CASE REPORT

Atraumatic Splenic Rupture After Coagulopathy Owing to a Snakebite

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Among the many complications that may follow envenomation by some species of venomous snakes, coagulopathy is common and well known. However, hemoperitoneum induced by coagulopathy after a snakebite is rare. Atraumatic spontaneous splenic rupture is also an uncommon and life-threatening condition. Here, we report a case of presumptive envenomation by *Gloydius* spp. that resulted in atraumatic splenic rupture as a probable manifestation of coagulopathy, which has not been previously reported.

Key words: snakebites, blood coagulation disorders, splenic rupture, hemoperitoneum

Introduction

Envenomation from snakebites is common and remains a significant health problem in many countries. According to World Health Organization (WHO) research from 2008, the incidence of snakebites is estimated to be 421,000 to 1,841,000 per year, and worldwide, approximately 20,000 to 94,000 deaths occur each year as a result.¹ Snake venoms may induce local tissue necrosis and destruction. Moreover, envenomation can have systemic effects, such as neurotoxicity, coagulopathy, shock, rhabdomyolysis, and renal failure.² Among these complications, coagulopathy causing spontaneous hemoperitoneum is an infrequent manifestation in snakebite victims.^{3,4} Here, we report a case of a snakebite resulting in hemoperitoneum caused by spontaneous splenic rupture with active bleeding.

Case Report

A 60-year-old man was admitted to a rural hospital after receiving a snakebite on his right foot while he was harvesting pears in an orchard. Because this bite happened so suddenly, he was unable to provide a description helpful in specifically identifying the snake. He was given 1 vial of antivenom (Kovax freeze-dried

Agkistrodon halys antivenin injection 6,000 IU/vial; Korea Vaccine, Ansan, Korea) approximately 2 hours after the bite and received conservative management with tetanus prophylaxis. On the third day after envenomation, his right foot swelled and the pain worsened. The patient was referred to our emergency department. He reported a 15-year history of controlled hypertension. On examination, his right foot was bruised, and the swelling reached the knee (Figure 1). His vital signs were as follows: blood pressure (BP), 120/80 mm Hg; heart rate, 82 beats/min; respiratory rate, 20 breaths/min; and body temperature, 36.6°C. His hemoglobin (Hb) level was 14.1 g/dL, white blood cell (WBC) count was 10,040/μL, and platelet count was 216,000/μL. Serum electrolyte and renal function tests were normal. However, a coagulation test demonstrated an unmeasurable prolongation of his prothrombin time (PT) (>120 seconds; normal, 11.9–14.3 seconds) and an activated partial thromboplastin time (aPTT) (>180 seconds; normal, 29.1–43.5 seconds). Furthermore, an extremely low fibrinogen concentration (<60 mg/dL; normal, 200–450 mg/dL), increased levels of fibrinogen degradation products (FDPs: 114 μg/mL; normal, 0–5 μg/mL), and a D-dimer level of 20 μg/mL (normal, 0–0.5 μg/mL) were obtained. However, no signs of bleeding were observed, and the patient was managed with 1 vial of antivenom (Kovax freeze-dried *Agkistrodon halys* antivenin injection 6,000 IU/vial). For pain relief, intravenous meperidine 25 mg was administered. Despite antivenom administration, the coagulopathy was

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Figure 1. Swelling and bruising after a snakebite on the right lower leg.

not reversed; thus the patient was given 2 additional vials of antivenom every 6 hours.

On the following day, the patient reported a sudden onset of severe abdominal pain that was associated with hypotension. His BP was 60/30 mm Hg, and his Hb level was 9.1 g/dL. Computed tomography (CT) of the abdomen showed splenic pseudoaneurysm and perisplenic hematoma with a large hemoperitoneum (Figure 2). However, there was no known history of thoracoabdominal trauma. One

more vial of antivenom was given, and 3 units of fresh frozen plasma, packed red blood cells, and 8 units of platelet concentrate were transfused for replacement. Furthermore, tracheal intubation was performed to protect the airway because of altered mental status. Splenic artery embolization was performed. However, the patient's symptoms and signs did not improve. He underwent total splenectomy, and his general condition gradually improved. Histopathologic examination after

Figure 2. Enhanced cross-sectional (A) and anteroposterior (B) computed tomography scans show splenic pseudoaneurysm and perisplenic hematoma with active contrast extravasations (arrows) and a large hemoperitoneum.

