

## Perspectives


# Minimising misidentification of common medically important snakes of Sri Lanka in the hospital setting

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## Abstract

This perspective highlights the misidentifications of medically important snakes that could commonly occur in hospitals and provides a quick-reference, illustrated guide for minimising such snake misidentifications in the Sri Lankan healthcare setting.

**Keywords:** Snakebite, Identification, Medically important snakes, Sri Lanka

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## Introduction

Snakebite is a significant public health issue in Sri Lanka, with annually over 30,000 snakebite victims admitted to government hospitals of the island [1]. The island has a rich diversity of reptiles, which includes 108 species of snakes inland as well as in coastal waters [2]. However, only five species of snakes, namely, Russell's viper (*Daboia russelii*), Merrem's hump-nosed pit viper (*Hypnale hypnale*), Indian or common krait (*Bungarus caeruleus*), Sri Lankan cobra (*Naja polyocellata*) and saw-scaled viper (*Echis carinatus*) are considered as snakes of highest medical importance due to the frequency and severity of their bites and envenomings [3,4].

According to the estimates, 35-45% of hospital admissions in Sri Lanka are due to Merrem's hump-

nosed pit viper bites while 30-40% are due to Russell's viper bites [5]. The remaining one-third of the bites are caused by the Indian krait, Sri Lankan cobra, saw-scaled vipers, and other snakes with lesser medical importance or no medical importance [5]. Sri Lanka currently uses Indian polyvalent antivenom that is developed against Russell's viper, Indian common cobra, saw-scaled viper and Indian krait venoms, and commercial monovalent antivenoms are not available in Sri Lanka. Although Merrem's hump-nosed pit viper envenoming frequently causes venom-induced consumption coagulopathy (VICC) and acute kidney injury (AKI), it is not covered by the Indian polyvalent antivenom and hence is not recommended [6-8]. Indian polyvalent antivenom frequently leads to severe acute adverse reactions [9]. Therefore, the decision to give antivenom should be

carefully made by selecting those who require antivenom by authenticating the identity of the snake. In addition, several species of non-venomous snakes are closely similar in colouration to medically important snakes such as kraits (*Bungarus* species) potentially causing confusion in snakebite management [10,11]. Many snakebite victims present to the hospital with the offending snake specimen or its pieces to assist in the management of the snakebite. The percentage of patients bringing the snake to the hospital could be as high as 46% in parts of Sri Lanka [12]. Additionally, patients or people admitting them could have images of the snake responsible for the bite. Therefore, knowledge of accurate identification of the offending snake specimen, when available, could lead to early and improved treatment and management of snakebites in Sri Lanka [8].

Given the frequency of snakebites presented to Sri Lankan healthcare settings, medical doctors are expected to confidently identify medically important snakes and distinguish them from the rest of the snakes. It is not a challenging task because,

- (1) medically important snakes are far and few compared to the vast majority of snakes that have no medical importance,
- (2) medically important snakes in Sri Lanka are morphologically quite distinguishable from each other, as well as from snakes that have no medical importance,
- (3) the unique distribution patterns of some medically important snakes make their bites only occur in specific geographical areas of Sri Lanka.

However, the identification keys and resources developed for identifying medically important snakes for medical doctors might be practically inconvenient in a busy setting because they include several steps of morphological examination of the specimens [8] or are cluttered with non-relevant information or other species. Further, most of the snake specimens that patients bring to the hospital are often severely damaged, hence the application of identification keys that are designed to identify a complete, undamaged specimen might not be practically useful. Therefore, the ability to identify the relevant species of snakes from multiple features is important.

This perspective is aimed at highlighting the common snake misidentifications that could occur in hospitals and providing a quick-reference, illustrated guide for minimising such snake misidentifications in the Sri Lankan healthcare setting.

### ‘Viper-like’ snake

There are six viperid snakes present in Sri Lanka, namely, Russell’s viper, the saw-scaled viper, three species of hump-nosed pit vipers (*Hypnale hypnale*, *H. nepa* and *H. zara*) and the green pit viper (*Peltopelorus trigonocephalus*) [2]. These snakes possess ‘viperine’ bodies, which are short and robust, and with triangular heads and prominent necks (viper-like bodies), that can be easily distinguishable from other forms (**Figure 1**). Their tails are notably short. However, juvenile pythons (*Python molurus*) have relatively short and robust body hence and are often misidentified as Russell’s vipers (**Figure 2**).

