Taking the Teeth Out of Canine Distemper Virus

Sandra Newbury, DVM
Director
University of Wisconsin-Madison Shelter Medicine Program
UW School of Veterinary Medicine
www.uwsheltermedicine.com

Many thanks to Maddie’s Fund and the ASPCA for funding diagnostic testing that has helped us work with shelters to develop lifesaving approaches to responding to canine distemper!

CDV

- Enveloped RNA virus
- Relatively easy to kill
- Dogs and ferrets are susceptible
- Raccoons and other wildlife species
- Not the same as feline “distemper” (aka panleukopenia)
Clinical signs

- Individual Animal
- "Herd" signs
- No signs
- Sub-clinical or inapparent infections
- Wide range of affected systems
- Range of severity
- Many (most) dogs will recover

Neurologic and Ocular Signs

- Seizures
  - Grand mal
  - "Chewing gum"
- Squinting / blinking
- Uveitis
- Ocular discharge
- Prognosis falls once neuro signs develop

Respiratory Disease

- Nasal / Ocular discharge
- Sneezing
- Coughing
- Dyspnea (trouble breathing)
- Pneumonia
- Secondary pneumonia
Gastrointestinal and Skin Disease

- GI SIGNS
  - Diarrhea
  - Vomiting
  - Anorexia
  - Wasting

- SKIN
  - Pustular Dermatitis
  - Nasal and Digital Hyperkeratosis

“Herd” signs

- Unusual or high number of dogs affected with “Kennel Cough”
- Pneumonia
- Some dogs progress to neurologic disease
- Post-adoption reports of neurologic disease
- Puppies who progress to neurologic disease

How frequently do you see it?

<table>
<thead>
<tr>
<th>Constant level</th>
<th>Outbreaks</th>
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<tbody>
<tr>
<td>Many isolated cases</td>
<td>Rare Isolated cases</td>
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</table>
| Almost never or never | }
1-6 week Incubation

Fever spike 3-6 days post infection

Exposure / Infection

Most common onset of illness

Transmission

- Highly contagious!
- Routes of infection
  - Direct
    - Aerosol
    - Fomite
  - Environment (less likely)
    - No Zoonosis

Direct, most common

- How do you define direct?
- Co-housing
- Improperly used housing, guillotine doors down
- Tie outs for cleaning
- Yards during cleaning
- Admitting areas
- Play groups?
Aerosol Transmission

• Up to 20 feet distance*

*Max Appel, Cornell University, 2006

Fomite over short distances

• Staff and volunteer handling

Environment: Co-mingling “Reservoir Dogs”
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Shedding

- Inapparent or sub-clinical shedding possible in exposed dogs
- Post-recovery shedding Usually less than 4-6 weeks

Long-term PCR positives

- Rare but real issue
- Many months past recovery
- Does PCR positive = viral shedding?
- Infectious potential is unknown, but thought to be low

Susceptibility?

- Many dogs are susceptible on intake
- Varies by community
- Primarily serologic response
- Puppies under 16 – 20 weeks of age assumed to be susceptible
- Maternal Antibodies

7/11 (64%) susceptible to CDV
Which dog is susceptible?

Vaccination

- Key to prevention
- Almost a magic bullet!
- But not quite.

Vaccine handling!!

- Mix just before use
- Don’t allow to sit even at room temperature
- Most important for CDV
- Drawback of having a virus that is easy to kill
Time to Onset of Immunity

- Sterile Immunity for most adults and susceptible pups in 3-5 days
  - (if they are not exposed before then)

We’ve known this for a while

- Twenty-one susceptible puppies in 10 litters were vaccinated with a single dose of combined canine distemper-infectious canine hepatitis modified live virus tissue culture vaccine, Tissuvax-DH (Pitman-Moore Division of the The Dow Chemical Company), simultaneously with introduction into a canine distemper contaminated environment. One of 21 vaccinated puppies and 14 of 16 nonvaccinated littermates died of a canine distemper infection.


Onset of immunity?

- "In my study at the University of Wisconsin, designed to mimic an animal shelter environment, I wanted to find the answer to the question “Will puppies vaccinated with 1 dose of Recombitek C6 four hours before being placed in a room with dogs shedding virulent CDV virus be protected?"

RD Schultz, University of Wisconsin
Onset of immunity?

• “All of the Recombitek vaccinated puppies were protected from development of clinical distemper... My study was designed to test the efficacy of a single dose or rCDV. The results indicate that protection was provided as soon as 4 hours after vaccination, something previously known to occur only with MLV CDV.”

RD Schultz, University of Wisconsin

The problem with puppies

Adapted from Greene’s infectious diseases of the dog and cat: Thanks Mike!

