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Splenic Artery Rupture: A Comprehensive Review of Clinical Presentation, Diagnosis and Management – A Case Report

Ruptura slezenske arterije: sveobuhvatan pregled kliničke prezentacije, dijagnoze i liječenja (prikaz slučaja)

Anton Turić[1*], Leona Ostojić[1], Lucija Grbić[2], Đordano Bačić[3], Zrinka Matana Kaštelan[4], Petra Valković Zujić[4]

[1] University of Rijeka, Faculty of Medicine, Rijeka, Croatia

[2] University of Zagreb, School of Medicine, Zagreb, Croatia

[3] Clinical Hospital Center Rijeka, Department of Surgery, Rijeka, Croatia

[4] Clinical Hospital Center Rijeka, Department of Diagnostic and Interventional Radiology, Rijeka, Croatia

[*]**Corresponding author:**
Anton Turić
University of Rijeka, Faculty of Medicine
Braće Branchetta 20, 51000 Rijeka, Croatia
E-mail: antonturic0@gmail.com

Abstract. ***Aim***: The aim of the paper is to present the complications of splenic artery aneurysm rupture, which include uncontrolled hemorrhage, multiple organ dysfunction syndrome (MODS), multiple organ failure (MOF) and their treatment. ***Case repor*t**: A 29-year-old man came by ambulance to the emergency room because of severe epigastric pain radiating below the right costal arch, accompanied by sudden weakness, nausea, and profuse sweating. The initial radiological work-up (radiogram of the chest organs and abdominal x-ray) was normal, however, collection of perihepatic and intra-abdominal anechoic liquid was observed on the ultrasound of the abdomen. Based on the findings of free fluid and the patient's severe condition, a computerized tomography (CT) of the abdomen and pelvis was indicated, which established the diagnosis of a ruptured aneurysm of the splenic artery and hemorrhagic ascites in the omental bursa. The patient underwent surgery with splenectomy and distal pancreatectomy. Close postoperative monitoring and appropriate medical care ensured an optimal outcome. In the postoperative follow-up of the patient for six months, the patient is in good health, without the development of complications ***Conclusion*:** The presented case emphasizes the importance of early recognition, timely intervention and surgical treatment of splenic artery rupture. Adequate triage, a multidisciplinary approach and urgent radiological and surgical intervention are key to a good outcome and reduction of morbidity and mortality associated with this life-threatening condition.

Keywords: aneurysm; emergencies; rupture; splenic artery

Sažetak. ***Cilj***: Cilj rada je prikazati komplikacije rupture aneurizme slezenske arterije koje uključuju nekontroliranu hemoragiju, sindrom višestrukog zatajivanja organa (engl. *multiple organ dysfunction syndrome;* MODS), višestruko zatajenje organa (engl. *multiple organ failure*; MOF) te njihovo liječenje. ***Prikaz slučaja*:** Dvadesetdevetogodišnji muškarac došao je kolima hitne pomoći u objedinjeni hitni bolnički prijam zbog jake boli u epigastriju koja se širila ispod desnog rebrenog luka, praćena iznenadnom slabošću, mučninom i obilnim znojenjem. Inicijalna radiološka obrada, tj. radiogram grudnih organa i nativni radiogram abdomena bili su uredni, međutim na ultrazvuku abdomena uočena je anehogena tekuća kolekcija perihepatalno i intraabdominalno. Na temelju nalaza slobodne tekućine i teškog stanja pacijenta indicirana je kompjutorizirana tomografija abdomena i zdjelice na osnovi koje je postavljena dijagnoza rupture aneurizme slezenske arterije i hemoragični ascites u omentalnoj burzi. Bolesnik je podvrgnut operativnom zahvatu uz splenektomiju i distalnu pankreatektomiju. Pomno poslijeoperacijsko praćenje i odgovarajuća medicinska skrb osigurali su optimalan ishod. U poslijeoperacijskom praćenju bolesnika u trajanju od šest mjeseci bolesnik je dobrog zdravlja, bez razvoja komplikacija. ***Zaključak***: Prikazani slučaj naglašava važnost ranog prepoznavanja, pravovremene intervencije i kirurškog liječenja rupture slezenske arterije. Adekvatna trijaža, multidisciplinarni pristup te hitna radiološka i kirurška intervencija ključni su za dobar ishod i smanjenje morbiditeta i mortaliteta povezanih s ovim stanjem opasnim po život.

