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COVID 19-Related Life-Threatening Spontaneous Retroperitoneal Bleeding: Therapeutic Modalities and Prognostic Factors of Mortality: A Retrospective Observational Study in An Isolation University Hospital

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ABSTRACT

Background: COVID-19 infection was linked to an increased risk of thromboembolism in high-risk individuals, so different anticoagulants were employed at varying doses. Anticoagulant-induced spontaneous retroperitoneal bleeding (SRB) is a rare condition.

Objective: To analyze spontaneous retroperitoneal bleeding (SRB) associated with COVID-19 infection owing to anticoagulation on a larger scale in terms of comorbidities and factors related with SRB, as well as discuss existing therapeutics modalities, factors influencing decision, prognosis, and associated mortality.

Patients and Methods: Twenty COVID-19 patients presented with SRB; 12 were treated surgically, and 8 were treated conservatively. Patients' demographic information, comorbidity evaluation, type of intervention, results, and prognostic factors were all evaluated.

Results: Eight patients were treated conservatively; three died as a result of refractory shock. Twelve patients were operated on; eight of them died as a result of myocardial infarction, pulmonary problems, and multiple organ failure. The date of the surgical consultation influenced care and outcome significantly. Increased blood component requirements were found to be substantially associated to mortality.

Conclusion: Management should be wise, yet not hesitate to intervene if necessary. In a progressive hematoma, this produces better results than conservation. Independent variables that necessitate intervention include vital instability, increasing hemoglobin decline, and transfusion requirements.

Keywords: COVID-19, Retroperitoneal bleeding, Anticoagulant therapy.

INTRODUCTION

COVID-19 (produced by the SARS-COV-2 virus) has been linked to a number of clinical occurrences since the outbreak's inception. Hypercoagulability and small vessel micro thrombosis are regarded to be significant manifestations that can lead to pulmonary thromboembolism and, ultimately, respiratory failure [(1)]. One of the characteristics of micro thrombosis is cerebrovascular stroke [(2)].

In COVID-19 infections, the incidence of thromboembolic symptoms may reach up to 21%, with an associated mortality of around 74%. Thromboembolic manifestations can affect up to 11% of COVID-19 infected patients admitted to the ICU [(3)]. Many trials, while with limited evidence, demonstrated that anticoagulant medication was successful in COVID-19, particularly in ICU settings, with heparin or its alternatives recommended for thromboembolism prophylaxis [(4)]. Retroperitoneal hemorrhage is a rare consequence of heparin, according to limited data and a few cases in the literature. Many randomized controlled trials, however, indicate that heparin is both safe and effective in patients of severe COVID-19 pneumonia [(4)]. Nowadays, many researchers are discussing internal bleeding such as spontaneous retroperitoneal bleeding (SRB) as a life-threatening complication as a result of the COVID-19 treatment strategy [(5,6)].

Pelvic hematoma is described as bleeding in retroperitoneal zone 3, which is anatomically bounded anteriorly by the dome of the urinary bladder, posteriorly by the sacrum, and laterally by the iliac wings. SRB as a side effect of anticoagulant therapy is regarded as a self-limiting condition. Surprisingly, such a consequence occurs in COVID-19 individuals who are not on anticoagulant medication and have severe symptoms [(7)].

The assumption that bleeding from anticoagulants is an established consequence is debatable because neither anti-factor Xa tests nor plasma heparin levels were performed to corroborate this data, leaving the cause of bleeding uncertain. In individuals with modest symptoms and a low risk of bleeding, the preventive anticoagulant recommendations propose a dose of 40 mg of low molecular weight heparin (LMWH) once daily and a dose of 0.5 mg/kg of LMWH in severe cases in ICU settings [(8, 9)].

The use of therapeutic anticoagulants may be required in cases of severe respiratory manifestations in need of ventilation and a rising trend of D-dimer levels [(8, 9)]. SRB is usually characterized by non-specific clinical manifestations, which may result in a delay in management due to misdiagnosis with other conditions. In the general population, SRB associated with anticoagulant therapy is considered a serious and life-threatening complication with an incidence ranging between 0.0 and 6.6% and a mortality rate ranging from 10 to 20% [(10)].

