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Venom-induced consumption coagulation in a hematotoxin snake bite in East Java, Indonesia: A case report

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Abstract

Background: Located in Southeast Asia, Indonesia is one of the countries with the highest incidence of fatal snakebites in the world. Difficulty in identifying snake species and limited availability of antivenom often pose challenges in treating snakebites.
Purpose: To illustrate a case of consumption coagulation caused by a hematotoxin-containing snake venom.
Method: A case study study describes a snakebite incident managed in the Emergency Department (ED) of a secondary general hospital in Tulungagung, East Java. A 53-year-old male patient presented with pain, swelling, and bleeding in his left thumb, after being bitten by a yellow-brown Bandotan snake, approximately two hours prior to arrival.
Results: The patient was given antivenom therapy according to the guidelines. Patients were also given antitetanus, antibiotics, platelet transfusions and fresh frozen plasma (FFP), supportive therapy, and strict monitoring. in the surgical high care unit (HCU). The patient showed improvement on the fifth day and was discharged on the tenth day.
Conclusion: The use of local polyvalent antivenom combined with antibiotics, antitetanus therapy, platelets, and FFP transfusion has shown promising results in the management of toxin-induced coagulopathy.
Suggestion: Further studies are needed to evaluate the effectiveness of therapy in different age groups, including children, adults, and the elderly. In addition, this study only focused on therapeutic management and did not assess the impact of treatment on organ dysfunction caused by post-treatment lesions.

Keywords: Antivenom; Calloselasma Rhodostoma; East Java; Hematotoxin; Snake Bite.

INTRODUCTION

Venomous snakes are a real threat in many tropical regions, including Indonesia which has significant biodiversity of venomous snakes (World Health Organization, 2016). Hemotoxic snakebites contain toxins that damage blood vessels and blood vessels, and can cause severe systemic effects if not treated efficiently (Ralph, Faiz, Sharma, Ribeiro, & Chappuis, 2022). East Java Province is one of the

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provinces with a high population density and diverse ecosystems, hemotoxic snakebite incidents often occur in rural areas and areas with dense vegetation. Species such as Calloselasma are known for their ability to produce hemotoxic toxins that can cause blood clotting, internal bleeding, and organ damage (Demde & Patil, 2020; Mohale, Varma, Bharadiya, Acharya, & Bawankule, 2021).

Although snakebites can occur in various regions, the biggest challenge lies in the delay in diagnosis and treatment, which is often related to limited access to medical facilities and antivenom serum (Bhaumik, Beri, Lassi, & Jagnoor, 2020; Patikorn, Ismail, Abidin, Blanco, Blessmann, Choumlivong, & Othman, 2022; Tan, Liew, Tan, & Tan, 2016). Therefore, understanding the incidence pattern of hemotoxic snakebites and the various factors that contribute to the prevalence and associated complications is essential (Pucca, Knudsen, Oliveira, Rimbault, Cerni, Wen, & Monteiro, 2020).

Furthermore, a better understanding of the clinical aspects of hemotoxic snakebites may contribute to future efforts to prevent and improve medical care, as well as provide valuable insights into the Indonesian health care system, which continues to face challenges in managing venomous snakebite cases.

RESEARCH METHOD

A case study study describes a snakebite incident managed in the Emergency Department (ED) of a secondary general hospital in Tulungagung, East Java. A 53-year-old male patient presented with pain, swelling, and bleeding in his left thumb, after being bitten by a yellow-brown Bandotan snake, approximately two hours prior to arrival. This case study describes the management of the snakebite according to World Health Organization (WHO) guidelines, as well as additional supporting protocols for the management of venomous snakebites.

RESEARCH RESULTS

Table 1. Characteristics of Patient

Variable	Results
Demographic data	
Age (year)	53
Gender	Male
Occupation	Farmer
Education level	Elementary School
Primary survey	
Airway (A)	Clear, patent
Breathing (B)	Symmetric, spontaneous, respiratory rate 20 tpm
Circulation (C)	Warm and dry acral, CRT < 2 sec, heart rate 78 bpm, regular, bounding pulse, BP 120/90 mmHg
Disability (D) and Exposure (E)	GCS E4V5M6 (compos mentis), body temperature 37.0°C
Triage	Yellow zone/Priority 2

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Based on Table 1. it is known that the subject of this study was a farmer, male, aged 53 years. The patient came with complaints of pain and swelling in the left hand after being bitten by a yellow-brown snake. Upon arrival at the emergency unit, the patient was conscious and oriented (Glasgow Coma Scale: E4V5M6). Initial assessment showed no abnormalities in the airway, breathing, circulation, disability, or exposure, and the patient was then prioritized to the yellow zone for further observation and care.