Figure 3. Histopathologic finding in the spleen showing hemorrhage including the accumulation of erythrocytes (hematoxylin and eosin stain, original magnification $\times 100$).

the splenectomy showed a hemorrhage including the accumulation of erythrocytes (Figure 3). He was discharged in good health on day 20 after admission.

Discussion

Approximately 200 (15%) of the 3000 known species of snakes are considered to be dangerous to humans.⁵ Viperidae snakes, such as *Gloydius blomhoffii*, *Gloydius brevicaudus*, *Gloydius saxatilis*, and *Gloydius ussuriensis*, are the most abundant venomous snakes in Korea.^{6,7} Among them, *G blomhoffii* and *G brevicaudus* are the most common cause of snakebite because these snakes are mainly distributed in lower mountain and field areas, where people can easily come into contact with them.⁷ The antivenom currently used in Korea, Kovax freeze-dried *Agkistrodon halys* antivenin, is acquired from pooled horse serum with an adequate antibody titer against Chinese mamushi (*Agkistrodon halys*) venom. This antivenom has been shown to have a neutralizing effect on the 3 most abundant venomous snakes in Korea, and it is now in clinical use.⁸

In general, viper bites tend to elicit a significant local reaction in the form of pain, swelling, bruising, and necrosis at the bite site as a result of the many enzymes and toxins that cause vascular damage and tissue destruction.⁵ Systemic effects, such as hemotoxic or neurotoxic envenomation, can also be caused by viper bites. Hemotoxic envenomation that causes bleeding and clotting disturbances is triggered by several factors: procoagulants (thrombinlike enzymes and prothrombin-activating toxins), anticoagulants (such as toxins activating protein C), platelet activation or inhibition and thrombocytopenia (including by the disintegrins, a group

of RGD-containing proteins), fibrinolytic activators, and hemorrhagins.^{9,10} The hemotoxic effect of most snakes that inhabit Korea typically results in coagulopathy owing to the extravasation that occurs as a result of hemorrhagin action (increase in capillary permeability) leading to active bleeding secondary to the consumption of clotting factors.⁴ In this case, our patient showed decreased levels of fibrinogen concentration and increased PT, aPTT, FDP, and D-dimer, suggestive of disseminated intravascular coagulation (DIC). The best management strategy for asymptomatic patients with coagulopathy is unclear. However, if life-threatening hemorrhage occurs, administration of additional antivenom should be undertaken, and transfusions of clotting factors and platelets may be considered.¹⁰ Furthermore, when these conservative management methods are not effective, vascular interventions, such as embolization and surgery, might be needed.

Two cases of spontaneous hemoperitoneum with active bleeding caused by coagulopathy have been reported after a snakebite. Rathod et al³ reported hemoperitoneum caused by intramural hematoma of the alimentary tract with active bleeding after snakebite by Russell's viper. Ahn et al⁴ also reported nontraumatic hemoperitoneum caused by hepatic necrosis and rupture after a snakebite. The latter case was managed successfully by hepatic artery embolization. Atraumatic spontaneous splenic rupture is an uncommon and ill-defined but life-threatening clinical condition. One systematic review including 845 atraumatic splenic rupture cases identified 6 major etiologies: neoplastic, infectious, inflammatory or noninfectious (amyloidotic, vascular, genetic, and autoimmune disorders), drug- and treatment-related, and mechanical (pregnancy-related disorders and congestive splenomegaly) and normal spleens.^{9,11} In addition, the overall mortality rate for atraumatic splenic rupture was reported to be 12.2%. In our patient, spontaneous splenic rupture occurred after a snakebite, and splenic artery embolization was initially performed. However, total splenectomy had to be undertaken because of the failure of the initial treatment. As a possible mechanism in our case, we believe that the combination of DIC and direct vascular endothelial injury resulted in splenic necrosis and rupture.

In this case, the coagulopathy after envenomation of snakebite was not reversed in spite of administration of 5 vials of antivenom. The lack of reversal could be taken to suggest that either (a) the antivenom was ineffective, (b) the presumed coverage of the antivenom may not be equally effective for all species as indicated, or, (c) the coagulopathy had evolved to a point of minimal reversal.

In conclusion, to our knowledge, this is the only case report of atraumatic splenic rupture after a snakebite.

In the event of coagulopathy after a snakebite, any life-threatening hemorrhage in patients must be recognized early. If catastrophic bleeding is observed, additional antivenom should be given, and blood replacement therapy may be necessary. Additionally, if major bleeding is not controlled, early vascular intervention or surgery should be considered.

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