

“Animal Bites Fact and Fiction”

WRAIR- GEIS 'Operational Clinical Infectious Disease' Course

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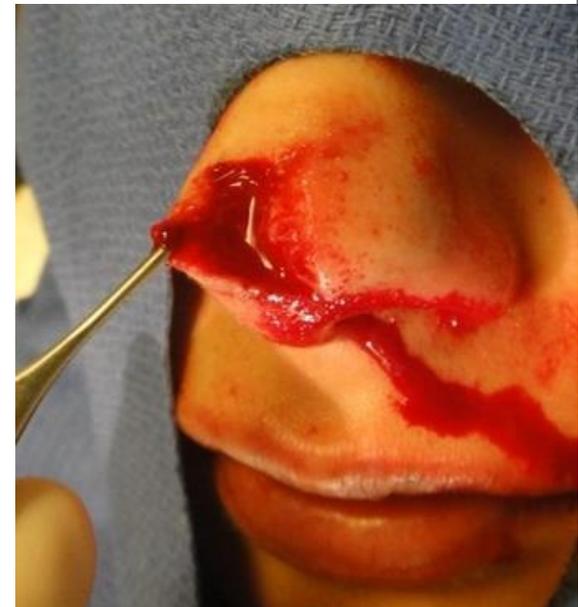
Two Great References:

- The current concepts in management of animal (dog, cat, snake, scorpion) and human bite wounds. Aziz, et al. Journal of Trauma and Acute Care Surgery, **2015;78:3:641-648**
- Dog and Cat Bites. Ellis and Ellis, American Family Physician. **2014;90(4):239-243**

A Most Common Story ...

An 8 Year Old Boy - Dog Bite to Face:

- Playing with neighbor's "Cocker Spaniel"
- Caught him under the right nose
- "Bitten and hung on"
- Nose partially removed, initially very bloody
- Quick to our Pediatric E.R
- Questions:
 - Initial care – what comes first?
 - Primary vs. delayed closure?
 - Antibiotics?
 - Other prophylaxis?



Risk Factors Quiz:

- Who is most likely to get bit by a dog?
 - 1 year old infant
 - 9 year old boy
 - 38 year old man
 - 75 year old woman
- Who is most likely to get bit by a cat?
 - 1 year old infant
 - 9 year old boy
 - 38 year old man
 - 75 year old woman
- Who is most likely to have a complication from human bites
 - 1 year old infant
 - 9 year old boy
 - 38 year old man
 - 75 year old woman
- Rank in order of most to least likely to get infected:
 - Dog, Cat, Human

Dog and Cat bite Overview:

- 4.5 million people are bitten each year (US)
- 1% of ER visits, 2% admitted, 10-20 deaths/yr
 - Dogs = 85% in USA, 103-118/100,000/yr
 - >70% known animal, 50% unprovoked
 - Children >> Adults (Peak dog = 5–9 year old boys)
- Dogs more likely to bite: male (6.2x), chained (2.8x), intact (2.6x)
- Wide Variety: **Pit bulls, Rottweiler's**, Presa canarios, Cane corsos, Mastiffs, Dogo argentinos, Fila brasileiro, Sharpeis, Boxers

Ellis and Ellis, Am Fam Physician. 2014;90(4):239-243



Presa canarios



Rottweiler



**Dogo
argentinos**



**Bull
terrier**



Fila brasileiro



Boxer



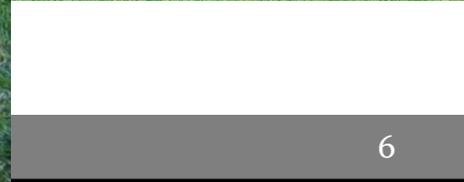
Sharpei



Mastiff



**"Pit
Bull"**



Animal Bites and Zoonoses: Dogs



2000-2009: 256 Fatal Dog Bites in US:

- Homicide detectives, animal control/media reports
- 85% of dogs “**unrelated/unknown**” to the attacked
- 87% without an **able bodied defender**/77% limited communication ability
- 76% of dogs isolated, limited contact with humans
- Only 21% history of owner neglect or abuse
- At least 20 breeds/mixes (negates breed-specific legislation – pit bull, wolf, etc.)

Cat Bites:

- #2 common reported bites US
 - 5% - 15%
 - Incidence of 400,000/year
 - Late reporting (less obvious trauma)
- 6% admitted
 - Similar/higher than dogs
 - **2x greater infection rate**
- Peak women > 75 yrs
- Arms > face > lower extremities

Aziz, et al. J Trauma Acute Care Surg, 78:3
2015: 641-648



Animal Bites and Zoonoses: Overview

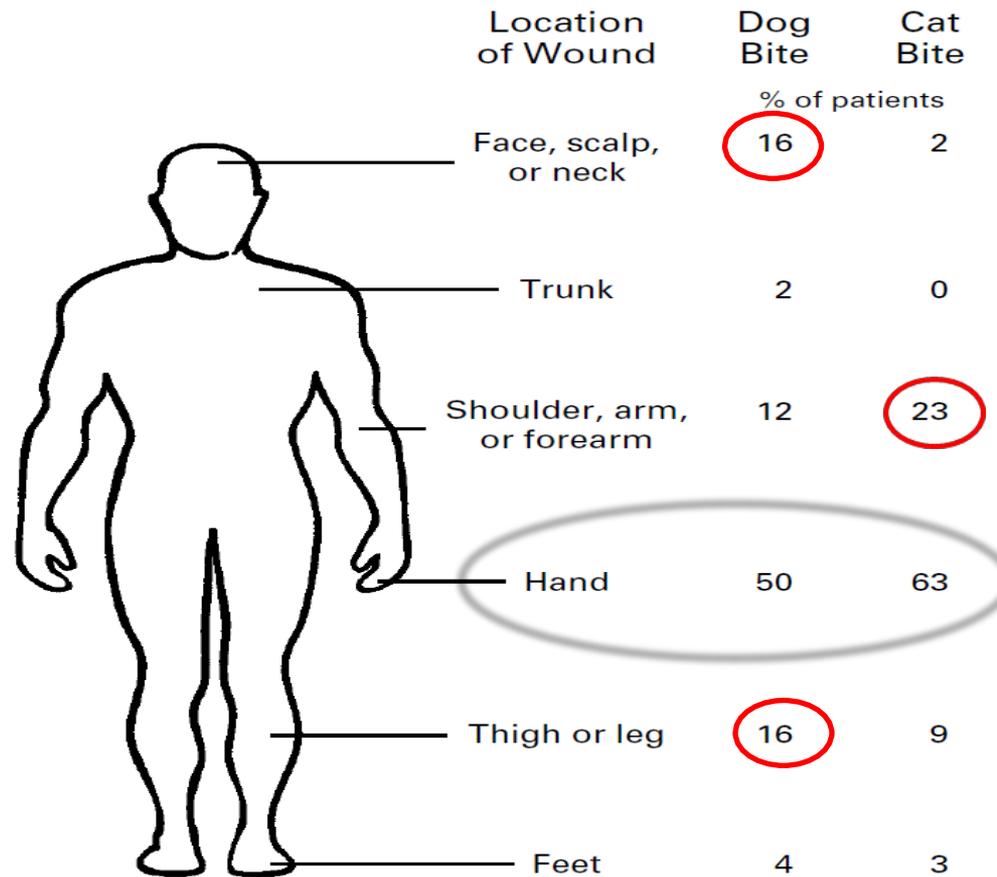


Figure 1. Location of Wound Infections in 50 Patients Bitten by Dogs and 57 Patients Bitten by Cats.