Ključne riječi: aneurizma; hitni slučajevi; ruptura; slezenska arterija

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INTRODUCTION

The splenic artery is responsible for the supply of oxygen-rich blood to the spleen. The artery originates from the celiac trunk and runs above the pancreas. Splenic artery aneurysms (SAA) are the predominant type of aneurysms that occur in the visceral arteries, and they are the third most common type of abdominal aneurysm, after the aorta and iliac vessels[1]. Aneurysms often have a saccular shape and can occur either as true aneurysms (more commonly observed) or as pseudoaneurysms. Although rare, ruptured splenic artery aneurysms (r-SAA) have a high morbidity and mortality rate, even in the case of emergency surgical repair[2]. Splenic artery aneurysms are less common in the general population and account for 60–80% of asymptomatic cases. The prevalence of SAAs is less than 1%. Most SAAs aren't diagnosed because they're asymptomatic, which is important to know. According to a recent retrospective analysis, most SAA cases (78%) are found in women. The death rates linked to rupture of splenic aneurysms in non-pregnant individuals, which vary from 2 to 40%, underscore the potential for severe outcomes. As maternal and fetal mortality rates rise to 75% and 95%, respectively, the risk increases for pregnant women. Early detection and proper treatment of SAAs are crucial to avoid potentially fatal outcomes[3].

In this case we present a young man with a ruptured splenic artery aneurysm and point out how timely diagnosis and intervention with appropriate postoperative care can lead to optimal outcomes in such cases.

CASE REPORT

A 29-year-old male patient was admitted to the emergency room complaining primarily of severe epigastric pain radiating below the right coastal arch. He suffered from sudden weakness, nausea, ringing in the ears, and sweating which started in the morning without him losing consciousness. On physical examination, the patient was assessed as being in poor general health with pallor, profuse sweating, and a diffusely tender abdomen on palpation. On admission, the patient's vital signs showed a blood pressure of 150/90 mmHg, a pulse of 120 beats per minute and a respiratory rate of 22 breaths per minute. Blood oxygen saturation was measured at 99%, and the patient was afebrile. Thirty minutes later, blood pressure dropped to 120/70 mmHg, and one hour after admission, it dropped further to 111/85 mmHg. The patient's medical history included primary glaucoma and obesity, with no known drug allergies. Laboratory analysis revealed elevated leukocyte levels of 21.4 x 109/L, especially neutrophils at 17.03 x 109/L. Based on the examination, the patient was assigned triage category three, meaning that the patient has a potentially life-threatening condition. Chest and abdominal X-rays were normal but abdominal ultrasound revealed free fluid perihepatic and intraabdominal, which raised suspicion of acute bleeding. Initial therapy included 1000 mL of Plasma Lyte infusion, 250 mL 0.9% NaCl infusion and 2.5 g metamizole. The emergency CT scan was crucial for establishing the diagnosis as it revealed pathologic findings, including hyperdense free fluid in the abdomen and pelvis, suggestive of hemorrhagic ascites (Figure 1, Figure 2). A larger, homogeneous collection with higher absorption coefficients, measuring 142 x 107 x 100 mm, was observed within the omental bursa and along the greater curvature of the stomach (Figure 3). A hazy area of aneurysm of the splenic artery was noted, near the tail of pancreas, which was suspected to be the cause of bleeding. Emergency surgery was performed based on the CT findings. An exploratory laparotomy revealed an extensive collection of blood throughout the abdomen and pelvis, with bleeding originating from the pancreatic tail region. Further exploration revealed a ruptured splenic artery aneurysm, so both splenectomy and distal pancreatectomy were performed. During surgery, two units of packed

Splenic artery aneurysms often go undiagnosed due to their asymptomatic nature. This case emphasizes the importance of thorough diagnosis and a multidisciplinary approach in the management of abdominal pain and hemodynamic instability.

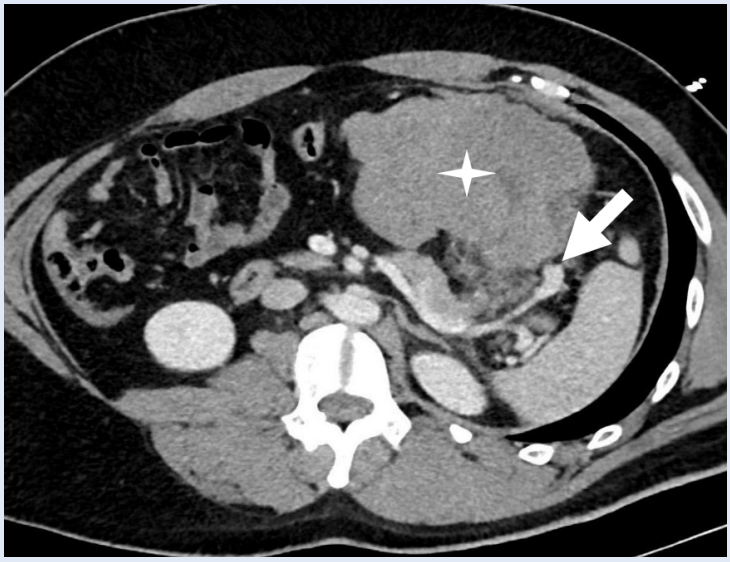

Figure 1. The angled CT image shows a splenic artery aneurysm (arrow) and a hemorrhagic collection within the omental bursa (star).

