Spiders and Stinging Insects

Brown Bag Webinar Series

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Disclosures

• Speaker
  – Thermofisher
  – Boehringer-Ingelheim
Learning Objectives

- Identify and manage stings in patients with stinging insect allergy
- Identify and manage bites from brown recluse and black widow spiders
- Identify and manage bites from other biting insects

Taxonomy
Epidemiology
(United States)

- Hymenoptera stings account for more than 1 million stings annually.
- Anaphylaxis secondary to Hymenoptera envenomation affects roughly 3% of an adult population, and 1% in children.
- Systemic reactions leading to life-threatening manifestations occurs in approximately 0.4-0.8% of children and 3% of adult patients.
- According the US Bureau of Labor Statistics, from 2003 to 2010, bees accounted for 52 fatal occupational injuries, wasps/yellow jackets 14, and ants 4. Additionally, fatal occupational injuries involving insects, by year, are as follows:
  - 2003: 6 deaths
  - 2004: 10 deaths
  - 2005: 15 deaths
  - 2006: 10 deaths
  - 2007: 11 deaths
  - 2008: 10 deaths
  - 2009: 9 deaths
  - 2010: 12 deaths

Epidemiology

- A 2009 study from Costa Rica reported on Hymenoptera sting fatalities over a 22-year period (1985-2006). The annual number of deaths varied from 0-6 (2.4 deaths/year average), with a total of 52 deaths over the study period. Most deaths were in older (>50 years) and younger (< 10 years) males.
- From 1979 through 1978, 7 fatalities from wasp stings were reported in Australia, all from rural areas; 5 of the 7 had a history of wasp or bee venom allergy.
  - Race
    - No race predilection exists.
  - Sex
    - Hymenoptera stings of all types are more common in males than in females, probably because of more frequent exposure.
  - Age
    - Although most deaths from toxic reactions occur at extremes of age, frequency of bites is not age dependent. Peak incidence of death from anaphylaxis is in people aged 35-45 years.
Taxonomy of Stinging Insects (Hymenoptera)

Hymenoptera

Vespidae

Vespinae

Vespa (yellowjacket)

Vespa analis

Polistes (tarantula hornet)

Polistes (tarantula hornet)

Apid (bumble bees)

Apis (honey bees)

Colletes (sweat bees)

Paravespula

P. occidentalis

P. maculata

Mymaridae

M. idaeus (jap 존재 ant)

Stinging Insect Allergy

Honey Bee

Yellow Jacket

Yellow Hornet

White-faced Hornet

Apids

Vespids
Stinging Insects

- **Solenopsis**
  - Imported Fire Ant

- **Polistes**
  - Paper Wasp

Fire Ants

- The red imported fire ant is found mainly in the Southern U.S.
- They are reddish brown to reddish black and have a stinger.
- They build large dirt mounds, usually in sunny areas.
- Their bite usually is painful, and will cause an itchy, raised area on your skin (hive), followed by a pus-filled blister.
Local reactions

- Only the part of the body near the sting is affected
  - Immediate pain, redness, swelling, and itching at the sting site may occur.
  - A large (greater than four inches across) local reaction may develop over the next 12-36 hours.
  - A bacterial skin infection is uncommon
  - An enlarging area of redness at the sting site is common as is lymphangitis, but this is usually sterile
  - Lip swelling is common and does not indicate impending anaphylaxis
**Fire Ant Stings**

- A fire ant bite causes a welt to develop.
- Hours later, a blister filled with pus can form.
- Over-the-counter pain relievers and antihistamines help relieve the pain and itching
- Do not break the blisters
- Keep the area clean to avoid secondary infection.

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**Systemic Symptoms**

- Systemic or allergic reactions (parts of the body away from the sting are affected)
  - Hives (raised itchy bumps on the skin) and itching all over the body
  - Swelling of the mouth or throat or both
  - Wheezing
  - Shortness of breath or other difficulty breathing
  - Nausea
  - Vomiting
  - Anxiety
  - Chest pain
- In severe cases, marked difficulty breathing, unconsciousness, and even death may occur.
## When a Patient should Seek Medical Care

- A large localized reaction (greater than about 10 inches in diameter) occurs, evidence of infection (increasing pain, swelling, redness, drainage of pus or fever) is present at the sting site.
- It has been more than 10 years since the last tetanus booster.
- Evidence of a generalized allergic reaction
  - The patient should consider calling 911 for an ambulance. (To avoid driving to the hospital if the patient is suffering from an allergic reaction and may lose consciousness and have an accident.)