NEJM 1999; 340: 85-92

Human Bites:

- #3 cause of ER referrals for Bites: (23% of bites)
 - Clench fist fighting
 - Violence /abuse
 - Sexual behavior
 - Seizure with self-biting
- 10-15% Infected



Aziz, et al. J Trauma Acute Care Surg, 78:3 2015: 641-648

- **Aulus Cornelius Celsus** (Not an MD):
 - Roman historian, 25 BC to 50 AD
 - “Rubor, Dolor, Calor, Turgor”
- **To prevent infection and rabies:**
“Cleanliness and washing wounds with solutions such as vinegar”
- Hold the victim under water to relieve thirst and cure rabies



Early Care -Clean/Clean/Clean!

- Stop Bleeding (> 10 min – acute care)
- Clean, clean, clean – soak, then 20 ml syringe
“If Open,” cannot for puncture
- Explore for deep damage (tendon sheaths)



Be a little more delicate
than this provider!

TABLE 3. Wound Management After Dog, Cat, or Human Bites

Obtain culture (in case of abscess, severe cellulitis, devitalized tissue, or sepsis)

Use saline solution for wound irrigation.

Debride necrotic tissue, and remove any foreign bodies.

Obtain radiographic study (in case of fracture or bone penetration).

Initiate prophylactic antibiotics in selected patients, depending on type of dog or cat involved.

Hospitalize patient (in case of fever, sepsis, spreading cellulitis, severe edema, or crush injuries).

Consider hospitalization for patients who are immunocompromised or are likely to be noncompliant.

Administer tetanus booster (if none given in the past year), or initiate primary series in nonvaccinated individuals.

Assess the need for rabies vaccine and immunoglobulin administration.

2 Big Decisions: Primary vs. Delayed Closure; Antibiotics:

- Equivocal data regarding increased infection risk with primary closure (if well irrigated) – use cosmetic/practical guidance
- Antibiotics – more supported if:
 - Wound factors: +/- Need to close, severe tissue damage
 - Site: face, hand, deep punctures
 - Sources: Cat bites, Human bites
 - Time of presentation: >6-12 hours for extremities, >24 hours for facial bites
 - Host: Immune compromised, asplenic, diabetes

TABLE 4. Organisms Causing Infections After Bites

Cat bites

- *Pasteurella* species, *Streptococcus* species
- *Staphylococcus* species, *Moraxella* species
- *Fusobacterium* species, *Bacteroides* species
- *Porphyromonas* species

Dog bites

- *Pasteurella* species, *Streptococcus* species
- *Staphylococcus* species, *Neisseria* species
- *Fusobacterium* species, *Bacteroides* species
- *Porphyromonas* species, *Prevotella* species
- *Capnocytophaga* species

Human bites

- *Viridans streptococci*
 - *Streptococcus pyogenes*, *S. aureus*
 - Anaerobes *E. corrodens*
 - Hepatitis B and C
 - HIV
-

Table 2. Prophylactic Antibiotic Dosages for Animal Bites

Adults

First-line

Amoxicillin/clavulanate (Augmentin), 875/125 mg every 12 hours

Alternatives

Clindamycin, 300 mg 3 times per day *plus* ciprofloxacin (Cipro), 500 mg twice per day

Doxycycline, 100 mg twice per day

Penicillin VK, 500 mg 4 times per day *plus* dicloxacillin, 500 mg 4 times per day

A fluoroquinolone; trimethoprim/sulfamethoxazole, 160/800 mg twice per day; or cefuroxime axetil (Ceftin), 500 mg twice per day *plus* metronidazole (Flagyl), 250 to 500 mg 4 times per day, or clindamycin, 300 mg 3 times per day

Children

First-line

Amoxicillin/clavulanate, 25 to 45 mg per kg divided every 12 hours

Alternative

Clindamycin, 10 to 25 mg per kg divided every 6 to 8 hours *plus* trimethoprim/sulfamethoxazole, 8 to 10 mg per kg (trimethoprim component) divided every 12 hours

Pregnant women who are allergic to penicillin

Azithromycin (Zithromax), 250 to 500 mg per day

Close monitoring is needed because of high failure rate

Animal Bites and Zoonoses: Cats

- Bacteria:
 - Aerobic
 - High rates of *Pasteurella*, *Streptococcus spp*, *Staphylococcus spp*, *Neisseria*, *Bartonella henselae*
 - Anaerobic
 - *Fusobacterium*, *Bacteriodes*, *Porphyromonas*, *Prevotella*
 - Bacteria located on the skin of person bitten
- Again, Augmentin is #1 choice
- Virus: RABIES actually more from cats in the US!