A computed tomography (CT) study on the abdomen and pelvis with contrast is considered the imaging procedure of choice in the diagnosis and suspicion of SRB. It is extremely valuable in detecting

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the exact location, anatomical boundaries, and pressure effects of the bleeding. In addition, it helps in the identification of the source of bleeding through the extravasation of contrast material [10]. Only a few cohort studies and sporadic case presentations provide evidence on the management of SRB. In short, the main aim of management strategy focuses on "volume support and cessation of bleeding".

Conservative medical management is employed in the control of more than 50% of SRB patients by infusion of crystalloids, colloids, and blood products. In addition to drugs, including inotropics and vasopressors whenever needed [11,12]. Reversal of coagulopathy medications could be considered when indicated (i.e., vitamin K, protamine sulfate, cryoprecipitate (cry) concentrates, and recombinant factor VIII and IX) [10]. Surgical intervention or interventional radiology techniques should be reserved for cases with vital instability and continuous active bleeding, as evidenced by CT, or in cases with severe visceral pressure effects [11, 12].

This retrospective cohort study aims to investigate SRB as a major consequence of anticoagulant therapy in COVID-19 infected patients and to compare alternative treatment options, results, and predictors of mortality.

PATIENTS AND METHODS

From June 2020 to September 2021, the medical data of twenty patients with COVID-19 infection diagnosed with spontaneous retroperitoneal bleeding (SRB) was retrospectively recruited from the medical data registry to include patients fitting the study design and the inclusion and exclusion criteria. The study was conducted at Ain-Shams University's Specialized Hospital in Obour City. The hospital was designed to be an isolation center for all COVID-19 patients diagnosed at different Ain-Shams University Hospitals.

Ethical consent:

All the infection control protocols were applied in different areas of the hospital, providing full safety for all the working staff. The study design was approved by the Ethical Committee of Ain Shams University, and all the participating patients gave their written informed consent. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

All patients were transferred from different university hospitals after a chest consultation for being suspicious of COVID-19 infection and whose chest CT findings were highly suspicious by CORAD's criteria or by being PCR positive for COVID-19 infection. Transferred patients were re-assessed in the hospital Emergency Department and sorted according to the severity of the case and oxygen demands to enter either the ward or the ICU.

The hospital adopted a multidisciplinary management protocol for admitted patients. Ward patients were under the medical supervision of chest, tropical medicine, and internal medicine physicians. ICU patients were under the medical supervision of ICU and chest consultants. The other departmental consultations were requested on demand.

The treatment regimen involved antiviral drugs in the form of 10-day oral hydroxychloroquine and favipiravir/ritonavir, with compassionate use of Remdesivir in selected cases. Initial empirical antibiotics, ceftriaxone and levofloxacin were used. Therapeutic doses of anticoagulation were used; later, after multi-departmental university meetings, the anticoagulation protocol changed to prophylactic doses unless there was an associated high risk other than COVID-19 infection, like atrial fibrillation, a history of DVT, a pulmonary embolism, or ischemic heart disease.

Patients were transferred from the ward to the ICU in cases of desaturation, hemodynamic instability, or any other indication for ICU admission, including the possibility of intubation and inotropic support administration.

In case of vital instability and the requested imaging study revealed SRB, the patient was directly transferred to the ICU for proper strict monitoring. After surgical consultation resuscitation was started, and strict monitoring and observation for the patient and conservative management were continued.

Strict hourly recording of the vital data, evaluation of abdominal complications related to decreasing abdominal compartments like ureteric hydronephrosis complicating ureteric compression, ileus, and DVT of the lower limbs. Complications might be related to resuscitation or a complicating reversal of anticoagulation, like thromboembolic complications.

We arranged the patients into two groups according to the modality of treatment used: the first group was composed of patients treated conservatively, and the second group was composed of patients who underwent surgical intervention after the failure of conservative management.

Both groups were compared as regards their demographic data, including age, gender, comorbidities, hospital medications and drugs, vital data, imaging studies indicating the location and size of the hematoma, laboratory studies, hemoglobin (HGB) decline, blood transfusion needs, the period of time between admission and surgical consultation, and the period of time between consultation and operation.

