DIAGNOSIS & MANAGEMENT OF CANINE DISTEMPER OUTBREAKS

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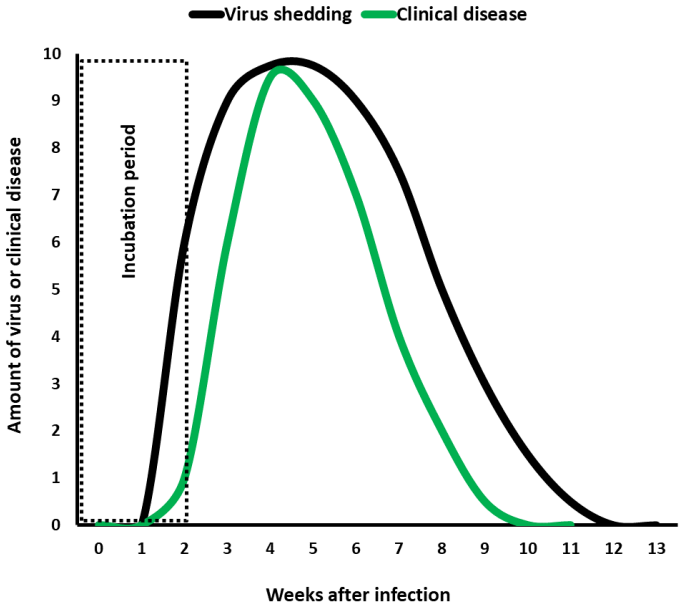
The most devastating and deadliest disease outbreak for shelters is canine distemper. Ask any private practice veterinarian about canine distemper and the likely reply is that they have never seen a case in their career and frankly thought vaccination had eradicated this disease in the US. Ask a shelter veterinarian and the reply will be entirely different, reflecting their fear and dread of this disease entering their shelter, many times from first-hand experience. Most shelters in the US are at risk for distemper outbreaks, including the Northeastern shelters that import dogs from Southern shelters where the virus is endemic and very prevalent in wildlife reservoirs. While the risk cannot be eradicated, distemper outbreaks can be successfully managed using life-saving interventions. This presentation provides experience-based insights on diagnosis and management of canine distemper in the shelter environment using strategies that maximize life-saving and achieve the quickest possible resolution.

Studies in different shelters have shown that more than half of adult dogs, whether stray or owner-surrendered, have no immunity to canine distemper virus (CDV) at the time of admission. Nearly all puppies <6 months old are naïve. Studies have also shown that it takes about 2 weeks for most naïve adult dogs to achieve a protective immune response to a modified-live CDV vaccine administered on admission and 4 weeks for a protective response to a recombinant CDV vaccine. Response to vaccination takes much longer for puppies due to interference by maternally derived antibodies and immune system immaturity. The large pool of dogs without immunity coupled with the time required for response to vaccination create favorable conditions for CDV outbreaks. Once the virus is introduced by an infected dog, in-shelter transmission is sustained by the pool of susceptible dogs.

Inherent properties of CDV contribute to spread of infection in a susceptible shelter population. CDV is unique among the common pathogens because of its long incubation period and shedding period: the incubation period is typically around 2 weeks and the shedding period continues for weeks to months, even after clinical recovery. The long incubation period causes delays in recognizing affected dogs, resulting in a slow insidious increase in the number of infected ones in the population. Additionally, infected dogs from the community enter shelters apparently healthy, but start shedding virus as they emerge from the incubation period. Up to 50% of dogs may have a subclinical infection where they are actively shedding virus but cannot be recognized as a contagious threat. The inability to identify dogs with subclinical infection ensures that more dogs are exposed. The prolonged shedding period causes



continual environmental contamination and exposure for the population. ***The long incubation and shedding periods have the greatest impact on options for management of CDV outbreaks.***

CDV infects multiple organ systems - respiratory, gastrointestinal, urogenital, ocular, nervous system, and skin. Multi-organ infection can mimic diseases caused by other conditions, confounding recognition and causing frequent misdiagnosis. The most common primary clinical presentation is respiratory, and CDV should be suspected for dogs with oculonasal discharge and subtle coughing that persists for weeks or progresses to pneumonia. Puppies can present with a mixture of respiratory and gastrointestinal signs that initially resemble parvoviral infection. In contrast to popular belief, neurological signs such as myoclonus and seizures are not common, occurring in only a small fraction of infected dogs within the first month of infection. While neurological signs lend strong suspicion to CDV infection, the absence of such signs does not rule out CDV. ***The bottom line is that CDV infection cannot be diagnosed by clinical signs alone. Infection must be documented and confirmed by testing***.

