LOCAL ENVENOMATION AND OVERALL MORBIDITY IN SNAKE BITES

A descriptive study of snake bites in Sri Lanka

Degree project in Medicine

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Abstract

Snake bite is an occupational disease that is a major concern in developing countries. Still, research on this subject is limited and a great deal remains to be investigated, especially when it comes to the local manifestations. Sri Lanka is a country in south-east Asia in which snake bites are common. This is a descriptive study with focus on the local manifestations. The aim of this study was to investigate whether severe local envenomation could reduce the systemic symptoms.

In total, 82 patients were included in the study. 39% were bitten by Russell's viper which also gave rise to the most severe envenomations, but mostly moderate swelling (median 4.3%). In comparison, Hump-nosed viper caused 12% of cases, more swelling (median 8.6%) and seldom gave rise to any systemic manifestations. One patient was bitten by a cobra and was the only patient with blistering. Three patients were bitten by kraits, out of one had signs of envenomation. A large group of patients were bitten by unidentified snakes.

The results are broadly consistent with the literature, except for the fact that there were no severe local manifestations (blistering and/or necrosis) among the patients bitten by *Viperidae spp.* The study has several limitations including potential inaccuracies in measurements, a single data collector with limited time, and poor documentation in medical records. The main limitation, however, is small sample size, meaning that it is not possible to draw any definite conclusions on the basis of this study, especially not concerning possible correlations between local and systemic manifestations.

Introduction

There are around 600 venomous snakes in the world, inhabiting all continents except Antarctica. They use their special canalized teeth to inject toxin containing saliva into their prey, in that way incapacitating it and making it an easy meal. However, sometimes these magnificent creatures encounter humans, resulting in bites. Especially *Viperidae* and *Elapidae spp.* are dangerous for humans and envenomation can result in blood incoagulability, paralysis and even death. Tissue destruction around the site of the bite can also result in permanent disabilities.(1)

Epidemiology

Snake bites were finally recognised by the WHO as a neglected tropical disease in 2009.(2, 3) It is a disease of poverty that affects mostly low- and middle-income countries.(4) Every year it is estimated that 20 000-94 000 people globally are killed by snakes.(1) The most affected areas include sub-Saharan Africa and South- and South-East Asia,(3) where the two latter locations have the highest morbidity and mortality. However, a great deal of the epidemiological data is highly unreliable due to under-reporting.(2)

Snake bite is an occupational disease affecting foremostly farmers (5, 6) with an incidence peaking during agricultural and raining season. Other affected occupations include food-workers, house wives and students. (5) Since most snake bite victims are of working age, the bites and their sequelae can have considerable socioeconomic consequences.(3) Studies show that a quarter of the people asked about their working conditions after the bite say that their work was affected in a negative way, and 10% said they had stopped working.(3) Chronic ulcers, arthritis, muscle contractures, kidney failure, depression and

PTSD are all known complications of snake bites, and the ulcers may become malignant after a couple of years.(3, 7)

Other risk factors of being bitten are male sex(5, 8, 9), sleeping on the floor (5), walking outdoors at night (9), not wearing boots while working in paddy fields or other types of plantations, and not using mosquito nets(2). It has been suggested the best way to prevent snake bites is to educate the people about protective footwear and that sleeping in a cot or under a mosquito net lowers the risk of being bitten. (2)

Sri Lanka

Sri Lanka is a country in South Asia with a population of 20.64 million people(2014).(10) It is classified by The World Bank as a lower middle income country and the GNI is 3.46 USD per capita. Despite this the country has one of the highest life expectancies at birth in South Asia, due for example to considerable achievements in reducing maternal and child mortality.(11) In 2013 the life expectancy at birth was 72 years for men and 78 years for women.(12)

Snake bites are a serious problem in Sri Lanka (13), which is home to over 89 different species of snakes from all major snake lineages.(14) Every year about 33-37 000 snake envenomations are admitted to the government hospitals of Sri Lanka.(1, 5, 15). The mortality seems low (0.5% in 2000(9)), but studies have shown that the number is actually greatly underestimated and that 50-66% of the actual deaths are missing from hospital records.(3, 5)

Snakes in Sri Lanka and clinical picture

There are six snakes in Sri Lanka of medical relevance: Russell's viper *(Daboia russelii)*, Hump nosed pit viper *(Hypnale hypnale)*, Kraits *(Bungarus caeruleus and Bungarus ceylonicus)*, Cobra *(Naja naja)* and Saw scaled viper *(Echis carinatus)*.(16) When envenomation occurs (which only happens in 10-25% of snake bite victims (1, 5)) they give rise to a wide spectrum of symptoms, from swelling of the bitten limb to respiratory paralysis due to neurotoxicity. Every snake gives rise to its own syndrome and this can be used to identify the snake and to initiate treatment even if the snake is not brought to the hospital for identification. (16)

Table 1: *Syndromes caused by the different species. This can in some cases be used to identify the offending snake. Source:(16)*

Signs	Species
Local envenoming, Incoagulable blood, renal failure, and neurotoxicity	Russell's viper (*Daboia russelli*)
Local envenoming, incoagulable blood, and renal failure	Hump-nosed viper (*Hypnale hypnale*)
Local envenoming and incoagulable blood	Saw-scaled viper (*Echis carinatus*)
Severe local envenoming (blisters/necrosis) and neurotoxicity	Indian cobra (*Naja naja*)
Minimum or no local envenoming, neurotoxicity, and bites occur on land while sleeping on the ground	Indian krait (*Bungarus caeruleus*)
No local signs, neurotoxicity, and bites occur in the sea	Sea snakes (*Hydrophis* spp. etc.)
Local envenoming only	Green pit viper (*Trimeresurus trigonocephalus*)

This method is, however, a blunt instrument since one venom can induce a wide variation of symptoms and should not be the primary diagnostic tool.(7) Neither can the patient's own description be completely trusted.(5) There have also been attempts to identify the venom via immunodiagnostics but this is not affordable in a developing country like Sri Lanka (17). Furthermore, cross-reactivity between the venoms complicates the tests and so far the methods have been found unreliable.(5) Ideally, the snake is brought to the hospital (dead or alive) for identification by trained staff or herpetologist, although this is not advised since the capture or killing of the snake could be dangerous.(7) In reality only a few patients bring the snake, (17) and even if they do, it is not always easy to differentiate between the species.

Harmless snakes can sometimes be mistaken for a dangerous ones, and the patient be given unnecessary anti-venom serum.(7, 16)

Geographic differences

The distribution of snakes through out Sri Lanka varies depending on climate, vegetation, preference of prey etc.(17) The island can be divided in to three climate zones: 1= wet zone, 2=intermediate zone, 3=dry zone.(18) When it comes to the medically relevant snakes, the wet zone is dominated by Hump nosed viper and on altitudes above 900 m this snake stands for almost 100% of the bites.(17) The intermediate zone is more mixed up, with Hump-nosed viper still dominating but with increasing numbers of Russell's viper bites and bites by the *Elapid spp*. In the dry zone Russell's viper is definitely the dominating biter (In Anuradhapura it accounts for almost 50% of envenomations(6)), followed by Kraits and Hump nosed viper.(17) In areas around the coast there is a small incidence of sea snake bites but this is rare, and in the far north the mildly venomous Saw scaled viper is sometimes responsible for hospital admissions.(18)

Snake bite has been recognized as a public health issue, especially in the dry zone, where paddy farming is one of the major economic activities. Anuradhapura is the most heavily affected city and the tertiary care hospital there receives snake bite victims from all over the dry zone.(19)

