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Original article

Envenomation and the bite rate by venomous snakes in the kingdom of Saudi Arabia over the period (2015–2018)



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ABSTRACT

Snakebite being medical emergency and known cause for increased mortality needs assessment and treatment on high-priority bases, even in patients of snakebite who appear fine initially. The current retrospective study presents the snake bites in Saudi Arabia from 2015 to 2018 reported by General Administration of Statistics and Information, Ministry of Health, Kingdom of Saudi Arabia. The data presented in the current study, was extracted, analyzed, and reported after getting ethical approval from institutional committee. Totally, 14,679 cases of snakebites were reported during the four-year study period, with a higher prevalence in males (80%) in their productive age. Most patients were within the age group between 25 and 44 followed by 44 to 64 years. The majority of snakebite affected inhabitants were reported from farms of the rural areas, commonly during night hours of spring and summer seasons when snakes are very active. Only 36 (0.24%) patients out of 14,679 were reported dead and 14,643 (99.63%) were discharged after the treatment. Awareness among the general public should be encouraged and early diagnosis and usage of proper snake antivenoms could be life-saving. The delay in appropriate treatment can lead to significant morbidity and mortality.

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1. Introduction

Snake bite envenomation remains a serious health risk and threat throughout the world, including Saudi Arabia with significant morbidity and mortality to farmers and plantation workers particularly in rural and poor communities (Ahmed et al., 2008; Alirol et al., 2010). Like other life threatening diseases, the risk of snake bite is always existent and the mortality linked with it is higher than other neglected tropical diseases (Williams et al., 2010). The cases of snake bite happening worldwide cannot be estimated accurately due to lack of instant access to hospitals, however, at least 421,000 snake bite cases and 20,000 mortality cases have been reported each year worldwide (Kasturiratne et al., 2008). Al-Durihim et al. (2010), reported 2.5 million victims and 100 000 deaths worldwide annually because of snake venom poisoning.

The snake bite victims belonging to the rural communities are at more risk because they have comparatively less awareness regarding precautionary measures and suitable first aid methods (Haidar and Deitch, 2015). In addition, the non-availability of anti-venom and supportive treatment, poverty, early diagnosis, hospitals at longer distances, all contribute significantly to the delayed proper treatment (Haidar et al., 2012).

Many reports on snake bites have been published from different parts of the world such as Nigeria (Pugh and Theakston, 1980; Paramonte, 2007), Papua New Guinea (Currie et al., 1991), Brazil (Franco et al., 2001), Senegal (Trape et al., 2001), Nepal (Sharma et al., 2004), Morocco (Arfaoui et al., 2009), India (Mohapatra et al., 2011), Malaysia (Chew et al., 2011), Central Iran (Dehghani et al., 2012, 2014a, 2014b) and Brazil (Magalhães et al., 2019). However, limited reports of envenomation from different provinces of Saudi Arabia are available in the literature (Al-Sadoon and Abdo, 1990; Al-Mohareb and Al-Sadoon, 1994; Al-Sadoon and Jarrar, 1994; Al-Durihim et al., 2010; Alkaabi et al., 2011, Al-Sadoon, 2015).

Among 3000 snake species reported worldwide, around 30% are venomous snakes (Hider et al., 1991; Al-Sadoon, 2015). In Saudi Arabia, fifty-one snake species belonging to different families have been documented, some of these like *Cerastes cerastes gasperetti*, *Naja haje Arabica*, *Walterinnesia aegyptia*, *Echis pyramidium*,

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Atractaspis microlepidoka andersoni, *Atractaspis engaddensis*, *Echis carinatus sochureki* and *Echis coloratus* are venomous and capable of causing lethal bites (Warrell, 1993; Al-Sadoon, 2015). In spite of the occurrence of these elapid and viperine snakes in the different areas of arid Saudi Arabia, studies on snake envenomation are scarce.

Therefore, the present study aims to assess the records of snakebites caused by venomous snakes in the Kingdom of Saudi Arabia over a period of four years extending from 2015 to 2018 which we hope will contribute to a better understanding of the Kingdom's envenomation and the bite rate scenario.

