Small Animal Reproductive Emergencies

H. Grady Bailin, DVM, DACVECC

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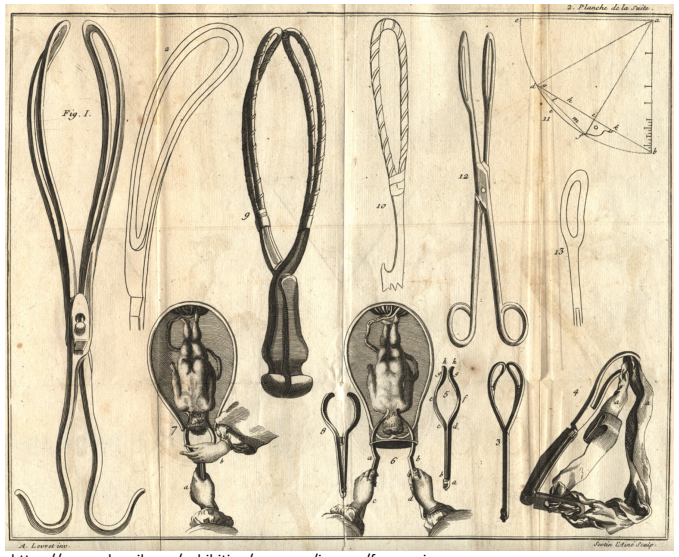
https://peoplinthepast.com/2022/06/07/podcast-season-3-episode-2-tara-mulder/#jp-carousel-5780



https://www.nlm.nih.gov/exhibition/cesarean/images/forceps.jpg

https://www.nlm.nih.gov/exhibition/cesarean.html


https://www.cliniciansbrief.com/article/canine-dystocia

Outline

- **Normal Gestation**
  - **Estimating gestation length and fetal age**
- Normal parturition
- Dystocia
  - Recognition
  - Medical and surgical management
- Neonatal Resuscitation
- Eclampsia
- Acute metritis
- Mastitis
- Antibiotic choices

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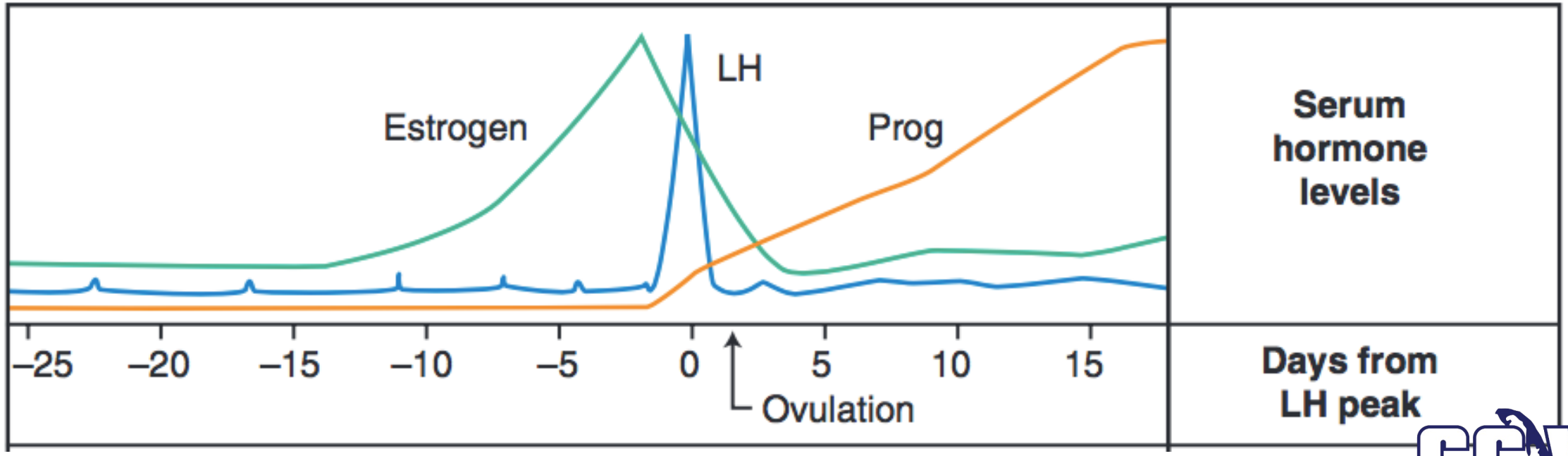
Gestation Length

- Dogs:
  - 57-72 days post breeding
  - Average 63 days
- Cats:
  - 63-65 days post breeding



Serum hormone levels in the bitch. (From Fransson BA. Ovaries and uterus. In Tobias KM, Johston SA (ed): Veterinary surgery: small animal: 2-volume set, Missouri, 2012, Saunders. 1821-1890.

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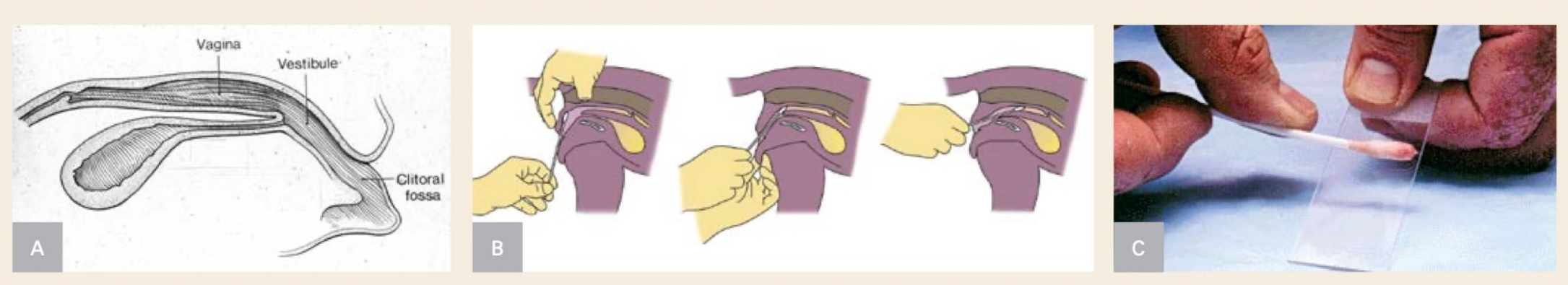
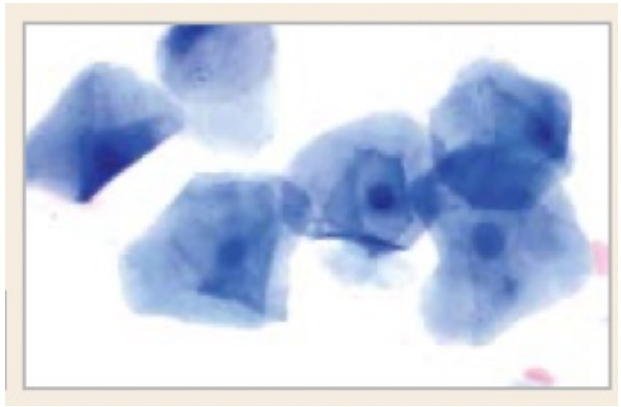
Estimating Gestation Length via Vaginal Cytology

- Technique



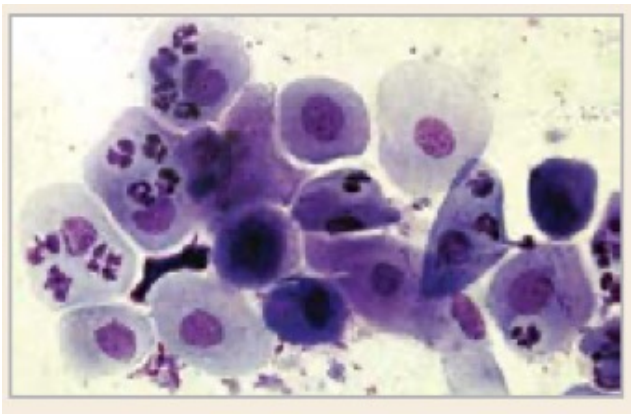
- Cell Types:



Keratinized cells

Daily

Smears



Basal/parabasal cells + WBCs

Parturition within
57 ± 1 days

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https://files.brief.vet/migration/article/22991/determining-canine-estrus-via-vaginal-cytology-22991-article.pdf

Estimating Gestation Length/Fetal Age

Table 1. Timing of selected events of the fertile ovarian cycle and pregnancy of the domestic dog in relation to the day of the preovulatory LH peak and to potential times of fertile matings (adapted from Concannon, 1986b)

Selected reproductive events	Days after LH peak*	Days after fertile mating†
Onset of pro-oestrus	−25 to −3	
Full vaginal cornification reached	−8 to +3	
Onset of oestrous behaviour	−4 to +6	
Oestradiol peak	−3 to −1	
Decreased vaginal oedema	−2 to 0	
LH surge and sharp rise in progesterone	−1 to 0	
LH peak	0	−9 to +3
First fertile mating	−3 to +9	0
Initial crenulation of vaginal mucosa	−1 to +1	
Peak vaginal crenulation	2 to 6	
Ovulation of primary oocytes	2	−7 to +5
Oviducal oocytes		
Resumption of meiosis	3	
Extrusion of first polar body	4	−4 to +7
Sperm penetration	2 to 9	0 to 7
Fertilization/pronucleus formation	4 to 9	0 to 7
Loss of unfertilized ova	6 to 9	
Two cell embryo	6 to 10	1 to 12
Loss of vaginal crenulation	6 to 10	0 to 9
Reduced vaginal cornification	6 to 11	1 to 9
Return of leucocytes to vaginal smear	5 to 13	
Morulae (8–16 cells) seen in oviduct	8 to 10	
Blastocyst (32–64 cells) entry into uterus	9 to 11	3 to 14
Intracornual migration (1-mm blastocysts)	10 to 13	
Transcornual migration (2-mm blastocysts)	12 to 15	
Attachment sites established, zonae pellucidae shed	16 to 18	9 to 21
Swelling of implantation sites, primitive streak formation	17 to 19	9 to 22
Amniotic cavities detectable by ultrasound	19 to 22	10 to 25
Uterine swellings of 1-cm diameter palpable	20 to 25	12 to 28
Fetal heartbeat detectable by ultrasound	22 to 25	13 to 28
Onset of pregnancy anaemia	25 to 30	
Uterine swellings detectable by X-ray	30 to 32	
Reduced palpability of 3-cm swelling	32 to 34	26 to 38
Haematocrit <40% PCV	38 to 40	30 to 43
Haematocrit <35% PCV	48 to 50	40 to 53
Fetal skull and spine radio-opaque	44 to 46	36 to 49
Radiographic diagnosis of pregnancy	45 to 48	38 to 50
Fetal pelvis becomes radio-opaque	53 to 57	45 to 60
Fetal teeth radio-opaque	58 to 61	50 to 64
Pre-partum luteolysis and hypothermia	63 to 65	55 to 68
Parturition	64 to 66	57 to 69

*Conservative estimates based on published and unpublished observations.
†Based on fertile single matings from 3 days before to 9 days after the LH peak.

