients had a history of malignancy or a detectable PNH clone.
Conclusion: The role of PNH in the pathogenesis of AVT may be limited. These findings need to be confirmed in larger studies.

Key words: Thrombosis, PNH, Hemolysis

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INTRODUCTION

Venous Thrombosis

Venous thrombosis refers to a range of conditions in which blood clots develop within veins. Primarily, these clots develop in the deep veins of the legs (deep vein thrombosis, DVT) or can migrate to the lungs (pulmonary embolism, PE) (1). In the general population, approximately 1-2 cases of DVT occur per 1,000 individuals annually, while around 0.5-1 cases of PE are observed per 1,000 individuals per year (2). Risk factors for venous thrombosis include prolonged immobility (such as after surgery or during long flights), cancer, pregnancy, hormonal therapies (like oral contraceptives), and genetic predispositions (such as Factor V Leiden mutation) (1, 2).

Abdominal venous thrombosis is a clinically significant subset of venous thrombotic events. The prevalence and incidence of abdominal venous thrombosis vary depending on underlying risk factors such as liver disease, malignancies, inflammatory conditions, and genetic predispositions. For instance, portal vein thrombosis is notably associated with liver cirrhosis, with reported incidences ranging from 5% to 15% in cirrhotic patients, while its occurrence in non-cirrhotic patients is relatively rare (3).

Paroxysmal Nocturnal Hemoglobinuria

Paroxysmal nocturnal hemoglobinuria (PNH) is a rare hematologic disorder characterized by deficient glycosylphosphatidylinositol (GPI)-anchored proteins on red blood cells, leading to hemolysis, bone marrow failure, and thrombotic events (4). The clinical presentation can manifest either as hemolytic, characterized by chronic intravascular hemolysis, or hypoplastic, linked to pancytopenia and bone marrow failure. These forms may coexist, and in some cases initially diagnosed as aplastic anemia, may later develop PNH (5).

PNH often presents in adults, with a peak onset typically occurring in young adulthood. PNH exhibits a prevalence rate of 1 to 5 cases per million individuals, displaying variation across diverse populations and geographical regions. Within five years of being diagnosed, approximately 35% of patients do not survive (6). Thrombotic events are also a major concern in PNH, occurring in 30-40% of cases (7).

Co-occurrence

Recent studies suggest individuals diagnosed with PNH exhibit a heightened vulnerability to thrombosis in atypical veins, possibly attributed to the pro-thrombotic condition triggered by chronic hemolysis and complement activation. Up to 40% of patients with PNH may experience thrombosis during their illness, primarily attributed to the chronic hemolysis and subsequent activation of the coagulation system (4, 8).

In clinical terms, the coexistence of venous thrombosis and PNH poses challenges in diagnosis and calls for a comprehensive approach to management. To effectively care for patients with PNH, health care providers must be proactive in assessing and managing thrombotic risks (8, 9). This may involve using strategies such as anticoagulation to prevent blood clots and targeted therapies to reduce hemolysis and mitigate thrombotic complications in specific patients (8). Addressing abdominal venous thrombosis in the context of PNH requires a personalized approach (4, 9).

Recognizing the epidemiology of venous thrombosis and PNH is crucial for better patient outcomes and reducing the burden of these medical conditions. This study aims to outline the demographic and medical characteristics of patients with abdominal vein thrombosis (VT), drawing from a single center's experience. In addition, the aim is to investigate the occurrence of the PNH clone in these patients.

Overall, this case series contributes to the existing literature by expanding our understanding of intra-abdominal venous thrombosis and highlighting the potential relationship with PNH clones.

PNH and Intra-abdominal Thrombosis: Clinical Relevance and Management

Intra-abdominal thrombosis (Budd-Chiari syndrome, portal vein thrombosis) significantly impacts morbidity and mortality in patients with PNH. The prevalence of atypical venous thrombosis, including intra-abdominal, reaches 40% among patients diagnosed with PNH (6, 19, 20).

