

# How has the COVID-19 pandemic changed the diagnosis of rectus sheath hematoma and its follow-up?

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## ABSTRACT

**BACKGROUND:** There has been an increased incidence of rectus sheath hematoma (RSH) due to chronic cough attacks and anti-coagulant therapy due to the COVID-19 pandemic. The present study aims to determine, in which parameters differ before and during the diagnosis of RSH in COVID-19 patients and what may be expected during diagnosis and follow-up.

**METHODS:** Thirty-five patients diagnosed with RSH were evaluated retrospectively between March 2016 and March 2021. The COVID-19 group comprised 11 patients. Various information including patient history and time of discharge/death were retrieved and compared between the experimental groups.

**RESULTS:** The rates of hypotension on admission ( $p=0.011$ ) and the rates of defense and rebound ( $p=0.030$ ) were higher in the patients with COVID-19 than in those without. Although there was no difference in terms of bleeding width, there was a greater decrease in the hemoglobin levels ( $p=0.009$ ) in the COVID-19 patients and the need for erythrocyte suspension ( $p=0.040$ ) increased significantly in that group.

**CONCLUSION:** The present study constitutes the first evaluation of RSH in COVID-19 patients. The clinical situation is serious due to high rates of hypotension, defense or rebound, and decreases in hemoglobin levels in COVID-19 patients. This makes the clinical management of RSH more difficult, resulting in longer hospitalization. Despite these difficulties, COVID-19 infection does not increase morbidity or mortality.

**Keywords:** Anticoagulant therapy; COVID-19; morbidity; mortality; rectus sheath hematoma.

## INTRODUCTION

In December 2019, the first cases of COVID-19 – which is caused by severe acute respiratory syndrome coronavirus 2 – were reported in Wuhan, China. A COVID-19 pandemic was declared on March 11, 2020 when the first case was seen in Turkey. The World Health Organization has received confirmed reports of 125,160,255 cases of COVID-19, including 2,748,737 deaths.<sup>[1]</sup> The authors of multiple studies have examined clinical and epidemiological aspects of the disease.<sup>[2-4]</sup> The literature suggests that COVID-19 infection provokes arterial and venous thrombotic events.<sup>[5]</sup> Interestingly, although anticoagulation therapy – such as the administra-

tion of low-molecular-weight heparin (LMWH) – is routinely used to prevent further thrombus formation, the potential for bleeding also increases.<sup>[6]</sup>

Rectus sheath hematoma (RSH) is a rare clinical condition that is most prevalent in elderly patients who are prone to bleeding.<sup>[7]</sup> The most common cause of RSH is the use of anticoagulant therapy. LMWH, which is one of the options of anticoagulant therapy, is routinely used to prevent arterial and venous thrombotic events in patients diagnosed with COVID-19. However, there is a risk of RSH due to the presence of chronic diseases, coughing attacks due to COVID-19, pneumonia, and anticoagulant therapy.

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In the present study, the clinical characteristics of patients who were hospitalized with COVID-19 and who developed RSH during follow-up were evaluated. The clinical characteristics of these patients were compared with those of patients who had developed RSH before the COVID-19 pandemic. The effects of COVID-19 disease on the clinical aspects of RSH were evaluated.

## MATERIALS AND METHODS

### Patients

Patients who were diagnosed with RSH whilst receiving treatment in Erzurum Regional Training and Research Hospital were included in the study. RSH patients diagnosed between March 2016 and March 2020 were placed in the COVID-19-negative group (the non-COVID-19 group), whereas RSH patients diagnosed with COVID-19 between March 2020 and March 2021 were placed in the COVID-19-positive group (the COVID-19 group). Patients in the pediatric age group (0–18 years) and patients who were diagnosed and treated at external centers before admission to our center were excluded from the study.

