

## Human Fatalities from Venomous Animals Autopsied at A Tertiary Care Centre A Five-Year Study (2018-2022)

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### Abstract

**Objective:** To evaluate the causes of human fatalities in cases autopsied at Chengalpattu government medical college from 2018 to 2022 that were caused by venomous animal encounters. **Methods:** Retrospective study of data collected from the police requests for autopsy and history of the cases from department of forensic medicine and toxicology in Chengalpattu government medical college. **Results:** From 2018-2022, 144 dead bodies were autopsied at Chengalpattu government medical college after venomous animal encounters. An average of 30 fatalities per year were recorded. Males appear to be the group most likely to die from an encounter. **Conclusions:** A significant loss of human lives are happening due to envenomation from venomous animals especially in the working age group in rural population. Rural population has a disproportionate impact on rural population.

**Key words:** Envenomation, snake, scorpion, bees, wasps, accidental, autopsy

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### Introduction

Animal envenomation causes around 100,000 deaths each year worldwide. Most of the death happens in tropical countries and are due to snakes, scorpions and anaphylactic reaction from other insect stings. Chengalpattu Government medical college lies in the sub urbs of Chennai city serving an area covering entirety of Chengalpattu district, some parts of Kanchipuram and Tiruvannamalai districts. Its service area covers a wide variety of landscapes from urban centres like Tambaram to coastal villages like Kalpakam to multiple reserve forests and communities residing in and around forested areas. Being in the tropics and with vast forest cover fatalities from envenomation is common in this area. This study hopes to evaluate the human fatalities with history of envenomation from animals.

### Method

Details of post mortem examinations with history of death following encounter with venomous animals were collected from Department of Forensic medicine and Toxicology department of Government Chengalpattu medical college were taken and data was collected from the police requests and history of case.

## Results

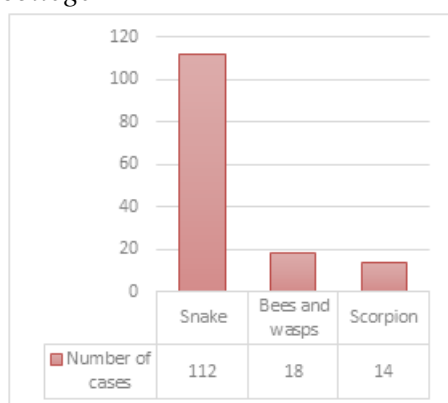
Between 2018 and 2022 a total of 144 venomous animal encounter cases underwent post mortem examination at Chengalpattu government medical college. An average of around 30 cases annually with a range of 14 in 2018 and 28 in 2022.

### Animal

**Table 1: Rank order of animal-related fatalities autopsied at Chengalpattu government medical college mortuary.**

Animal	Number of cases	% of cases
Snake	112	77.78%
Bees and wasps	18	12.5%
Scorpion	14	9.72%
<b>Total</b>	<b>144</b>	

Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college



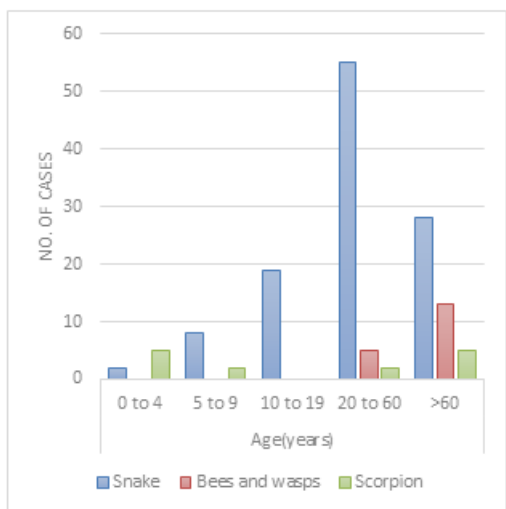
**Chart 1: Animal wise distribution of cases**

