

Occupational injuries with captive lance-headed vipers (*Bothrops moojeni*): experience from a snake farm in Brazil

Sérgio de A. Nishioka¹, Paulo Vitor P. Silveira¹, Fernando M. Peixoto-Filho¹, Miguel T. Jorge¹ and Adelheid Sandoz²

¹ Centro de Ciências Biomédicas, Universidade Federal de Uberlândia, Brazil

² Pentapharm do Brasil, Uberlândia, Brazil

Summary

We studied occupational injuries with captive lance-headed vipers (*Bothrops moojeni*) that occurred in a snake farm in south-eastern Brazil from February 1981 to May 1999. The risk of injury, taking into account 13 cases of snake-associated injuries (12 of them snake bites) was 2.73 per 10 000 person-days of work, and 3.51 per 100 000 venom extractions. Thirteen cases of injury occurred in seven workers, whereas 18 workers were never injured, suggesting that some individuals have a higher risk of injury than others perhaps due to lack of concentration or overconfidence. Eight episodes of occupational injuries occurring in four technicians, including a case of eye injury due to splashed venom during extraction, are reported. Assessment of whether envenoming occurred was facilitated by knowledge of the snake species and size, history of recent venom extraction and snake feeding, and examination of snake venom glands. Hypersensitivity reactions (anaphylaxis and serum sickness) to antivenom are a risk particularly to those workers who were bitten more than once and medicated previously. Antivenom therefore should not be administered to these individuals unless there is clear evidence that envenoming occurred or is likely to have occurred. Hypersensitivity to the venom is also a health concern for workers from snake farms.

keywords *Bothrops moojeni*, Brazil, occupational injury, snake, snake bite, snake farm

correspondence Sérgio de A. Nishioka, Al. Sosthenes Guimarães 667, 38411-160 Uberlândia, MG, Brazil. E-mail: snishioka@triang.com.br

Introduction

Since snake bite occurs mostly among rural workers during occupational activities in agriculture (Minton 1987), there is very little information in the literature regarding occupational injuries with captive snakes. We report here our recent experience with such injuries in workers at a snake farm in Brazil, and discuss some aspects that are peculiar to them. We also estimate the risk involved with this occupation at that particular snake farm and discuss possible preventive measures.

Methods, risk estimation and cases

Pentapharm do Brasil runs a snake farm in Uberlândia, a town with 500 000 inhabitants in the state of Minas Gerais in south-eastern Brazil. A single species of lance-headed viper, *Bothrops moojeni*, is raised there with the purpose of venom extraction. The extracted venom is dried and exported. The

number of extractions carried out at the snake farm for commercial purposes from February 1981 to May 1999 by each technician, the number of days worked by each technician at the snake farm, and a short report of each occupational injury involving snakes registered by the company were provided by Pentapharm do Brasil. From these data we calculated the risk of occupational injury expressed by person-day and by venom extraction. The calculations were performed dividing the number of injuries by, respectively, the sum of days worked by all the workers involved in extraction (technicians) and the total number of extractions.

There were 370 768 extractions performed by 25 technicians, with a mean of 14 830.7 (standard deviation [SD] 13 519.3) and a median of 11 661 (range 747–53 375). The mean time worked by each technician was 1901.7 days (SD 1436.6); the median 1251 days (range 401–4926). The average number of extractions performed by each technician was 1616 in 1985 and increased over time, peaking at 6054 in 1996. Thirteen injuries were accounted for in the risk

Table 1 Selected data of interest on eight episodes of occupational injury with captive lance-headed vipers (*Bothrops moojeni*) that occurred in four patients

Episode	Date	Description of the occupational injury	Clinical findings	Treatment/Outcome
Patient 1, 28 years old (at third episode)				
1	27.11.1994	Bitten on hand while transporting immature specimen	Signs of local envenoming	Given 4 ampoules of antivenom. Recovered uneventfully
2	27.7.1998	Venom splashed into left eye during extraction	Local pain. Transitory loss of sight. Subconjunctival haemorrhage	Eye rinsed with saline. Haematoma absorbed within four days
3	14.1.1999	Bitten on left hand while putting snake in cage after transporting it to a different sector of the farm	Scratch on left third and fourth fingers. Local pain and swelling	Given 6 ampoules of antivenom. Anaphylactic reaction. Serum sickness
Patient 2, 26 years old				
1	26.11.1998	Bitten on left second finger while attempting to remove a dead mouse from cage with long forceps held too close to the extremity	Puncture on finger. Clotting time 12 min. No swelling.	Discharged after a few hours of observation ('dry-bite')
2	17.12.1998	Bitten on left second finger while feeding snake	Two parallel scratches. No swelling. Normal clotting time	Discharged after a few hours of observation ('dry-bite')
Patient 3, 26 years old				
1	15.12.1998	Bitten on left fifth finger while cleaning cage	Local swelling and bruising. Clotting time 40 min.	Given 6 ampoules of antivenom. Superficial necrosis and abscess (<i>Citrobacter diversus</i>) requiring drainage, debridement and antibiotic therapy.
Patient 4, 40 years old (at second episode)				
1	No precise record	Bitten on right forefinger while handling immature specimen	Severe anaphylaxis (upper airway obstruction) to venom (known to be allergic to it).	Adrenaline. Recovered.
2	1.10.1999	Bitten on right hand while preparing to perform a necroscopic examination of a 'dead' snake.	Local swelling of rapid onset progressing up his forearm. Wheezing. Normal clotting time.	Prometazine and hydrocortisone. No antivenom administered.

calculation, comprising one case of eye injury and 12 snake bites. One case of snake bite was excluded because the victim was a trainee, and his contribution in time and number of extractions was not included in the denominator.