(Concannon, 1989)

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Fetal Age Estimates via Ultrasound: Dogs

Days of Gestation	Embryonic/Fetal Structures ID'd
18	Anechogenic gestational sac
23	Embryo + heart beat (unipolar, oblong structure apposed to uterine wall)
27-31	Bipolar embryo with limb buds
29-33	Stomach, skeleton (hyperechoic structures)
31-35	Urinary bladder
32-34	Fetal movement
34-36	Distinct abdomen and thorax
35-38	Hyperechoic lung, hypoechoic liver
41-43	Kidneys
57-63	Bowel

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Fetal Age Estimates via Ultrasound: Cats

Days After Mating	Embryonic/Fetal Structures ID'd
10-11	Spherical shape to the gestational sac
16-18	Fetal heartbeat
17-19	C-form embryo (head and trunk) with thoracic limb buds
29-30	Stomach
29-32	Urinary bladder
29-32	Hyperechoic lung, hypoechoic liver
30-33	Hyperechoic skeleton (long bones, thoracic limbs, head)
30-34	Lateral fetal movement

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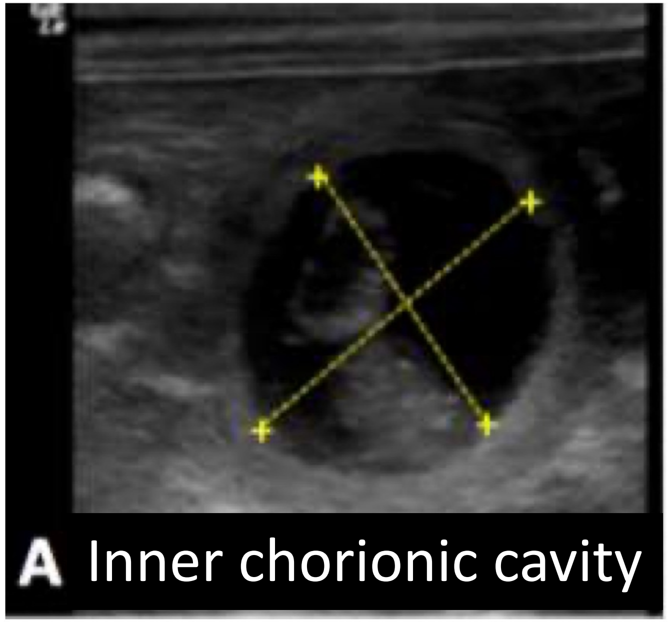
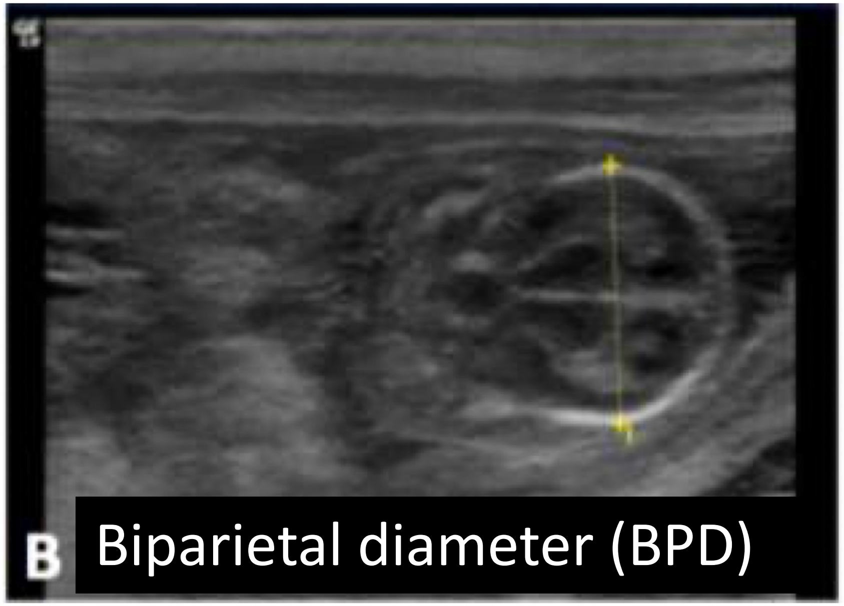
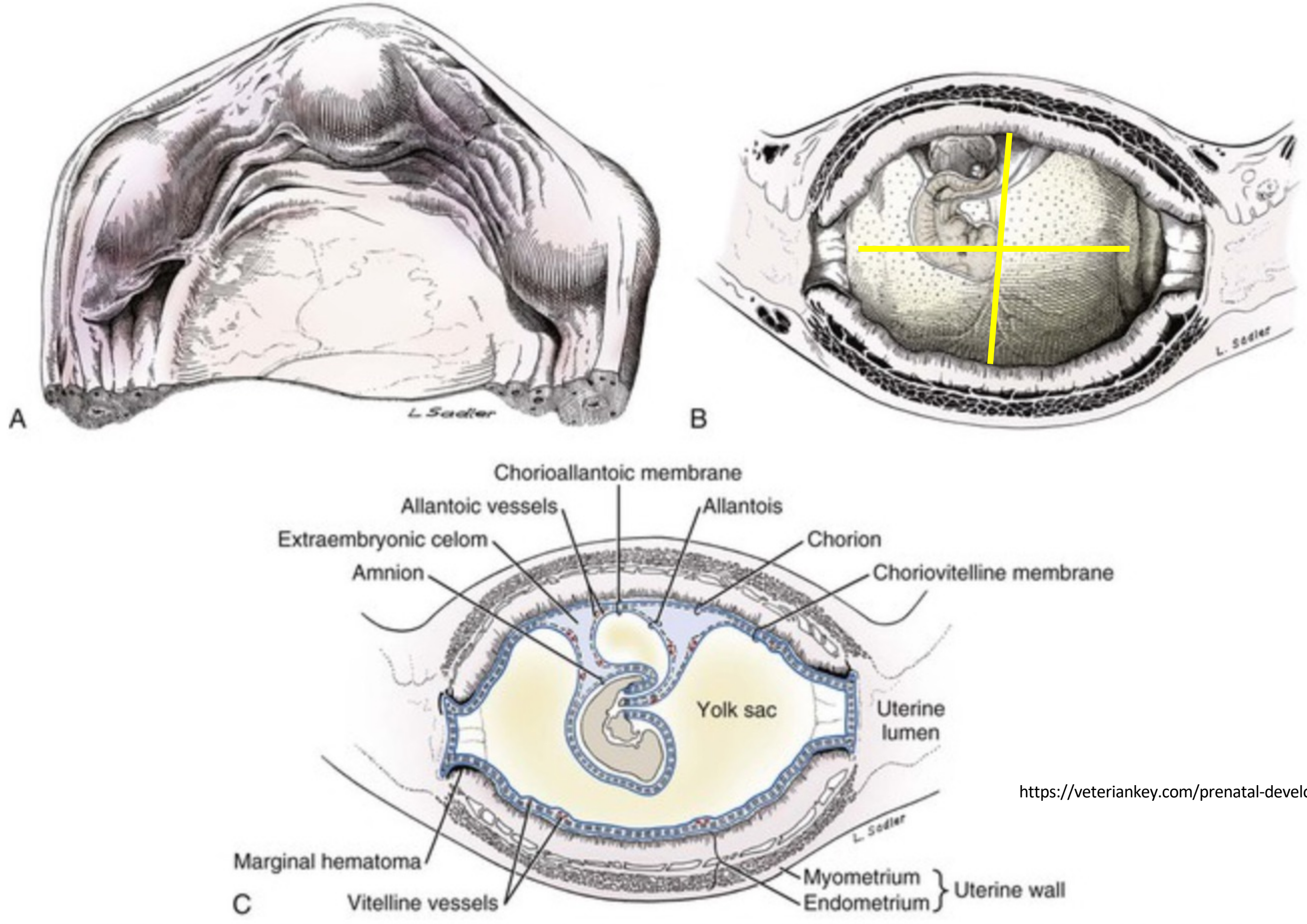
Ultrasound-based formulas for prediction of gestational age







https://veteriankey.com/prenatal-development/

https://pdfs.semanticscholar.org/9cd0/a2c50d9ec379c0bf70f09fadf7f0b582d8eb.pdf

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Ultrasound-based formulas for prediction of gestational age

- Dogs

ICC in small size bitches: DBP = (mm – 68.68)/1.53;

ICC in medium size bitches: DBP = (mm – 82.13)/1.8;

BP in small size bitches: DBP = (mm – 25.11)/0.61;

BP in medium size bitches: DBP = (mm – 29.18)/0.7;

Keiser 2016

- Cats

Formulas for predicting parturition in cats[32,33]

- DBP = (ICC [mm] – 62.03)/1.1
- DBP = (BP [mm] – 23.39)/0.47

Specific for Maine coons:

- DBP = (–0.79 x ICC [mm]) + 57.9
- DBP = (–1.86 x BP [mm]) + 49.3

DBP = days before parturition; ICC = inner chorionic cavity; BP = fetal biparietal diameter

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Accuracy of gestation-age prediction formulas?

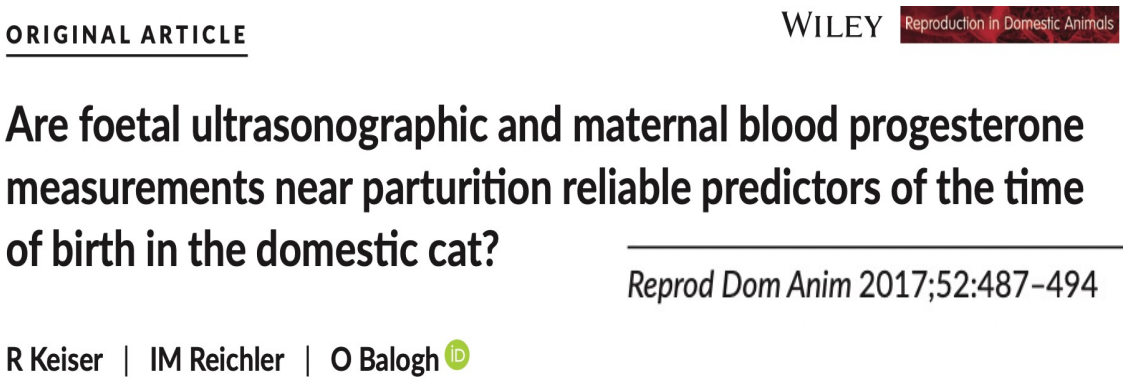
ORIGINAL ARTICLE

WILEY Reproduction in Domestic Animals

Determination of gestational time and prediction of parturition in dogs and cats: an update

Reprod Dom Anim 2016; 51 (Suppl. 1): 12–17

M. Beccaglia[1] | S. Alonge[2] | C. Trovo'[1] | G. C. Luvoni[2]



ORIGINAL ARTICLE

WILEY Reproduction in Domestic Animals

Are foetal ultrasonographic and maternal blood progesterone measurements near parturition reliable predictors of the time of birth in the domestic cat?

