Bites, Stings, and Envenomations in Children

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The Hike…

• Arthropods (Hymenoptera)
• Arachnids
• Snakes
• Mammals
• Toxic Sea Animals
Arthropods

- Phylum Arthropoda largest division of animal kingdom
- 85,000-90,000 cases reported yearly
- Approximately 100 resulted in severe reactions
- Fatalities usually from allergic reactions to Hymenoptera stings
Hymenoptera

• Three major subgroups
  1. Apidae: honeybee and bumblebee
  2. Vespidae: yellow jackets, hornets, wasps
  3. Formicidae: ants
Hymenoptera: Bees and Wasps

• Venom contains Melittin:
  – polypeptide, causes degranulation of basophils and mast cells
• All hymenoptera share similar polypeptides → cross-sensitization may occur
• Response to venom: pain, erythema, edema, pruritus
Hymenoptera: Bees and Wasps

• Large envenomation may evoke a systemic toxic reaction: Nausea, vomiting, diarrhea, syncope, DIC, renal & hepatic failure

• Anaphylactic reaction:
  – 15min-6 hours from time of sting.
  – The more rapid onset, the more severe the reaction.

• IgE mediated

• Delayed reactions: 5-14 days after sting: serum sickness-like: fever, malaise, headache, urticaria, polyarthritis. Immune complex mediated.
Hymenoptera: Bees and Wasps

- Treatment: remove stinger, clean wound, ice packs delay absorption of venom
- Pain relief
- Anaphylaxis: epinephrine, antihistamines and H2 receptor antagonists
- Steroids.
- No antivenom available… yet
- Consider Epi-Pen
Hymenoptera: Ants

- 8,800 different species of ants in the world
- In U. S. the imported fire ants most medically significant.
- Over 25,000 people in the U. S. seek medical treatment for fire ant bites each year.
- ~ 12 fatalities/year
Hymenoptera: Ants

• Swarm when provoked, attack in great numbers
• Sting simultaneously in response to an alarm pheromone released by one or several ants.
• the ant grabs the skin with its mandibles and then stings – as many as 20 times before releasing.
Hymenoptera: Ants

- Venom is an insoluble alkaloid
- Usually a papule \(\rightarrow\) pustule.
- Can result in localized necrosis, scarring, secondary infection
- Rarely systemic reaction with urticaria and angioedema
Hymenoptera: Ants

- Treatment: local wound care
- Diphenhydramine
- If systemic reaction, usual treatment for anaphylaxis.
Spiders

- 34,000 species of spiders worldwide
- Only a few dozen cause medically significant envenomations
- Most spiders do not harm because either fangs are too small to penetrate skin, amount of venom injected is too small or toxins do not affect mammalian cells.
Loxosceles

- L. reclusa (brown recluse)
- 1 cm body, tan color, violin-shaped mark on body
- Lives in warm, dry areas
- Venom contains hyaluronidase, alk phos, sphingomyelinase.
- Necrotic wounds due to neutrophil activation, platelet aggregation, and intravascular thrombosis
- Native in our area
Loxosceles

- Bite initially painless
- Usually mild erythema that heals over a few days.
- More severe reaction: severe pain hours after bite, erythema and blisters, bluish discoloration followed by necrosis over 3-4 days.
- Systemic effects rare
Loxosceles

- Treatment: pain control, debridement should be delayed until clear margins (2-3 wks after bite)
- Several treatments: no real benefit: dapsone (leukocyte inhibitor) hyperbaric O2, cyproheptadine, steroids, topical nitroglycerine.
- No antivenom
Latrodectus

• Black Widow L. mactans
• Red hourglass markings, 1.5 cm long, leg spans of 4-5 cm.
• Male 1/3 the size of female, bite cannot penetrate human skin
• Most bites between April and October
• Venom contains alpha-lactrotoxin → release of acetylcholine and NE from nerve terminals
Latrodectus

- Bite – pinprick sensation
- Local pain involving entire extremity
- Erythema ~ 20-60 min following bite evolves into target lesion (1/3)
- Muscle cramp-like spasms in large muscle groups
- 60% develop hypertension and headache, nausea, diarrhea diaphoresis, dyspnea (Autonomic features)
- Pain for ~24 hours
Latrodectus

- Treatment: ABC’s, pain control
- IV calcium gluconate not helpful
- Antivenom available, rapid resolution of symptoms, shorten course of illness.
- Derived from horse serum – anaphylaxis possible
Theraphosidae (Tarantulas)

- Bites: painful, local erythema and edema, local arthralgias. Systemic symptoms other than fever unusual
- Use hairs defensively. Use back legs to flick hairs.
- Rarely penetrate skin, but can imbed in eye. Ophthalmia nodosa: granulomatous, nodular reaction that can occur in cases of ocular exposure to hairs.
- Contact dermatitis from hair exposure
The one deadly spider species

Every Pediatric physician/nurse has heard of the dreaded....
MRSA Spider !!!
Ticks

- Transmit spirochetes, viruses, rickettsiae, bacteria, and protozoa.
- RMS, Lyme, tularemia, ehrlichioses, babesiosis, relapsing fever, and tick paralysis.
Ticks