A secondary survey revealed that the patient had been bitten while working in the field the same morning. After being bitten, the patient sought treatment from a shaman, who applied a topical herbal medicine (bobok). Approximately one hour after being bitten, the patient experienced bleeding gums. However, the patient denied experiencing other signs of spontaneous bleeding, including hematuria, melena, ecchymosis, hematemesis, or hemoptysis.

The patient described the snake as yellow-brown in color, with a triangular pattern around its body. Although he did not have a photo of the snake or its carcass, he was confident that the snake was a species known locally as "Bandotan land". When shown a series of snake images by ED staff, the patient identified Calloselasma rhodostoma as the most similar.

Table 2. Initial Treatment in the Emergency Room

Variable	Results
Secondary survey	
General physical examination abnormality finding	Gum bleeding
Local examination (left arm)	Inspection: Swelling from digitizes until the left wrist, fang mark (+), bleeding in the fang mark Palpation: Oedema (+), tenderness (+), pulsation (+)
Supporting examination	
Thrombocyte	$4.10^3/\mu L$
PT/APTT	No coagulation/No coagulation
INR	No coagulation
Working diagnosis	Snakebite suspect hematotoxin Spontaneous bleeding Coagulation disorder (VICC) Thrombocytopenia
Therapy	
Non-medication	Immobilization
Medication	Insert intravenous line (iv line) Anti-Venom Serum infusion 2 vials in 500 cc NS 0.9% 40-80 dpm repeat 6 hours

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Supportive	Ceftriaxone 2 x 1 gr (iv) Antitetanus serum 250 IU Ketorolac 2 x 30 mg (iv) Tranexamic acid 1 gr (iv) Omeprazole 2 x 40 mg (iv)
Monitoring	Continuous vital signs monitoring (up triage to red zone) Urine production Signs and symptoms of spontaneous bleeding Homeostatic function every 6 hours Liver and renal function
Evaluation (24 hours after antivenom administration)	The swelling extends to the left elbow with blisters around the lesion that break and bleeds easily. Lab result: PLT 81.10^3/µL, PT 16 s, aPTT 35 s, and INR 1.48
Plan	TC transfusion 500 cc every 24 hour FFP 500 cc every 24 hour Admit to Surgery High Care Unit

Based on Table 2. general physical examination, no significant abnormalities were found except bleeding from the gums. Local examination of the left hand showed swelling extending from the fingers to the left wrist, with visible fang marks on the thumb and spontaneous bleeding. Blood tests showed thrombocytopenia (platelet count 4,000/µL), unmeasured Prothrombin Time (PT) exceeding 14 seconds, Activated Partial Thromboplastin Time (aPTT) increased more than 30 seconds, and International Normalized Ratio (INR) more than 1.1. Based on these findings, the patient was diagnosed with a hematotoxic snakebite resulting in coagulation disorders, consistent with consumptive coagulopathy due to venom (VICC).