Surgical intervention was indicated in cases of failed conservative management with ongoing bleeding and vital instability, particularly in patients in whom no source of bleeding could be identified by CT (Fig. 1). The main target of surgery in such cases is to control bleeding and evacuate the hematoma. However, the

evacuation of hematomas may lead to heroic bleeding by removing the tamponade effect, making packing the only available option. In our study, the retro-peritoneum may require packing and re-exploration at 24-48 h; only 1 patient didn't undergo packing, 2 patients underwent packing only, and 9 patients underwent packing followed by de-packing. In our study, the surgical group of patients comprised twelve patients, while the remaining eight patients underwent conservative management.

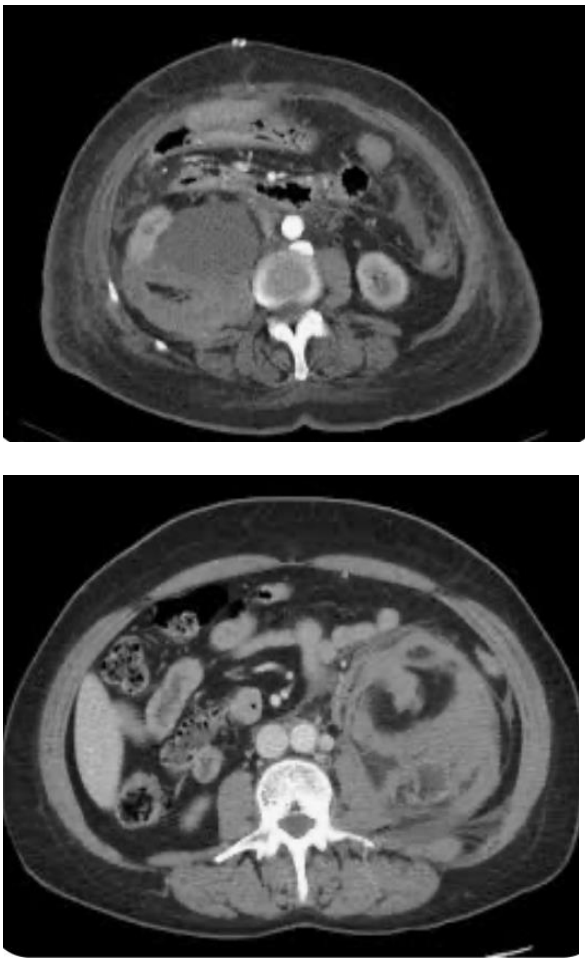

Figure (1): Multi-slice CT scan of the abdomen showing retroperitoneal hematoma.

The outcomes of treatment in both groups were compared, including causes of mortality and the incidence of thrombotic complications. Mortality and survival predictors including different variables were also analyzed and assessed.

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for the Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Wilk test. Qualitative data were represented as frequencies and relative percentages and were compared by Fisher's exact test. Quantitative data were expressed as mean ± SD (Standard deviation), median, and range. Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value < 0.05 was considered significant.

RESULTS

The study group included 20 patients, 11 males, and 9 females. Their mean age was high 59.4 ± 5.2 years which signifies that SRB is more common in elderly patients. The most common comorbidity was diabetes mellitus in 16 patients (80%). All the patients were treated according to our institutional standard treatment protocols. 17 patients received a therapeutic dose of anticoagulants (LMWH) and 3 patients received a prophylactic dose of anticoagulants.

In case of non-specific abdominal or flank pain or in case of vital instability imaging study (CT pelvic abdominal), hemoglobin level were checked and surgical consultation was requested. Surgical consultation was done with a median interval between admission and consultation of 1 (0-6) days. All the patients complained of non-specific abdominal and flank pain and 16 patients were vitally unstable, median hemoglobin decline was 4 gm/dl and ranged between (1-6) gm/dl.

Imaging studies revealed a retroperitoneal hematoma affecting more than one zone in 11 cases, isolated pelvic hematoma in 5 patients, and rectus sheath hematoma in 4 patients. The median size of a hematoma was 12 cm and ranged between 7 and 15 cm.