## Home Treatment of Bee and Wasp Stings

- Most simple insect stings in a nonallergic person can be treated at home.
- Avoid further stings by wearing protective clothing and avoiding infested areas.
- **Note:** Insect repellent does not work for stinging insects.
- Remove any stingers remaining in the skin (most likely from bees) immediately. Some experts recommend scraping out the stinger with a credit card. However, it is probably more important to get the stinger out as quickly as possible than to be overly concerned about how it is removed.
- Application of ice to the sting site may provide some mild relief. Ice may be applied for 20 minutes once every hour as needed. Cloth should be placed between the ice and skin to avoid freezing the skin.
- Consider taking an antihistamine such as diphenhydramine for itching.
- Consider taking ibuprofen or acetaminophen for pain relief as needed.
- Wash the sting site with soap and water. Place an antibiotic ointment on the sting site.
- If it has been more than 10 years since the last tetanus booster, the patient should get one in the next few days.
Sting Avoidance

- Avoid known areas of concentration such as hives and nests.
- Do not molest hives and nests.
- Take care with motorized equipment such as lawnmowers, because they may provoke the insects.
- If flying insects are around, leave the area and refrain from swatting at them.
- Avoid activities outdoors with sugary drinks, brightly colored clothing, and strong fragrances or perfumes because some insects may be attracted to them.
- Wear long pants and long-sleeved shirts because they may also provide some protection.
- Keep outdoor dining and camping areas clean and free from garbage.
- Insect repellant does not work for stinging insects!!!
Epidemiology of Venom Allergy

- Positive venom skin test or blood test in 15%-25% of adults.
- Transient positive skin test or blood test may occur after an uneventful sting in 30%-40% of adults.
- Presence of IgE venom antibody is not necessarily predictive of clinical reactivity or severity.
- Half of fatal reactions occur in people who had no previous reaction to stings.

Diagnostic Tests for Venom – IgE

- Venom-IgE (skin test or serum) is positive in 15%-25% of asymptomatic (history-neg) adults.
- History-pos / IgE-pos patients have no reaction to sting in 30%-70% of cases.
- Presence of venom-IgE is not necessarily predictive of clinical reactivity or severity.
Negative Venom Skin Tests with History of Sting Anaphylaxis

- Refractory (anergic) period
- Variability of venom skin tests
- Mast Cell Disorder
- No longer allergic / Never was allergic?

Negative skin test and serum IgE
- 5% chance of systemic reaction

Diagnostic Evaluation of Patients With History of Systemic Reaction to Stings


<table>
<thead>
<tr>
<th>Test</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin test positive</td>
<td>68%</td>
</tr>
<tr>
<td>ST negative / Blood positive</td>
<td>14%</td>
</tr>
<tr>
<td>ST neg / Blood neg</td>
<td>5.5%</td>
</tr>
</tbody>
</table>
Diagnostic Venom Test Reactivity after Systemic Sting Reaction  (Goldberg et al; JACI 1997)

<table>
<thead>
<tr>
<th>Time after sting</th>
<th>1 week</th>
<th>4 - 6 week</th>
<th>Any</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Test Positive</td>
<td>20 (53%)</td>
<td>15 (39%)</td>
<td>35 (92%)</td>
</tr>
<tr>
<td>Blood Positive</td>
<td>24 (63%)</td>
<td>8 (21%)</td>
<td>32 (84%)</td>
</tr>
<tr>
<td>Any Positive</td>
<td>30 (79%)</td>
<td>8 (21%)</td>
<td>38 (100%)</td>
</tr>
</tbody>
</table>

Elevated Tryptase (Mastocytosis) and Insect Sting Anaphylaxis

- Elevated baseline serum tryptase in:
  - 5 -10% of patients with sting anaphylaxis
  - up to 25% of patients with hypotensive shock

- Elevated tryptase associated with:
  - more severe reactions to insect stings
  - more frequent systemic reactions during VIT
  - more frequent VIT treatment failure
  - more frequent relapse after stopping VIT
Venom Immunotherapy: Who Needs It?

- Positive venom skin test or serum test, AND
- History of systemic reaction to sting
  - Life-threatening
  - Moderate throat/airway symptoms or dizziness
  - Cutaneous systemic ?
  - Large local ?

Systemic reaction to repeat stings

(Reisman JACI 90:335-9;1992.)