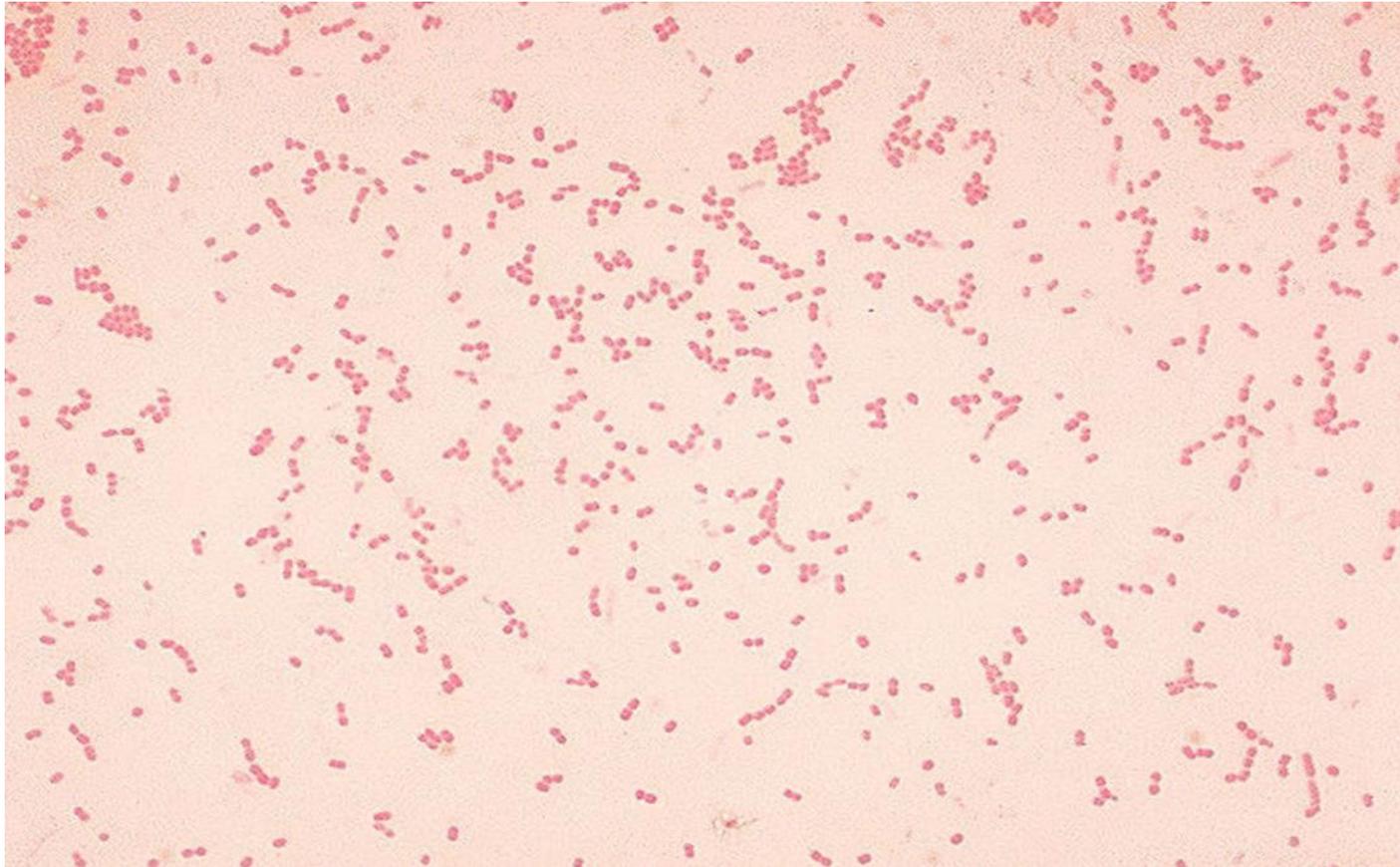
Animal Bites and Zoonoses: Cats

(Pasteurella multocida)



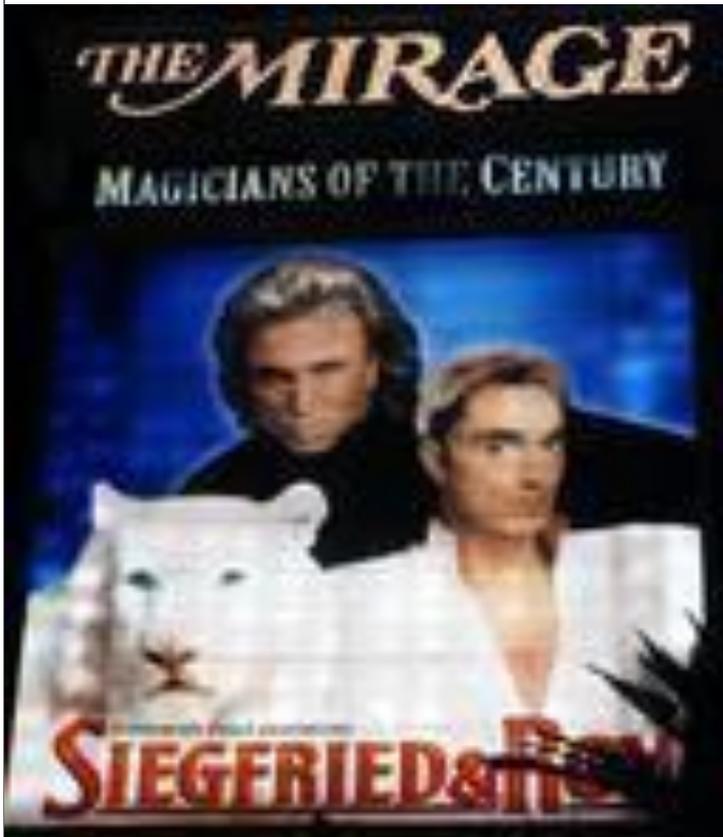
Animal Bites and Zoonoses: Cats

(Pasteurella multocida)



Gram-negative, non-spore-forming bacilli consistent with
Pasteurella multocida

Big Cat Bites



Wound Infection with *Neisseria weaveri* and a Novel Subspecies of *Pasteurella multocida* in a Child Who Sustained a Tiger Bite

Christian M. Capitini,¹ Inmaculada A. Herrero,² Robin Patel,^{2,3} Michael B. Ishitani,⁴ and Thomas G. Boyce³

¹University of Rochester School of Medicine and Dentistry, Rochester, New York; and Divisions of ²Clinical Microbiology and ³Infectious Diseases and ⁴Department of Surgery, Mayo Clinic, Rochester, Minnesota



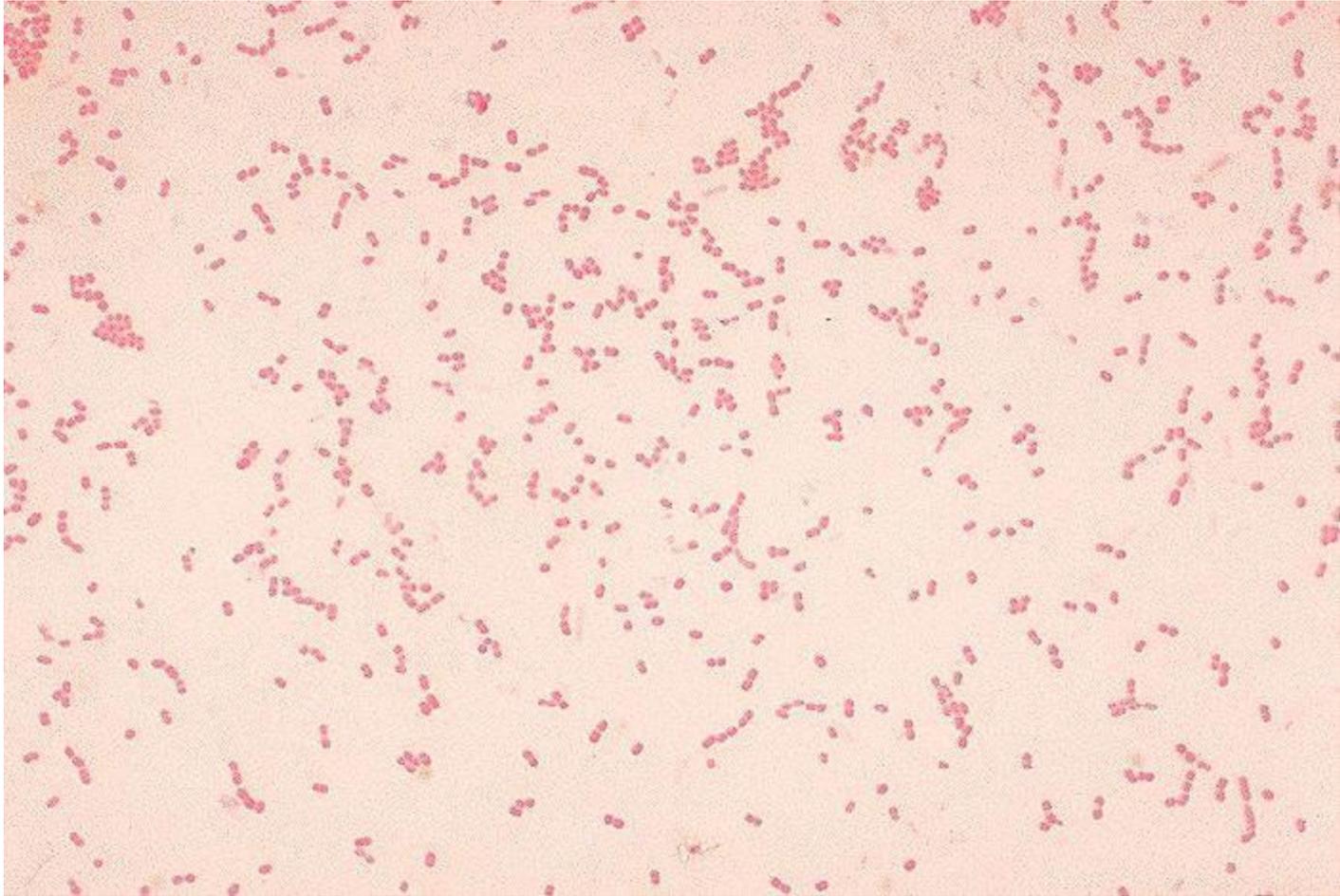
- Rapid onset cellulitis
- *P. multocida* most commonly reported
- Deep structure involvement
 - Tenosynovitis, septic arthritis, osteomyelitis, meningitis, spinal cord injury

