Characteristics and Surgical Outcomes of the Patients With Atraumatic Splenic Rupture

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Abstract

Background: Although splenic emergencies are rare in the case of the absence of trauma, late-diagnosed atraumatic splenic ruptures (ASR) may result in mortality.

Methods: All consecutive adult patients who underwent emergency splenectomy due to ASR between January 01, 2015, and January 01, 2021, were reviewed.

Results: 203 patients underwent splenectomy, 83 electively, 120 emergency splenectomy, and amongst them 15 for atraumatic reasons.

The median age of patients with ASR was 55 years (34- 90), and 10 patients (66. 6%) were male. The most pre-existing medical diseases are heart valve replacement (n=5, 33. 3%) and diabetes mellitus (n=6, 40 %). Eight (46. 6%) patients had more than one comorbid disease. Ten patients (66. 6 %) had splenic rupture due to splenic infarction and abscess. Two patients were diagnosed with diffuse large B cell lymphoma (DLBCL) postoperative by histological assessment. Two patients were diagnosed with lung cancer with spleen metastasis. One patient had aortic and mitral valve replacement and was receiving an oral anticoagulant drug. The median length of hospital stay was 6 (2- 24) days and the intensive care unit stay was 2 (0- 20) days. Three patients (20%) died in hospital.

Conclusion: Male sex, previous splenic infarctions, hematological malignancies, lung cancer spleen metastases, underlying cardiac diseases (valve replacement, endocarditis, atrial fibrillation) may increase the risk for ASR.

Introduction

The most common indication of emergency splenectomy is trauma to the spleen, whether external trauma (blunt or penetrating) or iatrogenic [1]. Atraumatic splenic rupture (ASR) is a rare condition [2]. Major causes of ASR are neoplastic, hematological, inflammatory, infectious, mechanical, treatment-related disorders, and idiopathic [2–7].

Spontaneous rupture in a normal spleen is called a 'true spontaneous rupture'. Spontaneous rupture in a diseased spleen is called 'pathologic spontaneous rupture' [2, 6]. There are three main pathogenetic factors of the ASR: splenic infiltration, splenic infarcts, and coagulation disorders [8]. These factors usually occur in patients with underlying diseases and patients who already have comorbid illnesses such as cardiovascular and hematological diseases. Other rare causes of splenic rupture include some congenital splenic lesions as hamartoma, hemangioma, and cysts and a miscellaneous group of diseases such as autoimmune diseases, hemolytic anemias, pregnancy, amyloidosis, and portal hypertension [9].

Although splenic emergencies are rare in the case of the absence of trauma, late-diagnosed splenic ruptures may result in mortality. In a systematic review, ASR-related mortality rate found 12. 2% [7]. Owing

to this rare and mortal clinical condition, ASR requires high clinical suspicion. The current literature mostly includes single case reports, case series and, reviews that were analyzed starting in the 1950s [7, 8]. We hypothesized that the causes of ASR may now change due to improved diagnostic and therapeutic approaches. Therefore, we aimed to investigate the cases with ASR in the last 6 years in our center. This study aims to review the reasons for ASR and draw attention to this rare and serious condition for emergency physicians, gastroenterologists, and surgeons.

Methods

This retrospective study was conducted at the University of Samsun, Samsun Training and Research Hospital. We reviewed our hospital records of all consecutive adult patients who underwent emergency splenectomy between January 01, 2015, and January 01, 2021.

Inclusion criteria; patients over 18 years, emergency service admission with hypovolemic shock or acute abdominal pain related to spleen diagnosed by an imaging test (ultrasound, computerized tomography [CT]) and underwent splenectomy within first 24 hours of admission.

Exclusion criteria; patients under 18 years and the patients underwent emergency splenectomy related to trauma (external or iatrogenic).

Records of patients with the following information were collected on admission: age, gender, Charlson comorbidity index (CCI), vital signs (body temperature, respiration rate, pulse rate, and blood pressure [BP]), hematology findings (white blood cell [WBC], hemoglobin, platelets, C-reactive protein [CRP], aspartate aminotransferase (AST), alanine aminotransferase (ALT), total bilirubin. In addition, data of the patients were evaluated for the method of diagnosis, etiology, histology results, Clavien-Dindo Classification (CDC), intensive care unit (ICU) stay, length of hospital stay (LOH), morbidity, and hospital mortality.

Ethics approval. The study was approved by the Institutional Review Board (IRB) of Samsun Training and Research Hospital. IRB protocol approval number is GOKA/2021/11/1. IRB of Samsun Training and Research Hospital has waived the informed consent. We confirm that all methods were carried out under relevant guidelines and regulations.

Results

203 patients underwent splenectomy between January 01, 2015, and January 01, 2021, at Samsun Training and Research Hospital, 83 electively, 120 emergency splenectomy, and amongst them 15 for atraumatic reasons.

