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To Study Clinical Presentation, Management, Complications and Outcome in Snake Bite Patients

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Abstract

The problem of snake bite is of considerable public health importance. Most of Indians lives in villages and the burden of immediate management rest with staff at the primary health centers and rural hospitals have staff and ASV shortage. These prompted us to do this study at KMCH Coimbatore between September 2013 to May 2014 with the aim to know the burden, type of snakes, clinical presentation, complications and management. This study is a descriptive, analytical case series. A retrospective case analysis was conducted based on case sheets obtained from the Medical Records Department of KMCH.

Results: Total cases 33 (22 males and 11 females), between 21 to 60 years age, 51% agriculture workers. Common snake was Viper, lower limbs were affected more, and cellulitis was the common presentation, with abnormal blood and renal profile, presented within 6 h with prior ASV administration, 88% patients recovered.

Keywords: Snakes; Cobra; Krait; Russel; ASV; Elisa Envenoming; Hematoxins; Neurotoxins; Nephrotoxins

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Introduction

Snakebite is a major public health problem worldwide with more than 5 million venomous bites occurs every year and nearly 125,000 die [1]. South Asia is the world's most heavily affected region, due to its high population density, widespread agricultural activities, numerous venomous snake species and lack of functional snakebite control programs [2]. India has the highest number of deaths due to snake bites with 35,000 to 50,000 people dying per year according to WHO [3,4]. An epidemiological survey from Burdwan revealed an annual incidence of snakebite of 0.16% and a mortality rate of 0.016% per year. Maharashtra reports an incidence of 70 bites per 100,000 populations and a mortality of 2.4 per 100,000 persons per year. Similar results were reported from other states [5]. This study was conducted in KMCH, Coimbatore a tertiary care hospital, with presence of four venomous snakes namely Cobra, Krait, and Saw scaled viper and Russell's viper. Agriculture is the main occupation; therefore, patients are poor farmers working in fields with barely have any protective gear. The commonest site of bite is exposed and vulnerable lower and upper extremity. Many of the patients in the present study were referred from other hospitals. An anaphylactic reaction to the ASV was the commonest complication with these references. Acute renal failure being next. Present study was conducted to look for clinical presentation of snake bite, to study the complications of snake bite and to analyze the clinical outcome. To a large extent the manifestation of snakebite depends upon the species of snake, therefore identification of the type of snake is important. At times the bite mark might not be visible (e.g., in the case of krait). The killed snake brought as evidence helps in identification of snake, in which case species-specific monovalent ASV can be administered. The clinical manifestations of the patient may not correlate with the species of snake brought as evidence. It is therefore advantageous to know the appearance of the snake so as to recognize the species. Snakebite is an occupational disease, as farmers, plantation workers, shepherds, or workers on development sites are mostly affected [5,6]. Snakebites usually happen when the snake has been unintentionally trodden upon, in the dark or in the shrubs where the villagers usually defecate, especially as they are often bare footed [5]. Snakebites show a classical seasonal variation, being more common in summers and in the rainy season, when agricultural activities are in full swing. Males are bitten almost twice as often as females, with the majority of the

bites being on the lower extremities [7-9].

Review of Literature: The Global Picture

1. Kasturiratne, Wickremasinghe et al. [4] in their literature analysis and modelling based on regional estimates of envenoming and deaths, estimate that globally at least 421,000 envenoming and 20,000 deaths occur each year due to snakebite. These figures may be as high as 1,841,000 envenoming and 94,000 deaths. Based on the fact that envenoming occurs in about one in every four snakebites between 1.2 million and 5.5 million snakebites could occur annually and concluded that snakebites cause considerable morbidity and mortality worldwide. The highest burden exists in South Asia, Southeast Asia, and sub-Saharan Africa.

2. Field diagnostic tests for snake species identification do not exist and treatment mainly relies on the administration of anti-venoms that do not cover all of the important venomous snakes of the region. Due to lack of training to health workers and poor information to rural populations they often apply inappropriate first-aid measures and vital time is lost before the victim is transported to a treatment center [10].

3. In WHO Bulletin Chippaux 1998 [3] found that global incidence of envenomation and their severity remain largely misunderstood. Since the comprehensive review by Swaroop and Grab in 1954 no global survey has been carried out on snake-bite epidemiology.

4. Brunda and Sashidhar 2007 [7] observed that snake-bites are the common cause of morbidity and mortality in tropical countries. In India, there are 216 species of snakes, of which only four are venomous snakes (cobra, krait, Russell's viper and saw scaled viper)". Their study was undertaken to "find out the epidemiological profile of snake-bite incidences. They analyzed data from 1,379 snake-bite cases collected from case reports for a 5-year period (1999-2003). On the basis of the forensic data, specimens were collected during rainy season and were analyzed for the venom antigens (cobra and krait) by "ELISA method" and found that 'the peak numbers of snake-bite cases were seen during June-September, majority in the age group 21 to 50 years (71%). Higher incidence was recorded in males (76%). Of the 22 cases analyzed 6 tested positive for cobra venom, 8 for krait venom, the remaining specimens tested negative for both cobra and krait venom. They observed that evaluation of forensic specimens (autopsy and biopsy) of human snakebite victims based on specific molecular epidemiological tool like ELISA gives a true estimate of the incidence supplementing clinical and circumstantial evidence".

5. Chippaux, Stock et al. 2010 [11] found "a total of 142 clinical studies of which 115 address snake bites, 20 scorpion stings, and 8 other animals. Anti-venom use was studied in 118, of which 82 addressed efficacy, 43 evaluated safety, 23 studied dosage and 8 explored other issues. Besides anecdotal clinical reports, three classes of clinical studies are distinguished: (a) observational clinical studies (55 of the total) which analyze series of cases, (b) comparative clinical studies which compare therapeutic products or treatment regimens without a gold standard for comparison and (c) randomized clinical trials. The review "found that all clinical studies of treatment of envenomation lean markedly toward the explanatory and suggest that, given some particularities of envenomation as a medical condition, a more pragmatic approach may be of value, particularly under the conditions prevalent for clinical studies in developing nations".

Clinical and Prognostic Factors Associated with Snake Bite Mortality

1. According to Bawaskar HS, Bawakar PH [12], snake bite is a common and frequently devastating environmental and occupational disease, especially in rural areas of tropical developing countries. Snake venoms are rich in protein and peptide toxins that have specificity for a wide range of tissue receptors, making them clinically challenging and scientifically fascinating, especially for drug design. Although the full burden of human suffering attributable to snake bite remains obscure, hundreds of thousands of people are known to be envenomed and tens of thousands are killed or maimed by snakes bite every year.

2. Kalantri et al. 2006 [13] found "the overall mortality rate 11 per 100 cases of snake bite. Vomiting, neurotoxicity and serum creatinine are significant predictors of mortality among inpatients with snake bite.

3. Suchithra et al. 2008s [14] studying snake bite envenoming, they studied "the clinical characteristics, factors involved in complications and the outcomes in relation to timing of polyvalent snake antivenom administration in patients with snakebite envenoming. Treated patients were analyzed to determine the factors involved in complications and the outcomes in relation to the timing of ASV". They found that "200 (34%) of 586 cases with snakebites had envenoming; 58% were men, 52% were aged 31 to 50 years and 93%were outdoor bites. The species of snake was identified in 34.5% of the venomous bites. 93.5% had signs of local envenoming. Regional lymphadenitis occurred in 61%. The mortality rate was 3%. Capillary leak syndrome, respiratory paralysis and intracerebral bleeding were the risk factors for mortality. Those who received ASV early (bite to needle time <6 h) had more severe local envenoming than those who received ASV late (bite to needle time > or =6 h), but the latter group were more likely to suffer complications. 39.5% had complications, with acute renal failure being the most common (25.5%). Those who received ASV late had a higher risk of developing acute renal failure. Higher rates of complications were seen in those with severe coagulopathy (OR=8.0), leukocytosis (OR=3.7) and those who received ASV late". They concluded that "early administration of ASV reduces the risk of complications. The presence of leucocytosis and severe coagulopathy can predict adverse outcomes".

4. Narvencar 2006 [15] "study the relationship between the time of anti-snake venom administration and development of complications. It was found that the incidence of complications was directly proportional to the duration of venom in the blood prior to neutralization by ASV. The early institution of ASV is beneficial in preventing complications however severe is the systemic envenomation". They studied all patients of snake bite that presented to their institution over a period of 1 1/2 years. A detailed clinical history, clinical examination and investigations were carried out. The patients were administered ASV within 10 min of presentation. The bite to needle time (time between the bite and start of ASV) was noted. The patients were then followed up to note any subsequent development of complications. The end-point of the study was normalization of hematological and neurological parameters; fifty patients became eligible for the study. Twenty patients (40%) had complications while remaining 30 patients (60%) were uncomplicated. An attempt was made to study relationship between bite to needle time and subsequent development of complications. It was found to

be significant (5% p<0.05).