2. Materials and methods

The occurrence and frequency of snake envenomation recorded across the Kingdom of Saudi Arabia were reviewed and reported for a period of 4 years beginning from 2015 till 2018.

This study was conducted by carrying out a review of envenomed patients brought to the different medical centers. Snake envenomation cases confirmed by a specialist across the medical centers were taken into the consideration.

The current report was based on 14,697 cases of snake envenomation cases received from General Administration of Statistics and Information, Ministry of Health, Kingdom of Saudi Arabia. The data was provided through a unified protocol by all hospitals and health centers and analyzed using a standard data sheet on the bases of rate and distribution of bites (yearly and monthly), sex of the victim, nationality of the victim, age groups of the vic-

tims, clinical findings, observation period. Identification of snake species was done by a specialist in cases where the snake involved was brought with the patient either caught or killed or with reference to the available photographs of venomous snakes. The data collected for each individual character were analyzed by using ANOVA and the data was expressed as frequency and percentage.

3. Results

3.1. Yearly rate and distribution of bites

The total snake bites by venomous snakes in all hospitals and health centers in Saudi Arabia over a period (2015–2018) was 14,697 with an average of 3674.25/year. The highest rate of snake envenomation ($P < 0.05$) recorded in 2016 was 29.72% ($n = 4363$) followed by 23.96% ($n = 3517$), 23.67% ($n = 3474$) and 22.65% ($n = 3325$) in 2017, 2015 and 2018 respectively (Fig. 1).

3.2. Monthly rate and distribution of bites

The detailed rate and distribution of snake bites month wise is presented in Fig. 2. As per the statistics obtained from Ministry of health, Saudi Arabia, during the period of 4 years from 2015 to 2018, most of the snakebite victims were enrolled in the month of August with a total of 12.08% ($n = 1764$), while the lowest rate of 4.84% ($n = 714$) was recorded in December.

3.3. Distribution of snake bites as per the sex of the victim

As per the statistical data obtained, the rate of male victims was higher ($P < 0.05$) than females. Male–female biting rate was 80% ($n = 11,744$) and 20% ($n = 2935$), respectively. The snake bite rate was recorded highest in 2016 (22.90%, $n = 3362$) among males, and the lowest rate was recorded in 2018 (18.58%, $n = 2727$). The highest (6.57%, $n = 1001$) and lowest (3.48%, $n = 598$) female bite rates were recorded in 2016 and 2018, respectively (Fig. 3).

3.4. Rate of snakebites based on the nationality of the victim

As per the data, the number of Saudi nationals subjected to snake bites during this study period was significantly higher 68% ($n = 10,034$) when compared to non-Saudis 32%, ($n = 4645$). The envenomation happened mostly in summer and spring seasons. The highest rate of bites among Saudi's was recorded in 2016 (21.90%, $n = 3110$) while the lowest rate was recorded in 2018

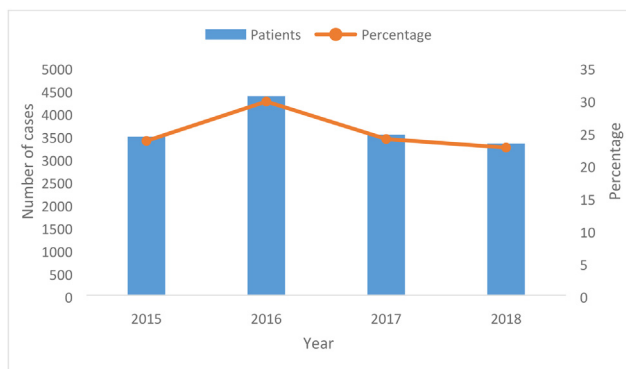


Fig. 1. Year wise frequency of snakebites over the period (2015–2018).

