



Atraumatic rupture of the spleen caused by *Plasmodium falciparum*, challenge in UN peacekeeping operations – a case report

Atraumatska ruptura slezine prouzrokovana *Plasmodium falciparum*-om, izazov u mirovnim operacijama UN

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Abstract

Introduction. Unlike traumatic rupture of the spleen, which is the most common consequence of blunt abdominal trauma and is well documented in the literature, and unlike the atraumatic rupture of the spleen, which is less common but also well described, spontaneous rupture of the spleen in a patient with malaria is a rare complication, with a potentially fatal outcome. **Case report.** A soldier aged 46 years, was hospitalized, with the clinical picture of abdominal colic and diarrhea, previously treated for a primary attack of acute malaria. During hospitalization, deterioration of health condition occurred, with the development of a clinical picture of an acute abdomen due to spontaneous rupture of the spleen which was successfully resolved by splenectomy. **Conclusion.** Splenectomy is the method of choice for patients with unstable clinical presentation due to atraumatic rupture of the spleen.

Key words:

central african republic; malaria; splenectomy; splenic rupture; united nations.

Apstrakt

Uvod. Za razliku od traumatske rupture slezine, koja je najčešća posledica tupe traume abdomena i dobro je dokumentovana u literaturi, i za razliku od atraumatske rupture slezine, koja je ređa, ali takođe dobro opisana, spontana ruptura slezine kod bolesnika sa malarijom je retka komplikacija, sa potencijalno fatalnim ishodom. **Prikaz bolesnika.** Vojnik star 46 godina, prethodno lečen od primarnog napada akutne malarije, hospitalizovan je zbog kliničke slike trbušne kolike i dijareje. Tokom hospitalizacije došlo je do pogoršanja zdravstvenog stanja sa razvojem kliničke slike akutnog abdomena usled spontane rupture slezine koja je uspešno rešena splenektomijom. **Zaključak.** Splenektomija je metoda izbora kod bolesnika sa nestabilnom kliničkom slikom usled atraumatske rupture slezine.

Ključne reči:

centralna afrička republika; malarija; splenektomija; slezina, ruptura; ujedinjene nacije.

Introduction

During the six-month rotation of the Serbian Armed Forces (SAF) contingent in peacekeeping operations – Multidimensional Stabilization Mission in the Central African Republic (MINUSCA), Bangui, Central African Republic (CAR), in the Level 2 hospital, a total of 1,002 patients were tested for suspected malaria, mainly repeated or recurrent infections. Malaria was confirmed in 375 patients, with 98% of cases caused by *Plasmodium (P.) falciparum*, and they were treated according to the protocol.

The SAF started the engagement in the CAR in the United Nations (UN) mission MINUSCA on September 20, 2014. This mission had the most numerous engagement of the SAF after the UN mission in Lebanon. Since 2020, the Serbian Level 2 military hospital of the UN mission in CAR has reached full autonomy and self-sufficiency, which means that all equipment and medical staff in the hospital were secured by the Republic of Serbia. The mission consisted of 72 members of the SAF, who provided the first and second lines of health care, emergency resuscitation/stabilization, emergency operations, limb and life salvage operations, basic

dental care, and the evacuation of the injured to the next level of medical care.

According to a World Health Organization report ¹, the African region takes the first place in the world in the number of malaria cases and deaths, with 93% of all global cases of malaria, while 15 countries in sub-Saharan Africa have 80% of all global malaria cases. In 2016, a total of 91 countries reported 216 million cases of malaria, with an annual global mortality of 450,000 cases. Children under five years of age are the most vulnerable group, and there were 67% (272,000) of deaths from malaria in 2018 in this group. The resistance of malaria parasites to antimalarial medications is growing, making malaria one of the deadliest diseases. Abdominal pain, fever, hypotension, and particularly an enlarged spleen are the classic symptoms that accompany infection with malaria, and splenomegaly is practically a cardinal sign.

The incidence of spontaneous splenic rupture in the literature is 0.1–0.5%, and the pathological one is the most common, while a rupture in the absence of any agent is known as idiopathic spontaneous rupture ².

There is no published data in the available literature on treated members of UN mission areas who suffered from malaria accompanied by complications such as pathological atraumatic spontaneous rupture (ASR) of the spleen. The aim of this paper was to present one potential fatal complication of splenic rupture that occurred during the first attack of *P. falciparum* infection in a member of a UN peacekeeping mission, which was resolved by splenectomy due to the clinical instability of the patient with hemorrhagic shock.

