

Canine Vaccinations

Core Vaccinations: Recommended for all dogs

- Core vaccines (except rabies) are given as early as 6 weeks of age then **every 3-4 weeks** until **14-16 weeks** of age
 - Maternally-derived antibodies will cause vaccine inactivation
 - Maternally-derived antibodies are generally lost by 9-12 weeks, but some are lost as early as 6 weeks
- Rabies is given as early as 12 weeks (depending on type), one year later, then every year (or 3 years depending on vaccine and state law)



Administration of a rabies vaccination to a dog in Papua New Guinea.

Image courtesy, Petty Officer 3rd Class Bryan M. Ilyankoff

	Antigen	Disease	Comments	Preferred type
Combination vaccine: DA2PP	CDV	Canine distemper – mild to severe systemic illness with high morbidity and variable mortality characterized by upper respiratory and gastrointestinal signs. Sometimes neurologic signs.	Very vulnerable to inactivation after reconstitution – use w/in 1 hr	modified-live or recombinant CDV (rCDV)
	CPV-2	Canine parvovirus – destruction of crypt cells of the villous epithelium of small intestine, lymphocyte depletion, neutropenia. Clinical signs are severe enteritis with hemorrhagic diarrhea, vomiting, shock	All current vaccines provide immunity from disease by any field variant (CPV-2a, -2b, and -2c)	modified-live
	CAV-2 (parenteral)	Canine adenovirus – highly contagious respiratory disease	<ul style="list-style-type: none"> CAV-2 intranasal is non-core for at risk dogs – can be given earlier, but does not protect against CAV-1 (hepatitis virus) Parenteral form protects against CAV-1 	modified-live
	Rabies	Fatal polioencephalitis of warm-blooded mammals (including humans); hydrophobia	See product literature for route of administration	killed

Definitions

- Efficacy** – ability to stimulate a protective immune response
- Purity** – pure culture of starting materials ie: attenuated strain, virulent strain to be inactivated later
- Potency** – quantity of antigen in a vaccine
- Safety** – reversion to virulence, local or systemic reactions, shedding of live vaccine organisms
- ...prevents infection with...** – product is able to prevent all colonization or replication of the challenge microorganism in vaccinated and challenged animals
- ...indicated for the prevention of disease...** – product provides complete or partial protection from severe clinical signs of disease in most animals.
- ...indicated as an aid in the prevention of disease...** – product efficacy is significantly different between vaccines and controls, but not at the level as the statements above

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Optional: p = parenteral form, IN = intranasal form

Antigen	Disease	Comments	Preferred type
MV	Measles virus – cross-protective against CDV in young puppies	<ul style="list-style-type: none"> Do not give to puppies < 6 weeks or female breeders after 12 weeks Follow-up with CDV vaccine Must be given IM 	Modified-live
CPiV	Canine parainfluenza virus - highly contagious respiratory disease	<ul style="list-style-type: none"> Only available in combination with core vaccines IN is only given once, then annually if at risk 	Modified-live (p), modified-live (IN)
<i>Bordetella bronchiseptica</i>	Bordetellosis is a bacterial infection that results in fever, lymphadenopathy, sneezing, oculonasal discharge	<ul style="list-style-type: none"> Erroneous SQ injection of intranasal vax can cause severe acute hepatic injury Intranasal is “core” for shelter dogs 	Inactivated (p) OR live (IN)
Canine influenza	Uncommon but highly contagious respiratory pathogen, mutation of equine influenza A subtype H3N8 virus	A single initial dose will not immunize a seronegative dog	Killed
<i>Borrelia burgdorferi</i>	Lyme disease – bacterial disease that infects humans, mammals, and birds. Less than 5% of seropositive dogs show clinical signs of arthritis, fever, lymphadenopathy, nephropathy	Controversial vaccine because severe nephropathy of canine Lyme disease is immune-mediated	Killed whole cell bacterin or recombinant
<i>Leptospira interrogans</i>	Bacterial disease affecting humans and animals. Most infections are asymptomatic. Symptoms include lethargy, anorexia, shivering, vomiting, lumbar pain, icterus, hemorrhage due to endothelial damage and vasculitis	Lepto 2-way killed bacterin is NOT recommended.	4-way killed whole cell or subunit bacterin – contains serovars <i>canicola</i> + <i>icterohemorrhagiae</i> + <i>grippotyphosa</i> + <i>pomona</i>
Canine oral melanoma	Oral melanoma	Only used in melanoma treatment . Not used for melanoma prevention.	
<i>Crotalus atrox</i>	Western diamondback rattlesnake vaccine – envenomation causes swelling, local tissue damage, systemic bleeding and coagulation	<ul style="list-style-type: none"> May have some cross-protection against Eastern diamondback venom but not Mohave rattlesnake venom Dog still requires treatment if envenomation occurs 	Toxoid
CCoV	Infectious intestinal disease that causes mild diarrhea in dogs	NOT recommended	Killed & modified live
<i>Giardia</i>	Protozoal disease that causes mild to severe diarrhea	May reduce shedding of cysts but ineffective in preventing infection	Not recommended