- ≤ 16 y.o. 45/112 (40%)
- > 16 y.o. 79/108 (73%)
- No decline in reaction rate over 10 years
- Variable reaction to repeated stings
Severity of Reaction to Sting Challenge vs Severity of Previous Sting Reaction

Golden et al 2007;119:S149 (Abstr)

<table>
<thead>
<tr>
<th>Previous Reaction (Hx)</th>
<th>Sting Challenge Reaction</th>
<th>Mild</th>
<th>Mod</th>
<th>Severe</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>(81)</td>
<td>10</td>
<td>2</td>
<td>12</td>
<td>15%</td>
</tr>
<tr>
<td>Moderate</td>
<td>(137)</td>
<td>18</td>
<td>5</td>
<td>23</td>
<td>17%</td>
</tr>
<tr>
<td>Severe</td>
<td>(41)</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>32%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>(259)</strong></td>
<td><strong>35</strong></td>
<td><strong>9</strong></td>
<td><strong>48</strong></td>
<td><strong>19%</strong></td>
</tr>
</tbody>
</table>

Insect Sting Allergy in Untreated Children
Long-term Follow-up (15-20 yrs)

(Golden et al, NEJM 2004.)

<table>
<thead>
<tr>
<th>History</th>
<th>Cutaneous Systemic</th>
<th>Mod-Severe Systemic</th>
<th>Large Local</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contacted</td>
<td>193/352</td>
<td>46 / 69</td>
<td>110 / 226</td>
</tr>
<tr>
<td>Stung (%)</td>
<td>89 (46%)</td>
<td>22 (49%)</td>
<td>44 (40%)</td>
</tr>
<tr>
<td>Systemic (%)</td>
<td>12 (13%)*</td>
<td>7 (32%)*</td>
<td>3 (7%)</td>
</tr>
</tbody>
</table>

*p = 0.05
Natural History of Insect Allergy: Risk Based on Severity of Previous Reactions

<table>
<thead>
<tr>
<th>Previous Sting Reaction</th>
<th>Any</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life-threatening</td>
<td>50 - 75%</td>
<td>30%</td>
</tr>
<tr>
<td>Moderate Systemic</td>
<td>30 - 50%</td>
<td>10%</td>
</tr>
<tr>
<td>Cutaneous Systemic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– child</td>
<td>1 - 10%</td>
<td>&lt;3%</td>
</tr>
<tr>
<td>– adult</td>
<td>10 - 20%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>Large Local</td>
<td>5 - 10%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Controlled Trial of Venom Immunotherapy

(Hunt et al, NEJM 1978)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Stung</th>
<th>Systemic (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venom (n=19)</td>
<td>18</td>
<td>1 (5%)*</td>
</tr>
<tr>
<td>W B E (n=20)</td>
<td>11</td>
<td>7 (64%)</td>
</tr>
<tr>
<td>Placebo (n=20)</td>
<td>12</td>
<td>7 (58%)</td>
</tr>
</tbody>
</table>

* after crossover, total 1/55 = 2% on VIT (p<0.01)
Severe of Sting Reactions Before VIT and After Discontinuing VIT (n=89)

<table>
<thead>
<tr>
<th>Sting Reaction</th>
<th>Before VIT</th>
<th>After VIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Gen. Urticaria angioedema (only)</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Respiratory</td>
<td>41</td>
<td>3</td>
</tr>
<tr>
<td>Hypotension</td>
<td>35</td>
<td>1</td>
</tr>
</tbody>
</table>

Mean Duration of VIT = 6.5 years (5-9 years)
Mean Interval After VIT = 3.5 years (2-7 years)

Epinephrine Auto-injectors for Insect Allergic Patients

Low risk
- large local reactors?
- children with cutaneous systemic reactions?
- on VIT?
- discontinued VIT?
- affected relative?

High Risk
- Systemic reaction during VIT
- Severe history
- Elevated baseline tryptase
Insects and Spiders

Black Widow Spider vs. Brown Recluse Spider

- Most spiders are harmless
- The black widow spider and the brown recluse spider are exceptions
- Both are more common in the southern U.S. and in warm, dry climates
- They tend to be found in environments that are undisturbed such as basements, closets, attics, under sinks, or in wood piles.
Black Widow Bites

• The bite of a black widow spider can affect a person’s nervous system.
• The spider produces a potent neurotoxin
• Some people may have a minimal reaction, while others may suffer from a severe response.
• Victims may experience these symptoms within an hour after being bitten:
  – severe muscle cramps
  – abdominal pain
  – weakness, and tremor
  – In severe cases nausea, vomiting, faintness, dizziness, chest pain, and respiratory difficulties.

