Venomous Snake Bite Injuries at Kitui District Hospital

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Abstract

Background
Snake bites are a neglected public health issue in poor rural communities, and the true burden of snake bites is not known. Kitui County has a high incidence of snake bites and no functional snake bite control programs exists. Diagnostic tests for snake species identification are not available and management mainly relies on clinical findings and administration of polyvalent antivenin. This study sought to describe common presentation patterns and treatments offered for snake bites at Kitui District Hospital, and to characterize the causative venomous snakes.

Patients and methods
This was a prospective case series carried out over a period of 8 months. Patients presenting at the hospital with snake bites were included in the study. A pre set questionnaire was administered by doctors in the surgical team

Results
A total of 70 patients were recruited. The M:F ratio was 1:1.4, and an age range 4-60y (median 8y). 51.4% were school going children who lived in houses mostly made of earthen bricks and thatch (n=38, 54.3%). The relationship between local names and physical description of the snakes, and scientific identification from the description and clinical presentation was significant(p=0.05). Most patients achieved complete recovery (n=62, 88.6%) No death was recorded.

Conclusion
Snake bites are common in Kitui County. In spite of the high rates of compartment syndrome and focal gangrene, all the patients were managed locally with excellent outcomes.

Recommendation
Care-givers need better training and sensitization. Formulation of regionalized guidelines fed by evidence-based data is needed. Improved infrastructure including a regional centre of excellence, and education will be the best preventive strategy.

Introduction

Management of snake bites is variable from region to region due to different fauna existing in different environments. This variation can be high even in the same country. It is therefore quite difficult to prescribe a uniform algorithm for managing snake bites. This is compounded by unavailability of proper resources and lack of prioritization of snake bites, amid infectious diseases and trauma. Snake bites therefore tend to become a neglected albeit important cause of morbidity in developing countries (1).

Kitui County has a higher incidence of snake bites as compared to studies done in other districts (2,6). Coombs showed an average incidence of 13.8/100000 population (2). In 2011, hospital records show that there were 129 patients with snake bites who were attended to at the District Hospital within the year, giving an estimated incidence of 25.8/100000 (129 cases per 500000 county population). The true worldwide burden of snake bites is not known due to misreporting (3,4). There is also a seasonal variation in incidence (5). Snow reported a mortality rate of 6.7/100000 in Kilifi, representing 0.7% of all deaths (6). Mortality in snake bites is not common, but some studies have reported 15 adult snakebite fatalities per 100 000 population per year (6, 7, 8).

There are numerous venomous snake species resident in the county (9). All the three major types of snakes were represented. However, the cobras *(elapidae)* and adders *(viperidae)* are more frequently implicated in snake bites in Kitui. Medically important snakes local to Kitui include the puff adder *(Bitis arietans)*, the black necked cobra *(Naja nigricolis)*, and the black mamba *(Dendroaspis polylepis)*. It is difficult to differentiate between the black necked cobra and the red spitting cobra *(Naja pallida)* from description alone, but the distribution of the red

cobra is more northerly (9).

There are no protocols for managing snake bites available specific to the region, most health workers using general management principles. Prevention of snake bites is based majorly on educating people on how to avoid conflict with the animals, and how to give first aid to victims of snake bites. Myriad types of first aid have been described, including application of tourniquets, snake stones, herbal antivenins, milk, potassium permanganate and bloodletting (10). Ogunbanjo showed gaps in management of snake bites in rural hospitals where necessary medications like tetanus toxoid are not administered and all patients receive unnecessary medications like promethazine (11). Antivenin administration is indicated only if serious manifestations of envenomation are evident (12). There has never been a population or hospital based documented research from Kitui County, and thus this audit will aim at providing a baseline on patterns of snake bites seen at the district hospital and to identify the causative venomous snakes.

Materials and methods

Design: Consecutive case series.

Setting: Kitui District Hospital in Kitui County, Kenya. It serves as a referral District Hospital in the larger Kitui County with a catchment population in excess of 500,000 inhabitants

Inclusion criteria: All patients with a history of having been bitten by a snake, and confirmed with identifiable fang marks, presenting at Kitui District Hospital

Exclusion criteria: Other animal bites, non-venomous snake bites with no fang marks.

