OUTBREAKS

TOOLS FOR MANAGING WORST-CASE SCENERIOS

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INTRODUCTION

With an increasing proportion of pets obtained from multi-animal backgrounds; a growing number of people involved with foster care or animal rescue; and an increasingly mobile society, any veterinary practitioner may be faced with an outbreak either within the clinic or in a shelter or rescue home. The rapid spread of canine influenza throughout much of the United States provides a vivid example of this phenomenon. In past years, draconian measures such as total depopulation have often been utilized in shelters to control outbreaks. Such measures are not viable when infectious disease invades a veterinary clinic or boarding facility, and are increasingly unacceptable at shelters as well. Fortunately, with a well-thought out and systematic approach, most outbreaks can be controlled successfully with far less drastic measures.

RISK FACTORS

Most outbreaks are multi-factorial, involving both the presence of a pathogen and environmental or animal risk factors that facilitate spread.

Animal risk factors for outbreaks include:

- STRESS
- Animals not vaccinated on intake (shelters) or prior to intake (boarding facilities)
- External and internal parasites
- Concurrent disease (such as upper respiratory infection)
- History of predation or scavenging

Environmental risk factors for outbreaks include:

- OVERCROWDING (and resultant lapses in cleaning, proper housing and care)
- "Some in – some out" housing
- Failure to isolate ill animals
- Mixing of species
- Antibiotic use

GENERAL GUIDELINES

Outbreaks should be managed using the following 4 step criteria

1) Diagnosis and Isolation
2) Risk Evaluation
3) Environmental Decontamination
4) Establishing a "Clean Break"

EFFICIENT DIAGNOSIS AND ISOLATION OF DISEASED ANIMALS

In order to be effective in halting an outbreak, rapid and sensitive diagnostic methods are needed so that affected animals can be recognized and appropriately isolated. For example, canine parvovirus and feline panleukopenia can often be quickly diagnosed using a snap ELISA test, and in-house blood smears can be used for supportive evidence. Woods lamp and direct hair exam can facilitate quick recognition of ringworm. PCR testing is becoming more widely available for a variety of diseases and turnaround time can be as little as 24 hours from some laboratories, but issues with specificity and sample handling complicate interpretation in some cases. Unfortunately, quick and accurate tests do not yet exist for some conditions.

When rapid diagnostic tests are not available, it is often necessary to proceed under the assumption of "worst case scenario" and treat all animals with suspicious clinical signs as if they are infected. A common and potentially dangerous misapprehension is the belief that mildly diseased animals do not pose a great risk to others. While this may be the case for some conditions, often the severity of disease manifestations in an individual animal reflects more on that individual's immunocompetence rather than the severity of the infecting pathogen. Transmission of severe and even fatal disease by mildly infected animals is commonplace with some important diseases such as canine distemper and hypervirulent feline calicivirus.

RISK EVALUATION:

IDENTIFICATION AND REMOVAL OF EXPOSED/AT-RISK ANIMALS

Animals which are not yet symptomatic but may be incubating disease must be identified and isolated for a suitable quarantine period (or euthanized in shelters if no quarantine facility exists or can be devised). Quarantine can be costly and labor intensive, and euthanasia is obviously a last resort; therefore it is important to distinguish those animals genuinely at risk for infection. In order to assess risk level, the veterinarian needs to know the method of disease spread, risk factors for infection such as age or breed, and the extent to which vaccinated animals are reliably protected.

Assessing exposure: For conditions that are spread via aerosol transmission, it may be necessary to consider all animals within a facility potentially exposed. "Hair-borne" disease such as ringworm can certainly drift through a facility or spread on contaminated clothing if care is not taken to prevent this. Environmental conditions also influence the likelihood of transmission. Factors which reduce the likelihood that disease will spread significantly within a facility include:

- ✓ Animal housing areas are constructed of stainless steel, sealed concrete, or other non-porous, non-scratched surface that can be successfully disinfected.
- ✓ A disinfectant proven effective against the pathogen in question is used on a daily basis.
- ✓ Animals are infrequently or never moved from one kennel to another (especially if they are not moved on a daily basis for cleaning, e.g. double sided runs or spot cleaning are correctly used).
- ✓ Common rooms, exam surfaces and carriers are effectively disinfected between each use.
- ✓ Sick animals are promptly identified and isolated
- ✓ Separate equipment and protective clothing is used between handling healthy and sick animals.
- ✓ The facility is not overcrowded.