Fig. 1: *Division of Sri Lanka into climate zones.*

Public Awareness

Most farmers seem to be aware of ways to prevent snakebites (not storing harvest inside the home, wearing protective foot ware, tapping the ground when walking outside after dark etc.), but practice is often still not coherent with the knowledge. Foot ware in the paddy field is considered a burden and many do not have anywhere else to store the harvest, making the problem with snakebite relatively constant.(19) Furthermore, most farmers seem to know about the importance of reaching the hospital fast to get anti-venom, and they prefer western medicine over traditional. Still, however, there is a perception that a tourniquet should be applied and that the snake has to be killed and brought to the hospital, which is not true and can even be dangerous (see First Aid).(19)

Snake Profiles

Russell's viper

Daboia Russelii (Sinhala: *Thith Polonga*) is part of the family Viperidae, and the subfamily Viperinae.(14) The colour is brown to grey with darker oval spots (that lightens up in the centre), lining the body in three rows. The head is triangular with small scales and two white lines in a V-formation.(18) It is a nocturnal snake that normally bites humans at night in roads, footpaths and gardens when looking for prey (mostly rodents), or in daytime when they seek the shelter and shade in paddy fields. The biting pattern is regular throughout the year.(6) It is easily provoked, when threatened it produces a hissing sound, and attacks rather than go in to hiding.(18)

As all vipers their long fangs (canalised elongated teeth) are placed on a rotatable maxilla, allowing the snake to fold them away when not used. When they open the mouth, the up to 2 cm long fangs become erect.(18) The venom duct then connects the fangs to the venom gland, situated behind the eye. This well-developed venom apparatus makes the "dry bite"(biting without injecting venom)-frequency very low in this species.(18)

The Sri Lankan Russell's viper seems to have evolved away from its other South Asian relatives and in addition to local envenomation, coagulopathy, nephrotoxicity and myotoxicity, the venom can also produce neurotoxicity, with neuromuscular paralysis when injected in to human flesh. (6) Hence, a division in to subspecies have been suggested where the Sri Lankan and south Indian subspecies is called *Daboia Russelii pulchella*, since they share both morphology and similarities in venom composition.(20)

Fig. 2: *Russell's viper, brought dead to Anuradhapura main teaching hospital.*

Hump nosed pit viper

Hypnale spp. (H. Hypnale, H. Zara, and H. Nepa) is often thought of as a mildly venomous snake and its medical relevance has been underestimated.(21) It is part of the Viperidae family, subfamily Crotalinae. The name "pit viper" comes from the small heat sensitive pit situated between the eye and the nostril that helps the snake to locate its prey (for instance a lizard(22)), and "hump nosed" refers to the snout that is turned slightly upwards.(18)

Fig. 3: *Hump-nosed pit viper, conserved specimen from Dept. of Parasitology, Rajarata University*

It is light brown in colour with small, oval, darker spots on each side of the spine and as Russell's viper it has long and rotatable fangs. The different subspecies differ when it comes to size of snout-humps, scales etc.(18) It is a fairly small snake, ranging from 28 to 55 cm in length, that is both arboreal and terrestrial, and inhabits both wet and dry zones.(21) Humans encounter this snake mostly while gardening, since the snake often rests in leaf litter under bushes and trees.(21)

Envenomation normally only results in local swelling (sometimes progressing to blistering and necrosis) but can also give raise to blood incoagulability and nephrotoxicity or even venom induced coagulopathy (VIC) with multiple organ failure. (18) Fatal cases have been reported, but is rare.(21)

Cobra

Naja naja (or Spectacled Cobra) belongs to the family Elapidae (14) and is well known for its characteristic hood with the spectacle mark on the dorsal side. However, the hood is only seen when the snake goes into strike position, rising its fore-body from the ground. The body is normally brown (can also be black, grey, yellowish or white) with thin white transverse bands, and the snake can grow up to almost 2 meters in length. In resting or creeping position even the spectacle mark is often hard to see and the snake is easily confused with for example a rat snake. (18)

Cobra is distributed all over Sri Lanka, except for highest altitudes, where it is too cold for this snake.(15) It is mostly active during daytime, and it climbs trees, swims and does not hesitate to enter houses looking for its prey (rats, birds, lizards, frogs, chicken eggs and other snakes). It can even be found in busy cities. Despite this, it is afraid of humans and in contrast to Russell's vipers it prefers to flee if possible when threatened. Sometimes it also prefers to flap the hood or strike with the mouth closed in attempt to scare away the human.(15, 18) However, bites do happen, and when they do the victim is usually a female who has been working in her compounds around the home which are usually ill-lit and messy – a perfect hiding place for cobras.(15) Dry bite-frequency tends to relatively high (15), but when envenomation occurs the venom can produce particularly severe local envenomation, with blisters and necrosis, often requiring surgical interventions. (16) Systemical envenomation does not happen as often, but can cause rapid onset respiratory paralysis (neurotoxicity). Because of post-synaptically working neurotoxins the paralysis is often resolved within 24 h if given proper ventilation treatment. There is some evidence of hematotoxicity after cobra bites but this needs further investigation.(15)

Fig. 4: *Spectacled Cobras prepared to strike their snake charmer ("dance") at a market in Anuradhapura. Spectacle mark clearly visible on the precipitated hood. In cases like this the fangs are usually removed to protect the snake charmer.*

Kraits

Bungarus caeruleus (Common Krait) and *Bungarus Ceylonicus* (Ceylon Krait) are members of the Elapidae family.(14) The two species differ slightly, *B. Ceylonicus* being endemic to Sri Lanka, preferring the wet zone and rarely biting humans, while bites by *B. Caeruleus* is common throughout south and south-east Asia, in Sri Lanka most common in the north central province.(18, 23) Both snakes are black with white cross-bands lining the body, but these are wider and more distinct in the Ceylon Krait. As the snakes grow older the bands grow smaller and sometimes disappear completely or are reduced to vertebral spots. The Common Krait has a white ventral aspect, while the Ceylon Krait has black and white bands also on the ventral side, which makes it very easy to confuse with the non-venomous Wolf snake (*Cercaspis carinatus*). To tell the venomous snake apart from the non-venomous, one has to see the ventral aspect of the tail where the venomous species has single sub-caudal scales and the non-venomous has double.(18)

Kraits are nocturnal and often creep into houses in hunt for their prey (other snakes, rodents and geckos). People sleeping on the floor or in poorly constructed houses are particularly vulnerable.(18) Bites are usually painless, occur while the victim is sleeping and might not even be noticed until the systemic symptoms start showing.(23) The first symptom is abdominal pain and admissions to surgical wards are not uncommon. Envenomation can then rapidly progress to neuromuscular paralysis, with 48% of patients needing assisted ventilation to survive(18), and not all patients reach the hospital in time.(24)

Fig 5 & 6: *Conserved specimens from Dept. of parasitology, Rajarata University.*
Left: Ceylon krait. Right: Common Krait

Saw scaled viper

Echis Carinatus is a Viperidae species in the same sub-family as Russell's viper; Viperinae.(14) It prefers dry, sandy areas and inhabits the north, north-west and east coastal areas of Sri Lanka.(25) The main prey is centipedes, but the snake also feeds on lizards, frogs and toads.(18)

It is a small but vicious snake. It grows up to a maximum of 32 cm in length and is brown and beige in colour. Spots line the mid-dorsum and white wavy lines run along the sides of the snake, making a beautiful pattern. The scales are rough and the snake use this to make a shrill sound when threatened by coiling up and rubbing its sides together. It strikes as swift as lightning at the slightest provocation and victims develop swelling and bleeding. However, envenomation is usually mild and no deaths have been reported in Sri Lanka.(18)