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Typical Schedules: p = parenteral form, IN = intranasal form

Puppies < 16 weeks	DA2PP	Rabies	Non-core (if at risk)
6 weeks	+		<ul style="list-style-type: none"> ▪ MV (single dose at 6-12 weeks) ▪ CPiV (p, IN) ▪ <i>B bronchiseptica</i> (IN) ▪ Influenza
9 weeks	+		<ul style="list-style-type: none"> ▪ CPiV (p) ▪ <i>B bronchiseptica</i> (p) ▪ Influenza
12 weeks	+	+	<ul style="list-style-type: none"> ▪ CPiV (p) ▪ <i>B bronchiseptica</i> (p) ▪ <i>B burgdorferi</i> ▪ Lepto
15 weeks	+		<ul style="list-style-type: none"> ▪ CPiV (p) ▪ <i>B burgdorferi</i> ▪ Lepto ▪ <i>Crotalus atrox</i> (16 weeks)
20 weeks			<ul style="list-style-type: none"> ▪ <i>Crotalus atrox</i>
12 months	+	+	<ul style="list-style-type: none"> ▪ CPiV (p)
Annually	Every 3 or so years	+ (depending on vaccine and state law – may be every 3 years)	<ul style="list-style-type: none"> ▪ CPiV (p, IN) ▪ <i>B bronchiseptica</i> (p, IN) ▪ Influenza ▪ <i>B burgdorferi</i> ▪ Lepto (only if high risk)

Adults and puppies > 16 weeks	DA2PP	Rabies	Non-core (if at risk)
Initial	+	+	<ul style="list-style-type: none"> ▪ CPiV (p, IN) ▪ <i>B bronchiseptica</i> (p, IN) ▪ Influenza ▪ <i>B burgdorferi</i> ▪ Lepto ▪ <i>Crotalus atrox</i>
3 weeks later			<ul style="list-style-type: none"> ▪ <i>B bronchiseptica</i> (p) ▪ Influenza ▪ <i>B burgdorferi</i> ▪ Lepto ▪ <i>Crotalus atrox</i>
12 mos later		+	
Annually	Every 3 or so years	+ (depending on vaccine and state law – may be every 3 years)	<ul style="list-style-type: none"> ▪ CPiV (p, IN) ▪ <i>B bronchiseptica</i> (p, IN) ▪ Influenza ▪ <i>B burgdorferi</i> ▪ Lepto (only if high risk)

Canine Vaccinations



Killed (inactivated) agent vaccines

- **Adjuvant**
 - Frequently used in killed agent vaccines to **enhance immune response**
 - Associated with **local inflammatory reaction** at injection site
- Slower response
- Predominantly systemic antibodies – little to no secretory IgA on mucosal surfaces
 - Poor protection at mucosal surfaces of respiratory and gastrointestinal tract
- Only cell-mediated immunity - type 1 T-helper
- More stable than live or attenuated
- More likely to have hypersensitivity reaction
- Usually requires at least 2 initial doses 2-6 weeks apart (rabies is exception)
 - First dose primes the immune system and second dose immunizes

Attenuated-live vaccines

- **May revert** to virulence
- Normal host immune response is required

Serologic Testing

- Useful for monitoring immunity to CDV, CPV-2, CAV-1, and RV
 - Can be used after 16 weeks to ensure immunity
 - Ensures protection in cases of previous adverse reactions to vaccine
 - Is sometimes used in lieu of CDV and CPV-2 revaccination
 - **Cannot be used in place of rabies vaccination by law**
- **Virus neutralization** is **gold standard** for CDV
- Virus neutralization and hemagglutination inhibition are gold standards for CPV

