

Outcomes of Snakebite Envenomation in Children

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Abstract

Introduction: Snakebite is a medical emergency, and is considered to be one of the major public health hazards in the Terai and inner-Terai regions of Nepal. Very few studies have been conducted so far in Nepal to highlight the epidemiology of snakebite in children. **Aim:** To review the pattern and characteristics of snakebites in children, focusing primarily on the outcomes, fatality and risk factors for death. **Settings:** An emergency department of a 136-bedded secondary care-referral hospital (Lumbini Zonal Hospital) situated at Butwal in the Western Nepal. **Methodology:** The study was carried out in 152 children aged < 15 years old, who got anti-snake venom (ASV) over a period of 48 months. Diagnosis of snakebite envenomation was based on clinical ground. **Results:** Children over 5 years of age constituted the highest number (87%) of cases. Peak incidence of poisoning (71%) was observed during the months of Asadh- Bhadra (June-September). Most of the bites (61%) were by unidentified snakes, most commonly (91%) on the extremities. Snakebite envenomation occurred more frequently (52%) during night time. 85% of children had local or systemic complications, commonest being respiratory paralysis (92/152). Case fatality rate (CFR) was 28%. Risk factors for death were: age < 5 years; bites by unidentified snakes and kraits and bites on ears & unknown sites. **Conclusion:** Compared with adults, children with snake envenomation have higher morbidity and mortality, which can be minimized by early diagnosis, appropriate treatment and close monitoring of children on ventilation for the timely management of complications. Emphasis should be given on developing a standard management protocol in children.

Keywords: Snakebite, Envenomation, Children, Outcomes and Nepal

Introduction

Snakebite is a preventable life-threatening medical accident, the dangers of which are amplified in children possibly because of a higher ratio of injected venom to body mass. Venomous snakebite is an important public health hazard in tropical and subtropical countries^{1,2,3}, including Nepal. Snakebite envenomation often leads to premature death of children mostly from rural areas. Studies have shown that children under 15 years old account for two-third to three-fourth of the total cases of snakebite^{4,5}. Children are at risk of sustaining snakebite mainly because of their curiosity about the unknown creatures, innocent act of invading the reptile's space, and habit of barefoot walking particularly in the darkness.

Although there are greater than 3,000 known species of snakes in the world, only 200 are poisonous to humans⁶. 90 % of these snakes are members of one

of three families⁶: the Elapidae (cobras, Kraits etc); the Viperidae (pit and Russel's vipers); the Hydrophidae (poisonous sea-snakes). In Nepal, out of 77 species of snakes recorded, 22 are poisonous⁵. Common venomous snakes in the 26 Terai and inner-Terai districts of Nepal are Kraits, cobras and vipers⁵.

Snake venom is a mixture of 20 enzymes and polypeptide toxins. Elapid snake venom contains *bungarotoxin*, a neurotoxin, which blocks the nerve transmission at the neuromuscular junction (akin to d-tubocurarin)^{7,8}. Death following Elapid snakebite envenomation is typically due to respiratory paralysis or depression.

It is important to remember that not all bites in children are by snakes. Moreover greater than 80 %

bites are by non-poisonous snakes in children⁶. Even after bites by the venomous snakes, 20-80 % of victims may have little or no envenomation at all^{9, 10, 11}.

Instantaneous death possibly due to cardiac arrhythmia, acute myocardial infarction or cardiac arrest in some persons may occur due to thought or fear of threat of death just on sighting the hooded cobra without a bite¹². Anxiety and tachycardia following venomous snakebite occasionally accelerates the rapid absorption of venom into circulation, precipitating the cardio-respiratory arrest¹². This phenomenon is, however not seen in children as they are unaware of death⁷.

Materials and methods

A hospital-based prospective study was conducted in 152 children under 15 years old, who were treated for snake envenomation in the emergency department of Lumbini Zonal Hospital (LZH), Butwal during a period of 48 months, starting from 2062-04-01 to 2066-03-32. LZH is a 136-bedded secondary level-care referral hospital in the western Nepal. Only cases of snakebite receiving ASV were included in this study. Diagnosis of envenomation was based completely on clinical ground (bilateral ptosis, ophthalmoplegia, salivation etc). *Venom detection kit* was not used at all in this study, because of its unavailability in Nepal. Data so collected were analyzed for age, sex, month of bite, site of bite, time of bite, type of biting snakes, clinical outcomes, CFR and risk factors for death etc.

Time of bite was grouped as *morning* (6am-12pm), *afternoon* (12pm-6pm) or *night* (6pm-6am).

