What’s bugging you????

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Objective
- Identify the arthropods discussed
- Recognize the cutaneous manifestations associated with the specific arthropods
- Discuss management of arthropod bites

Introduction
- Arthropod bites are a major cause of patient morbidity
- Can cause local or systemic effects
  - mechanical, toxic, infectious or inflammatory in nature
- Arthropods are vectors of potentially serious insect-borne diseases (e.g., Zika virus)

Arthropods in the garden
- Most likely encountered:
  - Spiders
  - Mites
  - Mosquitoes
  - Flies
  - Bees, wasps, ants
  - Caterpillars, moths, butterflies

Clinical reaction to arthropods influenced by
- Age
  - children and elderly tend to react more severely
- Presence of other skin disease
  - Atopics more likely to have severe reactions
- Immune status

Epidemiologic factors influencing reactions to arthropods
- Clothing- worn or not, color
- Perfume worn
- Repellants used
- Housing construction
- Pets
- Overcrowding, poor sanitation
- Political status of area (war, famine)
- Occupation

General Management
- Avoidance
• Symptomatic
  – Better if arthropods can be identified

9 Classification of Arthropods

10 Audience Response System

• Bites from which of the following spiders do NOT cause systemic symptoms?
  A) Lactrodatus mactans
  B) Loxosceles reclusa
  C) Tegenaria agrestis
  D) Phidippus formosus

11 Lactrodatus mactans (Black Widow)

• Throughout North America but most common in Southern and Western U.S
• Workplaces with undisturbed areas
  – Woodpiles, under eaves, fences or where debris have accumulated
  – Outdoor toilets
• Webs between objects
  – Not aggressive
  – Bites occur when humans come into direct contact with webs

12 Lactrodatus mactans (Black Widow)

• More active during warmer months
• Females are larger, darker and more venomous
• Black and shiny
  – red to orange hourglass, spots or stripes on abdomen
• Bites are painful
  – Not necrotic

13 Lactrodatus mactans (Black Widow)

• Venom: alpha lactrotoxin (neurotoxin)
• Latrodectism
  – alpha-lactrotoxin causes massive presynaptic release of neurotransmitters (acetylcholine, norepinephrine, etc)
  – Symptoms:
    • Occurs within 30 minutes to a few hours
    • Generalized pain, muscle cramps, and rarely fasciculations
    • Face may be contorted into grimacing expressions
    • Abdomen may become rigid, mimicking acute abdomen
    • Rarely, respiratory arrest, seizures, death
    • Usually resolves over a 3-7 day period
• Antivenom may be helpful in up to 90 hrs

14 Loxosceles reclusa (Brown Recluse)

• Midwestern and Southern U.S
• Workplaces w secluded, dry, sheltered areas
  – Underneath structures, logs, or in piles of rocks, leaves
• Dark areas indoors
  – Closets, shoes, attics
• Violin spiders
  – 6 eyes

15 **Loxosceles reclusa (Brown Recluse)**
• Bites may be burning or painless
• 6 hrs later: delineated ischemic area
  – Marble plaque: cyanotic, pale and erythema in affected area
  – +/- blister w hemorrhagic content
  – Very painful

16 **Loxosceles reclusa (Brown Recluse)**
• 1 wk:
  – plaque -> frank necrosis
  – eschar may be attached for up to three wks. No longer painful
• Eschar eventually falls off-> granular base w elevated borders
• Ulcer will resolve in months

17 **Loxosceles reclusa (Brown Recluse)**
• Venom: Several, Sphingomyelinase-D
• Viscerocutaneous loxoscelism
  – Fever, chills, vomiting, joint pain, hemolysis
  – hematuria, thrombocytopenia, hemolytic anemia-> shock and death
  – 5% hemolysis progress to acute renal failure
  – More severe in children

18 **Loxosceles reclusa (Brown Recluse)**
• Management
  – Ice
  – Avoid surgery
  – Antivenom (antivenin) and/or sulfones
    • Prevent/slow down the neutrophil migration to the point of necrosis

19 **Tegenaria agrestis (Hobo)**
• Pacific Northwest of United States
• Build funnel webs in holes, cracks and recesses
• Indoors: between storage boxes, on window sills, under heaters or radiators, behind furniture
• Do not climb but fast runners
• Herringbone pattern on abdomen

20 **Tegenaria agrestis (Hobo)**
• Bites may be painless
– Induration, erythema, numbness
– Necrotic eschar
• ? Venom
  – Can have systemic reaction -> hemodynamic changes

