UDC 61

THE CORRELATION BETWEEN THE TYPES OF SNAKES, GEOGRAPHICAL AREA, PRE-HOSPITAL TREATMENT AND THE OUTCOME OF SNAKEBITE PATIENTS

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ABSTRACT
Snakebite is a global health problem; yet, most of the cases are rarely discussed in depth. Snakebite is also known to cause high morbidity and mortality rates. This research is an observational analytic research with the cross-sectional approach taken from January to December 2016. The data are obtained from the medical record of snakebite patients at Emergency Department of Dr. Koesnadi Bondowoso General Hospital, East Java, Indonesia. A total of 56 snakebite cases (patients) are included in this study. Most types of snake venom found are Callaselasma rhodostoma (39.7%) followed by Bungarus fasciatus (34.5%) and Naja sputratix (25.9%). 81% cases of snakebite incidence occurred in untrained areas while the 19% of it occurred in trained areas. It is known that the most frequent pre-hospital handling of snakebite is string strap (32.8%) and wounding or immobilization (19%). There are many cases of poisonous snakebite. The factor that affects the outcomes of venomous snakebite cases is pre-hospital management (early handling of immobilization).

KEY WORDS
Snakebite, poisonous snake species, geographical area, pre-hospital management, time management.

Snakebite is a global health problem but most of the cases are rarely discussed in depth. Many cases of snakebite happened in the countries that have tropical and subtropical weather including Indonesia. This causes high morbidity and mortality rates. Based on several epidemiological studies, snakebite cases are more commonly experienced by farmers, plantation workers, herders, fishermen, and people who like to sleep on the floor or in open area. (Anjum *et al*., 2012; Hossain *et al*., 2016).

Most victims of snakebite do not know the type of snake that bites them and, as a result, the handling becomes difficult especially in the use of anti-snake serum. The identification of snakes is important because most of the cases involve dangerous snakes such as *Elapidae* (cobra, mamba, krait, sea snake) and *Viperidae* (*rattlesnake, pit viper*). There are 4 types of snake discussed in this study namely, Java cobra (*Naja sputarix*)*, weling* (*Bungarus candidus*), ground snake (*Callostelesma rhodostoma*), and green pit viper (*Trimeresurus sp.*) (Indraneil*, 2012*).

The issue of global health, especially snakebite cases, is often overlooked and not taken into account. This is due to the lack of data and report as well as the lack of knowledge about snakebite handling. Snakebites are often experienced by farmers, plantation workers, herders, fishermen, and people who like to sleep on the floor or in open area. It often occurs that the victims of snakebite do not know the type of snake that bites them. Consequently, it causes difficulties in handling the snakebite especially in the use of anti-snake serum. The

identification of snake types is important because most of the cases involve a dangerous type of snake. (Gutiérrez, Theakston & Warrell, 2006; Hossain *et al*., 2016).

Tropical geographical location and environment is a good place for snake breeding. There can be many kinds of snakes in that area. As in India and Bangladesh, there are 82 different species which includes 12 species found throughout the region and 28 species found to be venomous. Countries such as India and Bangladesh conducted a data collection through community associations in each region. The data obtained have more detail than the data from hospitals. In 1999, Bangladesh showed 4.3 cases of snakebite per 100,000 population where 2,000 of it died from snakebite. In 2009, it increased to 623.4 cases of snakebite per 100,000 population (Hossain *et al*., 2016).

Early treatment of snakebite can be done by both patients and helpers. Handling through traditional methods such as the installation of *tourniquet*, incision, or ice packs is proved to have no clinical benefit. This often makes the patients delaying to go to a health care center. According to WHO, the correct early treatment is immobilization and pressuring (bandaging) for neurotoxins cases. After that, the patient must be taken immediately to the health center to receive medical treatment and anti-snake serum and then brought to a hospital. The provision of anti-snake serum is recommended in the event of non-local systemic symptoms. Therefore, the serum will be effective because it costs much money and the manufacturer itself is limited. The standard and correct use of anti-snake serum must be done at all public health center. The giving of early anti-snake serum can be performed in the public health center but then must be referred to a referral hospital. However, it is possible to have anaphylactic shock because the use of anti-snake serum or *sabu* (biosave) must go through a sensitivity test (Vademien, 2016).

