

Snakebites and the Effect of *Serum Anti Bisa Ular (SABU) Antivenom* at Dr. Hasan Sadikin General Hospital Bandung, Indonesia: an Overview Period 2015–2019

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Abstract

Background: Snakebite is considered a global health issue, especially in the Southeast Asian region. However, data regarding snakebite cases in Indonesia are still very limited. This study aimed to explore the venomous snakebite cases and the serum anti bisa ular (SABU) antivenom effect in treating venomous snakebite caused by other than the snake species indicated in currently available SABU antivenom formulas.

Methods: The analytical descriptive method with a cross-sectional study design was conducted in 2021 using a total sampling from the medical records of 63 patients diagnosed with snakebite at Dr. Hasan Sadikin General Hospital Bandung from 2015 to 2019. Characteristics of patients, clinical manifestation, and correlation between snakes species and outcomes after treatment with or without administration of SABU antivenom were collected.

Results: Out of 63 patients, males (79%) were predominant with an average age of 39 years. Fifty-six patients arrived at the Emergency Room less than 24 hours after the occurrence (89%). Most cases were categorized as grade 2 (41.%) where the upper extremities were commonly bitten the body area (64%). Edema (83%) was the most common manifestation. There was no correlation between snake antivenom administered to a specific snake species and the stated outcome ($p=0.053$), meaning that SABU antivenom might be an effective alternative to treat more types of snakebites.

Conclusions: Snakebites are most common in males, attack the upper extremities, categorized as grade 2 with edema. Administration of SABU antivenom provides the similar outcome compared to the group caused by the Javan spitting cobra, Banded krait, and Malayan pit viper.

Keywords: SABU, snake antivenom, snakebite

Introduction

Snakebite is considered a global health issue, although globally there is a lack of data on the total number of the venomous snakebite.^{1,2} Annually in the United States, there are 7,000 to 8,000 venomous snakebites with reported deaths of five to ten cases per year.^{3,4} The incidence rate of venomous snakebites in Southeast Asia reaches 1.2 to 5.5 million per year, which is capable of causing 125,000 deaths and tens of thousands of chronic disabilities.⁵ As one of the largest tropical countries in the world, Indonesia has a fairly large potential for snakebite cases.⁶ As part of the Southeast

Asia region, Indonesia has been reported to have 12,739–214,883 cases of snakebite causing up to 11,581 deaths in 2007.⁷ In Indonesia, there were approximately 135,000 cases of snakebite that occurred in 2017.⁸ The snakebite incidence rate in West Java province is considerably high. Various snakebite cases were reported in the Emergency Room (ER) of Dr. Hasan Sadikin General Hospital with different clinical manifestations, from mild to quite severe to even cause death. Literature records reveal that more than 100 species of snakes have been reported from Java.^{9,10}

Snakebite is a type of case that could evoke plenty of complications hence elevating the

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mortality rate.¹¹ Snake venom produces a toxic effect on the body and further complicates the victim's body from the inflammatory response.¹² Precise identification, management, and rational usage of antivenom are expected to substantially reduce the mortality and morbidity rate of snakebites.¹³ Antivenom should be administered to all patients with apparent systemic signs and symptoms, including hemostatic disorders, neurotoxic signs, cardiovascular abnormalities, acute kidney failure and/or local chronic symptoms such as progressive and immediate swelling involving more than half of the body part bitten within 48 hours after snakebite occurred.¹⁴ The clinical presentations of snakebite victims vary according to the snake species, the number and location of the bites, quantity and toxicity of the venom, as well as the patient's age and body size. The bigger the size of the patient, the better the outcome due to the less amount of toxin per kilogram of body weight.¹² Most snakebite patients are men, related to their occupations, there are farmers or those who work in open area, there are also herpeto culture hobbyists and reptile keepers. Thus far, all snakebite patients who came to Dr. Hasan Sadikin General Hospital, Bandung, Indonesia were given SABU antivenom, because it is the only type of antivenom available in Indonesia, specifically in western Indonesia. SABU antivenom is indicated for snakebites by three most common types of venomous snakes namely Javan spitting cobra, Banded krait, and Malayan pit viper (polyvalent). Aside from these three snakes, Indonesia has not yet produced antivenoms that are more specific for other types of venomous snakes.¹⁵ Several countries in Southeast Asia such as Thailand¹² and the Philippines¹⁶ are known to produce their snake antivenoms but with a slightly different set of snake species.