Intra-abdominal thrombosis in the context of PNH is clinically challenging to diagnose and manage owing to its nonspecific presentation, characterized by abdominal pain, hepatomegaly, and ascites, symptoms that may overlap with those of liver disease or malignancy. Delayed diagnosis of PNH-associated intra-abdominal thrombosis may result in severe complications such as hepatic failure in Budd-Chiari syndrome or portal hypertension secondary to portal vein thrombosis (20).

A multidisciplinary, individualized approach is required for the effective management of intra-abdominal thrombosis in patients with paroxysmal nocturnal hemoglobinuria. Thrombotic risk mitigation relies primarily on anticoagulation therapy. Eculizumab and ravulizumab, among other complement inhibitors, represent a transformative advancement in PNH therapy, characterized by reductions in hemolysis and thrombotic events, and improved survival (6, 8).

The early diagnosis of intra-abdominal thrombosis in patients with PNH is essential to prevent irreversible organ injury. In young adults exhibiting unexplained intra-abdominal thrombosis and absent traditional risk factors, screening for PNH clones via flow cytometry is recommended (21). In addition, the strategic use of targeted therapies, specifically complement inhibitors, in managing

these patients has proven effective in mitigating thrombotic complications and improving long-term results (8, 19, 20).

MATERIAL AND METHODS

Research Design

In this retrospective case series conducted at tertiary research hospital, we present findings from a cohort of 32 adult patients aged 18 years and older, all diagnosed and treated for intra-abdominal venous thrombosis. These patients received a comprehensive evaluation and were subsequently monitored within the gastroenterology outpatient clinic and internal medicine service. Diagnosis of intra-abdominal venous thrombosis was confirmed through Doppler ultrasonography or computed tomography angiography, ensuring accurate detection and characterization of thrombotic events within the abdominal venous system.

Our investigation focused on examining medical records and laboratory reports to gain insight into the epidemiology, risk factors, clinical presentations, as well as the sites of thrombosis and any coexisting diseases associated with intra-abdominal venous thrombosis within our specific patient population. Moreover, the study aimed to explore the potential link between PNH and thrombotic events in the abdominal region.

Statistical Analysis

We used SPSS 15.0 for Windows software to analyze and interpret the collected data. Descriptive statistics were employed to present categorical variables as frequencies and percentages, providing a comprehensive overview of the patient characteristics within the study population. Quantitative data on thrombus size, laboratory values, and other metrics were summarized using mean and standard deviation.

Statistical comparisons were conducted to evaluate differences between the groups. The Student's t-test assessed mean differences between patient groups for variables like thrombus size or biochemical markers. When normal distribution assumptions were violated, the Mann-Whitney U test was used to compare medians. Categorical variables, including the prevalence of PNH clones and other associated conditions, were evaluated using Chi-square analysis to determine significant associations or differences between groups. When traditional statistical test conditions were not met, Monte Carlo simulation methods were employed for reliable statistical inference.

A significance level of $p < 0.05$ was used in the analysis to find meaningful relationships in the data. By using this approach, we investigated the connection between PNH clones and intra-abdominal venous thrombosis.

Procedure

As part of the patients' routine healthcare procedure, the medical staff collected hemogram and biochemistry samples, along with peripheral blood samples obtained using purple-capped EDTA tubes. Our hospital's contracted lab studied granulocytes for the PNH clone using the FLAER (fluorescently labeled inactive toxin aerolysin) method. Approximately 2 ml of blood is collected in a purple-capped EDTA tube and stored at room temperature for less than 24 hours.

Flow cytometry is widely regarded as the gold standard for PNH diagnosis. Anti-CD59 and anti-CD55 are the monoclonal antibodies typically employed in flow cytometric examination. By employing specific antibodies, such as FLAER, with flow cytometry, doctors can accurately identify and measure the PNH clone. (10 - 13). Flow cytometry quantifies GPI anchor and protein expression on hemopoietic cells. (14, 15).

RESULTS

In relation to the demographic data, the mean ages for female and male patients are 44.4 years (SD ± 15.8) and 45.5 years (SD ± 13.7), respectively resulting with no statistical difference ($p = 0.840$) between genders.

