

Black Widow Spider Envenomation

Introduction

There are over 20,000 species of spiders within the United States and all are venomous. They consume live prey consisting primarily of insects. Their venom is utilized to help secure and digest their prey. There are only 50 species of spiders that have fangs large enough to penetrate human skin and deliver venom. A few species produce venom potent enough to result in significant injury or death to humans. Fortunately, most spider bites are benign and result in minor localized inflammatory reactions. The true incidence of human spider envenomations is unknown. The American Association of Poison Control Centers (AAPCC) reported over 15,000 exposures to spiders nationwide in their last annual Toxic Exposure Surveillance System report (2000). There are probably thousands of additional cases that go unreported each year. Actual fatalities associated with spider envenomations are quite rare. In fact, in the 2000 AAPCC report, there were no fatalities due to spider envenomations. This low mortality rate is primarily because small quantities of venom are delivered with each bite. Most fatalities that occur happen in small children, the elderly, or individuals with significant underlying medical conditions. Two types of spiders are implicated in most of the medically significant spider envenomations: the black widow (genus *Latrodectus*) and the brown recluse (genus *Loxosceles*). This review focuses on the black widow.

Black Widow Spiders

Widow spiders are found all over the world, including Europe, Asia, Africa, Australia, and the Americas. There are five species of *Latrodectus* found indigenously within the United States. They are present in every state except Alaska. The two species that are thought to be responsible for most of the human envenomations occurring within the U.S. are *L. mactans* and *L. hesperus*. The former is found primarily in the eastern part of the country, whereas the latter is found primarily in the west. They are typically found in woodpiles, garages, storage sheds, rodent burrows, or stone walls. Their large, irregular webs will sometimes generate a characteristic crunching sound when manipulated or torn. Only the female is capable of envenomating humans. Mature females are easily identified

by their large globular abdomen, shiny black color, and characteristic red, yellow, or orange hourglass markings on the underside of the abdomen.

Pathophysiology and Clinical Effects of Envenomation

The major component of widow spider venom is alpha-latrotoxin. The venom from the variety of different *Latrodectus* species is structurally similar, which has important implications for antivenom development. Alpha-latrotoxin binds to specific receptors on central presynaptic neuronal membranes causing cation channels to open. These open channels cause a massive influx of calcium and the release of neurotransmitters (primarily acetylcholine) from synaptic vesicles at the neuromuscular junction. This results in excessive muscle depolarization and autonomic hyperactivity responsible for the majority of symptoms associated with widow spider bites.

The classic *Latrodectus* envenomation starts with a localized reaction. There is often a pinprick sensation at the time of the actual bite. Some bites may be painless. The bite site quickly develops into a pale central area with surrounding erythema, producing a 'target' or 'halo' lesion. Two individual fang marks can sometimes be seen within the pale center of these lesions. Usually within one to two hours, a dull crampy type pain begins at and around the bite site. In addition, there can be localized diaphoresis at the site. These local reactions can quickly progress to systemic involvement. Individuals will often have generalized pain in the abdomen, chest, back, and extremity muscles depending on the bite site. Cardiac symptoms include tachycardia, hypertension, and rarely shock or cardiovascular collapse. Respiratory symptoms include chest pain/tightness, shortness of breath, grunting, and respiratory distress. Other reported symptoms include: nausea, vomiting, headache, numbness, weakness, paresthesias, agitation, irritability, and generalized diaphoresis. Patient symptoms often have a waxing and waning quality, which last from 12 to 72 hours. The severity of symptoms is influenced by a variety of factors including the number of bites, the amount of venom injected, and the size and physical condition of the victim. Widow spider

bites tend to be most severe in young children, the elderly, and individuals with serious underlying medical conditions. Clark devised a grading system for widow spider envenomations, as depicted in Table 1.

Table 1. Grading scale for *Latrodectus* spider envenomations.

