Antivenom

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Antivenom (or **antivenin** or **antivenene**) is a biological product used in the treatment of venomous bites or stings. Antivenom is created by milking venom from a relevant snake, spider, insect, or fish. The venom is then diluted and injected into a horse, sheep, rabbit, or goat. The subject animal will undergo an immune response to the venom, producing antibodies against the venom's active molecules which can then be harvested from the animal's blood and used to treat envenomation. Internationally, antivenoms must conform to the standards of pharmacopoeia and the World Health Organization (WHO).[1]

It is on the WHO Model List of Essential Medicines, the most important medications needed in a basic health system.[2]

Milking a snake for the production of antivenom.

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Medical uses

The principle of antivenom is based on that of vaccines, developed by Edward Jenner; however, instead of inducing immunity in the patient directly, it is induced in a host animal and the hyperimmunized serum is transfused into the patient.

Antivenoms can be classified into monovalent (when they are effective against a single species' venom) or polyvalent (when they are effective against a range of species, or several different species at the same time). The first antivenom for snakes (called an anti-ophidic serum) was developed by Albert Calmette, a French scientist of the Pasteur Institute working at its Indochine branch in 1895, against the Indian Cobra (*Naja naja*). In 1901, Vital Brazil, working at the Instituto Butantan in São Paulo, Brazil, developed the first monovalent

and polyvalent antivenoms for Central and South American *Crotalus* and *Bothrops* genera, as well as for certain species of venomous spiders, scorpions, and frogs.

Antivenoms for therapeutic use are often preserved as freeze-dried ampoules, but some are available only in liquid form and must be kept refrigerated. They are not immediately inactivated by heat, however, so a minor gap in the cold chain is not disastrous. The majority of antivenoms (including all snake antivenoms) are administered intravenously; however, stonefish and redback spider antivenoms are given intramuscularly. The intramuscular route has been questioned in some situations as not uniformly effective.[3]

Antivenoms bind to and neutralize the venom, halting further damage, but do not reverse damage already done. Thus, they should be administered as soon as possible after the venom has been injected, but are of some benefit as long as venom is present in the body. Since the advent of antivenoms, some bites which were previously invariably fatal have become only rarely fatal provided that the antivenom is administered soon enough.

Antivenoms are purified by several processes but will still contain other serum proteins that can act as antigens. Some individuals may react to the antivenom with an immediate hypersensitivity reaction (anaphylaxis) or a delayed hypersensitivity (serum sickness) reaction and antivenom should, therefore, be used with caution. Although rare, severe hypersensitivity reactions including anaphylaxis to antivenin are possible.[4] Despite this caution, antivenom is typically the sole effective treatment for a life-threatening condition, and once the precautions for managing these reactions are in place, an anaphylactoid reaction is not grounds to refuse to give antivenom if otherwise indicated. Although it is a popular myth that a person allergic to horses "cannot" be given antivenom, the side effects are manageable, and antivenom should be given as rapidly as the side effects can be managed.[5]

In the U.S. the only approved antivenom for pit viper (rattlesnake, copperhead and water moccasin) snakebite is based on a purified product made in sheep known as CroFab.[6] It was approved by the FDA in October, 2000. U.S. coral snake antivenom is no longer manufactured, and remaining stocks of in-date antivenom for coral snakebite expired in the Fall of 2009, leaving the U.S. without a coral snake antivenom. Efforts are being made to obtain approval for a coral snake antivenom produced in Mexico which would work against U.S. coral snakebite, but such approval remains speculative. In the absence of antivenom, all coral snakebite should be treated in a hospital by elective endotracheal intubation and mechanical ventilation until the effects of coral snake neurotoxins abate. It is important to remember that respiratory paralysis in coral snakebite can occur suddenly, often up to 12 or more hours after the bite, so intubation and ventilation should be employed in anticipation of respiratory failure and not after it occurs, when it may be too late.