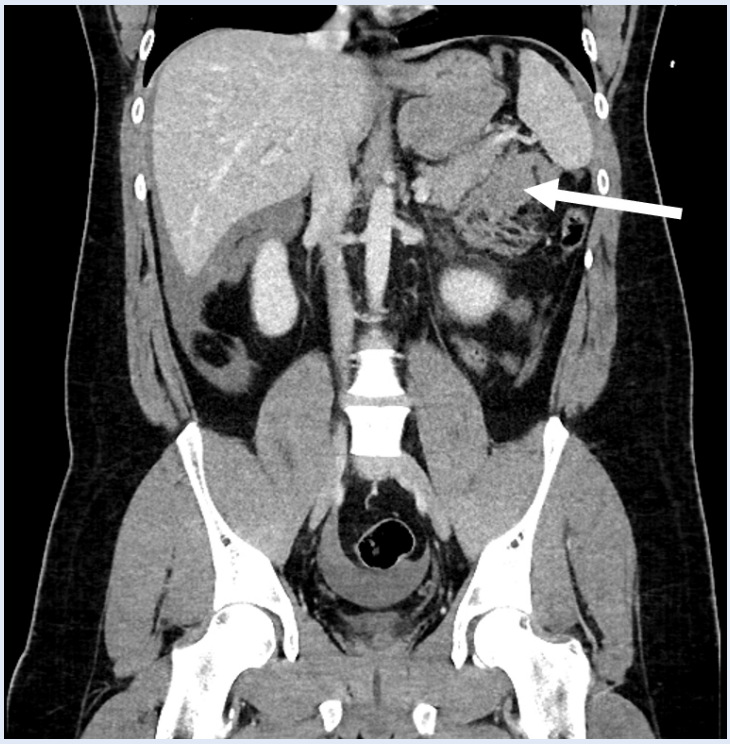

Figure 2. CT scan of the abdomen, coronal view. The arrow points at bleeding by the tail of the pancreas.

The emergency CT scan revealed hyperdense free fluid in the abdomen and pelvis, suggestive of hemorrhagic ascites. It also showed a large collection in the bursa and identified the ruptured splenic artery aneurysm near the tail of the pancreas as the source of the bleeding.

red blood cells and two units of fresh frozen plasma were administered to effectively stem blood loss. A continuous infusion of Sandostatin was initiated to reduce the risk of postoperative pancreatic fistula. The wound was closed in layers, followed by peritoneal lavage and abdominal drainage. In addition, two local drains were inserted to optimize postoperative care. On admission to the intensive care unit (ICU), the patient remained under residual anesthesia and had moderately dilated reactive pupils. Endotracheal intubation was performed and mechanical ventilation was maintained. Hemodynamic stability was successfully achieved by gradually reducing the dose of norepinephrine until the drug was. Proactive measures, including gastroprotection and thromboprophylaxis, were also initiated. In the evening, ventilator weaning was initiated and the patient tolerated extubation well and transitioned to spontaneous and adequate breathing. The next morning, a drainage output of 200 mL was documented, which was in line with the expected course of postoperative recovery. The patient received a Pneumovax-23 vaccination as part of his preventive care. Spleen tissue taken during surgery for histopathologic examination showed signs of congestion with occasional bleeding, while no significant changes were noted in the pancreatic tissue, with the exception of mild lipomatosis in some areas. After the procedure, laboratory findings showed a decreased calcium level of 1.86 mmol/L and a decreased erythrocyte count of 3.65 x 1012/L, hemoglobin of 109 g/L, and a decreased hematocrit of 0.324 L/L. In addition, the leukocytes were still elevated at 13.0 x 109/L. Three days after the operation, the patient's recovery had gone smoothly, he was no longer in pain, had regained his appetite and remained afebrile. The non-functioning right drain was subsequently removed and approximately 50 mL of fluid was drained from the left drain. Abdominal examination revealed a soft abdomen with no signs of tenderness. Repeat laboratory results four days after surgery showed a further decrease in erythrocyte count to 3.45 x 1012/L, hemoglobin to 105 g/L, and hematocrit to 0.312 L/L. The patient was in a good general condition and was switched to oral nutrition.