Fig. 7: *Saw Scaled Viper. (Source: https://en.wikipedia.org/wiki/Echis)*

Management

First Aid

There are many myths and traditions that concern how to treat a snake bite. Application of tourniquets might be the most known version, but incision, herbal treatments, and methods were they try to suck out the venom, scalding or heating the bite are not uncommon practices in some regions.(5) According to the WHO most of these traditional measures should be discouraged since they can do more harm than good and often delay the transport to the hospital.(2, 7) Tourniquets themselves can cause severe necrosis if left on too long (more than about 40 min) which may cause more damage than the actual venom effects.(7)

The recommended first aid treatment is immobilisation of the affected limb, reassurance of the patient (who might be very stressed or scared) and immediate transport to the hospital.(7, 26)

Management at the hospital

The following guidelines have been suggested by S.A.M Kularatne(18) and are to a high degree practiced in Sri Lankan hospitals:

When the patient arrives to the hospital resuscitation according to ABC (DE) should always be made, and vital parameters should be followed. When the patient is stable an attempt to identify the offending snake should be made, either by direct examination of the snake or by showing preserved specimens to the patient for identification. If nobody saw the snake, the only way is to follow the syndromic approach, as described above.

Symptoms can be divided into non-specific and specific symptoms. Non-specific symptoms are: abdominal pain, nausea, vomiting, faintness, heaviness of head, diplopia or blurred vision(18) Non-specific symptoms can sometimes occur even with non-venomous bites, caused by stress and fear.(7) Specific symptoms are: spontaneous bleeding, ophtalmoplegia, ptosis, generalized muscle weakness, oliguria, myalgia and Myoglobinuria; which vary with the type of snake. Envenomation is a developing process and all symptoms may not be present at once, meaning that repeated examinations have to be made.(18)

Whole blood clotting time (WBTC) should be measured in all snake bite victims even if there are no signs of systemic envenomation. In WBCT, a sample of the patient's blood is placed in a clean glass tube and rested for 20 minutes. If it is not clotted or partially clotted during that time the WBCT is prolonged, suggesting coagulopathy.

If possible WBCT can be completed with lab clotting time (lab-CT), APTT, PT-INR, full blood-cell count and ECG. (18) Other laboratory tests that may be useful are electrolytes, S-creatinine, Blood Urea, bicarbonates, arterial blood gas and aminotransferases.(7)

Antivenom

If the patient shows signs of systemic envenomation, anti-venom serum (AVS) should be administrated immediately.(18) The AVS used in Sri Lanka is a polyvalent serum, manufactured in India.(6, 9, 18) This is not ideal since the composition of the venom in the same species of snakes can vary geographically, but Sri Lanka does not have any production on their own. (18) This polyvalent, Indian serum covers Russell's viper, Common krait, Cobra and Saw scaled viper. There is no available AVS for Hump-nosed pit viper.(18, 27)

Anti-venoms are immunoglobulins, usually fragments of IgG purified from the plasma from an immunized horse or sheep. (18) They can be monovalent (possibly more effective at neutralizing the venom) but polyvalent serums are often preferred since specific identification of the offending snake is rare in most areas.(5)

Indications for giving AVS are one or more of the following(7, 18):

- *Haematological*: Spontaneous bleeding (haematuria, gum bleeding etc.), laboratory coagulopathy (ex: prolonged WBCT), thrombocytopenia (<100 x 10^9 / litre) or stroke
- *Neurotoxicity:* Ptosis, ophtalmoplegia, difficulty swallowing, weakness of neck flexors, generalized muscle weakness or paralysis
- *Cardiovascular:* Abnormal ECG, hypotension, chock, cardiac arrhythmia or elevated troponin test
- *Nephrotoxicity:* Rising S-creatinine or blood urea, fluid retention, oliguria/anuria, acidosis, or hyperkalaemia

- *Myotoxicity:* Dark brown urine, generalized myalgia, stiffness, trismus, hypokalaemia, elevated CK or other signs of rhabdomyolysis
- *Local envenomation:* Swelling of more than half of the limb within 48h, swelling that is rapidly extending and in association with blistering/necrosis/compartment syndrome or recently developed enlarged and tender lymph nodes

Antivenom is available in sterile vials with 10ml freeze dried Snake Venom Antiserum (28) and should be reconstituted with 10 ml of Sterile Water and then infused intravenously with 200 ml of normal Saline over one hour. Recommended initial dose is 10-20 vials, depending on the offending snake (Russell's viper bites require higher dosages) and the severity of the envenomation(18)

Spontaneous bleeding should stop within hours, WBCT should be normalized within 3-6 hours after administration and the general condition should be improving. If not, an additional dose of AVS should be given. However, neurological manifestation can remain for days even if the treatment is successful and is generally not an indication to increase the dose of AVS.(18)

Adverse reactions to anti-venom treatment

Anaphylactoid reactions (complement activated IgG-reactions such as urticaria, itch, nausea, vomiting, palpitations, bronchospasm, hypotension etc.) to the AVS are reported in around 50% of cases(29) and the patient needs to be closely monitored during the administration of AVS, and at least three hours after. (26) Skin tests are not useful to predict reaction.(27) An anaphylactoid reaction should be treated as common anaphylaxis, with intramuscular adrenalin and anti-histamines.(26) Attempts to prevent these reactions are often made by giving 1000mg Hydrocortisone as intravenous infusion prior to the administration of

AVS, and then adding a bolus of 10 mg Chlorpfeniramine (H1-antagonist) 5 min after starting the AVS. This practice has been shown to reduce the risk of early reactions significantly. However, the use of premedication with adrenalin is still debated, but currently not recommended, unless the patient has a history of AVS reaction, atopy or bronchial asthma. (18, 29)

Pyrogenic reactions (endotoxin mediated) can occur 1-2 hs after the AVS infusion. The patient develop fever, rigors and sometimes hypotension due to vasodilation. These reactions can, in most cases be treated successfully with paracetamol.(26)

Late reactions (serum sickness) are uncommon these days due to premedication with antihistamines and hydrocortisone(18) but can occur several days after treatment, when the patient has normally left the hospital.(26) These reactions are immune complex mediated and symptoms include fever, urticaria, itching, arthralgia, lymphadenopathy, mononeuritis multiplex, nephritis, postural hypotonia and encephalopathy.(18, 26) Treatment consists of antihistamines and a five days course of oral prednisolone.(18)

Other treatment

It is important to know that anti-venom therapy does not cure all symptoms. It is fairly good at restoring coagulopathy and cardiac function, but it is not as effective in reversing or preventing neurotoxicity, renal failure or local reactions.(5) Therefore one must always be prepared to initiate supportive treatment such as assisted ventilation, dialysis, blood and platelet transfusion or surgical intervention.(7)

Local envenomation

Symptoms of local envenomation range from swelling (which is by far the most common symptom) to blistering and necrosis, often with involvement of regional lymph nodes.(16) Surgery might be needed, but it should be taken into account that viper bites in particular can cause blood incoagulability and the risk of bleeding during surgery should always be compared to the risk of the local injury and the urgency of the surgery.(7) Cobra bites often give rise to severe tissue destruction. Ariaratnam *et al.* have shown that 76% needed wound debridement, 36% needed skin grafting and 18% were amputated.(16) Cobra bites however, account for only 5% of bites in Sri Lanka (17). Hump-nosed pit viper and Russell's viper are also known to produce local envenomation, if not as severe as that of Cobras(6, 8, 16), and surgery is not needed as often.(6)

AVS have been proven to reduce swelling, but does not have any effect on necrosis.(30)

Antibiotic prophylaxis

As with any wound, bacterial infection can occur, although there is no proof that the oral bacteria of the snake can give rise to infection when injected into human tissue.(13) Even if there is no data that supports systematic use(5), prophylactic antibiotic treatment is widely practised. A placebo-controlled study executed in Anuradhapura, Sri Lanka, showed no significant difference in outcome between placebo- and antibiotic group.(13) Similar studies have been carried out in other parts of the world with similar results, (31, 32) and prophylactic coverage is generally not recommended. Secondary infection should, however, be prevented with proper wound cleaning.(18) If signs of infection occur the recommended antibiotics are Cloxacillin or Cefalosporins with a daily dose of Gentamycin or Metronidazole.(18)

Local and systemic envenomation

There is a great deal of research on systemic envenomation in snakebites but very few studies have looked at the local effects. Some researchers have speculated in whether the inflammation at the bite site can prevent the venom from reaching the bloodstream or at least reduce the amount of venom.(4) There is also a theory among medical officers in Sri Lanka that a severe local reaction can delay the onset of a systemic envenomation.

Aims

The aim of this study was to do describe the clinical picture with focus on the local envenomation in snake bite victims admitted to the Main Teaching hospital in Anuradhapura, Sri Lanka, and to see whether there was any correlation between the severity of the local and the systemic envenomation.

Method

The study was conducted at the Main Teaching Hospital in Anuradhapura (a tertiary care center, and the largest hospital in the dry zone(20)) during daytime in March and April (harvesting season in the area) 2016. Patient data were collected by reading the admission book at the ETU (emergency treatment unit). The patients were examined either in the ETU and then followed up at the wards or, if they were admitted during night time, they were examined after they had been transferred to a ward.

For the gathering of data a data collection form was used (see Appendix 1) which included:

- a brief medical history
- details about the bite site and the snake
- a scoring system for local envenomation (no envenomation – swelling – blistering – necrosis)
- a scoring system for systemic envenomation (proposed by Kularatne *et al* (13), see Appendix)
- measurements of the swelling and lymph nodes
- Pain estimation before and after analgesics (using a Visual analogue scale that was shown to the patient, this is on the backside translated into a numeric scale of 1-10, where 1 is no pain and 10 is worst imaginable pain)
- intervention details such as AVS, antibiotics and/or surgical debridement
- days in the hospital
- need of intensive care

The systemic and local effects were then controlled 6 hourly during daytime (8am to 7 pm) to observe any progression. During evening and night no measurements were made, and this was marked as missing data in the data file. Lymphadenopathy was defined as tenderness or pain in the nearest draining lymph node station, with or without enlarged lymph nodes. The swelling was measured as the increase of circumference at the bite site and 5 cm away on both sides, compared to the healthy limb. Measurements of the circumference of the bitten extremity were made by the same person every time. The numbers were calculated into percentage increase and the calculation was done twice to eliminate mistakes. The extension of the swelling was estimated with the naked eye on a scale from 1-7 were 1 is only bite site and 7 is the whole limb. To make grading easier, the numbers were roughly translated into anatomical limitations such as half hand/foot, whole hand/foot, half forearm/calf etc., and if

the patient did not fit the chart (for example one patient had swelling of calf but not foot), the number was estimated as accurately as possible according to the scale.

The rest of the data was collected anamnesticly from the patient or relatives (with translation help of a medical pre-intern) or from the medical records. The study was only observational and if any data was missing in the medical records, no additional tests were made.

Snake identification

Identification of the snake was initially made by combining the patient's testimony and the symptoms, only the syndromic approach (16) or, if the patient brought the dead snake to the hospital, through direct inspection by a Medical Practitioner. The idea was that after identification we would take photos of the snakes and send to a herpetologist for expert identification, but the snakes were usually thrown away before they could be inspected. After three weeks of data collection we instituted a container of formalin in the ETU, where the staff could put the dead snakes that were brought to the hospital by the patients. These snakes were later photographed and sent to a specialist in snake identification.

Statistical analysis

The data was analysed using SPSS version 23 statistical software. Descriptive statistics were used for most of the data. To look for correlations, Spearman analysis for rank correlations was used. $P<0.005$ was considered significant. Median was used to compare the data, instead of mean, since the data was not normal distributed.

Ethical consideration

This study was only observatory and did not intervene with the care of the patients in any way. It was classified as an audit by the Dean of Rajarata University and no ethical approval was needed.

The patients were always given a Bed head ticket number (BHT-number) on admission which was used for identification during the data collection to assure anonymity.

Results

The cohort

The study included 82 patients. The mean age was 40, median age was 45, 62% were male and 38% female. Of the patients, 14 had been bitten by a venomous snake earlier in life, and 2 by a non-venomous snake. For most patients, however, this was their first snake bite.

Twenty patients (24.4%) brought the offending snake to the hospital for identification, of which four were photographed and sent to a snake specialist for confirmatory identification. In these cases the initial identification was correct. The rest were either thrown away or only brought to the local hospital and could not be confirmed with photographs. The most common biting species was Russell's viper (39%) and Hump-nosed pit viper (12%). In 38% of cases the offending snake was not possible to identify. One patient was bitten by a Cobra, three by Kraits and four were bitten by non-venomous snakes. One patient claimed to have been bitten by a sea snake.

The most common place to have been bitten was in the paddy field (dominating species: Russell's viper) or the area around the home (dominating species: Hump-nosed pit viper), and the most common part of the body bitten was the lower extremity (ankle or more distal).

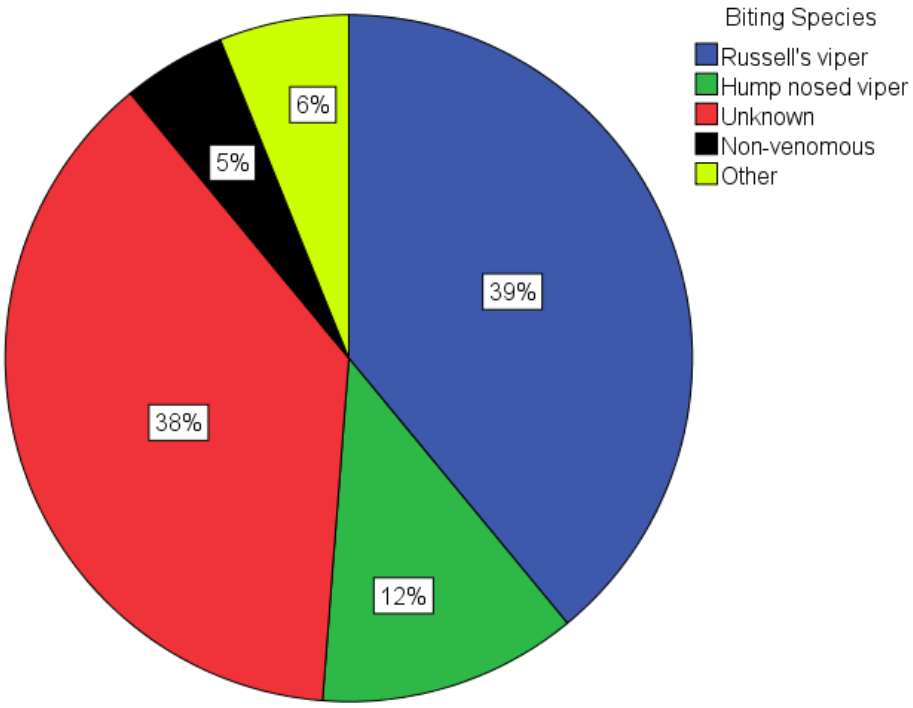

Fig. 8: *Distribution of the biting species.*

Table 2: *Characteristics of the cohort*

Characteristic	Russell's viper (n=32)	Hump-nosed (n=10)	Unknown (n=31)	Other (n=9)
Sex - Male - Female	 22 (68.8%) 10 (31.3%))	 7 (70.0%) 3 (30.0%)	 20 (64.5%) 11 (35.5%)	 2 (22.2%) 7 (77.8%)
Age, years median (min-max)	46 (13-62)	49 (35-74)	44 (14-75)	32 (14-61)
Place of bite - Paddy field - In home - Compound - other	 19 (59.4%) 1 (3.1%) 7 (21.9%) 5 (15.6%)	 3 (30.0%) 0 (0.0%) 6 (60.0%) 1 (10.0%)	 12 (38.7%) 3 (9.7%) 12 (38.7%) 4 (12.9%)	 1 (11.1%) 4 (44.4%) 3 (33.3%) 1 (11.1%)

Body part bitten - foot - hand - other	28 (87.5%) 2 (6.3%) 2 (6.3%)	6 (60.0%) 4 (40%) 0 (0.0%)	29 (93.6%) 1 (3.2 %) 1 (3.2%)	7 (77.8%) 3 (22.2%) 0 (0.0%)
Bitten Before	7 (21.9%)	3 (30.0%)	4 (12.9%)	0 (0.0%)

Clinical features

Russell's viper

Thirty-two patients were bitten by a Russell's viper. The envenomation frequency was 96.9% and this snake also gave rise to the most severe cases.

All patients with envenomation developed swelling to some extent. There was always swelling after 18 h. However, only 9 patients (29.0%) developed lymphadenopathy. During the first 24 h the median swelling of the study group tended to increase.

Table 3: *Swelling for patients with local envenomation following Russell's viper. Increase of circumference (%) compared to other limb. Note that all patients are not represented on all hours, see Method.*

	At bite site: Median (min-max)	5 cm proximal: Median (min-max)	5 cm distal: Median (min-max)	*n = (measurable 5 cm distal)*
Admission	1.7 %(0-16.0)	3.8 % (0-22.0)	0 (0-12.5)	11 (9)
6 h	4.2 %(0-33.3)	4.5 % (0-25.0)	2.2 (0-10.0)	13 (11)
12 h	4.3 %(0-14.3)	4.8 % (0-9.5)	0 (0-12.5)	13 (12)
18-24 h	5.3 %(0-16.7)	4.5 % (0-11.9)	4.3 (0-13.6)	31 (27)

Eighteen hours after admission 17 patients (56.7%) had swelling limited to the hand or foot, 13 (43.3%) had swelling that extended more proximal. Nine patients (30%) had swelling of more than half of the limb. One patient had swelling that extended to the chest wall. There

was no significant difference in swelling between the patients who had been bitten before and those who had not.

No patient developed more severe local envenomation such as blistering or necrosis. No patient had or was in need of any surgical intervention.

When assessing the systemical aspect (see systemic score, Appendix), 7 patients (21.9%) got 2 points, normally prolonged WBCT and ptosis. Six patients (18.8 %) had only 1 point. Five patients (15.6%) had 4 points. One (3.1%) patient had 8 points which was the highest score in the study. Two patients needed intensive care (one received assisted ventilation and the other dialysis).

All patients but 3 (90.6%) were given AVS in varying doses. Patients who received more than 20 vials did not have satisfactory response to the first dose. Only 2 (6.3%) had an allergic reaction that was documented in the chart.

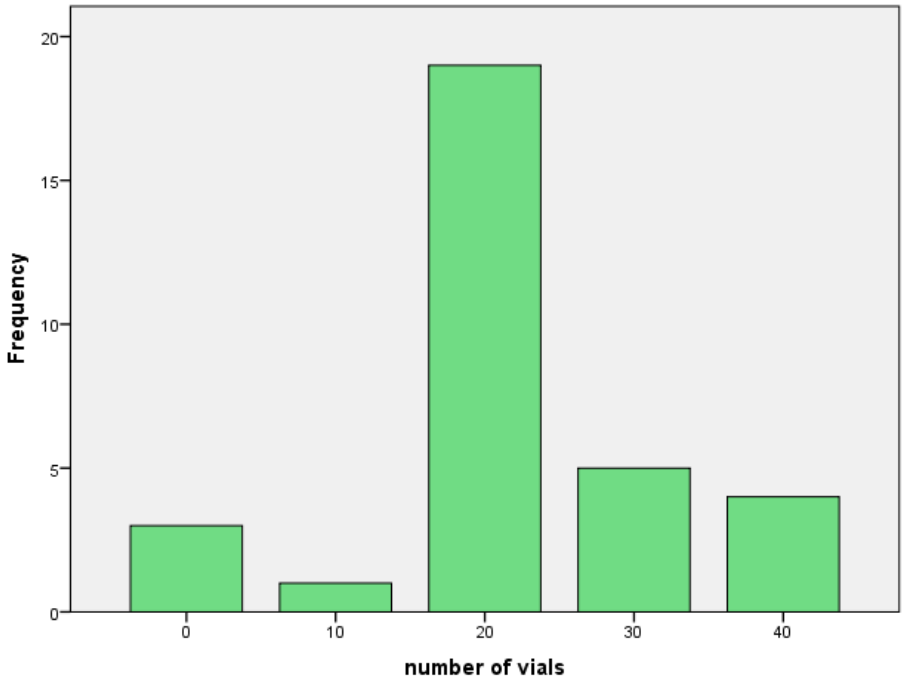

Fig. 9: *Number of vials of AVS given to treat systemic envenomation following Russell's viper.*

Twenty (62.4%) patients rated their pain before receiving any analgesics as 6 or higher on the pain scale (VAS: 1-10). Five patients (15.4%) rated the pain to 10, worst imaginable. Four patients (9.4%) had no relief from analgesics, 5 (15.6%) had unsatisfactory relief, 23 (71.9) were satisfied after analgesics.

Hump nosed pit viper

Ten patients were bitten by Hump nosed pit viper. All patients but one (90.0%) developed swelling. The other patient had systemic envenomation only. Three patients (30.0%) had lymphadenopathy.

Swelling was usually (60%) limited to the hand or foot where the patient were bitten. One patient (10%) had swelling that extended to half of the limb. 2 patients (20%) had swelling that extended beyond the hand/foot but did not reach half of the limb.

Median swelling on admission was 15.5 % (8.6-22.5) increase in circumference at bite site compared to the healthy limb.

Table 4: *Swelling for patients with local envenomation following Hump nosed viper. Increase of circumference (%) compared to other limb. Note that all patients are not represented on all hours, see Method.*

	At bite site: Median (min-max)	5 cm proximal: Median (min-max)	5 cm distal: Median (min-max)	*n = (measurable 5 cm distal)*
Admission	15.5 % (8.6-22.5)	9.4 % (0-18.8)	4.5 % (4.5-4.5)	2 (1)
6 h	11.4 % (11.3-11.5)	18.6 % (15.3-21.9)	Missing data or very distal bite	2 (0)
12 h	4.2 % (0-11.3)	6.3 % (0-12.8)	4.3 % (0-13.6)	7 (7)
18 – 24h	10.8 % (0-25)	4.7 % (0-12.8)	4.3 % (0-13.6)	8 (5)

No patient developed more severe local envenomation or required surgery.