Grade	Signs & Symptoms
Grade 1	No systemic symptoms Local pain at the bite site Normal vital signs
Grade 2	Muscular pain in bitten extremity Extension of pain to the chest or abdomen Local diaphoresis at bite site/extremity Normal vital signs
Grade 3	Generalized muscle pain to back, chest, & abdomen Diaphoresis distant from bite site/extremity Hypertension/tachycardia Nausea/vomiting Headache

The diagnosis of a widow spider envenomation can sometimes be difficult, especially in young children who cannot verbalize that they have been bitten or in adults when the spider bite was unwitnessed. Evidence of the classic ‘target’ lesion can aid in making the diagnosis. In addition, other subtle findings on physical exam can be helpful. The abdominal pain and associated rigidity of widow spider envenomations can often be mistaken for a surgical abdominal process such as appendicitis. The severity of the pain can be quite intense, and has been likened to that of labor pains or the passage of a kidney stone. Individuals who have suffered a widow spider envenomation usually do not have any peritoneal signs and are in constant motion to try and find a position of comfort. In contrast, individuals with appendicitis or peritonitis typically lie still to minimize peritoneal irritation.

Laboratory

Unfortunately, there is no laboratory test that can confirm a *Latrodectus* envenomation. Most tests are only helpful in excluding other etiologies such as appendicitis or kidney stones. Some laboratory abnormalities that have been reported in case series of widow envenomations include a leukocytosis and an elevated serum creatine phosphokinase. Adults who present with chest pain, chest tightness, or shortness of breath should have an EKG and cardiac enzymes to assess for evidence of ischemic injury, especially in the elderly and those with significant cardiac risk factors.

Management

The management of mild to moderate widow spider envenomations is primarily supportive. Wound cleaning should be performed at the bite site and tetanus status should be updated if needed. Rest, ice, and elevation to the affected bite site can provide some local relief. Oral analgesics are indicated for mild cases. Parenteral opioids, in conjunction with benzodiazepines, are the mainstay of therapy in moderate to severe cases (see Table 2 for dosages and scheduling). Calcium gluconate used to be considered standard treatment for widow envenomations. It has not been shown to provide lasting

relief of symptoms and almost always requires the addition of an opioid or benzodiazepine. Its routine use is no longer advocated.

Hospitalization and possibly antivenom should be reserved for patients exhibiting serious systemic symptoms or inadequate pain control. High-risk patients should be managed conservatively and warrant close observation or admission. High-risk factors include age > 60 years, grade 2 or 3 pediatric patient, or history of hypertension and coronary artery disease.

Table 2. Opioid and benzodiazepine treatment for widow envenomations.

Medication	Dosage	Route	Max Dose	Interval
Morphine	0.1 – 0.2mg/kg	IM/SC/IV	5 – 15mg	every 2 – 4 hrs
Diazepam	0.1 – 0.2mg/kg	IV	5 – 10mg (child) 30mg (adult)	every 2 – 4 hrs
Lorazepam	0.05 – 0.1mg/kg	IV	5mg	every 4 – 8 hrs

Antivenom

There is a commercially available antivenom for black widow spider venom in the U.S. It is an equine-derived IgG product from the venom produced by *L. mactans*. It has been shown to be highly effective in relieving symptoms and reducing the need for hospitalization. Rare reports of serious allergic reactions, delayed serum sickness, and one death due to anaphylaxis related to its use has led to considerable apprehension on the part of some health care providers to utilize this treatment. In reviewing these cases, they almost universally involved rapid IV infusion of undiluted antivenom. The risk of serious reactions can be significantly reduced with the dilution of antivenom prior to administration, a slow rate of infusion, and the routine premedication with diphenhydramine (50mg IV for adults, 1 – 2mg/kg IV for pediatric cases). Patients who are to be given antivenom should have a skin test performed with the product prior to intravenous administration. The development of an urticarial wheal within ten to twenty minutes is considered a positive test. A positive skin test does not necessarily mean that a patient absolutely cannot receive antivenom if in a life-threatening situation. Skin test positive patients should be pretreated with H1 and H2 blockers and IV corticosteroids. In addition, a negative skin test does not mean that an individual will not develop an anaphylaxis reaction when the antivenom is administered. One 2.5mL vial of antivenom is mixed with 50–100mL of normal saline or D5W to infuse intravenously over one hour. Usually only one vial is required for most widow envenomations. Antivenom should be used with caution and under appropriate monitoring conditions. Medications and equipment to manage anaphylaxis reactions should be readily available. Consultation with your local poison control center is recommended prior to its use.