Clinical Infectious Diseases 2002;34:e74–6

US Army Tiger Bite

- September 18, 2003, U.S. Army Reserve soldiers and Iraqi police on patrol in Baghdad zoo after closing
- Soldier attempted to feed a male Bengal tiger a chicken kabob; right arm severely mauled
- Bleeding stopped, wound debrided, placed on broad spectrum antibiotics, medevac'd to WRAMC for debridement/therapy
- Cultures obtained...

What is the organism?



Acinetobacter baumannii

- Environmentally present
- Seen often in wounded warriors (OIF/OEF)
- Treated with further wound revision, broad spectrum ABX to include amox-sulbactam and colistin
- Sustained a substantial amputation of arm in sequential surgical revisions
- Eventually died from complications of wound infection

Clubbing with the Rat Pack

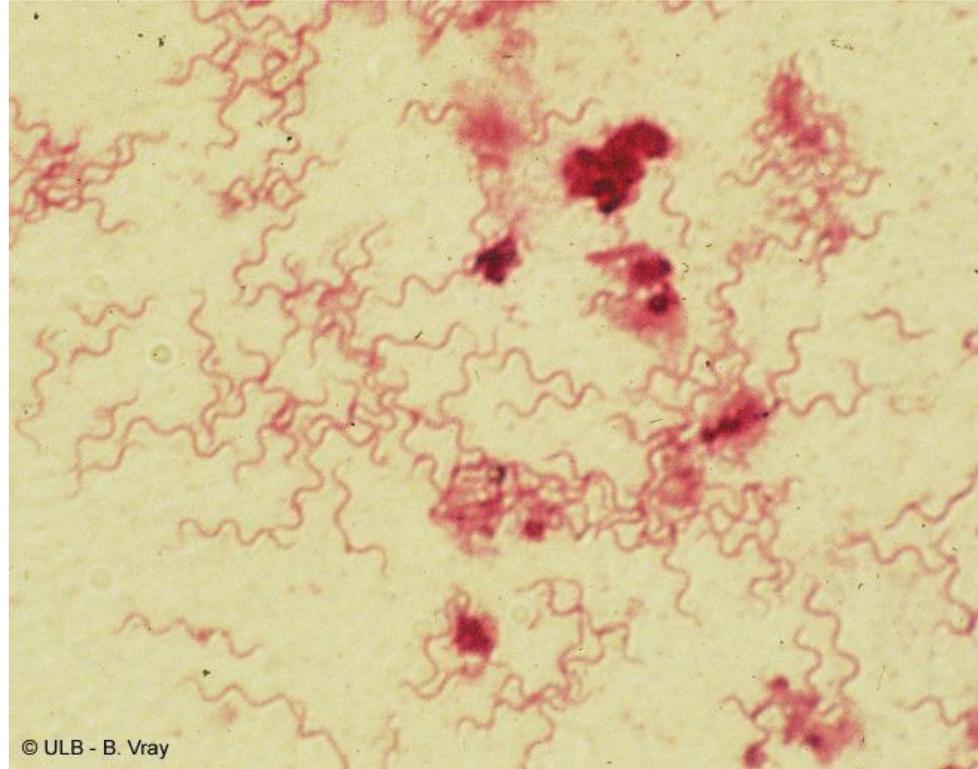
- 48 y/o male in SE Asia comes to the clinic with fevers and severe myalgias
- He had been slipped a ruffi while at a club, bushwacked when exiting, roughed up, robbed and left in a back alley, awakening in his own filth, shoes, valuables and ID all stolen
- No evidence of sexual assault
- On PE, animal bite marks around right ankle
- Faint rash on extremities
- Within 24hrs, blood cultures positive for pleomorphic GNR

QUESTIONS?

Pustular rash



Branching Gram-negative bacilli



© ULB - B. Vray

What is the most likely diagnosis?

Rat Bite Fever

- *Streptobacillus moniliformis* (US)
- *Spirillum minus* (Asia)
- Children, poor, pet shop, labs
- Symptoms:
 - Relapsing fever, rash, migratory polyarthralgias
 - Mortality 13%
- Treatment – PCN (amox-clav); doxycycline
- Endocarditis most common complication



FEAR THE FISH!! (Candiru)