Eight patients (80%) had no systemic envenomation at all. Those who had, had an increase in creatinine as the only feature. No patient received AVS. Eight patients (80.0%) rated their pain to 5 or lower. One patient rated the pain to 10.

Unknown Snake Bite

In 31 cases it was not possible to identify the biting species, as no one had seen the snake well enough to identify it and the patient's symptoms were not typical enough to reveal the snake.

As many as 80.6% of patients in this group had local and/or systemical envenomation. Of those, 20 patients (80.0%) developed swelling of some extent and 12 patients (48%) had lymphadenopathy.

Table 5: *Swelling following Unknown snake bite. Increase of circumference (%) compared to other limb. Note that all patients are not represented on all hours, see Method.*

	At bite site: Median (min-max)	5 cm proximal: Median (min-max)	5 cm distal: Median (min-max)	*N = (measurable 5 cm distal)*
Admission	6.7 % (1.7-12.5)	5.0 % (0-7.1)	2.2 % (0-4.3)	7 (4)
6 h	4.8 % (2.2-13.6)	6.4 % (0-8.9)	2.2 % (0-4.3)	7 (4)
12 h	4.5 % (1.4-33.3)	3.7 % (0-16.7)	2.2 % (0-12.5)	15 (13)
18 – 24h	6.7 % (0-30.3)	6.4 % (0-19.4)	2.0 % (0-12.5)	17 (14)

Nine patients (45% of all with swelling) had swelling limited to the hand or foot. Another 9 had swelling that extended up to half of the calf/forearm or more. No patient had blistering or necrosis and no patient needed surgery.

Sixteen patients (51.6%) had no systemic envenomation. Those who had (15 patients, 48.4%) ranged from 1-4 points. 10 patients (32.3%) were given AVS, and all received the standard dose of 20 vials. Four of those who received AVS (40.0%) had allergic reactions that were documented in the chart.

18 patients (58.1%) rated their pain to 5 or lower. 6 patients (19.4%) rated 8 or higher.

Other (identified) snake bites

This group includes one Cobra bite, 3 Krait bites, 4 bites from non-venomous snakes and one suspected sea snake bite, in total 9 cases. Only the cobra bite and one of the krait bites showed any signs of envenomation, both scored 1 point for weakness of facial muscles. Both received AVS (Cobra patient 20 vials, Krait patient 10 vials).

Only the Cobra bite led to any local envenomation. The patient was first examined approximately 24 h after admission. At that time she had swelling of half of the calf, and the increase of circumference was 2.3 % over bite site, 4.2% 5 cm distal and 0 % 5 cm proximal. Lymphadenopathy was present. After 2 days the swelling extended to half of the leg and after 1 week she had blistering. The patient also developed a local infection with fever spikes, and was treated with surgical debridement and iv antibiotics (Flucloxacillin, Metronidazol and Clindamycin). She recovered in 11 days.

All patients rated their pain to 4 or lower, except for the Cobra victim who rated it to 7. All felt that they had satisfactory relief from analgesics or the pain was relieved spontaneously.

Generally

The median increase of circumference over bite site was 4.25% compared to the healthy limb when at all the data was taken into account. Separated into groups, Russell's viper had a median swelling of 4.30%, Hump-nosed pit viper: 8.60%, Unknown: 4.50%, and Other snakes: 0.00%. Most patients were discharged within 3 days, and only 2 patients stayed more than 5 days. Median time spent in the hospital was 2 days (0.5-12). No patients died during the hospital stay.

Prophylactic antibiotics was used for 95% of patients and Cloxacillin was used the most. The 4 patients who did not receive antibiotics were in the group without any signs of local or systemic envenomation. In 15 % of cases more than one antibiotic was used, for example Cloxacillin + Penicillin or Cloxacillin + Cefotaxime.

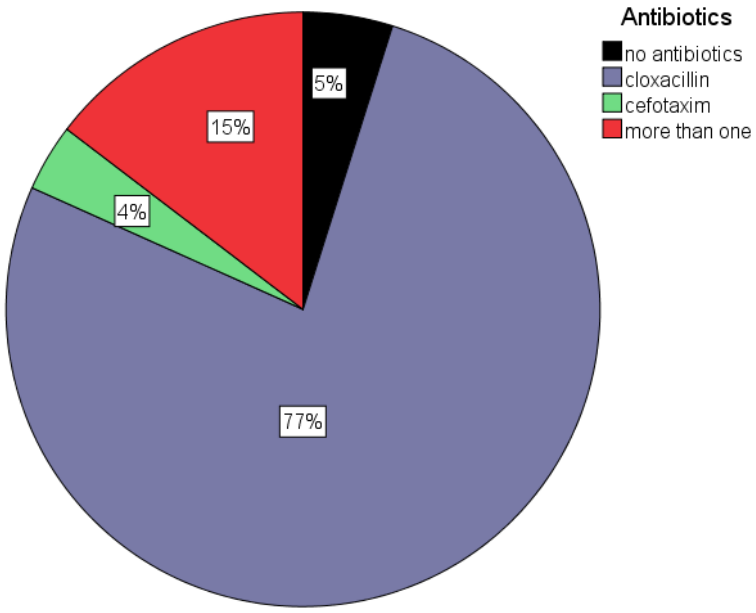

Fig 10: *Prophylactic antibiotics used in the treatment of snake bite.*

A small number of patients presented with severe local envenomation and no systemic envenomation or vice versa. However, bivariate Spearman analysis on all data showed significant results only between systemic score and anatomic extension of swelling at 18 h (p=0.034, rs= 0.263), swelling 5 cm distal at 18 h (p=0.026, rs=0.309) and swelling 5 cm proximal at 12 h (p=0.018, rs=0.288). In both the Russell's viper group and the Unknown group there was a rank correlation between systemic score and swelling over fang marks at 6 h (p=0.014, rs=-660 for Russell's and p=0.044, rs=0.646 for Unknown), but in Russell's viper the correlation coefficient was negative.

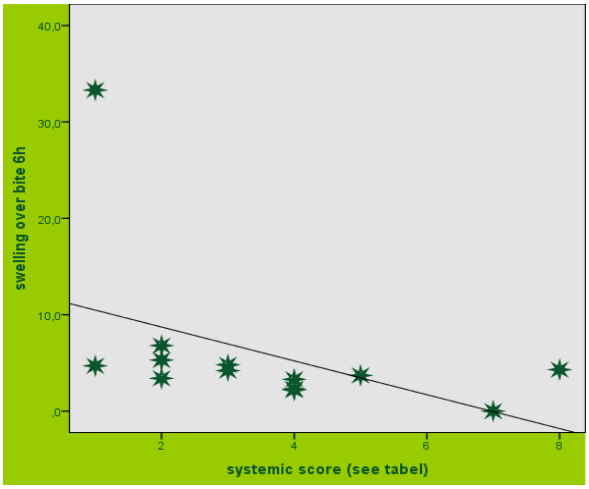

Fig 11: *Correlation between systemic and local envenomation at 6 h (bite site) for Russell's viper.*