CDV Diagnosis

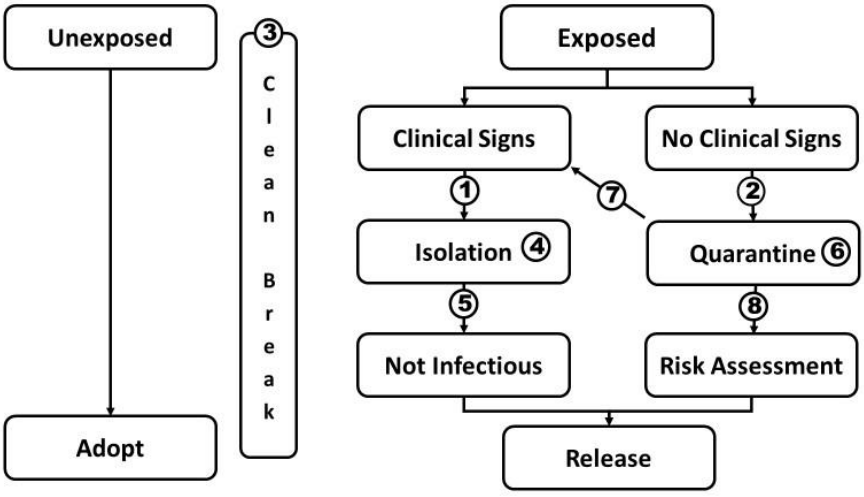
Diagnosis is essential for successful control and resolution of disease outbreaks. Timely diagnosis substantially impacts how many animals remain healthy and adoptable. No diagnosis or late diagnosis increases the number of sick and exposed animals due to improper management and ultimately the number of animals euthanized. Identification of the causative pathogen provides:

- Isolation time for sick animals (shedding period)
- Quarantine time for exposed animals (incubation period)
- Proper patient management, including treatment options and costs, prognosis for recovery, and average time to recovery
- Transmission routes important to biosecurity
- Disinfectants for pathogen inactivation
- Best strategy to prevent recurrence

Even shelters with tight budgets should invest in diagnostic testing since this is the key to management and prevention strategies. It is far costlier to base these core strategies on guesswork and trial by error, both in terms of the financial burden as well as the suffering of the animals and the shelter's reputation. The best diagnostic test for CDV is PCR performed on nasal and oropharyngeal swabs. Two swabs should be collected from each dog and pooled together as one sample to maximize the probability of pathogen detection Studies have determined that the modified-live CDV vaccine strains may be detected by PCR in <20% of dogs vaccinated within 2 weeks of testing, yielding potentially false positive results. False positives usually yield low viral counts (Idexx) or high Ct values. The infection status can be clarified by repeating the PCR test in 5 to 7 days – another positive result confirms true infection while a negative result is consistent with a false positive.

Management of Distemper Outbreaks

Here is the basic management flow diagram. Numbers refer to action steps.



1. **Isolation of sick dogs**
   - The first and most important step to stop exposure of more dogs and pathogen contamination of the environment.
   - PCR confirmation of CDV infection
   - CDV transmission routes include dog-dog contact, droplets emitted by sneezing, aerosols generated by coughing, and contact with contaminated environments and staff.
   - Isolation in a physically enclosed room or transfer to medical foster homes without other dogs or with well-vaccinated adult dogs
2. **Quarantine of exposed asymptomatic dogs**
   - The dogs should be considered an infectious risk and housed in a physically enclosed space separate from sick dogs and unexposed dogs.
   - No dogs should leave quarantine until expiration of the quarantine time or diagnostic testing determines they are not an infectious risk
   - Dogs can be quarantined in homes without other dogs or with well-vaccinated adult dogs.
   - Adoptions and transfers to rescue should be stopped to avoid transfer of disease by dogs that may be incubating CDV
3. **Provide a clean break**
   - Unexposed dogs and new arrivals must be housed in a separate, physically enclosed, clean area to shield them from sick and exposed dogs
   - Ideally, admission of new dogs is stopped or diverted to another facility, rescue groups, or foster homes until the disease outbreak is resolved
   - For animal control shelters, intake should be restricted to ill/injured strays and dogs that have bitten people or are a public safety threat. Owner surrenders can be discontinued until the outbreak is resolved.
   - Implement strategies that promote fast placement of unexposed puppies and dogs in homes or with rescue groups.
   - Staff should care for the “clean” dogs first using dedicated supplies before working in the quarantine and isolation housing areas. The best option is to assign separate staff to care of the unexposed dogs only to reduce risk of inadvertent cross-contamination.
4. **Isolation time is weeks to months**
   - Requires strict biosecurity conditions for 1 to 3 months.