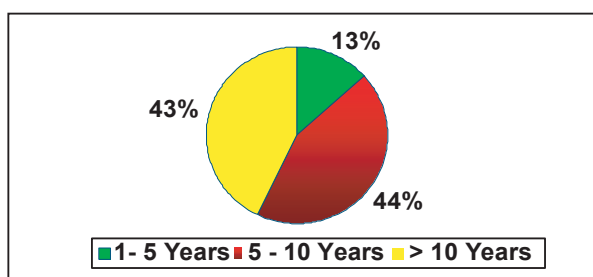


Fig 1: Showing age incidence (n=152)

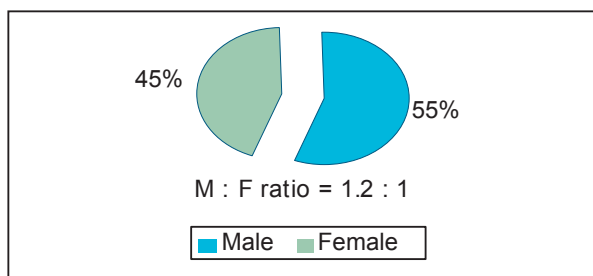


Fig 2: Showing sex incidence (n=152)

Results

Analysis of data on 152 children receiving ASV revealed the following findings:

Maximum (87%) incidence of poisoning was seen in children > 5 years old. Average age of children was 8.8 years (range: 17 months to 14 years). Pre-school aged children constituted 13% of snakebite envenomation.

Boys (55%) predominated girls (45%)

71% of bites occurred in Asadh- Bhadra (June-September)

91% bites occurred on the extremities with 60% bites being on hands and feet.

60% of the venomous bite occurred during night times.

60% of bites were by unidentified/unknown snakes. In 40% of cases, where the biting snakes were identified, the majority (74%) were by Kraits.

The CFR among the venomous bites was 28%.

Majority of bite (61%) were complicated by respiratory paralysis needing intubation and ventilation.

There was 100% site-specific fatality with bites on the ear: fatality rate was higher (40%) with bite on unknown site. Risk of death in U₅ children was higher (50%). Risk of death either due to unidentified snakes or to Kraits was double as compared to cobra.

Table 1: Showing Complications (Clinical Outcomes)
(No complications in 22/152 children)

Complications	Number (%)
Respiratory Paralysis needing intubation / ventilation	92 (61%)
Cellulitis	16 (11%)
Skin necrosis / gangrene	11 (7%)
Intubation complications	8 (5%)
Hypokalaemia leading to quadriparesis	4 (3%)
Kerato - conjunctivitis (corneal opacity)	2 (1%)
Gastro - intestinal bleeding	1

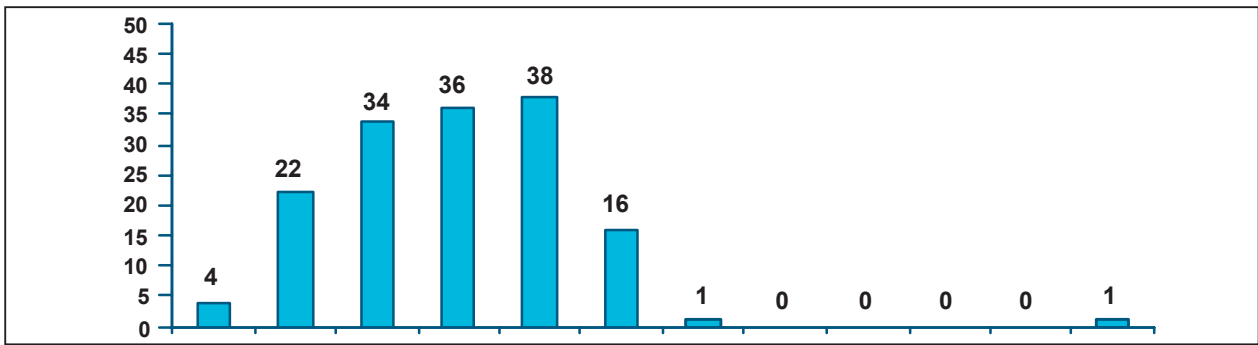


Fig 3: Showing monthly incidence (n=152)

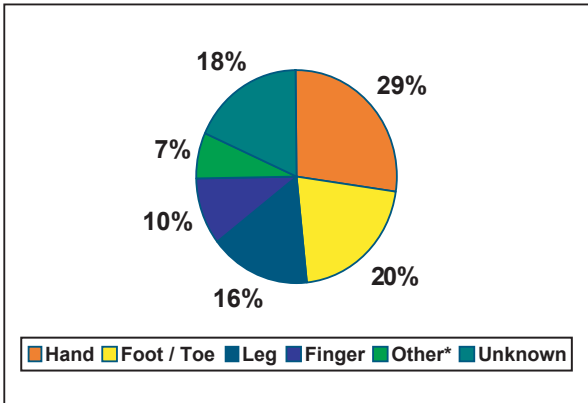


Fig 4: Showing site of bite (n=152)