Four months later, CT angiography of the intracranial arteries was performed to role out the presence of intracranial arterial stenosis or aneurysm, which yielded normal results.

DISCUSSION

Modifiable risk factors for splenic artery aneurysms include pregnancy, liver transplantation, atherosclerosis, portal hypertension, and connective tissue disorders such as Marfan syndrome or Ehlers-Danlos syndrome[3]. Studies have shown that up to 21% of people with chronic pancreatitis have splenic pseudoaneurysms. These aneurysms are also developmentally linked to non-modifiable risk variables such as female gender and advanced age. In addition to iatrogenic trauma from medical operations, splenic artery pseudoaneurysms have also been linked to other trauma types such stabbing and impact injuries. Prevention of problems associated with splenic artery aneurysms depends on timely recognition and treatment of these risk factors[4].

Clinically speaking, a sizable fraction of people with splenic artery aneurysms do not exhibit any symptoms. According to a comprehensive analysis conducted at the Mayo Clinic, 97.5% of those with unruptured splenic artery aneurysms had no symptoms[5]. Subsequent data suggest a lower rupture rate of approximately 2 to 3% although previous studies predicted a 10% risk of rupture[6] There is evidence that certain factors such as pregnancy, portal hypertension as well as liver transplantation are associated with a higher risk of rupture[7]. Hemodynamic instability, gastrointestinal bleeding and abdominal pain are common clinical signs of a ruptured splenic artery aneurysm. Pain in the left upper quadrant that starts suddenly is often a sign of rupture[5]. In addition, there may be situations in which spontaneous stabilization is followed by abrupt collapse of the circulatory system (a condition known as "double rupture"); in these cases, bleeding first occurs in the lesser sac and then bursts into the abdominal cavity. To avoid potentially fatal consequences, ruptured splenic artery aneurysms must be recognised early and treated quickly[8].

Uncontrolled bleeding is a critical complication that poses a significant risk of death in individuals who have sustained a severe injury or are experiencing internal bleeding due to other causes. Trauma induced coagulopathy (TIC) is a coagulation disorder caused by trauma. Hypocoagulability causes bleeding in the early stages of TIC, while hypercoagulability causes venous thromboembolism and multiple organ failure (MOF) later on. The "lethal triad" (coagulopathy, hypothermia, and acidosis) exacerbates endothelial, immune, platelet and coagulation activity caused by tissue injury and shock. Traumatic brain injury also impairs TIC. Decreased fibrinogen, poor thrombin production, reduced platelet function and impared fibrinolysis are hemostatic disorders. To prevent or limit exacerbation of TIC, blood loss must be reduced and circulating blood volume replenished to reverse shock. There is currently no agreement across countries on the optimal combination of transfusion components for the purpose of resuscitation. Tranexamic acid is administered in a targeted manner in the United States and is more frequently utilised in prehospital settings in Europe and other regions[9].

Multiple organ dysfunction syndrome (MODS) is a widespread phenomenon in critically ill people and is the main cause of death among them. Multiple organ dysfunction syndrome is a medical condition characterised by uncontrolled inflammation in the body, resulting in malfunction

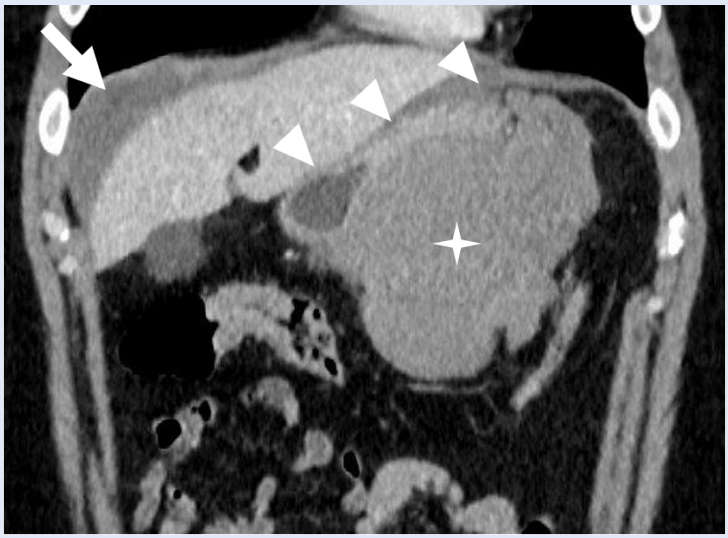

Figure 3. The coronal CT image shows a hemorrhagic collection (star) with compression on the stomach (arrow points), and hemorrhagic perihepatic free fluid

of many organs.. The primary approach to treating this condition is invasive organ support. Recently, there has been substantial advancement in comprehending the molecular pathways that initiate, relieve, and impact the result of MODS. As a result, MODS is now increasingly recognised as a distinct disease with its own causes, mechanisms, and potential treatment options. To prevent the development of MODS and improve outcomes, it is crucial to recognise it early and to admit the patient to the ICU as soon as possible In addition, initiation of invasive organ support is a successful strategy, as there is no effective therapy for MODS[10].