As an alternative when conventional antivenom is not available, hospitals sometimes use an intravenous version of the antiparalytic drug neostigmine to delay the effects of neurotoxic envenomation through snakebite.[7] Some promising research results have also been reported for administering the drug nasally as a "universal antivenom" for neurotoxic snakebite treatment.[8]

Natural and acquired immunity

Although individuals can vary in their physiopathological response and sensitivity to animal venoms, there is no natural immunity to them in humans. Some ophiophagic animals are immune to the venoms produced by some species of venomous snakes, by the presence of antihemorrhagic and antineurotoxic factors in their blood.

It is quite possible to immunize a person directly with small and graded doses of venom rather than an animal.

According to Greek history, King Mithridates did this in order to protect himself against attempts of poisoning, therefore this procedure is often called *mithridatization*. However, unlike a vaccination against disease which must only produce a latent immunity that can be roused in case of infection, to neutralize a sudden and large dose of venom requires maintaining a high level of circulating antibody (a hyperimmunized state), through repeated venom injections (typically every 21 days). The long-term health effects of this process have not been studied. Further, cytotoxic venom components can cause pain and scarring at the immunization site. Finally, the resistance is specific to the particular venom used; maintaining resistance to a variety of venoms requires multiple monthly venom injections. Thus, there is no practical purpose or favorable cost/benefit ratio for this, except for people like zoo handlers, researchers, and circus artists who deal closely with venomous animals. Mithridatization has been tried with success in Australia and Brazil and total immunity has been achieved even to multiple bites of extremely venomous cobras and pit vipers.

Because neurotoxic venoms must travel farther in the body to do harm and are produced in smaller quantities, it is easier to develop resistance to them than directly cytotoxic venoms (such as those of most vipers) that are injected in large quantity and do damage immediately upon injection.

Availability

Antivenoms have been developed for the venoms associated with the following animals:[9]

Spiders

Antivenom	Species	Country
Funnel web spider antivenom	Sydney funnel-web spider	Australia
Soro antiaracnidico	Brazilian wandering spider	Brazil
Soro antiloxoscelico	Recluse spider	Brazil
Suero antiloxoscelico	Chilean recluse	Chile
Aracmyn	All species of *Loxosceles* and *Latrodectus*	Mexico
Redback spider antivenom	Redback spider	Australia
Black widow spider (Latrodectus Mactans) antivenin (equine origin)	Southern Black widow spider	United States
SAIMR Spider antivenom	Button spider	South Africa
Anti Latrodectus antivenom	Black Widow spider	Argentina

Acarids

Antivenom	Species	Country
Tick antivenom	Paralysis tick	Australia

Insects

Antivenom	Species	Country
zoro antilonomico	*Lonomia obliqua* caterpillar	Brazil

Scorpions

Antivenom	Species	Country
Alacramyn	*Centruroides limpidus, C. noxius, C. suffusus*	Mexico
Suero Antialacran	*Centruroides limpidus, C. noxius, C. suffusus*	Mexico
Tunisian polyvalent antivenom	All Iranian scorpions	Tunisia
Anti-Scorpion Venom Serum I.P.(AScVS)	Indian red scorpion	India
Anti-scorpionique	*Androctonus spp.*, *Buthus spp.*	Algeria
Scorpion antivenom	Black scorpion, *Buthus occitanus*	Morocco
Soro antiscorpionico	*Tityus spp.*	Brazil
SAIMR scorpion antivenin	*Parabuthus spp.*	South Africa
Purified prevalent Anti-Scorpion Serum(equine)	*Leiurus* spp.& *Androctonus* scorpions	Egypt
INOSCORPI MENA (Middle East and North Africa)	*Androctonus australis Hector, Androctonus mauritanicus, Androctonus australis garzoni, Buthus occitanus mardochei, Buthus occitanus occitanus, Leiurus quinquestriatus quinquestriatus, Leiurus quinquestriatus hebreus" and related species.*	Spain

Marine animals

Antivenom	Species	Country
CSL box jellyfish antivenom	Box jellyfish	Australia
CSL stonefish antivenom	Stonefish	Australia

