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Positive and Negative Aspects of Snake Venom: An Overview

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Abstract: ***Snakes are limbless reptiles; Snakes can be poisonous or non-poisonous. Some snakes are venomous animals because they have a special apparatus or structure to inject toxin in the body of another animal. Venomous snakes are more abundant than other venomous animals. Snake venom is secreted by poison glands. Snake venoms have been studied much more thoroughly in members of the families Elapidae and Viperidae. Snake venoms can be hemotoxic, neurotoxic, or cytotoxic. There are negative and positive aspects of snake venom. Snake venom is fatal when mixed with blood of victim of snake bite, the venom in the bloodstream of an enemy brought a painful death or a never-healing wound. Our ancestors used snake venom in traditional medicines. Snake venoms can be valuable therapeutic tools for life saving in drug discovery***.

Keywords: Snake, Snake venom, Snake bite, drugs

1. Introduction

Snakes are members of order Ophidia which belongs to Class Reptilia. All snakes are classified within the suborder Serpentes of the reptilian order Squamata, named for their scaly skin. Snakes are limbless reptiles, they employ four types of locomotion on land, lateral undulations, rectilinear motion, concertina motion and side winding. Snakes can be poisonous or non-poisonous. Snake venoms have been studied much more thoroughly in members of the families Elapidae and Viperidae. Family Viperidae, contains around 331 species of vipers and pit viper snakes. It is the most prevalent family of venomous snakes with distribution throughout Europe, Africa, Asia, and the Americas, but absent in Australasia. The snakes of Viperidae family are known for their hemotoxic and cytotoxic effects. This family is responsible for approximately 98 % of all envenomation's in the United States and nearly 50 % in India. Elapidae consists of 358 species of kraits, corals, mambas, and cobra snakes. Elapidae snakes are worldwide with representatives in Africa, the Americas, Asia, and Australasia. However, they are most abundant in tropical and subtropical regions. Snakes do not chew their food but swallow it whole. During swallowing their sharp teeth which curve inward prevent the prey from slipping forward. Venomous animals are defined as those that inject their venoms into other living organisms using different apparatus such as spurs, stingers, spines, or fangs. Venoms are secreted and delivered through well-developed venom exocrine glands and coupled to a delivery system, which have different vital functions for these animals that include capturing, killing and digesting prey, but they can also be considered as a defence mechanism against potential enemies. The snake venom in the bloodstream of an enemy brought a painful death or a never-healing wound. Scientists can use this snake venom to develop new drugs to treat illnesses.

2. Poison Apparatus

Poison apparatus which is in head region of poisonous snakes includes two sac -like poison glands situated one on either side of the upper jaw, a narrow duct leads anteriorly from each poison gland to base of a poison fang to enter its canal, there are long, curved sharp, pointed fangs for injecting snake venom or poison into the body of victim and muscles. Those that are venomous produce a form of toxic saliva from glands in their jaws. It is injected using fangs in either the front or rear of the jaw. Some species of snakes have fangs that function like hypodermic needles, injecting the venom directly. Most, however, have grooves in their teeth that channel the venom into the wounds created by the fangs.

3. Snake Venom

Snake venom is secreted by poison glands and it is faint yellow or greenish sticky liquid, odourless and tasteless in nature. Snake venoms are complex mixtures of enzymes, phosphatides proteases, cholinesterase's, ribonucleases, ophioxidases, lecithin's, deoxyribonucleases, crepsins hyaluronidases and proteins of various sizes, carbohydrates, amines and nucleosides. Venoms also contain various metal ions that are presumed to act as cofactors and include sodium, calcium, potassium, magnesium, and zinc. There is a large degree of variability in venom composition at all taxonomic levels. In addition, within the same species, venom components have been shown to vary considerably among populations and across geographical areas. Venoms act on a variety of cells and tissues with pronounced physiological responses. Some of the actions of venom components include the digestion of cells and cell membranes, disruption of procoagulant and anticoagulant activities of blood, production of oxidizing agents, breakdown of collagen and the intercellular matrix between cells, and the disruption of nerve tissue. It is fatal only when mixed with blood. It can be dried and kept indefinitely, retaining its poisonous properties. It can be dissolved in water, salt solution or glycerine when it is equally poisonous. Snake toxins with defined actions include neurotoxins, hemotoxin, cardiotoxins, cytotoxins and myotoxins.

4. Negative Aspects of Snake Venom

Snake venom is fatal when mixed with blood of victim of snake bite, the venom in the bloodstream of an enemy brought a painful death or a never-healing wound. Snake venom can be neurotoxic, haemotoxic and cytotoxic.

Venom of viper is mainly haemotoxic, contains an endotheliotoxin which damages the capillary endothelium and produces haemorrhages in various tissues, and causes necrosis. Death may result due to paralysis of Vaso-motor centres and exhaustion from profuse bleeding.

Neurotoxins are typical of elapids for example, cobra, krait and sea snakes Poison of cobra is neurotoxic, that attack nerve centres and cause paralysis of muscles. Death results within a few hours due to failure of respiration or of heart activity.