5. "To identify the predictors of severe outcomes in patients with hemotoxic viper bite certain independent variables were recorded like age, sex, ethnicity, bite sites, duration of prehospital period, prehospital treatment, onset of systemic bleeding, local edema, ecchymosis, blister, hematocrit, platelet count, whole blood clotting time, serum electrolytes, renal function and urinary examination findings in 62 hospitalized patients by Bandyopadhyay, Ghosh et al. 2009 [16]. They found that "systemic bleeding was the commonest complication (45%). On multivariate analysis, alteration in coagulation parameters (like thrombocytopenia and prolonged whole blood clotting time) predisposed to systemic bleeding while local factors like bite site, faulty tourniquet application, and herbal treatment were responsible for local complications. Factors like massive envenomation and delayed hospitalization significantly contributed to major organ damage. Predictors of death were anuria and systemic bleeding. It is concluded that several epidemiological, clinical, and laboratory features predict adverse outcomes in hemotoxic viper bite".

6. Bawaskar et al. 2008 [17] found "nine hundred and eighty-two cases of snakebite were admitted during twelve months at five hospitals situated in five different districts of rural Maharashtra. Out of these 55 (30.2%), 38 (20.8%), 48 (26.3%), 41 (22.5%) cases were bitten by *Echis carinatus* (Eh), Russell's viper (Rv), krait (Kr) and Cobra (Cr) respectively. Clinical confirmation of snakebite with envenoming was by identification of the dead snake brought by victims and by clinical signs and symptoms such as absent or minimum local signs, pain in abdomen proceeding to neuro-paralysis, if the victim slept on floor bed, suggestive of krait bite. Rapid development swelling at the site of fangs marks with ecchymosis with rapid development of neuro-paralysis, respiratory depression suggestive of cobra bite. Severe local edema with fangs marks, active bleeding from fangs marks with rapid development of systemic bleeding with positive 20 min Whole Blood Clotting Test (20WBCT) suggestive of Russell's viper bite. Slow development mild local edema with fangs marks, delayed development of local ecchymosis and systemic bleeding (20WBCT) in a case of Eh bite. Irrespective of similar clinical effects of particular type of snake, the total dose of Anti-Snake Venom (ASV) administered differs [18]. Early detection of clinical signs and symptoms and rapid administration of adequate initial dose of ASV on arrival, endotracheal intubation and timely intervention with either manual ventilation by ambu bag or mechanical ventilation in neuroparalysis and early detection of renal failure and its rapid treatment helped to reduce the morbidity and mortality in a rural setting" [19,20].

7. In Southeastern Nepal, Sharma, Chappuis et al. 2004 did a "community-based study aimed at evaluating the impact of snake bites and determining the risk factors associated with a fatal outcome in southeastern Nepal. Extensive data from snake bite victims during the 14 previous months were recorded and analyzed. One hundred forty-three snake bites including 75 bites with signs of envenoming were reported (annual incidence- 1,162/100,000 and 604/100,000, respectively), resulting in 20 deaths (annual mortality rate 162/100, Characteristics of krait bites such as bite so occurring inside the house, while resting, and between midnight and 6:00 AM were all factors associated with an increased risk of death, as were an initial consultation with a traditional healer, a long delay before transport, and a lack of available transport. An initial transfer to a specialized treatment center was strong protective factors. Among the 123 survivors, wounds required dressing and surgery in 30 (24%) and 10 (8%) victims, respectively, the mean working in capacity period was 15 days, and the mean out-of-pocket expense was 69 U.S. dollars".

Snake Bite Pathophysiology

1. In a study to understand snakebite coagulopathy [21] found that "pro-coagulant toxins are important hemotoxins that have been investigated both as laboratory reagents and potential therapeutic agents. In human envenomation by some elapid and many viperid snakes, these toxins result in venom-induced consumption coagulopathy. Overall, the coagulant activity of the various venoms is difficult to characterize, and many studies simply characterize toxin conversion of isolated substrates, such as the effect of a snake toxin on purified fibrinogen, or on multiple single substrates. Although prothrombin activators cause a single effect *in vitro*, there may be complete consumption of fibrinogen, factor V, and factor VIII *in vivo* due to the downstream effects of the thrombin that is formed. Laboratory diagnosis is a key part of the treatment of snakebite coagulopathy. Assessing which assays are the most informative in snake envenoming, based on the pathophysiology of snakebite coagulopathy, will optimize diagnosis and timing of appropriate coagulation tests. A better understanding of the coagulation effects arising from human envenoming will also improve treatment with antivenom and define the role of adjuvant therapies such as factor replacement".

2. "Anti venomous immunotherapy is still used empirically. To improve the efficacy and safety of immunotherapy, the authors [22] studied the effects of administering antivenom antibodies (F(ab')2) on the pharmacokinetics of the *Vipera aspis* venom in rabbits. Free venom levels were measured by enzyme linked immunosorbent assay and total concentrations were quantified by measuring the radioactivity of Trichloroacetic acid-precipitable radioiodinated venom. The intravenous infusion of 125 mg of antivenom 7 h after intramuscular injection with 700 microg x kg (-1) of *V. aspis* venom produced a redistribution of the venom antigens from the extravascular to the vascular space. Moreover, anti-venom antibodies were able to neutralize the totality of venom antigens in the vascular space, because no free plasma venom was detectable by enzyme-linked immunosorbent assay within 15 min after antivenom injection. Similar effects were obtained after injection of 25 mg of antivenom; however, the venom was only partially neutralized with lower doses (5 mg and 2.5 mg). We further established that intravenous injection is the most efficient route for antivenom administration, and we examined the effects of early and late immunotherapy. Finally, the efficacy of Fab antibodies was compared with that of F(ab')2; the plasma redistribution and the immune neutralization of the venom were lower than those induced after injection of the same dose of F(ab')2. The difference between the effects of F(ab')2 and Fab could be explained by the differential pharmacokinetics of the two fragments. In the present work, we tested the effect of several doses of antivenom and of different routes of injection on the pharmacokinetics of venom. They also investigated the effect of early and delayed administration of antivenom, as well as the relative efficacy of different fragments of immuno-globulins".

3. Studying clinically applicable laboratory end-points for treating snake bite coagulopathy to determine which coagulation tests best reflect the return of clotting function after snakebite Venom Induced Consumptive Coagulopathy (VICC)". They found "the combination of the PT and a PTT is an effective, clinically available and cost-effective end-point for treating VICC, and may

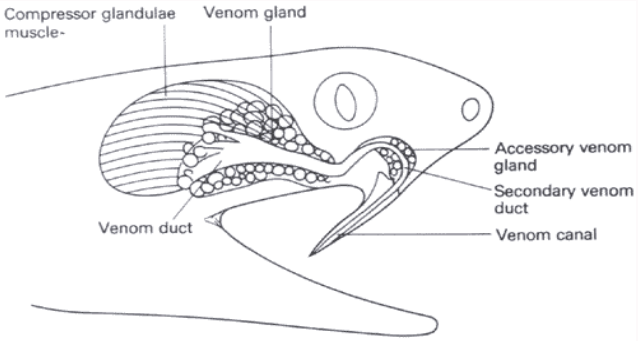


Figure 1: Venom apparatus of a Saw scaled viper.

take longer to return to normal after venom neutralization than previously believed. The fibrinogen assays that are generally in use do not provide any additional useful information". They had "cases of snake envenoming prospectively recruited to the Australian Snakebite Project (ASP) [23,24]. This study examined cases with VICC treated with antivenom and monitored with serial measures of clottable fibrinogen Prothrombin Time (PT) and activated Partial Thromboplastin Time (aPTT). The main outcome measures were times from antivenom treatment until a moderate recovery in the PT (<24 sec), a measurable aPTT and detectable fibrinogen". All in all, "forty-six cases were examined, including 27 brown snakes with proven complete venom neutralisation by antivenom in 25, 16 tiger snake group and three taipans. The times from initial antivenom dose to recovery were: PT<24 sec, median 9.2 h (IQR 6.2-11.3 h); measurable aPTT, median 5.2 h (IQR 3.4-8.8 h); and detectable fibrinogen, median 8.8 h (IQR 5.4-11.7 h). In 10 cases where fibrinogen was detectable earlier than recovery of the PT, the mean fibrinogen was 0.25 g/L (SD 0.10) compared with 0.6 g/L (SD 0.28) in the remaining 36 cases ($p<0.0001$), reflecting differing sensitivities between laboratories. In only three patients (7%) was fibrinogen measurable before the other two outcomes, using highly sensitive fibrinogen assays" [25].