Reprod Dom Anim 2017;52:487–494

R Keiser | IM Reichler | O Balogh

- Most accurate in middle of gestation using the biparietal diameter
  - Week 5 gestation
    - BPD 95.2% accurate within +/- 2 days of parturition
  - Within 5 days of parturition:
    - Only 27-40% accurate within +/- 1 day of birth
    - Only 50% accurate within +/- 2 days of birth

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https://www.cliniciansbrief.com/article/canine-dystocia

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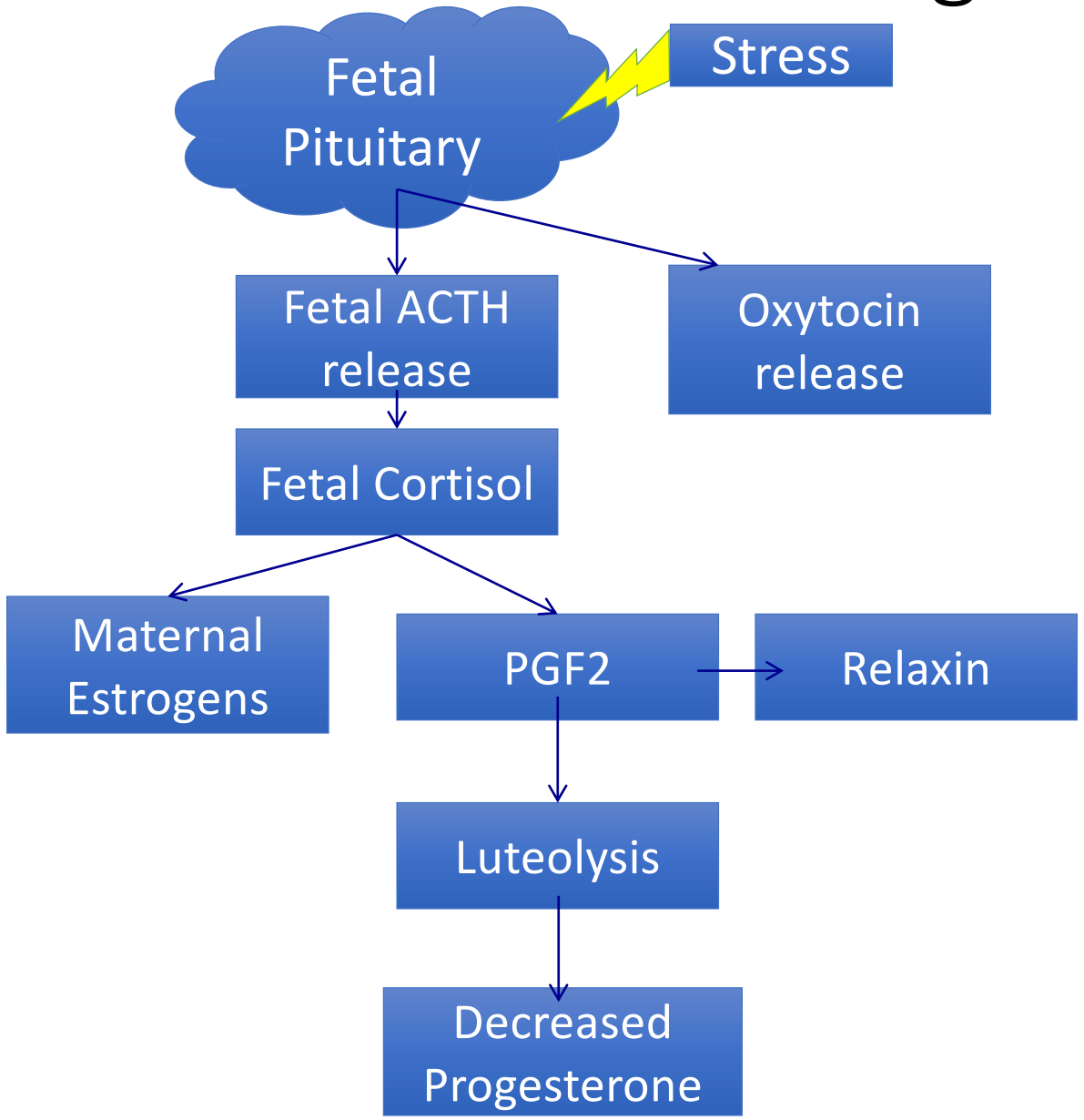
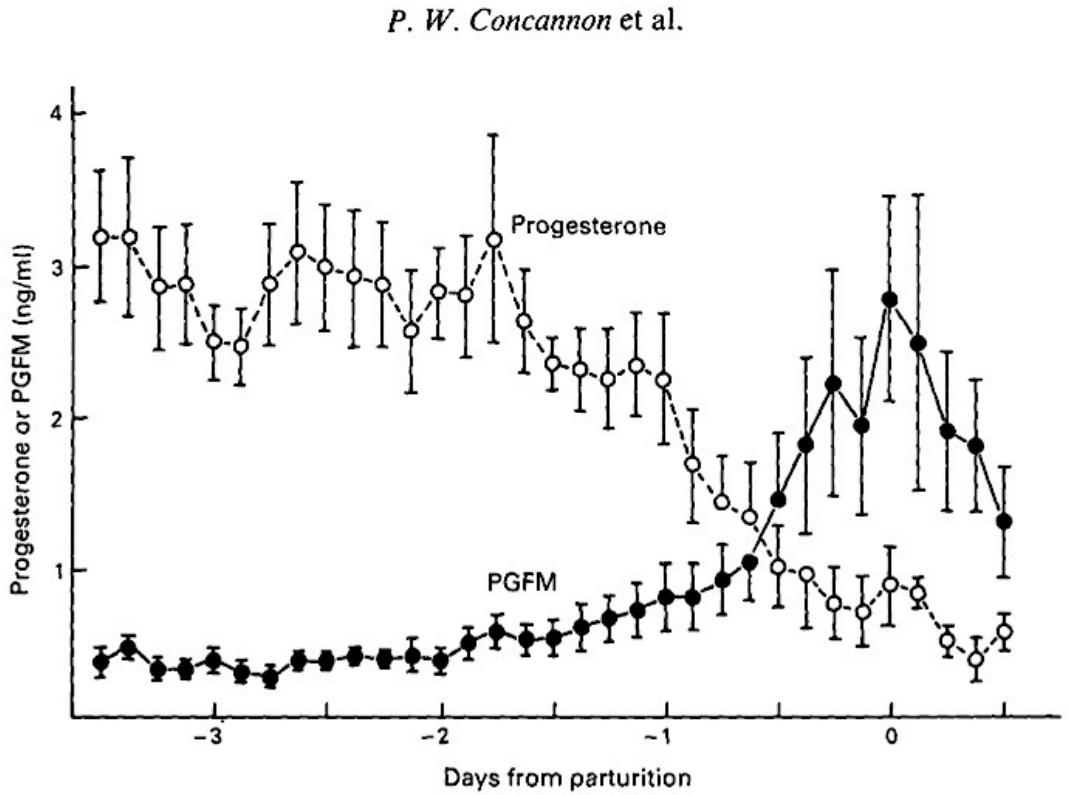
Hormonal Signals for Parturition





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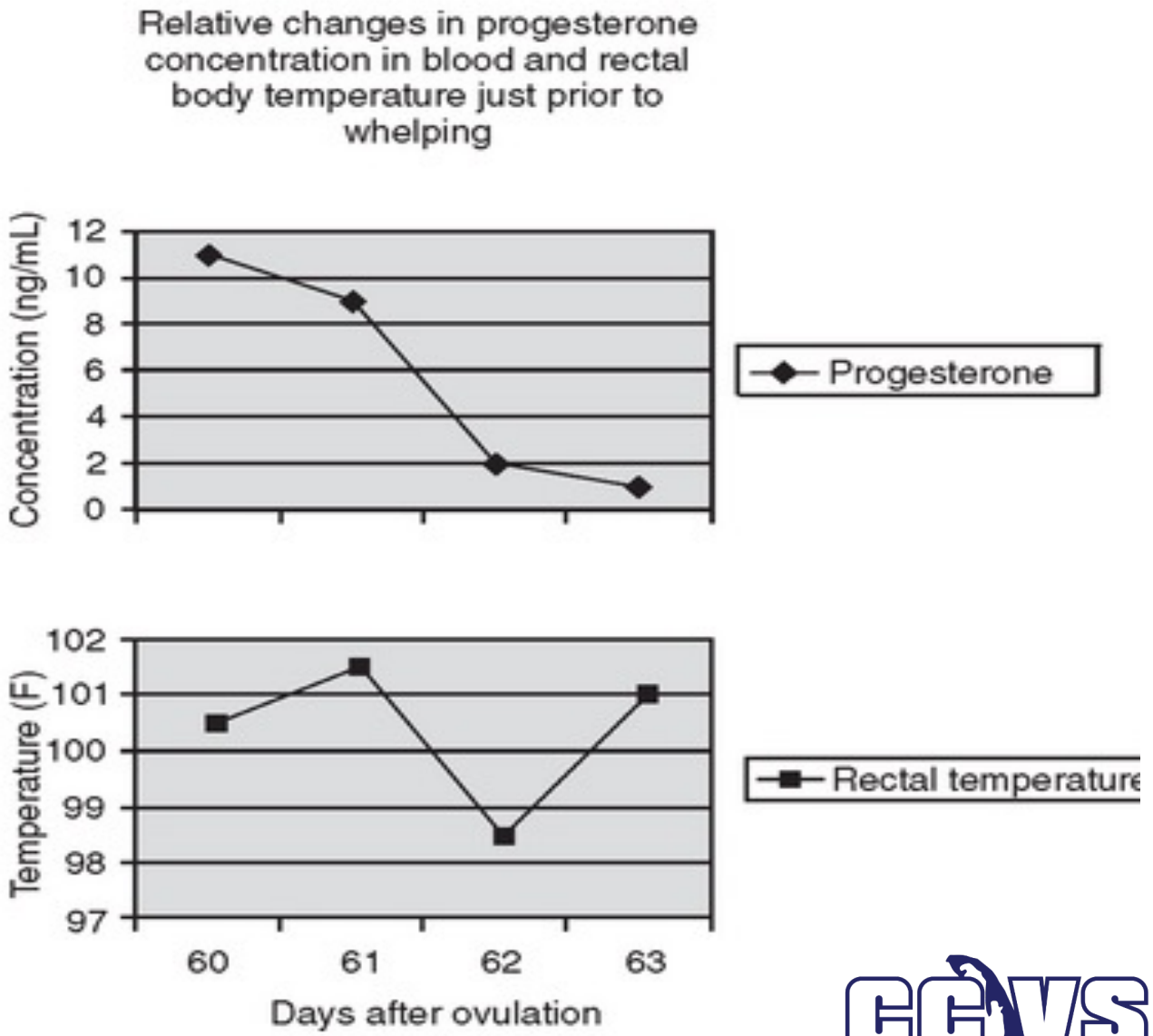
Timing of Parturition