DOWN BY THE RIVERSIDE 187

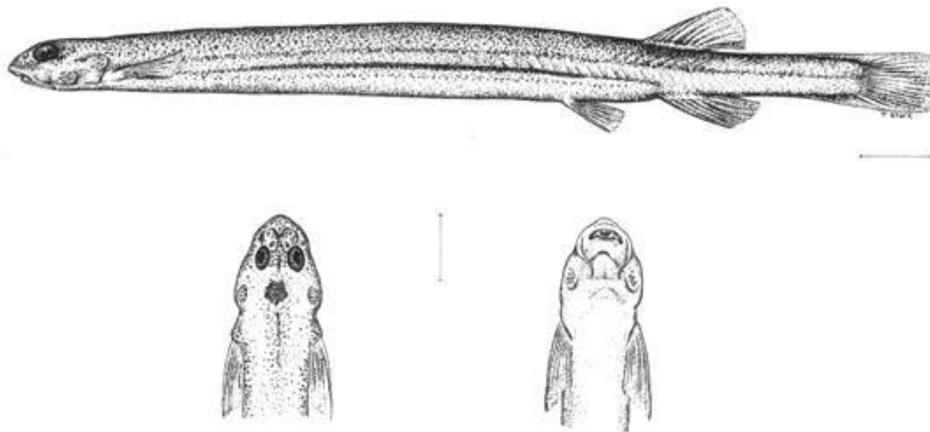
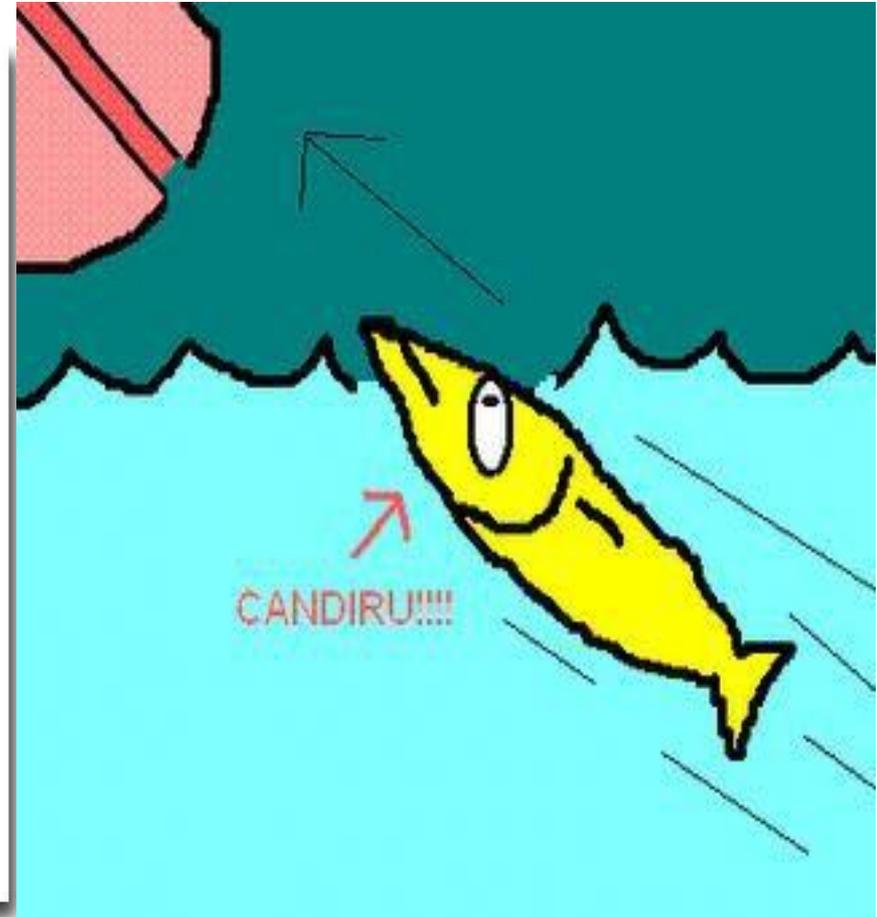


FIG.51 Illustration of a candiru (*Vandellia cf. plazai*) from the Rio Jauaperi. Top: Lateral view. Bottom left: Dorsal view of head and upper body. Bottom right: Ventral view of head and upper body. Scale bar = 5 millimeters. Illustrations by Tamara L. Clark. Source: Stephen Spotte.



<http://animal.discovery.com/videos/weird-true-freaky-fish-attacks-mans-urethra.html>

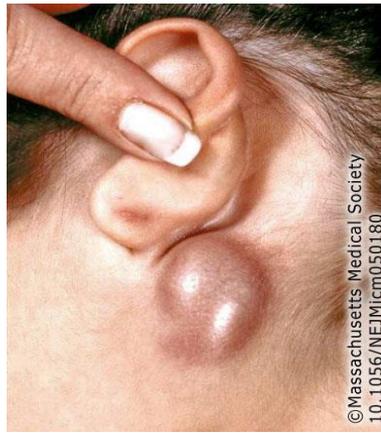
<http://animal.discovery.com/videos/weird-true-freaky-fish-attacks-mans-urethra.html>



Not all Zoonoses are due to “Bites”:

(Cat Scratch Fever)

- *Bartonella henselae*: gram-negative bacilli
- **Cats** are the **major reservoir**, but arthropods (fleas) and other animals may also play a role in the pathogenesis; Worldwide
- Transmission: **scratches; licks; bites**
- Clinical signs/lesions: Single-node / regional **lymphadenopathy**; **fever**; fatigue; **muscle/joint pain**; weight loss; and splenomegaly
- Treatment: No proven efficacy; +/- **Azithromycin** (Consider penicillin; tetracycline; cephalosporins; aminoglycosides; fluoroquinolones)



Animal Bites and Zoonoses: NHP

(Herpes B)



NEW WORLD MONKEYS

- Nostrils are far apart and open to the side
- Some species have prehensile tails
- Thumb orientation lies in line with other digits
- Some species have fingernails on big toe
- Live in trees

(Examples: *marmosets*, *tamarins*, *squirrel monkeys*)



OLD WORLD MONKEYS / Asia:

- Nostrils are closer together and open downward or forward
- Tail is not prehensile
- Thumbs are opposable
- Fingernails and toenails present on digits
- Live mostly on the ground
- Main source of Lab Animals

(Examples: *rhesus macaques*, *cynomolgus monkeys*, *baboons*, *African green monkeys*)

NHP and Herpes B

- Herpes B Virus
 - Macaquesine (formerly, Cercopethicine) herpes virus 1
 - Distribution: Worldwide

–#1 = rhesus macaques

- Bites/scratches/contact w/tissue fluids
- 80 – 90% of adult macaques infected; **ASYMPTOMATIC**
 - Virus is shed throughout life in ***oral, genital and ocular secretions***
- 3 patterns of disease:
 - Vesicular/ulcerative
 - Influenza like illness
 - **Neurologic** with nausea and vomiting

Human disease (encephalitis**) is usually **fatal (80%)** if untreated or results in severe neurologic impairment**

Animal Bites From NHP: *Herpes B*

Post exposure treatment:

- **Wash wound** for 15 minutes
 - Skin: antiseptic (betadine; chlorohexidine; or bleach 1:20)
 - Eyes, mucous membranes: flush with sterile saline
- **Cultures of wound** (post wash); **viral transport media** (refrigerate)
- Draw blood (5 mls. of serum)
- Seek medical attention!!!!
- Most receive **antiviral medication**



Animal Bites and Zoonoses: NHP

Herpes B (Post exposure treatment)

Post exposure treatment:

- **Prophylaxis**

- Acyclovir: (800 mg po qid) x 2 weeks, if 1 day post exposure

- Valacyclovir: (1g po tid) x 2 weeks

- **ANY Clinical signs**

- If no CNS/PNS findings: IV Acyclovir

- If **CNS/PNS findings: IV Gancyclovir**

- Additional treatment:

- Antimicrobials

- Tetanus verification/vaccination

- Rabies post exposure prophylaxis (PEP)

<http://cid.oxfordjournals.org/content/35/10/1191.full> Or CDC website

Animal Bites and Zoonoses: Herpes B

Herpes B (Potential Cases in Afghanistan)

- 126 animal bite exposures in Afghanistan
- 10 = monkey bites
- But **only 5** received appropriate B virus prophylaxis

Monkey Bites among US Military Members, Afghanistan, 2011

Luke E. Mease¹ and Kathryn A. Baker²

Bites from *Macaca mulatta* monkeys, native to Afghanistan, can cause serious infections. To determine risk for US military members in Afghanistan, we reviewed records for September–December 2011. Among 126 animal bites and exposures, 10 were monkey bites. Command emphasis is vital for preventing monkey bites; provider training and bite reporting promote postexposure treatment.