Complications of Snake Bites

1. Exploring the wound infections secondary to snakebite [26], the study "was performed to identify the important bacterial pathogens responsible for wound infections secondary to snakebite and to determine their antimicrobial susceptibility". "All cases of wound infection secondary to snakebite were included in this retrospective study. Infected tissues were surgically debrided and inoculated on blood agar and MacConkey agar for aerobic bacterial culture, followed by antimicrobial susceptibility testing of the isolates by Kirby-Bauer disk diffusion method". "*Staphylococcus aureus* (32%) was the most common isolate followed by *Escherichia coli* (15%); mono-microbial infections were more frequent than poly-microbial infections. The majority of the isolates were antibiotic sensitive. Ciprofloxacin, an oral drug covering both Gram-positive and Gram-negative isolates, was the most frequently prescribed antibiotic [27].

2. Acute renal failure; requiring dialysis. Intravascular hemolysis and hypotension and the presence of bleeding manifestations

Epidemiology

Reptiles came to the earth a million years ago. They are distributed throughout most of the earth's surface [6]. It is believed that there are over 2,900 different species of snakes in the world both venomous and non-venomous and they are classified into 10 groups called families. The poisonous snakes may be divided into five families [28]. Crotalidae, Viperidae, Elapidae, Hydrophidae and Colubridae [5,29]. In India, more than 200 species of snakes have been identified of which only 52 are poisonous [29]. The common Krait (*Bungarus caeruleus*), Indian Cobra (*Naja naja*), Russell's viper (*Daboia russelii*), and Saw-scaled viper (*Echis carinatus*) are the most poisonous ("the big four") [6,28-31]. In the Indian setting, almost two-thirds of bites are attributed to saw-scaled vipers, about one-fourth to Russell's viper, and only a small proportion to cobras and kraits [6,29]. Fangs and venom glands are present only in venomous snakes. The venom glands are developed from the salivary glands. Each fang is connected to the venom gland on either side of the upper jaw by means of a narrow tube [28] (Figure 1).

Russell's Viper

All Elapid snakes such as Cobras, Kraits, and Coral snakes have fangs in the front. The fangs are short and firmly fixed; hence they do not move. The contractions of the muscles help in pumping poison into the prey. Vipers also have fangs in the front of their mouths; they are attached to the front of the upper jaw. At the time of biting, the viper merely strikes releasing the venom the moment the fangs penetrate the skin [28]. The fang can penetrate, but part or most of the venom may be ejected superficially without entering the wound. As such even a thin layer of clothing may offer a great protection. This is of great epidemiological significance as a simple measure like protective shoes can dramatically reduce incidence of snake bite.

Snake venom

Chemical composition: Snake venom is referred to as highly modified saliva. The venom is secreted by the gland and passed on by the duct to the base of the tubular fang through which it is ejected. There is diurnal and seasonal variation in the concentration of venom. Venom travels in the body through lymphatics. It is a complex mixture of different kinds of proteins and enzymes [29]. Metalloproteinases, Phospholipase A2, Hyaluronidase and proteolytic enzymes, α-Neurotoxins, β-neurotoxins and polypeptides are present in snake venom. The normal function of snake venom is to immobilize the prey and to assist in digestion [28].

Toxic effects of snake venom: The toxic effect of snake venom results from both the protein and the non-protein component. It is further complicated by the inflammatory response of the victim's body. Pro-coagulant enzymes are present in viperine venom which leads to consumptive coagulopathy. Many different enzymes in the venom act at different points in the coagulation pathway and cause

formation of fibrin which is broken down by the body's fibrinolytic systems. A consumptive coagulopathy ensues [5]. The Colubrine venom is mainly neurotoxic and has primary toxicity for respiratory and cardiac centers. The Viperine venom is mainly hemotoxic. The sea snake venom is myotoxic [29].

The fatal doses areas:

- Cobra: 12 mg of the dried venom,
- Russell's viper: 15 mg of the dried venom,
- Echis: 8 mg of the dried venom,
- Krait 6 mg of the dried venom.

The average yield in one bite in terms of dry weight of lyophilized venom is:

- Cobra 170 mg to 325 mg;
- Russell's viper 130 mg to 250 mg;
- Krait 20 mg and
- Echis 20 mg to 35 mg [29].

Management Snake bite

WHO/SEARO: Has published guidelines, specific for the South East Asia region, for the clinical management of snakebites [5].

First aid: The aim of first aid is to retard the systemic absorption of venom and prevent life threatening complications and promptly transport the patient to a medical facility. First aid can be performed by the victim or by any person who happens to be nearby. Incision, suction, electric shocks, cryotherapy, or washing the wound are contraindicated. Any interference with the wound introduces infection, increases bleeding from the site, and hastens absorption of the venom. The pneumonic RIGHT provides a useful aid [32] (R: Reassure the patient. Seventy per cent of all snake bites are from nonvenomous species. Only 50% of bites by venomous species actually envenomate the patient. I: Immobilise in the same way as a fractured limb. Do not apply any compression in the form of light ligatures, they do not work and can be dangerous. G.H: Get to Hospital immediately traditional remedies have NO PROVEN benefit in treating snakebite. T: Tell the doctor of any systemic symptoms such as ptosis that manifest on the way to hospital.

Hospital treatment

Emergency department: In the emergency department, evaluation begins with the assessment of the airway, breathing, circulatory status, and consciousness. Resuscitation is urgently needed in those in shock, those with respiratory failure, and in those who have had cardiac arrest. Attempts should be made to determine whether a venomous snake has actually bitten the patient and if so, this can be cross-checked by looking for fang marks and signs of local envenomation. If the victim has brought the snake, identification of the species should be carried out. Attempt to determine the time elapsed since the snakebite. A brief medical history should be obtained.

Physical examination: Initial evaluation should include: Bite site examination- signs of local envenomation (edema, petechiae, bullae, oozing from the wound, etc.,) and for the extent of swelling. The bite site and at least two others, more proximal, locations should be marked and the circumference of the bitten limb should be measured thereafter, until the swelling is no longer progressing. Lymph nodes draining the limb should be palpated.

Signs of envenomation:

- Snake identified is a very venomous one
- Rapid early extension of local swelling from the site of the bite
- Early tender enlargement of local lymph nodes, indicating spread of venom in the lymphatic system
- Early systemic symptoms
- Early spontaneous systemic bleeding (especially bleeding from the gums)
- Passage of dark brown or red urine
- Neuroparalytic signs and impending respiratory failure.

Symptoms and signs vary according to the species of snake responsible for the bite and the amount of venom injected. Sometimes the identity of the biting snake can be confirmed by examining the dead snake. It can also be derived from the patient's description or the circumstances of the bite or from knowledge of the clinical effects of the venom of that species. This information will help to choose appropriate antivenom, anticipate the likely complications and take appropriate action. If the biting species is unknown, recognition of the emerging pattern of symptoms, signs and results of laboratory tests ("the clinical syndrome"), may suggest which species was responsible.

Laboratory investigations: Although lab tests are of little value in the diagnosis of snake envenomation, they are useful for prognosticating and for making decisions about specific interventions [6].

Specific investigations: The 20-min Whole Blood Clotting Test (20 WBCT): Is a simple bedside test of coagulopathy to diagnose viper envenomation. It requires a new clean, dry test tube made up of simple glass that has not been washed with any detergent. A few milliliters of fresh venous blood is drawn and left undisturbed in the test tube for 20 min; the tube is then tilted gently. If the blood is still liquid after 20 min, it is evidence of coagulopathy and confirms that the patient has been bitten by a viper. Cobras or kraits do not cause antihemostatic symptoms [32,33].

Enzyme Linked Immunosorbent Assay (ELISA): ELISA tests are now available to identify the species involved, based on antigens in the venom [6]. These tests, however, are expensive and not freely available and thus have limited value in diagnosis at present, they find use mainly in epidemiological studies.

Other nonspecific tests include: Hemogram: May show transient elevation of haemoglobin level due to hemo-concentration or anemia. Presence of neutrophilic-leucocytosis signifies systemic absorption of venom [5]. Thrombocytopenia may be a feature of viper envenomation.

Serum creatinine: This is necessary to rule out renal failure after viper and sea snakebite.

Serum amylase and Creatinine Phosphokinase (CPK): An elevated level of these markers suggests muscle damage (caution for renal damage).

Prothrombin Time (PT) and activated Partial Thromboplastin Time (aPTT): Prolongation may be present in viper bite.

Fibrinogen and Fibrin Degradation Products (FDPs): Low fibrinogen with elevated. FDP is present when venom interferes with the clotting mechanism. Arterial blood gas and electrolyte determinations if indicated especially with shock and respiratory compromise.

Urine examination: Can reveal hematuria, proteinuria, hemoglobinuria, or Myoglobinuria.

Electrocardiogram: Nonspecific ECG changes such as bradycardia and atrioventricular block with ST-T changes may be seen.

