

5-11-2018

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Recommended Citation

Gorham, Ariel, "Importance of Vaccinating for Canine Parvovirus: Best Practices for Prevention" (2018). *Honors Theses*. 440.
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Importance of Vaccinating for Canine Parvovirus: Best Practices for Prevention

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A thesis submitted to the University Honors Program
in partial fulfillment of the requirements for the
Honors Diploma

Southern Illinois University

April 25, 2018

Overview

This University Honors Thesis combines my cutting edge research on canine parvovirus and how to refine professional practice for optimal prevention. Canine parvovirus is a highly transmissible virus that infects the gastrointestinal tract of dogs and spreads through secretions of infected animals or fomites. Puppies younger than four months and unvaccinated adult dogs are most susceptible to the virus. There is no cure for the illness, and treatment usually centers on rehydrating the animal and maintaining good hygiene. Once the disease has been contracted, survival is not guaranteed; mortality associated with infection is between 16 and 48 percent (Cahn and Line 2005). However, a vaccine for the virus is widely available and extremely effective when given as a series of three shots beginning around 6 weeks of age and ending at 16 weeks of age, given at 3-4 week intervals (Baker Institute 2014). Canine parvovirus is one of the most common diseases diagnosed in puppies in the veterinary field. In order to show the significance parvovirus has in the veterinary community, I will be discussing the history and morphology of the virus, the importance of the vaccine and its administration, my personal experience dealing with cases of parvovirus in the workplace, and ways in which I have pushed to educate the public regarding the virus. I will accomplish this final task by discussing three specific clients whose puppies were treated for parvovirus at the facility I work for.

History and Morphology of Canine Parvovirus

The virus is a non-enveloped single stranded DNA virus. It was originally suggested that the virus initiated infection in intestinal cells (Carmen and Povey 1985), but initiation actually occurs primarily in pharyngeal lymphoid cells (Peters 1996). The virus then spreads to the bloodstream where it gains access to rapidly dividing cells in bone marrow, lymphopoietic tissue, and crypt epithelia of the jejunum (Cahn and Line 2005). Analysis of the three-dimensional structure of the virus found that its

surface contains two depressions that hinder the binding of antibodies, but allow the virus to bind to a receptor while rapidly changing its more exposed areas to avoid detection by the host's immune system (Tsao et al. 1991). Paradiso et al. (1982) found that around 18-24 hours post infection with CPV, nuclei of invaded cells undergo severe pathological effects; heterochromatin becomes condensed and localized at the nuclear membrane, and material forming nucleolar centers becomes fragmented and condensed, leaving vacuoles scattered throughout the nucleoli. Because it is resistant to many common detergents, temperatures, pH values, and disinfectants, the infectious stage of the viral life cycle can persist in an indoor, room temperature environment for up to two months, and up to several months outdoors depending on conditions (Baker Institute 2014).

Vaccine Development

The research to date shows that all currently available vaccines protect against all known strains of CPV, including the CPV-2c strain (Larson 2008). The vaccine was originally formulated in 1980 culturing the CPV 619 strain in non-oncogenic cells then deactivating the virus using formalin (Appel and Carmichael 1980). It is designed to be given in accordance with the immunity development of the puppy in order to ensure maximum effectiveness. The immune system of dogs is fully developed before birth, however, newborn puppies are essentially devoid of maternal antibody when they are born due to the fact that the maternal and fetal blood are separated. Only about 5-10% of maternal antibody is obtained in utero; the majority is obtained through colostrum present in the milk during the first 24 hours after birth. The protection from maternal antibody begins to dwindle between the ages of eight and 16 weeks old (Felsburg 2002). It is during this window of time that the vaccine is administered so that the dog is still partially protected by maternal immunity, but is able to mount its own specific immune response against the inactive virus. The vaccine often contains mechanisms for preventing other

common diseases in young dogs as well, including those for leptospirosis, canine distemper, adenovirus, hepatitis, and parainfluenza. It is recommended that this vaccine be given in a series of three shots with 3-4 weeks between each shot as well as an annual booster following the third. It is recommended that a booster be administered every 3 years afterward. Despite diligent vaccinations, some young puppies may still contract parvovirus depending on the exact time frame of their immunological development and during which periods during their development the vaccines were given. Dogs that survive parvovirus usually retain a long term immunity (AVMA 2017).

Treatment

Treatment is aimed at rehydrating the animal, taking proper precautions to prevent (or treat) sepsis, correcting blood nutrient levels, managing pain, and ceasing vomiting. During the entire duration of treatment, it is imperative that the pet is kept in isolation along with any supplies used throughout its stay. Gloves and gowns are worn upon entering the isolation room prior to handling the animal, and the room is kept clean by disposing of all contaminated gloves, gowns, potty pads, and paper towels twice daily, washing all surfaces and instruments in a bleach solution in cold water, and rinsing shoes in a bleach solution upon exiting the room. These precautionary measures are vital given how easily the virus is transmitted. Once the patient is willing and able to consume wet food orally on their own without vomiting or having large outputs of diarrhea, they are cleared to go home. The patient is sent home with instructions for the owners to continue administering the oral antibiotics and antidiarrheals and to monitor fecal excretions and note any vomiting. They are informed that viral contagions may still be shed in the feces for up to 10 days following clinical recovery and thus it is advised that they keep their pet away from any other young or unvaccinated dogs.