Military members deployed to Afghanistan face many risks; among these are bites from *Macaca mulatta* monkeys and possible subsequent infections. In August 2011, a 24-year-old US Army soldier died of a rabies infection contracted while in eastern Afghanistan. This tragedy highlights the threat that animal bites pose to deployed military members.

During 2001–2010, a total of 643 animal bites among deployed US military members were reported (1). Dogs were implicated in 50% of these bites, but several other animals pose risk as well. Prominent among these is the nonhuman primate *M. mulatta* (rhesus macaque), native to and commonly kept as a pet in Afghanistan (2) (Figure). Risks from *M. mulatta* monkey bites include physical trauma and/or infection with B-virus (Macacine herpesvirus 1), oral bacteria (including *Clostridium tetani*), and rabies virus. Although not well characterized in Afghanistan, the risk for exposure to *M. mulatta* monkeys has been described (3) for researchers (4), tourism workers (5), and US pet owners (6). We examined this risk for US military members deployed to eastern Afghanistan. The work presented herein was reviewed and deemed exempt from internal review board oversight by the Joint Combat Casualty Research Team, the human subjects review board responsible for oversight of human subjects research affecting US military members in Afghanistan.

Combined Joint Task Force–1 in eastern Afghanistan. We evaluated these records to identify and describe monkey bites and high-risk exposures among US military members serving in eastern Afghanistan during September–December 2011. For this study, eastern Afghanistan refers to North Atlantic Treaty Organization Regional Command East, which covers ≈43,000 square miles (110,000 km²). The US military population in eastern Afghanistan during the study period was ≈23,500 persons. Case information obtained included patient age, sex, rank, branch of military service, animal exposures, and treatment details.

We evaluated the cases for the 5 parameters that comprise appropriate initial treatment according to the literature. The parameters are wound care (appropriate cleansing of the wound) (7), antiviral medications for B-virus (valacyclovir) (8), antimicrobial drugs for oral bacteria (amoxicillin/clavulanic acid or clindamycin plus sulfamethoxazole/trimethoprim) (3), verification of up-to-date tetanus vaccination status or vaccine administration in accordance with Advisory Committee on Immunization Practices guidelines (9), and rabies postexposure prophylaxis (PEP). US military policy advised that rabies PEP should adhere to World Health Organization guidelines (10), which recommend giving human rabies immunoglobulin plus 5 doses of rabies vaccine. In accordance with the same policy, adherence to Advisory Committee on Immunization Practices guidelines for rabies PEP with human rabies immunoglobulin plus 4 doses of rabies vaccine was also acceptable (11).

When appropriate initial treatment was not administered, subsequent follow-up was conducted to ensure that patients received required treatment. Appropriate treatment was accomplished by contacting and coordinating with the responsible provider, the patients, and their commanders.

During the study period, we identified 126 cases of animal bites or serious exposures (involving animal neural tissue or saliva affecting the mucosal surfaces or open wounds of the patient). Among these cases, 10 were cases of monkey bites.

Among the 10 military members who had been bitten by monkeys, age range was 22–44 years (Table); most (7) were <30 years of age, and 8 were male. All were junior enlisted or noncommissioned officers; 8 were members of the Army, and 2 were members of the Air Force (Table).

A few Notes on Venomous Bites ...



US and Global Spiders:



- US: Black Widow
- *Latrodectus*
- muscle cramping, pain, and other neuromuscular-related symptom
- **Anti-venom**, pain control, muscle relaxants
- Calcium-gluconate?



- Brown Recluse:
- *Loxosceles*
- Dermonecrosis within 3 to 4 days
- Dapsone?
- Local/systemic steroids?

Clinical Symptoms “Widow” Spider Bites:

	<i>Latrodectus hasselti</i>	<i>Latrodectus mactans</i>	<i>Latrodectus curacaviensis</i>	<i>Latrodectus indistinctis</i>	<i>Latrodectus geometricus</i>	<i>Latrodectus mactans</i>	<i>Latrodectus tredecimguttatus</i>
Number of bites	68	163	77	30	15	89	56
Study design	Pr, PIC	R, ED	R	R	R	R	Pr, ED
Positive identification	100%	72%	75%	20%	67%	..	..
Pain							
Local pain*	100%	38%	56%	67%	93%	91%	90%
Radiating pain to limb	38%	18%	41%	57%	7%	..	..
Abdominal pain	9%	17%	17%	67%	27%	53%	35%
Chest pain, constriction	6%	4%	10%	30%	0%	..	14%
Back pain	..	56%	..	47%	7%	..	45%
Diaphoresis	34%	22%	28%	70%	..	70%	55%
Systemic effects							
Nausea	24%	11%	..	17%	0%	..	12%
Vomiting	4%	11%	5%	17%	0%	..	..
Headache	10%	9%	8%	21%	0%	..	12%
Abdominal rigidity	..	..	..	70%	7%	45%	..
Hypertension	1%	29%	4%	..	0%	17%	..
Agitation, irritation	..	..	14%	50%	13%	44%	..

Pr=prospective study. R=retrospective study. ED=emergency department study. PIC=Poison centre study. *In most studies, local pain seems to refer to persistent or severe pain only, rather than any discomfort of the bite (initial or persistent), which differs from the prospective study in Australia.²⁹

Table: Summary of clinical effects of widow spider bites from different regions of the world^{29,31-35}

- Antivenom for Black widows:

- Initial cold compress
- Acute anaphylaxis – 1 to 2%
- Serum sickness – 10%
- Also, potent analgesics; +/- use of benzodiazepines; weak evidence of Ca⁺⁺ or Mg⁺⁺ supplements
- Multiple studies – either underpowered or not significant

- Antivenom for Recluses:

- Common in Brazil, but ineffective once necrosis is present

Scorpion Bites:

- SW US and Mexico
- *Centruroides exilicauda*
 - Milder, Occ. neurotoxicity/ children
- *Centruroides vittatus*
 - More severe pain
- *Centruroides sculpturatus* (Arizona bark)
 - More durable pain, local dysfunction (72 hrs)