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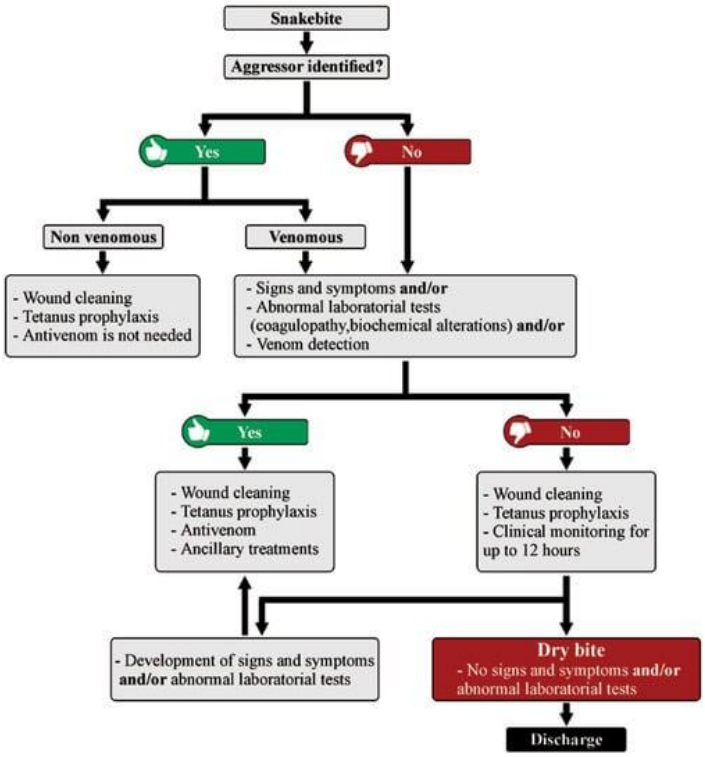


Figure 1. Diagnosis and Treatment of Snake Poisoning

Based on Figure 5. Diagnosis and treatment of snakebite poisoning involve several important steps. First, the diagnosis of snakebite poisoning includes; bite history, clinical symptoms (local and systemic), and laboratory examination. Second, treatment includes; antivenom, general treatment (patient stabilization and action at the bite site), follow-up treatment (further monitoring of symptoms and blood transfusion if severe bleeding occurs).



Figure 2. Day 1 the Patient Arrived

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Based on Figure 2. when the patient first arrived, there was swelling in the fingers to the left wrist. In addition, there was bleeding from the bite site. Initial treatment focused on immobilizing the left hand to prevent the spread of snake venom, installing an intravenous (IV) infusion, and starting fluid therapy with 0.9% Normal Saline (NS). The decision was made to administer a locally available antivenom, Biosave, a polyvalent antivenom that includes a neutralizing agent for Calloselasma rhodostoma venom. The patient was placed in the red zone for continuous monitoring of vital signs, urine output, symptoms, and bleeding.

The initial dose of antivenom was 2 vials (5 mL each) diluted in 500 mL of 0.9% NS, infused at a rate of 40-80 drops per minute. The patient was closely monitored during the infusion for adverse effects. In addition, the patient received prophylactic Ceftriaxone 1 gram (IV) twice daily, tetanus antitoxin (250 IU), ketorolac 30 mg (IV) twice daily for pain management, tranexamic acid (initially 1 gram IV, followed by 500 mg IV three times daily), and omeprazole 40 mg (IV) twice daily.



Figure 3. Day 2 Swelling

Based on Figure 3. Day 2, after 6 hours of observation, the patient's blood clotting disorder still persisted and local swelling had spread to the left elbow with blisters starting to form around the area affected by the snake venom. Additional doses of antivenom were given, and the patient was transferred to the High Care Surgical Unit (HCU) for further management. The patient also received a transfusion of 500 mL of Platelet Concentrate (TC) every 24 hours and 500 mL of fresh frozen plasma (FFP) every 24 hours.

After 24 hours, the wound began to show signs of necrosis, with increased blister formation. The blisters contained clear fluid, which was prone to rupture and bleeding. Laboratory results showed some improvement with platelets increasing to 81.103/µL, PT at 38.1 seconds, aPTT at 35 seconds, and INR at 1.48.

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Figure 4. Day 3 the Swelling Starts to Decrease

Based on Figure 4. on the 3rd day, the swelling began to subside, and the spread of the lesion was limited to the elbow area. However, the platelet count, PT, aPTT, and INR remained unstable and had not returned to normal values on the fifth day. On the sixth day, the wound showed signs of drying, and the platelets had stabilized within the normal range. However, PT, aPTT, and INR remained unstable. At this point, the intravenous line was removed, and the injected drug was switched to oral administration.



Figure 5. Day 20 of the Lesion Area Leaves a Blackened Scar

Based on Figure 5, the lesion area left a dark scar. On the 10th day, the patient was discharged and continued outpatient care. On the 20th day, the outpatient clinic was started. The wound has shown significant healing, although the left hand still has limited function compared to the pre-injury state. The affected skin area has developed a dark scar.