### Other Necrotic Araenism

- Running spider
- Sac spider
- Garden spider

### Phidippus Formosus (Jumping spider)
- Southern U.S
- Aggressive spider
- Dark body hairs and various white patterns
  - Most commonly encountered species started out a orange and black as juvenile and ends up w black and white as adult
- Bites are painful
- No systemic symptoms
- Venom: Hyaluronidase

### Theraphosidae (Tarantulas)
- Frequently found in Southwestern U.S
- World’s longest-lived (females live 25-30 yrs) and largest spiders (18-24 cm leg span)
- Do not build webs, live in underground burrows beneath rocks and embankments
- Popular household pets

### Theraphosidae (Tarantulas)
- Urticating hairs
  - Can cause pain by activating capsaicin receptor
  - Skin-> pruritic dermatitis
    • Remove urticating hairs as soon as possible
  - Lodge in cornea causing ophthalmia nodosa
    • Ophthalmia nodosa should be managed by ophthalmologist
    • Can become chronic w loss of vision
- No systemic toxicity

### Scorpions
- Southern and Southwestern U.S
  - Most live in dry, desert areas
  - *Centruroides exilicauda* (formerly *C. sculpturatus*) and *C gertschi* are primary species in the U.S
- Hide during the day, active at night
- Hide under rocks, wood or anything on the ground
Some species can burrow into the ground

- They are shy—> only sting in defense

### Scorpions

- Lobsterlike pedipalps for grasping their prey, a bulbous sac and pointed stinger at the end of their tail-like abdomens

### Local reaction
- Majority of stings do not have skin manifestation
- Burning pain at site +/- numbness beyond
- Some can cause necrosis, purpura—> ulcerate
- Regional swelling
- Ecchymosis, lymphangitis

### Systemic reaction
- Cardiopulmonary: hypertension, arrhythmias, pulmonary edema (most feared)
- Most scorpion stings cause cardiopulmonary problem w/o signs of cutaneous manifestation
- Neurologic: irritability, restlessness, tremor, convulsions, coma
- *C. exilicauda* has a powerful neurotoxin
  - muscle spasticity, excessive salivation, nystagmus, blurred vision, respiratory distress, and slurred speech
- Untreated stings maybe fatal in infants and young children

### Treatment
- All severe stings should be treated w anti scorpion serum
  - Anascorp: *Centruroides* Immune F(ab')2 injection approved in 2001
  - Analgesics without vasoconstrictors and local ice packs
- Any child stung by a scorpion, especially one identified as *C exilicauda*, should be admitted to a pediatric intensive care unit for monitoring

### Lyme Disease

- Tick-borne illness caused by *Borrelia burgdorferi* sensu lato
  - US: *B. Burgdorferi*
  - Europe: *B. Burgdorferi* < B *Afzelii, B garinii*
  - Asia: *B Afzelii, B Garinii*
- Transmitted by the *Ixodes* ticks
  - Rarely transmitted
diseases if attached
  < 48 hrs

### Three clinical stages:
- Early localized: erythema migrans w or w/o constitution symptoms (few days to 1mo)
- Early disseminated: multiple erythema migrans lesions (days to wks) and/or neurologic and/or cardiac findings (wks to mos)
- Late: intermittent or persistent arthritis on large joints (esp knee) and/or subtle encephalopathy or
polyneuropathy (mos to yrs)

33 Lyme Disease
- Serologic tests
  - Must applied to the appropriate patients
  - Adjunct to clinical diagnosis
  - Neither establish nor exclude the dx of lyme, simply changes the probability that a person has been infected
- Indication for serologic testing: hx of living or traveling to endemic area + risk factor to tick exposure + symptoms c/w early disseminated or late lyme disease

34 Lyme Disease
- Patients w EM who lives in endemic area should be treated for early lyme
  - Doxy 100 mg bid x 10-21 d (> 8 yo)
  - Amoxicillin 500 po tid x 14-21 d
  - Cefuroxime axetil 500 po bid x 14-21 d

35 Lyme Disease-Prophylaxis
- Infectious Diseases Society of America, prophylaxis (doxy 200 mg once) only for those who meet ALL the following criteria:

36 Mites
- Injure skin with their feeding habits and are vectors of numerous diseases
- Lack division between the abdomen and cephalothorax
- With the exception of Demodex and scabies mites, do not burrow and fall off after feeding
- Produce pruritus or allergic reactions through salivary proteins deposited during feeding

37 Chiggers (Harvest mites)
- Most common mite to attack humans
- Larval forms of the Trombiculidae family
  - Eutrombicula alfreddugesi most common species
- Contact usually occurs in summer and fall