TABLE 1. Scorpion Sting Evaluation and Treatment

Grade	Clinical Finding	Treatment
Grade I	Localized pain or paresthesia at site	Symptomatic care
Grade II	Local and remote pain or paresthesia	Symptomatic care
Grade III	Findings of Grade II plus cranial nerve abnormalities or	Symptomatic care
Grade IV	Somatic skeletal neuromuscular dysfunction	Give antivenom if available
	Localized pain, cranial nerve abnormalities, somatic skeletal neuromuscular dysfunction, and airway involvement are all present	Symptomatic care give antivenom if available

Aziz, et al. J Trauma Acute Care Surg, 78:3 2015: 641-648\

***2011 – Mexican anti-venom product licensed for use, mainly in Arizona for children**

Snake Bites (In General):

- South and Southeast Asia, sub-Saharan
- Africa, and Latin America (XX USA)
- 1.8 to 2.5 million venomous snake bites annually, 100,000 to 125,000 annual deaths
- Multiple injuries:
 - Local toxins: proteases/digestive = necrotic
 - Systemic toxins:
 - Neurotoxins = paralysis
 - Myotoxins = rhabdomyolysis
 - Hemostasis toxins
 - Cardiotoxins
 - Renal toxins

Cellulitis due to Snake/Reptile Bites:

- 5 million snake bites – 100,000 infections / year
- 43 infected bites; 31 Male/12 female; ¾ one bacteria isolated

Bacteria isolated (n=53)	Number
Gram-positive bacteria (n=28)	
<i>Staphylococcus aureus</i>	17
Coagulase negative staphylococcus	5
<i>Enterococcus faecalis</i>	4
<i>Streptococcus spp</i>	2
Gram-negative bacteria (n=25)	
<i>Escherichia coli</i>	8
<i>Klebsiella pneumoniae</i>	4
<i>Proteus spp.</i>	3
<i>Morganella morganii</i>	3
<i>Pseudomonas aeruginosa</i>	3
<i>Acinetobacter spp</i>	2
<i>Enterobacter spp</i>	2

Garg, et al, *J Infect Developing Countries* 2009; 3(3):221-223.

Reptile Bites:

- High rates of gram negative enteric bacteria
- Salmonella is fairly common:
 - 26% of rattlesnakes per Fitzgerald et al, 2013, even “in the wild”
- Recent British study – 2012 Warwick et al:

Table 1

Categories* of injuries, envenomations and stings probably attributable to exotic pets, number of incidents 2004–2010. Derived from NHS Health Episode Statistics.

<i>Injury, envenomation or sting</i>	<i>Episodes</i>	<i>Admissions</i>	<i>Hospitalization days</i>
Bitten or struck by crocodile or alligator	15	15	31
Bitten or crushed by other reptiles	398	376	1340
Contact with venomous snakes and lizards	307	287	463
Contact with scorpions	40	31	287
Total	760	709	2121

Back to Mammalian bites --- The “Most Dramatic Risk is....”



Animal-Associated Rabies Exposures 1997-2012 GeoSentinel Survey Network

Factors that Increase Risk of Exposure to Rabies:

- 2697 travelers assessed
- Length of trips – “short”
 - 15 day mean for those seeking care after trips
 - 20 day mean for those during trips(against the general belief that “longer trips” = better indication for Pre-exposure prophylaxis)
- Over half of all exposures – South/SE Asia:
 - Thailand, Indonesia, Nepal, China, and India
- **NO** demographic differences among travelers – hard to predict risk!

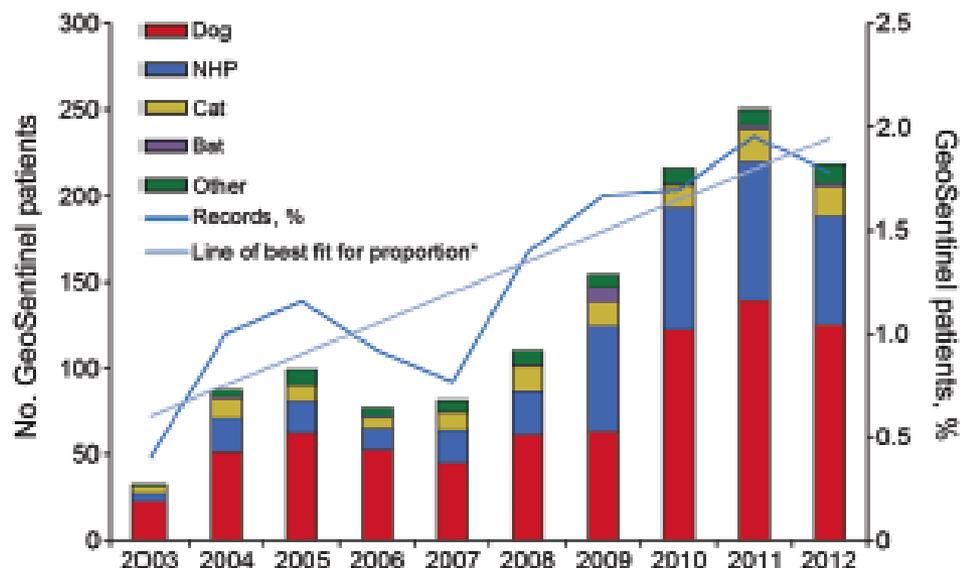
Gautret, et al. EID, 21(4), April 2015

Table 1. Characteristics of 2,697 patients who sought care for an animal exposure and received rabies postexposure prophylaxis at GeoSentinel Surveillance Network sites, January 1997–December 2012, by animal species*

Patient characteristic	Animal					Total‡
	Dog	NHP	Cat	Bat	Other†	
No. patients	1,618	638	271	46	126	2,697
Male sex, no. (%)	891 (55)	269 (42)	125 (46)	21 (46)	54 (43)	1,360 (51)
Age, y, no. (%)						
<14	160 (10)	65 (10)	50 (19)	2 (4)	14 (11)	291 (11)
15-44	1,027 (64)	460 (72)	151 (56)	28 (61)	75 (60)	1,739 (65)
45-64	340 (21)	103 (16)	56 (21)	16 (35)	33 (26)	548 (20)
≥65	87 (5)	9 (1)	13 (5)	0	4 (3)	113 (4)
Reason for travel						
Tourism	1,016 (63)	590 (92)	183 (68)	31 (67)	89 (71)	1,908 (71)
Visiting friends/relatives	264 (16)	6 (1)	41 (15)	1 (2)	11 (9)	323 (12)
Business	206 (13)	18 (3)	25 (9)	2 (4)	13 (10)	264 (10)
Missionary/volunteer/researcher/ aid worker	82 (5)	15 (2)	14 (5)	7 (15)	10 (8)	127 (5)
Student	36 (2)	7 (1)	7 (3)	4 (9)	3 (2)	57 (2)
Other§	13 (1)	2 (<1)	1 (<1)	1 (2)	0	16 (1)
Region of exposure, no. (%)¶						
Southeast Asia	570 (36)	414 (66)	99 (37)	10 (22)	37 (30)	1,129 (43)
South-Central Asia	406 (26)	146 (23)	21 (8)	3 (7)	22 (18)	598 (23)
Northeastern Asia	217 (14)	13 (2)	25 (9)	0	6 (5)	261 (10)
North Africa	76 (5)	6 (1)	45 (17)	1 (2)	9 (7)	137 (5)
Latin America	121 (8)	15 (2)	7 (3)	21 (46)	10 (8)	174 (7)
Sub-Saharan Africa	55 (3)	18 (3)	16 (6)	1 (2)	16 (13)	106 (4)
Middle East	47 (3)	3 (<1)	38 (14)	0	2 (2)	90 (3)
Eastern Europe	40 (3)	2 (<1)	4 (2)	1 (2)	4 (3)	51 (2)
Western Europe	28 (2)	3 (<1)	6 (2)	4 (9)	5 (4)	46 (2)
Oceania	14 (1)	0	1 (<1)	2 (4)	1 (1)	18 (1)
North America	3 (<1)	1 (<1)	2 (1)	3 (7)	8 (6)	17 (1)
Caribbean	8 (1)	2 (<1)	2 (1)	0	3 (2)	15 (1)
Australia	1 (<1)	0	0	0	2 (2)	3 (<1)

