Canine serum anti-parvovirus IgG titer is impacted by colostrogenesis

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Objective

This study aimed to analyze the impact of colostrogenesis on circulating serum IgG titer against canine parvovirus in the gravid bitch and its implication on nomograph analysis

Introduction

- During colostrogenesis, large amounts of IgG are moved into the mammary tissue via transcytosis from the bloodstream as mediated by the neonatal Fc receptor (FcRn)
- Colostrogenesis is known to have an impact on circulating IgG in other species, but has not been studied in the canine
- Maternally derived antibody (MDA) protects the neonate against infection but is also a major source of vaccine failure to immunize. Antibody titer of the dam is directly correlated with duration of MDA vaccine interference in her litter
- Canine nomograph testing applies known antibody half-life degradation analysis to breeding dam titers against canine distemper (CDV) and parvovirus (CPV-2) to provide a tailored vaccination schedule to the litter to best overcome MDA interference

Dam Name	Story Larson											
Sample drawn	7-Jul-21											
CDV Titer	128											
CPV-2 Titer	320											
Maternal Antibody Degradation, with standard variation												
Distemper	64	32	16	8		0	0	0	0	0	0	0
	128	**64**	**32**	**16**	**8**	**4**	**2**	**1**	**1**	**0**	**0**	**0**
	256	128	64	32	16	8	4	2	1	1	0	0
Parvo	160	80	40	20	10	5	3	1	1	0	0	0
	320	**160**	**80**	**40**	**20**	**10**	**5**	**3**	**1**	**1**	**0**	**0**
	640	320	160	80	40	20	10	5	3	1	1	0
Suggested Vaccination					**8 wks**			**12 wks**	**test**			
0 days	12	24	36	48	60	72	84	96	108	120	132	144
0 weeks	2	3	5	7	9	10	12	14	15	17	19	21
Birth												

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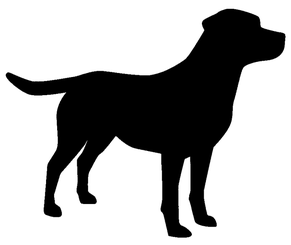
Figure 1. Example Nomograph Analysis

Methods

- Serum samples were collected from 56 pregnant beagle bitches at timepoints: 4 weeks pre-whelp, 2 weeks pre-whelp, at whelp, and 2 weeks post-whelp
- Samples were analyzed utilizing a hemagglutination inhibition (HI) assay to detect antibody against CPV-2
- Geometric mean titer values were statistically analyzed via a repeated measures, one-way ANOVA test and Tukey's multiple comparisons *post hoc* correction
- *p-value* was set at <0.05



Results

Effect of Colostrogenesis on Serum IgG Level against CPV-2

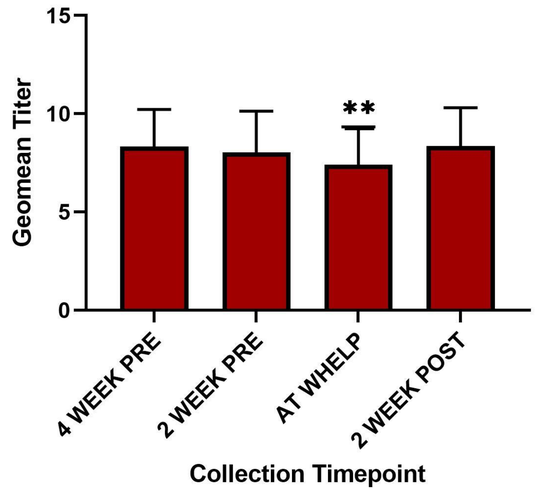
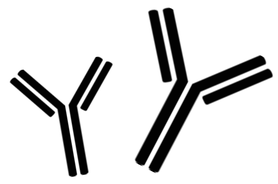


Figure 2. Effect of Colostrogenesis on Serum IgG titer against CPV-2

- Average geometric mean titer values were 8.1, 7.7, 7.1 and 8.1 over the course of colostrogenesis
- 49 (87.5%) bitches experienced a change in titer within the inherent variability of the HI assay
- 7 (12.5%) bitches experienced a change in titer outside of the inherent variability of the HI assay
- One-way ANOVA with repeated measures revealed significantly lower anti-CPV-2 titers at whelp ***p <0.0001*** *(*95% CI)

Discussion

- Maternally derived antibody interference is the primary cause of immunization failure
- Depending on the maternal titer, some litters can be prevented from responding to CPV-2 vaccine until 22 weeks of age, which is beyond the standard age for final dose in puppy series
- Nomograph testing is a conservative analysis of the degradation of maternally derived antibody in a litter relative to the measured titer of the bitch, in order to best overcome MDA interference
- Larson *et al* 2020 showed significant improvement to vaccination outcomes when nomograph had been completed
- Nomographs can decrease the number of doses administered when maternal titers are low, and in instances of higher titers the vaccination schedule will be extended
- Follow-up titer testing of the litter is included in the tailored schedule, and strongly recommended 2 weeks after the final dose of vaccine. In instances of low titers, this testing may be as early as 12 weeks of age
- AAHA guidelines should be utilized when bitch titer is unknown, with a final dose of core vaccine administered at 16 weeks of age



Conclusion

- Colostrogenesis significantly impacts maternal serum IgG titer against CPV-2 at whelp
- Serum samples for nomograph analysis should be collected prior to 2 weeks pre-whelp or after 2 weeks post-whelp (outside the periparturient period)
- Serum collections within the periparturient period require an adjustment to the resulting nomograph analysis

References

1. Carmichael LE, Joubert JC, Pollock RV: Hemagglutination by canine parvovirus: serologic studies and diagnostic applications. American Journal of Veterinary Research. 41(5): 784-91, 1980.
2. Ford RB, Larson LJ, McClure KD, et al. (2017). AAHA canine vaccination guidelines. J Am Anim Hosp Assoc 2017; 53:243-251.
3. Larson, L., Thiel, B., Santana, V., & Schultz, R. (2020). Canine nomograph evaluation improves puppy immunization. Clinical Theriogenology, 12(3), 215–221.
4. Pardo MC, Tanner P, Bauman J, et al : Immunization of puppies in the presence of maternally derived antibodies against canine distemper virus. J Comp Pathol 2007;137:72-75.
5. Pollock, R. V. H., & Carmichael, L. E. (1982). Maternally Derived Immunity to Canine Parvovirus Infection: Transfer, Decline, and Interference with Vaccination. *Journal of the American Veterinary Medical Association*, *180*(1), 37–42.

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Disclosure

All authors are employed at the Companion Animal Vaccine and Immuno Diagnostics Service (CAVIDS) Laboratory at the University of Wisconsin-Madison School of Veterinary Medicine, which performs fee-for-service titer testing, nomograph analysis and puppy follow-up titer analysis.

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