Each patient's demographical data (gender, age), medical history (presence of hypertension, diabetes mellitus, atrial fibrillation, and any heart disease), history of abdominal surgery, history of anticoagulant therapy, physical examination findings, laboratory test results (such as blood counts and platelet counts), international normalized ratio value, first diagnostic tool used, radiological examination findings obtained by computed tomography (CT), length of hospitalization, treatment method used (surgical approach, conservative approach, or blood transfusions) and outcomes, mortality, and cause of mortality were retrospectively retrieved from the hospital's computer system and the imaging archives in the patient's medical records. CT was used to confirm the results obtained when ultrasonography (USG) was used as the first diagnostic tool. The medical and surgical methods used to treat the patients were included, and the consequent morbidity and mortality rates were evaluated. The collected data were compared between the COVID-19 and non-COVID-19 groups.

### Statistical Analysis

Statistical evaluations were carried out using SPSS v22.0 software (IBM, Armonk, NY, USA). The normality distributions of quantitative variables were checked using the Shapiro–Wilk test. Either an independent t-test or a Mann–Whitney U-test was used according to the results of the Shapiro–Wilk test. A Chi-square test was used to compare qualitative variables. Differences with P-values below 0.05 were considered statistically significant.

Ethical approval was obtained from the Non-invasive Clinical Research Ethics Committee of Erzurum Regional Training and Research Hospital (decision number: 2021/05-114).

## RESULTS

Before the COVID-19 pandemic (between March 2016 and March 2020), 24 patients were diagnosed with RSH; during the pandemic, 11 patients were diagnosed with RSH. Therefore, a total of 35 patients were included in the study.

The mean age of the patients was  $68.20 \pm 17.36$  years (range: 22–92 years), and the female/male ratio (22/13) was 1.69. A total of 29 patients (82.9%) had some form of comorbidity. The most frequent comorbidity disorder was a heart disease, with a rate of 74.3% (n=26). The rates of cardiac disease and hypertension were higher in the COVID-19 group than in the non-COVID-19 group.

A total of 24 patients (68.6%) received some form of anti-coagulant or antiplatelet therapy. The drugs used before the diagnosis of RSH are shown in Table 1. Pre-diagnosis anti-coagulant or antiplatelet use was higher in the COVID-19 group than in the non-COVID-19 group, regardless of drug type. In addition, LMWH was used to treat all the COVID-19 patients. One patient (2.85%) had undergone inguinal hernia repair by the abdominal approach and one patient had experienced an abdominal aortic aneurysm.

The most frequent sign or symptom was abdominal pain (in 33 patients, 94.3%), followed by the presence of an abdominal wall mass (in 20 patients, 57.1%). Physical examination revealed that 16 patients (45.7%) experienced defense and rebound. Hypotension was present in 14 patients (40%). Abdominal wall ecchymosis was observed on the abdominal skin in 12 patients (34.3%). Hypotension severity and prevalence of defense and rebound were higher in the COVID-19 group than in the non-COVID-19 group. However, we think that the clinical picture of RSH in COVID-19 patients is more severe than indicated by the results that we obtained.

According to the laboratory evaluation, the mean platelet count was lower in the patients with COVID-19 ( $p=0.004$ ). With regard to the radiological evaluation, RSH was preferably diagnosed by CT scan in the COVID-19 group to prevent the spread of infection between patient and radiologist (52.6% vs. 6.3%) ( $p=0.003$ ). The first radiological method used for diagnosis was USG in 16 patients and CT in 19 patients. An evaluation of the radiological findings did not reveal any difference between the methods used. With regard to the localization of hematomas, RSH presented on the right side in 18 patients (51.4%) and on the left side in 17 patients (48.6%). Furthermore, there were no bilateral hematomas. RSH presented in the lower quadrant in 28 patients (80%) and in both the lower and upper quadrants in eight patients (20%). Moreover, the hematoma area (width  $\times$  height) was the same in both groups according to the statistical evaluation. A comparison of the laboratory values and radiological findings regarding the RSH groups is presented in Table 2.