The primary diseases are classified into portal thrombosis, splenic thrombosis, Budd Chiari syndrome, and renal thrombosis. Despite females demonstrating a higher prevalence of portal thrombosis (87.5% vs. 68.8%), and males exhibiting a higher prevalence of renal thrombosis (18.8% vs. 0%), the distribution of these diseases does not indicate a significant difference ($p = 0.302$), suggesting comparable disease profiles across genders. Additional thrombotic events such as splenic vein thrombosis, superior mesenteric vein thrombosis, and renal vein thrombosis are also evaluated. Gender parity in thrombotic risk factors is highlighted by the lack of significant difference between males and females ($p = 1.000$). Categorical data shows liver cirrhosis rates of 25.0% in females and 12.5% in males ($p = 0.654$). Table 1 provides detail characteristics of the patients.

Further investigation of hematologic diseases reveals the presence of polycythemia vera, F5 Leiden mutation, and deficiencies in proteins C and S. Although there are slight differences in their occurrence rates, the overall analysis shows a non-significant p-value of 0.121, indicating no significant gender-related discrepancies in these hematologic conditions.

Hemoglobin levels are measured with mean values of 12.0 g/dL (SD ± 1.6) for females and 13.4 g/dL (SD ± 2.8) for males (p-value = 0.111). Haptoglobin shows mean levels of 63.1 mg/dL (SD ± 87.3) in females and 119.8 mg/dL (SD ± 109.0) in males ($p = 0.211$). Biochemical markers including total and indirect bilirubin, direct and indirect Coombs tests, lactate dehydrogenase (LDH), and reticulocyte count (RTC) are also evaluated. Total bilirubin levels (mean ± SD) are 1.89 ± 1.18

mg/dL in females and 1.80 ± 1.82 mg/dL in males (p-value = 0.357). When examining the reticulocyte count (RTC) as an indicator of the bone marrow's reaction to anemia, it is observed that females exhibit mean percentages of 1.19 % while males exhibit 1.35 % (value = 0.885). There were no notable variations in laboratory results between genders in the cohort.

Both direct and indirect Coombs tests evaluate autoimmune hemolytic anemia, yielding non-significant p-values of 0.550 and 1.000, respectively. This suggests that there are no significant gender-related variations in antibody-mediated hemolysis. The mean LDH levels, commonly used to assess cellular damage and hemolysis, are 256.7 U/L (SD ± 85.3) in females and 214.8 U/L (SD ± 92.3) in males (p-value = 0.140). These results also indicate a comparable tissue injury profile among males and females.

Thrombotic Events

Among the 32 patients included in the study, the occurrence of specific conditions was observed as follows: portal vein thrombosis was present in 78.1% (n=25), splenic vein thrombosis in 3.1% (n=1), Budd-Chiari Syndrome in 9.4% (n=3), and renal vein thrombosis in 9.4% (n=3). The majority of patients, accounting for 81.3% (n=26), did not present any other hematological disorders. Polycythemia vera was identified in a single patient, while FV Leiden mutation was found in another. Two patients were diagnosed with protein C deficiency, one patient had protein S deficiency, and one patient was diagnosed with Hereditary Spherocytosis. Notably, the patient identified with Hereditary Spherocytosis had a recent history of surgical intervention. Table 2 contains detailed information on the etiology and location of thrombosis for each individual.

Hemolytic Events

The average hemoglobin (Hb) level in the 32 patients analyzed was 12.7 ± 2.3 g/dL, with observed Hb levels ranging from a minimum of 8.9 g/dL to a maximum of 17.6 g/dL. On average, the haptoglobin level in these patients measured 89.8 mg/dL, with a range of values between 0 mg/dL and 265 mg/dL. The measured concentration of total bilirubin exhibited a mean value of 1.85 mg/dL, ranging from 0.3 mg/dL to 6.3