Adverse Events

- Appetite loss, pain at injection site, lethargy, reluctance to walk/run, mild fever
 - May be expected for 2-3 days after vaccination – if longer, contact veterinarian
 - **Does not predict** future risk to vaccination
- Vomiting, diarrhea, seizures, facial swelling, collapse, difficulty breathing
 - Contact veterinarian immediately
 - These should be reported to the Technical Services section of vaccine manufacturer(s)
 - Report to the APHIS's Center for Veterinary Biologics (CVB)
- Examples
 - **Injection-site reactions**
 - Abscess, granuloma, seroma, pain, swelling, hair loss assoc. with ischemic vasculitis
 - **Transient post vaccinal nonspecific illness**
 - lethargy, anorexia, fever, regional lymphadenopathy, soreness, abortion, encephalitis, polyneuritis, arthritis, seizures, behavioral changes, hair loss or color change at injection site, respiratory disease

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Adverse Events (continued)

- **Allergic and immune-mediated reactions**
 - **Type 1** – acute anaphylaxis –
 - **Does not predict** future risk to vaccination because it is usually due to constituent proteins of the manufacturing process
 - Angioedema (especially head), hives, anaphylaxis, death
 - **Type 2** – cytolytic – **Avoid future vaccination if possible**
 - Immune-mediated hemolytic anemia, possibly immune-mediated thrombocytopenia
 - **Type 3** – immune-complex – **Avoid future vaccination if possible**
 - Cutaneous ischemic vasculopathy (rabies vaccine), corneal edema ('blue-eye') associated with CAV-1 vaccine, immune-mediated disease
- **Failure to immunize**
 - Puppy has enough maternally derived antibodies to block the vaccine (most common)
 - Inactivation of vaccine
 - Improper storage and handling
 - Reusing syringes
 - Cleansing skin with alcohol before injection can also inactivate vaccines
 - The dog is a poor or nonresponder (immune system doesn't recognize as an antigen)
- **Tumorigenesis** - Vaccine-associated sarcoma or other tumors
- **Multisystemic infectious/inflammatory disorder of young Weimaraner dogs**
 - May be genetically linked to immunodeficiency and autoimmune disorders
 - Ie: Hypothyroidism, Hypertrophic osteodystrophy
- **Vaccine-induced immunosuppression**
 - Assoc. w/ 1st or 2nd dose of combo MLV vaccines containing CDV and CAV-1 or CAV-2
 - Begins 3 days after vaccination and persists for 7-10 days
- **Reactions caused by incorrect administration of vaccine**
 - Fatalities reported after SQ administration of avirulent-live *B bronchiseptica* bacterin (intended for intranasal administration)
 - Intravenous vaccine administration
- **Reactions associated with residual virulence of attenuated vaccine**
 - Postvaccinal sneezing associated with intranasal attenuated vaccine
 - Such as *B bronchiseptica* and parainfluenza virus
- **Vaccine-induced interference with diagnostic tests**
 - False-positive PCR test results for parvovirus antigen in feces
 - Not an adverse reaction
- **Reversion of vaccine virus to a virulent pathogen**
 - Generally rare when used as licensed
 - More of a problem when used unlicensed with wild or exotic animals



Canine Vaccinations

Pearls: Vaccines are intended for *healthy, non-pregnant dogs*

- Avoid vaccination of pregnant dogs to avoid potential injury to the fetus.
- Avoid vaccination of dogs receiving immunosuppressive or cytotoxic therapy.
- Glucocorticoid treatment – short-term should not have a significant suppressive effect on antibody production, but it is a good idea to revaccinate 2-3 weeks after **long-term** therapy has ended.
- Do not give vaccinations more often than every 2 weeks, even if different vaccines.
- Do not vaccinate colostrum-derived puppies earlier than 4 weeks – may cause heart and CNS damage.
 - Artificial colostrum can be given if puppy is less than 3 days old
 - Serum (3-10 ml) from a well-immunized adult dog can be given SQ or intraperitoneally to a puppy twice daily for 3 days

Refs: Côté, Clinical Veterinary Advisor, 2nd ed, pp145-147 319, 448, 647, 831, 839-841, 963, 1110; American Animal Hospital Association: 2011 AAHA Canine Vaccination Guidelines; Merck Manual, 10th ed (online): Active Immunization, Rabies, Leptospirosis in Dogs, Canine Parvovirus, Canine Distemper,

My Notes: