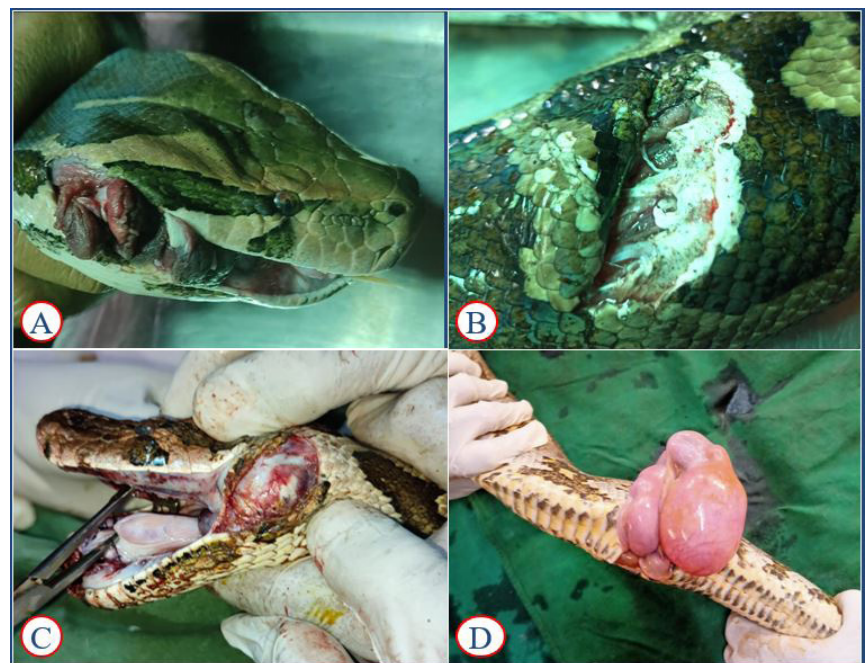




#240
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Snake-human conflict: rise in presentation of injured snakes at the Referral Veterinary Hospital in Kannur, Kerala, India

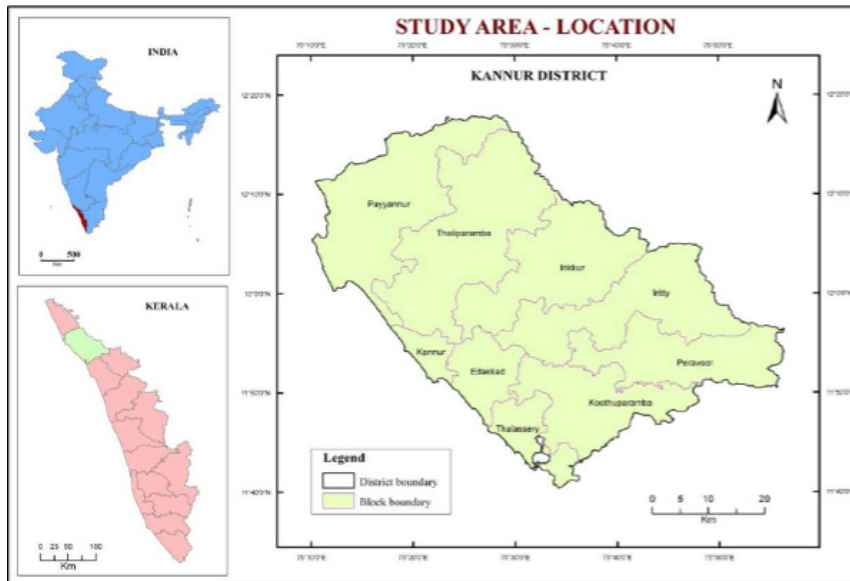
The state of Kerala has a rich diversity of 104 snake species including a few endangered ones (Kerala Forest Department 2021). They inhabit almost all kinds of environments and have a significant ecological impact keeping the local pest population in check and maintaining nature’s stability through food webs. Snakes were revered as sacred and their habitats were protected in the past. Presently, these habitats are dwindling causing the snakes to venture out in search of new areas (Roshnath & Divakar 2019). Owing to the easy availability of prey, they at times choose human settlements as hunting grounds. Instances of snakes being killed, snake bite cases and consequent mortality have



Severely lacerated jaw muscles (A), dorsal body wall (B) and skin over jaw (C), and rupture of coelomic cavity with evisceration (D) in Indian Rock Python.

risen as a consequence (Kerala Forest Department 2020). With the current trend of habitat loss and fragmentation, such incidents might escalate worsening the snake-human conflicts. A retrospective evaluation

was conducted on cases of snakes presented at the District Veterinary Centre, Kannur, Kerala from different parts of Kannur District during the period from 1 January 2020 to 30 May 2022. This district lies in the northern part of Kerala



The study area.