- Progesterone Levels:
  - During LH peak = 2-3 ng/mL
  - During ovulation = 4-10ng/mL
  - Decrease to < 2ng/mL within 24-48 hours of parturition
- Associated with a decrease in body temperature (99F) within 24 hours of parturition



https://veteriankey.com/parturition-and-dystocia/

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https://www.youtube.com/watch?v=8ZWB6-jJbYs

Stage I Labor

- Cervical dilation, subclinical uterine contractions
- Duration
  - Dogs: 6-12 hours
  - Cats: shorter
- Signs:
  - Dogs
    - Restlessness, panting, anorexia, nesting
  - Cats
    - Vocalization, tachypnea, restlessness, purring

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Stage II Labor

- Expulsion of offspring
- Strong uterine and abdominal contractions
- Fetal delivery:
  - Dogs: within 4 hours of onset
    - Puppy every 15 mins to 2 hours
  - Cats: within 1 hour of onset
    - Kitten every 10-60 mins

https://www.wikihow.com/Monitor-the-Stages-of-Labor-in-Dogs

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Stage III Labor

- Expulsion of the placenta

https://www.youtube.com/watch?v=AAvXMdnGHNs

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Stages of Labor Summary

Stages	I	II	III
Clinical Signs	• Subclinical uterine contractions, cervical dilation • Nesting behavior, restlessness, vocalization/purring, anorexia	• Fetal expulsion • Active abdominal contractions/straining	• Placental expulsion
Timing	• Dogs: 6-12 hours • Cats: <6 hours	• Dogs: within 4 hours, puppies q30-2hrs • Cats: within 1 hour, kittens q10-60 minutes	• 15 minutes • Simultaneous with stage II until last neonate delivered

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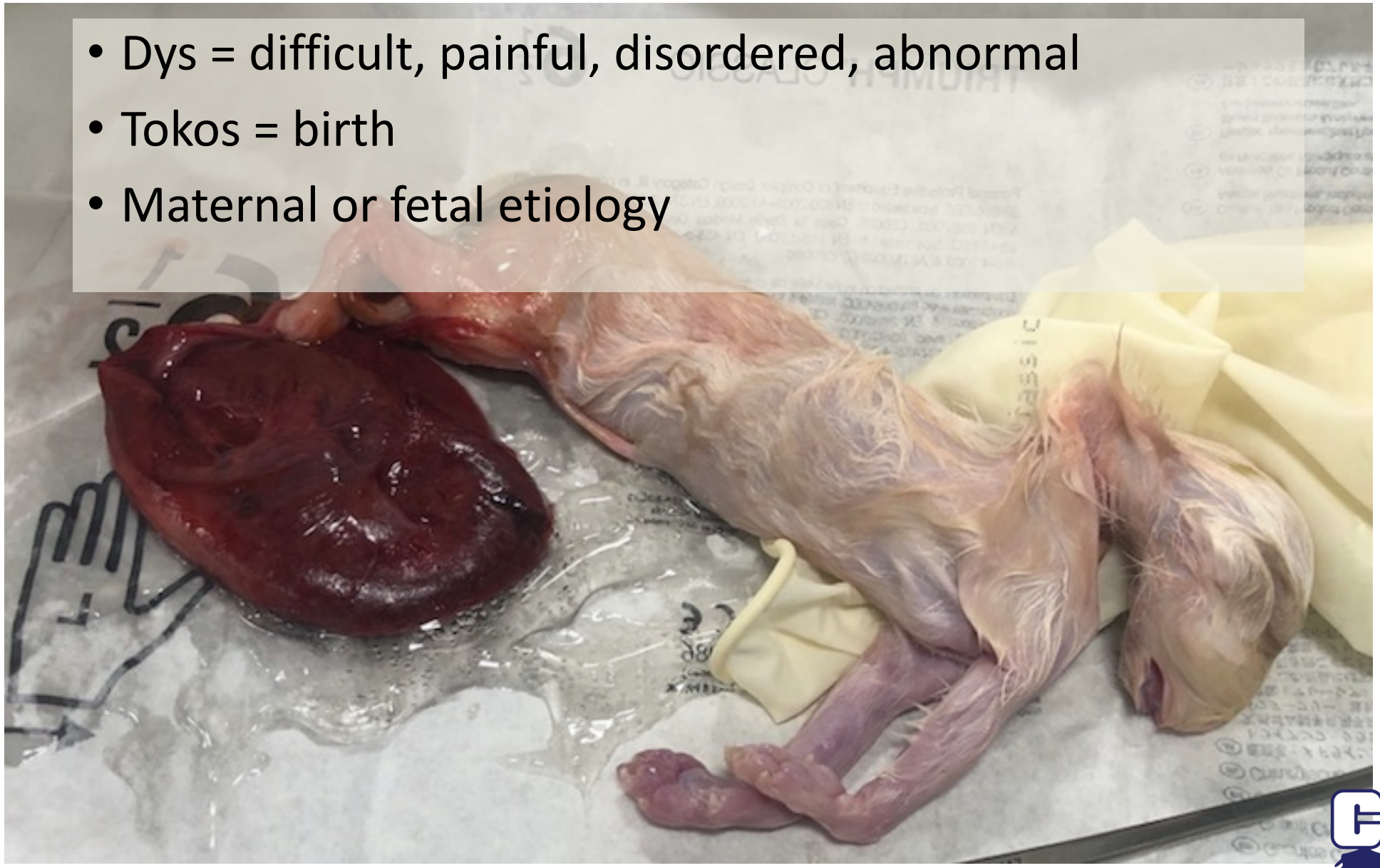
Dystocia



- Dys = difficult, painful, disordered, abnormal
- Tokos = birth
- Maternal or fetal etiology

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Maternal Causes of Dystocia

- Physiologic
  - Primary uterine inertia
  - Systemic disease
  - Uterine over/underdistention
  - Hormonal imbalance
  - Calcium/magnesium balance
  - Inadequate oxytocin secretion
  - Prematurity
- Secondary uterine inertia

- Morphologic
  - Primary (narrow birth canal)
  - Secondary
    - Pelvic fractures
    - Uterine disease
      - Torsion
      - Rupture
      - Herniation
      - Prolapse
    - Masses: pelvic, uterine, vaginal, vulvar
    - Fibrosis
    - Vaginal septum

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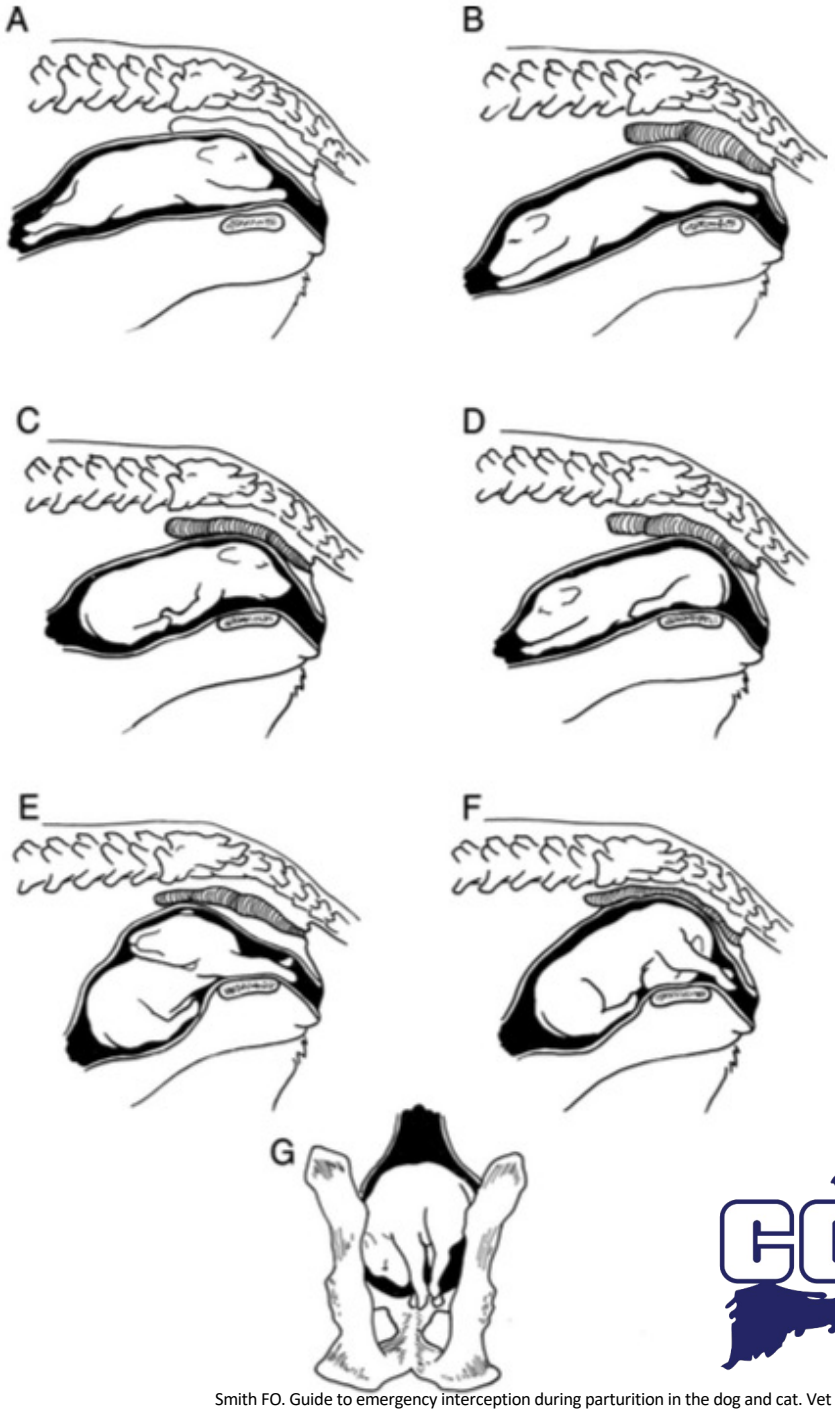
Fetal Causes of Dystocia

