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IMPACT OF POSTOPERATIVE COMPLICATIONS ON PORTAL THROMBOSIS IN SPLENECTOMY PATIENTS

SPLENEKTOMİ YAPILAN HASTALARDA POSTOPERATİF KOMPLİKASYON GELİŞİMİNİN PORTAL VEN TROMBOZUNA ETKİSİ

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ABSTRACT

Objective: Venous thromboembolism is one of the significant complications after elective and emergency splenectomy. Up to 35% of portal and splenic venous thromboembolism has been reported in the first two months after splenectomy for hematologic malignancy. Our objectives were to compare emergency and elective splenectomy and their complications, and to analyze the risks on the development of portal vein thrombosis (PVT).

Material and Method: A total of 78 splenectomy cases performed between 2017-2023 and that had complete medical records were included in this study. Of these cases, 39 were emergency and 39 were elective procedures. The two groups were compared retrospectively for risks of PVT.

Result: We found a significant relationship between the development of postoperative complications and the risk of PVT (p=0.004). The risk of developing PVT in emergency cases in the post-operative 2 weeks was significantly higher than elective cases (p=0.048). Shorter operation times, larger spleen sizes, lower platelet counts and malignancy in pathology results were found to be significantly in favor of elective cases (p=0.007, p=0.004, p<0.001, p=0.001, respectively). In emergency cases, the need for RBC transfusion and complications were more frequent (p<0.001, p=0.021).

Conclusion: High-risk patients should be evaluated for prophylactic anticoagulation with low-molecular-weight heparin in the postoperative period and after discharge. Anticoagulation should be considered for emergency splenectomy, factoring in cost-benefit, and a low suspicion for venous thromboembolism

ÖZET

Amaç: Terapötik ve acil splenektomi sonrası gelişen önemli komplikasyonlardan biri venöz tromboembolidir. Hematolojik malignite nedeniyle splenektomi sonrası ilk iki ay içerisinde %35'e varan portal ve splenik venöz tromboembolizm bildirilmiştir. Bu çalışmada, acil ve elektif splenektomi operasyonlarını ve komplikasyonlarını karşılaştırarak portal ven trombozu (PVT) gelişimi üzerindeki risklerin incelenmesi amaçlandı.

Gereç ve Yöntem: Çalışmaya 2017-2023 yılları arasında gerçekleştirilen ve kayıtları eksiksiz olan 78 splenektomi vakası dahil edildi. Bu vakalardan 39'u acil, 39'u ise elektif prosedürlerdi. İki grup portal tromboembolizm ve riskleri açısından retrospektif olarak karşılaştırıldı.

Bulgular: Ameliyat sonrası komplikasyon görülmesi ile PVT gelişimi riski arasında anlamlı bir ilişki saptanmıştır (p=0,004). Operasyon tipi olarak incelediğimizdeyse ameliyat sonrası ilk iki haftalık süreçteki acil vakalarda PVT gelişimi riski, elektif vakalara göre anlamlı ölçüde yüksek bulunmuştur (p=0,048). Ayrıca, kısa ameliyat süresi, büyük dalak boyutu, düşük trombosit sayısı ve patoloji sonuçlarında malignite olması elektif vakalar lehine anlamlı bulunmuştur (sırasıyla p=0,007, p=0,004, p<0,001, p=0,001, p=0,001). Acil vakalardaysa kan replasmanı ihtiyacı ve komplikasyonlar daha sık görülmüştür (sırasıyla p<0,001, p=0,021).

Sonuç: Yüksek riskli hastalar ameliyat sonrasındaki dönemde ve taburculuk sonrasında düşük molekül ağırlıklı heparin ile profilaktik antikoagülasyon açısından değerlendirilmelidir. Acil splenektomi vakalarında kar/zarar oranı göz önünde bulundurularak antikoagülasyon düşünülmeli ve olası venöz tromboemboli için

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should be maintained with timely investigation. In this sense, our study supports the existing data with its current results.

Keywords: Splenectomy, portal thrombosis, emergency surgery, splenomegaly

şüphe eşiği düşük tutulup erken tetkik edilmelidir. Bu anlamda çalışmamız güncel sonuçları ile mevcut verileri desteklemektedir.