Assessing risk: Even when animals are exposed to a pathogen it is not uncommon for some to escape infection, depending on the animal's risk factors and immune status. The two most important factors are age and vaccination status. For example, fully vaccinated adult cats exposed to feline panleukopenia are very unlikely to get sick and need not be quarantined. This assumption can be made regarding adult dogs vaccinated for parvovirus and canine distemper as well. On the other hand,

vaccine protection against respiratory infection and calicivirus tends to be mediocre at best, and all exposed animals should be assumed to be at risk regardless of vaccine status.

Use of serology for risk assessment: For diseases in which serologic status correlates well with protection, serological testing may be valuable in identifying animals which are NOT at risk for infection and therefore need not be quarantined or euthanized. Diseases for which this is the case include feline panleukopenia, canine parvovirus, and canine distemper. Only serological tests utilizing viral neutralization or hemaglutination inhibition or validated by same should be used. Positive titers at the time (or within a few days) of exposure *in asymptomatic animals* correlate well with protection; negative titers do not necessarily mean the animal is susceptible. In-house serological tests are available in some cases, and this may be a highly cost effective method of assessing risk.

Length of quarantine: The quarantine period must be equal to or longer than the longest probable incubation period of disease. Again, this is easier achieved with some diseases than others: a two week quarantine period for canine influenza or parvovirus is sufficient, while the incubation for some strains of canine distemper can be four weeks or even longer. In general, quarantine for all animals must be re-started if any animal within the quarantine area breaks with disease (exceptions may be made if vaccine protection has since been provided). Recommended quarantine periods for common shelter infections can be found at http://www.sheltermedicine.com/portal/is_infectious_diseases.shtml#top3.

Options for quarantine: The level of required precautions for quarantine depends to some extent on the ease of spread and route of transmission. Conditions that are extremely durable in the environment (such as canine and feline parvovirus), or that are spread via airborne transmission (such as canine distemper and canine infectious respiratory disease complex) require the most rigorous precautions. Ideal quarantine entails complete physical separation, including separate housing and ventilation, equipment and supplies. Full protective garments should be worn in quarantine areas, including long sleeved tops and long pants or jump suits, gloves, and shoe covers or dedicated boots. Foot baths are not sufficient to reliably prevent transmission of serious disease. Equipment and supplies used for quarantine should be clearly marked and used only in that area. Quarantine areas are reserved for healthy/at-risk animals not currently showing any signs of illness. Separate facilities are required for isolation and treatment of sick animals. If resources are such that adequate quarantine cannot be performed at the shelter, off site options or transfer to facilities that do have the resources for quarantine can be considered as described below for isolation and treatment.

RISK EVALUATION: DEFINING "THE POPULATION"

The population in a shelter setting during an outbreak can be divided into the following categories that can be used to determine next action steps.

1) Animals that are infected
2) Animals that have been exposed and are at risk of developing infection
3) Animals that have been exposed and are not at risk of developing infection
4) Animals that have not been exposed

Animals that are infected

Animals that are infected must be quickly identified and removed from the general population. These animals may be clinically ill or subclinical.

EXAMPLE 1. PARVOVIRUS

Dogs and puppies showing clinical signs of illness such as diarrhea should be tested. The Parvo Snap test can quickly be used to identify positive animals in clinically symptomatic populations. Testing the entire population is neither cost-effective nor appropriate in most circumstances. Those animals that are positive should be completely isolated with separate housing, equipment, supplies, and staff if the facility chooses to treat clinically positive animals. Some animals may be transferred to tertiary veterinary clinics for treatment. Due to the highly infectious nature of parvovirus, however, euthanasia is often the most humane choice for animals infected with parvovirus.

EXAMPLE 2. DERMATOPHYTOSIS (RINGWORM)

Screening the entire feline population with a thorough physical exam, Wood's lamp screening, direct fungal exam, and fungal culture is often the best tool for handling a ringworm outbreak. Animals that are infected should be placed under strict isolation procedures, oftentimes a separate facility, separate staff, and careful environmental control. Due to its highly infectious nature and its zoonotic potential, it may not be possible to treat all animals that are positive for ringworm in a shelter setting.

Animals that have been exposed and are at risk

Animals that are not yet symptomatic but may be incubating disease must be identified and isolated for a suitable quarantine period (or euthanized in shelters if no quarantine facility exists or can be devised). Quarantine can be costly and labor intensive, and euthanasia is obviously a last resort; therefore it is important to distinguish those animals genuinely at risk for infection. In order to assess risk level, the veterinarian needs to know the method of disease spread, risk factors for

infection such as age or breed, and the extent to which vaccinated animals are reliably protected.