Multiple organ failure (MOF) syndrome is a recently identified condition characterised by the sequential development of acute respiratory distress syndrome, hepatic, renal, cardiac, gastrointestinal, or neurologic failure in individuals with hyperkinetic hemodynamic and hypermetabolic states. The causes are infections, septic and nonseptic shock, burns, and numerous traumas. MOF syndrome is characterised as a systemic "inflammatory response" to tissue injury, involving a number of mediator factors (such as TNF and interleukins) derived from macrophages and lymphocytes. This reaction leads to the failure of many organs. Treatment is based on immediate resolution of cellular hypoxia caused by circulatory disturbances, provision of nutrition, administration of anti-infectives and possibly the use of immunotherapy to regulate mediator activity[11].

Although our patient is a male, it must be emphasized that rupture of the splenic artery aneurysm, although rare, is a significant risk during pregnancy, with maternal and fetal mortality rates of up to 75% and 95%, respectively. Most commonly seen in the third trimester of pregnancy, this condition is marked by a sudden and severe abdominal pain accompanied by quick hemodynamic collapse. Initially, the rupture can be confined to the lesser sac, but it can lead to a secondary rupture with severe bleeding. The possibility of aneurysm rupture during pregnancy is increased by several factors, including hormonal changes, increased arterial pressure from the uterus, and pre-existing vascular disease. These physiologic changes may contribute to a splenic artery rupture being misdiagnosed as placental abruption, leading to intraoperative discovery of hamoperitoneum without preoperative multidisciplinary team planning. Given the high risk, prompt diagnosis and immediate surgical intervention are essentialto prevent maternal and fetal mortality[12, 13].

According to most research, it is advisable to treat splenic artery aneurysms if they are symptomatic. Even in the absence of symptoms, individuals at high risk, such as cirrhosis, portal hypertension, pregnant women, and liver transplant recipients, should be considered for repair. For asymptomatic patients with splenic artery aneurysms, there is disagreement about the approach. Current guidelines suggest that those with a realistic survival expectancy of more than two years and asymptomatic aneurysms larger than 2 cm should be treated. In these situations, prompt action can help avert potential problems and improve patient outcomes[5, 9]. The location of the lesion, the age of the patient, the risks associated with surgery and the clinical condition all influence the best treatment option for splenic artery aneurysms. The mortality rate for elective repair is greater than 0.5%, which emphasizes the importance of careful patient selection[7]. A simple excision, in which the splenic artery is ligated both proximally and distally while preserving the spleen through the small gastric vessels, can be used to treat aneurysms located in the proximal or middle third of the splenic artery. If the aneurysm is located in the distal third, splenectomy is often required for resection[14]. Transcatheter embolization has become a viable substitute treatment[15]. The treatment is associated with much lower rates of operative morbidity and mortality, although its success rates of approximately 85% are slightly lower than those of direct surgery[16]. For patients with splenic artery aneurysms, a multidisciplinary approach to evaluating these many treatment options is critical for achieving the best possible outcome.

CONCLUSION

This case report emphasizes the critical importance of timely recognition and prompt surgical treatment of SAA, particularly because of the risk

of their rupture and resulting in severe illness and death. The rapid recovery of the patient after urgent surgical intervention emphasizes the efficacy of immediate exploratory laparotomy, splenectomy and distal pancreatectomy in the treatment of ruptured splenic artery aneurysm. Although r-SAA is rare, it carries significant risks. This case highlights the importance of being vigilant and performing a thorough workup in patients with nonspecific abdominal pain and hemodynamic instability. It also emphasizes the need for proactive therapy and monitoring in high-risk individuals such as pregnant women and patients with underlying conditions such as portal hypertension or connective tissue disease. This case clearly demonstrates the importance of multidisciplinary teams and modern imaging techniques for both the detection and treatment of SAA. The analysis also confirms the importance of follow-up in monitoring any problems and ensuring the best possible outcome for the patient.

Conflicts of Interest: Authors declare no conflicts of interest.

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