- Tick paralysis
- Latent period of 4-7 days
- Restlessness, irritability, and ascending flaccid paralysis.
- CSF pleocytosis.
- Supportive care and diligent search for ticks.
Centruroides exilicauda
Scorpions

- In **U.S.** only *Centruroides exilicauda* possess venom potent enough to cause toxicity
- Extremity is most frequent site of sting
- Local Pain and tingling
- Cranial nerve dysfunction
- Excessive motor activity
- Children younger than 10 = highest risk
- Sympathetic and parasympathetic sequelae
Scorpions

- Cryotherapy of sting site.
- Antivenom treatment available (mainly in Arizona) derived from goat serum. Production has been stopped.
- Sedative-anticonvulsants (benzos/phenobarbital) have been used to treat hyperactivity, convulsions, and/or agitation.

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• Many of the 10,000 victims of snakebite each year in the US are under 18 years of age. The snakebite management of this population has not been studied as extensively as adults. There may be particular characteristics specific to this population that could affect their emergency medical treatment.
Results

• There were 20,285 pediatric snakebites (31.4% of all snakebites). The number of bites/year decreased 23.7% from the high of 2,323 in 2000 to the low of 1,772 in 2009. For the entire study period, 69.8% were male. Their ages were 0-2 years (2.8%), 3-5 (18.9%), 6-12 (45.6%), 13-17 (29.7%), and unknown (3.0%). As expected, 74.1% of all bites occurred during the 5 months from May through September. July had the largest number of bites (16.8%), and December had the fewest (1.3%). Every State reported at least one pediatric snakebite during the study period. Florida (11.9%), Texas (10.1%), and California (5.5%) had the most, and North Dakota (0.1%), Alaska (5 bites), and Hawaii (only one bite) had the least.
Pediatric snake bites by month
Results: Type and Effect

• The type of snake was recorded as non-venomous (39.4%), venomous (29.7%), and unknown (30.9%). Copperhead snakes were the leading identified venomous species at 11.0%. Only 10.4% were rattlesnakes, 0.9% were coral snakes, and 0.6% were exotic snakes. Only 1.8% had major clinical effects, 20.8% had moderate effects, 62.4% had minor effects, 5.7% had no effects, and 9.3% had unknown effects. Over the 10 year study period there were 3 pediatrics deaths.
Conclusions

• This is the largest study of pediatric snakebite victims in the USA. Males living in the southern US during the summer make up the highest risk group. Fortunately, despite appropriate parental fears, major effects and death are rare. The chief limitation of this study is the dependence on the accuracy of the poison center charts based on caller information. This study reveals the characteristics and trends of pediatric snakebite victims.
Unified Treatment Algorithm for the management of crotaline snakebite in the United States: results of an evidence-informed consensus workshop

- Lavonas et al.
- BMC Emergency Medicine 2011, 11:2
- PT, Hgb, platelets, fibrinogen
- 6-8 hour observation period
- Systemic: hypotension, bleeding, refractory vomiting, diarrhea, angioedema, neurotoxicity.
- Adult dose CroFab=Peds dose
Mammalian Bites

- Dogs 80-90%
- 5-14 year old boy; mixed breed dog
- 80% of the time it’s a dog familiar to the patient.
- 10-20 cases a year die
Dogs

- Head and face 60-70% <5yrs
- Younger = (Shock)
- If violated scalp consider CT
Cats

• Usually punctures (~ 50% infected)
• *P. multicocida* 75%
• 2/3 upper extremities/face

*(NEJM 1999 Jan 14;340:85-92)*
Puncture Wounds

• Trim any superficial devitalized epidermal tissue
• Inspect the wound for evidence of deep puncture, especially if the wound is located in the scalp or near a joint
• Remove any foreign bodies or gross wound contaminants
• Superficially irrigate the wound, avoiding high pressure irrigation into the wound
• Avoid removal of deep tissue (eg, "coring")
• Tetanus update

Should I sew this up?

• **Yes:**
  
  Clinically uninfected  
  <12 hours  
  NOT hand/foot

• **No:**

  Puncture  
  >12hrs  
  Hands/Feet  
  Cat/Human  
  Compromised host

*K Always irrigate*

Another Animal...
Humans

- 2-3% of mammalian bites
- Dirty mouth...mixed flora
- Fight bites
- Osteo
- Consider NAT (3cm)
Antibiotics...?