38 Chiggers (Harvest mites)
- Gravid female lays eggs in soil-> red larvae crawl in search for suitable host
- Larvae insert their feeding parts into the epidermis feasting on tissues

39 Chiggers (Harvest mites)
- Intensely pruritic papules on ankles, legs or beltline 3-24 hours after the bites
  - new eruptions may occur for 2 days; duration may be up to 3 weeks
- In some parts of world, Trombicula species carry Rickettsia Tsutsugamushi (scrub typhus)

40 Crusted Scabies
- Scabies curstosa, Norwegian scabies, keratotic scabies
- Compromised cellular immunity
  - AIDS, Leprosy, lymphoma, etc
- Older pts w neurological disorder (Down syndrome)
- Minimal or absent itch

41 Crusted Scabies
- Poorly defined erythematous patches -> prominent scales -> crusts and fissures
- ANY areas can be affected
  - Favors scalp, hands and feet

42 Crusted Scabies
- Thickened, discolored, dystrophic nails
- May be come warty over bone prominences
- Malodorous
- Hundreds to thousands of mites

43 Crusted Scabies
- Complications:
  - Fissures -> port of entry for bacteria
- Needs to be isolated !!!
- Topical permethrin alone requires repeated application, high failure rate
- CDC:
  - 5% permethrin qd x 7 d then twice a week until cure
  - Oral ivermectin 200 mcg/kg/dose on d1, 2, 8, 9, 15 (day 22, 29 for those w severe infestation)

44 Coleoptera (Beetles)
- Blister beetle (*Lytta vesicatoria*)
  - Found in alfalfa fields and Southern U.S in flower beds
  - Do not bite or sting
  - Cantharadin, disrupt desmosomal plaques -> vesicles and bullae

45 Coleoptera (Beetles)

46 Hymenoptera (Bees, Wasps, Ants)
- Evolved poison glands for defense or overcoming prey
  - Honey bee (*Apis mellifera*)- leave a barbed ovipositor and paired venom sacs impaled in its victim; dies after stinging since it eviscerates itself after depositing its venom sac
  - Bumble bee, wasp- do not have barbed stingers and may sting repeatedly

47 Hymenoptera (Bees, Wasps, Ants)
- Stings can result in local reaction to fatal anaphylactic reaction
- Local reactions:
  - Immediate burning, pain followed by intense local erythematous wheal
  - “Normal” reaction subsides in several hours.
  - More severe local reactions can last up to 7 days (due to venom-specific IgE antibodies, cell-mediated immune response)
**48** Hymenoptera (Bees, Wasps, Ants)
- Systemic reaction
  - Massive stings -> multiorgan failure b/c venom is rich in phospholipases
  - Occur in 0.4-3% of patients
  - Generalized urticaria, angioedema, bronchospasm
  - Treatment: subcutaneous epinephrine, oral/parenteral diphenhydramine, systemic steroids for persistent symptoms. Needs to be monitored.
  - Intradermal skin puncture tests with very dilute venom identify patients with circulating venom-specific IgE
- Venom immunotherapy and EpiPen

**49** Fire Ants (Solenopsis invicta)
- First came to the U.S in 1930s
  - Mostly in Southeastern U.S

**50** Fire Ants (Solenopsis invicta)
- Attack in groups, aggressive
- Anthill is disturbed -> swarm and inflict multiple sting any passerby with venomous apparatus at base of abdomen
  - Up to 3000 stings on one person are not uncommon

**51** Fire Ants (Solenopsis invicta)
- Simultaneous injury w/ bites and stings
  - Venom: Solenopsin D -> release of histamine and vasoactive amines
- Sting begins as intense wheal and flare -> sterile pustule

**52** Fire Ants (Solenopsis invicta)
- Ants bite then pivot and sting in circular pattern -> ring shape pustules
- Become bullous

**53** Fire Ants (Solenopsis invicta)
- May pose greatest risk for anaphylaxis to adults who live in endemic areas
- Immunotherapy with fire ant whole-body extract
- Economic burden b/c of damage to livestock and crops

**54** Audience Response System
- Which one of the following patients will most likely benefit from venom immunotherapy?
  A) Patient with family history of anaphylactic reaction to bee stings
  B) Adults and children with skin reaction, such as urticaria and peripheral angioedema, to bee stings
  C) Patients with severe systemic reactions to bee stings
  D) Anyone who loves outdoor gardening

**55** Who needs immunotherapy?
• Stings by insect of the Hymenoptera order causes systemic reaction in ~3% of U.S. adults
• At least 40 die annually from these stings
  – 20% of anaphylactic related deaths
• In those with severe systemic reactions, 50% will experience anaphylaxis to future stings
  – With venom immunotherapy (VIT), this risk is <5%.