Anahtar Kelimeler: Splenektomi, portal tromboz, acil cerrahi, splenomegali

INTRODUCTION

Splenectomy is performed both for diagnosis and treatment of hereditary, hematologic, and oncologic diseases, as well as in cases of unexplained splenomegaly or traumatic splenic injury. Splenectomy is the complete removal of the spleen after ligation of all the arteries and veins of the spleen, including the accessory tissues of the spleen. In addition to laparoscopic and open procedures in adult patients, partial splenectomy may be performed in children to preserve immune function, and cholecystectomy may be performed in some patient groups due to the risk of pigment stone formation (1,2).

Possible complications after splenectomy include thrombosis, thromboembolism, disruption of vascular smooth muscle structure, arterial or venous stenosis or occlusion due to vasospasm or atherosclerosis, bleeding, infection, cardiovascular events, pulmonary hypertension, and splenosis (3). In a retrospective study by van`t Riet et al, venous thromboembolism was found in 6-7% of patients after elective splenectomy (4). Venous thromboembolism includes deep vein thrombosis (DVT), portal vein thrombosis, splenic vein thrombosis, and pulmonary thromboembolism. Portal vein thrombosis is an increasingly recognized and reported complication after splenectomy (4).

The purpose of this study was to evaluate the effect of elective and emergency splenectomy and the effect of patient demographic and clinical parameters on the development of portal vein thrombosis. In addition, clinical and surgical characteristics of patients with and without postoperative complications were analyzed and compared. The risk factors for venous thromboembolism in the patient group were evaluated, and the mortality and bleeding rates of the patients were analyzed.

MATERIAL and METHODS

In our study, patients who underwent splenectomy at our university hospital, in the Department of General Surgery between 2017 and 2023, were retrospectively reviewed through electronic medical records. Patients with complete records of demographic data, pathologic data, operative notes, preoperative clinical notes, preoperative imaging, preoperative and postoperative laboratory values, treatment and follow-up data, and whose necessary permissions were obtained were included in the study. Specimen weight was evaluated by comparison with pathology reports and preoperative imaging or clinical notes.

After all the data were collected and grouped, statistical analyses were performed using SPSS ver.26.0 (IBM Corporation, Armonk, NY, USA). For continuous data, normality was assessed by Kolmogrov-Smirnov test; data with normal distribution were assessed by Student's t-test, and data with non-normal distribution were assessed by Mann-Whitney U test. Chi-square test was used to compare categorical data. The confidence interval in our study was set at 95%, and $p<0.05$ was considered statistically significant. Survival analysis was performed by the Kaplan-Meier method, and risk factors for venous thromboembolism were evaluated by regression analysis.

The collected data were divided into two groups as elective and emergency surgery patients. Age, sex, comorbidities, mean operative time, mean need for blood product replacement, platelet and INR levels, preoperative appearance, venous thromboembolism during follow-up, complications, and survival were compared between these two groups. Risk factors for venous thromboembolism were evaluated between groups and the effect of risk factors on survival was analyzed.

This study was approved by Ege University Clinical Research Ethics Committee (Date: 21.09.2023, No: 23-9.1T/39).

RESULTS

A total of 78 patients were enrolled in the study who were within the inclusion criteria. Of these patients, 39 underwent emergency surgery and 39 underwent elective surgery. Demographic data, need for a blood product replacement, preoperative hemogram parameters, the length of hospital stay, development of complications, and pathology results are summarized in Table 1.

Fifty-one patients (65.4%) had no comorbidities as shown in Figure 1. Fifteen patients (19.2%) had previous abdominal surgery. The mean platelet count was 261,628 (5,000-1,401,000). The mean International Normalized Ratio (INR) was 1.06 (0.8-2.8) and the mean hematocrit was 33.99 (17.30-46.80). The preoperative imaging included ultrasound (USG) in two patients (2.6%) and computed tomography (CT) in the remaining patients.