- Malpresentation
- Oversize
- Fetal death
- Fetal malformations



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Smith FO. Guide to emergency interception during parturition in the dog and cat. Vet Clin Small Anim 2012. 42: 489-499

Criteria for Dystocia

- Definitive cause visible
- Prolonged gestation with no evidence of labor
- Temperature drop (<100F) with no evidence of labor
- Strong, persistent contractions with no fetus within 30 minutes
- More than 4 hours between fetal expulsions
- Fetal distress
  - HR<160bpm
  - Lochia or fetal fluids noted, >2 hours without fetal expulsion
- Maternal systemic illness or severe pain

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Diagnostics

- Thorough history
- Physical exam of dam
  - Sterile vaginal palpation
- Assess fetal heart rate - AFAST

	Canine	Feline
Normal	> 200	> 220
Distress	< 180	
Emergent	< 160	

- Ionized calcium, blood glucose, PCV/TS
- Abdominal Radiographs

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ORIGINAL ARTICLE

WILEY Reproduction in Domestic Animals

Blood calcium, glucose and haematology profiles of parturient bitches diagnosed with uterine inertia or obstructive dystocia

BL Frehner[1] | IM Reichler[1] | S Keller[1] | S Goericke-Pesch[2†] | O Balogh[1†]

- ~40% dystocic dogs were hypocalcemic
  - No correlation between [iCa] and dystocia type or litter size
  - Positive correlation between dam body weight and [iCa]
- No association with blood glucose

Retrospective evaluation of feline dystocia: clinicopathologic findings and neonatal outcomes in 35 cases (2009–2020)

Journal of Feline Medicine and Surgery
2022, Vol. 24(4) 344–350

DOI: 10.1177/1098612X211024154
journals.sagepub.com/home/jfm

This paper was handled and processed by the American Editorial Office (AAFP) for publication in *JFMS*

SAGE

H Grady Bailin, Liam Thomas and Nyssa A Levy

- Feline Dystocias:
  - iCa (mg/dL): median 5.4, mean 5.34, range = 4.9-5.8
  - Glucose (mg/dL): median 136, mean 130.9, range = 73-183

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Medical management

- Indications
  - Healthy dam
  - Labor has not been too long
  - Dilated cervix
  - Appropriate fetal size
  - Fetal heart rate normal

- NEVER WITH OBSTRUCTIVE DYSTOCIA

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Medical Management

- **Oxytocin**
  - 0.1U/kg or 0.5-2U IM or SQ
    - q30 mins x 2
  - Not to exceed 20U/dog

- **Calcium gluconate** (10%)
  - 0.2ml/kg IV OR 1-5mL/dog SQ
  - Controversial in queen

- +/- dextrose supplementation

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PAPER

A. Bergström, B. Fransson*,
A.-S. Lagerstedt and K. Olsson†

Journal of Small Animal Practice (2006)
47, 456-460

Primary uterine inertia in 27 bitches: aetiology and treatment

- Oxytocin levels significantly lower than in previous studies with dogs in normal labor
  - 30% of dogs did not respond to oxytocin in this study
- Group given calcium prior to oxytocin
  - Trended toward more puppies delivered
- Between 55-65% of cases required surgical management

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Surgical Management

- Inadequate response to medical therapy
- Primary/secondary uterine inertia
- Obstructive dystocia that cannot be quickly corrected
- Fetal distress
- Maternal abnormalities of the birth canal
- Uterine rupture or torsion

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ORIGINAL RESEARCH

Veterinary Surgery
23:48-52, 1994

En Bloc Ovariohysterectomy as a Treatment for Dystocia in Dogs and Cats

MITCHELL A. ROBBINS, DVM, and HOLLY S. MULLEN, DVM, Diplomate ACVS

- Ovaries and uterus removed with fetus inside

- Fetal survival rates:
  - Dogs 75%; Cats 42%

https://www.petcoach.co/dog/condition/pyometra/

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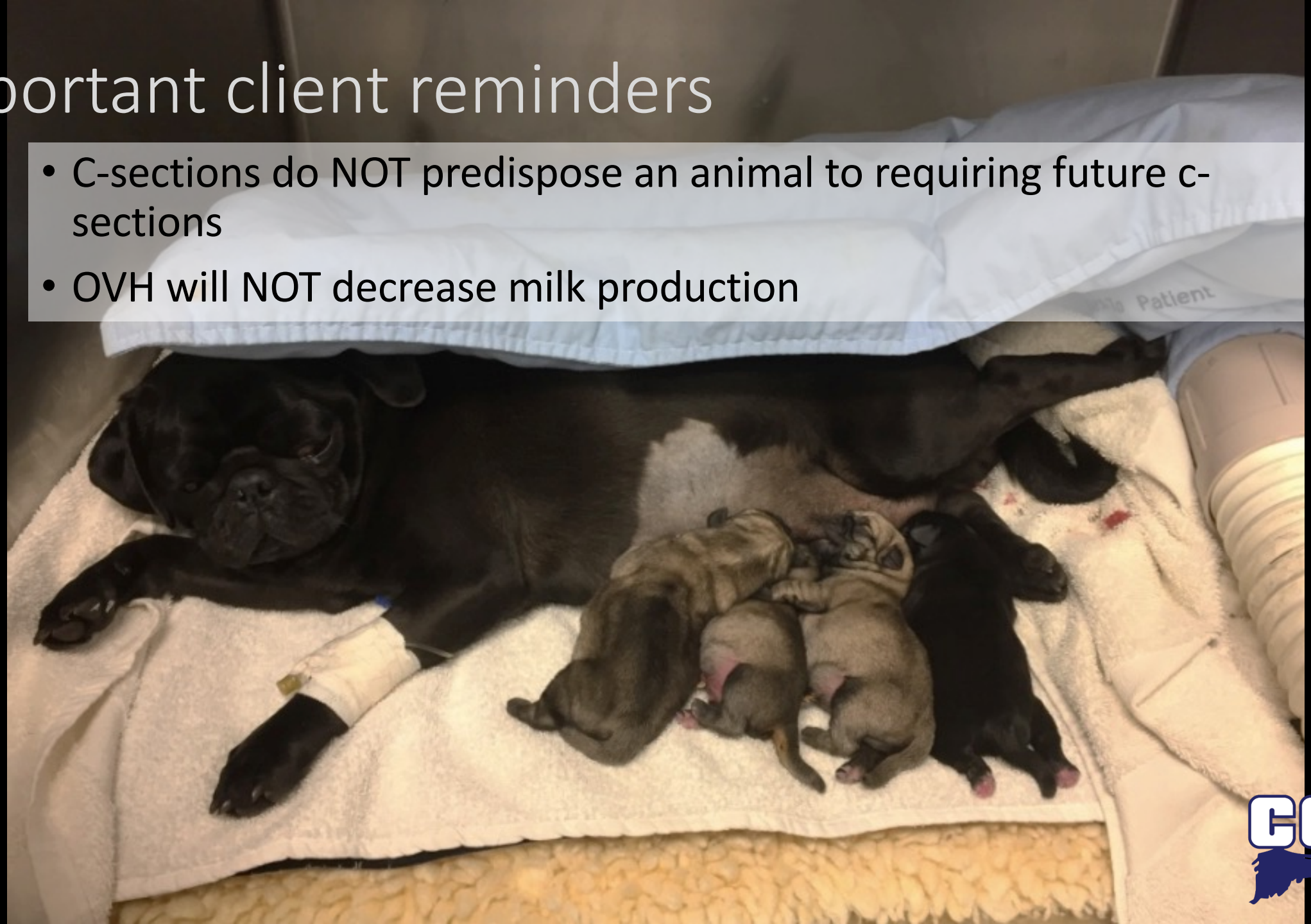
Important client reminders

- C-sections do NOT predispose an animal to requiring future c-sections
- OVH will NOT decrease milk production



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Pain management post-op C-section

- Important!
  - Humane
  - Improves maternal bonding and nursing
- Options:
  - Nocita
  - Carprofen

Dystocia summary

- The incidence of dystocia in cats and dogs is similar
- Dystocia occurs due to maternal and fetal factors
  - Maternal factors responsible for ~60-70% of dystocias in both cats and dogs
- Dystocia diagnosis based on history, PE, vaginal examination, and imaging
- Medical management is appropriate if:
  - Dam in good health, short period of labor, dilated cervix, no fetal distress
  - Inappropriate if obstruction present
- Surgical management is appropriate in all other cases

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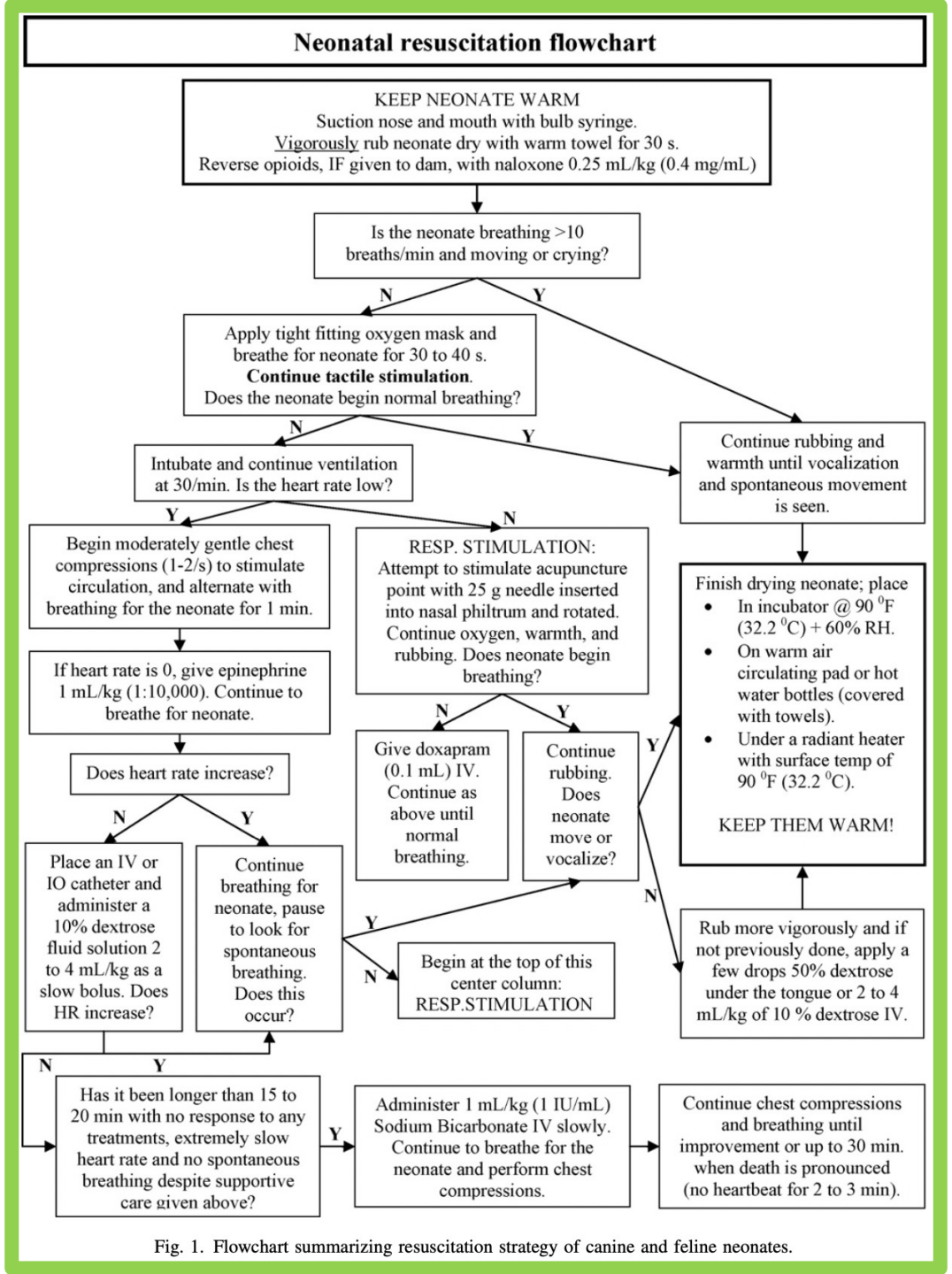

Fig. 1. Flowchart summarizing resuscitation strategy of canine and feline neonates.

