



Healthcare in Snakes: A Mini Review

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Abstract

Different types of venomous and non-venomous snakes are found throughout India. Snakes suffer from different diseases (*i.e.*, veterinary healthcare aspects) which are yet to be explored under Indian conditions. Snakes have remarkable differences in anatomy and physiology which are required to be understood by veterinarians while treating snakes. Veterinarians should also have basic information and knowledge about use of appropriate method of restraint in snakes depending on type of case. Details pertaining to certain infectious diseases of snakes are elaborated in literature published from studies conducted outside India. Indian literature on veterinary healthcare aspects of snakes is sparse. Therefore, an attempt has been made in the present paper to create a disquisition on healthcare in snakes. The details mentioned in the paper will provide veterinary practitioners with basic knowledge on anatomy, physical handling, chemical restraint, conflicts, infectious diseases and non-infectious conditions in snakes.

Keywords: Snakes, Restraint, Diseases, Conflicts

Introduction

India is blessed with vast biodiversity and the country's climatic zones are suitable for growth, reproduction and survival of wild flora and fauna. Remarkable variation has been noticed in distribution and presence of wild mammals, birds and reptiles throughout the nation. The country has a noticeable presence of reptiles such as venomous snakes, non-venomous snakes, lizards, crocodiles as well as different species of turtles which play a crucial role in the ecosystem [Ardesana *et al.* (2018); Bhadesiya *et al.* (2020b)].

Out of all reptilian species, different types of snakes are found in urban and rural areas. Snakes have been described in ancient legends, folklores, scripts and are also being worshiped by people. There are certain beliefs (or disbeliefs) for (or against) snakes in India which can lead to conflicts between humans and snakes. Some examples of such beliefs include [a] snake bites can be cured by mantras and magic spells; [b] snakes are revengeful; [c] snakes guard wealth; [d] old snakes have hairs or mustache; [d] snakes hypnotize; [e] snakes sway to music of flute; [f] cobras wear a 'Nagmani' on their head with brings fortune if

retrieved; [g] snake suck milk from cows udder by coiling around its legs; [h] a green tree snake pierces a man's head with its pointed head; [i] pythons suck their prey from a distance; [j] tails of rat snakes have singers, suffocates cows and lashes down on paddy; [k] bites by a snake with rings on its body gives victim's body a ringed pattern; [l] kraits suck a man's breath away while he sleeps etc.

Most of the native wild snake species are included in different schedules of the Indian Wildlife Protection Act, 1972. International trade of permitted snake species has also increased rearing of exotic species of snakes and pythons in India. Snakes suffer from a wide range of infectious diseases and disorders like every other living creature. Detailed investigations are not carried out on existing prevalence of all types of healthcare issues in snakes in India. The present paper highlights important healthcare aspects relevant to snakes.

Importance of Anatomy and Physiology

Veterinarians are frequently involved in diagnosis and treatment of clinical issues in animals. Sometimes, veterinarians may also encounter diseased snakes at their hospitals or private veterinary clinics. Therefore, it is important for veterinarians to have a basic knowledge on anatomy and physiology of snakes. The systemic anatomy of snakes includes almost all bodily systems which are present in mammals. However, characteristic difference is observed with regards to structure of pupil, movement, structure of the heart, metabolic process, excretory system, reproductive system and methods of homeostasis. 'Ecdysis' is a process of shedding skin which sometimes also helps the snake to get rid of ectoparasites such as ticks, lice and mites, if present. 'Dysecdysis' refers to an abnormal shedding of the skin which could be associated with underlying disease conditions. The linear cylindrical placement of systemic organs must be considered while placing tube (tracheal or esophageal) for treatment purpose. The pupils in snakes can be (a) Circular, (b) Vertical elliptical/slit like or (c) Horizontal elliptical/slit like depending on type of snake. This variation helps them to properly visualize surrounding areas to prevent themselves from other predators or threats. Four major categories or types of movements observed in snakes are (a) Concertina, (b) Serpentine, (c) Sidewinding and (d) Rectilinear. The type of movement varies between snakes and can have direct relationship with their habitat. Type of movement should be kept in mind