Brown Recluse Spider

• Brown recluse venom is more potent than that of a rattlesnake
• It is toxic to cells and tissues.
• Because the bite releases smaller quantities of poison into its victims, brown recluse bites cause less damage than rattlesnake bites.
Brown Recluse Symptoms

- Brown recluse spider bites may not even be noticed at first as they are often painless.
- Some people may notice minor stinging such as that felt with a bee sting when bitten.
- Symptoms of a brown recluse spider bite develop within eight hours after being bitten
  - severe pain at the bite site
  - severe itching
  - nausea, vomiting, fever
  - muscle pain

Black Widow Spider

- It gets its name from the erroneous belief that the female spider kills the male after mating
- There are five species of black widow spiders in the U.S.
- the southern black widow and the northern black widow are the most common.
- The spider is medium-sized and about half-inch long.
Southern Black Widow Spider

- The southern black widow spider is one of the two commonly found species of black widow spiders found in the U.S.
- Can be identified by its shiny, black, globular abdomen with the distinctive red hourglass shape on its underside.

Northern Black Widow Spider

- The northern black widow spider doesn’t have the red hourglass shape on its belly
- It can be identified by a row of red spots (spots may also be yellow or white) down the middle of the upper surface of its abdomen, and two crosswise bars on the underside
- The spider may be brown or have red legs
Brown Recluse Spider

- Native to the U.S. Midwest and Southeast
- It is rare to find them outside these areas
- There are 13 other species of spider in the same family that may be falsely identified as a brown recluse

Brown Recluse Spider

- Brown recluse spiders are identified by their characteristic violin pattern on the back of the cephalothorax (the part of the body where the legs attach).
- The base of the violin appears to be at the head of the spider and the neck of the violin points to the rear.
- Brown recluse spiders are small with one-inch legs, non-hairy, yellow-tan to dark brown in color, and darker legs.
- Most spiders have eight eyes, but the brown recluse has just six – it belongs to the genus Loxosceles.
- This feature is usually too small for people to see with the naked eye.
Habits of a Black Widow

- Black widow spiders are active at night (nocturnal), and they prefer dark areas.
- They tend to avoid houses where people live, but they may be found in garages or sheds.
- Only female black widow spiders bite humans, and they only do so if disturbed.

Habits of a Brown Recluse Spider

- Brown recluse spiders are not aggressive and will only bite if they feel threatened.
- They prefer dark, warm, dry environments such as attics, closets, basements, barns, and wood piles.
- Most brown recluse bites occur during the summer.
- The spider searches for prey at night and rests in the day in its small web, which is usually constructed in corners or crevices.
Black Widow Spider Bite

- A black widow spider bite may appear as double fang marks at the site of the bite.
- The bite is described as feeling like a pinprick, though there may only be a small localized reaction.
- Blood pressure or heart rate may rise.
- The severity of the reaction to the bite depends on the age and overall health of the victim.
- Children and the elderly are usually more seriously affected.

Progression of Black Widow Spider Bite

- Hours after being bitten by the black widow spider, the bite injury will swell.
- In the case pictured, two days after being bitten the redness and swelling continued past the elbow and down the forearm of the victim.
- Eight days after the bite, the swelling went down, the bite opened, and the infection was nearly gone.
Brown Recluse Spider Bite

- A brown recluse spider bite may appear slightly red and when you look closely you may see fang marks.
- In most cases, the bite site will become firm and will heal over the following days to weeks with minimal scarring.
- In some cases the local reaction will be more severe with redness, blistering, blue discoloration, tissue death, and scarring.
- Pictured: the bite area swelled to quarter-size within an hour, and within a day continued to swell, turning blue and dark red.

Progressed Brown Recluse Bite (Day Three)

- In severe cases, the reaction to a brown recluse spider bite can lead to death of the skin (necrosis) and subcutaneous fat.
- Pictured: the same patient as in the previous slide, after three days, with initial stages of skin necrosis.
Progression of Brown Recluse Spider Bite (Day Nine)

- As the reaction to the brown recluse spider bite progresses, severe necrotic lesions with deep, wide borders can result.
- Pictured: the same patient in the previous slides, eight days following the bite.
- The wound remained open the entire time for the spider’s toxins to drain, and the patient needed constant intravenous antibiotics and pain medications.

Brown Recluse Spider Bite (Day 38)

- Eleven days after the brown recluse spider bite a five-inch wide area of dead tissue was removed, and a skin graft was needed.
- Pictured: skin graft results 38 days after the bite.
When to Seek Medical Care For a Black Widow Spider Bite?

- Seek care immediately following a black widow spider bite at a hospital emergency department.
- Most doctor’s offices or urgent care centers are not equipped to deal with these types of injuries.
- Treatment for pain may require narcotic pain relievers and antivenin to counter the effects of the spider venom, which can usually only be found in a hospital setting.

