IWBDA Breeders Workshop 2 May 2023

Pregnancy, Whelping and Lactation In the Bitch

Small Animal Reproduction

Greg Burns DVM

Diplomate, American College of Theriogenologists



Who am I?

- Started in a veterinary canine reproduction practice in the 1990's
 - International Canine Genetics —Synbiotics —Pfizer Zoetis
- Mentorship residency program in 2000's and American College of Theriogenology Board Certification
 - Colorado State University
 - Veterinary Reproductive Specialist
- Private practice for 24 years
 - Exclusively small animal reproduction
 - International semen freeze/storage facility
 - TCI, Sex Sorted Semen
 - Faculty at Colorado State University
 - Small Animal and Wildlife Reproduction













Goals

- Discuss pre-breeding considerations in the bitch
- Normal canine pregnancy and parturition gestation length, pregnancy diagnosis, normal delivery
- Dystocia (abnormal delivery)
- Lactation and agalactia review
- Mastitis review



General Physical Examination

- Nose to tail physical examination
- Body condition score

Reproductive System Examination

- Vulvar conformation
- Vestibulo-vaginal junction
 - Persistent Hymen
 - Stricture
 - Septum







Mammary Glands

- Normal Anatomy
- Masses









Effects of inappropriate nutrition

Underfeeding:

- Small litter
- Decreased fertility
- Low birth weight
- Increased neonatal morbidity and mortality
- Decreased milk yield

Obesity:

- Decrease ovulation
- Decrease fertility
- Silent heat
- Small litter
- Dystocia





Development and validation of a body condition score system for dogs D. Lafarma - Published 1997 - Biology



Blood Profile

- General Health Profile and Urinalysis
- Heartworm Disease
- Regional Diseases
 - Lyme
 - Coccidioidomycosis
- Thyroid
- Brucellosis Test
- Fecal Examination



Colorado State University

James L. Voss Veterinary Teaching Hospital Fort Collins, CO 80523-1620 (970) 297-5000

Lab Results Report	Age:
	A
Visit ID:	Sex:
Patient ID:	Breed:
Veterinarian: Burns, Greg	Specie
Client:	Patient

Patient:	
Species:	Canine
Breed:	Cavalier King Charles Spaniel
Sex:	
 Age:	
4	

CBC with Retic 12/4/2020 5:00:19 PM Accession ID: 99236 Test Results Reference Range Units Plasma Protein H 7.6 6 - 7.5 g/dL RBC 6.88 5.5 - 8.5 10^6/uL Pathologist NONE 0-0 HCT 40 - 55 % 51 % Reticulocyte auto % 1.6 0-0 Hematology Tech. 1 LTS 0-0 Hematology Results Status FINAL 0-0 MCV H 75 62 - 74 fl 0 - 100 10^3/uL Reticulocyte auto # H 111.5 Cell Hgb 16 13 - 20 g/dL 22.3 - 27.9 CH-Retic 25.1 mg/dL MCHC L 32 33 - 36 g/dL MPV 13.5 7.5 - 14.6 fl Hematology Tech. 2 LTS 0-0 RDW 13.5 12 - 15 % 16.5 HGB 13 - 20 g/dL MCV-Retic 97 78 - 100 fl PLT 416 200 - 500 10^3/uL CHCM L 31 33 - 36 g/dL Nucleated Cells 12.1 4.5 - 15 10^3/uL



General Health Considerations

- Vaccination status/titers
- Parasite control protocol
- Current medication/supplements
- Brucellosis status











General Health Considerations

- Vaccination status
 - Core Vaccines
 - Parvo, Distemper, Parainfluenza, Adenovirus
 - Noncore Vaccines
 - As needed on risk/benefit basis

The 2022 AAHA Canine Vaccination Guidelines are available at aaha.org/canine-vaccinations.

