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# A Comparison of Drug Regimens and Analysis of Effective Factors for Blood Transfusion and Intervention in Spontaneous Rectus Sheath Hematomas

## Spontan Rektus Kılıf Hematomları: İlaç Rejimlerinin Karşılaştırılması ve Kan Transfüzyonu ve Müdahalesi için Etkili Faktörlerin Analizi

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### ABSTRACT

**Objective:** Rectus sheath hematomas (RSH) are mostly observed in older patients with a high number of comorbidities. The use of anticoagulants is the most common risk factor for the disease. Our study aimed to determine the effect of the drug regimens and analyze the risk factors for blood transfusion and intervention in cases of RSH.

**Method:** The records of 46 patients who had been treated for RSH between January 2015 and March 2020 were analyzed retrospectively. The demographic data, drug usage, tomography findings, clinical courses, and morbidity and mortality rates of the patients were recorded. The findings were compared according to the drug regimens, and the risk factors for blood transfusion and intervention were determined.

**Results:** The mean erythrocyte transfusion (3.61 U), number of patients who underwent erythrocyte transfusion (77%), mean hematoma size (10.07 cm), and length of hospital stay (7.53 days) were higher in Group 1 (only using acetylsalicylic acid) patients ( $p = 0.002$ ,  $p = 0.011$ ,  $p = 0.016$ , and  $p = 0.004$ , respectively). The common risk factors for blood transfusion and intervention, however, were low hemoglobin levels, contrast extravasation and type-3 hematoma on computed tomography (CT), and long hospital stay.

**Conclusion:** RSH are usually treated conservatively. Blood transfusion, vascular embolization, and/or surgical treatment may be required. Only acetylsalicylic acid use, low hemoglobin levels, long hospital stay, and contrast extravasation, and type 3 hematoma on CT were associated with more blood transfusion and intervention.

**Keywords:** Rectus sheath, hematoma, conservatively, blood transfusion, vascular embolization

### Öz

**Amaç:** Rektus kılıfı hematomları (RKH) sıklıkla komorbiditesi yüksek yaşlı hastalarda görülmektedir. Antikoagülan kullanımı, hastalık için en yaygın risk faktörüdür. Bu çalışma, rektus kılıf hematomunda ilaç rejimlerinin etkisini belirlemeyi ve kan transfüzyonu ve müdahale için risk faktörlerini analiz etmeyi amaçlamaktadır.

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**Yöntem:** Ocak 2015 ile Mart 2020 arasında rektus kılıf hematomu nedeniyle tedavi edilen 46 hastanın dosyası geriye dönük olarak incelendi. Hastaların demografik verileri, ilaç kullanımı, bilgisayarlı tomografi (BT) bulguları, klinik seyirleri, morbidite ve mortalite oranları kaydedildi. Veriler hastaların kullandıkları ilaç rejimleri arasında karşılaştırıldı ve kan transfüzyonu ve müdahale için risk faktörleri belirlendi.

**Bulgular:** Ortalama eritrosit transfüzyonu (3,61 U), eritrosit transfüzyonu yapılan hasta sayısı (%77), ortalama hematom boyutu (10,07 cm) ve hastanede kalış süresi (7,53 gün) Grup 1'de daha yüksekti (sırasıyla;  $p = 0,002$ ,  $p = 0,011$ ,  $p = 0,016$ ,  $p = 0,004$ ). Kan transfüzyonu ve cerrahi veya girişimsel embolizasyon için etkili olan ortak risk faktörleri, düşük hemoglobin seviyeleri, BT anjiyografide kontrast ekstrasvazasyonu ve tip 3 hematom ve uzun hastanede kalışı olarak bulunmuştur.

**Sonuç:** Rektus kılıfı hematomları genellikle konservatif olarak tedavi edilir. Kan transfüzyonu, vasküler embolizasyon ve/veya cerrahi tedavi gerekebilir. Sadece asetilsalisilik asit kullanımı, düşük hemoglobin seviyeleri, uzun hastanede kalış, BT'de kontrast ekstrasvazasyon ve tip 3 hematom daha fazla kan transfüzyonu ve müdahalesi ile ilişkilendirildi.