Electroencephalogram (EEG): Recently, EEG changes have been noted in up to 96% of patients bitten by snakes. These changes start within hours of the bite but are not associated with any features of encephalopathy. Sixty-two percent showed grade I changes, 31% cases manifested grade II changes (moderate to severe abnormality), and the remaining 4% showed severe abnormality (grade III). These abnormal EEG patterns were seen mainly in the temporal lobes [6]. The first blood drawn from the patient should be typed and cross-matched, as the effects of both venom and antivenom can interfere later with cross-matching.

Treatment

Anti-snake venom: Anti-Snake Venom (ASV) is immunoglobulins prepared by immunizing horses with the venom of poisonous snakes and subsequently extracting and purifying the horses' serum [34]. They are the only effective antidote for snake venom. Antivenoms may be species specific (monovalent/monospecific) or may be effective against several species (polyvalent/polyspecific). As per the recommendations of WHO, the most effective treatment for snakebite is the administration of monospecific ASV30. WHO recommends that if an adequate cold chain is in place, antivenoms should be prepared in the liquid form, since this reduces production costs and avoids the potential adverse physicochemical alterations to the product sometimes brought about by lyophilisation. On the other hand, if the integrity of the cold chain cannot be guaranteed, antivenoms should be lyophilized to maintain stability [35]. In India, polyvalent antivenom prepared by Central Research Institute, Kasauli (HP) is effective against the most common Indian species. Antivenom produced at the Haffkine Corporation, Parel (Mumbai) is effective against the venom of even more species. ASV is supplied in dry powder form and has to be reconstituted by diluting in 10 ml of normal saline/D5W. Mixing is done by swirling and not by vigorous shaking.

Indications for ASV: Antivenom treatment carries a risk of severe adverse reactions. Antivenom is indicated whenever there are signs of systemic envenomation or presence of severe local swelling.

Antivenom therapy: should be ideally administered within 4 h of the bite, but is effective even if given within 24 h. WHO/SEARO recommends the dose of antivenom to be the amount required to neutralize the average venom yield when captive snakes are milked of their venom [36-38]. Russell's viper injects, on average, 63 mg (SD: ± 7 mg) of venom in the first bite. As each vial of polyvalent ASV neutralizes 6 mg of Russell's viper venom [32]. As snakes inject the same amount of venom into children and adults, children should receive the same dose of antivenom as adults. Bleeding stops within 15 min to 30 min, though coagulation disturbances may take up to 6 h to normalize. Neurotoxicity begins to improve within the first 30 min, but patients may require 24 h to 48 h for full recovery. A repeat dose of ASV should be given when there is persistence of blood incoagulability even after 6 h or continued bleeding after 1 h to 2 h of the initial dose. ASV should also be repeated when there are worsening neurotoxic or cardiovascular signs even after 1 h to 2 h.

ASV administration; ASV can be administered either by slow intravenous injection at a rate of 2 ml/min or by intravenous infusion (antivenom diluted in 5 ml to 10 ml per kilogram body weight of normal saline or D5W and infused over 1 h). All patients should be strictly observed for an hour for development of any anaphylactic reactions.

ASV sensitivity testing: is no longer recommended as a lack of response does not predict the large majority of early (anaphylactic) or late (serum sickness type) reactions 5. ASV reaction approximately 20% patients treated with ASV develop either early or late reaction [5].

Early anaphylactic reactions: Occurs within 10 min to 180 min of start of therapy and is characterized by itching, urticaria, dry cough, nausea and vomiting, abdominal colic, diarrhea, tachycardia, and fever. Some patients may develop severe life-threatening anaphylaxis characterized by hypotension, bronchospasm, and angioedema.

Pyrogenic reactions: Usually develop 1 h to 2 h after treatment. Symptoms include chills and rigors, fever, and hypotension. These reactions are caused by contamination of the ASV with pyrogens during the manufacturing process.

Late (serum sickness-type) reactions: Develop 1 to 12 (average 7) days after treatment. Clinical features include fever, nausea, vomiting, diarrhea, itching, recurrent urticaria, arthralgia, myalgia, lymphadenopathy, immune complex nephritis and, rarely, encephalopathy.

Treatment of ASV reaction: Antivenom administration must be temporarily stopped and adrenaline (1 in 1000) given intramuscularly in an initial dose of 0.5 mg in adults or 0.01 mg/kg body weight in children. The dose can be repeated every 5 min to 10 min if necessary. After adrenaline, ananti-H1 antihistamine such as chlorpheniramine maleate, it may be followed by intravenous hydrocortisone [32]. Late (serum sickness-type) reactions usually respond to a 5-day course of oral antihistamine. Patients who fail to respond within 24 h to 48 h should be given a 5-day course of prednisolone (5 mg six hourly in adults and 0.7 mg/kg/day in divided doses in children) [6].

Supportive therapy: Patients with presence of fang marks, moderate pain, minimal local edema, and no systemic reactions can be closely monitored on the medical ward. Supportive therapy is continued till clinical parameters improve. In most cases follow up and ongoing supportive care is tailored to address issues around:

Coagulopathy with bleeding: Coagulopathy usually reverses after ASV treatment. In some cases, when there is severe bleeding, restoration of coagulability can be accelerated by giving fresh frozen plasma, cryoprecipitate (fibrinogen, factor VIII), fresh whole blood, or platelet concentrates [38].

Neurotoxic symptoms: Antivenom treatment alone cannot be relied upon to save the life of a patient with bulbar and respiratory paralysis. Once there is evidence of respiratory distress, endotracheal intubation and initiation of mechanical ventilation is indicated. Since Elapid toxin results in pathophysiological changes resembling those of myasthenia gravis, anticholinesterase drugs can have a useful effect in patients with neurotoxic envenomation, especially in those bitten by cobras. A trial of anticholinesterase should be performed.

Figure 2: The "Big Four". Saw scaled viper (*Echis carinatus*), Common krait (Bungarus caeruleus), Cobra (*Naja naja*), Russell's viper (*Daboia russelii*).

Injection neostigmine can be given as 50 μg/kg to 100 μg/kg 4 h or as a continuous infusion. Glycopyrrolate 0.2 mg can be given before neostigmine as, unlike atropine, glycopyrrolate does not cross the blood-brain barrier.

Care of bitten part: The appearance of a tensely-swollen, cold, and apparently pulse less snake-bitten limb may suggest the possibility of increased intracompartmental pressure, especially if the digital pulp spaces or the anterior tibial compartment are involved. Swelling of envenomed muscle within such tight fascial compartments could result in ischemia. However, the classical signs of an intracompartmental pressure syndrome may be difficult to assess in snakebite victims. Fasciotomy should not be contemplated until hemostatic abnormalities have been corrected, otherwise the patient may have fatal bleeding [6]. As most snake's harbor aerobic as well as anaerobic bacteria in their mouths, a prophylactic course of penicillin (or erythromycin) and a single dose of broad-spectrum antibiotic course which will cover anaerobes together with a booster dose of tetanus toxoid is recommended [38] (Figure 2).

Clinical features: Ptosis in patient with Krait bite. Ptosis in Russell's viper bite. Local cellulitis-right lower limb. Hematuria in Russell's viper bite. Discolouration and skin necrosis Local cellulitis-left upper limb local skin and soft tissue necrosis. Compartment syndrome, after surgery.

Aims and Objectives of the Study

- To look at the type and clinical presentation of snake bite.
- To study the complications of snake bite.
- To analyse the clinical outcome.

Materials and Methods

This study is a descriptive, analytical case series. A retrospective case analysis was conducted based on case sheets obtained from the medical records department of KMCH between September 2013 to May 2014 after approval from hospital ethical committee and participants consent. All snake bite presented to KMCH were included in the study. Total N=33 patients were included in the study.

Inclusion criteria

All the patients presented to KMCH with alleged history of snake bite.

Exclusion criteria

Unknown bites with no signs of envenomation by snake were excluded from the study. Venomous bites were defined by signs and symptoms of toxicity based on clinical assessment and laboratory tests.

- Presence of fang marks
- The dead snake if brought in for identification. (In other cases, attempt was made to characterize the snake as venomous or not via a good verbal description).
- Presence of local manifestations – swelling, cellulitis and blister formation Neurotoxic manifestations based on clinical examination.
- Hemotoxic manifestations based on clinical examination and coagulation profile.

Outcome categories

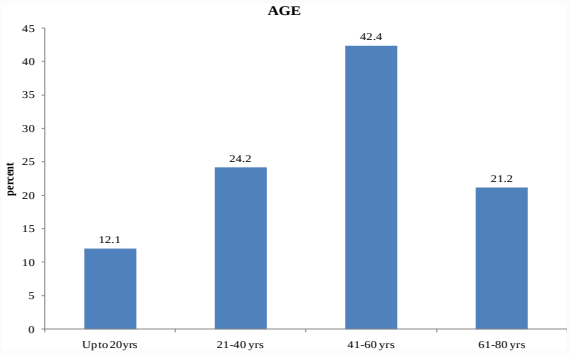
Based on the clinical condition at the time of discharge, outcomes were classified into:

1. Complete recovery was defined as a state of complete recovery without any associated physical or physiological abnormality.
2. Admission to discharge without sequelae was defined as those who at the time of discharge had cellulitis. These patients were followed in the OPD till resolution of symptoms.
3. Admission to discharge with sequelae was defined as those who local swelling with necrosis requiring debridement or skin grafting and compartment syndrome requiring fasciotomy and release surgery. This group had residual disability from the above complications.
4. Fatality was defined as a state of brain death as certified by the physician after active resuscitative measures like respiratory support and CPR for 30 min.