- Most municipal shelters do not have space, staff, medical resources, or funding for in-shelter housing and treatment and must opt for euthanasia of confirmed cases
- An alternative is transfer of cases to a safe foster home or rescue group. This eliminates risk for virus spillover in the shelter and provides social and enrichment needs for the dogs
- Another alternative is off-site housing of infected dogs in a warehouse or other facility
- Staff must wear full coverage PPE (hair cover, Tyvek suit, gloves, boots) and use supplies dedicated to this area.

5. **Release from Isolation**
   - Safe release requires serial PCR testing until there are 2 consecutive negative results
   - Recent evidence suggests that dogs stop shedding live infectious virus after the peak of virus RNA detection by PCR. Once PCR values start to decline, the dog can be released even though they are still PCR-positive. This can substantially reduce isolation times by weeks to months.
6. **Quarantine time is 2 weeks from last known exposure**
   - Dogs may not be sick because they are in the preclinical incubation period, have a subclinical infection, or are not infected due to immunity
   - Monitor dogs twice daily for clinical signs
   - Staff must wear full PPE (hair cover, Tyvek suit, gloves, boots) and use supplies dedicated to this area
7. **Move new clinical cases from Quarantine to Isolation**
   - Re-start the 2-week clock for remaining dogs in quarantine
   - Multiple re-starts with clinical breaks can extend quarantine for weeks to months, creating a strain on housing capacity and staff and poor welfare for the dogs
8. **Release from Quarantine**
   - Perform a CDV PCR test on asymptomatic dogs after expiration of the last quarantine time. Release dogs with negative PCR tests.
   - An alternative to waiting out the quarantine clock is to to perform a risk assessment for all potentially exposed dogs at the start of quarantine. This requires paired PCR and antibody titer testing for each dog. Swabs are collected for CDV PCR and serum samples for CDV antibody titer testing using point-of-care test kits or a reference laboratory. Dogs with antibody titers ≥64 are considered protected from infection.

CDV PCR	CDV Antibody Titer	Interpretation	Action
Negative	Negative	Uninfected/not immune	Quarantine
Negative	Positive	Uninfected/immune	Release
Positive	Negative	Infected/no immune response	Isolation
Positive	Positive	Infected/immune response	Isolation

This paired testing identifies uninfected and immune dogs that can be safely released, uninfected dogs without protective immunity that must remain in Quarantine, and dogs with subclinical infections that should be housed in Isolation to stop exposure. This reduces the number of quarantined dogs, shortens the total quarantine time, alleviates strain on housing capacity and capacity for care, and provides quicker resolution of the outbreak.

Other important steps for management of distemper outbreaks include:

1. Proactive transparent communication about the circumstances of the outbreak and the control strategy being used. This provides an opportunity to disseminate accurate information to shelter staff as well as community stakeholders such as adopters, rescue groups, veterinarians, and pet owners.
2. A written statement describing the disease, what animals are at risk, and the transmission modes should be provided to all shelter staff, including managers, directors, and public information officers. This can serve as a press release to inform the public.

Key Takeaways

- CDV is a systemic, multi-organ infection with clinical signs that mimic other diseases.
- Diagnosis must be confirmed by testing, not based on clinical signs alone. The PCR test on nasal and oropharyngeal swabs is the most accurate diagnostic test for CDV.
- CDV has a long incubation period (about 2 weeks) and long shedding period (weeks to months). These promote virus spread through a susceptible population and impact how distemper outbreaks are managed.
- The basic management strategy includes isolation of sick dogs for the duration of the shedding period, quarantine of exposed asymptomatic dogs for the incubation period, and establishment of a clean break to protect unexposed dogs.
- The clean break is best achieved by stopping admissions altogether or by reducing admissions to dogs that must come into the shelter, such as ill/injured strays, dogs needing rabies quarantine, dangerous dogs, dogs from cruelty cases.
- Separate housing for isolation, quarantine, and unexposed dogs creates substantial strain on housing capacity and care capacity. Shelters may need to house selected populations offsite or move some dogs to foster or rescue to alleviate the strain and avoid euthanasia.
- Safe release of dogs from isolation is determined by serial PCR tests conducted until a negative status is reached. Cessation of positive PCR tests may take weeks to months. A time-and cost-saving alternative is release of dogs once the PCR test values start to decrease as the likelihood of shedding live infectious virus may be minimal.
- Safe release of asymptomatic exposed dogs from quarantine also depends on PCR testing performed at the end of the final quarantine time. Since the 2-week quarantine clock must be re-started with every new clinical case, the final quarantine time can be weeks to months.
- A time-, housing-, and cost-saving alternative for triaging dogs during an outbreak is to perform paired CDV PCR and CDV antibody titer testing on every potentially exposed dog. Dogs with a negative PCR and protective titer are uninfected and immune and do not need isolation or quarantine. Dogs with a negative PCR but no protective titer must enter quarantine due to risk of infection. Dogs with a positive PCR are infected and must be isolated, regardless of the antibody titer status.