### Age

**Table 2: Age wise distribution (age in years)**

Animal	Age				
	0-4	5-9	10 -19	20-60	>60
Snake	2	8	19	55	28
Bees and wasps	0	0	0	5	13
Scorpion	8	2	0	1	3
<b>Total</b>	<b>10</b>	<b>10</b>	<b>19</b>	<b>61</b>	<b>46</b>

Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college



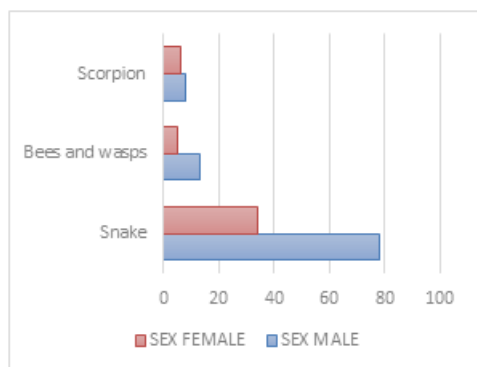
**Chart 2: Age wise distribution**

**Sex**

**Table 3: Sex wise distribution**

Animal	SEX	
	MALE	FEMALE
Snake	78	34
Bees and wasps	13	5
Scorpion	8	6
<b>Total</b>	<b>99</b>	<b>45</b>

Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college



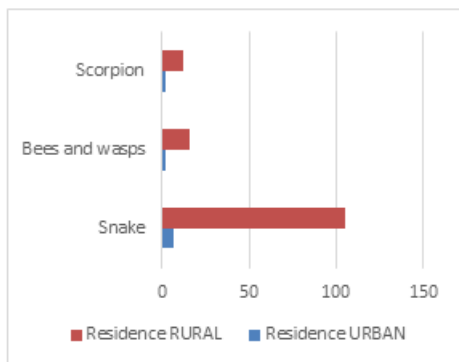
**Chart 3: Sex wise distribution**

**Residence**

**Table 4: Residence of victims.**

Animal	Residence	
	URBAN	RURAL
Snake	7	105
Bees and wasps	2	16
Scorpion	2	12
<b>Total</b>	<b>11</b>	<b>133</b>

Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college

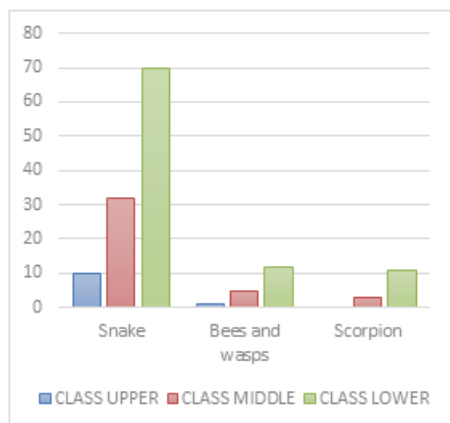


**Chart 4: Residence of deceased Socio-Economic Status**

**Table 5: Socioeconomic status of deceased.**

Animal	CLASS		
	UPPER	MIDDLE	LOWER
Snake	10	32	70
Bees and wasps	1	5	12
Scorpion	0	3	11
<b>Total</b>	<b>11</b>	<b>40</b>	<b>93</b>

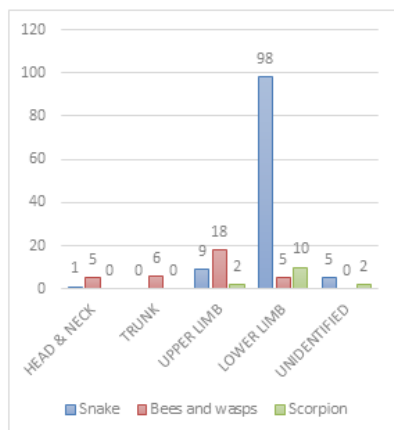
Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college