Procedure: All patients attended to at the district hospital, with a history of snake bite, within the study period were included (from the outpatient department and surgical wards). A Pretested questionnaire was then administered. They were then followed up until the time of discharge from the hospital. All treatment procedures done on them were recorded in the questionnaire.

Data handling: Data was captured using Microsoft Excel and analyzed using SPSS. Categorical variables were summarized by frequency and percentage, while continuous variables were summarized by mean and standard deviation.

Results

The study was conducted over a period of 8 months. 51.4 %(n=36) of the patients were less than 10 years. 36(51.5%) were school going children (5-18y), farmers 28(40%) and preschoolers 6(8.5%).

Table 1 summarizes some of the patient characteristics.

Table 1. Characteristics of snake bite victims in Kitui County.

Sample size n=70		
1	Age	Range 4-60 years, median 8 years
2	Gender	Male to female ratio 1:1.4
3	Occupation	Children and students accounted for 60% of all victims. Farmers 40%. No one described himself as a herdsman.
4	Time of bite	20% nocturnal, 32.9% while herding in the bush, 18.6% in the shamba, others 28.5%
5	Delay between bite and treatment	1-35 hours (mean 7.4h)
6	First aid	81.4 %(n=57) received first aid. 32.9%(n=13) was inappropriate first aid such as tourniquets and pierre noir (snake stone) Trained medics administered first aid in only 13 cases out of 57 (23.8%), the rest being a family member

Most victims lived in houses made of locally manufactured bricks and thatch or iron sheets 38 (54.3%), followed by mud and thatch 27(38.6%). Only 5 residences were made of stone and iron sheets (7.1%). Most patients (45.7%) came from Kitui Central where the hospital is located, while the others came from other regions within the catchment area. Fig 1 shows the activities patient were undertaking at the time of bite.

The most identifiable snake by local name was *kiko* (cobra) in 31 (44.3%) of cases. Others were *kimbuva* (likely black mamba) 8(11.4%), and *ngua* (likely puff adder) 7(10%). No snake was identified in 24 (34.3%) cases. A detailed description of the snake was then taken and in 22 of the 46 (47.9%) cases where the snake was identified, it was described as being red and black with black neck. In 12(26.1%) cases it was described as pure black, in 5(10.9%) as brown or reddish brown, in 4(8.7%) as white and black, and in 3 cases (6.5%) as green. In instances where the snake was identified, it ranged in size from 30cm to 150cm, with an average size of 70cm. Three suspected puff adder cases were later reclassified as black mamba and green mamba according to this detailed description. The most likely snake according to description is shown in Fig 2. The snake was produced for identification in only one case, where it was identified as a juvenile black necked spitting cobra.

Fig 1. Activity at time of bite.