Results and Statistical analysis: Data was analyzed using

Table 1: Age wise distribution of patients.

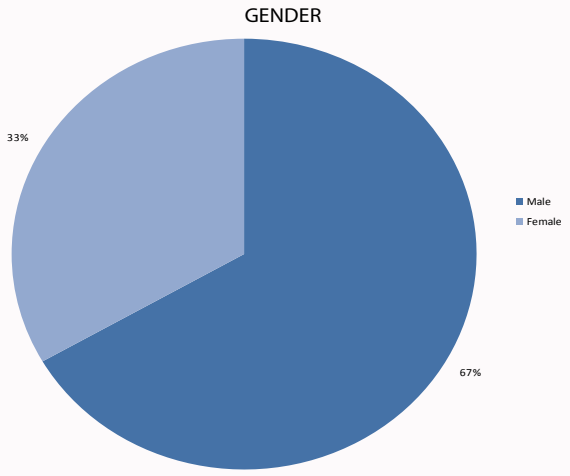
Sex	No. of Cases	Percent
Male	22	66.7
Female	11	33.3
Total	33	100.0



Above table and bar diagram show age wise distribution of the study population.

Table 2: GENDER.

Sex	No. of Cases	Percent
Male	22	66.7
Female	11	33.3
Total	33	100.0



Above table and Pie chart show gender distribution in the study population.

Table 3: Occupation.

Occupation	No. of Cases	Percent
Agriculture Field Work	17	51.5
Textile Industry	4	12.1
House Wife	9	27.3
Others	3	9.1
Total	33	100.0

appropriate statistical methods and is compared with similar standard studies (Tables 1-21).

Result

As shown in above table (Table 22), 32 out of 33 patients were

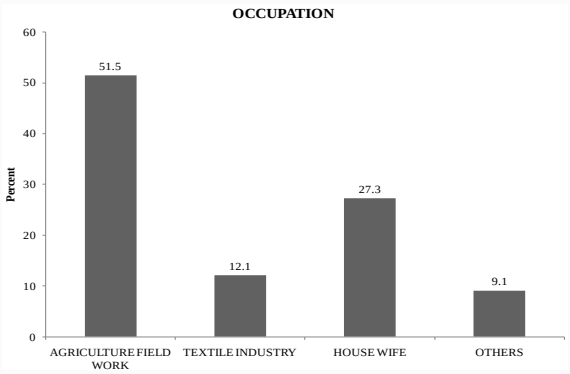
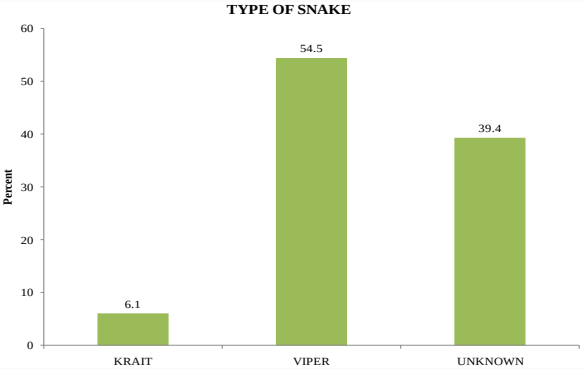


Table 3 and bar diagram show 51.5% of the study population is from Agriculture field workers.

Table 4: Snakes.

Type of Snake	No. of Cases	Percent
Krait	2	6.1
Viper	18	54.5
Unknown	13	39.4
Total	33	100.0



Above table and bar diagram show that 54.5% of the snakes were Vipers.

Table 5: Site of Bite.

Site of bite	No. of Cases	Percent
Upper half of the body	6	18.2
Lower half of the body	27	81.8
Total	33	100.0

given ASV. One of the patients required 10 vials of ASV which was the minimum required amount of ASV, while another patient required 84 vials of ASV which was the maximum required amount of ASV in the present study. Mean value of the amount of ASV vials was observed to be 21.94 and the Standard deviation was 14.73. Thirty-one patients were admitted in the ICU on arrival to KMCH, remaining 2 were admitted directly in the ward. One patient was admitted for 14 days in the ICU which was the maximum duration of stay in ICU. Mean value of ICU stay was observed to be 2.42 and Standard deviation was 2.69. Thirty-two the patients were admitted in the ward. One patient was discharged from the ICU, so the minimum duration of stay in the ward was 0 days. In ward 1 patient stayed for 48 days which was the maximum duration of stay in the ward. Mean of the ward stay was observed to be 7.67 and Standard deviation was 10.13. One Patient was admitted for only 1 day in ICU and was

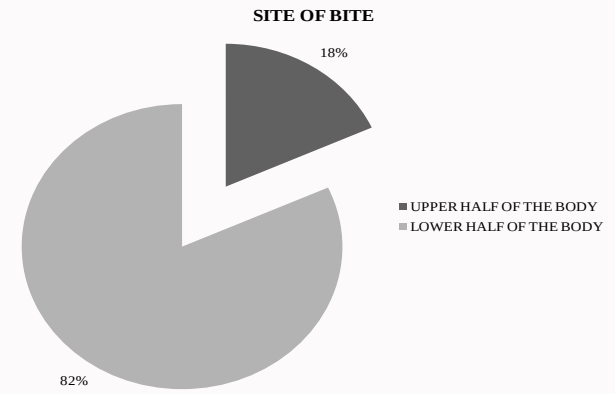
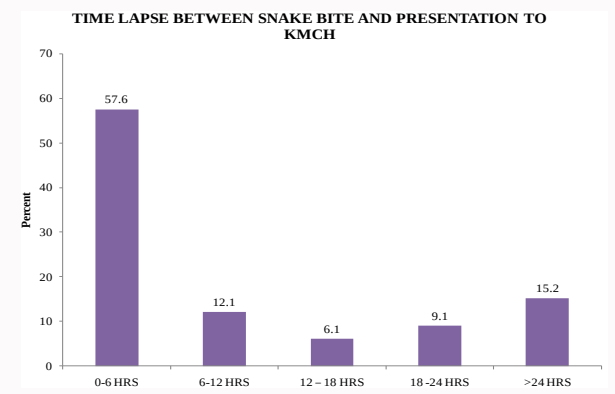


Table 5 and pie chart that 82% of the study population had the Snake bite over the lower half of their body.

Table 6: Time Lapse b/w bite and presentation to KMCH.

Time lapse	No. of Cases	Percent
0-6 h	19	57.6
6-12 h	4	12.1
12-18 h	2	6.1
18 -24 h	3	9.1
>24 h	5	15.2
Total	33	100.0



57.6% patients presented to KMCH within 6 h of the Snake bite.

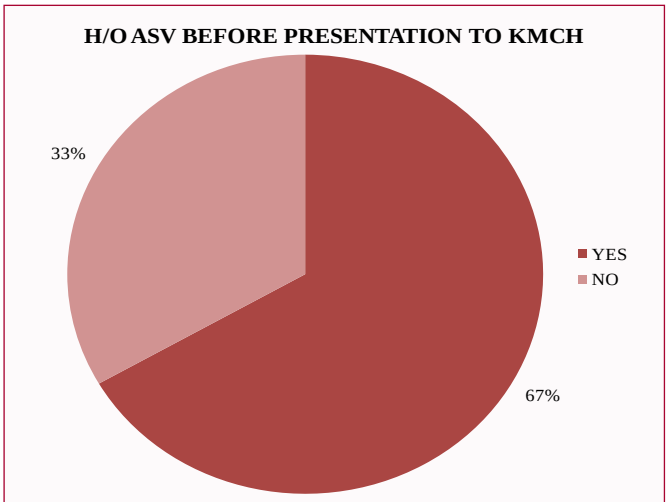
Table 7: H/O ASV administration before coming to KMCH.

H/O ASV	No. of Cases	Percent
YES	22	66.7
NO	11	33.3
Total	33	100.0

discharged, so the minimum hospital stay was 1 day. While another patient was admitted in the hospital for 62 days (including ICU and ward stay). Mean of the total hospital stay was observed to be 10.09 and Standard deviation was 12.13.