Snakes

Antivenom	Species	Country
Polyvalent snake antivenom	South American Rattlesnake *Crotalus durissus* and fer-de-lance *Bothrops asper*	Mexico (Instituto Bioclon)
Polyvalent snake antivenom	South American Rattlesnake *Crotalus durissus* and fer-de-lance *Bothrops asper*	South America
INOSERP MENA	*Bitis arietans, Cerastes cerastes, Naja haje, Macrovipera lebetina obtusa, Vipera palestinae, Naja pallida, Naja nigricollis, Walterinnesia aegyptia, Echis leucogaster, Macrovipera deserti, Cerastes vipera, Cerastes gasperettii, Echis coloratus, Echis pyrramidum, Echis khosatzkii, Echis sochureki, Echis megalocephalus, Echis omanensis, Echis carinatus sochureki; Macrovipera lebetina transmediterranea, Macrovipera lebetina turanica, Macrovipera mauritanica, Naja nubiae, Pseudocerastes persicus fieldi, Pseudocerastes persicus persicus, Vipera bornmuelleri, Vipera latastei, Vipera raddei kurdistanica*	Spain
INOSERP Pan-Africa (Sub-Sahara)	*Naja nigricollis, Dendroaspis polylepis, Echis ocellatus, Bitis arietans, Echis leucogaster, Echis pyramidum, Echis coloratus, Bitis gabonica, Bitis gabonica rhinoceros, Dendroaspis viridis, Dendroaspis angusticeps, Dendroaspis jamesoni, Naja haje, Naja pallida, Naja melanoleuca*	Spain
Polyvalent snake antivenom	Saw-scaled Viper *Echis carinatus*, Russell's Viper *Daboia russelli*, Spectacled Cobra *Naja naja*, Common Krait *Bungarus caeruleus*	India
Death adder antivenom	Death adder	Australia
Taipan antivenom	Taipan	Australia
Black snake antivenom	*Pseudechis spp.*	Australia
Tiger snake antivenom	Australian copperheads, Tiger snakes, *Pseudechis spp.*, Rough-scaled snake	Australia
Brown snake antivenom	Brown snakes	Australia
Polyvalent snake antivenom	Many Australian snakes	Australia
Sea snake antivenom	Sea snakes	Australia
Vipera tab	Vipera spp.	UK
Polyvalent crotalid antivenin (CroFab —Crotalidae Polyvalent Immune Fab (Ovine))	North American pit vipers (all rattlesnakes, copperheads, and cottonmouths)	North America
Soro antibotropicocrotalico	Pit vipers and rattlesnakes	Brazil
Antielapidico	Coral snakes	Brazil

SAIMR polyvalent antivenom	Mambas, Cobras, Rinkhalses, Puff adders (Unsuitable small adders: *B. worthingtoni, B. atropos, B. caudalis, B. cornuta, B. heraldica, B. inornata, B. peringueyi, B. schneideri, B. xeropaga*)	South Africa[10]
SAIMR echis antivenom	Saw-scaled vipers	South Africa
SAIMR Boomslang antivenom	Boomslang	South Africa
Panamerican serum	Coral snakes	Costa Rica
Anticoral	Coral snakes	Costa Rica
Anti-mipartitus antivenom	Coral snakes	Costa Rica
Anticoral monovalent	Coral snakes	Costa Rica
Antimicrurus	Coral snakes	Argentina
Coralmyn	Coral snakes	Mexico
Anti-micruricoscorales	Coral snakes	Colombia

Terminology

The name "antivenin" comes from the French word *venin*, meaning venom, which in turn was derived from Latin *venenum*, meaning poison.