Case report

A 46-year-old soldier, a member of the contingent of the Police Force of Mauritania, was admitted to the Serbian Level 2 military hospital due to prolonged vomiting, diarrhea, and occasional abdominal pain. Two days before the hospitalization, due to a positive malaria rapid diagnostic test for *P. falciparum* and elevated body temperature, an outpatient doctor in the patient's home contingent administered him an antimalarial treatment, artemether ampoules 80 mg/24 h with antibiotic treatment, amoxicillin 500 mg/8 h, to which the patient reacted favorably. As a consequence, his condition improved partially, but the symptoms continued. On admission, the patient was conscious, afebrile, and

spontaneously mobile. On physical examination, it was found that he had mild epigastric pain, and his spleen was enlarged by a length of three fingers below the left rib cage. His trauma history was negative. There was a history of multiple malaria attacks in the endemic area from which he came, the suburban area of the capital city, Nouakchott, Mauritania. His complete blood count and biochemical values were in the normal range. During the hospitalization, he vomited twice and had frequent stools with previous constipation; substitution rehydration therapy was administered. During the second day of hospitalization, intensive condition deterioration occurred, accompanied by severe abdominal pain with a drop in blood pressure and tachycardia. Urgent laboratory test showed a blood count deterioration with the following values: hemoglobin 76 g/L [reference range (RR) 115.0–165.0 g/L], red blood cell count $2.52 \times 10^9/\text{mL}$ (RR 3.80–5.80 $\times 10^9/\text{mL}$), hematocrit 22.9% (RR 37–47%). After repeated tests, the values were as follows: hemoglobin 65 g/L, red blood cell count $2.13 \times 10^9/\text{mL}$, hematocrit 19.1%. Due to a technical failure of an ultrasonic device, a diagnostic abdominal paracentesis was performed, which was positive for the presence of blood. A midline laparotomy was urgently performed, and intraoperatively, an enlarged spleen, transverse lacerations on both surfaces, and a rupture of the splenorenal ligament, accompanied by active hemorrhage, were found (Figure 1). A large amount of blood was in the abdomen (2,000 mL). A splenectomy was performed, and the abdomen was dried, drained, and closed. During the operation, the patient received a transfusion of three whole blood units (660 mL). On the first postoperative day, another unit of blood was administered. A control ultrasound of the abdomen on the sixth postoperative day did not detect the presence of any collection in the abdomen. A rapid diagnostic test for malaria was performed, and the smear was negative. Due to high levels of platelets in the postoperative period during hospitalization, a therapy with low-molecular-weight heparin Lovenox[®] 4,000 UI anti-Xa/0.4 mL s.c./12 h, Aspirin[®] tablets 75 mg up to 1 \times 1 daily was administered. In addition, due to a high leukocyte count, an antibiotic therapy with ceftriaxone 2.0 g/12 h, vancomycin 1 g/12 h, and fluconazole tbl. 50 mg/24 h was applied. The further postoperative course was significantly improved. A histopathological specimen analysis was not performed due to the impossibility of sending the same, that is, the non-existence of a medical facility that would perform it in the capital city of CAR, Bangui. The



Fig. 1 (A and B) – Transverse lacerations on both surfaces of the spleen.

patient was detained until complete recovery and departure to his country on the eleventh postoperative day. Because of the nature of the patient's medical condition, according to UN policy, Chapter 5, Annex A, Medical Support Manual 2015, the patient was not medically fit to stay on the mission. The patient was repatriated on the medical grounds. The patient was unable to continue his therapy in Bangui, CAR, for technical reasons, i.e., because of vaccine deficiency. Therefore, he was advised to continue with antibiotics and receive some vaccines (Pneumococcal, *Haemophilus influenzae*, and Meningococcal vaccine, in case of non-updated insight into the vaccination card) as an integral part of patient protocols after splenectomy, as quickly as possible after arriving to his home country³.

Discussion

Malaria is the most common infectious disease in the CAR and originates from the *Plasmodium* family with its five species: *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale*, and *P. knowlesi*, while *Falciparum monospecies* is predominant⁴. At the same time, malaria is the number one killer in the CAR and the leading cause of death for children under five years of age¹.

In the population living in endemic areas, multiple malaria attacks result in the gradual enlargement of the spleen, contributing to a low probability of rupture, while it is more frequent in non-immunized people⁵. In 1958, Orloff and Peskin⁶ proposed four criteria for defining a true spontaneous rupture of the spleen, which had to be met. The four criteria are the following: the absence of trauma, the absence of any disease that affects the spleen directly or indirectly, the absence of perisplenic adhesions, and the normal microscopic and macroscopic appearance of the spleen. In 1874, Atkinson⁷ first described idiopathic spontaneous rupture of the spleen.