In Indonesia, the cases of snakebite need to be considered as a health problem as a whole, especially for rural areas. However, due to the lack of data on the spread of snake species in Indonesia, especially in East Java, it is necessary to have a research in concern to that issue which will be useful for the handling of snakebite cases.

In order to know the relation between snake types, geographical area, pre-hospital management, and the outcome of snakebite patients in Indonesia, it is required to have a case recording and reporting. Currently, Indonesia uses a form (sheet) for snakebite cases adopted from the *Guidelines for the Management Snake Bites WHO 2010*. This is the first research conducted in Indonesia to know the relation between snake types, geographical area, pre-hospital management, and the outcome of snakebite patients when they come to the emergency department at Bondowoso General Hospital. Bondowoso is one of the regions in Indonesia which have a high incidence of snakebite.

METHODS OF RESEARCH

The design of the research which will be used in this research is analytic observational research with the cross-sectional approach. The variables measured will be observed and data retrieval will be performed at the same time. This research took place at the Emergency Department (ED) of Dr. Koesnadi Bondowoso General Hospital, East Java from January to December 2016. The population of the study was all patients who arrived in the ED at the appointed time period. The geographical area that is based on the distribution of poisonous snakes around Bondowoso covers urban and mountainous areas. The types of the snakes are divided into four such as Java Cobra (*Naja sputarix*), *weling* (*Bungarus candidus*), ground snake (*Callostelesma rhodostoma*), and viper snake (*Trimerusurus sp*). The pre-hospital treatment includes *first aid,* antibody response observation, and complications. The outcome of the patient's state will be assessed whether it is normal or in a sequel and followed for 7 days.

RESULTS AND DISCUSSION

In this study, the patients who are observed for one year were 56 people. The characteristics of the patients include sex, the type of snakebite, the geographical area, the time arrived in the ER, and the type of pre-hospital action. In this study, there are 72.4% (42

people) of male patients and 27.6% (16 people) of female patients. The most venomous types of snakes are *Trimeresurus sp* (39.7% or 23 tails), followed by *Bungarus fasciatus* (34.5% or 20 tails), and *Naja sputatrix* (25.9% or 15 tails). The geographical area is divided into areas that are trained and untrained to handle the venomous snakebite. The incidence of snakebite often occurred in untrained areas for around 81% of cases (47 occurrences), while in the trained area there were 19% of cases.

Jenis Kelamin	
Laki – laki	42 (72,4%)
Perempuan	16 (27,6%)
Jenis Ular	
Trimeresurus sp	23 (39,7%)
Bungarus fasciatus	20 (34,5%)
Naja sputatrix	15 (25,9%)
Lokasi Geografis	
Terlatih	11 (19%)
Tidak Terlatih	47 (81%)
Lama Tiba Di IGD	
< 6 jam	35 (60,3%)
≥ 6 jam	23 (39,7)
Prehospital	
Ikat Tali	19 (32,8%)
Balut luka / Imobilisasi	11 (19%)
Ramuan Tradisional	10 (17,2%)
Insisi	6 (10,3%)
Pengisapan di lokasi gigitan ular	4 (6,9%)
Kompres Nacl 0,9%	2 (3,4%)
Observasi tanpa tindakan	6 (10,3%)

The highest period of time for patients to arrive at the ED is less than 6 hours (60.3%). It is known that the most frequent pre-hospital treatment on snakebite is in the form of string strap (32.8%) followed by wounding/immobilization (19%), traditional herb (17.2%), incision action and no action (10.3%), and lastly, bite suction (6.9%).