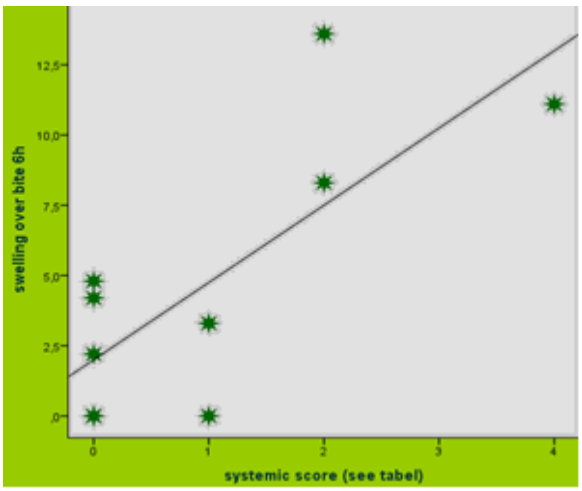

Fig 12: *Correlation between systemic and local envenomation at 6 h (bite site) for Unknown snake bites.*

Discussion

This study shows the clinical picture among patients with snake bites in Anuradhapura, Sri Lanka during harvesting season. It is one of the first studies that attempts to quantify swelling and focuses on local envenomation. The study found that swelling is by far the most common sign of local envenomation, with a median increase over fang marks of 4.25% (0-33.3), compared to the healthy limb (all data). Russell's viper was the most common biting species, giving rise to swelling in all cases but one (a dry bite), and caused the most severe systemic envenomations. Hump-nosed viper caused the most swelling. It was also found that a highly questionable amount of prophylactic antibiotics were administered. Concerning the possible correlation between severity of local and systemic envenomation, analyses showed significant results only in single variables, and no definite conclusion can be drawn on the basis of this study.

During 2 months, data from 86 patients were collected. Data could only be gathered during weekdays, and further, the Sri Lankan New Year occurred during the end of this time period. During this holiday, many Sri Lankan people stay very calm, avoid unnecessary risks, and do not work as much as usual. This limited the number of study participants as the amount of patients in the hospital decreased to a roughly estimated 20 % of normal, and there was a significant decrease of snake bite victims around and the week after New Year. However, the study population is probably fairly representative, at least for this period of the year. All patients who arrived to the ETU were included, and snake bites is an occupational disease, affecting mostly farmers(5), which means that the incidence should not vary too much over the week. Nocturnal bites were also included but were not examined until 6-12 h after admission. Children were not included because of the possibility of a different reaction

pattern. However, it is important to note geographical and seasonal differences in snake bites (see background) and one should be careful to generalize this data too much.

A majority of the patients (62.2%) were men, except for the “Other” group where 77.8% were women. This group consists partly from patients bitten by Cobra and Kraits, which are known to bite inside the home or in the home compound, explaining the alternative gender distribution.

The distribution of the different species is this study is not surprising since Russell’s viper and Hump-nosed pit viper are known to be the most common species.(17) However, compared to a previous study by Kasturiratne it seems like there were more bites by Hump-nosed viper, and less of Krait bites than is common in this area. (17) This may be due to the large amount of unknown bites, misidentification of the biting species in this study (because of limited time it was not possible to exclude patients who did not bring the snake etc.) or an actual change during the last few years.

The envenomation frequency was high in the Viperidae species in this study, which is coherent with the literature.(6, 18) There were only 4 identified Elapidae in this study, making it unreliable to calculate the envenomations frequency, although it seems low.

Concerning the degree of swelling, Kularatne has previously used a similar methodology in a placebo-controlled study on prophylactic antibiotics, which measured the change in circumference of the bitten limb. This study found a mean increase of 1.42 and 1.65 cm in the two groups.(13) However, the results are difficult to compare since the previous study presented results as mean increase in cm, and in this study the results are presented as median increase, in percent. Also, the Kularatne study does not divide the bites into different species groups.

Also, Ariartanam showed that 62 % of Hump-nose viper victims developed blistering, and in a study by Kularatne 3% of patients bitten by Russell's viper needed surgery(6), which is not consistent with this study where only the cobra bite patient developed blistering and needed surgery. This may, of course, be due to the significantly smaller number of patients in this study, but the clinical experience by medical practitioners is that reactions worse than swelling are unusual, which supports the findings in this study.

The Unknown snake bite group was almost as big as the Russell's viper group indicating the difficulty in identifying the offending snake. This high prevalence of unknown snake bites is generally not a clinical problem since the AVS is polyvalent, covering all dangerous snakes in the country except Hump-nosed pit viper. Treatment with AVS is given based on the presence of specific symptoms (indicating systemic envenomation) and not the type of snake. However, it becomes a problem in research, since the venoms are so different and conclusions cannot be made across species and the study population has to be divided in to groups. This is problematic as the Unknown group large enough to make the other groups smaller, thereby making the analyses less conclusive. Syndromic approaches, as proposed by Ariartanam or Pathmeswaran (16, 33), can be used, but there will always be cases that do not fit into these frames or that do not display enough symptoms to make the identification reliable.

In this study we tried to make the identification of snakes more reliable by combining patient's description with the symptoms (if present). We also instituted a formalin jar at the ETU so that we could send pictures to a specialist in snake identification, but as only one snake was put in the jar by the ETU staff, the effect on reliability was limited. In cases where the patient was not able to identify the snake and the patient lacked typical symptoms there was no possibility of identifying the snake. However, one can speculate in that the Unknown group consists of a high amount of viper bites since they are the most common species in this area and the characteristics are very similar considering sex, age, place bitten etc. Also, the

symptoms were often prolonged WBCT or ptosis and 80% had swelling, which suggest viper envenomation. This group had a maximum systemic score of 4 points, median 0 points, (Russell's viper: maximum8 points, median 2 points) which is natural, because if they had more symptoms they would have been classified using the syndromic approach, and would not have belonged to this group.

Correlations

The results concerning a possible correlation between the severity of local and systemic envenomations are inconclusive. The hypothesis was that more swelling could prevent the venom from reaching the bloodstream, but this was only indicated in one variable in the Russell's viper group where the correlation coefficient was negative. However, when plotted in a chart, an obvious outlier is visible, decreasing the significance of this correlation. All other analyses showed a simple, non-linear "increase-increase" correlation (positive correlation coefficient). Further, given the amount of variables, the correlation may also be a coincidence, since it was only present in single variables. The study population was small, and it is not possible to say that the kind of correlation predicted does not exist, but neither can this study confirm it. However, there is clinical experience amongst medical practitioners that a gross swelling can delay the onset of, or reduce, systemic envenomation. Furthermore, researchers have been speculating in whether inflammation or degrading of tissue can prevent the venom from reaching the bloodstream, after concluding that some snake venoms have very low bioavailability when injected intramuscularly.(4) One can also speculate that such a correlation was not visible in this study because it almost exclusively included patients with swelling. If the study population had included more patients with blistering and/or necrosis, the difference between these groups would have been more significant and possible

correlations might have appeared clearer. Further research including larger study populations needs to be carried out in order to reject or confirm the theory that local envenomation could protect against systemic manifestations.

Antibiotic prophylaxis

An interesting finding, was that even though there is no data supporting the use of prophylactic antibiotics in snake bites,(2) 95% of patients in this study received one or more types of antibiotics. Although, Staphylococcii, Enterobacter, Pseudomonas and Clostridia have been isolated from the mouth cavity of vipers, reflecting the faecal flora of their prey (31, 34), there is no evidence that the amount of bacteria injected at a bite is big enough to give rise to infection.(13) Notably, the most frequently used antibiotic prophylaxis in this study was Cloxacillin, which covers only staphylococci and streptococci. There are also laboratory findings suggesting that snake venom itself can be antibacterial.(31)

Hence, this attempt to prevent infections is not only ineffective(13, 31), it may also help to select more resistant microorganisms(35). In a world of increasing antibiotic resistance, and a possible future when even the minor infections can be deadly(36), such unnecessary use should be discouraged, and antibiotics should be reserved for patients with necrosis, severe blistering and abscesses. Preferably, bacterial cultivation should be done before administration, but if that is not possible, an antibiotic that covers at least Staphylococci and Enterobacteriacae should be used. (37)

Proper wound cleaning is always recommended to prevent bacteria on the patient's skin, clothes, dirt etc. from entering the wound. However, in Sri Lankan governmental hospitals hygiene tends to be left to the patient and relatives. Many bitten limbs were covered in mud and dried blood for days, constituting an obvious risk of infection. Providing proper wound

toilet would probably be a method at least as good as antibiotic prophylaxis, and with no adverse effects.