**Anahtar kelimeler:** Rektus kılıf hematomu, konservatif tedavi, kan transfüzyonu, vasküler embolizasyon

## INTRODUCTION

Rectus sheath hematoma (RSH) is usually caused by damage to the superior and inferior epigastric arteries and their branches or directly to the rectus muscle <sup>(1)</sup>. Diagnosis of RSH may be difficult because patients mostly present with abdominal pain or an abdominal mass that may mimic many other conditions <sup>(2,3)</sup>. The disease is usually characterized by a benign course, but more serious problems including mortality have been reported in literature <sup>(3)</sup>. Oral anticoagulants are the most common risk factors associated with RSH. Other risk factors include antiplatelet, drugs pregnancy, hypertension, previous abdominal surgery, and hematological diseases <sup>(4,5)</sup>. The most common trigger factor is acute paroxysmal cough <sup>(1,4)</sup>. RSH is usually diagnosed by a good physical examination and abdominal USG and/or abdominal computed tomography (CT) imaging methods <sup>(6)</sup>. Abdominal CT is not only useful in the exclusion of other intra-abdominal pathologies but is also considered as a gold standard for the diagnosis of RSH with 100% specificity and sensitivity. RSH is generally managed conservatively. If the bleeding cannot be controlled, vascular embolization or surgical intervention may be required <sup>(6,7)</sup>.

Although the biggest risk factor for RSH has been stated as anticoagulant use, it may also develop by the use of antiplatelet drugs, such as acetylsalicylic acid (ASA) and clopidogrel, or in patients who do not use any drugs <sup>(1,4,8)</sup>. There are no studies in the relevant literature comparing the results of RSH cases caused by these drugs and the mortality and morbidity rates according to the drug types.

The present study aimed to examine the etiology of RSH, compare RSH cases according to the types of drugs used by the patients, and identify the risk factors in patients requiring interventions like blood transfusion and vascular embolization and/or surgery.

## METHOD

The records of patients treated for RSH between January 2015 and March 2020 were reviewed retrospectively. Patients > 18 years of age, patients with hematoma that developed due to the use of blood thinners, and patients with a hematoma that did not have an etiological cause or that developed due to strain of the rectus muscle caused by heavy load lifting, sports, and straining were included in the study. Patients < 18 years of age, patients exposed to penetrating or blunt trauma, and patients with RSH that developed after a medical intervention were excluded from the study. A total of 46 patients were included in the study.

The patients included in the study were divided into four groups. Patients who developed RSH due to the use of only ASA were named as Group 1, patients who developed hematoma due to the use of anticoagulants only as Group 2, patients with anticoagulant + clopidogrel use as Group 3, and patients without a history of drug use as Group 4. Patients' information, such as age, gender, body mass index (BMI), Charlson comorbidity indexes (CCI), laboratory values, tomography results, hematoma sizes, blood transfusion needs; intervention requirements, such as vascular embolization or surgery; length of hospital stay; and morbidity and mortality rates were recorded. In the tomography results, the size of the hematomas, whether there was extravasation, and the type of RSH were evaluated. Hematomas were divided into three types according to tomography findings. In type 1, the hematoma was unilateral and limited to the rectus muscle. In type 2, it could be unilateral or bilateral and could cause bleeding between the rectus muscle and transverse fascia. In type 3, the hematoma spread over the transverse fascia, peritoneum, and perivesical area <sup>(7)</sup>. The results were compared between the four groups.

To investigate the factors that affect blood transfusion and intervention needs, patients were divided into two groups as, those who were and could not be transfused and those who were and were not intervened. The results obtained were also compared between these groups, and the risk factors that increased the need for blood transfusion and intervention were determined.

### Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) 24.0 software was used for statistical analysis. Differences between the groups were tested using Pearson's chi-square test or Fisher's exact test for categorical variables, and one-way analysis of variance (ANOVA) and Kruskal-Wallis for continuous variables. The Pearson's chi-square, likelihood, Fisher's exact, and Kruskal-Wallis tests were used in the comparison between groups separated by drug use. The Pearson's chi-square, likelihood, Fisher's exact, and one-way ANOVA tests were used in the comparison between groups created to investigate the factors that affect blood transfusion and intervention needs. The results were considered statistically significant at  $p < 0.05$  and  $p < 0.01$ .