Discussion

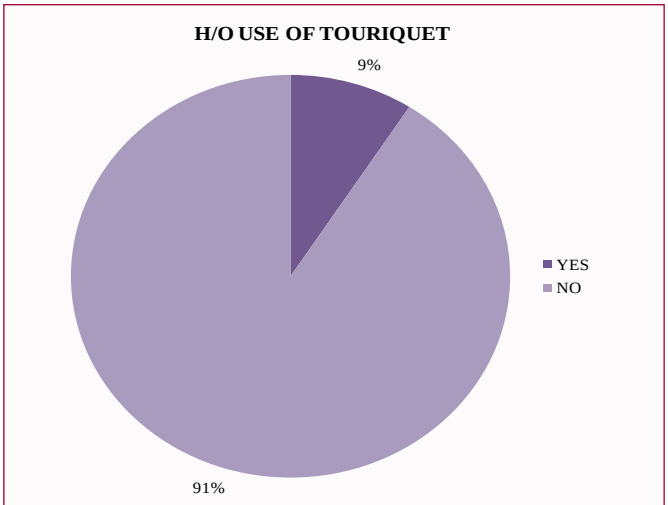
The magnitude of the problem associated with snakebites is formidable. This is even more compelling in the rural and low socioeconomic population in India. Numerous studies indicate associations with demographic, epidemiological, clinical and laboratory factors that lead to poor outcomes in snake bite cases.



2/3rd of the total population gave the h/o ASV administration before presenting to KMCH.

Table 8: Use of tourniquet.

Tourniquet	No. of Cases	Percent
YES	3	9.1
NO	30	90.9
Total	33	100.0



Out of 33 patients only 3 patients had used Tourniquet before presenting to KMCH.

Table 9: Evidence of Snake Bite.

Evidence of snake bite	No. of Cases	Percent
Present	33	100.0
Absent	0	0

Key among those are in appropriate first aid measures, delayed presentation to health care facilities, precious initial time wasted with traditional healers and non-availability of transportation. Delay in instituting ASV was a significant factor associated with poor outcome regardless of the degree of envenomation [14,15,39]. Experienced health staff conversant in the management of snake bites and prompt institution of therapy with ASV shape better outcomes. The degree of envenomation, local signs at presentation and "bite to needle time" added to morbidity indicators. Clinical indicators

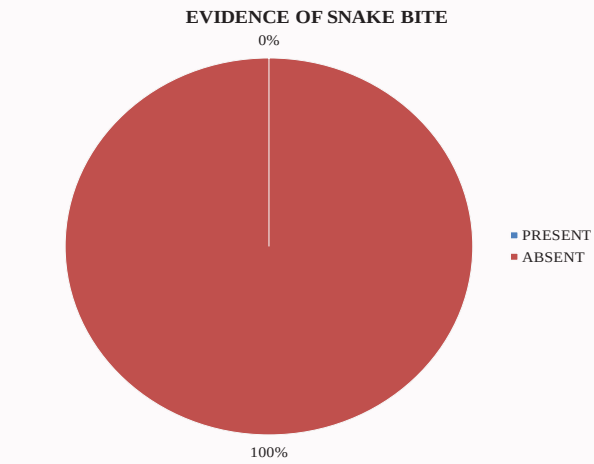
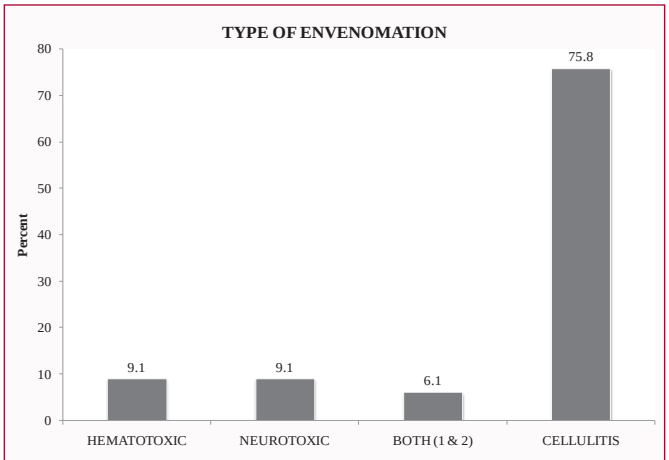


Table 9 shows all the patients in the study population had the evidence of Snake bite.

Table 10: Type of envenomation.

Type of Envenomation	No. of Cases	Percent
Hematotoxic	3	9.1
Neurotoxic	3	9.1
Both (1 & 2)	2	6.1
Cellulitis	25	75.8
Total	33	100.0



Above table and bar diagram show types of envenomation observed in the study population.

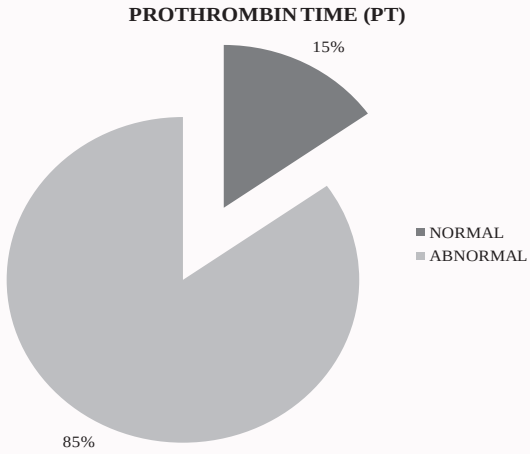
like neuro-paralysis, bleeding complications and local signs provide clues to the type of envenomation and also act as signposts in clinical management. Findings of renal failure and systemic bleeding were associated with increased mortality in all the studies. All these factors can be utilized to form prognostic tools which will be helpful for medical staff. In our study, we analyzed the impact of demographic factors on the severity of venomation and clinical presentation, then attempt to readdress the important issue of ASV usage. Knowing the cost and production issues associated with ASV in South Asia, we suggest the use of a protocol with overall less usage and hence costs, but with good overall clinical outcomes [40].

We discuss these findings under three different sections

1. Demographic pattern of study population,

Table 11: Prothrombin Time (PT).

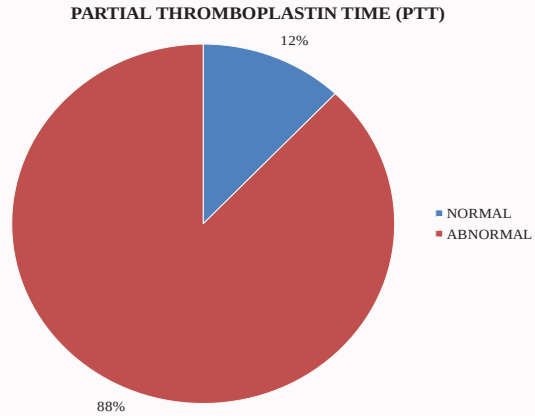
PT	No. of Cases	Percent
Normal	5	15.2
Abnormal	28	84.8
Total	33	100.0



Above table and pie diagram show the result of PT.

Table 12: Partial Thromboplastin Time (PTT).

PTT	No. of Cases	Percent
Normal	4	12.1
Abnormal	29	87.9
Total	33	100.0



Results of PTT are shown in above table and pie diagram.

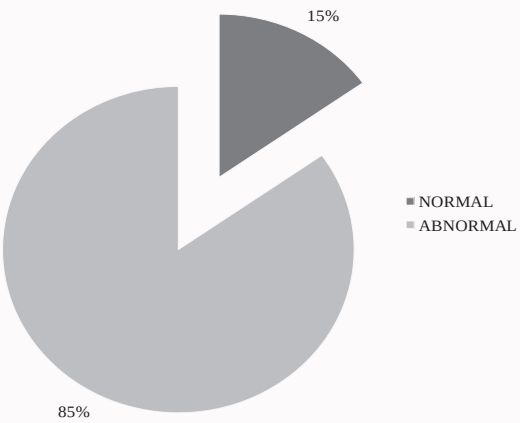
2. Management of Snake bites envenomation.
3. Clinical outcomes in our patient population.

Demographic pattern of snake bite

In our study, the population is mostly native of Coimbatore district, Tamil Nadu. KMCH being a multi-specialty tertiary care hospital, patients are referred here from all over Coimbatore as well as nearby districts. 42.4% of the study population was from 41 to 60 years of age. In our study, male to female ratio was observed to be 2:1. Male predominance has been seen in most of the studies [7,9]. In our study, 17 out of 33 (51.5 % of the total population) were Agricultural field workers. And in agreement with other studies [6,8],

Table 13: International Normalised Ratio (INR).

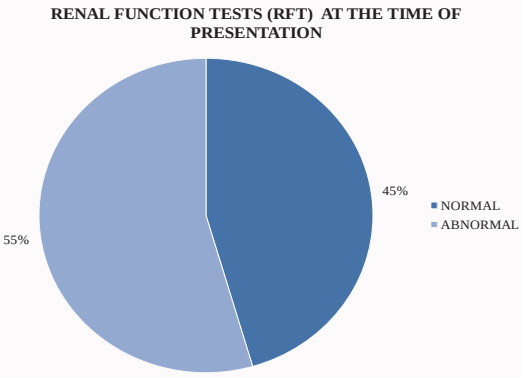
INR	No. of Cases	Percent
Normal	5	15.2
Abnormal	28	84.8
Total	33	100.0



Results of INR are shown in above table and Pie diagram.