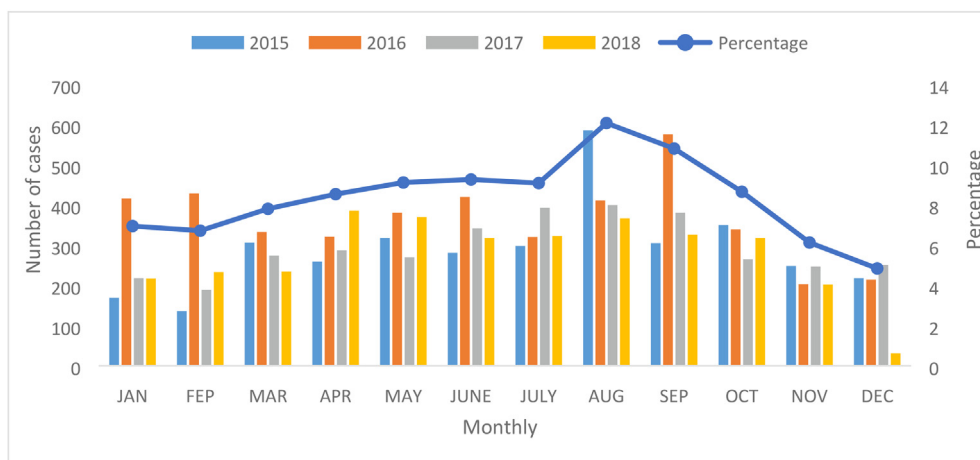


Fig. 2. Monthly frequency of snakebites over the period (2015–2018).

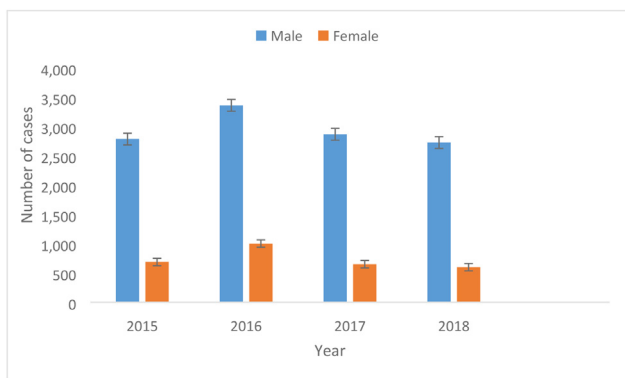


Fig. 3. Frequency of snakebites according to sex of the victim over the period (2015–2018).

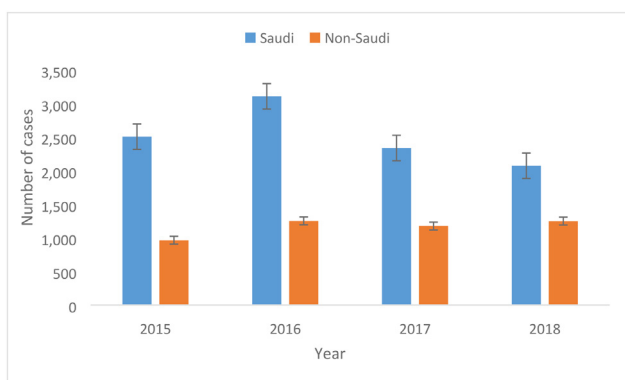


Fig. 4. Frequency of snakebites based on the nationality of the victim over the period (2015–2018).

(14.14%, n = 2075). The highest (8.54%, n = 1253) and lowest (6.57%, n = 965) bite rates among non-Saudi’s were recorded in 2016 and 2015 respectively (Fig. 4).

3.5. Distribution of bites according to age groups

As seen in Fig. 5, the highest number of victims with a total of 34.95% (n = 5130) were recorded within the age group between

25 and 44 years. The lowest age group subjected to snake bites was less than 5 years with 3.28% (n = 582). A total of 7.25% (n = 1064) snake bite cases were above 65 years old.