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DISCUSSION

Calloselasma rhodostoma also known as Agkistrodon rhodostoma or Malayan poisonous snake, is commonly referred to by locals as "bandotan" or "blandotan." This snake belongs to the Viperidae family and is widely distributed throughout the island of Java. Classified as a category 1 snake by WHO, this snake is considered one of the most medically important due to its highly venomous nature (World Health Organization, 2016).

Locally, there are two known species of snakes, namely the ground snake (Calloselasma rhodostoma) and the tiger snake (Ptyas mucosus). Both species have yellowish brown skin with patterned motifs along their bodies. However, C. rhodostoma has a large triangular motif that resembles a batik pattern, while P. mucosus has small irregular spots that resemble tiger stripes. P. mucosus is non-venomous, while C. rhodostoma is highly venomous (Bhalla, Mhaskar, & Agarwal, 2014; Mubarak & Mohapatra, 2021).

Calloselasma rhodostoma is often difficult to detect among a pile of leaves, challenging the long-held belief that venomous snakes always have striking physical features. As reported in many cases, victims often have difficulty identifying the snake that bit them and many only seek medical attention after severe symptoms have appeared (Hawa, Mhaili, Boutakioute, Idrissi, & El Ganouni, 2022; Simangunsong, Habib, & Simbolon, 2024). Most snakebites that do not result in serious clinical manifestations often go unreported, as these victims typically do not seek further medical care (Ralph et al., 2022). In the current case study, for example, the patient initially sought help from a traditional healer who applied a topical medicine made from local leaves (called “bobok”) and only sought medical attention after experiencing bleeding gums.

According to the snakebite management guidelines in Southeast Asia, the initial response to a snakebite should prioritize resuscitation in life-threatening situations. Immobilization of the bitten area is essential to slow the spread of venom. However, the use of a tourniquet above the bite site is not recommended as it can cause necrosis (World Health Organization, 2016).

A thorough physical examination should be performed once the patient is stable. A general examination includes examining the gums, nose, skin, and mucous membranes for signs of bleeding or chemosis. An abdominal assessment is essential to identify potential internal bleeding, while a neurological examination helps detect signs of intracerebral hemorrhage or ischemia. Cardiac arrhythmias have been reported in some cases, so monitoring the heart rate is also important. A local examination of the bite site is performed to assess for tenderness, swelling, early signs of necrosis (such as blistering and hyperpigmentation), or a foul odor (Ralph et al., 2022). Further, the bite site examination focuses on assessing for tenderness, swelling, early signs of necrosis—including blistering and hyperpigmentation—and the presence of a foul odor (Tan, Tan, & Tan, 2021).

The next step is to quickly determine whether antivenom is needed, making snake identification a critical part of the process to ensure the correct antivenom is administered. Identifying the type of snake can be quite challenging (Bhaumik et al., 2020). Local names used by the community can sometimes complicate the identification process. While descriptions provided by patients and others can help identify snakes, this method is inherently subjective and carries the risk of misidentification.

Several methods have been developed to simplify the process of determining whether snakebite treatment is necessary, one such method is the algorithm. According to the algorithm, antivenom should be administered if the patient has been confirmed to have been bitten by a snake and shows signs of systemic envenomation, which can be validated by one or more abnormal laboratory findings. These findings may include spontaneous

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systemic hemorrhage, coagulopathy, thrombocytopenia, neurotoxic symptoms, cardiovascular abnormalities, renal failure, hemoglobin/myoglobinuria, or localized swelling of more than half of the bitten extremity within 48 hours (Pucca et al., 2020).

In this case study, the clinical manifestations and laboratory findings strongly indicated a hematotoxic snakebite. Identification of the snake species was based on the patient's description and clinical symptoms, which were consistent with C. rhodostoma. The decision was made to administer antivenom, along with other recommended treatments, including tetanus prophylaxis and wound care, and other supportive therapy.

Antivenom is a specific antidote for snake venom. Antivenom is available in two types of preparations, namely monovalent (neutralizes one type of snake venom) and polyvalent (neutralizes several types of snake venom). In Indonesia, there is only 1 type of snake antivenom, namely Biosave polyvalent snake antivenom serum. This antivenom is used for 3 types of snakes, namely Naja sputatrix, Bungarus fasciatus, and Calloselasma rhodostoma (Tan et al., 2016).