The other complication reported with widow antivenom is serum sickness. The actual incidence of this is relatively low. Serum sickness is more common following the use of

Crotaline polyvalent antivenom for rattlesnake bites due to the large number of vials (10-20) that is often required. Serum sickness can occur several days to two weeks after an individual receives antivenin. It is characterized by fever, rash, myalgias, and hematuria. Treatment is with oral antipyretics, analgesics, and prednisone. The use of antivenom has been advocated for individuals with significant systemic signs of widow envenomation or symptoms refractory to opioids and benzodiazepines. In addition, it should be considered in pediatric patients with grade 2 or 3 envenomations or adults with serious underlying medical conditions.

Paul Bryan, MD
Pediatric Emergency Medicine

Bibliography

- Allen C. Arachnid Envenomations. *Emerg Med Clinics North Am* 1992; 10(2): 269-98.
 Clark RF. The Safety and Efficacy of Antivenin *Latrodectus mactans*. *Clin Toxicol* 2001; 39(2): 125-7.
 Clark RF, et al. Clinical Presentation and Treatment of Black Widow Spider Envenomation: A Review of 163 Cases. *Ann of Emerg Med* 1992; 21(7):782-7.
 Gaudins A, et al. Red-Black Spider (*Lactrodectus hasselti*) Antivenom Prevents the Toxicity of Widow Spider Venoms. *Ann of Emerg Med* 2001; 37(2): 154-60.
 Henkel AW and Sankaranarayanan S. Mechanisms of α -latrotoxin action. *Cell Tissue Res* 1999; 296: 229-233.
 Litovitz TL, et al. 2000 Annual Report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. *Am J Emerg Med* 2001; 19(5): 337-95.
 Moss HS and Binder LS. A Retrospective Review of Black Widow Spider Envenomation. *Ann of Emerg Med* 1997; 16(2): 188-92.
 Reeves JA, et al. Black Widow Spider Bite in a Child. *Am J Emerg Med* 1996; 14(5): 469-71.
 Woestman R, Perkin R, Van Stralen D. The black widow: Is she deadly to children? *Ped Emerg Care* 1996; 12(5): 360-4.


UPDATE FROM THE UPCC

New Website

The UPCC is pleased to announce a new website. Effective August 1, the new web address is: <http://uuhsc.utah.edu/poison>. The site has general information about the poison center, poison prevention education programs, professional education and more. In the health professional section you will find information about our professional education programs, links to current and past issues of Utox Update as well as find out about toxicology clinic referrals. Please visit our new location. Your feedback on our new website would be most helpful.

Speaking of Feedback....

In the next few months we will also be conducting a Needs Assessment Survey of Health Professionals. We want to know what services you need from the Utah Poison Control Center and the best way for us to provide those services to you. We look forward to hearing from you.



Nationwide Toll-Free Number
 The new national toll-free number is here! Calling this number anywhere in the US will connect you with the poison control center for that area. The UPCC hotline can be accessed by this number when calling from within the state. Our other number remains operational.