Limitations

When it comes to the measurements of swelling there is a great deal of missing data due to the fact that measurements could only be made during a limited number of hours. In one case, data is missing because the patient was in too much pain to allow measuring. The large amount of missing data for different hours makes it difficult to interpret any change in swelling over time, and also makes it difficult to compare patient data between the groups. Many patients though, were most swollen at the last measuring and it would have been interesting to follow this for a longer period of time than what was done in this study.

There was also a problem with accuracy of the measurements, as a slight change of the angle or position of the measuring tape, or if the patient flexed or relaxed the muscles, easily could alter the outcome with up to a centimetre. It was not possible to make any inter- or intra personal validation since the swelling constantly changed.

The anatomic extension could have been measured in cm, but because of the problems with accurate measuring, it was decided that two different ways of rating the swelling would be included. These two ways of measuring the swelling correlate fairly well with each other, but in the case with the cobra patient it seems like the anatomic extension of swelling is a better measurement to predict severe local envenomation since she had swelling extending beyond the foot (and later up to the knee), but only a circumference increase of 2.3-4.2%. However, this is only one case which makes it impossible to draw any conclusions, and it may also result from inaccurate measurements, but it may be worth to investigate in further studies.

When it comes to the systemic envenomation the clinicians often had trouble determining whether there was any subclinical coagulopathy or not. The recommended test for this is WBCT, but this was often thought to be unreliable because of contamination. The WBCT was often completed by a lab-CT, but then there was mistrust in the laboratory equipment and there was no consensus in what test was the most reliable. This insecurity amongst medical practitioners sometimes resulted in many repeated tests before it was decided if the patient should be given AVS or not, obviously delaying the treatment for those who needed it and possibly resulting in that unnecessary, highly allergenic treatment was given. As far as this study concerns, it was sometimes a problem to give the patient the right systemic score, for example if the patient had 3 prolonged WBCTs, but still had not received AVS. In that case the WBCT was obviously not taken seriously clinically, but there were 3 objective tests. More research needs to be carried out to determine what laboratory analysis is the most reliable, and hospital staff need explicit guide lines so that the management of patients can be as equal as possible.

There is a similar uncertainty in management of elevated serum creatinine following snake bites. Viper venom is known to cause acute renal failure and S-creatinine is a standard investigation following snake bite in Anuradhapura main teaching hospital. However, the high prevalence of CAN (chronic agrochemical nephropathy) in this area(38) seems to make the medical practitioners somewhat tolerant to high creatinine levels, and they do not always follow-up on these test results. Again it seems like there are no explicit guide lines, and the management differs a lot between consultants and wards, also making systemic scoring for the purpose of this study difficult.

This study was to a great extent based on patient charts (Bead head tickets). These were handwritten, sometimes very difficult to read and contained very different amounts of information. For example when it comes to adverse reactions to AVS, other studies

demonstrate rates as high as 68% (29), but in this study only 6 patients (7.3%) were identified, and one of those only because the administration of AVS in that patient was observed. This is such a regular event that the doctors do not even bother writing it down, making the allergy variable in this study highly unreliable. This may also be the case with other information found (or not found) in the chart.

Conclusion

Local envenomation is common, especially in vipers, with swelling as the by far most common manifestation. However, the possible correlation between this symptom and the degree of systemic envenomation needs to be investigated further. The study also demonstrates an overuse of antibiotics, and measures have to be made to reduce this practice and prevent antibiotic resistance.

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Appendix

Data Collection Form

Local envenoming and overall morbidity in snake bites

BHT-nr: Age:

Date: Sex:

Time of bite: Occupation:

Place of bite: Previously bitten:

Co-morbidities:

Snake responsible: **Method of Identification:**

Body part bitten:

Number of fang marks:

Pattern:

	Admission	**6h**	**12h**	**18h**

Local score:

1. No signs of local envenoming
2. Local swelling
3. Lymphadenopathy
4. Blistering
5. Necrosis

Circumference (swelling)

Over fang marks:

5 cm over:

5cm under:

Other limb:

Anatomic extension of swelling:

Lymphnodes:

Number:

Size:

Tenderness:

Painful nodes at rest:

Pain before analgesics:

Pain relieved with analgesics:

Antivenom:	**Time**	**Number of vials**
1st dose		
2nd dose		
3rd dose		
4th dose		
5th dose		

Antibiotics:

Surgical intervention:

Systemic score:

Positive WBCT20	1	Elevated creatinine	1
Positive repeated WBCT20	2	Oliguria	2
Spontaneous bleeding	3	Requiring dialysis	3
Weakening of facial muscles	1	Tender muscles	1
Generalized muscle weakness	2	Myoglobinuria	2

Resp. failure requiring mechanical ventilation	3	Above with hyperkalemia	3
ECG changes	1		
Hypotension, arrhythmia, ischemic chest pain	2		

Intensive care:

Date of discharge/death:

Cause of Death:

Populärvetenskaplig sammanfattning på svenska

Ormbett är något man sällan hör något om, särskilt inte I forskningssammanhang. Trots detta dör upp emot 100 000 människor på grund av ormbett varje år, framför allt i södra och sydöstra Asien och söder om Sahara, i Afrika. Bönder och andra fattiga människor drabbas hårdast då de arbetar barfota i de risfält där många ormar vilar på dagarna eller sover på golvet där nattaktiva ormar tar sig in för att leta efter byten. Många ormar är dödliga om patienten inte får motgift och många dör innan de har hunnit fram till sjukhuset. Den här studien är utförd på Sri Lanka, ett av de ormrikaste länderna i världen, där ormbett är ett stort problem. Den är i första hand beskrivande, med fokus på vävnadsskada runt bettstället, men syftar också till att undersöka huruvida svår svullnad, blåsbildning eller nekros kan hindra giftet från att nå blodbanan och ge upphov till direkt livshotande symptom.

Studien inkluderar 82 ormbitna patienter, där 39% blev bitna av den vanligaste giftormen i regionen: Russell's viper (släkt med vår svenska huggorm). Denna gav upphov till svullnad och svåra symptom som blödningar och förlamning. En mindre grupp blev bitna av en släkting till ovanstående, Hump-nosed pit viper som gav upphov till mer svullnad men mindre farliga, kroppsliga symptom. Den enda patient som utvecklade blåsor och behövde opereras blev biten av en Kobra. Tre patienter blev bitna av Krait, men bara en blev sjuk och fick då enbart förlamning, ingen svullnad. Inga patienter dog och tack vare motgift återhämtade sig majoriteten inom 3 dagar.

Resultaten i den här studien stämmer i stora drag med tidigare studier, men det fanns ingen patient med blåsbildning eller nekros bland de huggormsbitna vilket var förvånande. När det gäller eventuella samband mellan vävnadsskada och kroppsliga symptom är studiematerialet för litet för att dra några slutsatser. Större studier bör göras.