## RESULTS

### General Findings

The study included a total of 46 patients. Of the patients, 34 (74%) were female and 12 (16%) were male. The average age was 65.17 years, and the average BMI was 26.92. There was at least one comorbid disease in 40 (87%) patients, and the mean CCI was 4.47. While 33 (71.73%) of the patients had a history of drug use, 13 (28.2%) were not using any medication. Of the patients using drugs, 13 (28.2%) used only ASA, 11 (23.91%) used only anticoagulants, and 9 (19.5%) used anticoagulants and clopidogrel. Among patients who did not use any medication, two had anamnesis because of sports, three because of heavy lifting, one because of breast cancer, and one because of a hematological disease. No etiological cause was found in six patients. While 36 (78%) patients presented with complaints of abdominal pain, 28 (60%) patients presented with a mass in the rectus muscle and 9 (19.5%) patients with complaints of ecchymosis. RSH was located on the right side in 22 (47.8%) patients, on the left side in 20 (43.47%) patients, and bilaterally in four (8.69%) patients. The mean hematoma size on abdominal tomography was 8.30 cm. Contrast extravasation was detected in nine (19.5%) patients. Of these extravasations, six were caused by damage to the inferior epigastric artery, two to the superficial circumflex iliac artery, and one to

the superior epigastric artery. While 15 patients had type 1 RSH, 21 patients had Type 2, and 10 patients had type 3 RSH. Red blood cell (RBC) transfusion was performed in 21 patients, vascular embolization in 8 patients, and surgery in 2 patients. Vascular embolization had previously been applied to one of the patients who had undergone surgery. A total of 37 (80.43%) patients were successfully treated conservatively without the need for any intervention. The average length of hospital stay was 5.21 days. A total of six patients developed morbidity due to the following reasons: disseminated intravascular coagulation (DIC) in one patient, cardiopulmonary complication in one patient, and development of an abscess in four patients at the location of the hematoma. Mortality developed in two patients with DIC and cardiopulmonary complications (Table 1).

### Etiology and Comparison of the Types of Drugs that Cause RSH

The patients were divided into four groups according to their drug use and the type of drug used. Group 1 ( $n = 13$ ) comprised patients who used only ASA, Group 2 ( $n = 11$ ) of those who used anticoagulants, Group 3 ( $n = 9$ ) of those who used anticoagulants and clopidogrel, and Group 4 ( $n = 13$ ) of those who did not use drugs. Two of the patients using anticoagulants used low-molecular weight heparin, whereas the others used warfarin group drugs. The mean age and number of comorbid diseases of Group 4 were significantly lower compared to those in the other groups ( $p = 0.002$  and  $p = 0.001$ , respectively). The groups were similar in terms of gender and BMI. The mean hemoglobin values were significantly higher in Group 4 ( $p = 0.003$ ). The mean INR values were significantly higher in groups 2 and 3 ( $p = 0.001$ ). The mean platelet values were similar. The mean erythrocyte replacement (3.61 units), number of people who underwent erythrocyte replacement (10), mean hematoma size (10.07 cm), and length of hospital stay (7.53 days) were significantly higher in Group 1 patients ( $p = 0.002$ ,  $p = 0.011$ ,  $p = 0.016$ , and  $p = 0.004$ , respectively) than the other groups. The erythrocyte suspension and fresh frozen plasma (FFP) replacement were significantly less observed in Group 4 compared to the other groups ( $p = 0.011$  and  $p = 0.001$ , respectively). Other parameters were similar among the groups (Table 2).

### Factors Affecting Blood Transfusion

RBC erythrocyte suspension transfusion was performed in 21 (45.65%) patients. Older patients and those with high CCI had a significantly higher need for blood transfusion

( $p = 0.005$  and  $p = 0.001$ , respectively). The need for more erythrocyte suspension transfusion in patients using only ASA was statistically significant ( $p = 0.002$ ). Other statistically significant factors that increased the risk of

