Cross neutralization of common Southeast Asian viperid venoms by a Thai polyvalent snake antivenom (Hemato Polyvalent Snake Antivenom)

Poh Kuan Leong, Choo Hock Tan, Si Mui Sim, Shin Yee Fung, Khomvilai Sumana, Visith Sitprija, Nget Hong Tan

Department of Pharmacology, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia
Department of Molecular Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia
Queen Saovabha Memorial Institute, Ramathibodi Hospital, Bangkok, Thailand

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ABSTRACT

Snake envenomation is a serious public health threat in many rural areas of Asia and Africa. Antivenom has hitherto been the definite treatment for snake envenomation. Owing to a lack of local production of specific antivenom, most countries in these regions fully depend on foreign supplies of antivenoms. Often, the effectiveness of the imported antivenoms against local medically important species has not been validated. This study aimed to assess cross-neutralizing capacity of a recently developed polyvalent antivenom, Hemato Polyvalent Snake Antivenom (HPAV), against venoms of a common viper and some pit vipers from Southeast Asia. Neutralisation assays showed that HPAV was able to effectively neutralize lethality of the common Southeast Asian viper venoms examined (Calloselasma, Cryptelytrops, Hoplo, and Daboia sp.) except for Tropidoclonius maurus venom. HPAV also effectively neutralized the procoagulant and hemorrhagic activities of all the venoms examined, corroboratively supporting the capability of HPAV in neutralizing viperid venoms which are principally hematotoxic. The study also indicated that HPAV fully prevented the occurrence of hematuria and proteinuria in mice envenomed with Thai Daboia siamensis venom but was only partially effective against venoms of Myanmar D. siamensis. Thus, HPAV appears to be useful against its homologous venoms and venoms from Southeast Asian vipers including several medically important pit vipers belonging to the Viperidae family. Nevertheless, the effectiveness of HPAV as a parasepecific antivenom for treatment of viperid envenomation in Southeast Asian region requires further assessment from future clinical trials.

1. Introduction

Snake envenomation has been a serious yet often neglected global medical threat. According to the highest estimates, 1.8 million envenomings with an annual death toll of 94,000 occur from snakebites worldwide (Kasturiratne et al., 2008). Asia (1.2 million cases and 58,000 fatalities), Africa (420,000 cases and 32,000 fatalities) and America (210,000 cases and 2000 fatalities) are the three worst affected continents. Most of the snake envenomation cases are inflicted by snakes from the Elapidae and Viperidae families (Warrell, 2010). The Viperidae family comprises of four major subfamilies, i.e. Acanthophis (false vipers), Causus (night adders), Viperinae (true vipers) and Crotalinae (pit vipers) (Vidal et al., 2007). Members of the Viperinae and Crotalinae account for most of the mortality and morbidity of viperid envenoming (Chippaux, 2010). The Viperinae subfamily, whose members are known as the "Old World" true vipers, consists of 12 genera and more than 60 species distributed widely across Asia, Africa and Europe; whereas the Crotalinae subfamily, also known as the 'pit vipers', is represented by 18 genera and more than 150 species. Pit vipers are found only in Asia and the Americas. Venoms of the viperid snakes are generally highly hemotoxic and most of the envenomings inflicted by the vipers are often characterized by hemorrhage and tissue necrosis (Gutiérrez et al., 2006).

Antivenom treatment has hitherto been the definitive treatment for snake envenomation. In recent years, owing to high production costs and low profit margin, many antivenom manufacturers have discontinued the production of antivenoms (Theakston and Warrell, 2000; Williams et al., 2011), resulting in a critical global shortage of antivenoms. Such shortage problem could possibly worsen in future if more manufacturers put a halt to the antivenom production due to economic constraints. The concept of producing