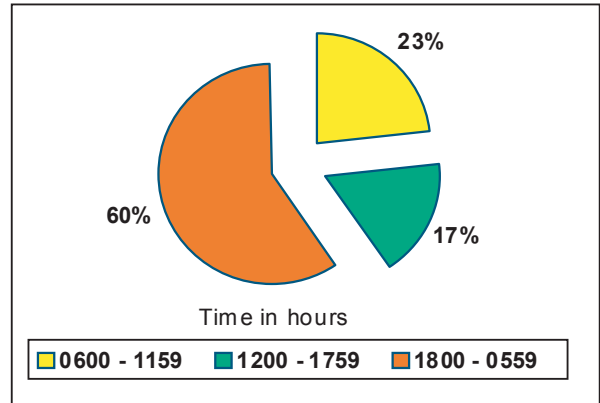


Fig 5: Showing time of bite (n=133)

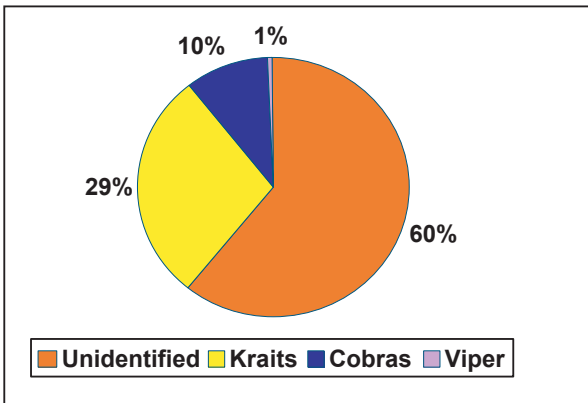


Fig 6: Showing type of biting snakes (n=152)

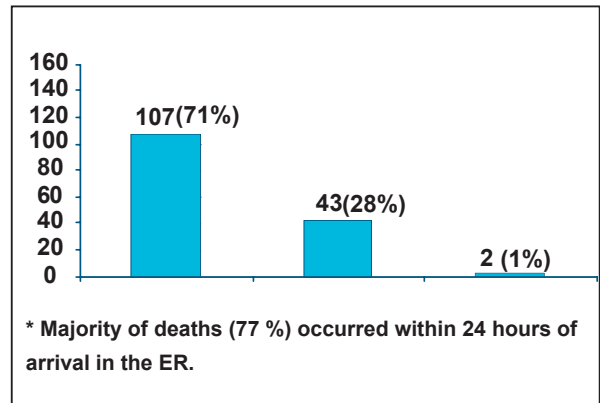


Fig 7: Showing outcome (n=152)

Table 2: Showing risk factors for death (n=43)

Risk Factors		Risk (%)
Age (in years)	1 - 5	50
	5 - 10	27
	> 10	23
Sex	Male	27
	Female	30
Type of snake	Kraits	27
	Cobras	13
	Unidentified	30
Site of bite	Hand and finger	30
	Foot /toe	23
	Leg	24
	Ear	100
	Unknown	39

Figures of possible complications



Fig 8 : Blister/Bulla

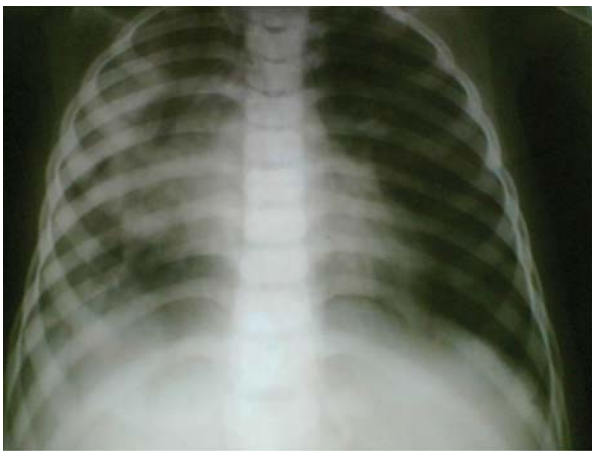


Fig 9: Pneumonia following intubation



Fig 10: Acute respiratory paralysis needing bag and tube ventilation

Discussion

Present study has clearly shown the highest (87%) incidence of snake envenomation in children over 5 years old. Pre-school aged (0-5 yr) children in this study comprised of 13 % of victims in contrast to 35 % in a