NONCOPE VACCINES: De

These guidelines were prepared by a Task Force of experts convened by the American Animal Hospital Association (AAHA) and were subjected to a formal peer-review process. This document is intended as a guideline only, not an AAHA standard of care. These guidelines and recommendations should not be construed as dictating an exclusive protocol, course of treatment, or procedure. Variations in practice may be warranted based on the needs of the individual patient, resources, and limitations unique to each individual practice setting. ©2022 AAHA.



CORE VACCINES: Recommended for all dogs irrespective of lifestyle, unless there is a specific medical reason not to vaccinate

ANTIGEN	INITIAL V	ACCINATION	REVACCINATION			
al -	Dogs ≤16 Weeks of Age	Dogs >16 Weeks of Age				
Distemper Adenovirus Parvovirus +/- Parainfluenza	At least 3 doses of a combination vaccine between 6 and 16 weeks, 2-4 weeks apart.	2 doses of a combination vaccine, 2-4 weeks apart.	 A single dose of a combination vaccine within 1 year following the last dose in the initial vaccination series. Administer subsequent boosters at intervals of 3 years. 			
Rabies	As required by law.					

ANTIGEN	INITIAL VA	CCINATION	REVACCINATION
	Dogs ≤16 Weeks of Age	Dogs >16 Weeks of Age	<u> </u>
Leptospira (killed) 4-serovar	Two doses, 2-4 weeks apart, starting at 12 weeks of age.	Two doses, 2-4 weeks apart, regardless of dog's age.	 A single dose within 1 year following the last dose in the initial vaccination series. Administer subsequent boosters annually.
Borrelia burgdorferi (canine Lyme disease)	Two doses, 2-4 weeks apart.	Two doses, 2-4 weeks apart, regardless of dog's age.	 A single dose within 1 year following the last dose in the initial vaccination series. Administer subsequent boosters annually.
Bordetella bronchiseptica & canine parainfluenza virus	A single (IN) dose is indicated	d for dogs at risk of exposure.	 Administer subsequent boosters annually.
Bordetella bronchiseptica only	Parenteral (SQ): Two doses, IN: Administer a single dose Oral: Administer a single dose	2-4 weeks apart. intranasally. into the buccal pouch.	 Administer subsequent boosters annually.
Canine influenza virus-H3N8/H3N2	Two doses, 2-4 weeks apart.	8	 A single dose within 1 year following the last dose in the initial vaccination series. Administer subsequent boosters annually.
Crotalus atrox (Western diamondback rattlesnake)	Dosing requirements and fre exposure risk.	quency of administration vary	among dogs depending on body weight and



General Health Considerations

- Vaccinating the pregnant bitch
 - Vaccinate the prior to pregnancy!
 - Attenuated (live weakened) vaccines are not considered safe during pregnancy
 - Risk/benefit basis
 - Provide exceptionally clean environment
 - Reduce exposure
 - Inactivated (Killed) vaccines
 - Elicit immune response without replicating in body
 - Still not recommended during pregnancy but safer than attenuated vaccines
 - Might be required by law Rabies



General Health Considerations

- Titers
 - Some breeders perform vaccination based on titers
 - Important to remember that these titers are measuring the protection that the bitch has from disease, not necessarily how that protection is passed to nursing offspring
 - Use nomograph if relying on titers, as this will help determine when to vaccinate offspring

	Dam Name			Mini Bull Terrier, whelped 10 September 2022										
Sar	nple drawn	26-Sep-22									Companio	on Animal V	accines	
	CDV Titer	32									And Îmm	uno-Diagnos	stic	
	CPV-2 Titer	320									Service La	boratory - C	CAVIDS	
											School of Veterina	ry Medicine		
	Maternal A	ntibody Deg	gradation, with	n standard v	variation						_			
Distemper	16	8	4	2	1	1	0	0	0	0	0	0	0	
	32	16	8	4	2	1	1	0	0	0	0	0	0	
	64	32	16	8	4	2	1	1	0	0	0	0	0	
Parvo	160	80	40	20	10	5	3	1	1	0	0	0	0	
	320	160	80	40	20	10	5	3	1	1	0	0	0	
	640	320	160	80	40	20	10	5	3	1	1	0	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													

Laurie Larson, DVM, Director, CAVIDS Laboratory

www.vetmed.wisc.edu/lab/CAVIDS



General Health Considerations

Deworming

Clinical Trial > J Am Vet Med Assoc. 1983 Nov 1;183(9):987-90.