Table 2. Countries with 5 highest levels of exposure among 2,697 patients who sought care for animal exposure and received rabies postexposure prophylaxis at GeoSentinel Surveillance Network sites, January 1997–December 2012, by animal species

No.	Animal, country of exposure, no. (%) exposures					
	Dog, n = 1,618	NHP, n = 638	Cat, n = 271	Bat, n = 46	Other, n = 126	Total, n = 2,697
1	Thailand, 294 (18)	Indonesia, 200 (31)	Thailand, 59 (22)	Indonesia, 7 (15)	Thailand, 16 (13)	Thailand, 534 (20)
2	Nepal, 198 (12)	Thailand, 166 (26)	Turkey, 31 (11)	French Guyana, 5 (11)	India, 10 (8)	Indonesia, 314 (12)
3	China, 197 (12)	Nepal, 82 (13)	China, 25 (9)	Peru, 4 (9)	Indonesia, 10 (8)	Nepal, 295 (10)
4	India, 124 (8)	India, 43 (7)	Indonesia, 17 (6)	Mexico, 3 (7)	China, 6 (5)	China, 241 (9)
5	Indonesia, 80 (5)	Vietnam, 21 (3)	Algeria, 15 (6)	Surinam, 3 (7)	Nepal, 6 (5)	India, 185 (7)



Dogs first, Higher rates of NHP's

Figure 2. Number of patients requiring rabies postexposure prophylaxis for animal-related exposure, by exposure species and by year and line of best fit for proportion of all GeoSentinel records accounted for by animal-related exposure requiring postexposure prophylaxis, 2003–2012. Limited to patients treated at GeoSentinel sites that were active contributors for the entire listed period. NHP, nonhuman primate. *Linear regression was used to calculate a line of best fit of $y = 0.0015x + 0.006$.

Tetanus

- *Clostridium tetani*
- Environmental pathogen: soil, dust, manure
- Spores enter via wound or breach in skin
 - Disseminate toxin that acts within CNS
 - Toxin interferes with neurotransmitter release, blocking inhibitor impulses
 - Result: unopposed muscle contraction, spasm

Tetanus – Clinical Presentation

- Clinical syndrome
 - no confirmatory lab tests
- Painful muscular contractions
 - Masseter (“lock jaw”) and neck muscles
 - Trunk muscles
 - Abdominal rigidity
- Generalized spasms
- Seizures



Tetanus - Treatment

- Tetanus immune globulin (TIG)
- Tetanus toxoid booster
- Aggressive wound care
- Antibiotics
- Mechanical ventilation
- Sedation
- Muscle relaxants

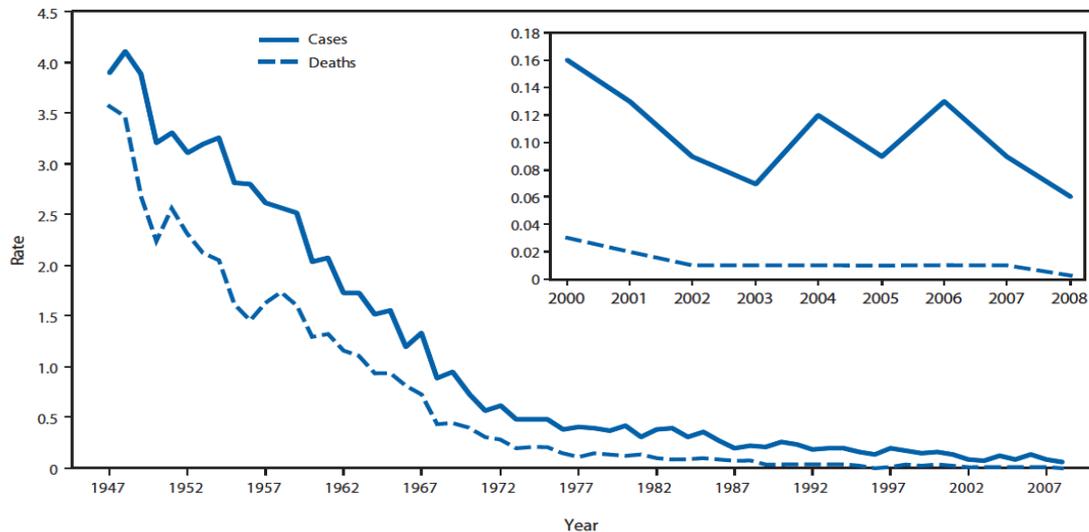
Tetanus:

Table 3. Indications for Tetanus Prophylaxis

History of tetanus immunization	Clean, minor wounds		All other wounds	
	Vaccine	Immune globulin	Vaccine	Immune globulin
Uncertain or < 3 doses	Yes	No	Yes	Yes
≥ 3 doses	No, unless > 10 years since last dose	No	No, unless > 5 years since last dose	No

Adapted from Kretsinger K, Broder KR, Cortese MM, et al.; Centers for Disease Control and Prevention. Preventing tetanus, diphtheria, and pertussis among adults: use of tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine recommendations of the Advisory Committee on Immunization Practices (ACIP) and recommendation of ACIP, supported by the Healthcare Infection Control Practices Advisory Committee (HICPAC), for use of Tdap among health-care personnel. *MMWR Recomm Rep.* 2006;55(RR-17):25.

FIGURE. Annual rate* of tetanus cases and tetanus deaths — National Notifiable Diseases Surveillance System, United States, 1947–2008



* Per 1 million population.

Take-Home Points

- Don't mess with animals...or people
- Recognize the most common pathogens in animal and human bite infections
- Recognize importance of aggressive wound cleaning
- Recognize other less common animal-associated infections – cat scratch disease, rat bite fever, herpes B virus
- Don't forget about rabies and tetanus prophylaxis

QUESTIONS?