<b>Table 1. General findings and outcomes of patients with spontaneous rectus sheath hematoma</b>	
Mean age (SD)	65.17 (16.81)
Gender	
Male	12 (26%)
Female	34 (74%)
Mean BMI (kg/m <sup>2</sup> ) (SD)	26.92 (3.22)
Mean CCI (SD)	4.47 (2.42)
<b>Etiology (drug regimens)</b>	
ASA	13 (28.26%)
Anticoagulants	11 (23.91%)
Anticoagulant + clopidogrel	9 (19.56%)
No drug	13 (28.26%)
<b>Application complaints</b>	
Abdominal pain	36 (78%)
Abdominal mass	28 (60%)
Ecchymosis	9 (19.5%)
Mean hemoglobin level	9.83 mg/dL
Mean platelet level	250.954
Mean INR	2.09
<b>BT findings</b>	
Mean size (cm) (SD)	8.30 (4.04)
Vascular extravasation	9 (19.5%)
Type 1	15 (32.60%)
Type 2	21 (45.65%)
Type 3	10 (21.73%)
Mean RBC transfusion needed	1.84 U
RBC transfusion	21 (45.65%)
Mean FFP need	2.02 U
FFP transfusion	22 (47.82%)
Vascular embolization	9 (19.5%)
Surgery	2 (4.34%)
Morbidity	6 (13.4%)
Abscess	4 (8.69%)
Disseminated intravascular coagulation	1 (2.17%)
Cardiopulmonary complications	1 (2.17%)
Mortality	2 (4.34%)
Mean length of hospital stay (days) (SD)	5.21 (4.69)
RBC: Red blood cell, CCI: Charlson Comorbidity Index, ASA: Acetylsalicylic acid, FFP: Fresh frozen plasma, CT: Computed tomography, SD: Standard deviation	

blood transfusion were low mean hemoglobin values, FFP replacement, large mean hematoma size, type 3 RSH on CT, and contrast extravasation ( $p = 0.001$ ,  $p = 0.003$ ,  $p = 0.001$ ,  $p = 0.001$ ,  $p = 0.001$ , and  $p = 0.023$ , respectively). Additionally, more vascular embolization and longer hospital stay were statistically significant in patients who needed more blood transfusion ( $p = 0.009$  and  $p = 0.001$ , respectively) (Table 3).

### Factors Affecting Intervention

During the follow-up period, nine (19.5%) patients required intervention. Vascular embolization was performed in eight (17.3%) of these patients. Surgical intervention was performed in two patients. One patient who had undergone surgery had a history of vascular embolization. The vascular embolization success rate was 87.5% (7/8). The patient who had undergone surgery after vascular embolization developed mortality due to DIC on the 32<sup>nd</sup> postoperative day. This patient had 20 ERT and 20 TDP suspension replacements. Only vascular embolization was performed in the other patient who died. This patient was 93 years old and had multiple comorbidities. There was no decrease in hemogram after vascular embolization. Due to cardiopulmonary complications, the patient died on the eighth day of follow-up in the intensive care unit. The factors that statistically increased the risk of intervention were low mean hemoglobin and platelet values, a high need for blood transfusion, contrast extravasation on CT, type 3 hematoma, and long hospital stay ( $p = 0.045$ ,  $p = 0.011$ ,  $p = 0.007$ ,  $p = 0.0001$ ,  $p = 0.003$ , and  $p = 0.001$ , respectively) (Table 4).

### DISCUSSION

The incidence of RSH is approximately 0.0001% among all emergency department admissions<sup>(9)</sup>. The disease is mostly observed in elderly females with multiple comorbidities<sup>(1,4,6,10)</sup>. In line with the literature, 73% (34/46) of the patients were female in the present patient series, and 31 patients had at least one comorbid disease. The patients were generally of advanced age (mean age = 65.17 years). Due to RSH, patients were generally admitted to the emergency department with abdominal pain and sometimes with a mass that did not cross the midline due to the enlargement of the hematoma. Ecchymosis may also be observed among the clinical findings<sup>(1,11,12)</sup>. The most common cause of admission to the emergency department for patients in this study was abdominal pain. Of the patients, 78% (36) had abdominal pain, 60% (28) had a mass, and 19.5% (9) had ecchymosis.

The use of anticoagulants is the most common risk factor in the etiology of RSH<sup>(1)</sup>. Antiplatelet use, trauma, pregnancy,

surgical intervention, difficult exercises, cough attacks, and vascular diseases, such as constipation-related strain, atherosclerosis, and hypertension, are other risk factors effective in the development of RSH (12-16). In the present study, the use of anticoagulants was observed in 20 (43.47%) patients and was determined as the most common risk factor for RSH. A total of 13 (28.26%) patients were using ASA, and 9 (19.56%) patients were using clopidogrel. In the case of the patients without drug use anamnesis, three patients had performed heavy lifting activities, two patients had performed difficult exercises, one patient had breast cancer, and one patient had hematological disease anamnesis. No etiological factors were found in six patients. The disease might have been caused by excessive strain due to RSH cough attacks and/or constipation in these patients.