**Table 1.** Comparison of the patients' demographical data and medical history regarding the RSH groups

Clinical parameters	Value	COVID-19 group (n=11)	Non-COVID-19 group (n=24)	p-value
	n (%)	n (%)	n (%)	
Age (mean, years)	68.20	67.33	70.09	0.958*
Gender				>0.999**
Male	13 (37.1)	4 (30.8)	9 (69.2)	
Female	22 (62.9)	7 (31.8)	15 (68.2)	
Comorbid disease				0.640**
Yes	29 (82.9)	10 (34.5)	19 (65.5)	
No	6 (17.1)	1 (16.7)	5 (83.3)	
Any cardiac disease				0.033**
Yes	26 (74.3)	11 (42.3)	15 (57.7)	
No	9 (25.7)	0 (0)	9 (100)	
Hypertension				0.004**
Yes	16 (45.7)	9 (56.3)	7 (43.8)	
No	19 (54.3)	2 (10.5)	17 (89.5)	
Diabetes mellitus				>0.999**
Yes	13 (37.1)	4 (30.8)	9 (69.2)	
No	22 (62.9)	7 (31.8)	15 (68.2)	
Atrial fibrillation				0.685**
Yes	9 (25.7)	2 (22.2)	7 (77.8)	
No	26 (74.3)	9 (34.6)	17 (65.4)	
Chronic obstructive pulmonary disease				>0.999**
Yes	7 (20)	2 (28.6)	5 (71.4)	
No	28 (80)	9 (32.1)	19 (67.9)	
Cerebrovascular disease				0.157
Yes	5 (14.3)	0 (0)	5 (100)	
No	30 (85.7)	11 (36.7)	19 (63.3)	
Bypass history				0.314**
Yes	1 (2.9)	1 (100)	0 (0)	
No	34 (97.1)	10 (29.4)	24 (70.6)	
Any anticoagulant or antiplatelet therapy				0.007**
Yes	24 (68.6)	11 (45.8)	13 (54.2)	
No	11 (31.4)	0 (0)	11 (100)	
Type of anticoagulant or antiplatelet therapy				<0.001**
Low molecular weight heparin				
Yes	17 (48.6)	11 (64.7)	6 (35.3)	
No	18 (51.4)	0 (0)	18 (100)	
Acetylsalicylic acid				0.640**
Yes	6 (17.1)	1 (16.7)	5 (83.3)	
No	29 (82.9)	10 (34.5)	19 (65.5)	
Clopidogrel				>0.999**
Yes	5 (14.3)	1 (20)	4 (80)	
No	30 (85.7)	10 (33.3)	20 (66.7)	
Rivaroxaban or apixaban				>0.999**
Yes	3 (8.6)	1 (33.3)	10 (31.3)	
No	32 (91.4)	2 (66.7)	22 (68.7)	
Warfarin				>0.999**
Yes	2 (5.7)	0 (0)	2 (100)	
No	33 (94.3)	11 (33.3)	22 (66.7)	

\*Mann-Whitney U Test, \*\*Chi-Square Test. RSH: Rectus sheath hematoma.

**Table 2.** Comparison of the patients' symptoms & signs, laboratory values and radiological findings regarding the RSH groups

Clinical parameters	Value	COVID-19 group (n=11)	Non-COVID-19 group (n=24)	p-value
	n (%)	n (%)	n (%)	
Symptoms & signs on admission				
Abdominal pain and tenderness				
Yes	33 (94.3)	10 (30.3)	23 (69.7)	0.536*
No	2 (5.7)	1 (50)	1 (50)	
Abdominal mass				
Yes	20 (57.1)	6 (30)	14 (70)	>0.999*
No	15 (42.9)	5 (33.3)	10 (66.7)	
Defense and rebound				
Yes	16 (45.7)	8 (50)	8 (50)	0.030*
No	19 (54.3)	3 (15.8)	16 (84.2)	
Hypotension				
Yes	14 (40)	8 (57.1)	6 (42.9)	0.011*
No	21 (60)	3 (14.3)	18 (85.7)	
Ecchymosis				
Yes	12 (34.3)	5 (41.7)	7 (58.3)	0.451*
No	23 (65.7)	6 (26.1)	17 (73.9)	
Laboratory parameters (mean, at the time of RSH diagnosis)				
White blood cell (10 <sup>3</sup> /mm <sup>3</sup> )	10.08	11.29	9.52	0.472**
Hemoglobin (g/dL)	12.58	12.64	12.55	0.903***
Platelet (10 <sup>3</sup> /mm <sup>3</sup> )	227.7	167	255.5	0.004**
International normalized ratio	1.28	1.35	1.25	0.687**
Radiology				
First diagnostic tool				
Ultrasonography	16 (45.7)	1 (6.3)	15 (93.8)	0.003*
Computed tomography	19 (54.3)	10 (52.6)	9 (47.4)	
Side of the hematoma				
Right	18 (51.4)	6 (33.3)	12 (66.7)	>0.999*
Left	17 (48.6)	5 (29.4)	12 (70.6)	
Location of the hematoma				
Below Umbilicus	28 (80)	10 (35.7)	18 (64.3)	0.392*
Below and Upper Umbilicus	7 (20)	1 (14.3)	6 (85.7)	
Hematoma area (cm <sup>2</sup> )	66.94	57.63	71.21	0.793*