Table 1: Comparison between two groups

		Elective n, [CI], (%)	Emergency n, [CI], (%)	p value
Age	Year	47.6 [42.4-52.8]	42.04 [33.7-50.3]	p=0.184
Operation time	Min	97.4 [93.7-101.3]	107.9 [102.3-113.6]	**p=0.007**
Erythrocyte	Units	0.21 [0.11-0.52]	0.96 [0.47-1.46]	**p<0.001**
Spleen size	cm	16.2 [13.5-18.8]	8.3 [5.6-11.1]	**p=0.004**
PLT number		145.1 [109.3-180.8]	337.5 [222.3-452.7]	**p<0.001**
INR		1.04 [0.99-1.08]	1.08 [1.01-1.15]	p=0.522
Hematocrit		32.5 [30.3-34.8]	35.4 [33.3-37.5]	p=0.150
Length of stay	Day	9.4 [7.8-11.1]	11.3 [7.9-14.5]	p=0.362
Previous operation	No	27 (74.4%)	34 (87.2%)	p=0.151
	Yes	10 (25.6%)	5 (12.8%)	
Gender	Female	21 (53.8%)	10 (25.6%)	**p=0.018**
	Male	17 (43.6%)	29 (74.4%)	
Complication	No	39 (100%)	34 (87.2%)	**p=0.021**
	Yes	0 (0%)	5 (12.8%)	
Portal vein Thrombosis	No	39 (100%)	35 (89.7%)	**p=0.040**
	Yes	0	4 (10.3%)	
Pathology result	Benign	27 (69.2%)	38 (97.4%)	**p=0.001**
	Malign	12 (30.8%)	1 (2.6%)	

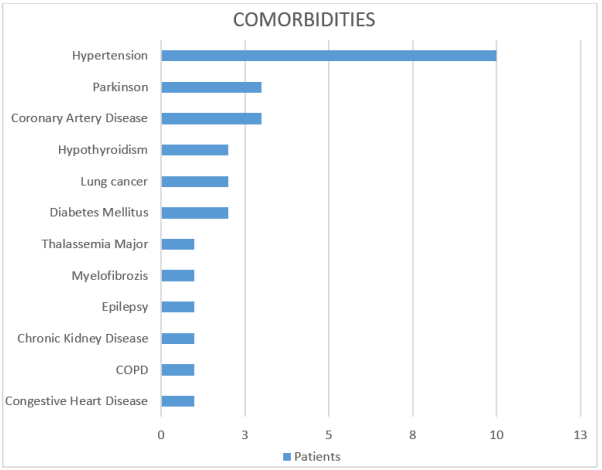

Figure 1: Comorbidities

Thirty-nine patients underwent emergency surgery and their indications are summarized in Table 2. Among the 15 patients with preoperative diagnoses, 12 patients (15.4%) had idiopathic thrombocytic purpura (ITP) and three patients (3.8%) had hereditary spherocytosis. No patient was diagnosed with splenic hemangioma and autoimmune hemolytic anemia. Twenty-four patients received a diagnosis after pathological examination and simple cysts were reported in two patients (2.6%), lipoma in one patient (1.28%), hemosiderosis in one patient (1.28%), and nonspecific hemorrhagic foci in dense congested tissue in the remaining 20 patients (25.6%).

Table 2: Indications for emergency surgery

Indication		Patient number	Percentage
Trauma	Grade 3	10	12.8%
	Grade 4	18	23.1%
	Grade 5	8	10.3%
Splenic abscess		3	3.8%

Comparing elective and emergency patients in terms of age, INR, hematocrit, hospital stay and previous surgery, no statistically significant difference was found (p=0.184, p=0.522, p=0.150, p=0.362, p=0.151). In addition, a shorter operation time, larger spleen sizes, a lower platelet count and more malignancy in pathology results were found to be significantly in favor of elective cases (p=0.007, p=0.004, p<0.001, p=0.001, p=0.001 respectively). In emergency cases, the need for RBC exchange was more frequent and complications and portal vein thrombosis were more frequent (p<0.001, p=0.021, p=0.040, respectively). Gender was not equally distributed between the two groups (p=0.018). The mean follow-up of the patients was 35.73 months (2-64). The associated parameters are summarized in Table 3.