From the table above, the relationship between sex and outcome was analyzed by using *Chi-Square* test. The test showed that p=0.06 (p>0.05). This means that there is no relationship between sex and outcome.

The relationship between the types of snakes and the outcome was analyzed by using *Chi-Square* test. It is shown that p=0.396 (p>0.05). Therefore, there is no relation between venomous snake types and the outcome.

The data of geographical area was tested by using *Chi-Square* test to see the relationship between geographical area and outcome. From the Table 5.4 above, it is obtained that p=0.081 (p>0.05), meaning that there is no correlation between geographical location and outcome.

The relationship between the time of arrival at ED with the outcome was analyzed by using *Chi-Square* test and showed that p=0.28 (p>0.05). This indicates that there is no relationship between the time of arrival at ED and outcome.

The relationship between the action of string strap and outcome was analyzed by using *Chi-Square* test. The test showed that p=0.032 (p <0.05). There is a correlation between string strap and outcome. OR=10.7 (CI 95% 1.3 – 86.9) means that the string strap may cure 10.7 times more effective compared with no action.

The *Chi-Square* test conducted on the relationship between the act of wounding/immobilization and outcome showed that p=0.028 (p<0.05). This means that there is a correlation between wounding/immobilization and outcome. OR = 20 (CI 95% 1.4 -

287.6) indicates that the treatment of wounding/immobilization could cure 20 times more effective compared with non-action observation.

The *Chi-Square* test on the relationship between the action of giving traditional herb and outcome showed that p=1.000 (p>0.05). By that, there is no relation between the action of giving traditional herb and outcome.

The relationship between incision action and the outcome was analyzed by using *Chi-Square* test and obtained a result of p=0.242 (p>0.05). This shows that there is no relationship between incision action and outcome.

From the table above, the relationship between the action of snakebite suction and outcome was analyzed by *Chi-Square* test and showed that p=1.000 (p>0.05). This indicates that there is no relationship between snakebite suction and outcome.

The relationship between the action of NaCl 0.9% compression and the outcome was also analyzed by using *Chi-Square* test. The test showed that p=1.000 (p>0.05). Therefore, there is no relation between the action of NaCl 0.9% compression and outcome.

DISCUSSION OF RESULTS

Based on the results of research conducted at the ED of Dr. Koesnadi Bondowoso General Hospital, there are a total of 58 snakebite patients in Bondowoso during the 1-year period of observation from January to December 2016. The incidence is almost the same when compared with the incidence of snakebite in other regions. In Bengkulu, Sumatra, it is reported that 2 to 4 cases happened per week. While in Java, there are 1 to 3 cases/week in Semarang, 5 to 8 cases/week in Serang, 5 to 6 cases/week in Jogjakarta, and 2 to 5 cases/week in Surabaya. In Kalimantan, precisely in Samarinda, there are 1 to 4 cases/week occurred. Meanwhile, in Palu, Sulawesi it is reported that there are 1 to 2 cases/week. In Timika, West Papua, there are also 1 to 3 cases/week. Although Indonesia still does not have a national report in concern to the incident of snakebite cases per year, some of the data presented by Dr. Tri Maharani are very helpful to know the prevalence number of snakebite in some Indonesian areas. The small number of the report is probably due to the lack of standard methods or procedures for reporting snakebite cases in Indonesia (Hayati, 2016)

Of the 58 patients, it is known that 72.4% of the cases are experienced by men. Several studies in India reported that the incidence of snakebite was higher in males than in females with a ratio of 2: 1. More than half of the patients reported in this study worked as farmers (53.6%). The incident occurred in the area of paddy fields and in the morning or afternoon. Working in agriculture area has a higher risk of contact with snakes. A study conducted in Davangere and Maharashtra (India) also reported a high incidence of snakebite during the day. The prevalence of snake venom types in this research is mostly Callaselasma rhodostoma by 39.7%, Bungarus fasciatus by 34.5%, and Naja sputatrix by 25.9%. In addition, this is also due to several types of snakes such as cobra *(Naja sp), weling* or krait *(Bungarus sp),* and ground snake or viper (*Calloselasma sp)* which actively seek for food during the day (Hayati, 2016).