Traas AM. Resuscitation of canine and feline neonates. Theriogenology 2008. 70: 343 – 348.

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Neonatal Resuscitation Supplies

- Warming device (set to 90F [32C] and 50-60% humidity)
- Warm, dry towels
- Bulb syringes
- Hemostats
- 22 and 25 g needles; 25g IVC
- 1mL syringes
- Oxygen
- Miniature face mask
- Size 1-2 ETT, uncuffed
- 12-16g IVC (for ETT in kittens/very small puppies)
- Infant stethoscope or doppler ultrasound to assess fetal heart rates
- Isotonic fluids, 50% dextrose, 2% iodine solution, naloxone, epinephrine
- Suture to tie off cord
- Ideally: one skilled person available to resuscitate EACH expected neonate

Figure 3 (a and b). Resuscitation equipment and drugs should be organized before induction of anesthesia.

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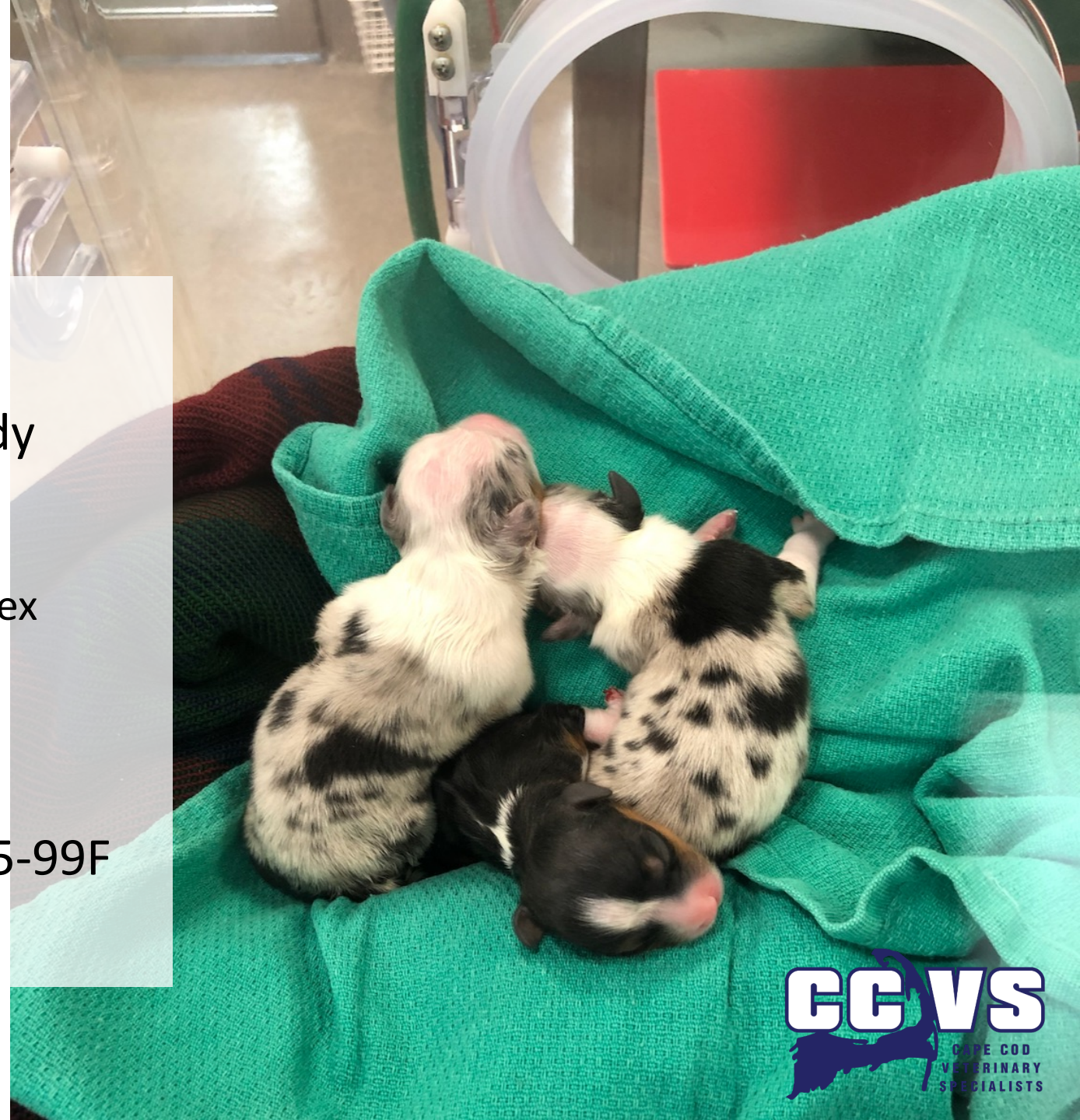
Temperature support

- PREVENT HYPOTHERMIA!
  - Neonates unable to regulate body temperature
    - No shiver or vasoconstrictive reflex
  - Keep dam warm intra-op
    - Towel dry neonate once delivered
  - Normal neonatal body temp = 95-99F
    - Check temperatures frequently!



Airway

- Clear nose/mouth of membranes and fluids with towel
- Vigorous tactile stimulation and rubbing
  - Genital and umbilical regions
  - Lumbar area
- Do NOT swing neonates

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Figure 4. Rub the newborn pup vigorously with clean, warm towels to stimulate respiration.

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Figure 5. Suction of fluid from mouth and pharynx can be accomplished with a neonatal bulb syringe.

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Breathing

- Normal neonatal RR = 10-18brpm
- If not breathing immediately:
  - Tight fitting mask applied to face
  - If normal breathing not achieved after mask, intubate
- If not breathing even when intubated, can attempt Renzhong acupressure point

https://www.merckvetmanual.com/multimedia/image/small-tight-fitting-mask-neonatal-puppy

© Bonnie Hay Kraus

Figure 6. The JenChung GV26 acupuncture point used to stimulate respiration; a 25G needle is inserted into the nasal philtrum until it contacts bone and then twisted.

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Circulation

- Decreased heart rate most likely due to myocardial hypoxia
- Treatment for neonatal bradycardia = increase respiration, correct hypoxia
- If appropriately respiratory resuscitated and still bradycardic
    - Begin chest compressions @ 1-2beats/second → pause for respiration
    - Administer epinephrine

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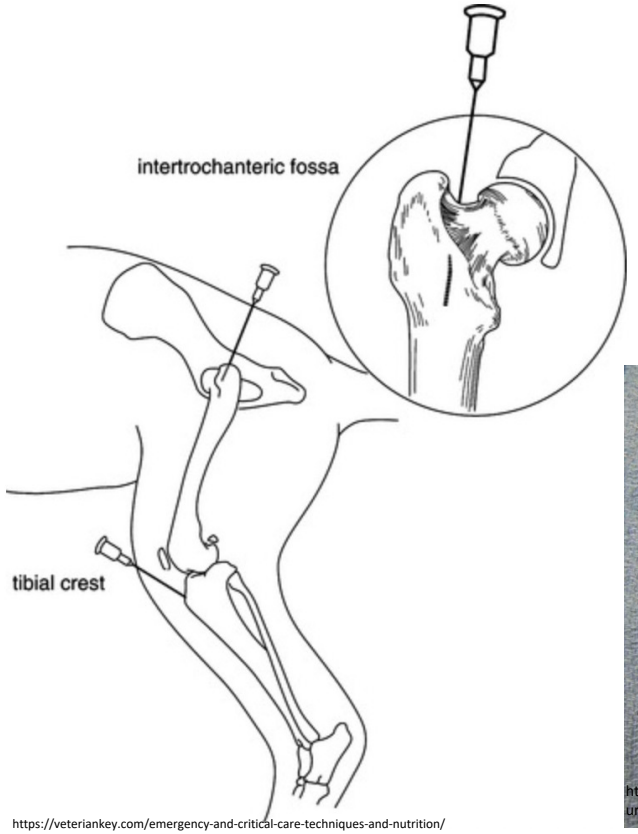
Vascular Access

- Umbilical vein for injections
  - Do not place indwelling catheter into umbilical vein
- Jugular vein
  - All other veins difficult to access and are fragile
- Intraosseous catheter placement
  - Proximal femur
  - Tibial crest
  - Proximal humerus
- Sublingual route for naloxone, doxopram



https://veteriankey.com/emergency-and-critical-care-techniques-and-nutrition/


https://www.cliniciansbrief.com/article/intraosseous-catheterization-often-underused-life-saving-tool


https://vetgirlontherun.com/top-10-tips-treating-neonatal-pediatric-veterinary-patients-vetgirl-veterinary-ce-blog/

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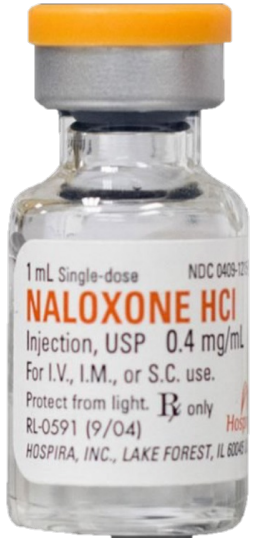
Drugs

- Epinephrine
  - 0.1-0.3mg/kg IV or IO
- Doxapram
  - 0.1mL IV
- Naloxone
  - 0.1mg/kg IV, SQ, IM, NOT ET
- Dextrose and fluids
  - 10% IV or IO @ 2-4ml/kg slow bolus



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APGAR Scoring

Table 1
The modified Apgar scoring system used in this study (rr = respiratory rate).