EXAMPLE 1. PARVOVIRUS
Isolate animals that have been exposed and quarantine for 2 weeks if facilities are available for quarantine. Titer evaluation is a good alternative to holding animals for 14 days in a facility. Close evaluation of the population flow through and average length of stay will greatly aid in determining the best course of action for individual organizations. In general, all puppies under the age of 5 months are considered high risk. Adults that are not protected by an effective modified live parvovirus vaccine at the time of exposure may also be high risk. Titer evaluation will help distinguish those animals that have appropriate protection.

EXAMPLE 2. DERMATOPHYTOSIS (RINGWORM)
Animals that have been exposed to ringworm often carry the fungus themselves. Proper screening of this population includes a thorough physical exam, Wood's lamp test, and DTM. While the DTM is processing, those animals that are exposed without identifiable lesions can be lyme sulfur dipped.

Animals that have been exposed and are not at risk

EXAMPLE 1. PARVOVIRUS
Adult animals without any clinical signs that have been vaccinated with a modified live parvovirus vaccine at least 5 days prior to the first date of exposure should be considered low risk. Titer evaluation can be used to confirm protection.

EXAMPLE 2. DERMATOPHYTOSIS (RINGWORM)
All animals that are exposed to ringworm are considered at risk.

Animals that have not been exposed
It is very important to keep this population separate from the other three groups who have exposure risk. In some disease settings, any animals that were in the shelter at the time of the outbreak may be considered exposed.

PROTECTION OF NEWLY ADMITTED ANIMALS: ESTABLISHING A "CLEAN BREAK"

Restriction of intake: Protection of newly admitted animals must often take place simultaneously with the steps to identify and isolate at-risk animals outlined above. Ideally, intake will be halted until the outbreak is resolved, or at least until initial control measures have been put in place and a clean, safe area created. To facilitate this, plans should be made ahead of time: contact other shelters, rescue groups and even veterinary clinics or kennels in the area, and determine who can help should

intake need to be temporarily diverted (and offer the same if possible should other organization be faced with a crisis). For municipal shelters or those with animal control contracts, check whether some categories of intake, such as owner-surrendered animals, can be temporarily restricted. Even if intake cannot be formally suspended, counsel surrendering owners and finders of stray animals about the current risks, and ask if they can keep the animals for even a few extra days while initial preventive measures are put in place. If a vaccine is available for the outbreak condition, consider vaccinating these animals prior to sending them home with the owner or finder, giving the animal an extra measure of protection should it eventually wind up in the shelter.

Create a clean break: Unless the entire shelter operation can be shut down for a quarantine period, it will be necessary to create a clean break between the exposed/at risk population and newly admitted animals. This is most easily accomplished if an entire, distinct building or ward can be emptied. If absolutely necessary, it may be preferable to double up compatible animals with similar exposure histories (e.g. double up two exposed/at-risk dogs in one run, or combine multiple exposed cats in a group room) to achieve this, so that all at-risk animals may be combined in a single area, rather than intermingling un-exposed with exposed animals. If it is not possible to create an entire clean ward, some shelters have successfully managed outbreaks by creating a break of several kennels/separate cage banks between exposed and naïve animals. Creating such a break requires very clear visual, and ideally physical, barriers between "clean" and "dirty" areas. If sufficient staff is available, "red" and "green" teams should be designated, and each team should enter only the dirty and clean areas respectively. Members of the public should only enter "dirty" areas when escorted by staff.

Vaccination and prophylactic treatment of new intakes: Vaccination of all animals on intake forms the cornerstone of prevention for several diseases that otherwise may lead to serious outbreaks in shelters. Intake vaccination becomes even more critical in the face of a known outbreak. In general, during an outbreak vaccines for the disease in question should be started at the youngest possible age, and revaccination of kittens and puppies performed at the shortest safe interval while they remain in the shelter (every two weeks with parenteral FVRCP and DAPP respectively). If vaccines can be given prior to admission that is ideal(e.g. by vaccinating animals and returning them to the owner or finder for a few days). If exposed animals have not been vaccinated, it is helpful to vaccinate them as well. While this will not prevent disease from a prior exposure, it will not increase the risk of illness if exposure has already occurred, and will increase herd immunity as well as protect individuals should spread continue.

In general, blanket drug treatment should be avoided in multi-animal facilities due to the risk of selecting for drug resistant pathogens. However, in the case of a few infectious conditions, prophylactic treatment may be useful for animals that must be exposed to a contaminated environment. For example, cats being admitted to a ringworm-contaminated facility may benefit from a single dip with lime-sulfur, or kittens and puppies may benefit from prophylactic treatment for coccidia when housed in a chronically contaminated environment.