A large number of systematic papers describe only approximately the etiological cause of ASR of the spleen. ASR is an entity that is not precisely defined. In addition, there are numerous unknowns in the literature, particularly the characteristics of patients, incidence, and etiology, and there is no clear guide and management. The terms are often confusing, unclear, ambiguous, and even contradictory: spontaneous, idiopathic, atraumatic, occult, pathological, etc. The most common term is spontaneous rupture. The most extensive, comprehensive analysis of available papers published so far in the literature was systematized and analyzed by Renzulli et al.⁸. In a systematic review of 845 patients, with a total of 632 publications, the unknowns regarding ASR, excluding iatrogenic and traumatic ruptures of the spleen, were clearly defined, including ruptures of a vascular nature, such as thrombosis, or aneurysms of the splenic vein or artery. To clarify the nomenclature, the same authors propose the classification of splenic rupture into atraumatic idiopathic without etiological causes and traumatic pathological rupture of an already altered spleen that can arise spontaneously without trigger factors or with a minimal trigger (sneezing, coughing, vomiting, straining during defecation, and other

muscular efforts), wherein the first one is present in 7% of patients and the second one in 93%. According to aetiological factors, ASRs are classified into six large aetiological groups (neoplastic, infectious, inflammatory – non-infectious, of a genetic origin, caused by medications and treatments, mechanical causes) and subdivided into 18 minor groups, stating that 93% of ASR patients had pathohistological changes in the spleen. As such, they should be classified as atraumatic pathological spontaneous rupture of the spleen. The knowledge of etiology is crucial for making decisions on the type of treatment, and splenomegaly is the common denominator in 55% of all ASR cases. The same study reports an overall mortality rate in ASR of 12.2%, which is related to malignant diseases and age over 40 years⁸.

The average weight of a normal spleen is 156 (\pm 87) g in men and 140 (\pm 78) g in women, while the spleen size measured ultrasonographically is smaller than 110 \times 70 \times 50 mm⁹. In contrast to a normal spleen, the spleen is palpable in 50–80% of the cases in endemic areas with intense transmission of parasites, which is correlated with the immune response, the genetic predisposition, and the level of antibodies, while the enlarged spleen is practically present in 80% of patients with acute rupture¹⁰.

A change in the spleen structure during malaria most frequently results in an asymptomatic enlargement of the spleen, i.e., splenomegaly, which acts by combining all three mechanisms and may lead to complications, the occurrence of a subcapsular hematoma and spontaneous rupture. In addition, we rarely find a detailed pathohistological substrate of a removed spleen in the literature. Therefore, Machado Siqueira et al.¹¹, in their representation of splenic rupture caused by a non-treated *P. vivax* infection provide a detailed description of a microscopic analysis with an expansion of the white pulp and hypercellularity in the red pulp with an intensive plasmablastic proliferation in subcapsular and perivascular compartments, and a large number of intact infected reticuloocytes. Newly created secondary lymphoid follicles were also present. The histological feature resembles a B cell lymphoma and can be excluded with the polymerase chain reaction-PCR method.

A very extensive Vietnamese study¹², conducted in patients who died from complications of *P. falciparum* malaria, found loss of B cells from the marginal zone, as well as a significant change in the structure, in the form of an architectural reorganization of the spleen.

The mechanism of the occurrence of atraumatic spontaneous pathological rupture

One of the roles of the spleen as a complex organ, apart from the immunological sense, is selective blood filtration, the removal of red blood cells whose lifespan has passed, as well as the removal of various micro-organisms and red blood cells infected with *Plasmodium* parasites. Multiple malaria attacks by the endemic strain of *P. vivax* in the surroundings of the capital city, Nouakchott, the city of origin of the described case, caused an asymptomatic enlargement of the spleen. Such remodeling resulted in changes in the

structure of the spleen, such as a hematoma, focal necrosis, and thinning of the capsule. A new malaria attack by another species, in this case, *P. falciparum*, led to a critical increase, so a small trigger factor caused a rupture.

The clinical presentation of ASR patients is accompanied by local and systemic signs: the local presentation is a result of peritoneal irritation, while the systemic presentation is a result of hemorrhage. Therefore, its manifestations are, most commonly, hypotension, tachycardia, a decreased heart rate, oliguria, and, of course, a fever as a result of the infection itself. An early diagnosis is crucial. Moreover, the use of abdominal ultrasound is sufficient in evaluating the presence of blood through abdominal imaging windows and making decisions on surgical or non-surgical management¹³. A definite diagnosis of malaria infection is made after analyzing a peripheral blood smear and a thick blood smear. It is an integral part of a precise diagnosis and successful treatment.

Looking back through history, mortality from splenic rupture without surgery and therapy was almost 100%, which was described by Hershey and Lubitz¹⁴ in their paper as early as 1948, compared to 12% after splenectomy, wherein a third of patients can be treated with non-surgical

management, which includes exclusively resting in bed for 1–3 weeks and resuscitation with transfusion of blood and blood products if needed. Similar experiences with spontaneous atraumatic pathological rupture of the spleen caused by infection with *Plasmodium* parasites are also published by other authors in their articles as a quite rare but possible complication of individual cases. They applied an aggressive surgical approach – splenectomy, recommending surgical treatment in case of an emergency or as a result of worsening of the general condition in case of failure of conservative treatment^{15–17}.

Conclusion

Spontaneous splenic rupture caused by malaria is a potentially lethal complication when there is no adequate choice of treatment. The surgical approach is the method of choice for unstable patients with atraumatic spontaneous rupture.

Conflict of interest

The authors declare no conflict of interest.

R E F E R E N C E S

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