\*Chi-Square Test, \*\*Mann-Whitney-U Test, \*\*\*Independent T-Test. RSH: Rectus sheath hematoma.

The mean duration of hospitalization was 22.14±14.24 days (range: 3–72 days). During follow-up, surgical procedures were performed on only three patients (8.6%), whereas 32 patients (91.4%) were managed conservatively. Both the decreases in hemoglobin levels and the requirement for erythrocyte suspension were higher in the COVID-19 group, but there was no difference in the requirement for fresh frozen plasma (FFP) between the groups.

There were complications during follow-up in eight patients (22.9%), multi-organ failure in three patients, acute renal failure in two patients, intra-abdominal bleeding in two patients, and myocardial infarction in one patient. Nine patients died (a mortality rate of 25.7%) – 5 of whom were in the COVID-19 group – and 26 patients were discharged. The presence of COVID-19 exacerbated the clinical severity of RSH but did not increase the rates of morbidity or mortality. However,

**Table 3.** Comparison of clinical outcomes of rectus sheath hematoma patients' groups

Clinical parameters	Value	COVID-19 group (n=11)	Non-COVID-19 group (n=24)	p-value
	n (%)	n (%)	n (%)	
Hemoglobin decrease (mean, g/dL)	4.26	5.34	3.77	0.009*
ES replacement (mean, units)	5.51	7.72	4.5	0.040*
FFP replacement (mean, units)	5.8	5.72	5.83	0.390*
Treatment				0.536**
Conservative	32 (91.4)	11 (34.4)	31 (65.6)	
Surgery	3 (8.6)	0 (0)	3 (100)	
Morbidity				0.077**
Yes	8 (22.9)	5 (62.5)	3 (37.5)	
No	27 (77.1)	6 (22.2)	22 (77.8)	
Mortality				0.103**
Yes	9 (25.7)	5 (55.6)	4 (44.4)	
No	26 (74.3)	6 (23.1)	20 (76.9)	
LOS (mean, day)	22.14	28.27	19.33	0.047*

\*Mann-Whitney U Test, \*\*Chi-Square Test. RSH: Rectus sheath hematoma; ES: Erythrocyte suspension; FFP: Fresh frozen plasma; LOS: Length of stay.

the length of stay was prolonged by COVID-19 infection. The outcomes of RSH are shown in Table 3 for both the COVID-19 and non-COVID-19 groups (28.27 days vs. 19.33 days).

## DISCUSSION

RSH accounts for 2% of unexplained cases of abdominal pain. Clinical presentation, physical examination, medical history, and drug use should be scrutinized carefully to ensure the correct diagnosis.<sup>[8]</sup> We predict that the incidence of RSH will increase in the future due to severe coughing attacks and the use of anti-coagulant drugs resulting from the COVID-19 pandemic. In the present study, we aimed to determine the effects of the COVID-19 pandemic on the diagnosis, treatment, and follow-up associated with RSH.

We found that no such study has been reported in the literature to date. We have only identified a few reports of COVID-19 cases, in which RSH was subsequently diagnosed during the follow-up. Therefore, in the present study, we aimed to determine, in which parameters should be considered when RSH develops in COVID-19 patients, and what can be expected during diagnosis and treatment.