According to the World Health Organization (WHO),⁵ snakebite is suggested to be made a certain case that must be reported in all regions of Southeast Asia, because more than 95% of snakebite cases occur in tropical and/or developing countries. Since 2017, snakebite has been categorized as a Neglected Tropical Disease category A. However, in Indonesia there has not been a proper national epidemiological reports. There is almost no epidemiological data for snakebites and the data obtained are only hospital-based case reports. Many factors could determine the accuracy of information from the reported cases, such as the number of snakebite cases occurring in rural areas, traditional medicine

practice, or some patients who never come to the hospital. As a result, the real issue of snakebites might be bigger than expected.^{17–19} This study aimed to acknowledge the overview of venomous snakebite cases and the effect of the *serum anti bisa ular* (SABU) antivenom in treating venomous snakebite other than the snake species indicated in the SABU formula available.

Methods

This research used descriptive-analytical method with cross-sectional study design. Total data were collected from the medical records of patients diagnosed with snakebite at Dr. Hasan Sadikin General Hospital in the 2015–2019 period using the International Classification of Diseases (ICD) 10 code T63. Only complete data were included, meaning that information such as age, gender, complaints, type of snake, prehospital time, grade of severity, area of body bitten, administration of SABU antivenom, and outcome should be clearly mentioned in the medical records.

The grade of severity used was based on the Snakebite Severity Score (SSS) which was divided into 4 grades.^{20,21} Grade 1 (minor) indicated no occurrence of symptoms. In this condition, snakebite wound usually did not cause local or systemic reactions. Grade 2 (moderate) indicated local symptoms of mild envenomation such as bite marks, moderate pain, mild local edema with a diameter of 0–15 cm, redness, ecchymosis, and no systemic reaction. Grade 3 (severe) progressed further to cause regional symptoms including bite marks, severe pain, moderate local edema with a diameter of 15–30 cm, redness, ecchymosis, systemic weakness, sweating, syncope, nauseous, vomiting, anemia or thrombocytopenia. Whereas grade 4 (major) was indicated by bite marks, severe pain, severe local edema (>30 cm), redness, ecchymosis, hypotension, paresthesia, coma, lung edema, and respiratory failure. Several factors might affect the grading of severity and outcome of snake envenomation such as the size of patient's body, comorbidities, body area bitten, physical training, individual sensitivity, type of snake, secondary infection, and treatment administered.¹²

Out of all snakebite patients who were included in the study, there were 63 distinguished patients with the complete records. The correlation between snakebite of particular types of snake administered antivenom and patients outcomes was

Table 1 Characteristics of Snakebite Patients

Characteristic	n=63	
	n	%
Age, average (year)	39.27	
Gender		
Male	50	79
Female	13	21
Prehospital time		
<6 hours	29	46
6–24 hours	27	43
>24 hours	7	11
Grade of severity		
0	4	6
1	6	10
2	26	41
3	24	38
4	3	5
Area of body bitten		
Upper extremities	40	64
Lower extremities	21	33
Other	2	3

conducted using the chi-square method. The study has been approved by the Ethics Committee of Dr. Hasan Sadikin General Hospital with a number of approval 1191/UN6.KEP/EC/2020.

Results

From 2015 to 2019, 66 medical records of snakebite patients were obtained at Dr. Hasan Sadikin General Hospital. Out of 66, only 63 records were completed with information on the type of snake that caused the bite. In the following study, the average age of snakebite patients was 39 years. A total of 50 patients were male (79%). More than 50% of patients arrived at the emergency room of Dr. Hasan

Sadikin General Hospital in less than 24 hours, collectively 56 patients (89%). The most common grade of severity found was grade 2 as many as 26 cases (41%) with the most common body area bitten occurring in the upper extremities (64%). Data explanation regarding the characteristics of snakebite patients was presented in Table 1.

The percentage of each clinical manifestation that occurred in the snakebite patients was shown in Table 2. Each subject might have multiple complaints. The most often clinical manifestation was edema with a total of 52 patients (83%).

Number of patients who were given the SABU antivenom and those who were not, based on the type of snake that caused the

Table 2 Clinical Manifestations in Snakebite Patients

Complaints	n	%
Edema	52	83
Headache	18	29
Nausea	17	27
Sensory disturbance	12	19
Hemorrhage	11	18
Vision impairment	7	11
Loss of consciousness	6	10
Shortness of breath	5	8

Table 3 Total of Patients Treated with and without SABU Antivenom

Type of Snake	SABU	Without SABU	Total
Javan spitting cobra, Banded krait, Malayan pit viper	20	4	24
Other snakes	36	3	39
Total	56	7	63

Table 4 Correlation between the Type of Snakes and the Outcome

Type of Snake	Recovery/Improvement	Deceased	Total	p-value
Javan spitting cobra, Banded krait, Malayan pit viper	18	2	20	0.053
Other snakes	36	0	36	
Total	54	2	56	

bite was depicted in Table 3. There were 36 patients who were bitten by snakes that had no indication of antivenom, and were given the antivenom.