Table 3: Assessments for patients with portal vein thrombosis

		Portal vein	Thrombosis	p value
		Absent n, [CI], (%)	Present n, [CI], (%)	
Operation type	**Elective**	39 (100%)	0	**p=0.040**
	Emergency	35 (89.7%)	4 (10.3%)	
Gender	**Female**	30 (93.8%)	2 (6.3%)	p=0.708
	Male	44 (95.7%)	2 (4.3%)	
Pathology report	**Benign**	61 (93.8%)	4 (6.2%)	p=0.358
	Malign	13 (100%)	0	
Age	**Year**	45.6 [40.9-50.2]	39.3 [36.13-78.79]	p=0.654
Operation time	**Min**	100.87 [97.65-104.09]	120 [70.32-169.68]	p=0.170
Erythrocyte	**Units**	0.54 [0.24-0.84]	0 [0-0]	p=0.218
Spleen size	**cm**	13.33 [11.23-15.44]	5.67 [4.3-11.3]	p=0.398
PLT number		204.4 [160.9-247.8]	631.0 [102.5-228.7]	p=0.060
INR		1.06 [1.01-1.10]	0.97 [0.89-1.05]	p=0.341
Hematocrit		34.03 [32.2-35.8]	35.5 [25.9-45.1]	p=0.904
Hospitalization	**Days**	10.1 [8.4-11.8]	11.3 [7.6-16.8]	p=0.607

The relationship between the type of surgery and the development of DVT during follow-up is shown in Figure 2. The development of portal vein thrombosis during follow-up was significantly different between the two groups in favor of emergency cases (p=0.045).

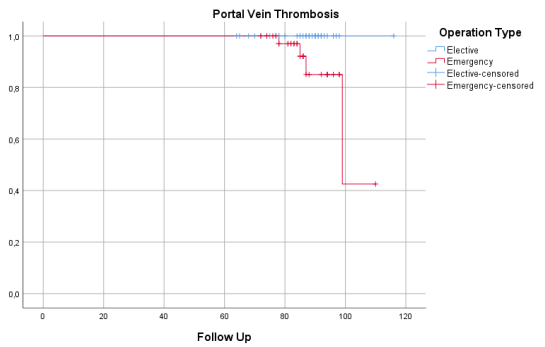

Figure 2: Development of portal vein thrombosis by type of surgery

DISCUSSION

Although the spleen is an important organ for the immune system and coagulation mechanisms, it can be compensated by other organs and tissues. Splenectomy may be performed as part of treatment or diagnosis in emergency or elective conditions, depending on the risk/benefit ratio. The indications for splenectomy in the patients included in our study were mostly splenic injuries and hematologic diseases.

The indication for splenectomy is made with a multidisciplinary approach by evaluating clinical, laboratory, and radiologic imaging studies. Szasz et al. also reported that the importance of complete blood count and computed tomography in the indication for splenectomy was higher than other tests (5). In our clinical practice, blood tests and radiological imaging are performed in all patients diagnosed by the hematology department and referred to us, and blood tests and all radiological imaging are performed in all patients admitted from the emergency department, unless there is hemodynamic instability.

Although the majority of patients (93.59%) had an uneventful postoperative follow-up, the most common complications were portal vein thrombosis (5.06%), bleeding (2.53%), and infection (1.26%). There was a difference in venous thrombosis between the two groups, with a statistically higher incidence of venous thrombosis in the group that underwent emergency splenectomy. A study by Dendle et al. found that venous thrombosis increased after splenectomy in both elective and emergency cases, regardless of the indication for surgery (6).

Apart from venous thromboembolism, the most common complications in our study group were infection and bleeding. Venous thromboembolism and other complications were evaluated on a patient-by-patient basis, and it was found that venous thromboembolism did not correlate with other complications in our study. In this context, the possibility of venous thromboembolism in the subgroup without postoperative complications, which was the majority of our patients, was also evaluated. Since

no additional imaging and testing was performed in this uncomplicated group, the relationship between venous thromboembolism, which may occur in the follow-up of patients, and the surgical procedure and technique used was evaluated. Crary et al. showed in a study that the risk of postoperative venous thromboembolism peaks in the first three weeks postoperatively and then the possibility of development decreases (3). Given the average length of hospital stay in our study, it is concluded that the number of patients missed, not imaged because of lack of suspicion, but who developed venous thromboembolism would not significantly change the data.