If RSH is suspected in a patient with or without COVID-19 infection, the diagnosis should be based on patient history, physical examination, and the findings from USG and CT scans. Early diagnosis and conservative treatment can avoid the need for surgical intervention, even in the case of a large hematoma. Surgical procedures may be necessary in cases, where hemodynamic stability cannot be achieved, or when

there are symptoms of compression and compartmentalization. RSH patients with hemodynamic imbalances are often of advanced age, and the mortality rates in such patients are high (ranging from 4% to 25%). Therefore, early diagnosis and appropriate clinical treatment will reduce mortality rates.

In the absence of COVID-19, RSH often occurs in the 5<sup>th</sup> or 6<sup>th</sup> decade and is more common in females.<sup>[9]</sup> The mean age of the RSH patients with COVID-19 was slightly lower than the mean age of those without COVID-19, but the difference was not statistically significant. However, the gender distribution was similar to that before the pandemic.

Comorbid diseases and anticoagulation therapy are the most important factors that directly affect the occurrence of RSH. Severe coughing and a history of surgery are also important factors. In the present study, the rates of occurrence of any heart disease and hypertension were higher in the COVID-19 group than in the non-COVID-19 group. The use of anticoagulants and anti-platelet drugs was similar in both groups. However, the use of LMWH was noticeably greater in the COVID-19 patients.

The most frequent signs or symptoms were abdominal pain and the presence of an abdominal mass. Symptoms of peritoneal irritation – such as defense and rebound, tachycardia, and hypotension – were less common. Although there was no difference between the groups in terms of abdominal pain and abdominal mass, the rates of defense, rebound, and hypotension were higher in the COVID-19 group than in the non-COVID-19 group. These results suggest that clinical RSH is more severe in COVID-19 patients.

In the laboratory evaluation of the RSH patients at the time of diagnosis, only the platelet count was affected by COVID-19. The platelet count was lower in the COVID-19 group. However, the half-life of platelets is 10 days on average. The lower platelet count in the COVID-19 group suggests that COVID-19 infection either stimulates platelet destruction or affects the bone marrow. This requires further investigation. Both USG and CT are effective imaging methods for the diagnosis of RSH.<sup>[10]</sup> However, in the present study, CT scanning emerged as the preferred method for RSH diagnosis in COVID-19 patients. We attribute this to the fact that there is contact between the infected patient and the radiologist during USG and consequently a desire to reduce the risk of COVID-19 transmission. We also found that neither hematoma location nor hematoma width differed between the two groups.

In most RSH patients with or without COVID-19 infection, conservative treatment – the first choice during follow-up – is sufficient for the elimination of predisposing factors. Conservative methods include bed rest, analgesia, intravenous fluid resuscitation, the application of ice packs, compression, blood transfusions, and the correction of coagulopathy. After the discontinuation of anticoagulant and antithrombotic therapies, it is recommended that coagulation disorders be corrected with Vitamin K, FFP, and protamine sulfate; blood replacement is also recommended.<sup>[7,11]</sup>

Decreases in hemoglobin levels were greater in the COVID-19 group than in the non-COVID-19 group. In total, 193 units (median 5.51 units) of red blood cells (RBC) were given to 29 patients (82.9%). In total, 203 units (median 5.8 units) of RBC were given to 28 patients (80%). The COVID-19 patients required significantly more RBC: the mean requirements were 7.72 units in the COVID-19 group and 4.5 units in the non-COVID-19 group. However, the FFP requirements were similar in the two groups: the mean requirements were 5.72 units in the COVID-19 group and 5.83 units in the non-COVID-19 group.

Surgery should be considered in patients with severe bleeding, in those who are hemodynamically unstable despite blood transfusion, and in those who have compression symptoms and abdominal compartmentalization, because a decrease in pressure in the hematoma can lead to more severe bleeding.<sup>[12]</sup> Unfortunately, surgery is mandatory in this group of patients.<sup>[13,14]</sup> In the present study, three patients (8.6%) with hemodynamic instability and enlarged hematomas underwent surgical procedures (bleeding control by vascular ligation). There was no morbidity or mortality in any of the patients who underwent surgery during follow-up.