The outcome of snakebite patients who were given SABU was shown in Table 4. As many as 36 snakebite patients who were bitten by other than the three snakes indicated an outcome of recovery or improvement. There was no correlation between the administration of SABU antivenom and the type of snake ($p=0.053$).

Discussion

This study has shown that the snakebite occurred most commonly in male of average age in the workingclass population. The average patients arriving at the hospital is less than 24 hours. Administration of SABU antivenom to snakebites caused by other than the Javan spitting cobra, Banded krait, and Malayan pit viper was able to provide the same outcome as the three main indicated snakes. Presuming that a wider scope of data collection on snakebite cases will be done, thus the distribution of antivenom in Indonesia could be further acknowledged for more immediate and effective management.

In this study, the age of patients ranged from one to ninety years with an average of 39.27 years. In addition, snakebites are often experienced by men. This could be because the majority of the patients were bitten while they were in the rice fields or doing activities, so that more than 50% of the patients were working age population. Snakebites in Indonesia often occur in plant farmers in plantations or rice farmers in rice fields.¹⁵ In this study, most

of the adult patients were attacked at work, students got struck while playing on the farm, and some patients confessed to keeping snakes as pets and were bitten while playing or participating in snake contests. This activity also explains why most bites are found in the upper extremities.

Collectively, 89% of patients were brought to the ER in less than 24 hours. Public awareness towards the emergency of snakebite is adequate, although sometimes traditional medicine is still carried out before being taking to the hospital. Patients who come more than 6 hours after being bitten might be because the incident was far from Bandung city, for example in West Bandung Regency. Treatments include tying knots over the the bitten body area, sucking the blood out, covering the wound with certain leaves or herb, and even incising the bite wound area. The management of first aid that is most often carried out by patients is the use of tourniquet, even though it is not accordance with the WHO guidelines.⁵

In the data collection process, it is rather difficult to ruling out the exact type of snake that caused the bite based on the anamnesis, hence it is decided only by looking at the snake color. However, some data from medical records show some non-specific characteristics of snake. Nevertheless, it could be roughly pinpointed that the green-colored snake in Indonesia is most likely a green pit viper (*Trimeresurus albolabris*), a black snake is referred to as the Cobras (*Naja sumatrana* and *Naja sputatrix*), and the brown striped or brown-colored snakes might be the pit viper (*Calloselasma rhodostoma*).

Based on the data collected, almost

every snakebite with the grade of severity above 1 was given the SABU antivenom regardless of the type of snakes. Indications for administration of antivenom such as hemostatic disorders, neurotoxic signs, cardiovascular abnormalities, acute kidney failure, hemoglobinuria, myoglobinuria, local swelling of more than half of the body area bitten within 48 hours after the occurrence, progressive swelling immediately, and enlarged lymph nodes. A total of 54 patients recovered or improved after being given the antivenom. The correlation between the outcome of antivenom administration and snakebite with certain types of snakes is not significant ($p=0.053$). SABU available in Indonesia is only indicated to neutralize the neurotoxins produced by *Naja sputatrix*, *Bungarus fasciatus*, and hemotoxins produced by *Agkistrodon rhodostoma*, however the same outcome was acquired in snakebites caused by the type of snakes that was not indicated in the antivenom formula. Previous related studies stated that the SABU antivenom was not effective in neutralizing the venoms produced by snake species inhabiting eastern Indonesia area such as *Acanthopisantarticus*, *Xyuranusscuttelatus*, *Pseudechispapuanus*, and *Enhydrinacysta*.⁸

The limitation of this study is secondary data, so that a clear overview of the anamnesis, especially the type of snake could not be obtained. Low prevalence due to limited cases, as there are not many documented. However, this is an overview of the referral hospital showing the result of antivenom management. For further research, it is better to obtain more complete data by looking for newer cases or maintaining the quality of completeness of medical records document.

To conclude, snakebite most commonly occur in men with an average age of working-class population who arrived at the hospital less than 24 hours. Administration of SABU antivenom for snakebites caused by other than Javan spitting cobra, Banded krait and Malayan pit viper is able to provide the similar outcome to the three main indicated snakes, suggesting that antivenom in Indonesia could be further acknowledged for faster and effective management.

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