Fenbendazole treatment of pregnant bitches to reduce prenatal and lactogenic infections of Toxocara canis and Ancylostoma caninum in pups

T M Burke¹, E L Roberson

Affiliations + expand PMID: 12002591

Abstract

A granulated formulation of fenbendazole was tested in a total of 23 treated and control, pregnan parasite-free Beagle bitches experimentally infected with Toxocara canis and Ancylostoma caninur The drug was administered to each treated bitch once daily in canned dog food at a dosage of 50 mg/kg body weight. Each of 2 treatment regimens tested was initiated on the 40th day of pregnanc One regimen involved daily treatment continuing through the 14th postpartum day, and it resulted in 89% fewer ascarids and 99% fewer hookworms in pups born to medicated bitches, as compared with pups born to unmedicated controls. The other regimen of treatment, which was stopped on the day of parturition, was less effective in reducing ascarid and hookworm burdens (64% and 88% reductions, respectively). Three to 5 bitches from each of the treatment and control groups were allowed to whelp a 2nd litter without further treatment or further exposure to parasite infections. Hookworm burdens in 2nd-litter pups born of bitches that had initially received fenbendazole through the 14th postpartum day were significantly lower (P < 0.01; 85% reduction), when compare with the 2nd-litter control pups. All other parasite burdens were not significantly different. It was concluded that granulated fenbendazole is effective in reducing burdens of Ancylostoma caninum and Toxocara canis in newborn pups when the bitch is treated during the last third of pregnancy especially when treatment (50 mg/kg/day) extends from the 40th day of pregnancy through the 14th postpartum day.

"The ability of Toxocara canis to be transmitted from the dam to the fetal offspring, together with the hardy nature of larvated eggs in a contaminated environment, contribute to the high prevalence of infection even among pets that are well cared for and routinely treated for intestinal parasites."

- Dam should be on appropriate deworming protocol prior to breeding!
- Deworming during pregnancy
 - Fenbendazole has been demonstrated to be safe during pregnancy
 - **Protocol 1** "high risk"
 - » Deworm once daily starting 3 weeks prior to delivery date and continue 2 weeks after delivery
 - Protocol 2
 - » Deworm 2 weeks prior to delivery date, 2 days after delivery and 16 days after delivery
 - Each deworming course consists of once daily for 3 days in a row

Age Consideration

- Litter sizes and pregnancy rates are optimal 2-4 years of age
- Conception rates and litter sizes decline significantly after 4 years of age
- Complication rates increase at age 5 and greater
 - Dystocia
 - Periparturient Disorders
- Managing Expectations







Maternal and neonatal canine cortisol measurement in multiple matrices during the perinatal period: A pilot study

Debora Groppetti, Sara Meazzi, Joel F. S. Filipe, Carla Colombani, Sara Panseri, Sergio A. Zanzani, Clara Palestrini, Simona Cannas, Alessia Giordano , Alessandro Pecile

