ABSTRACTS

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Kinetics of the intestinal barrier closure in puppies

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OBJECTIVES AND METHODS: In puppies, mortality rates from birth to weaning ranges from 20 to 40%, with half the cases occurring during the first three weeks after birth (1). In bovine, equine or porcine, the passive immune transfer of maternal immunity to the newborn through the colostrum is one of the key element to control morbidity and mortality rates (2). Optimization of the passive transfer of immunoglobulins requires that ingestion of colostrum occurs within the first hours after birth (6 hours for calves for example) : the ability of gut to absorb ingested immunoglobulins decreases rapidly with time elapsed from birth. This phenomenon, known as intestinal barrier closure, is not precisely timed in the canine species, despite its interest for puppies management. The aim of this study was thus to describe the kinetics of the intestinal barrier closure in puppies.

Colostrum: Mammary secretions from ten Beagle bitches were collected one or two days after natural whelping. The bitches were routinely vaccinated against distemper, adenovirus, parvovirus, parainfluenza and specifically vaccinated against canine herpesvirus 1 within 10 days after insemination and at 30 days after insemination (EURICAN HERPES, Merial, Lyon, France). Colostrums from these ten bitches was then aliquoted (3mL samples) and frozen (-20°C) until use.

Design of puppies neonatal feeding: Five Beagle bitches were inseminated with the sperm collected on two Beagle males of proven fertility. Insemination was performed with fresh sperm 48 and 72 hours after ovulation, as diagnosed through blood progesterone assay and transabdominal ultrasound examination (3). Sixty or sixty-one days after ovulation, the bitches were delivered by elective caesarean section. Every four hours, puppies were fed through babybottle with artificial milk previously assayed for canine immunoglobulins (no detectable canine IgG, M, A; see method below), except for one meal at which they were given 3mL colostrum through a feeding tube. Depending on the experimental group, colostrum was given at birth (H0 group; n=4) or four (H4; n=3) or eight (H8; n=3), twelve (H12; n=4), sixteen (H16; n=3) and 24 (H24; n=5) hours after birth.

Immunoglobulins assay: Blood (1 mL) was collected on dry tubes at the jugular vein just before colostrum ingestion, and then 4 and 48 hours after. Serum was then assayed for canine IgG, M and A (Dog IgG-, IgM-, IgA-Quantitation Kits, Bethyl Lab, Montgomery, USA).

RESULTS: Before colostral administration, circulating immunoglobulins concentrations were low (below 0.3 g/L IgG, 0.05 g/L IgM, non-detectable for IgA). Four hours after administration, a significant increase was observed for the three Ig classes (Figure 1, 2 and 3). Nevertheless, the concentrations reached were affected by the time of colostrum ingestion: they decreased significantly when the delay since birth increased. No significant increase was obtained when colostrum was fed 12 hours and later. The rate of absorption (quantity of Ig present in the circulation of the puppy / quantity of Ig ingested) steadily decreased from 62% at H0, 37% at H4, 27% at H8, 14% at H12, 12 at H16, 2% at H24. At 48 hours after administration, the situation differed between Ig classes. IgG concentrations at 48 hours were equivalent to those assayed at 4 hours and the concentrations were still higher for earlier administrations. IgM concentrations continued to increase, whereas IgA concentrations dramatically decreased between 4 and 48 hours after ingestion; no difference appeared between groups after 48 hours for IgM and IgA concentrations. No mortality was observed between birth and 2 months of age, whatever the time of administration of the colostrum.
CONCLUSION: IgG was the predominant isotype during the first days of life as observed by (4) and (5). Intestinal barrier is permeable to immunoglobulins mainly during the 12 first hours after birth, but with a sharp decrease of absorption as early as after the first 4 hours. The kinetics seems thus similar to that observed in other species (6). Nevertheless, closure seems to occur differentially for the different classes of immunoglobulins, with permeability to IgM persisting later than 24 hours after birth. Attention for maternal suckling has thus to be given very early after birth for the optimization of the passive immune transfer in puppies.