Table 14: Renal Function Tests (RFT).

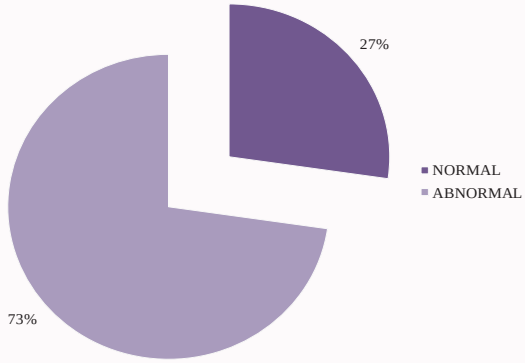
RFT	No. of Cases	Percent
Normal	15	45.5
Abnormal	18	54.5
Total	33	100.0



54.5% Patients had Abnormal RFT at the time of presentation.

Table 15: Platelets (PL).

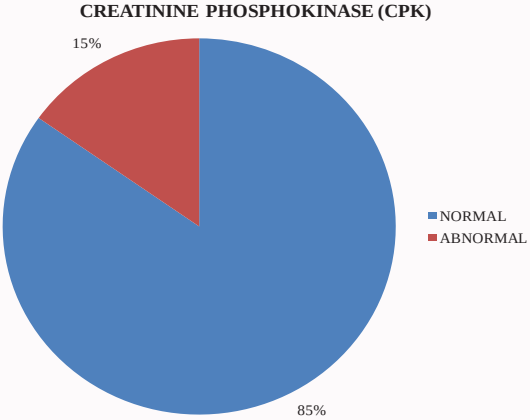
PL	No. of Cases	Percent
Normal	9	27.3
Abnormal	24	72.7
Total	33	100.0



73% of the study population had abnormal value of platelets at the time of presentation.

Table 16: Creatinine phosphokinase.

CPK	No. of Cases	Percent
Normal	28	84.8
Abnormal	5	15.2
Total	33	100.0

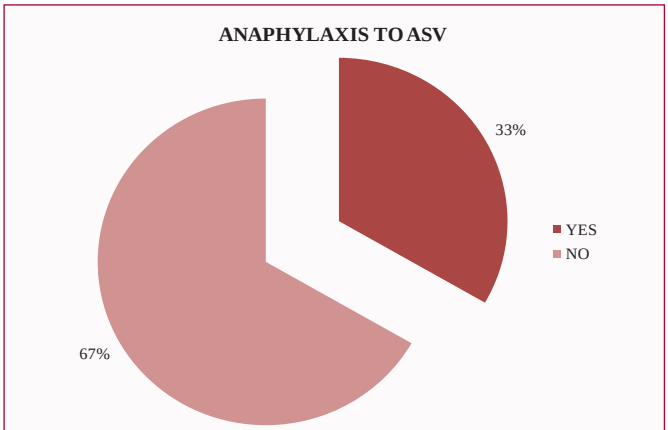


85% Of the study population had normal values of CPK at the time of presentation.

majority of the bites were on the peripheries. Farmers walk bare foot in the fields and use bare hands for handling crops. Our study shows 27 out of 33 (81.4% of the total study population), bite was at the lower extremities. There is a big scope for prevention of snake bites using simple protective measures like gum boots and rubber gloves [41]. It may prove to be a very effective measure, as seen in the study done in Myanmar by Tun-Pe [41] where boots were provided free of cost. We suggest subsidizing the costs for these simple measures for this very vulnerable group. It has become common practice to bring the dead snake to the health facility which greatly helps the health practitioners. But many of the patients could not identify the species of the snake. This was also observed in other studies [6]. These patients with history of snake bite and showing signs of envenomation were grouped as unknown (type of Snake). In our study Viper was the commonest species of snake identified. A similar occurrence was seen in the study by Punde [8]. Visible changes have been seen in our population with respect to seeking prompt and timely medical care. We feel that educating the native population with regard to the snake itself and their typical characteristics will further improve awareness and in conjunction with education about appropriate first aid measures, potentially improve outcomes even more. Most of the patients (57.6% of the total population) in our case series presented to the hospital within six hours of the bite. This was seen in the study by Jasjit et al. [28] in a Military Hospital; but was not the case in most other studies where a later presentation has been reported [9,42-44]. Institution of 108 ambulance services, which is the

Table 17: Anaphylaxis to ASV.

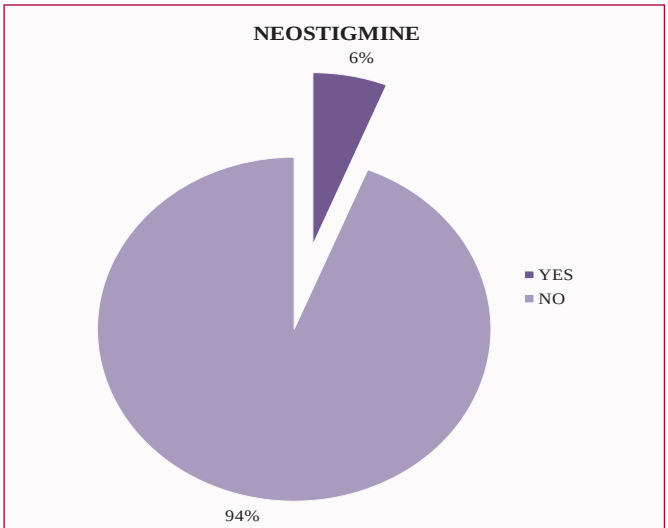
Anaphylaxis to ASV	No. of Cases	Percent
Yes	11	33.3
No	22	66.7
Total	33	100.0



33 % of the study population showed Anaphylactic reactions to the ASV.

Table 18: Patients requiring Neostigmine.

Neostigmine	No. of Cases	Percent
Yes	2	6.1
No	31	93.9
Total	33	100.0

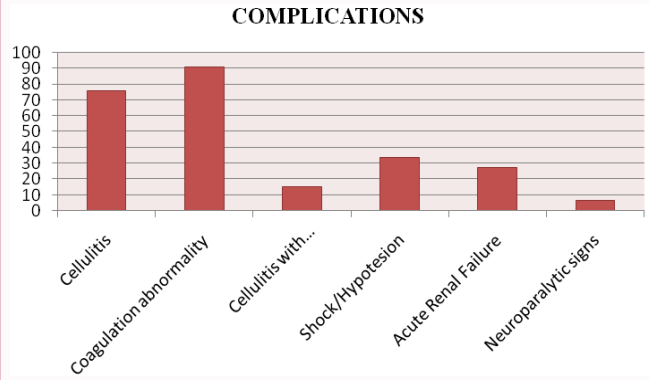


Only 2 patients from the study population required Neostigmine, which comprises 6.1% of the total population.

free service provided in collaboration with the Govt. of Tamil Nadu, for speedy access to health care facilities is one of the contributing factors for the early presentation and thereby better clinical outcome of the Snake bite envenomation. Other factor could include increased anxiety associated with this particular problem. It is clear that this problem requires interventions at different levels. One such initiative addressing transportation has changed the overall outcome favorably. Similar to other studies we found that the species of the snake and the type of envenomation produced are the strongest determinants of the severity of the clinical picture. Early presentation and institution of

Table 19: Complications.

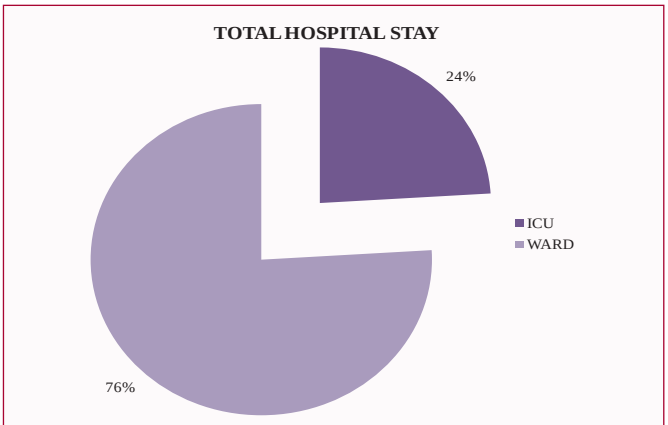
Complications	No. of cases	Percent
Cellulitis	25	75.75
Coagulation abnormality	30	90.90
Cellulitis with debridement	5	15.2
Compartment syndrome	0	0.0
Shock/Hypotension	11	33.33
Acute renal failure	9	27.27
Neuroparalytic signs	2	6.1
Neuroparalysis requiring ventilation	0	0.0
ALI/ARDS	0	0.0
Death	0	0.0



Above table and bar diagram show different types of complications developed in the study population.