Fujita et al. reported a thrombosis frequency of 1.5% in splenectomies of hematologic origin (7). In a prospective analysis, Chaffanjon et al. reported thrombosis rate of 6.7% in sixty cases of open splenectomy. In another prospective analysis, Hassn et al. reported an incidence of venous thromboembolism of 10% in 50 cases of open splenectomy (8,9). Harris et al. examined laparoscopic techniques and found a 14% PVT rate in 17 individuals having elective splenectomy over a year (10). In 64 open, and 37 laparoscopic cases it was found that the incidence of portal vein thrombosis was 8%, with no discernible difference between the open and laparoscopic procedures (11). The findings of Tsamalaidze and colleagues, who reported a postoperative thrombosis rate of 6.6% in 229 splenectomized patients over 21 years, are consistent with this (12). Ikeda et al. showed that the incidence of portal vein thrombosis was statistically significantly higher in the CT images of patients who had undergone splenectomy (13). In our study, portal vein thrombosis was detected in 5 patients (5.06%) on control CT imaging, and the detection rate of this thrombosis was found to be higher in the first two months. Our study has a similar incidence of venous thromboembolism compared to case reports in the literature. Due to possible additional comorbidities, it has been observed that the risk of thrombosis is higher in emergent cases than in elective cases.

In our study, splenectomy was performed in all patients, including elective cases diagnosed by the hematology department. Laparoscopic surgery was not performed in any patient. However, in the literature, Segalini et al. performed laparoscopic surgery in 21 patients in a series of 202 patients with splenic trauma and reported a mortality rate of 2.5% and a morbidity rate of 7.7%. These rates are encouraging for laparoscopic surgery even in emergency situations (14). Di Buono et al. showed that laparoscopy was associated with a lower rate of reoperation and postoperative recurrence of anemia in a comparison of all surgical splenectomy techniques (15).

From a thrombosis standpoint, laparoscopic surgery is beneficial because it is associated with less trauma and quicker postoperative recovery than open surgery, but the incidence of venous stasis and thrombosis is significantly increased because the pneumoperitoneum created during laparoscopy changes the hemodynamics of the splenic portal venous system. Another study included 149 normal and cirrhotic patients undergoing laparoscopy and found that the risk of postoperative thrombosis was 32% in cirrhotic patients and 9.5% in patients without cirrhosis (16).

A systematic review was performed to investigate the effect of laparoscopy, especially non-splenectomy laparoscopic surgery with only intra-abdominal insufflation and pneumoperitoneum, on portal vein thrombosis. It has also been found in non-splenectomy surgical cases where laparoscopy was performed such as cholecystectomy, fundoplication, gastric bypass, appendectomy. In this review, James et al. found a dose-dependent relationship between insufflation pressures and venous stasis in laparoscopic cases (17).

CONCLUSION

In high-risk patients, venous thromboembolism is a rather frequent consequence following splenectomy. Although it may be fatal, anticoagulation is a viable treatment option. The presence of pain or fever after splenectomy is suggestive of venous thromboembolism. Due to the high risk of thromboembolism in the first two months, low-molecular-weight heparin should be considered for prophylactic anticoagulation in high-risk patients, and anticoagulation should be continued after the patient is sent home. Therefore, anticoagulation should be considered in emergency cases and especially in multiple trauma cases with difficult-to-control bleeding foci, taking into account the risk/benefit ratio, attention should be paid to possible venous thromboembolism. In this sense, our study supports the current data with its current results.

The single center and small number of patients are the limitations of our study. To evaluate the development of venous thromboembolism in patients undergoing splenectomy, to determine the risk factors, and to take appropriate preoperative or postoperative precautions, multicenter studies with larger groups of patients are needed.

Ethics Committee Approval: This study was approved by Ege University Clinical Research Ethics Committee, (Date: 21.09.2023, No: 23-9.1T/39).

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