Zoonotic Diseases in Veterinary Personnel: Protecting Yourself from the Known and the Unknown

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• Examples of common zoonotic infections in veterinary personnel
• CDC/AVMA survey of veterinary infection control practices
• Veterinary Standard Precautions

What Started All This?

Monkeypox: 2003 Outbreak

• 6 Midwestern states
• Animal illness
  – Total cases: 93
• Human illness
  – Total cases: 71
  – 18 (25%) cases were veterinarians or veterinary technicians
  – All had contact with infected prairie dogs

Source: July 11, 2003, MMWR

Why So Many Veterinarians and Veterinary Technicians?

• We isolate animals with contagious and infectious diseases to protect other animals
• We warn our clients about zoonotic diseases affecting their animals
• We don’t always protect ourselves

Wake-Up Call for Veterinarians

• No-one can predict this stuff
• We CAN predict that we will continue to have introductions of zoonotic foreign animal diseases in the future, and that veterinarians may be on the frontlines and among the first exposed
Where Do Emerging Diseases Come From?

- Previously unrecognized agents
- New agents (causing clinically distinct diseases) from evolution of existing organisms
- Known agents spreading to new geographic locations or to new populations
- Newly recognized infectious etiologies for chronic diseases or known syndromes

The Risk is Not Only from Exotic or Emerging Diseases:

Veterinary personnel are also at risk for contracting endemic zoonotic infections

Occupationally Acquired Zoonotic Infections among Veterinary Personnel:

- Bite wound infections
- Dermatophytosis
- Cryptosporidiosis
- MRSA
- Salmonellosis
- Campylobacteriosis
- Psittacosis
- Plague
- Q Fever
- Sporotrichosis
- Zoonotic Influenza
- Monkeypox

1995 Study of 701 Mixed (45%) and Small Animal (55%) North Carolina Veterinarians

- 68% reported a major animal-related injury during their career; 8% hospitalized
- The animal involved was:
  - Canine 35% -- Porcine 2%
  - Feline 28% -- Ovine 0.6%
  - Bovine 17% -- Other 3%
  - Equine 14%
- The mechanism was:
  - Bite 49% -- Crush 8%
  - Kick 17% -- Other 13%
  - Scratch 13%

1988 Study of 995 Mixed or Large Animal (70%) and Small Animal (30%) MN and WI Veterinarians

- 65% reported major animal-related injury during their career; 17% hospitalized
- The animal involved was:
  - Bovine 47% -- Porcine 2%
  - Canine 24% -- Other 2%
  - Feline 10%
  - Equine 15%
- The mechanism was:
  - Kick 36% -- Scratch 4%
  - Bite 34% -- Other 15%
  - Crush 12%

Dog and Cat Bite Wound Study

- 3-18% of dog bites and 28-80% of cat bites became infected
- The median latency period (time from bite to signs of infection) was 24 hours for dog bites and 12 hours for cat bites
- Median number of isolates per culture was 5 (range 0-16)
- 48% of dog bites and 63% of cat bites were mixed aerobic/anaerobic infections

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J of Agromedicine 1995; 2 (1) 23-52
J of Trauma 1988; 28 (8) 1255-59
NEJM 1999; 340 (2): 85-92
### Bacterial Analysis of 50 Dog Bite and 57 Cat Bite Wound Infections in Humans

<table>
<thead>
<tr>
<th>Aerobic Bacteria</th>
<th>Dog Bite (%)</th>
<th>Cat Bite (%)</th>
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<tbody>
<tr>
<td>Pasteurella Spp.</td>
<td>50</td>
<td>75</td>
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<tr>
<td>P. Canis</td>
<td>26</td>
<td>2</td>
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<tr>
<td>P. multocida</td>
<td>22</td>
<td>82</td>
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<tr>
<td><em>sap multocida &amp; septica</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Streptococcus Spp.</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Staphylococcus Spp.</td>
<td>46</td>
<td>35</td>
</tr>
<tr>
<td>Staph. aureus</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Staph. epidermidis</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

NEJM 1999; 340 (2): 85-92

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<table>
<thead>
<tr>
<th>Anaerobic Bacteria</th>
<th>Dog Bite (%)</th>
<th>Cat Bite (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusobacterium Spp.</td>
<td>32</td>
<td>33</td>
</tr>
<tr>
<td>Bacteroides Spp.</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>Porphyromonas Spp.</td>
<td>28</td>
<td>30</td>
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<tr>
<td>Prevotella Spp.</td>
<td>28</td>
<td>19</td>
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<tr>
<td>Propionibacterium Spp.</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Peptostreptococcus Spp.</td>
<td>16</td>
<td>5</td>
</tr>
</tbody>
</table>