Education

Pushing to educate the general public about this disease and its prevention has been my main goal throughout my work in the veterinary field. In the following paragraphs, I will describe three specific scenarios in which a dog was diagnosed with the virus due to owners that were misinformed about the disease or vaccines. Each scenario represents a unique situation that we see commonly throughout the veterinary world. I will discuss what errors the owners made in regards to the vaccination process as well as outline how I personally educated them about these mistakes and aided them in making future decisions regarding their pet's health.

Client A

The first case I will discuss is one that we were unable to treat due to financial constraints of the client. This particular client had not vaccinated their animal at all which was the most likely cause of it contracting the virus given that it was almost three years old. During the time frame this case was hospitalized, there were two other cases of parvovirus in the hospital as well. What was unique about the circumstance was that this dog was three years old and another was a year and a half. As described above, these are very uncommon ages for dogs to contract the virus. Further questioning of the owners revealed that neither of these dogs had ever had a vaccine in their entire life. This meant that the immune system of the dog had most likely never come into contact with the virus and had built up no immunity to it, making the dog easily susceptible to falling ill from it. So then, you may be wondering why it took three years for the dog to come into contact with the virus given that it is extremely resilient in the environment and passed so easily in feces. Following further conversation with both owners on separate occasions, we discovered that these two older dogs lived in the same neighborhood. This let us to deduce that the most likely reasoning for the three year old to become infected was that the younger dog

introduced the virus into an area somewhere around the neighborhood and it managed to spread to an area the older dog came into contact with. The two dogs had never physically interacted with each other and yet spread the virus between them. This proved how easily communicable the virus really is.

Upon successful treatment of both dogs, this information was relayed to the owners. I was able to discuss with them the consequences of not vaccinating their dogs by going over a generalized summary of how the canine immune system functions and why vaccinating is of the utmost importance especially at a young age. I also alerted them of why the disease spread so easily to their animals and discussed the life cycle of the virus, paying attention to the details of how long it can remain viable in the environment. My team and I were able to vaccinate both dogs for other common illnesses (Distemper, Adenovirus, Leptospirosis, and Rabies) once both families understood just how important vaccines really are. They changed their perspectives from believing that their dogs would be fine without vaccines so long as they never came into contact with other dogs to truly understanding the benefits of vaccines and how easily vaccinating prevents these common illnesses.

Client B

The next case is one that involved a large amount of treatment that ended in the clients being forced to relinquish their animal because they were unable to complete the treatment. This dog was vaccinated through store bought vaccines, not vaccinated at a veterinarian. One of the most common mistakes owners make when purchasing or adopting a puppy is that they choose to vaccinate the dog themselves using store bought vaccines in order to save money. The vaccines available in stores are not regulated the way those given at veterinary facilities are; they must be kept at a very specific temperature for the entire duration of their journey from being formulated, transported, and stored until they reach their destination where they must remain refrigerated until they are administered.

Administration of the vaccines is extremely important, given that the vaccine containing CPV usually comes with a vial containing a solidified formula accompanied by a separate vial containing a diluent. In order for the vaccine to be effective, these vials must remain stored at the proper temperature prior to mixing, and must be administered immediately following mixing. As mentioned before, these vaccines must be given at specific ages and the complete set of three must be administered at the proper intervals. Purchasing the vaccines from a store runs the risk of giving the dog a vaccine that may have become denatured due to lack of regulated temperatures during transportation and storage. It also increases the chances of administering the vaccine incorrectly or incompletely thus leaving the dog vulnerable to infection. Owners who choose this route (like this one in this particular case) are often unaware of these consequences or are uneducated and believe that giving one round of the vaccine protects their dog. Educating these owners on the safest and most effective way to vaccinate their pet is of utmost importance, especially if their dog tests positive for any of the diseases the vaccine was supposed to protect them from.

Client B was one of these owners that was completely misinformed about the safety and effectiveness of store bought vaccines. They had read online that giving the vaccines themselves was completely safe and that it worked just as well as taking their dog to a veterinarian. Of course, they were not aware of the aforementioned consequences that may come with this choice. This particular client did not have a lot of money which is the main reason they chose to administer the vaccines themselves and buy them from Rural King. They saw that it was much cheaper to go this route then to take their pet to a veterinarian and have them examined and get the proper vaccines administered. These financial constraints were what forced them to relinquish their animal during the treatment for the virus because they could no longer afford it. The treatment can take anywhere from a couple days to weeks depending on the severity of the case and how well the pet responds to the treatment. Sometimes, owners elect to

euthanize if no improvement is seen after several days of treatment. However, this was not the case with this client; they wished to give up their ownership of the animal so that it could finish the treatment it needed under the financial care of the hospital since the patient was responding well to it thus far. The animal ended up surviving and one of our technicians adopted him and he is still fully healthy (and fully vaccinated) today.