In the literature, there is no detailed study comparing drug regimens during RSH cases. In the study by Smithson et al. (10), anticoagulant drug subtypes were compared between patients treated conservatively and patients who underwent surgery, and the need for more intervention was found to be statistically significant in patients using low-molecular weight heparin. They thought this was due to the absence of an antidote to this drug (10). In the study by Warren et al. (8), drug regimens were compared in terms of blood transfusion and interventional radiology, and while there was no statistically significant difference between the patients in terms of the need for blood transfusion, patients using ASA were found to have a lower need for interventional radiology. In the comparison between drug regimens in this study, the need for more blood transfusions, larger hematoma

**Table 2. Etiology and comparison of the drug regimens that cause rectus sheath hematoma**

	<b>Group 1 (only ASA) (n = 13)</b>	<b>Group 2 (only anticoagulant) (n = 11)</b>	<b>Group 3 (anticoagulant + clopidogrel) (n = 9)</b>	<b>Group 4 (no drug) (n = 13)</b>	<b>p-value</b>
Mean age (SD)	72.00 (15.26)	73.54 (14.00)	66.60 (10.80)	50.23 (15.10)	<b>0.002</b>
<b>Gender</b>					
Male	3 (6.52%)	1 (2.17%)	4 (8.69%)	4 (8.69%)	0.303
Female	10 (21.73%)	10 (21.73%)	5 (10.86%)	9 (19.56%)	
Mean CCI (SD)	6.23 (2.12)	5.09 (1.51)	5.00 (0.70)	1.84 (1.99)	<b>0.001</b>
Mean BMI (kg/m <sup>2</sup> ) (SD)	25.61 (7.75)	26.90 (3.14)	26.11 (3.28)	28.92 (3.04)	0.060
Mean hemoglobin level (SD)	9.15 (1.80)	9.47 (1.02)	8.38 (1.70)	11.83 (2.23)	<b>0.003</b>
Mean platelet level (SD)	259.38 (155.21)	276.00 (55.66)	252.22 (79.90)	220.38 (94.70)	0.321
Mean INR level (SD)	1.19 (0.18)	3.63 (2.95)	3.03 (1.30)	1.05 (0.09)	<b>0.001</b>
Mean RBC transfusion (SD)	3.61 (5.60)	1.81 (2.78)	1.77 (1.92)	0.15 (0.55)	<b>0.002</b>
Per person RBC transfusion	10 (76.92%)	5 (45.45%)	5(55.5%)	1 (7.8%)	<b>0.011</b>
Mean FFP transfusion (SD)	2.92 (5.86)	2.36 (2.50)	3 (1.32)	0.15 (0.55)	<b>0.001</b>
Per person FFP transfusion	5 (38.46%)	7 (63.63%)	9(100%)	1 (4.54%)	<b>0.001</b>
Size of hematoma (SD)	10.07 (4.19)	9.72 (3.90)	7.66 (3.74)	5.76 (3.03)	<b>0.016</b>
<b>Hematoma types</b>					
Type 1	2 (4.34%)	3 (6.52%)	3(6.52%)	7 (15.21%)	0.078
Type 2	6 (13.04%)	5 (10.86%)	5(10.86%)	5 (10.86%)	
Type 3	5 (10.86%)	3 (6.52%)	1(2.17%)	1 (2.17%)	
Vascular extravasation	3 (23.07%)	3 (27.27%)	1(11.11%)	2 (15.38%)	0.777
Vascular embolization	3 (23.07%)	2 (18.18%)	1(11.11%)	2 (15.38%)	0.899
Surgery	2 (15.38%)	0	0	0	0.152
Total intervention	4 (30.76%)	2 (18.18%)	1(11.11%)	2 (15.38%)	0.669
Length of hospital stay (days) (SD)	7.53 (7.80)	5.09 (1.92)	4.66 (1.41)	3.38 (2.72)	<b>0.004</b>
Morbidity	4 (30.76%)	1 (9.09%)	1(11.11%)	0	0.086
Mortality	2 (15.38%)	0	0	0	0.152

