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Differential Hematotoxic Activity of Southeast Asian Pit Viper Venoms: The Cross-Neutralizing Effect of Available Antivenoms

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Abstract

Background/Objectives: Pit vipers (subfamily Crotalinae) are responsible for a large proportion of snakebite envenoming cases in Southeast Asia. Envenomation by these snakes commonly causes hematotoxic effects, including platelet dysfunction and coagulation disturbances. Although antivenom remains the mainstay of treatment, species-specific antivenoms are not available for several regional pit viper species. This study evaluated the hematotoxic activities of selected Southeast Asian pit viper venoms and the cross-neutralizing capacity of commercially available antivenoms. **Methods:** Venoms from five medically important pit viper species—*Calloselasma rhodostoma*, *Trimeresurus albolabris*, *T. hageni*, *T. purpureomaculatus*, and *Tropidolaemus wagleri*—were tested. Washed platelets and platelet-poor plasma obtained from healthy individuals (n = 10) were used to assess venom-induced platelet aggregation and coagulation, respectively. The

neutralizing effects of three antivenoms including hemato polyvalent antivenom (HPAV), *T. albolabris* antivenom (TAAV), and *C. rhodostoma* antivenom (CRAV)—were examined in vitro. Results: All tested venoms induced in vitro platelet aggregation (%Max > 50%) and promoted plasma coagulation. At the manufacturer-recommended concentration, TAAV significantly cross-neutralized the hematotoxic effects of *T. purpureomaculatus* and *T. hageni* venoms ($p < 0.0001$) but failed to neutralize coagulation induced by *T. wagleri*. CRAV showed no cross-neutralization against arboreal pit viper venoms. In contrast, HPAV strongly inhibited platelet aggregation and coagulation induced by all tested venoms ($p < 0.0001$). Conclusions: These findings highlight the limited cross-neutralization capacity of monovalent antivenoms against arboreal pit viper hematotoxicity. In contrast, HPAV demonstrated broad cross-neutralizing activity and may represent a practical therapeutic option for Southeast Asian pit viper envenoming when species-specific antivenoms are unavailable. © 2026 by the authors.

Author keywords

antivenom; coagulation; platelet aggregation; snake; venom

Indexed keywords

MeSH

Animals; Antivenins; Asia, Southeastern; Blood Coagulation; Blood Platelets; Cross Reactions; Crotalid Venoms; Crotalinae; Humans; Platelet Aggregation; Snake Bites; Southeast Asian People

EMTREE drug terms

viper venom; snake venom; venom antiserum

EMTREE medical terms

activated partial thromboplastin time; adult; Article; blood toxicity; *Calloselasma rhodostoma*; Crotalinae; evaluation study; female; high performance liquid chromatography; human; in vitro study; male; snakebite; Southeast Asian; animal; blood clotting; cross reaction; Crotalinae; drug effect; drug therapy; Southeast Asia; Southeast Asian; thrombocyte; thrombocyte aggregation

Device trade names

Commercial names given to devices, used for branding and differentiation in the market, commonly referenced in scientific and clinical research.

Tradename	Country	Manufacturer
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Tradename	Country	Manufacturer
IBM SPSS version 21	United States	IBM
Sysmex CS-2500 coagulation analyzer	Japan	Sysmex
Sysmex XN-9000 automated hematology analyzer	Japan	Sysmex
GraphPad Prism version 9.0	United States	Graphpad

Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

snake venom	55230-69-8
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Antivenins

Crotalid Venoms

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