while handling a snake physically. The anatomic features in-between venomous and non-venomous snakes also differ with regards to the venom delivery system, structure of head, tail patterns and dental placement. The venom delivery system comprises of venom gland, specialized teeth and venom itself. Snake venom can be hemotoxic or neurotoxic depending on the type of snake. Other types of snake venoms are also being explored; however, veterinarians frequently encounter cases of snake-bite from neurotoxic or hemotoxic snakes [Bhadesiya *et al.* (2016)]. The digestive system of snakes ends into a three-chambered cloaca (having urodeum, coprodeum, proctodeum) which opens into the vent for removal of excreta. Some snakes (e.g., boas) have vestiges of hindlimbs in form of 'Spurs' which are small, claw-like protrusions from each side of the cloaca. A basic knowledge on placement of different organs in snake enables veterinarians to take decision on proper handling and to initiate treatment regimen [Lillywhite (2014); Divers and Stahl (2019)].

Considerations for Restraint

Generally, snakes seek shelter away from their natural habitat when there is a disturbance in the surroundings, when their habitat has been damaged, when there is a scarcity of food etc. Venomous or non-venomous snakes generally move out of their habitat during monsoon season and they tend to bite when approached. Moreover, human-snake conflicts are also on the rise and experienced snake handlers/rescuers are frequently called for rescue operations. Therefore, trained rescuers/handlers, members of non-government organizations and trained persons from forest departments are frequently called for snake rescue and rehabilitation [Bhadesiya *et al.* (2020c)]. These types of practices require basic understanding of methods for physical restraint of snakes. Non-veterinarian persons can handle snakes physically while anesthetic agents must be used by qualified veterinarians only.

There are basic two types of restraint methods for snakes, *viz.*, (a) Physical and (b) Chemical. The common indications of physical restraint are rescue and rehabilitation, physical examination, medicinal treatment, minor surgeries, venom extraction at venom research stations, sample collection for laboratory diagnosis and research. Veterinarians should consider taking help from experienced/trained rescuers and snake handlers while he/she is performing expert veterinary procedures on snakes. Points to be

considered during physical restraint are (a) purpose/requirement of capture, (b) behavior of snakes being handled, (c) type of snake – avoid physical handling of head in venomous snakes, (d) rapid availability and use of suitable restraint devise/tools, (e) awareness, knowledge, skill and experience of handler/rescuer, (f) physical handling is a basic requirement before administering chemical anesthesia. Rescuers can use their hands (especially for non-venomous snakes) as well as items such as hooks, pipes, fork, tong, cloth, jar, pipes, shield and other suitable items for physical restraint of snakes depending on type of snake being approached. One should always consider looking after public or media attention while handling a snake in revenue areas. On the other hand, the chemical restraint in snakes can be performed by use of anesthetic agents such as volatile anesthetics (e.g., isoflurane, sevoflurane, CO₂), injectable anesthetic (e.g., propofol, ketamine, tiletamine and zolazepam) as well as local anesthetic agents (e.g., lignocaine) to manage surgical affections depending on severity of the condition. Exact documentation on stages and signs of anesthesia are not available for snakes. Snakes may show open mouth condition, star-gazing like position of head, occasional regurgitation/vomition, diminished bodily reflexes, dilated pupils (not in all cases), gradual loss of control over bodily movements, inability for self-defense against attack, gradual muscle relaxation and changes in heart rate as well as respiratory rate depending on type of anesthesia. One should always consider proper placement of snakes while using anesthesia. Veterinarians should be prepared with life-saving drugs while performing surgeries in anesthetized snakes. Other medicines can be used at doses and dosages recommended for different conditions as per standard literatures or textbooks [Fowler and Miller (2003); Lillywhite (2014); Divers and Stahl (2019)].