Table 20: Hospital stay.

Hospital Stay	No. of days	Percent
ICU	80	24.02
WARD	253	75.98
TOTAL	333	100.00



Out of total hospital stay, 24% was in ICU.

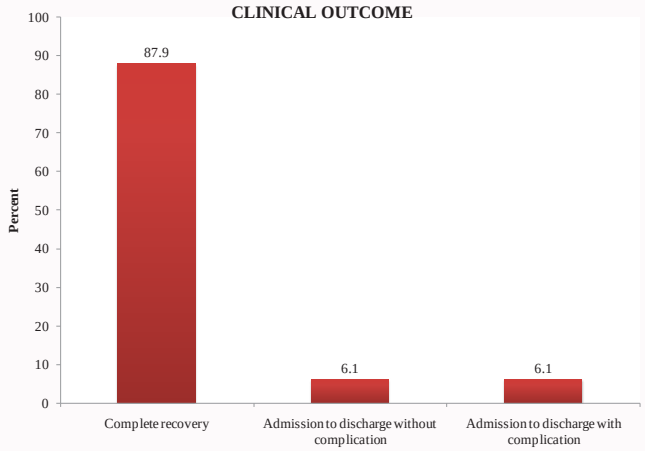
ASV is of paramount importance to get better outcomes.

Management of snake bite envenomation

There is no consensus on the dose of the ASV required in the management of snakebite. Since the dose of ASV is empirical, several institutions have reported regimen in variation with the national

Table 21: Clinical outcome at the time of discharge.

Clinical outcome	No. of Cases	Percent
Complete recovery	29	87.9
Admission to discharge without complication	2	6.1
Admission to discharge with complication	2	6.1
Total	33	100.0



Above table and bar diagram show the clinical outcome at the time of discharge.

protocol and have reported good results with smaller doses of antivenoms. It appears that standard high dose ASV administration that is not tailored to the clinical toxic manifestation results in wastage of expensive and scarce antivenom, whereas too little ASV is also counterproductive. We will discuss the ASV use in our study, with respect to the protocol, the dosage, end point of ASV administration as well as a comparative analysis with other studies on the same topic.

Our protocol

Followed the same criteria for the administration of ASV as the National Snake bite Protocol [45]. Our initial dose at the time of admission was 10 to 15 vials of ASV, diluted in 250 ml of Normal Saline infused over the period of 1 h to 2 h, for the patients who had not received ASV before and for those who had received the bolus dose of the ASV before presenting to us, it was decided depending upon presence of Coagulopathy. Patients showing anaphylactic reaction (11 out of 33 i.e., 33.33% of the total study population), were treated with following regimen: Inj. 100 mg Hydrocortisone, inj. 10 mg of Chlorpheniramine maleate and 2 ml to 3 ml of 1:10000 dilution of Adrenaline injected subcutaneously. Followed by slower infusion of ASV. The exact dose of venom injected at the time of bite by the snake is not known, similarly the amount of ASV required to neutralize the venom cannot be detected clinically [6]. Clinicians need to understand the overall picture, be aware of the clinical and laboratory factors indicative of a poorer prognosis; and base ASV dosage on initial presentation, type of snake bite and follow laboratory parameters and clinical signs closely. Numerous studies have addressed the question of optimal ASV dosages. Some trials like those by Paul et al. [46] and Srimannarayana et al. [47] are well designed trials. They suggest that the use of lower dose ASV is equally effective and there is nocompromise in patient outcome as measured by clinical and laboratory improvements. These studies are very useful in the setting of limited ASV production and need for judicious usage. Riviere G, Choumet V, Audebert F, et al. found that an initial optimum dose of antivenom complexed all the antigenic sites of venom proteins and the subsequent concentration of free venom did not reach toxic levels [22]. In the study conducted by Srimannarayana et al. [18], a bolus dose of 70 ml in Regimen III caused further quicker correction of CT compared to that in Regimen II which did not have an 11 initial bolus dose. With regard to end point of ASV usage, in hemotoxic bites, the normalization of PT/PTT/PL is considered the end point of ASV administration. Srimannaryana et al. [47] have recommended ASV infusion for 24 h after normalization of CT. In case of neurotoxic snakebites (2 out of 33 patients i.e., 6.1% of the total study population) the initial dose of ASV is guided by the severity of neuroparalytic signs at presentation or the rapid progression of neurological signs. ASV administration is undertaken along with other supportive measures like Inj. Neostigmine and Inj. Atropine. Both of these patients improved over the period of two days. We did not practice the continued use of ASV infusion up to 48 h till recovery of Neuroparalytic signs as reported by Prithwis Bhattacharya, Arpan Chakraborty [48], and by Sanjibkumar et al. [49] where a total of 700 ml of ASV was given till the disappearance of ptosis. Therefore, we opine that the continued presence of signs of venomation (like cellulitis in hemotoxic bites, ptosis and external opthalmoplegia in neurotoxic bites) is not a clinical indication for the continued administration of ASV. However, the appearance of new signs of envenomation is a strong indication for further administration of ASV. The studies reflect that there may be scope for better management as far as dose of ASV is concerned. We are still far from defining an optimal dose. Each study had its own unique low and high dose protocol [50]. One could assume that regional differences in the species of snake and the efficacy of nonspecific polyvalent ASV could account for the differences in the dosages formulated. Region specific standardization and development of protocols would still be helpful. In our study only 3 out of 33 patients (9.1% of the total study group) used the Tourniquet before presenting to us. One of these 3 patients developed wound necrosis and had to undergo debridement. All the patients (100%) included in the study had the evidence of Snake bite in the form of Fang marks. 9.1% of the study population showed the signs of envenomation in the form of Hematotoxic reactions, other 9.1% had the envenomation in the form of neurotoxic reactions. 6.1% of the patients had signs of both the hematotoxicity as well as neurotoxicity. Cellulitis was the commonest type of presentation, observed in 75.8% of the total population. Prothrombin Time (PT), Partial Thromboplastin Time (PTT), International Normalised Ratio (INR), Platelet count and Renal function tests were the indicators for the severity of the envenomation. And same were considered for deciding the dosage of ASV administration to the patients. Of 28 (84.8%) of the patients had abnormal values of the PT at the time presentation. PTT was observed to be abnormal in 29 (87.9%) patients. RFTs were abnormal in only 54.5% i.e., Eighteen out of total 33 patients. Twenty four out of 33 i.e., 72.7% of the total study population showed abnormal values of the platelet counts. These laboratory parameters clearly show that

Table 22: Descriptive Statistics.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Total ASV	32	10	84	21.94	14.73
ICU Stay	31	0	14	2.42	2.69
Ward Stay	32	0	48	7.67	10.13
Hospital Stay	33	1	62	10.09	12.15

large number of the study population had hematotoxic reactions as the type of envenomation, though clinically it was observed in only 3 patients. Two patients with the signs of neurotoxicity (ptosis and swallowing difficulty) were treated with Inj. Neostigmine and Inj. Atropine. Coagulation abnormality was the most commonly observed complication in the present study. Of 30 (90.90%) had coagulation abnormality and these patients were treated with blood and/or blood products transfusion. Of 25 (75.75% of the total population) patients developed cellulitis at the site of bite, out of which 5 (15.2% of the total population) had to undergo debridement. Of 11 (33.33% of the total population) presented with hypotension/shock, which was corrected with IV fluids and vasopressors. Of 9 patients in the present study developed acute renal failure as the complication of the Snake bite envenomation. These patients required dialysis. Neuroparalytic signs were seen in 2 patients who had bite by Krait. These patients required treatment with Inj. Neostigmine and Inj. Atropine. Their neurological status was monitored. Despite of early presentation and appropriate management, patients spent 24.02% of the total hospital stay in the ICU.

Clinical outcome

Maximum number of patients (87.9%) with snake bite had complete recovery and could return to work and productive life almost immediately. Only 6.1% of the patients had complications with sequelae needed frequent follow ups but could return to work later. No fatality was encountered in our study. It is important to understand that the costs associated with snake bite management are significant, more so in a country where healthcare financing is largely on an out-of-pocket payment basis. An average farmer would expend all his assets for a single such episode and trail well below the poverty line. While beyond the scope of a detailed discussion, it is imperative to look at alternative means of funding to make health care affordable for our population.

Conclusion

Snakebite is a major problem worldwide. Majority of the deaths occur in the rural population. India has the largest number of deaths due to snakebites in the world. In our study, male agricultural field workers showed preponderance. Maximum bites were attributed to Viper. We studied three aspects of snake bites:

1. Demographic pattern of the study population.

2. Clinical presentation and management of the Snake bite envenomation.

3. Clinical outcome. It was concluded that early presentation of the patients and appropriate treatment measures were the factors responsible for the good clinical outcome in this study.

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