RBC: Red blood cell, CCI: Charlson Comorbidity Index, ASA: Acetylsalicylic acid, FFP: Fresh frozen plasma, SD: Standard deviation

sizes, and longer hospital stay were found to be statistically significant in the patients using ASA. ASA irreversibly inhibits the cyclooxygenase (COX) pathway in platelets as an irreversible non-selective COX-inhibitor, preventing the formation of thromboxane-A2 and platelet aggregation, and this inhibition lasts for approximately 7 days of the platelet life. It has no other antidote <sup>(17)</sup>. Anticoagulants have an antidote called protamine sulfate, and vitamin K, FFP, and prothrombin complex concentrates may be used in case of an overdose. Vitamin K-dependent clotting factors allow de novo synthesis, whereas FFP and prothrombin complex concentrates provide complementary clotting factors, including C and S proteins in some preparations, and INR begins to decrease within 1-2 hours <sup>(18,19)</sup>. In the study by Fitzgerald et al. <sup>(20)</sup>, these methods were applied successfully to reverse the anticoagulant effect. The fact that we have

more agents to eliminate the anticoagulant effect causes the bleeding to stop earlier, and the need for blood is less in these patients, which is in contrast to patients who used ASA since no agent eliminates the effect of ASA and its duration of action continues for 7 days despite discontinuation of the drug. This might have caused more need for blood transfusion, larger hematoma sizes, and longer hospital stay. There was no significant difference between drug groups in terms of interventional procedures and the need for surgery. In the non-drug group, the mean age and CCI were significantly lower. The group that had the least need for enzyme replacement therapy was the non-drug group. In the literature, patients with RSH who did not use drugs were younger, which is compatible with the results of the present study <sup>(1,3)</sup>. Comparable data on mortality and morbidity due to RSH caused by different drug regimens could not be found

**Table 3. Factors affecting blood transfusion**

	<b>RBC transfusion (+) (n = 21)</b>	<b>RBC transfusion (-) (n = 25)</b>	<b>p-value</b>
Mean age (SD)	72.52 (14.40)	59.00 (16.44)	<b>0.005</b>
<b>Gender</b>			
Male	4 (19.04%)	8 (32%)	0.319
Female	17 (80.96%)	17 (68%)	
Mean BMI (kg/m <sup>2</sup> ) (SD)	26.04 (2.71)	27.72 (3.54)	0.119
Mean CCI (SD)	6.28 (1.38)	2.96 (2.05)	<b>0.001</b>
<b>Drug regimens</b>			
ASA	10 (47.61%)	3 (12%)	<b>0.002</b>
Anticoagulant	5 (23.80%)	6 (24%)	
Anticoagulant + clopidogrel	5 (23.80%)	4 (16%)	
No drug	1 (4.76%)	12 (48%)	
Mean hemoglobin levels (SD)	8.34 (1.47)	11.09 (1.84)	<b>0.001</b>
Mean platelet levels (SD)	257.95 (140.09)	245.04 (65.93)	0.834
Mean INR levels (SD)	1.87 (1.35)	2.28 (2.25)	0.447
FFP transfusion	14 (66.66%)	7 (28%)	<b>0.003</b>
<b>Hematoma types</b>			
Type 1	4 (19.04%)	11 (44%)	<b>0.001</b>
Type 2	8 (38.09%)	13 (52%)	
Type 3	9 (42.85%)	1 (4%)	
Vascular extravasation	7 (33.33%)	2 (8%)	<b>0.023</b>
Size of hematoma (cm) (SD)	10.47 (3.66)	6.48 (3.44)	<b>0.001</b>
Vascular embolization	7 (33.33%)	1 (4%)	<b>0.009</b>
Surgery	2 (9.52%)	0	0.203
Total intervention	8 (38.09%)	1 (4%)	<b>0.007</b>
Length of hospital stay (days) (SD)	7.42 (6.20)	3.36 (1.13)	<b>0.001</b>

RBC: Red blood cell, CCI: Charlson Comorbidity Index, ASA: Acetylsalicylic acid, FFP: Fresh frozen plasma, SD: Standard deviation

in the literature. In this study, the rates of mortality and morbidity were similar between the drug regimens.