3.6. Treatment and mortality

Out of 14,679 envenomed snakebite patients, 10,586 (72.11%) victims were emergency cases while 3172 (21.60%) were admitted in the hospitals. The cases referred to the outpatient clinics reached 497 (3.38%). Few cases (2.89%, n = 424) were referred to other specialty hospitals. Year wise treatment plan is given in Fig. 6. There were only 0.24% (n = 36) mortality cases among our studied patients. Other bitten patients evolved to cure after being hospitalized (Fig. 7).

3.7. Antiserum dose

Equine polyvalent Anti Snake Venom (The Antivenom and Vaccine Production Center, National Guard Health Affairs, Saudi Arabia) was administered intravenously to the bitten patients. Each vial contained 10 ml of purified immunoglobulin fractions. On average, patients received less than 5 ml of antiserum dose, however, in few cases more than 5 ml was given.

4. Discussion

Snakebite is still one among the focal public health concerns in different regions of the globe (WHO, 2016). Worldwide, the reports published on the occurrence, injury or mortality caused due to snakebites are mainly based on the data collected from hospitals and medical centers. Our study aimed to evaluate the frequency of snakebite victims caused by the venomous snakes in different parts of Kingdom of Saudi Arabia. Saudi Arabia has a rich fauna of reptiles, particularly venomous snakes. Among fifty-one snake species reported from different regions of Saudi Arabia, nine of these snakes are venomous (Gasperetti, 1988; Al-Sadoon, 1989; Al-Sadoon, 2015). The climate of this part of the world varies from semiarid to arid, is one of the reasons of diverse fauna of venomous snakes and snake bites in Saudi Arabia.

During the study period of our survey from 2015 to 2018, the total number of snakebite cases due to poisonous snakes reported in the country were 14697. This static is much higher than a similar survey carried out in Riyadh province with 1019 cases of snake bites over a period of 5 years (Al-Sadoon, 2015).

The rate of snake bite envenomation was higher during the months of summer as compared to other seasons of the year with

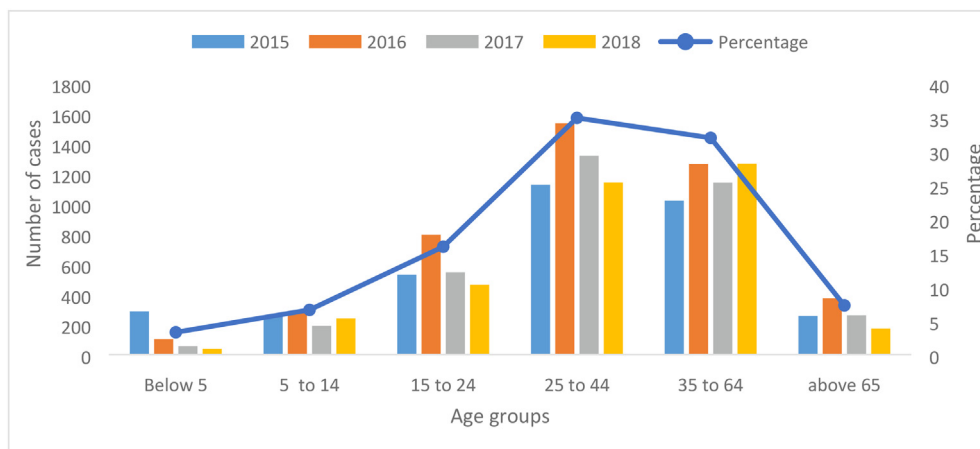


Fig. 5. Frequency and percentage of the snakebite victims according to age groups over the period (2015–2018).

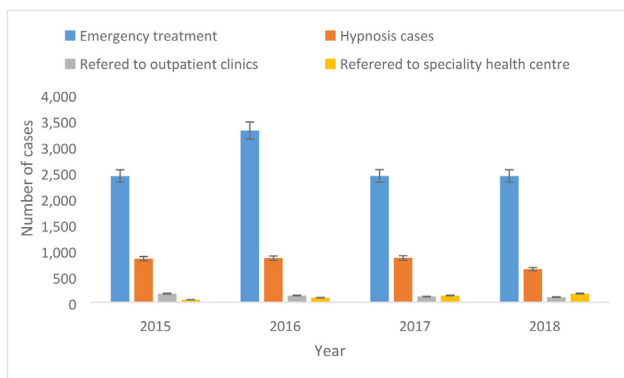


Fig. 6. Incidence of clinical complications due to snake envenomation over the period (2015–2018).