The risk of an occupational injury was 2.73 per 10 000 person-days of work, and 3.51 per 100 000 extractions. The risk of occupational snake bite was 2.52 per 10 000 person-days of work, and 3.24 per 100 000 extractions.

Table 1 summarizes eight occupational injuries with captive specimens of *B. moojeni* occurring with four technicians. Seven of these occurred in three individuals. Taking into account data about the other injuries provided by Pentapharm, we found that the 13 cases of injury (excluding the one with the trainee) occurred in seven individuals (15 360 person-days of work and 130 598 extractions), and that 18 other technicians had never had a snake-related injury (32 183 person-days of work and 240 170 extractions).

Discussion

Occupational injuries with captive snakes occur in people who handle snakes for professional purposes such as venom extraction and snake-handling demonstrations in zoos. In this series all injuries were caused by *Bothrops moojeni*. Although there are no relevant figures available, it is likely that the vast majority of occupational snake bites by captive snakes involve venomous species, given that these snakes are kept for venom extraction. Snake venoms are used to manufacture antivenoms and other pharmaceutical products; they are a high-priced commodity.

Occupational injuries with captive lance-headed vipers are rare whether the risk is expressed by number of events by person-days of work or by number of extractions; the latter was chosen as the denominator because it expressed workload. Actually, only one injury of the eight episodes reported here, and five of the total of 14 (including the others

registered by Pentapharm) occurred during extraction. Although rare, the events tended to cluster in time and in certain technicians. There was also a single event with a trainee. It can be speculated that as they get more experienced, some technicians become overconfident and stop adhering strictly to safety procedures, particularly those not involving extraction, a situation where the risk is perceived as higher. The time clustering might be explained by a temporary lack of confidence of the group, and of the victims themselves, once an injury occurs. Whenever an occupational injury occurs, a meeting should be organized with the technicians to review safety procedures and try to identify how the injury could have been prevented. Psychological support of the victims provided by a specialist might also be beneficial, at least in some cases.

Some clinical aspects of occupational injuries with captive snakes deserve mentioning. In addition to knowing for sure which species of snake bit his/her patient, the physician who attends a victim of occupational snake bite should have the snake examined to assess whether the venom glands are empty or full, which may provide useful information as to whether envenoming did occur. Venomous snake bite without envenoming is relatively common (Silveira & Nishioka 1995), and in fact occurred in this series in four of seven snake bites. Information about the size of the snake, which is a known risk factor for complications (Kouyoumdjian & Polizelli 1989; Jorge *et al.* 1997), is also important, as is knowing when the snake was last fed and had its venom extracted – both provide indirect evidence of the amount of venom available in the venom glands. A good example from this series is patient 1, whose less swollen finger was probably less injured than the other because less venom was injected in it. Examination of the snake shortly after the bite showed that only one of its venom glands was empty. All this information, which is seldom if ever available in ordinary cases of snake bite, helps the attending physician to decide whether antivenom administration is required, a decision that is not straightforward when the victim seeks medical help very soon after the bite, before the signs of envenoming are detectable.

Our patients had most of the clinical manifestations caused by lance-headed viper bites (Jorge & Ribeiro 1990; Nishioka & Silveira 1992), from dry-bites to complications such as abscess and necrosis. Two patients developed allergic reactions. Patient 1 had anaphylaxis when injured for the third time and given antivenom for the second time, suggesting that he was sensitized to the antivenom after the first bite. Later on the same patient suffered from classic manifestations of serum sickness. Patient 4 had mild or no manifestation of envenoming, but had severe allergic reactions to the venom itself on both occasions when he was bitten. Both sensitization to venom and antivenom are to be feared in occupational snake bite, and workers who present with either should be alerted to their risk. A kit with adrenaline to be administered intramuscularly should be available at the workplace and may be life-saving in case of early (anaphylactic) reactions. Prevention of snake bite by compliance with safety procedures is especially important for technicians who are allergic to venom or antivenom.

References

- Jorge MT & Ribeiro LA (1990) Acidentes por serpentes peçonhentas no Brasil. *Revista da Associação Médica Brasileira* **36**, 66–77.
- Jorge MT, Ribeiro LA & Nishioka SA (1997) A comparison of clinical and epidemiological aspects of bites by small and large South American rattlesnakes. *Tropical Doctor* **27**, 106–107.
- Kouyoumdjian JA & Polizelli C (1989) Acidentes ofídicos causados por *Bothrops moojeni*: correlação do quadro clínico com o tamanho da serpente. *Revista do Instituto de Medicina Tropical de São Paulo* **31**, 84–90.
- Minton SA (1987) Poisonous snakes and snakebite in the US: a brief review. *Northwest Science* **61**, 130–137.
- Nishioka SA & Silveira PVP (1992) A clinical and epidemiologic study of 292 cases of lance-headed viper bite in a Brazilian teaching hospital. *American Journal of Tropical Medicine and Hygiene* **47**, 805–810.
- Silveira PVP & Nishioka SA (1995) Venomous snake bite without clinical envenoming ('dry-bite'): a neglected problem in Brazil. *Tropical and Geographical Medicine* **47**, 82–85.