Self-Care Home Treatments For a Black Widow Spider Bite

- For minor black widow spider bites, home care treatments are limited.
- Cold or warm compresses and hot baths may help ease pain.
- Over-the-counter pain relievers such as acetaminophen (Tylenol) or ibuprofen (Advil, Motrin) may help for mild bites.
- Folk remedies do not work.
When to Seek Medical Care For a Brown Recluse Spider Bite

- If a patient has been bitten by a brown recluse spider they should see a doctor immediately or go to a hospital emergency department.
- If possible, bring the spider to the doctor’s office so the physician can identify the spider to help make the proper diagnosis.

Self-Care Home Treatments For a Brown Recluse Spider Bite

- Clean the wound area thoroughly with soap and water first, and then seek medical care.
- Home care is for relief of symptoms only after treatment by a doctor.
- Apply ice to decrease pain and swelling, and take acetaminophen (Tylenol) for pain.
- Elevate the area above the heart if possible.
- Avoid strenuous activity which can spread the spider venom through the skin.
Ticks

- Ticks are often found in plants and brush, and can attach to and bite people and animals.
- Most tick bites are not harmful; however, ticks can carry serious diseases including Lyme disease and Rocky Mountain spotted fever.

Tick Bites

- Most commonly, ticks attach to warm, moist, and hard-to-see parts of the body including the scalp, armpits, groin, skin folds, and other hairy areas.
- Ticks must be removed properly to minimize the chances of infection:
  - Wear appropriate clothing outdoors to reduce exposure
  - Use tick repellant with DEET
  - Check for ticks if you spend time in the woods
Lyme Disease

- The Lyme disease bacterium is carried in the deer tick (in the northeastern, mid-Atlantic, and north-central U.S.) and the western blacklegged tick on the Pacific Coast.
- In most cases, the tick must be attached 36-48 hours to spread Lyme disease.
- A circular, red, expanding rash (erythema migrans, or a “bullseye” rash) is one of the first symptoms of Lyme disease.
- Other symptoms include fatigue, chills, fever, headache, muscle and joint aches, and swollen lymph nodes.
- Treatment in the early stages with antibiotics is generally effective.

Fleas

- Fleas are about 2.5 millimeters (mm) long, they are reddish-brown in color, and can jump large distances.
- They suck blood from their host to feed.
- Some people may develop an allergic reaction to a flea bite.
- Scratching an itchy flea bite can cause the skin on and around the bitten area to break open, which can lead to infection.
- Make sure all pets in the home are on flea preventative products,
- treat any flea infestations that may occur.
Chiggers

- Chiggers are a type of mite from the family known as *Trombiculidae*.
- They are barely visible to the naked eye, and in their juvenile (larval) form, can bite humans.
- Chiggers found in the U.S. do not spread disease.
- Their bites can cause intense itching and small red bumps.
- Itching from chigger bites is most intense 1 to 2 days following the bite.
- This is when the chigger falls off and can leave red welts that may resemble a blister or pimple.
- Scratching can lead to a secondary infection; treatment is directed at relief of itching.
- Over-the-counter antihistamine creams help relieve itching and prevent scratching.

Scabies

- Scabies are mites that burrow into the skin, causing intense itching.
- Scabies spread by close contact with a person infested with scabies, or by sharing towels, sheets, and other personal items with a person infested with scabies.
Scabies

- It can take weeks after the scabies mites burrow into the skin before severe itching or rash, with small blisters or sores.
- The intense itching is usually worse at night.
- Most commonly, the itching will be between the fingers, on the outside of the elbows or armpits, around the waistline, or on the buttocks.
- Scabies can only be cured with medicated creams, lotions, or pills.
- Family members who share a household with a person infested with scabies may also be prescribed treatment.

Bedbugs

- Bedbugs are reddish brown, and less than 1 millimeter (mm) in size.
- They are frequently found in bedding, but can also be found in areas of clutter, or in old furniture.
- Most of the time, the reaction to a bedbug bite is mild, and usually in the form of small, red, itchy bumps.
- Treatment includes over-the-counter cortisone creams and antihistamines to relieve the itching.
- Excessive scratching can cause a secondary infection.
Mosquitoes

- Mosquitoes cause itchy hives when they bite.
- But they can also carry diseases such as West Nile virus, dengue fever virus, malaria, and others.
- Scratching mosquito bites can also cause infection.
- Prevent mosquitoes in your yard by draining standing water.
- Keep them out of your home by using window screens.
- To protect yourself, always use insect repellent when outdoors, wear protective clothing, and avoid being outdoors during peak mosquito hours of dawn and dusk.
- It is possible to be allergic to mosquito bites, however, there is no specific treatment for that.
- Patients with large mosquito bites do not need to carry epinephrine.