The resuscitation was started immediately, and the median transfusion needed 4 (2–7) units of packed RBCs. CT follow-up was requested and revealed 2 cases of stable hematoma, and both patients were maintained on conservative management. Vital instability and continuous hemoglobin decline were observed in 12 patients, and surgery was planned for them (Figs. 2-5 and table 1).

Figure (2): Exploration of a pelvic hematoma in zone 3

The median period between surgical consultation and operation was 1 day and ranged between 0–2 days. The main target of surgery in such cases is to control bleeding and evacuate the hematoma.

However, the evacuation of a hematoma may lead to heroic bleeding (Fig. 3) by removing the tamponade effect, making packing the only available option. In our study, the retro-peritoneum may require packing and re-exploration at 24-48 h; only 1 patient didn't undergo packing, 2 patients underwent packing only, and 9 patients underwent packing followed by de-packing (Fig. 4).

In our study, the surgical group included twelve patients, while the remaining eight patients received conservative care (Table 1).

Figure (3): Evacuation of pelvic hematoma and encountered bleeding.

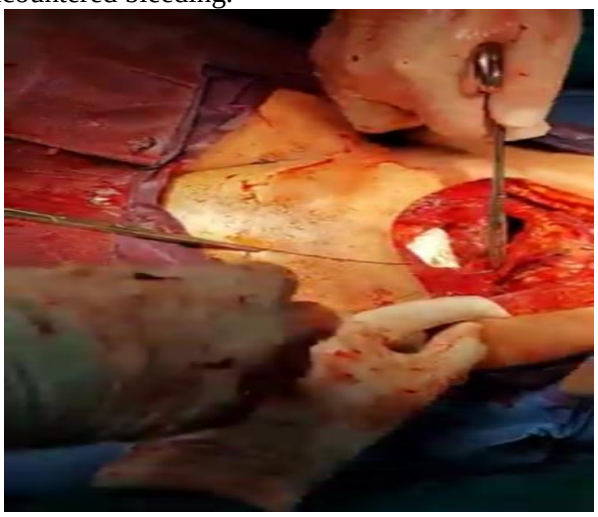

Figure (4): Packing of pelvic hematoma

Figure (5): Exploration of anterior rectus sheath hematoma

Upon comparison of different variables and patient data between both groups, a significant difference was found between both groups concerning the median period of time between admission and surgical consultation, presenting vital data, hemoglobin decline, and transfusion needs, pushing the decision towards surgical intervention, indicating delayed surgical consultation, vital instability, more decline in hemoglobin level, and more transfusion needs were associated with surgical intervention (Table 1).

Table (1): Patients demographic data

	Overall patients n=20	Conservative group n=8	Surgical group n=12	P value
Mean age (SD) years	59.4 ± 5.2	60.3 ± 7.1	58.1 ± 3.4	0.31
Gender (n) (%)				0.52
• Male	11(55)	4 (50)	7(58.3)	
• Female	9(45)	4(50)	5(41.6)	
Comorbidities (n) (%)				0.21
• Diabetes mellitus	16(80)	8(100)	8(66.6)	
• Hypertension	11(55)	6(75)	5(41.6)	
• Ischemic heart disease	2(10)	1(12.5)	1(8.3)	
The median period between admission and surgical consultation (range) days	1 (0-6)	1.5(0-2)	10(0-12)	0.037
Presenting vital data (n)(%)				0.01
• Stable	4(20)	4(50)	0(0)	
• Unstable	16(80)	4(50)	12(100)	
Drugs (n)(%)				
• Solumedrol	18(90)	6(75)	9(45)	0.44
• Actemra	8(40)	4(50)	4(33.3)	0.232
• Remdesivir	4(20)	2(25)	2(16.7)	0.446
• Anticoagulants	20(100)	8(100)	12(100)	
1. Therapeutic	17(85)	6(75)	11(91.7)	0.32
2. Prophylactic	3(15)	2(25)	1(8.3)	0.13
Location of hematoma on CT (n)(%)				
• Retroperitoneal	11(55)	5(62.5)	6(50)	0.62
• Pelvic	5(25)	1(12.5)	4(33.3)	0.51
• Rectus sheath	4(20)	2(25)	2(16.6)	0.23
• Stable	2(10)	2(10)	0(0)	0.06
Median size of hematoma (range)in cm	12(7-15)	8.5(7-15)	15(10-15)	0.16
Median hemoglobin decline (range) in gm/dl	4(1-6)	2.5(1-4)	5(4-6)	0.009
Median transfusion needs (range) in units	4(2-7)	3(2-4)	5(4-7)	0.002
Median interval between surgical consultation and operation (range) days	1(0-2)	(-)	1(0-2)	0.731