NEJM 1999; 340 (2): 85-92

### Rare Invasive Pathogens

- *Capnocytophaga canimorsus*
  - Normal oral flora in dog (25%) and cat (15%) J Infect 1998 36 (1): 134
  - Septicemia, septic shock, meningitis, purpura fulminans
  - Splenectomy, alcoholism increase risk, but infection also occurs in immune-competent patients
- *Bergeyella zoohelcum*
- *Bartonella henselae*

### Study of Dog and Cat Bites, Conclusions

- *Pasteurella Spp.* are most common isolate from dog and cat bite infections in humans
- *Staph aureus* and *Strep pyogenes*, normal human skin flora, are relatively uncommon isolates
- *Staph intermedius*, normal canine skin flora and most common isolate from bite wounds in dogs, is a relatively uncommon isolate in humans

### Study of Dog and Cat Bites, Conclusions

- Empirical therapy should be directed against *Pasteurella, Streptococci, Staphylococci* and anaerobes
- Some treatment options:
  - β-lactam antibiotic and β-lactamase inhibitor (Augmentin)
  - 2nd or greater generation cephalosporin effective against anaerobes
  - Clindamycin and a fluoroquinolone
  - Azithromycin

NEJM 1999;340:85-92

### Risk Factors for Bites Among Animal Caregivers in a Veterinary Teaching Hospital

- Warning sign on cage; OR= 5; CI 1.9-13
- Considered difficult to handle; OR 3.9; CI 1.8-8.5
- Study found that dogs and cats that appear likely to bite are the ones that bite
- Only 47% (95% CI, 34-61%) of dogs and cats considered likely to bite were muzzled

JAVMA 2003; 223 (3) 312-316
Dermatophytosis

- Most common occupationally-acquired zoonoses reported by veterinarians
  - Langley 1995; Constable 1982; Gummow 2003; Wright 2008
- Most common source is kittens or young cats
- Dogs, cattle, horses, goats, sheep, rabbits, and rodents are also sources of infection

Reports of Cryptosporidiosis among Veterinary Students


Cryptosporidiosis in Humans

- Protozoan parasite – *Cryptosporidium parvum*
- Small infectious dose
- Incubation period 1-12 days, mean 7 days
- Profuse watery diarrhea, and cramping over days to weeks. Fever and vomiting also may occur
- 20-25% are hospitalized

Cryptosporidiosis (cont.)

- Two main species of *Cryptosporidium* cause human illness:
  - *C. hominis* (formerly *C. parvum* genotype 1); human reservoir; infects only humans
  - *C. parvum* (formerly *C. parvum* genotype 2); ruminant reservoir; infects ruminants, humans, other animals
**Cryptosporidium parvum**

- Strongly immunogenic – does not evade the immune system – successful due to ability to develop rapidly and flood the environment with oocysts
- Parasite of neonatal animals – even naive adult animals rarely develop serious infections
- Humans are the only known host that can be infected at any age – only previous exposure results in immunity

Upton 2008

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**Plague**

During 1977-1998, 6/23 cat-associated human plague cases in 8 western states occurred in veterinarians or veterinary technicians


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**Sporotrichosis Among Veterinary Staff**

Of 37 people who acquired sporotrichosis from cats, 23 were veterinarians or veterinary assistants.


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Broad Implications for Public Health

• Can high risk behaviors be identified?
  – 2005 CDC/AVMA veterinary survey to identify knowledge, attitudes, and practices regarding infection control
• What recommendations can be made to prevent or reduce transmission of zoonotic pathogens from animals to veterinary personnel?

2005 CDC/AVMA Survey of Infection Control Practices and Zoonotic Disease Risks among Veterinarians in the U.S.

• Random selection within small, equine and large practice types
  – 2,133 of 5,168 (41%) surveys returned
• Respondent characteristics:
  – Small: 48% male; 73% ≥ 10 yrs in practice;
  – Equine: 57% male; 67% ≥ 10 yrs in practice;
  – Large: 81% male; 76% ≥ 10 yrs in practice

JAVMA 2008;232 (12):1863-72

Survey Results: Hand Hygiene

<table>
<thead>
<tr>
<th></th>
<th>Small (%)</th>
<th>Equine (%)</th>
<th>Large (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always/mostly wash hands before eating</td>
<td>93</td>
<td>79</td>
<td>83</td>
</tr>
<tr>
<td>Always/mostly wash hands between patients</td>
<td>88</td>
<td>59</td>
<td>55</td>
</tr>
<tr>
<td>May eat in animal treatment areas</td>
<td>86</td>
<td>83</td>
<td>79</td>
</tr>
</tbody>
</table>