**Chart 4: Socioeconomic status of deceased**

**Anatomical Location**

Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college



**Chart 6: Anatomical location of bites and stings**

### Manner of Event

**Table 7: Manner of event.**

Animal	Manner		
	Suicidal	Homicidal	Accidental
Snake	1	0	111
Bees and wasps	0	0	18
Scorpion	0	0	14
Total	1	0	143

Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college

### Discussion

Bites and envenomation to humans occur worldwide. Of the creatures that bite and sting, venomous snakes account for more cases of severe morbidity and mortality [1][2]. Most of these occur in tropical countries and are mainly due to snakes, scorpions and anaphylaxis from insects. More than 146 million people live in areas without quality healthcare and disproportionate access to antivenom. An additional 600 million live more than 1 hour from population centres where adequate treatment could occur [5]. India alone is responsible for 80% of snakebite deaths and with the wide variety of venomous fauna in the country death from variety of venomous organisms are also very high compared to rest of the world. Chengalpattu being tropical region in southern state of Tamil Nadu with high forest cover is a hot bed for envenomation from venomous animals and due to the rural nature of the area, delay in access to healthcare being a real threat to life, the number of fatalities from envenomation being high in the region is a real possibility.

WHO characterized snakebite envenoming as a “highest priority neglected tropical disease” in June 2017 for these reasons. As a result of these efforts, the Venomous Snakes Distribution Database was developed to aid health-care providers and other users to identify snakes in their area and information on antivenom available in the area. Venom is used by the snake to facilitate the capture of prey by immobilizing or killing, assist in digestion, and as a defence mechanism when threatened by apparent predators. Snake venom is a mixture of biologically active proteins and polypeptides, which comprises more than 95% of the venom inoculation. Other components include carbohydrates, lipids, and amines [6]. Most of the potent snake venoms target specific targets mostly affecting the neuromuscular junction and/or hematologic systems. In the wild, this would result in immobilization of their prey, aid in

digestion, and a mechanism of defence [7]. Neurotoxins, clinically, result in paralytic effects at the neuromuscular junction which, if left untreated, could lead to death from respiratory failure [8]. Neurotoxins may have effect at pre- and/or postsynaptic junctions. Presynaptic toxins result in neurotransmitter release and, ultimately, complete cessation of neurotransmitter release from the significant damage to the axonal structure. This results in progressive flaccid paralysis that can be complete in 24 hours. The time to recovery is dependent on how soon antivenom is given, as once paralysis is complete, recovery rate is dependent on axonal repair. Postsynaptic toxins bind to acetylcholine receptors but do not damage the cells. Thus, flaccid paralysis may occur but is reversible with antivenom therapy. Myotoxins may also be present in elapid and vipers. These toxins cause myolysis of skeletal muscle with little to no effect on cardiac or smooth muscle. The damage is to the cell but not the basement membrane, which allows muscle regeneration within days of the bite. However, significant muscle damage can result in increased release of myoglobin, creatine kinase, and potassium into systemic circulation leading to renal damage in some patients. Antivenom has little effect on myolysis once the process is established. Myotoxins may also work with necrotoxins to result in the local injuries and necrosis that is seen most commonly after a snake envenomation. The hematologic system is a common target for venom from the majority of venomous snake families. Toxins include those that act as procoagulants, anticoagulants, platelet aggregators and promoters, and direct hemorrhagins. The net effect of these toxins is to induce bleeding, but some components result in thrombus formation and consumption of fibrinogen and/or disseminated intravascular (IV) coagulation. Envenomation from snakes involves the injection of venom through the skin of the prey that enters the systemic circulation. Depending on the snake and venom components, the location on the body of the envenomation, and the amount of venom injected, local and systemic effects may occur. The rate of absorption and development of systemic effects can be altered depending on the route of inoculation [IV vs intramuscular (IM) vs subcutaneous (SC)]. When venom enters through the IM or SC route, absorption may be slower with decreased bioavailability compared to the IV route [9-12]. Similarly, the terminal half-life was longer after IM injection compared to IV administration, although this is not consistent between studies [13][14].