Concerning patient outcomes, out of 20 patients, only 7 survived; 3 of them were surgically managed and 4 were managed conservatively. The main cause of death was a refractory irreversible shock in 8 patients; other causes included myocardial infarction (2 patients), respiratory failure (1 patient), and multiple organ failure (2 patients).
Thrombotic complications occurred in 5 patients: three patients suffered a myocardial infarction (one of them survived after coronary angiography and stenting), and two patients developed bilateral lower limb DVT (both of them survived on conservative management). No significant difference was observed between the two groups concerning the outcomes or the causes of mortality and thrombotic complications (Table 2).

Table (2): Outcomes

	Overall patients n=20	Conservative group n=8	Surgical group n=12	P value
Outcome (n)(%)				0.06
• Died	13(65)	5(62.5)	8(66.6)	
• Discharged	7(35)	4(50)	3(25)	
Cause of death (n)(%)				
• Refractory shock	8(61.5)	3(60)	5(62.5)	0.58
• Myocardial infarction	2(15.38)	1(20)	1(12.5)	0.643
• Respiratory failure	1(7.6)	0(0)	1(12.5)	0.446
• Multiple organ failure	2(15.38)	1(20)	1(12.5)	0.446
Thrombotic complications (n)(%)	5(25)	3(37.5)	2 (16.6)	0.62
• Myocardial infarction	3 (15)	2(25)	1(8.3)	0.61
• Bilateral DVT	2(10)	1(12.5)	1(8.3)	0.24

Upon the analysis of mortality statistics (Table 3), mortality occurred in 13 patients (65%) of the total. Concerning age and gender, though the mean age of the patients was high and the mortality was higher in males (11 out of 13 cases), this had no significance on mortality. Diabetes and ischemic heart disease were both associated with increased mortality rates.

In our study, 11 of the 13 patients who died were taking anticoagulants at a therapeutic dose, which had a significant relationship with mortality. This finding was not associated with the use of prophylactic anticoagulants. The presenting hemodynamic instability was associated with increased mortality in 11 out of 16 patients who presented with vital instability and passed away; however, this finding did not reach statistical significance.

The median period between admission of the patient and timing of surgical consultation was 9 days, ranging between 5 and 12 days in the mortality group, with a p-value approaching significance.

A high level of statistical significance was associated with mortality and retroperitoneal bleeding in more than one zone; all 11 such patients died. Anterior rectus sheath and stable hematoma were significantly associated with survival.

It was noted in the mortality group that the median size of a hematoma of 16 cm, ranging between 12 and 22 cm, was associated with increased mortality, though this value was approaching statistical significance.

We also observed a sharp decline in hemoglobin level of 5 g/dL, ranging between 4 and 7 g in the mortality group, reflecting the association of hemoglobin drop with mortality, though it did not reach statistical significance. The median blood transfusion needs of 7 units, ranging between 3 and 8 units, showed a significant association with mortality. It is worth mentioning that the type of treatment, either conservative or surgical, or the type of surgical procedure performed, has a significant impact on mortality.

Thrombotic complications occurred in 5 patients (25%) of the patients in our study group; 3 patients developed myocardial infarction, and 2 patients developed deep venous thrombosis of both lower limbs; 2 patients of those died of myocardial infarction. It should be noted that none of these findings showed statistical significance.