Abdominal ultrasonography (USG) and computerized tomography are quite effective imaging methods for diagnosing RSH. The sensitivity of USG in the diagnosis of RSH is between 80% and 90%. Tomography is the best diagnostic imaging method, and its sensitivity and specificity values are 100%<sup>(16,21,22)</sup>. In this study, 34 patients underwent USG, and 28 (82.3%) patients were diagnosed by this method. Tomography was performed in 43 patients, and all patients (100%) could be diagnosed with RSH. The results of the present study were found to be compatible with the literature.

Regarding treatment, the severity of the RSH is important, and bed resting and analgesic treatment may be sufficient in clinically stable patients<sup>(3)</sup>. In large hematomas, fluid resuscitation and blood transfusion may be performed in hemodynamically unstable patients, and it is also

recommended that anticoagulants and antiplatelets are discontinued<sup>(3,8)</sup>. Vascular embolization or surgical treatment options should be considered in cases where conservative treatment is unsuccessful<sup>(3,10)</sup>. Surgical treatment should not be chosen as the first option because draining the hematoma eliminates the tamponade effect and may cause more bleeding<sup>(23)</sup>. Vascular embolization should be the first treatment of choice in patients who do not respond to conservative treatment<sup>(23,24)</sup>. In this study, 37 (80.4%) patients were treated conservatively. Their anticoagulants and antiplatelets were cut. Fluid resuscitation and, if needed, blood transfusion in those who used anticoagulants, FFP replacement, and vitamin K were applied. When INR dropped below 2.5 in patients using anticoagulants, low-molecular weight heparin was initiated if the patients were hemodynamically stable. In the study by Sheth et al.<sup>(3)</sup>, 80% of patients were treated conservatively, which is in accordance with the current results. In the study by Cherry

**Table 4. Factors affecting the intervention**

	Intervention (+) (n = 9)	Intervention (-) (n = 37)	p-value
Mean age (SD)	65.11 (19.24)	65.18 (16.47)	0.870
<b>Gender</b>			
Male	2 (22.22%)	10 (27.02%)	0.765
Female	7 (77.77%)	27 (72.97%)	
Mean BMI (SD)	26.55 (2.40)	27.05 (3.46)	0.828
Mean CCI (SD)	5.33 (2.23)	4.22 (2.45)	0.169
<b>Drug regimens</b>			
ASA	4 (44.44%)	9 (24.32%)	0.669
Anticoagulant	2 (22.22%)	9 (24.32%)	
Anticoagulant + clopidogrel	1 (11.11%)	8 (21.62%)	
No drug	2 (22.22%)	11 (29.72%)	
Mean hemoglobin level (SD)	8.55 (2.05)	10.15 (2.09)	<b>0.045</b>
Mean platelet level (SD)	175 (98.87)	269.40 (99.45)	<b>0.011</b>
Mean INR (SD)	1.72 (1.64)	2.19 (1.95)	0.567
Mean RBC transfusion (SD)	6.55 (5.85)	0.70 (1.102)	<b>0.007</b>
Per person RBC transfusion	8 (88.88%)	13 (35.13%)	<b>0.001</b>
Per person FFP transfusion	7 (77.77%)	15 (40.54%)	<b>0.003</b>
Vascular extravasation	8 (88.88%)	1 (2.70%)	<b>0.0001</b>
Size of hematoma (SD)	9.22 (2.04)	8.08 (4.38)	0.217
<b>Hematoma types</b>			
Type 1	0 (0%)	15(40.5%)	<b>0.003</b>
Type 2	3 (33.33%)	18(48.64%)	
Type 3	6 (66.66%)	4(10.81%)	
Mean Length of hospital stay (day) (SD)	10.00 (8.94)	4.05 (1.61)	<b>0.001</b>

RBC: Red blood cell, CCI: Charlson Comorbidity Index, ASA: Acetylsalicylic acid, FFP: Fresh frozen plasma, SD: Standard deviation

et al. <sup>(1)</sup>, however, 92% of patients were successfully treated conservatively only by observation or medically.