Survey Results: Sharps Control

<table>
<thead>
<tr>
<th></th>
<th>Small (%)</th>
<th>Equine (%)</th>
<th>Large (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always/mostly use sharps container</td>
<td>98</td>
<td>96</td>
<td>89</td>
</tr>
<tr>
<td>May recap needles</td>
<td>92</td>
<td>99</td>
<td>97</td>
</tr>
</tbody>
</table>

Small animal veterinarians who always recapped needles were more likely to have sustained a needlestick in the past 12 months OR 2.08, P=0.001

Survey Results: Reported Use of Appropriate Personal Protective Equipment (PPE)

<table>
<thead>
<tr>
<th></th>
<th>Small (%)</th>
<th>Large (%)</th>
<th>Equine%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam dermatologic</td>
<td>18</td>
<td>53</td>
<td>11</td>
</tr>
<tr>
<td>Exam respiratory</td>
<td>6</td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>Exam GI</td>
<td>21</td>
<td>54</td>
<td>52</td>
</tr>
<tr>
<td>Exam neurologic</td>
<td>16</td>
<td>63</td>
<td>18</td>
</tr>
<tr>
<td>Handle fecal samples</td>
<td>44</td>
<td>78</td>
<td>16</td>
</tr>
<tr>
<td>Parturition</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Necropsy</td>
<td>37</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

Observations from Inside the Veterinary Profession

• We have a casual attitude toward blood, feces, and other body fluids
• We have a casual attitude toward zoonotic infectious agents, known and unknown
Observations

• We need to embrace and utilize standard preventive infection control practices to minimize the risk of occupational zoonotic infections from recognized and unrecognized sources
  – Regardless of the presumed diagnosis
  – Regardless of the presumed risk of infection
  – Whenever contacting feces, body fluids, exudates, blood or non-intact skin

Veterinary Medicine vs. Human Medicine

• Veterinary practices are truly unique environments
  – Close contact with animals
  – Increased risk of exposure to zoonotic pathogens
• Zoonotic infections in veterinary personnel are primarily related to bite wounds and exposure to animal feces, infected skin and droplets - not blood

Current NASPHV Compendiums

• Rabies Compendium
• Psittacosis Compendium
• Petting Zoo Compendium
• Standard Precautions Compendium
• All are available at NASPHV.org

Standard Precautions Compendium

Objectives

• Raise awareness of the scope of zoonotic disease risk in veterinary medicine
• Address issues specific to the veterinary profession
• Provide practical, science-based guidance
• Provide a model infection control plan
• Limit focus to private practice

What would standard precautions for veterinarians look like?
Hand Hygiene

- Hand hygiene, using soap and water or alcohol-based products, is the single most important measure to reduce the risk of disease transmission.
- Handwashing is preferred in veterinary settings because hands are routinely contaminated with organic material.

Wash Your Hands

- Before and after each patient encounter.
- After contact with feces, blood, body fluids, exudates, or articles contaminated by these substances.
- After cleaning cages or animal care areas.
- Before eating or drinking; after using the toilet.

Soap Considerations

- Handwashing with plain soap and running water mechanically removes soil and reduces the number of transient organisms on the skin.
- Antimicrobial soap inhibits growth of both transient and resident flora.
- Use of either type is OK.
- Liquid soap dispensers should be completely emptied (not topped off), before cleaning and refilling.

Hand Rubs

- Disinfect immediately.
- Effective when hands are not visibly soiled.
- Highly effective against bacteria.
- Less effective than handwashing against protozoan parasites and non-enveloped viruses.

Moist Wipes

- When running water is not available, moist wipes followed by alcohol-based hand rubs may be used.
- Used alone, wipes are not as effective as alcohol-based hand rubs or washing hands with soap and running water.

Ability of Hand Hygiene Agents to Reduce Bacteria on Hands

- [Graph showing bacterial reduction over time for alcohol-based handrub, antimicrobial soap, and plain soap.]

Adapted from: *Hosp Epidemol Infect Control, 2nd Edition, 1999*
Wear Gloves
• When touching feces, blood, body fluids, exudates, and non-intact skin
• For dentistry, resuscitations, necropsies, OB’s
• For venipuncture on animals with a suspected infectious disease and for soft tissue-aspiration
• To clean cages, litter boxes and contaminated environmental surfaces
• To handle dirty laundry
• To handle diagnostic specimens

Change Gloves
• Between examination of individual animals or animal groups
• Between dirty and clean procedures performed on the same patient
• Whenever torn

Gloves, continued
• Wash hands after removing gloves
• Gloves are not a substitute for handwashing
• Gloves are not necessary for handling normal, healthy animals
• Contact with animal blood (except primate blood) has not been a recognized source of occupational infection. Avoid percutaneous and mucosal exposure anyway!