Table 1. Distribution of Patient Characteristics by Gender

Characteristic	Female	Male	p
Age (years)	44,4±15,8	45,5±13,7	0,840
Primary Disease			0,302
Portal thrombosis	14 (87,5)	11 (68,8)	
Splenic thrombosis	1 (6,3)	0 (0,0)	
Budd Chiari	1 (6,3)	2 (12,5)	
Renal thrombosis	0 (0,0)	3 (18,8)	
Additional Thrombosis			1,000
None	13 (81,3)	13 (81,3)	
Splenic vein thrombosis	2 (12,5)	2 (12,5)	
Superior mesenteric vein thrombosis	0 (0,0)	1 (6,3)	
Renal vein thrombosis	1 (6,3)	0 (0,0)	
Liver Cirrhosis	4 (25,0)	2 (12,5)	0,654
Additional Hematologic Disease			0,121
None	15 (93,8)	11 (68,8)	
Polycythemia vera	0 (0,0)	1 (6,3)	
F5 Leiden mutation	1 (6,3)	0 (0,0)	
Protein C deficiency	0 (0,0)	2 (12,5)	
Protein S deficiency	0 (0,0)	1 (6,3)	
Hereditary spherocytosis	0 (0,0)	1 (6,3)	
Hemoglobin (g/dL)	12,0±1,6	13,4±2,8	0,111
Haptoglobin (mg/dL)	63,1±87,3	119,8±109,0	0,211
Total Bilirubin (mg/dL)	1,89±1,18	1,80±1,82	0,357
Indirect Bilirubin (mg/dL)	1,22±0,70	1,23±1,25	0,430
Direct Coombs			0,550
Negative	8 (88,9)	5 (71,4)	
Positive	1 (11,1)	2 (28,6)	
Indirect Coombs			1,000
Negative	8 (88,9)	6 (85,7)	
Positive	1 (11,1)	1 (14,3)	
LDH (U/L)	256,7±85,3	214,8±92,3	0,140
RTC (%)	1,19±0,46	1,35±0,95	0,885

Note: SD = Standard Deviation; LDH = Lactate Dehydrogenase; RTC = Reticulocyte Count. Mean ± SD is used to represent numeric values, while n (%) is used for categorical values.

mg/dL. Whereas indirect bilirubin averaged 1.23 mg/dL, with values ranging from 0.09 mg/dL to 5 mg/dL. Lactate dehydrogenase (LDH) had an average value of 234.3 U/L, varying from 116 U/L to 480 U/L. Reticulocyte count (RTC) averaged 1.27%, with a range from 0.43% to 3.37%. Table 3 provides a breakdown of these measurements.

Within the patient cohort, 16 subjects were subjected to both direct and indirect Coombs tests. Direct Coombs tests

Table 2. Descriptive Results of Etiology and Thrombosis Locations in Individuals

Patient	Gender	Age	Location of Thrombosis	Etiology
1	Male	56	PVT	No risk factors
2	Female	59	PVT	FV Leiden mutation
3	Male	60	PVT	No risk factors
4	Male	36	PVT	No risk factors
5	Female	53	PVT, Renal vein thrombosis	No risk factors
6	Female	70	Splenic vein thrombosis	Cirrhosis
7	Male	35	Budd-Chiari Syndrome	Protein C deficiency
8	Female	44	PVT	Cirrhosis
9	Male	60	PVT, Splenic vein thrombosis	Protein S deficiency
10	Female	34	PVT	Cirrhosis
11	Male	58	Renal vein thrombosis	Protein C deficiency
12	Female	64	PVT	No risk factors
13	Male	55	PVT	No risk factors
14	Female	28	PVT	No risk factors
15	Female	22	Budd-Chiari Syndrome, Splenic vein thrombosis	No risk factors
16	Male	41	PVT	Cirrhosis
17	Female	26	PVT, Splenic vein thrombosis	No risk factors
18	Male	26	PVT	No risk factors
19	Male	36	PVT	No risk factors
20	Female	37	PVT	No risk factors
21	Male	50	Renal vein thrombosis	No risk factors
22	Female	42	PVT, Superior mesenteric vein thrombosis	No risk factors
23	Male	64	PVT	Polycythemia vera
24	Male	22	Budd-Chiari Syndrome, Splenic vein thrombosis	Hereditary spherocytosis
25	Female	48	PVT	No risk factors
26	Female	26	PVT	No risk factors
27	Female	33	PVT	No risk factors
28	Female	61	PVT	No risk factors
29	Male	27	PVT	No risk factors
30	Male	55	PVT	No risk factors
31	Male	47	Renal vein thrombosis	No risk factors
32	Female	64	PVT	Cirrhosis