Types of vaccines

• MLV

• Canarypox vectored (Merial)
  - Designed to be more effective at overcoming MDA
  - Recombitek™
Vaccination recommendations

- MLV or rCDV vaccination immediately on intake
  - OR SOONER
- Repeat at two week intervals for pups under 16 weeks of age
- Recommend re-vaccination post adoption
- Community vaccine clinics

Diagnostics

- Collection of clinical signs, history, and herd history
- Diagnostic testing
- Community information

Evaluate Risk Factors

- No vaccines
- Late or postponed vaccination
- Puppies
- Crowding
- Co-mingling (doubling up)
- Some in / some out housing
- Minimal or no isolation for respiratory disease
- Dogs need to move out during cleaning
- Transfer from high risk sources
Evaluation of Clinical signs

- Individual illness
- Signs in the group **

- Is it an outbreak?
  - Severity of RDC
  - Ages affected
  - Numbers affected
  - Timing
  - Vaccination policies and PRACTICES
  - Reported disease in the community

Diagnostic Testing

- rtPCR *
  - WVDL
  - IDEXX
  - Shelter pricing for both
- IFA
  - May be more specific, less sensitive
- Serology?
  - Best used to evaluate susceptibility in a shelter setting
  - Very sensitive test, but limited value due to time and vaccination
  - Especially in unvaccinated dogs

- Negative tests do NOT rule out disease
- May be variations between labs

Is that positive from vaccination?

Understanding quantitative PCR

- Low viral load may suggest:
  - Early infection
  - Late infection
  - Vaccine shedding
  - Low viral shedding
  - Poor virus recovery

- Clinical judgment call based on history and context
- There is no direct means to differentiate vaccine virus vs. field stain with PCR alone

Is that positive from vaccination?
Vaccine Interference

• Most likely to interfere with testing if blood cells are present
• Less likely to interfere with testing from swab samples
• Most likely to interfere 1-3 weeks post-vaccination
• Interference / False positives are usually RARE

Other testing

• CSF Antibody detection
  – Acute encephalopathic disease
  – Compare antibody levels to serum
• Caution with neurologic disease in shelter dogs and dogs with unknown history!!
  – Rabies risk
  – Poor prognosis
  – Welfare concerns

Necropsy and Histopathology

• Best way to rule out disease
  – Evaluate risk for the group
• Explore other potential causes for disease
• Check with the lab before sending samples
Source?

- Community acquired?
- Shelter acquired?
- Source shelter acquired?

Timing?

Fever spike 3-6 days post infection

Week 0 1 2 3 4 5 6

Exposure / Infection

Most common recognition of signs

Amplification and infectious potential

Oops!
Random co-housing increases risk

 Oops!

Timing?

3-5 days of some susceptibility

Shelter Intake Vaccination

Exposure / Infection

Week 0 1 2 3 4 5 6

Continued susceptibility for pups

Shelter entry

Week 0 1 2 3 4 5 6 7 8

Clinical signs

CAUTION!
Timing?

Shelter entry

Week 0 1 2 3 4 5 6

Clinical Signs?

Timing?

Source shelter entry

Destination Shelter entry

Week 0 1 2 3 4 5 6

Clinical Signs?

Prevention: Eliminate Risk Factors

• **Vaccinate** on INTAKE or sooner!!
  – Community outreach vaccine clinics
• **Protect the puppies**, but get them out quickly
• **Isolate** / **separate** sick dogs promptly
• **Avoid intake co-housing** for dogs
  – Plan co-housing for dogs who stay longer than 1 week
• **Monitor** closely for illness
• **Test** periodically or when clinical signs indicate

• Take respiratory disease seriously
Fighting Back: Response to Illness:

Things are changing!

…but prevention is still key.

Individual Animal Illness

- Individual health and welfare
- Group health and welfare
- Potential for spread or an outbreak to occur
- Potential for adoption
- Available isolation
- Capacity to provide treatment and supportive care
- Clinical signs - prognosis
- Numbers of other susceptible animals
- Resources!

- Do you need an outbreak response plan?

Outbreak Response?

Key Concept:
- Stop the cycle of transmission.

Problems:
- LONG incubation period
- Ease of transmission
- Clinical signs overlap with CRDC
- "Reservoir" dogs
- Susceptible puppies
- Long “recovery” period
- Resources!
Response

- “Clean Break”
- Please don’t do nothing

PLEASE, Don’t go this alone

- Veterinary assistance is essential to response implementation
- Maximize life saving
- Minimize resource investment

Communication!