The median age of patients who underwent emergency splenectomy for ASR was 55 years (34- 90), and 10 patients (66. 6%) were male. The most pre-existing medical diseases were heart valve replacement

(n=5, 33. 3%) and diabetes mellitus (n=6, 40 %). Eight (46. 6%) patients had more than one comorbid disease.

None of the patients had a true spontaneous splenic rupture. Only one patient had a histologically normal spleen except for the rupture. This patient had aortic and mitral valve replacement and was receiving oral anticoagulant (warfarin, 10 mg once per day). All of the remained patients had a diseased spleen.

Ten patients (66. 6 %) had splenic rupture due to splenic infarction and abscess. We determined that all of the rupture splenic abscesses were related to previous splenic infarction. They had received medical treatment within the last few months. 90% of patients with splenic rupture due to splenic infarction and an abscess had WBC >12,000 and 50% had platelet count above 400.000/mm³. The microscopic appearances were suggestive of a splenic rupture occurring in areas of infarctions on histopathologic evaluation.

Two patients were diagnosed with diffuse large B cell lymphoma (DLBCL) postoperative by histological assessment. Another two patients had been diagnosed with lung cancer with spleen metastasis. Indications for surgery in ten patients were hemodynamic instability due to splenic rupture. Fourteen patients had acute abdominal pain. Abdominal pain could not be evaluated because patient number 15 was presented with hemorrhagic shock. Demographics and characteristics of the patients are listed in **Table 1**.

The median length of hospital stay was 6 (2- 24) days and intensive care unit stay 2 (0- 20) days. Three patients (20%) died in hospital. Two patients diagnosed with splenic infarction died due to cerebrovascular infarction in the postoperative period although anticoagulant therapy. One patient died due to mesenteric ischemia on the postoperative second day. Outcomes of the patients after atraumatic emergency splenectomy are listed in **Table 2**.

Discussion

Excluding trauma-related cases, splenectomy is rarely performed as an emergency procedure. Moreover, true spontaneous rupture of the normal spleen is extremely rare [2, 5, 6]. In our study, none of our patients had a true spontaneous splenic rupture. Orloff and Peskin described some criteria for the diagnosis of spontaneous splenic rupture. They have emphasized that there should be no history of trauma, no evidence of disease in other organs that are known to affect the spleen adversely, no proof of adhesions or scarring of the spleen, and the spleen should be normal on histological examination [6]. They reviewed 71 reports documenting spontaneous splenic rupture, of which only 20 met all criteria. In another study, authors have emphasized this because most of the pathological ruptures they document include the word spontaneous in the title and there is no information about the associated pathology [8]. We have found that all of our patients had underlying diseases. Only one patient had a histologically normal spleen, except for signs of rupture. This patient had aortic and mitral valve replacement and was receiving anticoagulant therapy. In our opinion, many authors misinterpret the rupture of diseased spleens as spontaneous.

ASR has been reported to occur more frequently in men [4, 7, 9]. There was a 2: 1 male predominance in a systematic review including 845 patients with atraumatic splenic rupture [7]. In our study also most of the patients with ASR were male (66. 6%).

Symptoms in patients with ASR vary. The presence of abdominal pain in splenic rupture has been frequently reported [10]. However, abdominal pain was frequently confused clinically with that of biliary tract disease, perforated peptic ulcer, acute pancreatitis, ruptured aortic aneurysm, and myocardial infarction. In a study including splenic rupture in patients with hematologic malignancies, hypotension was documented in 66%, fever in 74%, and tachycardia in 75% [4]. Nearly all patients (93. 3 %) experienced abdominal pain in our study. In addition to abdominal pain, ten patients (%66. 6) had hypotension.

In the present study, two cases of pathological rupture of the spleen in patients with hematologic malignancy. Both of them were diffuse B-cell non-Hodgkin lymphoma (DLBCL).

Interestingly they were the first admission of the patients related to splenic pathology. Patients underwent emergency splenectomy and the histopathological report confirmed the diagnosis as DLBCL. Previous studies are presented along with a review of the 48 cases in the literature [4]. Pathologic splenic rupture has been reported in patients with hematological malignancies such as leukemia and lymphoma in the literature [3, 4, 7, 10, 11].

In this study, the splenic rupture was detected in two patients due to splenic metastasis of lung cancer. Both of the patients were brought to our emergency department with hemorrhagic shock. One of the patients was receiving concurrent radiotherapy. In the review of 613 patients, only 4 cases of splenic rupture due to lung cancer were reported [8]. Although splenic metastasis of lung cancer is extremely rare, it should be kept in mind that rupture may occur due to splenic metastasis.

In the literature splenic rupture due to splenic infarction is rare according to other reasons. In the review with 613 patients, only 6 patients were reported [8]. In our study, most reasons for atraumatic emergency splenectomy were splenic rupture due to splenic infarctions and abscesses. We determined that all of the rupture splenic abscesses were related to previous splenic infarction.