Note: PVT = Portal Vein Thrombosis

Table 3. Descriptive Analyzes of Hemolytic Results in Patients

Laboratory Results		n	Mean (SD)
Hemoglobin (g/dL)		32	12,7±2,3
Haptoglobulin (mg/dL)		32	89,8±99,3
Total bilirubin (mg/dL)		32	1,85±1,47
Indirect bilirubin (mg/dL)		32	1,23±0,97
		n	**%**
Direct Coombs			
	Negative	13	81.25
	Positive	3	18.75
Indirect Coombs			
	Negative	14	87.5
	Positive	2	12.5
PNH Clone			
	Negative	32	100
	Positive	0	0

Note: PNH = Paroxysmal Nocturnal Hemoglobinuria

were negative in 13 patients, accounting for 81.3% of those tested, while 18.8% (3 patients) tested positive for both Ig and complement. Indirect Coombs tests yielded negative results in 14 patients (87.5%) and positive results in 2 patients (12.5%). Table 3 displays the results of these findings. None of the 32 patients examined tested positive for paroxysmal nocturnal hemoglobinuria (PNH).

DISCUSSION

PNH is a clonal disease that presents with chronic intravascular hemolysis, bone marrow failure, and thrombosis. Hemolysis, cytopenia, and thrombosis are warning signs for the physician. Thus, when faced with Coombs negative or non-spherocytic hemolytic anemia, in the absence of schistocytes or obvious signs of infection, it is crucial to consider PNH as a potential diagnosis, regardless of the presence or absence of hemoglobinuria. The addition of thrombosis, iron deficiency, and/or cytopenia should increase suspicion of PNH. PNH should also be considered in cases of unusual venous thrombosis. Thrombosis in PNH cases is often accompanied by hemolysis and/or cytopenia. Although arterial thrombosis may manifest in PNH patients, the predominant progression of the disease is characterized by venous thrombosis. (16 - 18)

This study revealed no statistically significant disparity in thrombosis type distribution between male and female participants ($p = 0.302$). However, the disproportionate occurrence of portal vein thrombosis in females (87.5% vs. 68.8%) and renal thrombosis in males (18.8% vs. 0%) requires further investigation. Despite the lack of statistical significance in these findings, they may indicate that the origin and symptoms of thrombosis vary between genders. Prior research suggests potential sex-based variations in thrombotic distribution and pathophysiology, possibly due to hormonal, genetic, and lifestyle influences, necessitating larger-scale studies for validation (1,2,8).

In particular, portal vein thrombosis is more commonly reported in females in association with liver cirrhosis and prothrombotic conditions. Conversely, renal vein thrombosis, although rare, appears to be more frequently observed in males, potentially due to differences in underlying risk factors like protein C deficiency, as seen in this cohort. Understanding these gender-specific patterns may aid in targeted diagnostic and therapeutic approaches for thrombosis management.

Within our study, we conducted screening of the PNH clone in 32 adult cases aged 18 and above, who displayed venous thrombosis in the abdomen as confirmed by Doppler USG or Abdominal CT Angiography. Out of all the patients, 18.8% had a previous diagnosis of cirrhosis, while none of them had any indication of malignancy. One patient had a history of polycythemia vera, another had the FV Leiden mutation, two patients had protein deficiency, one patient had protein S deficiency, and one patient had a history of Hereditary Spherocytosis. Six out of the 32 patients had simultaneous thrombus in two vessels, and among these, two patients had accompanying risk factors for thrombosis. One patient had Hereditary Spherocytosis and a recent splenectomy, while another patient had Protein S deficiency. Notably, none of the 32 patients in our cohort, who were carefully screened for the condition, showed positive results for paroxysmal nocturnal hemoglobinuria (PNH). Our results differ significantly from previously published prevalence rates of PNH clones among patients with intra-abdominal thrombosis. These rates varied from 0.5% to 5%, a discrepancy likely attributable to variations in the methodologies and populations used in those studies (20, 21). In their study, Qi et al. (20) discovered a PNH prevalence of 4.2% among Chinese patients with Budd-Chiari syndrome, whereas Ahluwalia et al. (21) observed a lower prevalence of PNH in Indian patients with abdominal vein thrombosis.