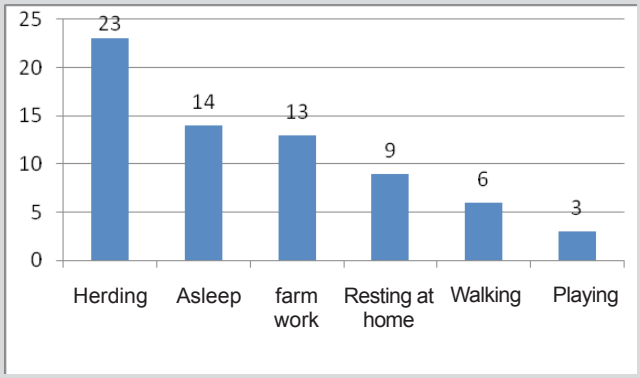


Fig 2. Type of snake

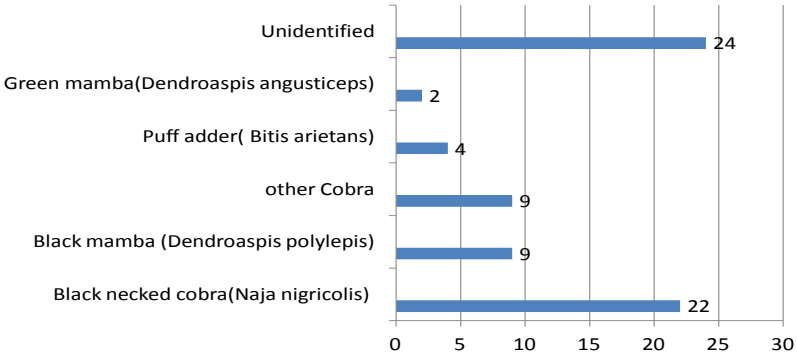
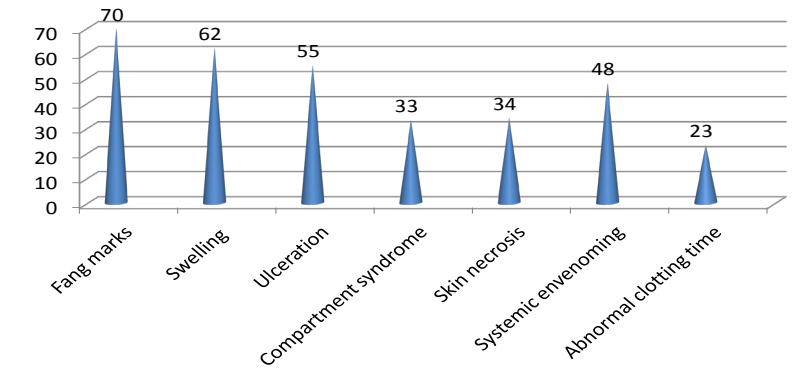


Fig 3: Pattern of presentation



Fangs marks were identified in all patients. Other patterns of presentation were as shown in Fig 3. Only 4(5.7%) patients had generalized swelling. Blistering and ulceration at presentation ranged from 5mm to 10cm. Compartment syndrome was diagnosed clinically. Necrosis was present in 34 (48.6%) patients, and among these, in 19 (55.9%) it was localized to within 1cm of the fang marks, while 15 (44.1%) gangrene larger than 1cm but within the same body region. No patient had gangrene spreading beyond one region. Systemic signs of envenomation such as difficulty breathing, blurred vision, confusion, bleeding, tachycardia, sweating, nausea and vomiting, weakness, hypotension and convulsions were present in 48(68.6%) of patients. Whole blood clotting time was done in all patients and it was prolonged in 23(32.9%) of the patients.

All patients received supportive treatment like painkillers and fluids. Antivenin was administered only when there were constitutional symptoms and signs of envenomation. It was indicated in 48 (68.6%) patients. However, only 31(44.3%) received the antivenin. Of these,

adverse reaction was observed in 13(41.9%) patients. All patients with prolonged whole blood coagulation time received antivenin. Table 2 summarises the treatments given.

Table 2: Treatment given to snake bite victims

Type of treatment	Frequency	Percentage
Supportive (painkillers, fluids, tetanus toxoid)	70	100
Antivenin	31	44.3
Fasciotomy and debridement	31	44.3
Amputation	0	0
Secondary suturing	9	12.9
Skin grafting	11	15.7
Reconstructive surgery (flap rotation, release of contractures)	3	4.3

All patients received treatment at Kitui District Hospital and there was no referral. Most patients, 62 (88.6%) had complete recovery while 5 (7.1%) had moderate impairment, affecting activities of daily living, and 3(4.3%) developed residual disability like contractures and tendon injuries. No deaths were recorded after admission into our hospital.

Discussion

There was a high frequency of snake bites in this study. This compares to other regions with high incidence (3, 4, 5). Coombs reported an incidence of between 1.9/100000 to 67.9/100000 in areas notorious for snake bites in Kenya (2). This could compare with our estimated frequency of 25.8 per 100000. There exists a population of poisonous snakes in Kitui County due to its dry and hot climate. The type of housing and agricultural activities predispose to bites. Most snake bites occur in moderately populated villages and settlements surrounding towns. Most houses in Kitui Central are made of earth bricks and thatch, and this is known to attract snakes which seek warmth in crevices (9).