- Communicate early and often
- Ask for help
- Explain the life saving work you’re doing
Understanding Risk Assessment and Immunity

- Risk group designation
  - Based on controlled challenge studies in dogs with known active immunity
- Active immunity vs. Passive immunity

Risk group evaluation and “Clean Break”

- General principles:
  - Stop the cycle of transmission
  - Send low risk dogs on their way
  - Isolate or separate sick dogs
  - Identify susceptible dogs

Risk Evaluation Overview

“Clean break”
New Incoming dogs
Clinical signs
Sick
Antibody Titer
Negative Titer
Positive Titer
No sign

Start: Get Ready

- Vaccinate ON INTAKE or sooner!
- Repeat at two-week intervals if puppies stay that long
- Get them out sooner
- Evaluate potential for adoption
- Consider every dog in current population
- Evaluate capacity

Step one: “CLEAN BREAK”

- New, incoming dogs must be separated from exposed dogs
- Clean and disinfect the area first
- Evaluate expected intake
- Plan any co-mingling
- Clean and care for new arrivals first
- Separate staff if possible

Step Two: Evaluate Clinical Signs

- Carefully evaluate each dog
- ANY suspect clinical signs = High Risk
  - Respiratory disease
  - Unexplained GI disease
  - “ADR”
  - PCR testing?
- Assessment by veterinarian to rule out clinical signs
### Step Three: Antibody titers

- High Risk and Low Risk groups
- Can’t evaluate dogs with clinical signs*
- Evaluating pups
- In House testing
  - Faster
  - Positive / Negative
- Diagnostic Lab testing
  - More quantifiable
  - Longer turn around
  - Needs to validated against challenge data

### In house kits

- Canine VacCiCheck
- Synbiotics TiterCheck
- Carefully follow instructions
- Experienced technicians
- Tests validated by VN
- Cost = approx. $20 / dog tested

### Antibody TEST Interpretation

<table>
<thead>
<tr>
<th>Age</th>
<th>CPV</th>
<th>CDV</th>
<th>IC</th>
<th>Risk Category</th>
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<td>+</td>
<td>+</td>
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<td>LON</td>
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- Positive is **GOOD**
- Positive test in an adult dog with no clinical signs indicates **low risk**
- Low risk does not equal NO risk
- Negative test indicates high risk
- High risk does not equal disease
- Clinical sings means high risk – no testing needed
Puppies?

- Negative titer = High Risk
- Low Risk? – only for now
- Interpreting positive antibody levels in puppies is less clear
- Prevention!

Step Four: Evaluate Risk

- How high is the risk?
- Vaccination practices?
- Sanitation practices?
- Co-mingling practices?
- Level of current disease?
- Age?

- Not Stray vs. Surrender
- Not all friendly dogs

Step Five: Shuffle
**Clinical Signs**

- Isolate or remove sick dogs
- Carefully weigh risks of keeping sick dogs in the shelter.
- Can you care for sick dogs?
- Post-recovery shedding can be prolonged
- Ideally, two negatives before release

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**Positive In-House Titer = Low Risk**

- Send them home
- Inform potential adopters
- Keep separate from “clean” population
- Move as cohorts whenever possible

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**Negative or Low Titer = High Risk**

- What to do?
- Remember this list?

Problems:
- LONG incubation period
- Ease of transmission
- Clinical signs overlap with CRDC
- “Reservoir” dogs
- Susceptible puppies
Quarantine and release?

- Risk evaluation often allows many (most) dogs to be saved.
- Quarantine alone would be 6 weeks
- Challenges to capacity and welfare
  - Begin quarantine –
  - Cleared when no clinical signs plus
  - Antibody positive and pcr negative
- Consider impact on capacity and crowding
- Consider maintenance of health and emotional well-being

Can you safely send them somewhere else?

- Prioritize Healthy High Risk Dogs**
  - What is safe?
  - Well vaccinated adult dogs
  - Resilient humans
  - No puppies
  - No uninformed adopters

Depopulation

"The Association of Shelter Veterinarians believes that depopulation in response to a disease outbreak should only be considered as a last resort, when morbidity and mortality of disease are uncommonly severe. While depopulation may create a break between exposed and unexposed populations and lead to quicker resumption of normal sheltering activities, it may result in the euthanasia of healthy animals. Along with stakeholders such as shelter administrators, board members, and staff members, veterinarians experienced in outbreak management should be consulted for guidance before deciding to depopulate."
Long Term Response Plan

• Eliminate risk factors
• Vaccinate ON INTAKE
• Protect the pups
• Disease detection at intake and ongoing
• Isolate or separate sick dogs
• All in / all out
• Planned co-mingling (if unavoidable)
• Encourage vaccination in your community

Summary

• CDV is one of the most preventable infectious diseases we battle.
• Help work toward a community solution.
• Don’t wait for an outbreak to put good practices in place.
• Outbreaks can be managed in life saving ways.

Thanks to you, everyday.