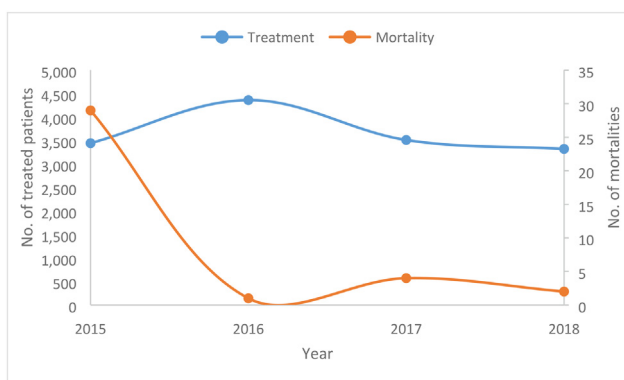


Fig. 7. Number of treated patients and mortality by snakebite over the period (2015–2018).

lowest in winter months. The reason may be the snakes remain inactive in hibernation because of low ambient temperatures. The current data showed variation in frequency of the snakebite cases recorded in different years of this study period. The peak of the frequency (29.72%) was seen in 2016 with 4363 cases. Furthermore, overall the highest number of snake envenomation was seen in the month of August with 1764 cases and lowest in December with 714 cases. These figures are in agreement with the reports published by other authors in different provinces of Saudi Arabia (Al-Sadoon and Jarrar, 1994; Alkaabi et al., 2011; Al-Sadoon, 2015) and in Morocco (Arfaoui et al., 2009) but contrasts with literature where higher snake bites were reported between months of November and April (Tchoua et al., 2002; Paula Neto et al., 2005).

Majority of the victims in the current study were males (80%), and more than half of the cases got snake bites while working in agricultural lands. These reports are in agreement with studies from other areas of Saudi Arabia (Al-Sadoon and Jarrar, 1994; Al-Mohareb and Al-Sadoon, 1994; Mahaba, 2000; Al-Durihim et al., 2010) and some other parts of the world like Brazil with 89.5% (Franco et al., 2001); Morocco with 53% (Arfaoui et al., 2009), southeast of Arabian Peninsula with 87% (Alkaabi et al., 2011) and Iran, Isfahan province with 96% (Dehghani et al., 2014a, 2014b) male predominance. Furthermore, maximum snakebite victims reported in this study were young adults between 25 and 44 years old followed by 44–64 years. As per our data, the male patients were bitten during irrigation time while working in farm or field mostly during night hours. This variation in the incidence of bites based on sex and age of the victim could be due to the fact that majority of females devote their time at indoor activities whereas males are bound to work in deserts and agricultural lands

(Al-Sadoon, 2015). Contrary to our report, a study in India showed that the majority (60%) of the victims were females (Monteiro et al., 2010).

No doubt, the number of snake bite cases reported from different regions of this country are high, but low mortality rate (0.24%) of victims shows the achievements and progress of the national strategy of Saudi Arabia against the fatal snake bite envenomation making excellent medical facilities available and the development of supportive care in recent years even in remote areas of the country.

Fortunately, anti-venom is accessible in all medical centers throughout the country even in remote areas. In addition, on the bases of the current data, the Saudi national strategy is effective in dealing with snake bite envenomation by establishment of national records and keeping targeted poly antivenom available. Still, we advise that the awareness and training among general public, particularly inhabiting and working in rural areas, regarding venomous snakes, avoidance of snakes, timely management of allergic reactions post snake bite, administration of adequate and timely dose of antivenom and the importance of referral to the hospital at the earliest and proper treatment of victims can significantly reduce mortality rate.

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