ENVIRONMENTAL DECONTAMINATION

In some cases minimal cleaning with almost any disinfectant will suffice to render a contaminated environment safe again. However, several of the infectious agents associated with outbreaks in cats and dogs are extremely durable and resistant to all but a handful of disinfectants. This includes the un-enveloped viruses (such as canine parvovirus, feline panleukopenia) and ringworm (Microsporum canis. Once a clinic, home or shelter is contaminated with one of these pathogens, careful mechanical cleaning followed by effective disinfection is imperative before naïve animals can be re-introduced.

An often over-looked source of ongoing contamination is subclinically affected or carrier animals, (those that are chronically infected but show no signs of disease). Feline respiratory infections are notorious for establishing carrier states, and this can be an issue in resolving a feline calicivirus outbreak. Subtle or subclinical infection may also be an issue in diarrheal or ringworm outbreaks; it may be necessary in diarrheal outbreaks to prophylactically treat all exposed animals, and in ringworm outbreaks to culture and treat accordingly regardless of visible lesions.

Basic steps for environmental decontamination following any outbreak:

1. Identify and treat/isolate carrier or subclinically affected animals, as described above.

2. Mechanically clean the environment as well as possible. Irrigate outdoor areas such as lawns and gravel yards. Steam clean carpeting and furniture. Clear surfaces of clutter, wash with detergent, disinfect and rinse to the extent possible. Allow all areas to DRY thoroughly between cleaning, and maximize exposure to sunlight. Often environments can be rendered safe through careful mechanical cleaning, even following contamination with highly durable agents such as parvo.

3. Use disinfectants with broad spectrum. If you know what pathogen you are dealing with, use a disinfectant proven effective by independent studies. For un-enveloped viruses such as parvovirus, this includes sodium hypochlorite (5% household bleach diluted at 1:32) and potassium peroxymonosulfate (e.g. Trifectant®). For ringworm, only sodium hypochlorite diluted at 1:10 has proven reasonably effective. If dealing with an unknown pathogen, consider using an additional disinfectant to that normally utilized: if you usually use a quaternary ammonium disinfectant, follow with bleach, or vice versa (check to ensure compatibility, or rinse thoroughly between disinfectants).

4. Scope out possible fomites/overlooked contaminated areas. Often a tremendous effort is expended cleaning animal areas, but key locations are over-looked. Especially important are animal transport vehicles, carriers, exam surfaces and equipment. In one shelter, an outbreak was apparently sustained for several months by a contaminated "rabies pole"; in another, contamination was detected in the siphon hose used to dispense disinfectant! It may be necessary to discard scratched plastic items such as carriers, beds and litter pans if these cannot be successfully cleaned/disinfected.

5. Tincture of time? It is a common practice to empty a cage or facility for some time following a disease outbreak. While this may be helpful for relatively fragile pathogens such as canine influenza or distemper, it is not always necessary if careful mechanical cleaning and disinfection has been accomplished. In some cases, it may even lead to a false sense of security – a couple of weeks is insufficient to eliminate durable agents such as parvovirus or ringworm. In these cases, the only real benefit of holding areas closed is to allow multiple cleaning cycles to take place; this process can be accelerated by cleaning and drying repeatedly at shorter intervals if a shelter, clinic or boarding kennel is eager to re-open an area.

EXAMPLE 1. PARVOVIRUS

Include Bleach, Trifectant, Wysiwash, or Accelerated Hydrogen Peroxide in the cleaning protocol to kill this durable virus. If organic material is not able to be removed prior to cleaning, use Trifectant, which is more effective in the face of organic material and sunlight than bleach.

EXAMPLE 2. DERMATOPHYTOSIS (RINGWORM)
Mechanical cleaning and 10% bleach are required to remove this hardy organism. It is very important to repeat environmental cultures when dealing with ringworm to ensure that the environment is clean. Cleaning carriers and toys thoroughly with bleach and allowing them to dry in the sun will assist with killing this fungus.

DOCUMENTATION & COMMUNICATION

It is important to keep good records to assist with managing an outbreak. Information that is important includes:

1) What is the cause of the outbreak?
2) Who is affected?
3) How many animals affected?
4) When did disease develop?
5) Where did the affected animals reside?
6) What is the time course of disease spread?
7) When were control measures taken in relation to new cases of disease?

ADDITIONAL RESOURCES & REFERENCES

WWW.SHELTERMEDICINE.COM

Infectious Disease Management in Animal Shelters; K.Hurley & L. Miller; 2009

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