Additional studies in literature have examined the etiology of cases involving intra-abdominal venous thrombosis. According to a study conducted by Afredj et al. in Algeria, the average age of 115 thrombosis patients who were monitored over a period of 7 years (2004-2010) was 34 years old. Out of 115 patients, 73 had the chronic form of Budd-Chiari, 10 had the acute form, and 3 had the fulminant form. Based on the radiological findings, secondary BCS was identified in 5.3% (n=6) of cases, while primary BCS was identified in 94.7%. In the case of patients characterized as secondary BCS, the etiology included hydatid liver cyst (n = 5) and hepatocellular carcinoma (n = 1). The presence of prothrombotic causes was observed in 27% of the patients (n = 31). PNH clones were identified in 4 out of 115 patients, with MPH and antiphospholipid antibody syndrome being the predominant etiological factors. Among the 4 patients, one was diagnosed with PNH before thrombosis (19).

Qi et al. found PNH clone in a study on Chinese patients with Budd-Chiari Syndrome, noncirrhotic nonmalignant PVT, and cirrhosis and PVT (20). Ahluwalia et al.'s 2014 study in India found the PNH clone in 2 out of 142 patients with thrombosis. The study revealed that 13.4% of the patients had Protein S deficiency, 4.9% had protein C deficiency, and 2.1% had antithrombin 3 deficiency (21). Ageno et al. conducted a study in 2014, which involved 202 cases of intra-abdominal thrombosis. Out of these cases, 15.3% had liver cirrhosis, 10.9% had previous surgery, and 10% had previous surgery. While MPH was found in 6% of the patients, a surprising 34.6% showed no detectable risk factors. None of the 202 patients showed a clear positivity for PNH clone, but two patients had a low positivity (0.014% and 0.016%) for PNH clone.

The present study aimed to evaluate the prevalence of the

PNH clone in patients with abdominal venous thrombosis. Our findings did not show a significant association between the classic triad of hemolysis, cytopenia, and thrombosis in this patient cohort. This is in contrast to previous research, which has documented varying yet significant rates of PNH clone detection in venous thrombotic populations.

The variations in the occurrence of PNH can be attributed to multiple factors. The observed rates may be influenced by heterogeneity in patient demographics, diagnostic criteria, and geographic regions. Furthermore, the presence of co-morbidities, such as cirrhosis and inherited thrombophilia, can confound the association between PNH and thrombosis. In comparison to studies reporting higher PNH prevalence, our patient population exhibited a distinct profile with a lower frequency of these confounding factors.

It is important to recognize the limitations of our study. Our findings are limited in their generalizability due to the relatively small sample size and narrow focus of the patient cohort. In addition, the absence of a control group hinders the ability to directly compare the prevalence of PNH in populations with and without thrombosis.

Future research should involve comprehensive phenotyping of patients and larger, prospective studies to further our understanding of the link between PNH and venous thrombosis. By carefully describing the clinical symptoms, genetic factors, and laboratory results of these patients, we can identify specific groups that may have a greater likelihood of developing PNH-related blood clotting. Moreover, investigating the role of PNH in different thrombotic locations and severities could yield valuable information about the underlying causes of the disease.

Conclusion

In our hospital-based research on intra-abdominal venous thrombosis patients, comprising a sample size of 32, we found no evidence of a PNH clone. This outcome can be explained by the nature of our study, which specifically investigated the presence of paroxysmal nocturnal hemoglobinuria, a rare disease, among patients with intra-abdominal thrombosis, who themselves are part of a rare population. Despite its rarity, PNH should be thoroughly considered and examined when cases of thrombosis are found in unusual locations. This is particularly important in cases of recurrent thrombosis or when non-immune hemolytic anemia is present.

Understanding the epidemiology of venous thrombosis and PNH is vital in improving patient outcomes and easing the impact of these medical conditions. It is essential to maintain a commitment to ongoing research and vigilant clinical monitoring to fully comprehend the intricate interplay between these disorders and to optimize therapeutic approaches for individuals affected by this disease.

Etik Kurul: The study was conducted with the endorsement of the ethics committee (Decision number 319, 17.02.16).

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