Historically, the term *antivenin* was predominant around the world, its first published use being in 1895.[11] In 1981, the World Health Organization decided that the preferred terminology in the English language would be *venom* and *antivenom* rather than *venin* and *antivenin* or *venen* and *antivenene*.[12]

Antivenom sources

The following groups assist in locating antivenoms:

- Africa: South African Institute for Medical Research, Johannesburg, Republic of South Africa.
- Asia:
  - Bharat serums and vaccines Ltd, India
  - Haffkine Biopharmaceutical Corporation, Parel, Mumbai, India.
  - National Institute of Health (NIH), Islamabad, Pakistan. Produces polyvalent antivenom.
- Australia: CSL Limited, Parkville, Victoria.
- Americas:
  - Brazil: Instituto Butantan, São Paulo
  - Costa Rica: Instituto Clodomiro Picado, San José
  - Mexico: Instituto Bioclon
  - Spain: Inosan Biopharma, SA
  - Mexico: Veteria Labs SA de CV
  - Colorado, United States: Poisindex central office
  - The Antivenom Index of the Association of Zoos and Aquariums and the American Association of Poison Control Centers which helps locate rare antivenoms (online link below)

- The Venom Response Program of the Miami-Dade Fire Rescue service (online link below)

References

1. Theakston RD, Warrell DA, Griffiths E (April 2003). "Report of a WHO workshop on the standardization and control of antivenoms". *Toxicon*. **41** (5): 541–57. doi:10.1016/S0041-0101(02)00393-8. PMID 12676433.
2. "19th WHO Model List of Essential Medicines (April 2015)" (PDF). WHO. April 2015. Retrieved May 10, 2015.
3. Isbister GK. (2002). "Failure of intramuscular antivenom in Redback spider envenoming". *Emerg Med (Fremantle)*. **14** (4): 436–9. doi:10.1046/j.1442-2026.2002.00356.x. PMID 12534488.
4. Bhoite RR, Bhoite GR, Bagdure DN, Bawaskar HS (2015). "Anaphylaxis to scorpion antivenin and its management following envenomation by Indian red scorpion, Mesobuthus tamulus". *Indian Journal of Critical Care Medicine*. **19** (9): 547–549. doi:10.4103/0972-5229.164807.
5. See, for example, the Antivenom Precautions paragraph of the Medication section of James Forster (2006-03-14). "Snake Envenomations, Sea". *eMedicine Emergency Medicine (environmental)*. Archived from the original on 26 June 2006. Retrieved 2006-06-25.
6. http://www.savagelabs.com/Products/CroFab/Home/crofab_frame.htm Link to PDF for full prescribing information, retrieved 11/11/12
7. Franklin, Deborah, "Potential Treatment For Snakebites Leads To A Paralyzing Test (http://www.npr.org/blogs/health/2013/07/30/207050435/potential-treatment-for-snakebites-leads-to-a-paralyzing-test)", NPR.org, July 31, 2013.
8. "Universal antidote for snakebite: Experimental trial represents promising step (http://www.sciencedaily.com/releases/2014/05/140528105256.htm)", California Academy of Sciences via *Science Daily*, May 28, 2014.
9. "Appendix: Antivenom Tables". *Clinical Toxicology*. **41** (3): 317–27. 2003. doi:10.1081/CLT-120021117.
10. Spawls, S; Branch B (1995). *The Dangerous Snakes of Africa*. *Ralph Curtis Books*. Dubai: Oriental Press. p. 192. ISBN 0-88359-029-8.
11. "Antivenin". *Merriam-Webster Dictionary*.
12. World Health Organization (1981). *Progress in the characterization of venoms and standardization of antivenoms*. Geneva: WHO Offset Publications. p. 5. ISBN 92-4-170058-0.

External links

- Snakebite (http://www.emedicine.com/med/topic2143.htm) article on Medscape online resource
- New antivenom could save more snakebite victims (https://web.archive.org/web/20080206004009/http://www.newscientist.com/article.ns?id=dn9277&feedId=online-news_rss20)
- Red Cross Snake Antivenin Online Store (http://www.snake-antivenin.com)
- Antivenom Index (http://www.aza.org/antivenom-index/), a joint project of the Association of Zoos and Aquariums and the American Association of Poison Control Centers which helps locate rare antivenoms
- Venom Response Program (http://www.miamidade.gov/fire/about-special-venom.asp) of the Miami-Dade Fire Rescue service

Categories: Toxicology treatments | Polyclonal antibodies | Antitoxins | World Health Organization essential medicines

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