Poison of krait cause destruction of RBC, krait injects a very large quantity of poison and paralysis of trunk and limbs occur. Death results within 6 to 24 hours.

5. Positive Aspects of Snake Venom

Our ancestors used snake venom in traditional medicines. Snake venoms are known as some of the richest sources of the enzymes. Venomous snakes are more abundant than other venomous animals. Snake venoms comprise a combination of biological active components that are involved not only in envenomation pathophysiology but also in the development of new drugs to treat many diseases. There are Snake venom-based drugs in the market and in clinical trials.

Peptide toxins isolated from snake venom are used to cure many diseases:

5.1 Antivenom Preparation

Tiny doses of venom of snakes used to prepare antivenom from animals, injected with venom of different species of snakes.

5.2 Antimicrobial activity of snake venoms:

1) **Antiviral:** Crotoxin and PLA_2, isolated from snake venom of *Crotalus durissus terrificus* is used to cure Measles, yellow fever and dengue viruses. Cytotoxins component isolated from snake venom of Naja nigricollis is used against Sendai virus, Crotoxin, PLA_2 and crotapotin extracted from *Crotalus durissus terrificus* is used against *Hepatitis C virus* (HCV), L-amino acid oxidase isolated from snake venom of *Trimeresurus stejnegeri, Bungarus candidus*, *Naja naja* and *Naja kaouthia* is used against Human Immunodeficiency Virus (HIV).
2) **Antifungal:** Metalloproteinases and PLA2, isolated from *Crotalus durissus cumanensis* is used against *Candida parapsilosis* and *Sporothrix schenckii.*
3) **Antibacterial:** L-amino acid oxidase, isolated from *Bothrop alternatus*, *Bothrop pirajai, Bothrop asper*, *Bothrop leucurus*, *Crotalus adamanteus, Daboia russelli russelli, Ophiophagus hannah* and *Pseudechis australis* is used against Gram-positive and gram-negative bacteria.
4) **Antiparasites:** L-amino-acid oxidases isolated from *Brothrops* s is used against parasites *Leishmania* species, *Plasmodium falciparum* and *Trypanosoma cruzi.*

5.3 Snake venom-based drugs

Snake venoms possess enzymes such as proteolytic enzymes, arginine ester hydrolase, thrombin-like enzymes, hyaluronidase, phospholipase A_2, acetylcholinesterase, nucleases (RNase, DNase, and Phosphodiesterase), and L-amino-acid oxidase. In fact, the proteins in snake venom are used to treat many diseases, such as cancer, pain, high blood pressure, heart attacks, strokes, Alzheimer's and Parkinson's disease. some snake venom affects blood pressure and blood clotting.

Table 1: Diseases cured by snake venom

Serial no.	Snake species	Component /Protein/Proteases	Function	Diseases
1.	Cobra venom	Exanta (Ximelagatran)	Direct thrombin inhibitors	Thromboembolic complications of atrial fibrillation
2.	*Bothrops atrox & B. moojeni*	Defibrase/Reptilase (Batroxobin)	Converts fibrinogen into fibrin.	Stroke, pulmonary embolism, deep vein thrombosis and myocardial infarction
3.	*Bothrops atrox*	Hemocoagulase	Catalyzes the coagulation of the blood.	Plastic surgery, abdominal surgery, and human vitrectomy
4.	*Sistrurus miliarus barbouri*	Integrilin (Eptifibatide)	Glycoprotein (GP) IIb/IIIa inhibitors.	Acute coronary syndrome
5.	*Bothrops jararaca*	Captopril	Inhibiting angiotensin-converting enzyme.	Heart attack
6.	*Echis carinatus*	Aggrastat (Tirofiban)	Glycoprotein IIb/IIIa inhibitors.	Heart attack

Figure 1: Snake Venom

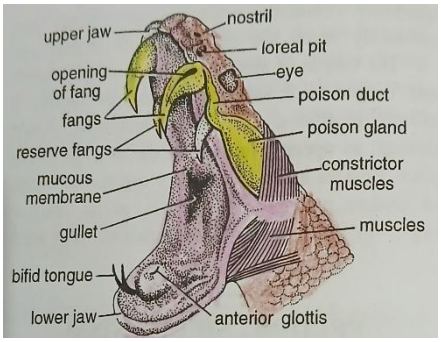

Figure 2: Poison Apparatus of snake

6. Discussion

Snake venoms have been studied much more thoroughly in members of the families Elapidae and Viperidae. There are negative and positive aspects of snake venom. Snake venom is fatal when mixed with blood of victim of snake bite, the venom in the bloodstream of an enemy brought a painful death or a never-healing wound. Snake venoms are known as some of the richest sources of the enzymes. Snake venoms comprise a combination of biological active components that are involved not only in envenomation pathophysiology but also in the development of new drugs to treat many diseases. Some examples are cancer, pain, high blood pressure, heart attacks, strokes, Alzheimer's and Parkinson's disease. There are snake venom-based drugs in the market and in clinical trials. Many snake venom components are now involved in preclinical and clinical trials for therapeutic applications. Scientists can use this snake venom to develop new drugs to treat illnesses. More research is required on snake venom and its use in medical science and drug industry.

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