Parameter	Score		
	0	1	2
Heart rate	<180 bpm	180 to 220 bpm	>220 bpm
Respiratory effort	No crying/ < 6 rr	Mild crying/6 to 15 rr	Crying/ > 15 rr
Reflex irritability	Absent	Grimace	Vigorous
Motility	Flaccid	Some flexions	Active motion
Mucus color	Cyanotic	Pale	Pink

Veronesi, 2009

- APGAR ≤ 6 more likely to die at 2hr mark than APGAR>6
  - Less likely to seek the mammary gland or have suckle reflexes

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Neonatal Viability Reflexes Scoring

Table 2
The Neonatal Viability Reflexes

Parameter	Weak (0 Score)	Moderate (1 Score)	Normal (2 Score)
Suckle	Absent	Weak (> 3 suckles/min)[27]	Strong (5 suckles/min)[27]
Rooting	Absent	Slow muzzle fitting inside the circle	Immediate fitting muzzle within the circle
Righting reflexes	Absent (continues in initial position)	Slow body repositioning	Fast body repositioning

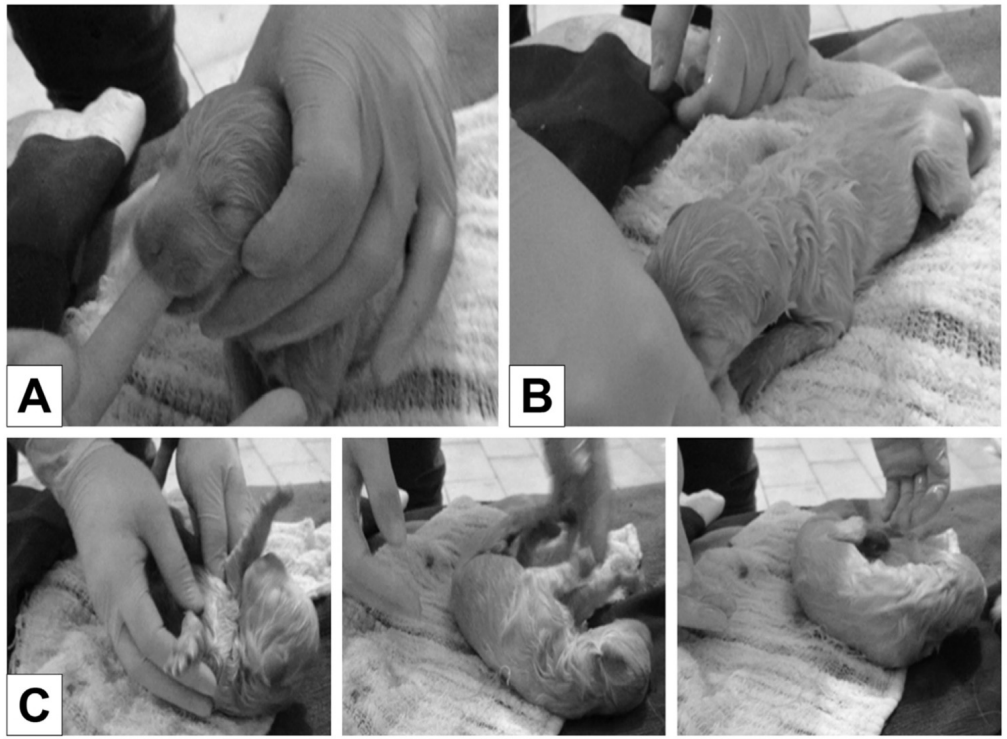

Fig. Demonstration of suckling (A), rooting (B), and righting reflexes (C) in a neonate.

Vassalo, 2015

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https://www.cliniciansbrief.com/article/canine-dystocia

Outline

- Normal Gestation
  - Estimating gestation length and fetal age
- Normal parturition
- Dystocia
  - Recognition
  - Medical and surgical management
- Neonatal Resuscitation
- **Eclampsia**
- Acute metritis
- Mastitis
- Antibiotic choices

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Eclampsia/puerperal tetany

https://www.stortvet.com/whelping-potential-problems/

- Hypocalcemia in periparturient period
  - Time period: 2-4 weeks post parturition, occasionally late gestation
- Causes:
  - Ossification of fetal skeletons, production of large volumes of milk
  - Poor GI absorptions of dietary calcium
  - Parathyroid atrophy caused by improper nutrition and supplementation

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Eclampsia/puerperal tetany – clinical signs, diagnosis

- Clinical signs:
  - Dogs
    - Stiff gait, trembling, twitching, seizures, tachycardia, panting, hyperthermia, facial pruritis, death
    - ~20% have atypical signs
      - Whining, vomiting, diarrhea, behavior changes
  - Cats
    - Similar to dogs, but may include hypothermia, hyperexcitability, hypersensitivity, flaccid paralysis

- Diagnosis
  - iCa < 0.8 mmol/L (RI 1.2-1.4mmol/L)
    - Total calcium levels < 9mg/dL

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Eclampsia/puerperal tetany – treatment

- Life threatening stabilization:
  - Calcium gluconate 10% administered IV over 10-30 minutes and titrated to effect
    - 5-15mg/kg elemental calcium = 0.5-1.5ml/kg CaGlu
    - Monitor ECG!
  - IVF to correct fever, dehydrations, tachycardia

- Oral calcium carbonate (Tums)
  - 50mg/kg/d elemental calcium
    - Each 500mg Calcium carbonate tablet (TUMS) contains 200mg of elemental calcium
  - Wean puppies onto bottle feed

- Supplementation of Ca prior to whelping not recommended
  - Animals with history of eclampsia or at risk (small breed dogs with large litter, dam unable to maintain adequate nutrition) should have tums administration begun after whelping

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Acute metritis – definition and causes

- Bacterial infection of the uterus that occurs within first week of parturition

- Causes:
  - Retained fetuses or placentas, abortions, uterine trauma due to dystocia or obstetric manipulation, uterine prolapse, ascending infection from vaginal canal

- Pathogens:
  - Most common =
    - *E. coli*
  - Others =
    - *Staphylococcus*, *Streptococcus*, *Klebsiella, proteus, pasteurella, pseudomonas*, etc

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Acute metritis – clinical signs and diagnosis

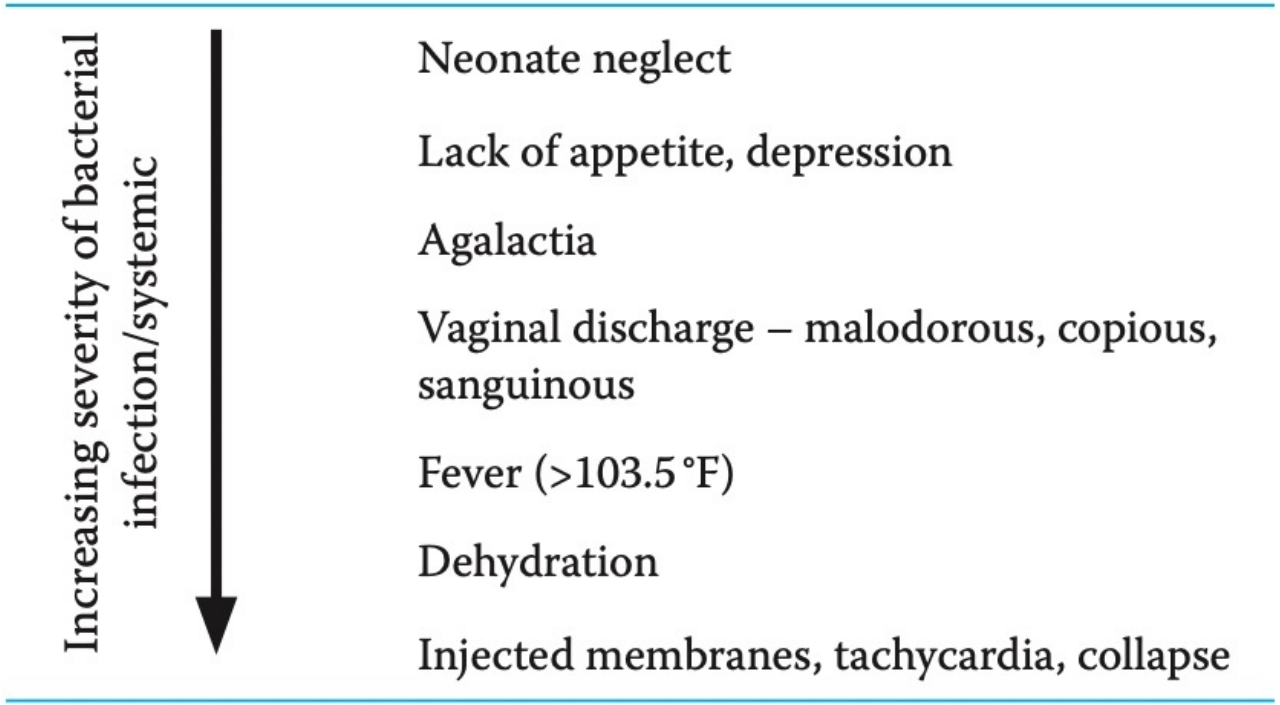

Figure 122.1 Range of clinical signs of metritis in the bitch and queen.