According to several studies, the mortality rate in RSH patients ranges from 0% to 14.7%.<sup>[10,11]</sup> The morbidity and mortality rates in the present study were 22.9% and 25.7%, respectively. In one previous study, the length of hospital stay

ranged from 4 to 10 days.<sup>[15]</sup> Contrary to the data presented in the literature, the length of hospital stay was longer in both groups (mean 22.14 days) in the present study. However, the RSH patients with COVID-19 spent longer in the hospital than those without COVID-19 (28.27 days vs. 19.33 days). An important finding of the present study was that COVID-19 infection had no effect on morbidity or mortality but did extend the time spent in hospital.

## Conclusion

For patients with RSH, the rates of cardiac disease and hypertension were higher in the COVID-19 group than in the non-COVID-19 group. Furthermore, regardless of the type of blood thinner used, the use of anticoagulants – especially LMWH – was higher in the COVID-19 group. The clinical situation is serious due to the high prevalence of hypotension and defense or rebound. Although there was no difference in terms of bleeding width, the decrease in hemoglobin levels was higher in the COVID-19 patients and the requirement for erythrocyte suspension also increased significantly in that group. This situation makes the clinical management of RSH more difficult and prolongs hospitalization. However, despite all these difficulties, COVID-19 infection does not increase morbidity or mortality.

**Ethics Committee Approval:** This study was approved by the Erzurum Regional Training and Research Hospital Clinical Research Ethics Committee (Date: 01.03.2021, Decision No: 2021/05-114).

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**Conflict of Interest:** None declared.

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## ORJİNAL ÇALIŞMA - ÖZ

### COVID-19 pandemisi rektus kılıf hematomu tanısını ve takibini nasıl değiştirdi?

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**AMAÇ:** COVID-19 pandemisi nedeniyle kronik öksürük atakları ve antikoagülan tedavi nedeniyle rektus kılıf hematomu (RKH) insidansında artış olmuştur. Bu çalışma, COVID-19 hastalarında RKH tanısı öncesi ve sırasında hangi parametrelerin farklılık gösterdiğini ve tanı ve takip sırasında neler beklenebileceğini belirlemeyi amaçlamaktadır.

**GEREÇ VE YÖNTEM:** Mart 2016 ile Mart 2021 arasında RKH tanısı alan 35 hasta geriye dönük olarak değerlendirildi. COVID-19 grubu 11 hastadan oluşuyordu. Hastaların geçmişi ve taburculuk/ölüm zamanı dahil üzere çeşitli bilgileri alındı ve deney grupları arasında karşılaştırıldı.

**BULGULAR:** COVID-19'lu hastalarda, başvuru sırasında hipotansiyon oranları ( $p=0.011$ ) ve defans ve rebound ( $p=0.030$ ) oranları, olmayanlara göre daha yüksekti. Kanama genişliği açısından fark olmamasına rağmen, COVID-19 hastalarında hemoglobin düzeylerinde ( $p=0.009$ ) daha büyük bir düşüş oldu ve o grupta eritrosit süspansiyonu ihtiyacı ( $p=0.040$ ) anlamlı olarak arttı.

**TARTIŞMA:** Bu çalışma, COVID-19 hastalarında RKH'nun ilk değerlendirmesini oluşturmaktadır. COVID-19 hastalarında yüksek hipotansiyon, defans veya rebound oranları ve hemoglobin seviyelerindeki düşüşler nedeniyle klinik durum ciddidir. Bu, RKH'nun klinik yönetimini daha da zorlaştırarak daha uzun hastanede yatışla sonuçlanır. Bu zorluklara rağmen, COVID-19 enfeksiyonu morbidite veya mortaliteyi artırmaz.

**Anahtar sözcükler:** Antikoagülan tedavi; COVID-19; morbidite; mortalite; rektus kılıf hematomu.

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