Identifying vipers to the species level is highly important in a hospital setting because,

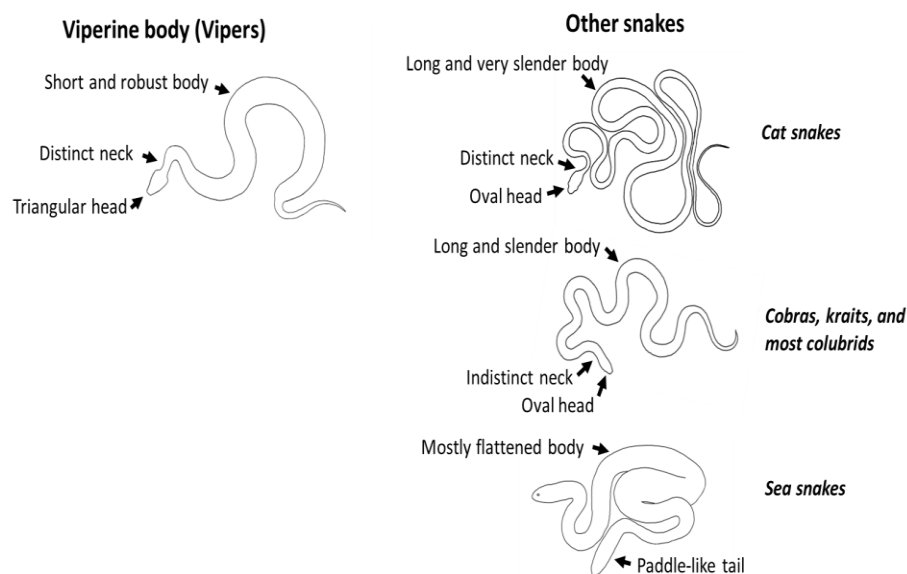
- (1) two-thirds of all snakebites admitted to Sri Lankan hospitals are viperine bites,
- (2) all six of the local species are medically important,
- (3) administration of antivenom is recommended for only Russell’s viper and saw-scaled viper bites.

Although the distributions of the viperids in the country generally do not overlap, the three species of hump-nosed pit vipers morphologically closely resemble each other so as do their effects of envenoming and management [7,13]. Therefore, distinguishing them at the hospital by a medical officer is not required. Therefore, in this article, we treat them together as ‘hump-nosed pit vipers’.

### Juvenile Russell’s viper vs hump-nosed pit vipers.

With regard to patient management, the most-important differentiation is Russell’s vipers, especially their juveniles, from hump-nosed pit vipers. Hump-nosed pit vipers are widespread in the country and cause the most number of medically important snakebites in Sri Lanka. Distinguishing the envenoming caused by these snakes based on clinical grounds is challenging at times. Similar to the hump-nosed pit vipers, the juvenile Russell’s vipers usually do not cause neurotoxicity [14], and both snakes cause VICC and AKI, while local effects may not be prominent enough to distinguish them in some cases. Although adult Russell’s vipers are much larger snakes, the Juvenile Russell’s vipers could almost be the same size as the hump-nosed pit vipers.

In a specimen with an undamaged head, examining the presence or absence of raised snout or loreal pit could assist in differentiating the hump-nosed pit vipers (**Figure 2**).



**Figure 1:** Comparison of the body shapes of the vipers with other snakes.

Russell's vipers have large nostrils, but no pits (a notable hole) between the nostril and the eye. Russell's viper also has an unmistakable body colour pattern with three rows of dark elliptical markings with clear margins (often black and white) running along the body (**Figure 2**). Of these, the middle row runs dorsally and the other two run on each side of the body. In some specimens, a few of these elliptical markings could also be fused or faded. These markings are much darker, almost close to black in juveniles (**Figure 3**). In addition, a white colour "inverted V" mark could also be seen on the head. In contrast, hump-nosed pit vipers have two rows of dark, often triangular blotches running on either side of the midline (**Figures 2 and 3**). However, it is noteworthy that the base body colouration of the hump-nosed pit vipers could greatly vary, so as the colour and shape of the dark blotches (**Figure 3**).

Distinguishing saw-scaled viper is straightforward because it is exclusively found in arid zone, and the characteristic series of white blotches connected to the white arches running along the body. In addition, a 'bird-foot mark' could be seen dorsally on the head. However, this mark may appear in oval or a diamond shape as well.

#### **Black or grey snakes with white bands**

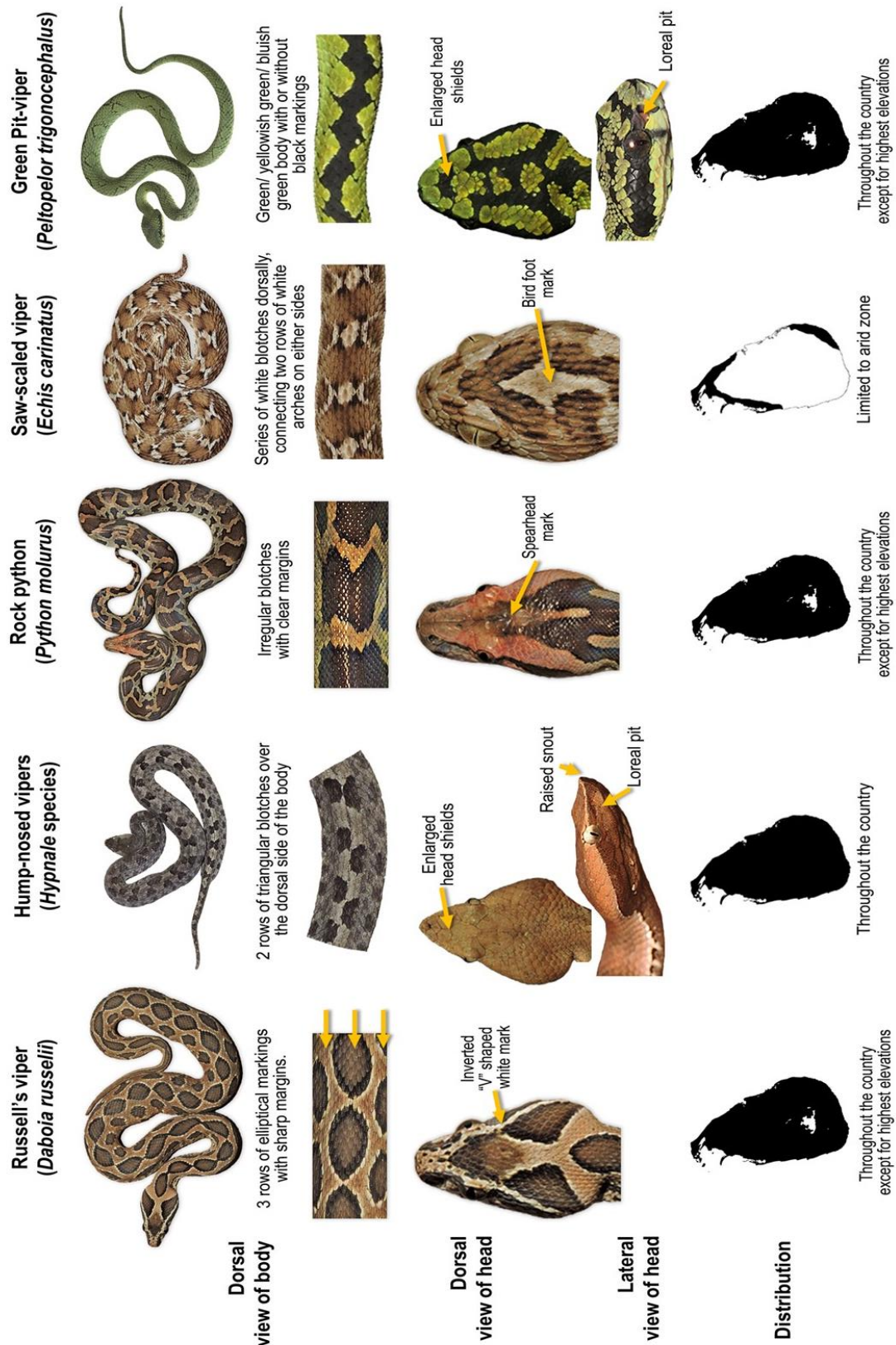
A black, grey or dark brown snake with white bands is perhaps the most confusing scenario a medical officer could face. This is because several non-venomous snakes such as wolf snakes (*Lycodon* species) and bridal snakes (*Dryocalamus* species) mimic the colouration of the medically important kraits (*Bungarus* genus).

These groups can be distinguished using the following morphological characteristics (**Figure 4**):

- (1) kraits have prominently enlarged, hexagonal scale rows on the midline of the dorsal side of the body (vertebral scale row), whereas the vertebral scale row is not notably different to the lateral scales in the other group of snakes,
- (2) scales under the tail in kraits are arranged as a single row (uniserial sub-caudal scales), whereas they are paired in the other group of snakes, except in the Sri Lankan wolf snake (*Lycodon carinatus*).

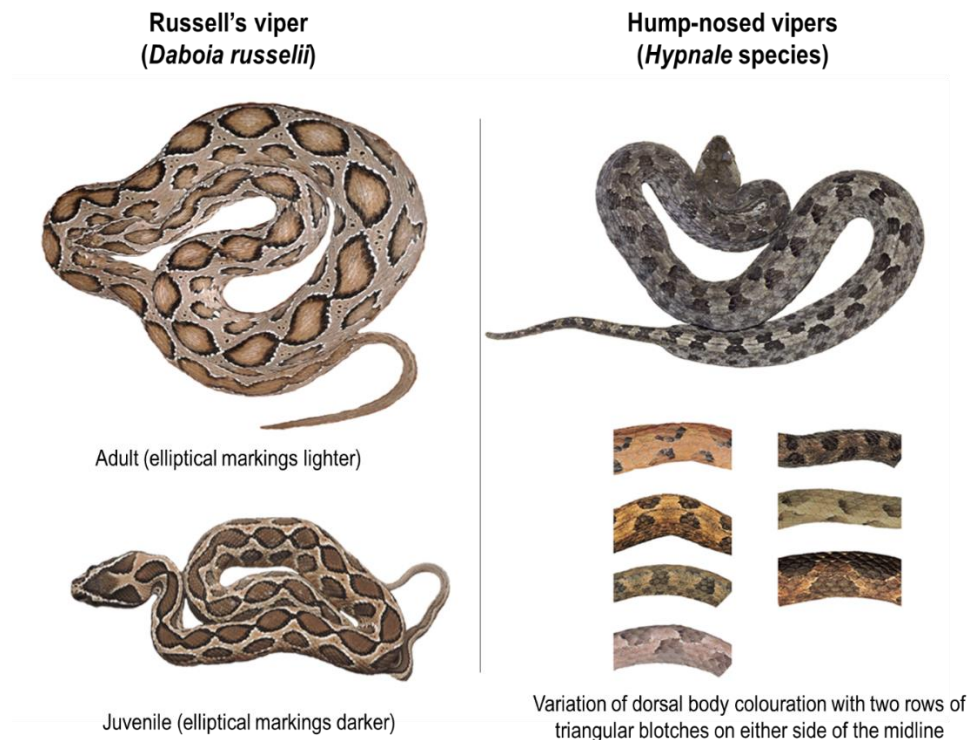
To confirm a krait specimen, a medical officer should check the snake specimen for the presence of both these characters. Kraits also have non-keeled, smooth and notably shiny scales and smaller heads.

Indian and Sri Lankan kraits could be clearly distinguished based on their colouration (**Figure 4**). The juveniles and young specimens of Indian krait for large part have narrow white bands arranged in pairs, while the Sri Lankan krait specimens have broad, individually arranged white bands. However, both these species tend to lose their white bands when they become mature and at times some Indian kraits have fused bands that look thicker and resemble those of Sri Lankan kraits.



**Figure 2:** Unique morphological identification characteristics of the viperine snakes in Sri Lanka and their geographical distributions, in comparison to rock python which has a similar body shape and colouration.





**Figure 3:** Colour variations of Russell's viper (*Daboia russelii*) and Hump-nosed pit vipers (Genus: *Hypnale*)

Therefore, it is not uncommon to find mature, large snakes of both these species, without a single white band, often referred to as 'Habarala' in some parts of the country. The ventral side of the Indian krait is uniformly white, while the ventral side of the Sri Lankan krait is black or dark with white bands. However, the juveniles of Sri Lankan kraits have uniformly white colour ventral sides.

These two species could be separated based on their distribution. Indian krait is distributed mainly in the dry zone of the country while the Sri Lankan krait is limited to the wet zone of the country, with possible overlap of their distributions in the intermediate zone. There are also increasing recent records of Indian kraits in the western coastal belt as well as around Colombo. However, in a broad perspective, a patient from a wet zone is less likely to have an Indian krait bite while a patient in the dry zone is unlikely to have a Sri Lankan krait bite.

### Cobra vs rat snake

Sri Lankan cobra and rat snake both exist almost throughout the country and both these snakes are common around human settlements. A live, defensive cobra could be unmistakably identified due to its display of the hood. Dead specimens can be identified using a combination of markings on the neck (both dorsally and

ventrally) and the number of dark edges on the lip scales (**Figure 5**). The neck of dead specimens can be stretched to confirm the presence or absence of markings. Rat snakes also have a notably large eyes compared to their head size. It is noteworthy that Sri Lankan cobra has narrow white bands on the dorsal side of the body and some rat snakes too have the same colour pattern.

### Concluding remark

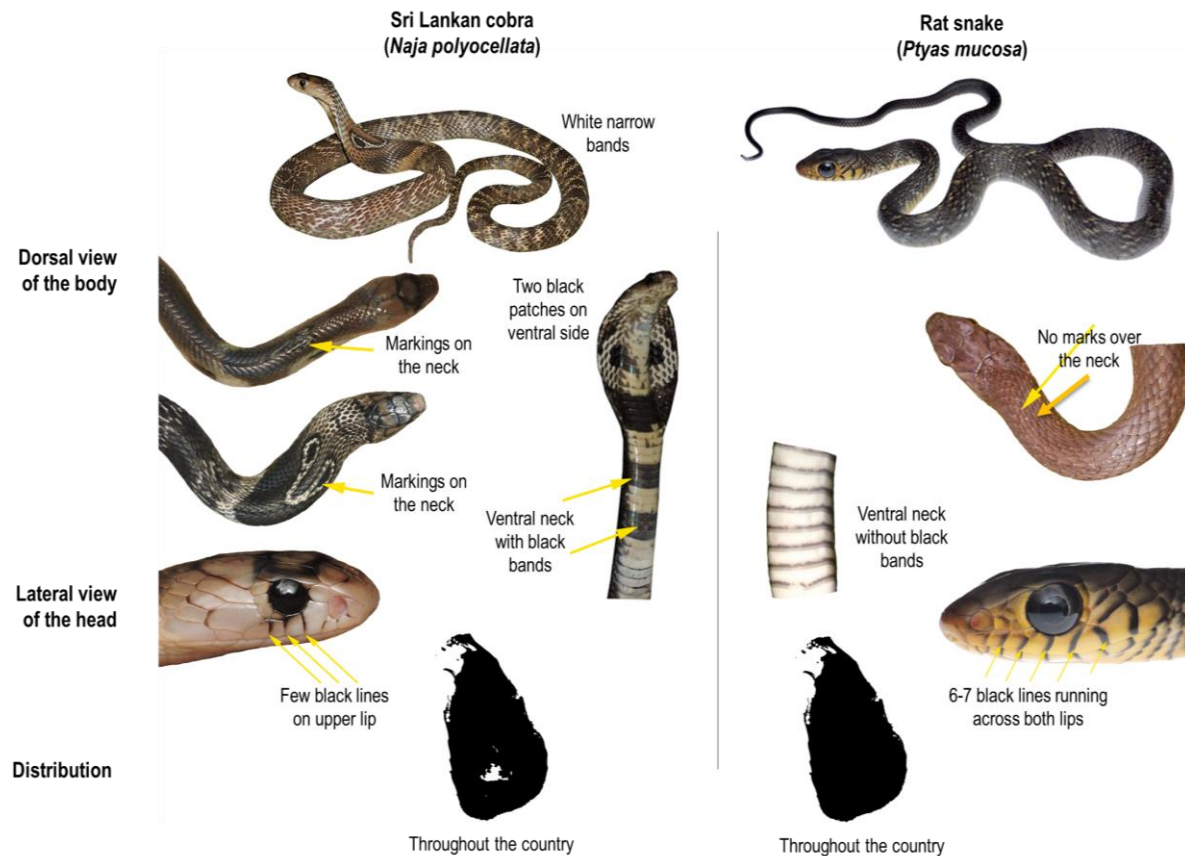
Fast and confident identification of medically important snakes could affect early intervention in snakebite management, thus ultimately saving lives. The three scenarios described in this perspective are the most commonly encountered confusions in Sri Lankan healthcare settings with regard to snakebite management. Therefore, it is advisable to thoroughly go through these scenarios prior to treatment. However, in any uncertain instances, medical doctors are advised to seek expert assistance for the identification of the snake.

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**Figure 4:** Unique morphological identification characteristics of Indian krait and Sri Lankan krait and their geographical distributions in comparison with two non-venomous snakes with similar colouration



**Figure 5:** Unique morphological identification characteristics and geographical distribution of Sri Lankan cobra in comparison with a rat snake.

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