Splenic infarction occurs in case of occlusion of the splenic vascular supply, leading to tissue ischemia and necrosis. Thromboembolism is the most common cause of splenic infarctions [12–15]. Splenic infarction may be due to arterial or venous occlusion. Also, occlusion is caused by septic emboli or venous congestion by abnormal cells. This occurrence is caused by a wide variety of underlying diseases and the prognosis is mostly related to these diseases [13]. In the present study, all the patients with splenic infarction had one or more risk factors for thromboembolism (heart valve replacement, diabetes mellitus, hypertension, and coronary artery disease).

Splenic infarction may result from various cardiovascular diseases (atrial fibrillation, myocardial infarction, bacterial endocarditis) or developed from complications of cardiac angiogram [12]. Ting et al

reported 108 patients with left-side endocarditis undergoing valvular surgery revealed a 19% incidence of splenic infarction [12, 16]. As similar to this study, we have detected 33% of the patients who developed splenic rupture due to splenic infarction had previous heart valve surgery.

Treatment of splenic infarction is mainly supportive care. However, the patients should follow up closely. Surgery is indicated in the case of complications such as rupture, abscess, or persistent pseudocyst [12, 13]. Splenectomy is necessary to lower the mortality rate of a complication of the infarction [14].

Nores et al reported an analysis of operative indications of the patients with splenic infarct. Complications of splenic infarction were a frequent indication for splenectomy in patients with emboli (60%) [17].

The ideal management for a splenic abscess is still debate. Some authors reported that the effect of antibiotic therapy alone on splenic abscess is limited. In addition, timely splenectomy is thought to be an appropriate choice for splenic abscesses [19, 20]. Whereas a unilocular abscess can be managed successfully in select cases with percutaneous catheter drainage, splenectomy still recommends for the splenic abscess with a larger diameter or multiple cavities [20, 21].

Several studies also reported that splenic infarction is a rare cause of spontaneous rupture leading to massive hemoperitoneum [22–25]. Therefore, with its potential for complications such as rupture or abscess, splenic infarction should be included in the differential diagnosis whenever evaluating a patient with acute abdominal pain and hemorrhagic shock.

The mortality of the patients following ASR is probably well correlated with the course of the underlying disease (6). Researchers reported in a review, 136 cases of pathological splenic rupture, 88 underwent surgical intervention, 55 (63%) survived and 33 (37%) died. Among 43 patients who did not undergo surgery, 40 died [6, 8]. In our study, we found that the mortality rate was very high (20%) and related to underlying diseases.

Therefore, physicians should be aware that splenic rupture may occur in the absence of trauma. It is essential to an assessment of the patients for differential diagnosis of an ASR in patients with acute abdominal pain. In some cases, the clinical picture does not indicate any disorder. In particular, ASR should be suspected when acute abdominal pains and signs of hemodynamic instability occur in a background of splenic infarctions, hematological disorders, malignancies, therapeutic anticoagulation. These rare and life-threatening conditions require a high degree of clinical suspicion of ASR.

The present study includes current cases from the last 6 years. As a matter of fact, in our study, the rates of splenic rupture due to splenic infarction are higher than in previous studies. The reason for this may be that early diagnosis and treatment of hematological and infectious diseases is possible with new diagnoses and treatment methods. On the other hand, increasing cardiac diseases and cardiac invasive interventions may be the reasons for higher splenic infarctions. We consider that the causes of ASR may be affected by conditions such as changing treatment approaches, early diagnosis possibilities, easier

access to treatment resources, and increased invasive procedures. In this regard, we believe that our current findings are important for emergency physicians, gastroenterologists, and surgeons.

There are some limitations related to this study. The main limitation is that it is a retrospective study, where the electronic medical record was obtained retrospective data, and the interpretation of these data might suppose a bias. In addition, it has been influenced by interindividual variability in clinical decision-making.

To conclude, this study shows that male sex, previous splenic infarctions, hematological malignancies, lung cancer spleen metastases, underlying diseases (heart valve replacement, diabetes mellitus, endocarditis, atrial fibrillation) may increase the risk for ASR.

Declarations

Data availability

The datasets generated during the current study are available from the corresponding author on reasonable request.

Author contributions

E.C. conceived the presented idea for the study. E.C., A.B.C. designed the research study, collected, and analyzed the data. E.C. drafted the manuscript. E.C., A.B.C. contributed to the interpretation of results E.C., A.B.C. critically revised the paper. EC., A.B.C. contributed with data acquisition and interpretation. All authors approved the submitted and final version of the manuscript.

Competing interests

The authors declare no competing interests.

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Ethical approval

This study was approved by the Review Board of the University of Samsun, Samsun Training and Research Hospital.

Additional information

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Tables

Due to technical limitations, table 1,2 is only available as a download in the Supplemental Files section.

Supplementary Files

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