1-800-222-1222



Meet the UPCC Staff

Debbie Moss

Debbie moved to Utah from Maryland in 1985. She has been with the Utah Poison Control Center for nearly 10 years. She has a bachelor's degree in Nursing from the University of Maryland. Previously, she worked for three years in the Burn Trauma ICU and the Burn Outpatient Clinic as a Wound Care Specialist at the University of Utah Hospital. She has also worked in ICU, Pediatric ICU, Outpatient Psychiatry and more. She runs 50-100 miles a week and is an elite Ultrarunner. Favorite Patients: Geriatrics. Favorite Poisons: Black Widow spider bites and antidepressants. Hobbies: sewing, reading, skiing and camping.

Customer Satisfaction

The UPCC has initiated a customer satisfaction program. A Health Professional Customer Satisfaction survey will be mailed to each health care professional who calls the UPCC to consult on a case. Your input is very important to ensure that we meet our mission and objectives. Please help us improve our service by completing a survey and sending it back in the enclosed self-addressed postage paid envelope. Providing your full name to the specialist at the time of the call, will help us to get the survey to you. If you haven't received a survey, but would like to provide us with feedback, please contact Barbara Insley Crouch at (801) 585-9419 (E-mail: barbara.crouch@hsc.utah.edu) or E. Martin Caravati at (801) 581-7504 (E-mail: martin.caravati@hsc.utah.edu)

From the UPCC Educator: HYDROCARBON UPDATE

The U.S. Consumer Product Safety Commission, CPSC, now requires child-resistant packaging for household products containing hydrocarbons. The purpose of this new law is to prevent injury and death in children under age 5 who are at highest risk for these types of exposures. Children orally explore their environment, tasting and drinking substances that may cause severe adverse reactions. Aspirating products containing 10 percent or more hydrocarbons with low viscosity may lead to chemical pneumonia.

Products now required to be packaged in child-resistant containers include:

Cosmetics:

Baby oils	Suncreams	Nail enamel dryers
Hair oils	Bath oils	Makeup removers
Body oils	Massage oils	

Automotive Chemicals:

Gasoline additives	Fuel injection cleaners
Carburetor cleaners	

Cleaning Solvents:

Wood oil cleaners	Adhesive removers
Spot removers	General use-household
Metal cleaners	Gun cleaning solvents
Oils containing kerosene	

And:

Water repellents containing mineral spirits used for decks, shoes, and sports equipment.

For more information about hydrocarbons contact a poison control specialist at 1-800-222-1222.

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Editorial Advisor

Heather Hunter, MS, CHES

Please send comments and suggestions for future articles to the editor of UTOX Update at:
410 Chipeta Way, Suite 230
Salt Lake City, Utah 84108

Or e-mail at

barbara.crouch@hsc.utah.edu or
martin.caravati@hsc.utah.edu

*CSPI denotes Certified Specialist in Poison Information.

2001 Annual Report

The 2001 Annual Report is complete! If you would like to receive a copy, please contact the UPCC administrative offices at (801) 581-7504 or E-mail: barbara.crouch@hsc.utah.edu. Alternatively, you can download a copy from our new website at <http://uuhsc.utah.edu>.

New Employees

The Utah Poison Control Center is pleased to welcome Kathleen Theresa Anderson, PharmD and Brian R. Beck, PharmD as poison information specialist-pharmacists. Kathleen graduated from the University of Colorado Health Science Center in 2001 and completed a pharmacy practice residency at the VA Medical Center in Salt Lake City in June 2002. Brian graduated from the University of Utah in 2001 and completed an ambulatory care residency in June 2002.

Employment Opportunities

The UPCC has two positions available. The UPCC is looking for a Specialist in Poison Information to work primarily the night shift (seven on, seven off) and for an Assistant Director. You can find out more about these positions on our website at <http://uuhsc.utah.edu/poison>

The Utah Poison Control Center expresses its sincere thanks to

MCNEIL CONSUMER HEALTHCARE

for their generous contribution that allowed us to produce and distribute this newsletter.

Utah Poison Control Center

410 Chipeta Way, Suite 230
Salt Lake City, UT 84108

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