56  Who needs to be screened?
• No need to screen asymptomatic patients
  – >20% adults are sensitized to insect venom but not at an elevated risk for anaphylaxis
• Those w severe systemic reactions-> refer for testing. If positive:
  – VIT x 5 yrs, Epipen, avoid insect
• No consensus if low risk pts need Epipen

57  Who does NOT need VIT?
• Those with large local reaction
  – Treat symptomatically
  – Risk of anaphylaxis is < 5%
• Skin only systemic reaction (urticaria, peripheral angioedema)

59  Other recommendations
• Measuring baseline serum tryptase
  – high risk for anaphylaxis
  – mastocytosis
• B-blockers and ACE inhibitors may increase risk of serious adverse events from stings or VIT, uses w VIT if absolutely necessary

60  Lepidoptera (Caterpillars, Butterflies, Moths)
• 50-150 species of lepidoptera are thought to produce lepidopterism
• Specialized hairs (setae) with irritant and allergenic properties
  – mechanical irritation from pointed setae
  – cell-mediated hypersensitivity to the setae
  – toxin injection through hollow setae
• Incidence increases in warm weather
• Pets
  – may transport allergenic setae on their fur into the home or workplace

61  Lepidoptera (Caterpillars, Butterflies, Moths)
62  Lepidoptera-Gypsy Moth Caterpillar
• Massive infestation in NE US

63  Lepidoptera-Gypsy Moth Caterpillar
• Pruritic, stinging dermatitis with erythematous papules in linear streaks
  – Dyspnea, respiratory difficulties
• Resolved within a few days to 2 weeks

64 Lepidoptera- Puss caterpillars
• Found along eastern seaboard and states bordering Gulf of Mexico (esp Texas)

65 Lepidoptera- Puss caterpillars
• Sting results in intense pain and characteristic train-track/grid like pattern of purpura
  – due to hairs that penetrate skin and inject venom

66 Lepidoptera (Caterpillars, Butterflies, Moths)
• Treatment:
  – Stripping of setae from skin with adhesive tape

67 Diptera (Flies, Mosquitoes)
• Transmit more diseases worldwide than any other arthropod
  – Anopheles mosquito- malaria
  – Culex mosquito- filarial disease, encephalitis virus, west nile virus
  – Aedes mosquito- yellow fever, dengue, chikungunya, zika
• In US, female Aedes mosquitoes are responsible for most bites

68 Diptera (Flies, Mosquitoes)
• Pruritic wheals and papules
  – injection of irritating salivary secretions
• Depending on individual sensitivity, bites may have an urticarial, vesicular, eczematoid or granulomatous appearance

69 West Nile Virus
• Mosquitoes are responsible for outbreaks of West Nile virus in US
  – Culex mosquitoes

70 West Nile Virus
• West Nile fever develops in 20% of infected persons
  – Flu-like illness
  – Erythematous macular, papular, morbilliform or psoriasiform eruption of neck, trunk, extremities
  – Rare severe neurologic manifestations (meningitis, encephalitis)
  – Advanced age most important risk factor for fatal outcome
  – Therapy is supportive
Chikungunya virus
- Prior to 2013, outbreaks in countries in Africa, Asia, Europe and the Indian and Pacific oceans
- Late 2013, first local transmission of chikungunya virus in the Americas was identified in the Caribbean

Chikungunya virus
- Aedes aegypti and Aedes albopictus

Chikungunya virus
- Most people infected with the virus will develop some symptoms
- Symptoms usually begin 3-7 days after bites
  - Most common: sudden high fever, chills, joint pain (small-> large joint) +/- headache, muscle pain, joint swelling, maculopapular eruption
  - Joint pain can last for months and be disabling
  - Usually do not result in death
- Treatment is supportive

Audience Response System
- Which one of the following insects is responsible for most of the Zika virus transmission?
  A) Glossina
  B) Aedes albopictus
  C) Aedes aegypti
  D) Simulium
  E) Sandfly

Zika Virus
- Discovered in 1947, named after Zika forest in Uganda
  - First human case identified in 1952
- May 2015: Pan American Health Organization issued an alert regarding first confirmed Zika infection in Brazil
  - Prior to 2015: Africa, SE Asia and the Pacific islands
- Feb 1st 2016: WHO-> Public Health Emergency of International Concern (PHEIC)
- Feb 8th 2016: CDC-> Level 1 activation