Published: July 22, 2021 • https://doi.org/10.1371/journal.pone.0254842

Abstract

Stress exposure during perinatal period may lead to maternal cortisol increase that negatively affects the offspring development. In recent years, the interest on non-invasive sampling methods to measure cortisol as a marker of stress is increasing in both humans and animals. Indeed, discomfort due to blood collection may compromise the diagnostic outcome, mainly in uncooperative patients. So far, some alternative matrices but not milk have been explored in adult dogs, while no data are available on the neonate and paediatric live pups. This study aimed to measure cortisol concentration in different biological substrates in both dams (blood, saliva, hair and milk) and pups (saliva and hair) at established times from proestrus up to two months after parturition. For this purpose, five female German shepherd bitches and their 22 pups were enrolled. Cortisol concentration if required. Cortisol concentrations as assessed using the enzyme immunoassay kit (Salivary Cortisol ELISA kit, Salimetrics) after matrices appropriate preparation if required. Cortisol concentrations differed among the matrices (P < 0.0001) with the highest values recorded in plasma (median 0.596 µg/dL) compared to saliva (median 0.159 µg/dL), hair (median 0.038 µg/dL) contisol was always higher than hair (median 0.049 µg/dL; P < 0.0001). At birth (P = 0.01) and two months later (P = 0.05), neonatal salivary cortisol was higher compared to other samplings. The present study demonstrates the suitability of these innovative substrates for cortisol was negative to the saliva birth (P = 0.01) and two months later (P = 0.05), neonatal salivary cortisol was higher compared to other samplings. The present study demonstrates the suitability of these innovative substrates for cortisol measurement, suggesting them as potential diagnostic support in canine neonatology and welfare.

Pre-Breeding Considerations

Stress During Pregnancy:

- Increase in perinatal cortisol may produce negative affects premature labor, lower birth weights, etc.
- What increases cortisol?
 - Intense exercise
 - Heat/Cold
 - Illness





Photo Courtesy ASPCA





Photo Courtesy AKC





Pregnancy in the Canine

Ovulation

- Ovulation occurs ~48h after LH peak (Day 0) and is complete in about 12 hours
 - Oocytes are immature and require 48 hours to mature (complete meiosis) in uterine tubes

Implantation

• Blastocysts enter uterus around day 12 (or so) and implantation occurs day 18 (or so)

Placentation

• Endothelial-chorial, zonary, circumferential

Maintenance of Pregnancy

- The Corpus Luteum is the only known source of progesterone in the canine
 - LH and Prolactin are luteotropic hormones (relaxin too?)











Pregnancy in the Canine

Gestation length

- Normal gestation is 63 days from ovulation (62-64 days)
 - 65 days from LH peak (64-66 days)
 - 58 days from first day of onset of cytologic diestrus
- Bitches may stand to be bred 6-7 days prior to LH peak, semen can last up to 9-11 days in the female reproductive tract
 - Results in an "apparent" gestation length of 57-72 days

LIBRAR

REPRODUCTIO





Determining Prolonged Gestation in the Canine

- >66 days post LH peak
- >64 days post ovulation (ovulation typically consistent with 5.0 ng/ml progesterone)
- >60 days after onset of cytologic diestrus



SUN	MON	TUE	WED	THU	FRI	SAT
	Owners				Actual	



Download & Print Free Calendara From www.wiki-calendar.com



Pregnancy Diagnosis - Canine

There is NO pregnancy specific gonadotropin (ie. hCG, eCG) for pregnancy diagnosis in the canine

Palpation

- Discrete uterine enlargements best between days 22-35
 - Depends on body condition

Ultrasound

• Best after day 22 (or so)

Radiograph

• Fetal skeletons evident around day 46

Relaxin

- Secreted by fetoplacental unit
 - Accurate day 30 or greater
 - In-house test available



Courtesy LSU, Dr. Bruce Eilts





Normal Parturition

Stage I (canine)

- Synchronous uterine contractions leading to complete cervical dilation
- Anorexia, restlessness, panting, shivering, "nesting"
- Averages 6-12 hours
- Nervous, primiparous bitches can experience up to 36 hours of stage I

Stage II (canine)

- Puppies moving through birth canal
- Usually delivered every 30-60 minutes
- Up to 2 hours between can be normal
- Stage II usually complete in 6 hours, can extend up to 24 hours



Normal Parturition

Stage III (canine)

- Expulsion of fetal membranes
- Often occurs during stage II
- Pass with puppies or within 15 minutes
- Retained fetal membranes are rare in the canine



Dystocia (canine)