When conservative treatment is unsuccessful, the first-line treatment is vascular embolization, and success rates have been reported to be between 70% and 98% <sup>(1,25-28)</sup>. In the present study, vascular embolization was successful in 7 of 8 patients (87.5%), which is consistent with the literature. Open surgery was performed in two patients. Blood transfusions to the patients were reported at various rates in the literature. In the study by Warren et al. <sup>(8)</sup>, 80% of patients had blood transfusions. In the study by Smithson et al. <sup>(10)</sup>, blood transfusion was needed at a rate of 50%. In another study, blood transfusions were reported at a rate of 39% <sup>(1)</sup>. In the present study, blood transfusion was performed in 45% of the patients. In the study by Warren et al. <sup>(8)</sup>, the only statistically significant predictive factor for blood transfusion was "shock." No statistically significant difference was found in comparisons made among drug regimens, age, and comorbidities. In the study by Smithson et al. <sup>(10)</sup>, statistically more blood transfusions were performed in patients requiring intervention. In the study by Karapolat et al. <sup>(29)</sup>, a comparison was made in terms of blood transfusion according to hematoma types in tomography, and it was seen that the need for blood transfusion was similar in all types. In the present study, contrary to the literature, it was found that blood transfusion was statistically significant in older patients with high CCI values, patients using only ASA, patients with contrast extravasation on CT, patients with wider and type 3 hematoma, and patients requiring intervention. In the study by Cherry et al. <sup>(1)</sup>, an average of 3.5 U of erythrocyte suspension replacement was reported in patients requiring blood transfusion. In the present study, an average of 4 U of erythrocyte suspension replacement was performed in patients requiring blood transfusion.

Risk factors for intervention have been reported in a small number of studies <sup>(8,10)</sup>. In the study by Warren et al. <sup>(8)</sup>, the need for intervention was less in the group using ASA, whereas factors such as age, comorbid diseases, and blood transfusion requirement did not increase the need for intervention. Smithson et al. <sup>(10)</sup> found that the need for intervention was higher in patients using low-molecular weight heparin, patients with the clinical picture of shock, patients who underwent blood transfusion, and patients with longer hospital stay. In the study by Baekgaard et al. <sup>(30)</sup>, the risk factors for intervention were extravasation on CT and pain in the flank area. In the present study, low mean

hemoglobin and platelet levels, blood transfusion, contrast extravasation, type 3 hematoma, and long hospital stay were statistically significant risk factors for intervention.

The mean length of hospital stay has been reported in the literature at intervals ranging from 8 to 25 days <sup>(10,20,29)</sup>. In this study, the mean length of hospital stay was less than that in the literature at 5.2 days. Factors prolonging the mean length of the hospital stay were ASA use, blood transfusion, and intervention.

Mortality is rarely seen in RSH cases, and several cases have been reported in studies till date <sup>(1,10)</sup>. In the study by Sheth et al. <sup>(3)</sup>, the mortality rate was reported as 0%. In the study by Warren et al. <sup>(8)</sup>, 13 patients died, but none were reported to die due to the bleeding. In the case series by Fitzgerald et al. <sup>(20)</sup> comprising 7 patients, mortality was reported in a patient using ASA. A total of two patients died in the present study. These two patients were in the group using ASA only. Despite surgery and vascular embolization, bleeding could not be brought under control in one patient, and mortality developed due to the DIC, clinical picture due to excessive blood transfusion. In the other patient, mortality due to cardiopulmonary complications developed due to comorbidities.

## CONCLUSION

In conclusion, the comparison of drug regimens revealed that hematoma size was wider, more blood transfusions were needed, and the length of hospital stay were longer in patients who used ASA and that these patients had a worse prognosis than patients who were using other drug regimens. Only ASA use, low hemoglobin levels, long hospital stay, contrast extravasation, and type 3 hematoma on CT were associated with more blood transfusion and intervention. Larger multicenter studies are needed to identify risk factors affecting the prognosis of RSHs and to be an effective guide in their treatment.

## Ethics

**Ethics Committee Approval:** Ethical approval from the local ethics committee (2020-299/06.07.2020) was obtained.

**Informed Consent:** Is a retrospective study.

**Peer-review:** Externally peer reviewed.

## Authorship Contributions

Concept: A.S., M.A.B., B.A., T.D., E.G., S.F., H.A., A.K., M.K., Design: A.S., M.A.B., B.A., T.D., E.G., S.F., H.A., A.K., M.K., Writing: A.S., M.A.B., B.A., T.D., E.G., S.F., H.A., A.K., M.K.



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