(11.6669 & 12.8003 N; 75.1669 & 75.9503 E). The district covers around 2,966 km² and is bordered on the east by the Ghats of Karnataka's Coorg District, on the south by Kozhikode and Wayanad districts, on the west by the Lakshadweep Sea, and on the north by Kasaragod District. According to 2011 Census, the total population of the district was 2,523,003 (Prasad 2018). Kannur has a complex plant life, with several types of forests such as west coast tropical evergreen forest, west coast semi-evergreen forest, south Indian moist deciduous forest, southern hilltop evergreen forest, plantation crops, and coastal and midland region crops

(Kerala Forest Department 2022). The climate is humid, with summer season lasting from March until the end of May. The southwest monsoon follows, which lasts until the end of September. The post-monsoon or receding monsoon lasts from October through November. The coolest climate in the district spans from November through March (Prasad 2018).

A total of 34 snakes were rescued and presented at the hospital following accidental trauma during the period of study. The number of cases increased from seven to 21 during 2021 and already six have been reported by May 2022. The snakes presented

were Indian Rock Python *Python molurus* (17), Indian Spectacled Cobra *Naja naja* (7), Russell's Viper *Daboia russelii* (5), Indian Rat Snake *Ptyas mucosa* (2), King Cobra *Ophiophagus hannah* (1), Banded Kukri *Oligodon arnensis* (1), and Indian Sand Boa *Eryx johnii* (1).

Moderate to severe lacerated wounds due to road accidents, trauma from sharp objects and agricultural machineries, and even dog bite were the most common type of injuries encountered in all the species of snakes. Often, the wounds were infected with mucopurulent discharge (Indian Rock Python, Indian Spectacled Cobra, Russell's Viper, Indian Rat Snake, and Indian Sand Boa) or infested with maggots (Indian Rock Python). Punctured wounds over skull, body and trachea were observed in Indian Rock Python, Indian Spectacled Cobra, and Russell's Viper, with concurrent injuries such as severely lacerated wound over body, anterior lower and upper jaw, exenterated teeth and bilateral corneal opacity. Among them, three snakes (Indian Rock Python, Indian



Spectacled Cobra, and Russell's Viper) were presented with streaks of blood in the mouth, trachea and severe internal hemorrhage of which two (Indian Rock Python and Russell's Viper) were in shock during presentation.

The two snakes presented in severe shock succumbed to death within an hour after presentation. Penetrating wound, following trauma with a sharp pointed object, along the dorsal skull to ventral jaw was observed in an Indian Spectacled Cobra. Rupture of coelomic cavity with subsequent evisceration of internal organs was observed in two Indian Rock Python and two Indian Spectacled Cobra. Among them, the Indian Rock Python with severely devitalized internal organs and the Indian spectacled cobra with fracture of multiple ribs, lacerated lung and multiple lacerated wounds succumbed to death in spite of initiation of treatment. Luxation of the vertebrae was observed in two snakes (Indian Spectacled Cobra and Banded Kukri) following fall from height and the body wedged between objects. Severely lacerated jaw muscles along with luxation of joint between the mandible and quadrate was observed in an Indian Rock Python presented following a road traffic accident.

Immediate medical and/or surgical treatments were adopted in all the cases for the stabilization and management of traumatized patients. Fluid therapy was initiated in all the snakes presented with severe dehydration or in shock, administered either subcutaneously or intracoelomically. Moderate lacerations and punctured wounds were thoroughly lavaged with luke warm normal saline solution under

manual restraint. In cases of penetrating wounds and severe lacerations, the scales over the skin around the wounds were clipped. The site was scrubbed with 1% chlorhexidine solution and was aseptically prepared with povidone iodine (5%) solution for application of apposition sutures wherever possible under butorphanol-xylazine-ketamine anaesthesia. Topical maggotocidal agents were used in wounds infested with maggots.

Endotracheal intubation was done during anaesthesia to keep the airway patent and the body temperature was maintained with heating pads. In snakes presented with evisceration, the repositioning of eviscerated abdominal organs and surgical repair of ruptured coelom was resorted to under general anaesthesia. The peritoneum, abdominal muscles and its fascia were apposed in simple continuous suture pattern, using 2-0 polyglactin 910 followed by the skin in horizontal mattress suture pattern using 2-0 monofilament polyamide. The luxated mandible in an Indian Rock Python was reduced and fixed in apposition with the quadrate bone by double loop reinforced surgeon's knot using 1-0 polyglactin 910 followed by apposition of the lacerated right anterior temporalis muscle along with its fascia in simple continuous suture pattern using 2-0 polyglactin 910 and the skin in horizontal mattress suture pattern using 2-0 monofilament polyamide. In snakes with tracheal puncture, the wounds were apposed in simple interrupted suture pattern using 3-0 polyglactin 910 under general anaesthesia. The exenterated teeth were surgically removed. The snakes presented with streaks of blood in oral cavity were in shock and hence could be moped

Table 1. The species of snake and the type of injuries.