- Defined as "Abnormal Parturition"
- Common in the canine
 - Overall incidence has been reported as 5%^{*}, 16%^{**} and 28%^{***}
 - As much as 100% in some breeds!
- Factors Leading to Dystocia
 - Fetal
 - Maternal
- *Linde-Forsberg and Eneroth In Ettinger, 2000
- **Bergstrom et al., 2006 Incidence and breed predilection for dystocia and risk factors for C-section in a Swedish population of insured dogs Vet Surg 35:786-791
- *** Hollinshead and Hanlon 2017 Factors affecting the reproductive performance of bitches: A prospective cohort study involving 1203 inseminations with fresh and frozen semen Theriogenology 101; 62-72



Maternal Factors

- •Primary Uterine Inertia
- •Secondary Uterine Inertia
- •Breed
- Conformation
- Uterus
 - Torsion, Rupture, Adhesion
- Pain
- Fear



Fetal Factors

- Presentation
- Position
- Posture
- Abnormal Fetal Development
- » 40% born caudal longitudinal !!!



Image from: Johnston, Root-Kustritz, Olson, Canine and Feline Theriogenologhy, WB Saunders Company, Philadelphia, PA, 2001



Indications to go to the Veterinarian when whelping

- More than 3 (2) hours between normal delivery of pups
- Delivery of a dead pup
- Evidence of systemic illness weakness, collapse, excessive bleeding, etc
- Stage II (hard) abdominal contractions for 20 minutes with no pup born
- U Vulvar discharge (green, black, bloody) not associated with birth of a pup
- More than 12 hours of Stage I labor (panting, pacing, restlessness, nesting behavior)
- □ Partial birth evident fetus or fetal membranes from vulva with failure of delivery to progress
- □ Fetal distress as determined by fetal heart rates



Determining Fetal Distress

- Generally accepted that normal fetal heart rate is 180-220 bpm
- Heart rate of 150-180 is consistent with fetal distress
- Heart rate <150 is considered an emergency
- Heart rate <100 is a very poor/grave prognosis









Images Courtesy of WhelpWise, Wheatridge, CO



Dystocia Treatment

Classify Patient as "Mild" Dystocia or "Severe" Dystocia

Mild Dystocia

- -Healthy bitch with normal conformation
- –Pups normal size and appropriate position
- -No evidence of obstruction
- -No evidence of fetal distress or compromise
- -4 or less pups remaining
- -Weak or infrequent contractions

Severe Dystocia

- -Obvious oversized fetus(es)
- -Evidence of fetal compromise
- -Green/black discharge with no pup born in 20-30 minutes
- –Progesterone level <2ng/ml for 24 hours
- -Obstructive dystocia (any cause)
- –Dystocia for any reason with 5 or more pups remaining



Dystocia Treatment

Treatment Options for "Mild" Dystocia

- Manipulative Intervention
- Medical Therapy
- C-Section



Dystocia Treatment

Treatment Options for "Severe" Dystocia

Surgical Intervention

- Advise Cesarean Section if the bitch is suffering from
- severe dystocia



Reducing incidence of dystocia

- Be mindful of the breed
- Maintain appropriate health and body condition
- Breed at appropriate age (not >4-5 years)
- Be mindful of dam if she experienced dystocia due to primary uterine inertia, she will likely again, as will her offspring





When to breed again

- Maternal behavior
- Complications including surgical complication, short and long term recovery, etc.
- Indication for C-section might not want to keep breeding if primary inertia
- Body condition and general health status
- Age
- Appropriate interestrus interval

If all is above is acceptable, most experts agree to breed on the next cycle



Lactation

- Nutritional demands are very high about 3x normal caloric intake
- High demand for water during lactation
- High quality, easily digestible, high-energy diet



NEONATE CARE

Colostrum

•What is Colostrum?