Client C

The final case is one of the most common types that we see come through our hospital: the dog had received partial vaccines. As described above, the vaccination set included three doses of the same vaccine, which must be given 2-3 weeks apart. This distinction is due to the way that the dog's immune system functions in its production of antibodies and its development as puppies grow. The vaccine is specifically designed to be administered in accordance with this function to provide the utmost success of the vaccine working. The short time frame between doses is important because it aligns with the function of antibody production and degradation rates within the body; if the vaccine is given too soon the immune system will not mount a separate response because it will already have an abundance of antibodies against the strain floating through the system, making the booster useless. If the next dose is given too long after the first dose, the "booster" effect is lost. The way the immune system works is after the initial exposure to the antigen (the first vaccine) it produces antibodies along with certain cells that remember the disease so that the next time the body is exposed to the disease, the response is faster and more efficient. If the booster vaccines is given too long after the initial the system mounts this response instead of creating a primary response (when given within two weeks of each other, the immune system still has a small amount of antibodies to the disease and thus administering a booster at the correct time increases the strength of this protection). Without the boosters, the immune response is a fairly weak one

that is much less likely to protect the animal from the disease. Upon treating this animal for parvovirus, this information was relayed to the owner and they were able to understand why it is so important to complete the full set of puppy vaccines and to complete in the correct time frame, otherwise the dog is much more likely to contract the virus.

Significance

Cases of parvoviral enteritis are the most abundant type of cases I have seen during my two years working in the veterinary field. The treatment is extremely costly given that it requires intensive care in the hospital for extended periods of time. The majority of the cases I have encountered were young puppies that were newly acquired by their owners and had not received full sets of vaccines. The reason CPV receives so much attention from staff members in the veterinary field is because we understand how easy it is to prevent the disease and how detrimental the virus can be if contracted. Owners are always concerned about the amount of money they spend on their pet, and they don't always understand how much financial responsibility goes into owning an animal, especially a puppy. They try to cut corners on providing the proper care so they can save a few dollars which almost always results in them ending up having to spend the money to bring their sick puppy to a vet anyway. And if their attempts to save money caused their dog to contract a virus that could have easily been prevented, they can end up spending thousands treating it, and may still end up losing their animal. My personal experience dealing with clients whose puppies become ill from CPV has been similar in that the clients are often uneducated and financially unstable. It can be very frustrating to have an owner upset that their new puppy may die of a virus that could have been vaccinated against. The amount of information available on this topic is growing still, but many people do not do their research before obtaining a new pet. This encourages members of the veterinary profession to continue to educate and stress the importance of

vaccines. At the clinic I work for, our doctors explain the reason the vaccines are given and why it is crucial to give them at such specific stages in the puppy's life so that clients understand instead of just haphazardly getting their dog's vaccines at their leisure.

One particular time frame perfectly shows how unaware clients are of PCV and how contagious it is. One weekend, four cases of parvovirus enteritis were hospitalized all at once at the hospital I worked at. The odd part was that two of the dogs were three years old. Although possible, it is highly unlikely that dogs this age become infected with parvovirus, unless they were incompletely vaccinated or not vaccinated at all. Their history revealed that neither had ever been vaccinated in their lifetime. The fact that both dogs of this age had contracted the virus showed just how important vaccinating is, in adolescent and adult stages of a dog's life. It had also been discovered that these dogs lived in the same neighborhood, however, had never come into direct contact with one another, proving the distance the virus can travel and its resistibility. These cases reflected the importance of vaccinating and the degree of contagiousness the virus possesses.

Conclusions

Canine parvovirus enteritis is an interesting disease because it is easily preventable, but not curable and likely to be fatal if not treated (fatal even if treated in some cases). Its extreme resilience and septicity have continued to spark interest among the science community and its researchers. Personal experiences of dealing with clients of pets who contract the virus can be emotionally and physically draining, because it is impossible to say if the dog will survive or not. The only way to lower instances of parvovirus is to educate the public on the importance of vaccinating and easy ways to prevent the spread of the virus.

The Dos and Don'ts of Vaccinating

Do:

- Take your puppy to a **veterinarian** to have vaccines administered
- Make sure you return to the vet **within the timeframe** suggested to have the booster vaccines administered
- Seek **medical advice** only from a veterinarian, not the internet
- Take your animal to the vet if you notice **vomiting or diarrhea**
- Be aware of taking your puppy around other animals that could be unvaccinated until your puppy has received their **full set** of vaccines
- **Ask your veterinarian** questions if you are unsure of the benefits or side effects of the vaccine

Do Not:

- Trust that a breeder had the puppy you purchased vaccinated at a veterinarian unless they have **physical records** of it
- Purchase vaccines from a store and administer them at home
- Wait longer than three weeks between booster vaccines
- Believe everything you read online
- Try to cut corners on veterinary care, do it right the first time!
- Give any medications at home without consulting a veterinarian first
- Take your animal around other animals if they are presenting any signs of illness such as coughing, vomiting, or diarrhea

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