	Name of species	No.	Type of injury and number of snakes affected	Status
1	Indian Rock Python <i>Python molurus</i>	17	Severely lacerated jaw muscles along with luxation of joint between mandible and quadrate, punctured wound on trachea	1 Released
			Lacerated wounds over body due to road traffic accidents	2 Released
			Lacerated wounds over body following trauma from sharp objects	2 Released
			Lacerated wounds over body following trauma from agricultural machineries	4 Released
			Lacerated wounds over body with mucopurulent discharge	2 Released
			Lacerated wounds over body infested with maggots	2 Released
			Punctured wounds with severely lacerated anterior lower and upper jaw, exenterated teeth and bilateral corneal opacity	1 Released
			Severe lacerated wounds over body, streaks of blood in the mouth, trachea and severe internal hemorrhage with punctured wounds over the skull and trachea	1 Dead
			Rupture of coelomic cavity with subsequent evisceration of internal organs	1 Released
			Rupture of coelomic cavity at multiple areas with subsequent evisceration of devitalized internal organs	1 Dead
2	Indian Spectacled Cobra <i>Naja naja</i>	7	Lacerated wounds over body with mucopurulent discharge	1 Released
			Lacerated wounds over body following trauma from sharp objects	1 Released
			Lacerated wound on hood	1 Released
			Streaks of blood in the trachea with severe internal hemorrhage and punctured wounds over the skull and along the cranial and caudal one third of the body. Penetrating wound along the dorsal skull to ventral jaw	1 Released
			Lacerated wounds and rupture of coelomic cavity with subsequent evisceration of internal organs	1 Released
			Rupture of coelomic cavity with fracture of multiple ribs, lung laceration and multiple lacerated wound over body	1 Dead
			Luxation of the vertebrae	1 Released
3	Russell's Viper <i>Daboia russelii</i>	5	Severe punctured and multiple lacerated wounds with hemorrhage following dog bite. Snake was in shock	1 Dead
			Lacerated wounds over the body with mucopurulent discharge	2 Released
			Lacerated wounds over body following trauma from sharp objects	2 Released
4	Indian Rat Snake <i>Ptyas mucosa</i>	2	Lacerated wounds over body following trauma from sharp objects	1 Released
			Lacerated wounds over the body with mucopurulent discharge	1 Released
5	King Cobra <i>Ophiophagus hannah</i>	1	Lacerated wound on hood	1 Released



	Name of species	No.	Type of injury and number of snakes affected	Status
6	Banded Kukri <i>Oligodon arnensis</i>	1	Luxation of the vertebrae	1 Released
7	Indian Sand Boa <i>Eryx johnii</i>	1	Lacerated wounds with mucopurulent discharge	1 Released

dry under manual restraint. Rest was advised in snakes presented with luxated vertebrae.

Postoperatively, long acting enrofloxacin at the rate of 10 mg/kg body weight and meloxicam at the rate of 0.2 mg/kg body weight were administered intramuscularly in all the cases. Regular dressing of the skin and oral wounds was carried out. The skin wound healed completely by the 4th postoperative week in all the snakes and the sutures were removed. The snakes were kept under captivity by the rescue team during the course of treatment under the supervision of the Forest and Wildlife Department, Kannur Division, Kerala and were later released into the wild after recovery. Among the 34 snakes presented with traumatic injuries, four snakes (Two Indian Rock Python, one Indian Spectacled Cobra and Russell’s Viper) succumbed to death in spite of initiation of treatment because of the severity of injury.

The human intervention such as urbanization and industrialization have attributed to severe loss of the forest area and rapid degradation of the natural habitats of snakes (Soga & Gaston 2020; Hiremani et al. 2022). The majority of injuries recorded were from agricultural operations using automated machineries to prepare the soil. The district had a reserve forest area of 207.39 km² and vested forest area of 98.90 km² in 2009 (Kerala Forest

Department 2009). This has shrunk by 55 per cent (114.03km²) and 39 per cent (38.52 km²) respectively by 2019 with a staggering loss of 50% of total forest area of the district and is still dwindling at an alarming rate (Kerala Forest Department 2019). When a human sees a snake, they typically assault it out of panic (Burghardt et al. 2009) resulting in severe harm, which account for another cause of death. Road accidents also accounted for a significant share of injuries inflicted on these reptiles (Bhandarkar & Paliwal 2021). The majority of the incidents occurred on roads that ran through snake inhabited forests or similar environments (Filius et al. 2020; Bhandarkar & Paliwal 2021).

Snakes in their native environment regulate the populations of their prey and are the nature’s most effective pest controllers especially rodents that can spread diseases and wreak havoc on crops (Mullin & Seigel 2009). On the other hand, they can be prey for a variety of predators, including other snakes. When they are an invasive species in the ecology with little or no control over their population, they might pose a problem. Both the introduction and removal of snakes can have unforeseen effects on an ecosystem. Land clearance for agriculture, urban expansion, and the introduction of domestic pets has put snake species in jeopardy. Thus, in order to reduce human-snake



conflicts and to create a snake-friendly society, organized conservation strategies and initiatives for snake rescue are required. Also, public education and awareness programmes need to be formulated for better knowledge and understanding of snakes and their conservation.

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