Zika Virus
- Nov 2016 WHO ended “Public Health Emergency of International Concern” status of Zika
  - Crisis is not over
  - Zika is here to stay

Zika Virus Around the World

Zika Virus- United States

Zika Virus- US Local Transmission
Florida (214)
- Miami-Dade County, July 2016
- Pregnant women who lived in, traveled to, or had sex without a condom with someone who lived in or traveled to Miami-Dade County after August 1, 2016, should be tested for Zika virus
- “Yellow areas”

80 Zika Virus- US Local Transmission
- Texas (6)
  - Brownsville Tx
  - First local transmission reported on 11/28/16
  - Pregnant women who live in, traveled to, or had sex without a condom with someone who lives in or traveled to Brownsville on or after October 29, 2016, should be tested for Zika virus
  - “Yellow areas”

81 Zika Virus- Transmission
- *Aedes aegypti*
  - Possibility that Zika may adapt and then be able to be transmitted by *Aedes albopictus* is a cause of concern

82 Zika Virus- Transmission
- Sexually transmitted
  - + in semen despite - serum
- Through transfusion
  - FDA Aug 2016: testing Zika in all donated blood and blood components in the US and US territories
- Through human cells, tissues and cellular and tissue-based products
  - FDA guideline

83 Zika Virus- Transmission
- Perinatal: mother sick within 2 wks of delivery
- Vertical/intrauterine/congenital transmission: mother sick during pregnancy
  - 20 fold increased rate of microcephaly
- No transmission via breast feeding so far

84 Zika Virus- Symptoms
- Approximately 80% are asymptomatic
- Symptoms similar to dengue and chikungunya, usually mild
- “Rash”, fever, arthralgia, myalgia, conjunctivitis
- 91.3 % of symptomatic patients develop “rash”
  - Most common maculopapular eruption
  - Trunk, extremities > face, neck
  - Medium duration 6 days
  - Worsening of pre-existing skin disease (psoriasis)

85 Zika Virus- Symptoms
- Once infected, likely to have protection from future infections
- Complications: Guillain-Barre Syndrome, intrauterine infection

86 Zika Virus- Diagnostic testing
- CDC, local and state health department
  - Contact locally first
• Reportable disease
• Molecular testing: RNA nucleic acid testing
  – Serum- collected within 2 wks of symptom
  – Urine- collected < 14 days after symptom onset
  – Urine should always be collected with a patient-matched serum specimen

87 Zika Virus-Diagnostic testing
• Serologic testing:
  – IgM and neutralizing ab – end of first wk of illness
  – IgM positive – d 4 after on set of symptom- 12 wks
  – Antibody testing could cross react w flaviviruses: dengue, chikungunya
  – Negative molecular tests -> antibody testing for zika, dengue, chikungunya
• All positive, equivocal, or inconclusive IgM test results must be forwarded for confirmation by plaque reduction neutralization test

88 Zika Virus Management
• Supportive
• No antiviral or vaccine yet
  – As of 2/7/17, Clinicaltrials.gov has 11 trials in the world regarding Zika vaccination (8 in the United States)
  – 2018

89 Zika Virus- CDC travel guideline
• Sign up to receive Zika updates for your destination with CDC’s new text messaging service. Text PLAN to 855-255-5606 to subscribe
• Updated regularly for both international and United States
  – Country/region specific advices
• Delay/avoid travel

90 Zika Virus-Prevention
• House screens
• Air conditioning
• Mosquito control:
  – Removal of household or yard debris and containers
• Wearing long sleeves and pants
• Permethrin-treated clothing and gear
• Insect repellents
• Men reside or travel to endemic area: abstinence, consistently use condoms
  – Wait x 6 months

91 Diptera (Flies, Mosquitoes)
• Other biting flies: midges, horse flies, deer flies, black flies
  – Black flies (Simulium)- onchocerciasis, tularemia, ? Fogo selvagem
  – Dermatobia hominis- cutaneous myiasis
  – Sandfly (Lutzomyia, Phlebotomus)- leishmaniasis
  – Tsetse fly (Glossina)- sleeping sickness
Diplopoda (millipedes)
- Two pairs of legs per body segment
- No fangs, do not bite

When disturbed may emit toxic substances
- burning, stinging or
- brown to black skin discoloration which persists for months

Management
- Alcohol or ether on the site because can dissolve toxin
- If eye injury occurs-> Ophthalmologist (blindness)

Chilopoda (Centipedes)
- One pair of legs per body segment
- Fangs w poison glands containing metalloproteases

Pain +/- erythema and edema
- Few w headache, malaise, anxiety and dizziness
- Secondary infection is the main complication