Table (3): Mortality statistics and effect of different variables on the prognosis

	Alive (n=7)	**Dead n=13**	**P value**
Mean age (SD) years (range)	58.3 ±5.29 (49.7-72)	59.67 ±7.24 (50-80)	0.716
Gender (n)(%)			0.072
• Male	1(14.2)	11(84.6)	
• Female	6(85.7)	2(15.38)	
Comorbidities (n)(%)			
• Diabetes mellitus	4(57.14)	12(92)	0.021
• Hypertension	5 (71.42)	4 (30.7)	0.25
• Ischemic heart disease	0(0)	2 (15.3)	0.033
Anticoagulant therapy			
• Therapeutic	6	11	0.034
• Prophylactic	1	2	0.10
Presentation vital data (n) (%)			0.112
• Stable	5(71.4)	2(15.38)	
• Unstable	2(28.5)	11(84.6)	
Median period between admission and surgical consultation (range)days	1(1-2)	9(5-12)	0.071
Location of hematoma on CT (n)(%)			
• Retroperitoneal zone 2,3	0(0)	11(84)	0.005
• Pelvic	2(28.5)	1(7.6)	0.496
• Rectus sheath	3(42.8)	1(7.6)	0.04
• Stable	2(28.5)	0(0)	0.02
Median size of hematoma (range)in cm	10(6-13)	16 (12-22)	0.055
Median hemoglobin decline (range) in gm/dl	4(1-4)	5(4-7)	0.06
Type of treatment (n)(%)			0.793
• Conservative	3(42.8)	8(61.5)	
• Surgical	4(57.14)	5(38.4)	
Median transfusion needs(range)in units	4(2-4)	7(3-8)	0.024
Median period between diagnosis and mortality(range) days	2(0-2)	1(0.5-3)	0.83
Type of operation (n)(%)			
• Packing and de-packing	4(57.1)	5(38.46)	0.21
• Packing only	0(0)	2(15.38)	0.37
• No packing	0(0)	1(7.69)	0.56
Thrombotic complications (n)(%)			
• No	4(57.14)	11(84.61)	
• Yes	3 (42.85)	2 (15.38)	
1. Myocardial infarction	1 (14.28)	2(15.38)	0.8
2. Bilateral DVT	2 (28.57)	0 (0)	0.33

DISCUSSION

Spontaneous retroperitoneal bleeding is a rare life-threatening condition. In the literature, the data about spontaneous retroperitoneal bleeding associated with COVID-19 infection is scarce, apart from a few case reports. In our study, we had the opportunity to manage a good number of consecutive patients in a single center designed as an isolation hospital with good documentation of the medical data that allowed our retrospective analysis and interpretation of the data. This may be one of our areas of strength.

Although the first case described in the literature was in September 2020 [(2)], our hospital registered a case of a 61-year-old male with a right upper quadrant retroperitoneal hemorrhage related to the inferior vena cava (IVC) and right kidney; unfortunately, he was explored and a hematoma was evacuated, but he died 2 days later from MOF. Our case was registered in August 2020.

Many factors may play a role in the pathogenesis of spontaneous retroperitoneal bleeding in a COVID-19 infection. SRB is an established complication of the use of anticoagulant therapy [(2)]. One of the most common symptoms of COVID-19 is cough, which can increase intraabdominal pressure and lead to small vessel rupture [(3)]. Another factor may be the use of ventilatory support and continuous positive airway pressure (CPAP), which may also increase the intraabdominal pressure [(13–15)].

The mainstay in the management of retroperitoneal bleeding is conservative, involving the reversal of anticoagulation and immediate volume resuscitation with parenteral fluids and blood products. In a recent case report of a retroperitoneal hematoma presented with flank pain followed by desaturation and abdominal distention, the case was managed successfully and conservatively.

Follow-up CT 3 months later revealed total hematoma absorption [(16)].

A 51-year-old female with COVID-19 infection on prophylactic anticoagulant therapy developed acute abdomen, tachycardia, and right iliac swelling; a CT revealed a large pelvic hematoma displaying the ureter and external iliac vessels and an enlarged pelvicalyceal system; and an angiography revealed no bleeding point.

The multidisciplinary team decided on conservative measures; however, the patient's kidney function deteriorated, and she developed hyperkalemia and acute renal failure, multiple organ failure, and passed away [(17)].