Most victims are farmers or children who are herding livestock. Despite their predisposition due to economic activities, adults were affected less than children. This is attributed to the fact that children are curious and lack inherent judgment about snakes. Female patients were more than male patients, as they are more likely to be working in the farm. It is also a peculiarity that school going girls are also involved in herding animals in Kitui County. School going children accounted for the largest demographic group. Another large number were those asleep in the house when the bite happened.

We compared the known biological features of the snake such as color, size, locale and predominant type of venom they produce, with patients own description. The relationship between patient knowledge of the type of snake and probable snake causing the bite was statistically significant (p=0.05) Thus most patients were able to describe snakes with similar local names in various degrees of similarity. This is attributable to constant interaction with the snakes. The types of snakes deduced from patient description will usually reflect the types that are known to exist in Kitui County. It is therefore possible to know the type of snake even if the snake is not physically produced (9). Patients do not, as a rule, bring the snake to hospital, as it is taboo in the region to handle snakes. Therefore monovalent antivenin is not clinically viable. A significant number of patients could not describe the snake as it either slithered away into crevices or the bite occurred while asleep at night.

Most snakes are medium sized. The black necked cobra is very poisonous but adults and large snakes tend to live in sparsely populated bushes. The small juvenile snakes will invade houses in search of rodents like mice and rats, and stored water. This brings them into direct conflict with people.

Despite its suspected occurrence and detriment, no patients visited traditional healers, and relatives or neighbors administered initial therapies including cuts, herbs and snake stones (10). There was an inordinately long delay of about 7.4 hours before presentation to hospital, attributed to poor infrastructure and lack of proper transport. Few tourniquets were encountered at the outpatient department and they were promptly removed.

The most frequent presenting symptoms were local, at or around the fang marks, such as localized swelling, ulceration and blistering. Fang marks were present in all patients as it was an inclusion criteria. Systemic symptoms were more clinically significant with an implication in antivenin administration, despite lack of diagnostic tests. Diagnostic tests to determine envenomation and the implicated species are important but in resource poor environments, their utility is not clear. Most snake bite victims are able to be diagnosed and severity graded with a good history and examination.

The mainstay treatment modality in patients with evidence of systemic envenoming was administration of polyvalent snake antivenin. Administration of this is technically easy and most healthcare workers are able to handle complications like adverse reactions. In Kitui County, due to the frequent contact with snake bite victims, many caregivers were able to comfortably administer antivenin. This has therefore resulted in the good outcomes for most snake bite victims. No referral is needed in management of snake bites, as long as the primary care giver is adequately equipped in terms of skills, antivenin and other consumables.

There could have been an over diagnosis of established compartment syndrome, as clinical presentation between snake bites with subfascial envenomation and compartment syndrome are almost similar. The importance of compartmental pressure monitoring has been shown to avoid unnecessary operations (13). There were no tests to detect onset of compartment syndrome and the staff had to rely on clinical diagnosis. This, however, resulted in no cases of limb loss, and it could be vindicated. There was however a shortage of antivenin in the central hospital and peripheral centers. Most peripheral centers had to refer patients to the district hospital for treatment, despite the fact that they are capable of handling these types of patients.

In spite of the high rates of compartment syndrome and focal gangrene, all the patients were managed at the District Hospital with excellent outcomes. No referral was warranted, and the outcomes were favourable in most cases. Only 3 patients required reconstructive surgery, and no patient with snake bite died after arrival at the hospital. This is not unlike other studies with a similar sample size, where no mortality was reported (7, 8). It is however possible patients died before reaching the hospital.

Conclusion

The implicated snakes are mostly the black necked cobra and puff adder. Snake bites are common in the county. Most bites are of moderate severity with little mortality or long term morbidity. Polyvalent antivenin and supportive measures is the mainstay of managing snake bites at the hospital. Treatment was noted to be mostly adequate at the District Hospital.

The following recommendations are therefore made: There is need for a comprehensive snake bite control program including a regionalized approach.

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