Aerosols
• Aerosols may be large droplets deposited on the mucous membranes or smaller particles that can be inhaled
• In general, risk of infection increases with proximity to the source and duration of exposure

Facial Protection
• Use a mask and goggles, or a face shield during procedures that are likely to generate splashes or sprays of blood, body fluids, or exudates
  – Dentistry
  – Abscesses
  – Suctioning, lavage
  – OB
  – Necropsy

Resuscitation and Obstetrics
• High concentrations of zoonotic agents can be found in birthing fluids
• Use standard precautions
• Don’t make assumptions about etiology
• Do not give mouth to mouth resuscitation!
• Do not blow into an endotracheal tube
Injections

- Cat bites, dog bites and needle sticks are the most commonly reported accident/injury
  - JAVMA 1998; 212 (9) 1386-89
- Inadvertent injection of a vaccine most common needlestick injury

Syringes and Needles

- When injecting live vaccines or aspirating body fluids or tissue, the used syringe with the needle attached should be placed in a sharps container
- Otherwise, the needle and syringe can be separated for disposal of the needle in the sharps container and disposal of the syringe in the regular trash

Preventing Needlestick Injuries

- Needles should never be removed from the syringe by hand
  - Use the needle remover device on the sharps container
  - Use a forceps
- Needle caps should never be removed by mouth!

Avoid Recapping Needles

Small animal veterinarians who always recapped needles were more likely to have sustained a needlestick in the past 12 months OR 2.08, P=0.001

Preventing Needlestick Injuries

- If it is absolutely necessary to recap a needle:
  - Use a forceps
  - Or use the one-handed "scoop" technique: hold the syringe with the attached needle and scoop the cap, which is lying on a flat surface, onto the needle’s sharp end. Tighten by pushing it against an object or by pulling the base of the needle cap onto the hub of the needle with the same hand holding the syringe

Bite and Trauma Prevention

- Whenever possible don’t allow people to hold their own pets
- Consistently use muzzles, cat bags, drugs, or whatever it takes to prevent bites
- Eliminate a common culture among veterinary technicians that they should put themselves at risk to prevent veterinarians from being bitten

Picture courtesy of Dr. J. McQuiston
Disinfectants

- Need to choose the right disinfectant for the job and use it correctly
- Surfaces must be cleaned before disinfection

Comparing Disinfectant Effectiveness

<table>
<thead>
<tr>
<th>Virkon or Trifectant</th>
<th>1:100</th>
<th>Canine parvovirus</th>
<th>Complete inactivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roccal-D (QAC)</td>
<td>1:256</td>
<td>Canine parvovirus</td>
<td>Did not completely inactivate</td>
</tr>
<tr>
<td>Nolvasan (chlorhex.)</td>
<td>1:256</td>
<td>Canine parvovirus</td>
<td>No reduction</td>
</tr>
<tr>
<td>Phenol (pHiso-Hex)</td>
<td>1:256</td>
<td>Canine parvovirus</td>
<td>Did not completely inactivate</td>
</tr>
</tbody>
</table>

www.antecint.co.uk/main/virparvso.htm

Safety of Peroxygen Disinfectants

- Environmentally friendly: Non toxic and biodegradable
- No occupational exposure limits
- In 1% solution, non-irritating to skin or eyes
- Not harmful to most environmental surfaces and materials, including most fabrics

Efficacy of Peroxygen Disinfectants in Veterinary Teaching Hospitals

- Environmental disinfection with 4% directed mist reduced bacterial CFU of S. aureus and S. Typhimurium by >99.9999%
  - JAVMA 2005; 227 (4) 597-602
- Footbaths using a 1% solution: bacterial concentrations on boots, 67%-78% lower than controls. No significant difference using QAC’s over controls
  - JAVMA 2005; 226 (12) 2053-58

Is this O.K.?
Environmental Controls

- Designate staff break areas that are separate from animal care areas
- Use separate refrigerators for human food, animal food, and biologics
- Clean and store dishware for human use away from animal care areas
- Use separate storage and transport bins for clean and dirty laundry

Creating a Written Infection Control Plan

- Appendix 3 of the Compendium provides a model plan that can be tailored to individual practice needs
- A modifiable electronic version is available on the NASPHV website at www.nasphv.org

Summary

- Veterinarians can’t be expected to immediately recognize exotic zoonotic diseases
- However, even when faced with relatively common endemic zoonotic agents in animals, veterinarians haven’t always taken simple steps that would protect themselves and their employees from infection

Summary (cont.)

- We have an obligation to keep veterinary personnel safe
- Veterinarians should set the standard for infection control practices in their clinics!