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Implications of medicinal plants as medicine in snakebite management

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DESCRIPTION

Medicinal plant therapy is one of the most widely used against snakebite induced complications effective practice among folk treatments. This involves application of various plant concoctions prepared usually from leaves or other plant parts. The extracts are either applied to the bite region or are administered orally. A large number of plants and their components are claimed to antagonize the action of snake venoms. Indian plants used in the treatment include *Gymnema sylvestre, Acalypha indica, Capsicum annum, Achyranthus superba, Achyranthus aspera, Capsicum annuum, Datura fastuosa, Strychnos colubrine, Rauwolfia serpentina, Hemidesmus indicus, Aristolochic indica, Mimosa pudica* and *Withania somnifera*. The medicinal properties of herbal extracts are attributed to the presence of diverse classes of bioactive molecules such as phytochemicals, proteins, hydrolytic enzymes, carbohydrates, polypeptides, etc. However plant-based medicines are extensively used to treat snakebite victims, there is no clear reports for active candidates exploited to neutralize snake venominduced local toxicities. In this regard, diverse research groups reported the phytochemicals (secondary metabolites; small molecules) as promising agents to neutralize snake venom-induced local toxicities namely edema, hemorrhage, myonecrosis, tissue necrosis so on. Unfortunately, those plant-based small molecules have failed to reach the Snake venom-induced tissue necrosis and its neutralization. This is not due to lack of neutralizing potency of the small molecules, but rather to the rapid development of local tissue necrosis with an unknown cause, which prevents the inhibitors from accessing to the site of necrosis. There are several scientific reports on pharmacological applications of plant hydrolytic enzymes such as proteases, invertases, β-galactosidase, and DNases. However, the role of plant hydrolytic enzymes, in particular DNases and proteases in the neutralization of venom-induced local tissue necrosis has not been addressed. To evidence the above said ubiquitous form of hydrolytic enzymes is major class of the enzymes present in medicinal plants which are characterized for therapeutic applications including treatment of cancer, chronic wounds, viral disorders so on. Although, the ASV (Anti-Snake Venom is the main treatment. In India, polyvalent ASV, i.e. effective against all the four common species; Russell's Viper, Common Cobra, Common Krait and Saw-Scaled Viper) is used for the treatment of snakebite; it is successful only for the systemic treatment but fails to treat local toxicity. To overview the stated problem for the future therapy against snake venom-induced local toxicity, plant hydrolytic enzymes as an effective and alternative candidate for treatment along with ASV was depicted. With this background, the present research work highlights the importance of medicinal plant species used and recommendations for the treatment of snakebite-induced local toxicities. However, no reports are available for plant hydrolytic enzyme therapy against snake envenomation. Further, we attempted for the first time to show evidence for venom neutralizing properties of plant hydrolytic enzymes, and evidences conclude the remarkable new avenue for the snakebite-induced local toxicity treatment. Snake venom-induced tissue necrosis and its neutralization.

Snake Venom-Induced Tissue Necrosis and its Neutralization

Echis carinatus commonly known as Saw-Scaled Viper belongs to the viperid family and is one among the “Big Four” venomous snakes of India. Instantaneously after *E. carinatus* envenomation, venom toxins induce severe inflammation and progressive tissue necrosis at the bitten site. Although ASV therapy helped to save the snakebite victims from death, the therapy seriously failed to protect from progressive tissue necrosis at the bite site. In addition, recent studies showed that Neutrophils Extracellular Traps (NETosis) at the venom injection site and proposed that the formation of NETs-venom complex

blocks blood vessels leading to hypoxia and progressive tissue necrosis. However, the specific venom toxin/s responsible for NETosis and cellular mechanism involved is unclear. So far many reports suggested that Echis Carinatus Venom (ECV) is rich in Snake Venom Metalloproteinases (SVMPs) and are involved in the local tissue necrosis. Therefore inhibition of these enzymatic toxins present in ECV by specific inhibitors can reveal the enzyme toxin involved in the NETosis resulting in local tissue necrosis.