- Human and cat bites through dermis
- Bites closed prematurely
- Bites more than 8 hours old with a significant crush injury
- Potential damage to bones, joints, or tendons
- Bites to hands and feet
- Patient with increased risk of infection
- Signs of infection within 24 hours
- (Augmentin; Cephalosporin & TMPSx, Clindamycin)
Toxic Marine Animals

- Half of the population lives within 125 miles of coast (we don’t….bummer)
- Marine toxins can be extremely potent
- Knowledge of marine toxins lags far behind land based toxins.
- Development of marine antivenoms still in infancy.
Envenoming invertebrates

• Five Phyla:
  1. Cnidaria (jellyfish)
  2. Porifera (sponges)
  3. Echinodermata (five-part radial symmetry)
  4. Mollusca (cone snails and octopii)
  5. Annelida (fireworms)
Jellyfish

• Four classes: Hydrozoa, Scyphozoa, Cubozoa, and Anthozoa
• Nematocyst: unique stinging apparatus
• Thousands of Nematocysts, mainly on tentacles, also on body
Nematocysts

- Harpoon-like mechanism: physical or chemical stimulus triggers release of hollow, sharp tube from nematocyst
Jellyfish Stings

- Wide spectrum of severity
- Depends on venom dose, species, age and size of victim.
- Mild envenomation: acute skin reactions with immediate stinging pain and erythema or wheal formation “hemorrhagic and zosteriform reaction”

Severe envenomation results in life threatening systemic symptoms: standard resuscitative measures and sheep-derived antivenom
Jellyfish Stings: Treatment

• Deactivation of attached (undischarged) nematocysts: Acetic acid or isopropyl alcohol, or slurry of sodium bicarbonate. Do not rinse with freshwater because hypotonicity stimulates discharge.
• Then remove visible tentacles
• Reversal of venom effects: venoms are heat labile → hot water immersion shown to be effective
• Pain relief
Porifera (the Sponges)

- Horny skeletons, spicules of silicon dioxide or calcium carbonate
- Produce crinotoxins (surface liquids) cause skin irritation and dermatitis
- No pain on initial contact, after a few minutes burning sensation unbearable by day 2-3, associated local joint stiffness
- Papules, vesicles may develop
- Run their course over 3-7 days.
- Treatment: Remove spicules, pain relief, steroids
Echinodermata

• Five part radial symmetry
• Starfish and sea urchins
• Venom apparatus: spines with venom glands, some have hollow spines that can inject venom, others have grasping mechanism
• Immediate intense burning, tender for weeks
• First aid: hot water immersion until pain relief, removal of spines, X rays
• Delayed granuloma formation
Annelida

• Fireworms: cactus-like bristles
• Bristles detach in skin, and hard to remove. Intense inflammation and burning
• Remove bristles with forceps or tape
• Topical vinegar or isopropyl alcohol
• Corticosteroids
Mollusca

- Cone snails, nudibranchs, and octopi
- Cone snails feed by injecting neurotoxins using detachable, dart-like teeth
- Local pain and numbness, quickly spreads to complete paralysis, respiratory failure
- No specific antidote
- Few reported cases
Mollusca

• Octopus: bites typically occur on upper extremity when animal is picked up.
• Injects tetrodotoxin
• Paresthesias, flaccid paralysis, respiratory failure
• No antivenom → advanced life support
Poisoning with tetrodotoxin occurs after ingestion of puffer fish.
The flesh (fugu) is considered a delicacy in Japan.
The level of toxicity is seasonal -- in Japan, fugu is served only from October through March.
Hypotension and dysrhythmias central nervous system dysfunction and seizures develop. Severe toxicity may result in deep coma, apnea, and loss of all brain stem reflexes.
Death can occur within 4-6 hours; death from respiratory failure.
Envenoming Vertebrates

- Stingrays
- Venomous Fish
- Sea Snakes
Stingrays

- Whip-like tail houses venomous spines
- Bury in sand when not swimming
- If stepped on – tail whips upwards and thrusts spines into victim
Stingrays

- Local intense pain, sometimes significant blood loss (infrequent systemic effect)
- Death from penetration and secondary infections
Venomous fish

- Stonefish (Synanceiidae)
  - Tropical and warmer oceans
  - Bottom-dwellers
  - Camouflage effectively
  - Usually stepped upon
  - Myo-, neuro-, and cardiotoxic components in venom
  - Severe local pain, edema and erythema, nonspecific systemic effects (sweating, nausea, hypotension.)
Venomous fish

• Catfish (Siluriformes)
  – Single dorsal spine and 2 pectoral spines
  – Spines have venom glands that rupture and contents can be forced into wounds
  – Also produce a “crinotoxin” can cause severe pain by just handling fish
Venomous fish

• Others include Scorpionfish, rockfish, scats
• Primary effect of envenomation is localized severe pain.
Venomous Fish: treatment

• Manage both trauma and envenomation
• Reverse effects of venom, alleviate pain, prevent infections
• Hot water immersion therapy (30-90 min or until pain relief)
• Wound cleaned and debrided, radiographs to visualize spines
• Prophylactic antibiotics
• Stonefish antivenom available for severe systemic reactions.
Sea Snakes

- Occur in tropical and warm temperate Pacific and Indian Oceans
- Most are 3-4 ft long some up to 9 ft
- Flat tails, valve-like nostril flaps, distinguished from eels by presence of scales and absence of gills and fins
- Venom apparatus: 2-4 maxillary fangs with venom glands
- Contains neurotoxins and myotoxins
Sea Snakes

- Usually no pain from bite, it may initially go unnoticed
- Symptoms 30min – 4 hrs after bite: myalgias and muscle weakness. Trismus in jaw. Neurotoxicity with ascending flaccid or spastic paralysis with opthalmoplegia, ptosis, facial paralysis, death by respiratory failure
Thank You:

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- My patients...