- Diagnosis:
  - Uterine/vaginal fluid cytology
    - TNTC degenerate neutrophils with intracellular and extracellular bacteria, RBCs, debris
  - AXR to evaluate for retained fetuses
  - Uterine ultrasound: evaluate for retained placentas, abdominal free fluid

Grundy Chp 122 in Drobatz 2019

Acute metritis – treatment


https://www.marvistavet.com/pyometra.pml

- Systemic stabilization!
- Ovariohysterectomy
- Prostaglandin therapy (Lutalyse)
  - Narrow range of safety in dogs (lethal dose = 5.15mg/kg)
  - SIDE EFFECTS!
    - Tachycardia, panting, anxiety, hypersalivation, D+, V+, urination
    - COMPLICATIONS
      - Uterine rupture, peritonitis, coagulopathies, sepsis
  - Contraindications
    - Increased concern for uterine rupture, severe illness/sepsis

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Mastitis – Clinical signs

- Mammary glands: extremely painful, hot, swollen, erythematous, edematous tissue
- Caudal most mammary glands most likely to be affected during acute phase
- Secretions:
  - Can be normal, but more commonly purulent, brownish, bloody, or malodorous
- Systemic signs:
  - Lethargy, fever, vomiting, dehydration, inappetance
  - Untreated → sepsis
  - Neglect neonates → fading/death
- Chronic/subclinical mastitis
  - Poorly defined condition
  - No systemic signs other than fading offspring
    - Affected glands and expressed milk generally appear macroscopically normal
      - Mammary parenchyma may palpate thickened and hardened

https://criticalcaredvm.com/wp-content/uploads/2018/03/Mastitis-in-Dogs.jpg

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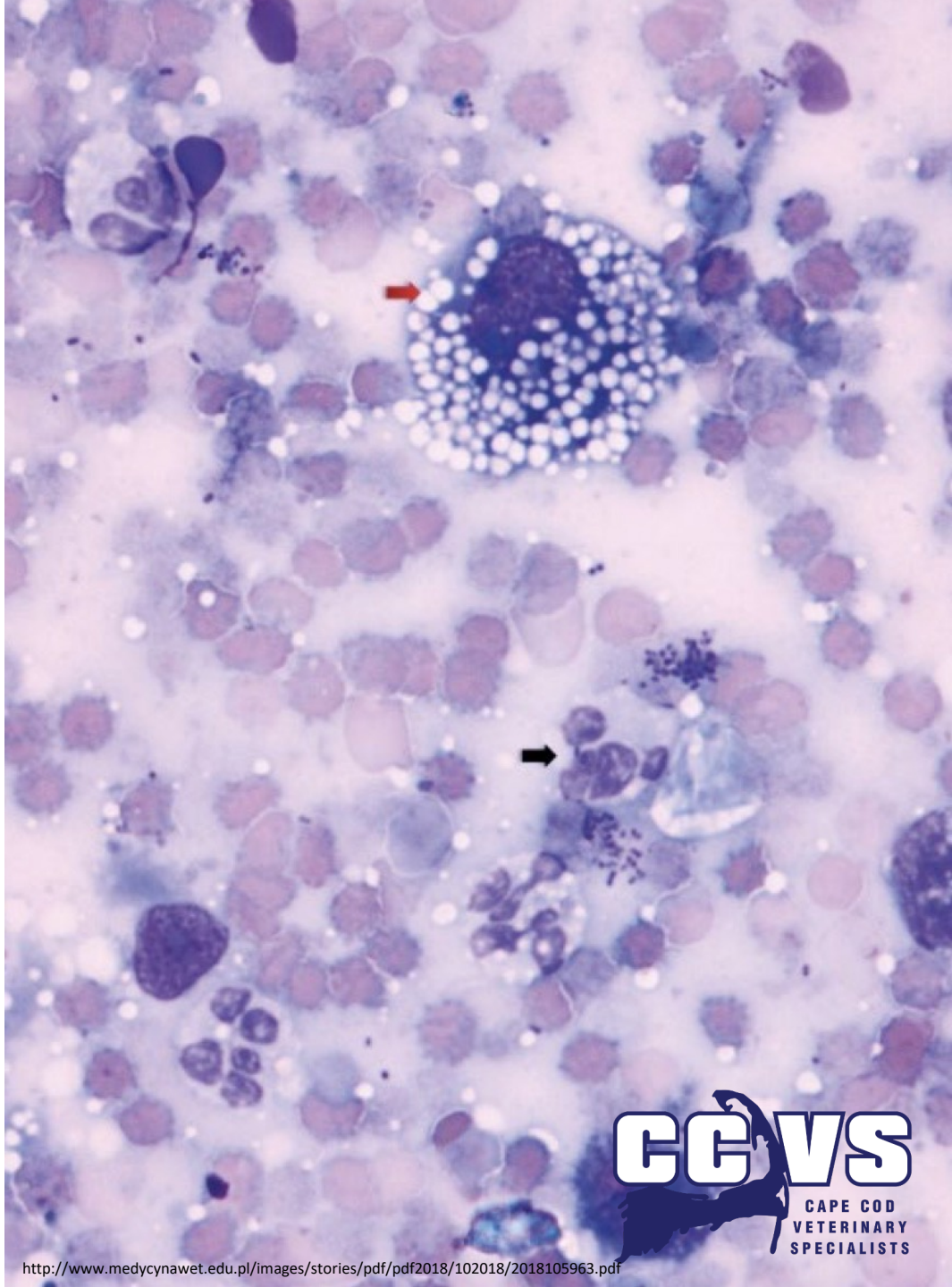
Mastitis – Diagnosis

- History and clinical signs
- Aseptically collected milk (discard first drop)
  - Cytology
    - Early acute mastitis
      - Macrophages and neutrophils with intracellular bacteria
    - 3d post onset
      - Degenerate neutrophils
    - 6d post onset
      - Lymphocyte invasion
    - 2wks
      - Lymphocytes predominate
  - Culture and sensitivity



http://www.medycynawet.edu.pl/images/stories/pdf/pdf2018/102018/2018105963.pdf

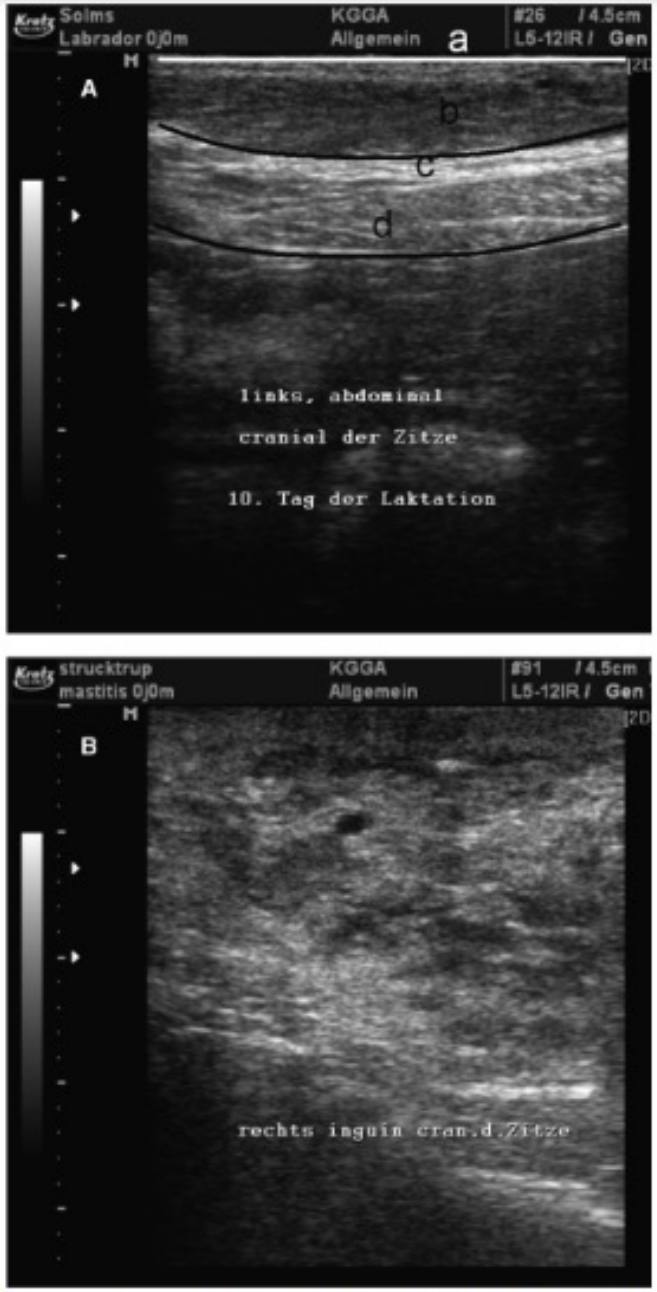


FIG. 1. Transverse ultrasound image of a normal lactating gland (A) an
of an inflamed lactating canine gland (B). The loss of separation betwee
tissue layers is apparent in (B). The lines in the image in (A) indicate the (ski
(a), parenchyma (b), fascia (c), and muscle (d). The glandular parenchyma i
coarse-grained and of medium echogenicity 152 × 101 mm (300 × 300 DPI

Veterinary Radiology & Ultrasound

Full Access

ULTRASONOGRAPHIC DESCRIPTION OF CANINE MASTITIS

KATJA TRASCH, AXEL WEHREND, HARTWIG BOSTEDT

First published: 22 October 2007 | https://doi.org/10.1111/j.1740-8261.2007.00301.x | Citations: 6

Mastitis:

- Loss of wall layering
- Hypoechoic regions +/- anechoic areas

Blood Flow = prognostic indicator:

- Increased blood flow/vessel density → improved outcome

Mastitis – Treatment

- Systemic stabilization, if sepsis signs present
- Mainstays:
  - Antibiotics
    - Choose based on cytology, adjust based on milk culture
  - Warm compress
  - Wound management
    - Demarcation present, draining tract absent
      - Aseptically prepare tissue, lance, saline flush
        - Leave open, heal by second intention
    - Draining tract open
      - Debride necrotic tissue
      - Leave open, heal by second intention
    - Clean wound 2-3x/d
    - If severe or non-healing
      - Mastectomy
  - Pain management
  - Separate dam from litter if necessary for dam's comfort

FIGURE 100-1 **A,** Acute mastitis with areas of distinct demarcation *(arrowheads)*. **B,** Formation of abscesses with development of necrotic tissue resulting in tearing of the skin *(arrows)*. **C,** Acute mastitis with ruptured abscesses and gangrene *(arrows)*. (***A,*** *Courtesy Dr. Lauren Jones, Country Companion Animal Hospital, Morgantown, Penn.* ***B,*** *Courtesy Dr. Kit Kampschmidt, Brittmoore Animal Hospital, Inc., Houston, Tex.* ***C,*** *Courtesy Dr. B. J. Parsons, Kanuga Animal Clinic, Hendersonville, NC.)*

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Safe Antibiotics

Table 1
Antibiotics considered safe to use in pregnancy and lactation

Antibiotic	Lactation
Ampicillin Amoxicillin Cephalosporins (cefazolin, cefpodoxime, cephalexin) Clavulanic acid-amoxicillin Penicillin Ticarcillin/clavulanate	Excreted in milk in low concentrations
Erythromycin	Excreted into milk in moderate concentrations
Azithromycin	Accumulate in milk because of ion trapping

Gonzales, 2018

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Not as safe antibiotics

Antibiotics that should be used cautiously owing to neonatal toxicity include:

- Tetracyclines (discoloration of teeth).[6,26]
- Fluoroquinolones (impaired cartilage development).[6] Controversy surrounds its use in neonatal/pediatric populations; however, the benefits may outweigh the risk of cartilage abnormalities.[37] The risk may be low in non–weight-bearing neonates less than 3 weeks of age, but informed consent with the client is recommended.
- Sulfas (autoimmune disorders and bone marrow suppression).[6]
- Chloramphenicol (safety to neonates has been questioned owing to its association with toxicity in infants,[3] although it has good penetration into milk).

Gonzales, 2018

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QUESTIONS?

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