Examples of Diseases and Disorders

Snakes do suffer from infectious and non-infectious diseases and disorders. Literature suggests that snakes can suffer from [a] bacterial diseases (e.g., mycobacteriosis), [b] mycotic diseases (e.g., clinical infection by dermatophytes), [c] viral diseases (e.g., inclusion body disease, iridovirus infection, herpesvirus infection), [d] ectoparasitic infestations (e.g., tick infestation by *Amblyomma* spp.), [e] protozoal infections, [f] endoparasitic infestations (e.g., roundworms, pinworms), [g] environmental conditions, [h] infectious stomatitis or mouth rot,

traumatic injuries, [i] abscesses (e.g., sub spectacle abscessation), [j] inflammatory conditions (e.g., cloacitis, conjunctivitis, simple stomatitis), [k] metabolic, [l] endocrine diseases, [m] reproductive disorders and [n] certain neoplastic conditions [Fowler and Miller (2003); Lillywhite (2014); The Merck Veterinary Manual (2016); Divers and Stahl (2019)].

Such a detailed categorization is available on the basis of diseases reported in countries other than India. Published literature is available in form of small-scale research or case studies on captive and/or wild snakes in India. For example, [a] tick infestation in captive and wild snakes [Saundhararajan *et al.* (2013); Catherine *et al.* (2017)], [b] necrosed venom gland [Raj *et al.* (2017)], [c] injury in captive and rescued snakes [Ali *et al.* (2017); Raut *et al.* (2018)], [d] dog-bite [Bhadesiya *et al.* (2020c)], [e] poisoning [Bhadesiya *et al.* (2020a)], [f] dysecdysis [Bhadesiya *et al.* (2020c)], [g] dehydration [Bhadesiya *et al.* (2020c)], [h] debility [Bhadesiya *et al.* (2020c)], [i] worm infestation by *Strongyle* spp. [Bhadesiya *et al.* (2020c)], [j] pneumonia and [k] rostral abrasion [Bhadesiya *et al.* (2020c)]etc. Furthermore, experiment-based drug formulary for Indian snakes is also not available. Veterinarians should always refer to drugs, dose and dosage recommended for different conditions in available standard literatures or textbooks.

The non-infectious conditions are generally associated with conflicts such as [a] injuries while man-handling of snakes by snake charmers/snake preachers or inexperienced persons, [b] performing life-threatening stunts (such as kissing a snake) while rescue operations, [c] keeping venomous snakes (either knowingly or unknowingly) as pets, [d] exposing children to pet snakes, [e] using other pets (e.g., cats and dogs) to encourage fight with snakes, [f] snake-bite related conflicts, [g] damage while organizing illegal snake-shows, [h] illegal collection from wild and transport without proper knowledge on effects of transport, [i] sealing of jaws and cutting of fangs by snake charmers, [j] roadkills, [k] electrocution, [l] intentional killing to make ornamental products from snake skin, [m] intentional killing to use snake meat for food products, [n] snakes getting stuck in glue traps kept for rats, [o] fractures, [p] burns, [q] accidental or intentional exposure to toxic compounds, [r] crush injuries, [s] foreign body ingestion, [t] snakes getting stuck in inanimate objects (such as cans), [u] accidentally killing non-venomous snakes confusing them as venomous snakes etc. Awareness among

people in revenue areas and cooperation of experienced snake handlers/rescuers as well as members of the forest department can effectively reduce occurrence of human-snake conflicts [Bhadesiya *et al.* (2020c)].

The lacuna on availability of veterinary resources can affect the decision making process while treating sick or injured snakes. Moreover, most of the drugs and dosage recommendations for snakes are documented in standard textbooks based on observations recorded in countries other than India. Therefore, there is a need to establish baseline information on prevalence of existing diseases and preparation of a ready-reckoner of diseases in snakes to enable veterinarians in decision-making process while treating snakes.

Conclusion

Snakes can suffer from a wide variety of diseases and disorders. Existing prevalence of diseases in snakes is not available at length in India. The present paper has highlighted different aspects of snake's anatomy, physical restraint, chemical restraint, infectious diseases, non-infectious diseases and conflicts in snakes. Database on prevalence of infectious and non-infectious health conditions can be generated in future for effective healthcare and management in snakes.

Conflict of Interest

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