- "First Milk" yellowish and more viscous than milk high in antibodies and nutrients (slight laxative effect)
- Canine neonates rely almost exclusively on **passive immunity** from colostrum, not transplacentally
- Survival depends on this passive immunity and weight gain during first 48 hours of life



NEONATE CARE

Immune System

- Neonates MUST receive colostrum the first 12-24 hours of life
- Susceptible to systemic sepsis (infection) that can lead to death if no colostrum
- Cross foster, Oral serum administration (15ml/100g bw), Colostrum bank



- Inadequate milk production
- Somewhat uncommon in canine and feline
- Signalment/Presentation
 - Nursing bitch
 - Poorly developed mammary glands late gestation/early after parturition (true agalactia)



- History/Clinical Signs
 - No milk obviously present in glands
 - Pups not gaining weight, not nursing for long
 - Sometimes post C-section (prematurity?)
 - Nervous bitch?
 - Progesterone supplementation during pregnancy?



- Etiopathogenesis
 - Genetic ____
 - Stress epinephrine inhibiting oxytocin (milk letdown) -----
 - Systemic Illness —
 - Dehydration
- **Risk Factors**
 - Premature ____
 - Progesterone supplementation during gestation ____



- Diagnosis
 - History/PE
 - No milk with hand stripping
 - Are neonates gaining and content?
 - Pituitary-Ovarian-Mammary gland axis
 - Evaluate for systemic illness
 - Assess: Body condition, pain, hydration, vulvar discharge
 - CBC
 - Chemistry
 - +/- u/s of uterus



- Treatment
 - Recognize and treat quickly if possible
 - Correct dehydration if present
 - Reduce stress if present
 - Get pups suckling ASAP
 - Oxytocin
 - Helps milk "letdown"
 - 0.5-2U SC
 - Metoclopramide
 - Might help prolactin release
 - 0.1-0.2 mg/kg SC q 8-12h





- Treatment
 - Domperidone
 - Dopamine receptor antagonist
 - Results in increase in prolactin
 - 2.2 mg/kg po BID
 - Acupuncture







Mastitis

Inflammation of the mammary gland caused by infectious agent (bacteria)

- Signalment/Presentation
 - Nursing bitch (rarely pseudocyesis)
 - Small litters
 - Large litters
 - Firm, reddened, painful mammary gland
 - Can be one or multiple glands
 - Abnormal milk





Courtesy: Margaret V. (Peggy) Root Kustritz, DVM, PhD







- History/Clinical Signs
 - Hot, painful gland(s)
 - Fever, lethargy, anorexia
 - Neglecting neonates
 - Pups not gaining weight



Mastitis

Etiopathogenesis

- Ascending infection (hematogenous spread possible)
- Milk congestion (galactostasis)
 - Infrequent milk expression leads to gland congestion
 - Ascending bacterial infection
 - E.coli, Strep, Staph

Risk Factors

- Infrequent nursing galactostasis
- Poor sanitary conditions
- Trauma



- Diagnosis
 - Usually based on history and physical exam
 - CBC
 - Leukocytosis in severe cases
 - Chemistry
 - Usually within normal limits
 - Cytology
 - Milk/discharge often reveals inflammatory cells
 - Culture
 - Always culture milk/discharge (even if it appears normal)
 - FNA v. Expression



- Treatment
 - Supportive
 - Patients can present severely ill (dehydration, shock) IV fluid therapy, IV antibiotics
 - Pain/Inflammation Control
 - Patients are significantly painful
 - Base therapy knowing all meds will be passed to nursing offspring
 - Hot packing encourage drainage
 - Cabbage leaves
 - Alternating warm/cool
 - Enzyme action? Glucosinolates reduce inflammation....



- Treatment
 - Antimicrobial Therapy
 - All antibiotics will be passed in milk
 - Start with broad spectrum and base final decision on culture
 - Probiotics dam and offspring
 - Keep glands expressed
 - Hand stripping
 - Keep pups nursing
 - Controversial







- Treatment
 - Surgery
 - Abscess drainage might be necessary in severe cases
 - Mastectomy



Thank you