In the present study it was found that the snakes, scorpions, wasps and bees are responsible for the deaths. Out of which 112 deceased were bitten by snake. This comes as no surprise since Chengalpattu area has all the major venomous snakes of India and moreover the rural community live very close to the forested areas can also be considered as a risk factor for this. In majority of cases working age group people are more affected and of which males are more in number. Low socio-economic status and living in rural areas seems to be at more risk of dying from a snakebite than urban and upper- and middle-class population. One case of suicidal snakebite has been reported in past 5 years while the rest were all accidental deaths.

**Table 6: Location of bites and stings in the dead bodies**

Animal	LOCATION OF BITE & STINGS				
	HEAD & NECK	TRUNK	UPPER LIMB	LOWER LIMB	UNIDENTIFIED
Snake	1	0	9	98	5
Bees and wasps	10	6	18	5	0
Scorpion	0	0	2	10	2

*Source: Department of forensic medicine and Toxicology, Govt.Chengalpattu medical college*

The order Hymenoptera contain three medically important families: Apidae (honeybees and bumblebees), Vespidae (yellow jackets, wasps, and hornets), and Formicidae (fire ants). Hymenoptera tend to avoid humans unless they are disturbed. Most tend to live in colonies or hives, which, if threatened, can result in massive envenomation [15][16]. The venom from the Hymenoptera is similar with only slight variations. More than 75 venom components have been identified across 31 species. The primary component is melittin which, after envenomation, enters the phospholipid bilayer of the cell membrane and destroys red blood cells, platelets, and the vascular endothelium. Phospholipase A1 is present in wasps and fire ants. Phospholipase A2 is present in honeybees, bumblebees, and some wasps. It is considered the primary allergen causing histamine release and inflammatory reactions [18]. Hyaluronidase is believed to facilitate the movement of venom through tissues surrounding the sting site. Research shows that 90% of venom is injected within the first 20 seconds after a sting with 100% injected at 1 minute [17]. Human toxicity occurs from massive envenomation resulting in anaphylactoid reactions or from immunoglobulin E-mediated anaphylaxis. Death from anaphylaxis is more common [2]. 18 cases of bees and wasp sting related deaths were autopsied at Chengalpattu government medical college and hospital during the study period and of this older age group population living in rural areas are found to be more prone to succumb to death from envenomation from bees and wasps. This might probably be due to the other health ailments they might be having due to old age. Only one deceased out of the 18 survived past 48 hours and she died due to complications of bee sting (septicaemia).

There are more than 1250 species of scorpion in the world out of which 100 are found in India [1]. Of the over 800 species of scorpions, only 25 have venom that is considered fatal to humans; most belong to the family Buthidae (e.g., *Leiurus*, *Hottentotta*, *Centruroides*, and *Androctonus*) and found worldwide. The neurotoxin is a small protein containing hyaluronidase components that blocks the inactivation of sodium channels, decreasing the duration and amplitude of neuron action potentials, and increasing the release of acetylcholine. Parasympathetic and sympathetic results may occur. This results in pain, muscle fasciculations, increased secretions (e.g., respiratory, gastric, and pancreatic), and cardiac dysrhythmias [15]. Presence of poisonous scorpion species *H. tamulus* in the area makes it significant to look into the death from scorpion stings. Number of children were higher than adults when it comes to death from scorpion sting and rural population is at more risk as in other envenomation too. Of the 14 cases in 2 cases bite marks were not identified.

The rural population is more at risk of dying from animal envenomation when compared to the urban population, A study conducted in 2013 found that 3.9% of rural Tamil nadu population has suffered from snakebite [19]. Hence its quintessential to equip hospital serving this area with necessary treatment amenities to handle such a situation, also it is necessary to educate the population regarding the immediate first aid procedures post envenomation from a venomous animal.

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