The geographical location of this study is divided into two areas; the trained areas and untrained areas. The case of snakebite in the trained areas occurred as much as 19% of cases while in the untrained areas, there are 81% of cases. A large number of snakebite incidents in untrained areas needs deeper training especially in areas where there are many cases of poisonous snakebite.

As many as 60.3% of patients come to the ED within <6 hours while the rest come >6 hours (39.7%) since the onset of snakebite incidence with the arrival time range of 15 minutes to 4 days. Some of the reasons for the patients delaying to go to the hospital are long distances, lack of transportation, patient's ignorance about snakebite management, and choosing alternative therapeutic solutions. A total of 3 patients who came to the hospital took >6 hours after the onset of the incident. As a result, they had necrosis complications on their fingers so that an amputation should be performed. In addition, 17 patients also experienced symptoms of cellulitis around the location of the snakebite. Meanwhile, the patients who

came to the ED within <6 hours did not show severe clinical symptoms and there were no complications such as necrosis and cellulitis. However, some patients also experience symptoms and signs of hematocele or neurotoxic. Further studies are needed to evaluate the differences in clinical symptoms that occur in snakebite patients who come within <6 hours and >6 hours.

Various pre-hospital handling performed by the patient include wounding, string strap, suction, incision, ice packs, and traditional herb preparations. A total of 19 patients (32.8%) did a string strap at the proximal location of snakebite. 11 patients (19%) are known to bandage the snakebite with clothes and went directly to the ED. Some patients also give traditional herbs such as leaves and herbs in snakebite (17.2%). The incision in snakebite wounds was carried out by approximately 6 patients (10.3%) either by health workers in health centers or by patients themselves. Only 4 patients (6.9%) did a suction at the site of snakebite and 2 patients (3.4%) who applied ice packs. Nevertheless, the rest of the patients (10.3%) did not do pre-hospital treatment.

Inadequate pre-hospital handling such as the installation of a tourniquet, pressing and binding, suctioning, incision, or the giving of ice packs are proved to have no clinical benefit. This is often caused a delay for patients to come to a health center. It is said that binding with a rope or tourniquet in the proximal part of the bite is ineffective in preventing the spread of snake venom which has entered the blood circulation. Additionally, suction, incision, ice packs, or traditional herb preparation will increase the contamination and risk of infection (WHO Guidelines, 2016). According to WHO, the right initial treatment for snakebite is immobilization with bandage and splint on the wound and immediately refer to the nearest health center (WHO Guidelines, 2016).

There is a difference in the early handling of snakebite cases in some primary health care centers in Indonesia. This is also one of the causes of inadequate early handling of snakebite cases. Therefore, it is necessary to socialize the standard early handling procedures of snakebite to all health centers and hospitals. With fast and precise early handling, it is expected that morbidity and mortality rates from snakebite cases can be reduced.

CONCLUSION

From the data analysis and discussion of the relationship between snake types, geographic area, pre-hospital treatment, and outcome of snakebite patients, there are some conclusions that can be put forward as findings in concern to the outcome of poisonous snakebite patients:

- Several types of snakes reported in this study are a group of venomous snakes such as green snake red tail (*Trimeresurus albolaris*), ground snake (*Calloselasma rhodostoma*), *weling* snake (*Bungarus fasciatus*), and cobra (*Naja sputatrix*);
- Snakebite is still prevalent in areas that have never been trained in the handling of poisonous snakebite;
- Several factors affecting the outcome of snakebite patients are pre-hospital treatment and the duration of the treatment;
- Pre-hospital treatment of venomous snakebite performed by immobilization has a better outcome when compared to other pre-hospital treatment.

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