Antivenom administration should be carried out according to specific guidelines to minimize the risk of side effects (Sriapha, Rittilert, Vasaruchapong, Srisuma, Wananukul, & Trakulsrichai, 2022). Approximately 10% of antivenom administrations can cause adverse reactions, which can include anaphylaxis, pyrogenic reactions, and serum sickness (World Health Organization, 2016). The average time to onset of these reactions is approximately 48 minutes, so it is very important to monitor patients closely, for at least one hour after antivenom administration (Alangode, Rajan, & Nair, 2020). However, some reports suggest that allergic reactions can also develop several hours to days later. To ensure safety, antivenom administration should be accompanied by the availability of epinephrine at the bedside in case of adverse reactions (Isbister, 2024).

Antivenom is given intravenously, either by slow push injection or as an intravenous infusion. It is usually dissolved in 5 ml of isotonic fluid per kilogram of body weight and given over 30-60 minutes (World Health Organization, 2016). The dose of antivenom can vary depending on the manufacturer, this information is stated on the packaging. In this case study, the antivenom used was Biosave polyvalent antivenom (Tan et al., 2016). According to local guidelines, the initial dose of this antivenom is 2 vials mixed with 500 ml of physiological fluid (such as Ringers Lactate, NaCl, or Asering) and given at a rate of 40-80 drops per minute (Ministry of Health of the Republic of Indonesia, 2023).

The correct dose of antivenom usually results in improvement in clinical symptoms within 15 minutes to 9 hours (Isbister, 2024). Signs and symptoms of systemic toxicity generally resolve within 24-48 hours (Ralph et al., 2022). If coagulation problems persist, a repeat dose may be given 6 hours later or 1 hour later if spontaneous bleeding occurs. If no appropriate antivenom is available, the patient can be managed conservatively (World Health Organization, 2016).

In patients with hemostatic disorders, bed rest is recommended to avoid trauma. Transfusion of cryoprecipitate, fresh frozen plasma (FFP), whole blood, and platelets can be given based on clinical conditions and laboratory test results (World Health Organization, 2016). In this case study, the patient received platelet and FFP transfusions. Platelet transfusions are given to increase the low platelet count in the patient's blood, helping to prevent bleeding during the toxin neutralization process. FFP transfusions are intended to replace blood clotting factors that have been damaged by the toxin.

Some studies have shown that FFP administration after antivenom treatment is not significantly different from antivenom alone, while other studies have shown contrasting results (Zeng,

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Liang, Liang, Han, Wu, Liu, & Wang, 2022). It is important to note that antivenom administration does not necessarily reverse the effects of the poison that has occurred (Tan et al., 2016). The main purpose of antivenom is to prevent further damage, because the damage caused by the poison cannot be overcome by the antivenom itself.

Severe local lesions at the bite site can be treated with surgical intervention and the patient is given broad-spectrum antibiotics to prevent infection (World Health Organization, 2016). In this case study, in addition to receiving prophylactic tetanus injections and antibiotics, the patient also underwent daily wound care. Unlike some other studies, there were no reports of necrosis or the need for invasive surgical procedures (Berling, & Isbister, 2015; Mohaleet al., 2021; Verma, Baveja, Thakur, Patnaik, Tilak, & Mutreja, 2023). The lesion resulted in a hyperpigmented scar that persisted until day 20. Although long-term functional impairment was not observed in this case, other studies have reported that dysfunction or malignancy can develop years later (ALQuwaiay, Alshammari, Eltoum, Almutairi, Alshamari, & Ahmed, 2022).

CONCLUSION

Systemic envenomation due to snakebite with hematotoxic manifestations in Java Island is most often associated with Calloselasma rhodostoma. The use of local polyvalent antivenom, combined with antibiotics, antitetanus treatment, platelets, and FFP transfusion has shown promising results in the management of envenomation coagulopathy.

SUGGESTION

This study is a case study with a limited number of subjects. Further research is needed to evaluate the effectiveness of therapy in various age groups, including children, adults, and the elderly. In addition, this study only focused on therapeutic management and did not assess the impact of treatment on organ dysfunction caused by post-treatment lesions. This aspect can be considered for future research.

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