In our study, we advocated for conservative management in all patients; however, vital instability, a sharp drop in hemoglobin level, progressive increase in hematoma size on follow-up, and an increase in transfusion needs were driving forces toward surgical intervention. The period between admission and surgical consultation was significantly associated with mortality, indicating that early detection is associated with a better prognosis.

Surgical intervention was successful in a case presentation that reported a 77-year-old male who presented with severe left upper quadrant abdominal pain after failed conservation. The patient underwent exploration, packing, and de-packing after 48 hours and was discharged after 6 days [(10)].

Another therapeutic option addressed in the literature is selective arterial embolization performed by competent interventional radiologists if an active source of bleeding can be detected by angiography. CT revealed a massive retroperitoneal hematoma measuring 25 cm with active extravasation from lumbar arteries in a case presentation of an 81-year-old female patient complaining of pelvic pain.

A successful selective embolization was performed. Unfortunately, the patient's HGB level dropped by 6 g/dL a few hours later, he was arrested, and he died [(18)]. **Gupta *et al.*** [(19)] described three cases where internal iliac, lumbar, and obturator arteries were effectively embolized and patients were discharged in satisfactory condition after bleeding control.

This may be one of the limitations of our study, as selective embolization was not present in our facility, and it may be a subject for further studies for discussion of different treatment modalities of SRB specifically, which is associated with COVID-19 infection.

Reversal of anticoagulation associated with thromboembolic complications (ischemic heart disease, stroke, DVT, or pulmonary embolism) could be added to the morbidity of SRB. In our study, 5 patients developed thrombotic complications, and two of them died.

The high occurrence of thrombotic complications may be due to hypercoagulability and high D-dimer levels associated with COVID-19 infection and a high incidence of micro thrombosis [(20)]. A strong balance between benefits and risks is needed to optimize anticoagulant therapy. At the same time, those patients should be strictly monitored for early detection and urgent management of hemorrhagic complications.

Although the anticoagulation dosage is controversial, a retrospective study of 355 patients with COVID-19 reported that a therapeutic dose of anticoagulant was significantly associated with an increased risk of bleeding and mortality compared with a sub-therapeutic (intermediate dose) or prophylactic dose [(20)].

This agrees with the findings in our study: the use of therapeutic anticoagulants was significantly associated with mortality, which occurred in 11 out of 13 patients who died.

It is worth mentioning that after the multidisciplinary university meeting there was a change in the protocol of anticoagulant therapy towards the use of prophylactic doses of anticoagulants in patients with COVID-19, unless there was a contraindication for that.

The British Thoracic Society and Scottish Intercollegiate Guidelines in the UK suggest the use of prophylactic dose LMWH for patients who are managed on a ward and intermediate-dose LMWH (twice daily standard prophylactic dose) for patients in critical care, and this could be the regimen of choice [(21)].

13 patients died in our study (65%). Most of the patients in our study were elderly, with a mean age of 59.4 $\pm$ 5.2 years. Diabetes and ischemic heart disease have been linked to increased mortality and a poor prognosis.

This could be due to the poor prognosis associated with diabetic immunocompromised patients infected with COVID-19—patients with ischemic heart disease who had been on long-term anticoagulant therapy prior to infection and were receiving therapeutic anticoagulation rather than prophylactic doses. Even after reversal of anticoagulation after a diagnosis of SRB, the rate of thrombotic complications remains higher in such patients.

It should be noted that neither the type of treatment (conservative or surgical) nor the type of surgical procedure was significantly related to mortality. The need for blood transfusions and the presence of retroperitoneal hematoma in more than one zone were significantly associated with mortality. Anterior rectus sheath hematomas and stable hematomas on follow-up were significantly associated with survival.

CONCLUSION

Anticoagulant therapy optimization and strict monitoring of patients with a high index of suspicion are critical in COVID-19 patients at risk of life-threatening SRB. Management should be wise, yet not hesitate to intervene if necessary. In a progressive hematoma, surgical intervention produces better results than conservation. Independent factors such as vital instability, rapid hemoglobin drop, and increasing transfusion requirements necessitate intervention.

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Author contribution: Authors contributed equally in the study.

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