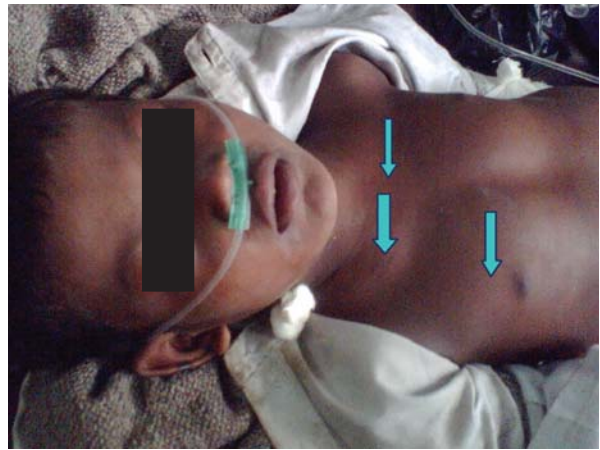


Fig 11: Sub-cutaneous emphysema following intubation



Fig 12: Hand necrosis and cellulitis

previous study done by Jamieson and Pearn¹⁴, who found the prepubescent boys as the highest “at-risk group” for snakebite. Children over 5 years are at risk of snakebite because they are involved more in outdoor games. Furthermore, the older children in Terai are given the responsibility of carrying out the outdoor activities such as grass-cutting, cattle-grazing and firewood-collecting etc. Incidence of poisoning was slightly higher in boys (55%) than in girls (45%). Finding of male predominance seen also in other studies^{4,14} probably relates to the behavior patterns of boys⁴. Saborio et al found no significant gender differences¹⁵.

Current study showed maximum snakebites (73%) with envenomation occurring during the rainy/ monsoon season, Jestha to Bhadra (May – September). During this season snakes come out of their shelter because of increased humidity and warmth. This characteristic seasonal pattern of snakebite was also reported in other studies^{1, 4, 16}.

Most of the victims (nearly 61%) could not identify the biting snakes. This event denotes either the lack of

knowledge of children about snakes or poor visibility due to nocturnal bites while sleeping and to walking in darkness. Krait bites mostly occurring at night are usually less painful and the victims forget the local pain because of blunting of reflexes during sound sleep^{1, 11, 17}

In 91% of cases the snake had bitten the extremities with 59% of these bites being on the hands and feet. Curious young children, while playing put their fingers/hands into the hiding places of snakes such as holes, pits etc. Similarly older children, while cutting grass sustain bites on hands. This finding is similar to that of Currie et al who found 100% bites on the extremities with 71% of the bites being on the ankle or below. Some other studies found 70- 86% bites occurring on the lower extremities^{1, 4, 14, 15, 18, 19}, which were possibly because of accidental stampede while walking in the darkness¹.

Current study showed more frequent (52%) bites at night time between 6 pm and 6 am. This finding is similar to that of Campbell²⁰ while in contrast to the finding of Currie et al (15%)⁴. Barefoot walking in darkness without using light and sleeping on the ground at night are the risk factors for sustaining nocturnal bites. Most of the bites where the time of bite is not known (12% in the present study) do occur at night, and are likely by Kraits.

Majority of children (85%) following snakebite envenomation developed local or systemic complications. Respiratory paralysis/ failure needing intubation and ventilation occurred in nearly 61% (92/152) of cases. CFR in the current study was quite high (28%), where as in other studies it varied from 0-14%^{1, 4, 18, 20, and 21}. High CFR in children, as in this study is mainly because children sustain a more severe envenomation as a result of increased venom: body mass ratio²². Conversely the larger adult body mass may provide a diluent for the snake toxin, theoretically causing a less potent envenomation²³. Moreover, children seem to have more serious complications than adults, and therefore need a higher dose of ASV²⁴. Further more, in this study only cases getting ASV were included so as to look at the real morbidity and mortality of snakebites.

The major risk factors for death in this study were: age < 5 years (50%); unidentified snakes & kraits (29%) and bites on ears (100 %) followed by unknown site of bite (40%). In children <5 years old, either reporting is late or diagnosis of bite is difficult. Similarly treatment of bites by unidentified snakes or kraits is mostly very late because of failure to diagnose biting early. More over, krait venom is 10 times more lethal than cobra venom. Bites on ears or hands/fingers lead to rapid absorption of venom into circulation, with consequent higher mortality.

Conclusion

Compared with adults, children with snake envenomation have higher morbidity and mortality, which can be minimized by early diagnosis, appropriate treatment and close monitoring of children particularly those on manual ventilator for timely management of complications.

Recommendations

Emphasis for the treatment of snakebite in children of Nepal should further be given on the following:

1. Development of a standard management protocol in children.
2. Health education about preventive and improved first-aid measures. and
3. Inclusion of course on snake envenomation in graduate and post-graduate medical training.

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