

A. Pyometra

Pyometra should be ruled out in any sick, intact bitch or queen. It tends to happen 35 days (20-70 days) after proestrus or heat in the bitch and within 4 weeks of estrus in the queen. Clinical signs may include vaginal discharge (if open cervix), fever, polyuria, polydipsia, vomiting, lethargy and anorexia. On physical exam you may note tachycardia and tachypnea, fever, dehydration, a painful abdomen with palpation of tubular structures and pale or hyperemic gums.

-Diagnostics and common findings

- Vaginal cytology if discharge: should show degenerate neutrophils and bacteria
- Abdominal radiographs: fluid filled structure between the bladder and colon
 - Differentials: mucometra, hydrometra, pregnancy
 - Note: if open cervix the uterus may not be very large
- Abdominal ultrasound: 2 tubular fluid filled structures dorsal to the bladder but ventral to the colon, “Mickey mouse” appearance (bladder the head, the uterine tubes are the ears)
 - Examine for free fluid due to uterine rupture
 - Differentiate vaginal discharge due to pregnancy or losing pregnancy
- CBC: leukocytosis, neutrophilia with left shift OR a leukopenia with a neutropenia and degenerative left shift, anemia (nonregenerative, normochromic, normocytic anemia), thrombocytopenia
- Serum Chemistry: azotemia (due to pre-renal causes (dehydration) or renal tubular damage secondary to E. Coli LPS decreasing the effect of ADH), electrolyte abnormalities, elevated liver enzymes (poor perfusion or sepsis)

-Treatment

- Stabilization: correct electrolyte balance, correct intravascular volume and rehydrate
- Antibiotics: broad spectrum with gram negative coverage (E. Coli the infectious agent in 60-70% of cases)
 - Ampicillin (22 mg/kg IV q 6-8 hours), potentiated Beta lactam (ampicillin/sulbactam(30 mg/kg IV q 8 hours), ampicillin (22 mg/kg IV q 6-8 hours) + enrofloxacin(10 mg/kg q 24 hours), third generation cephalosporin
 - Caution with aminoglycosides (gentamicin and amikacin) due to renal effects in face of dehydration)
- Surgery: Ovariohysterectomy is the preferred treatment for patient
 - Should be performed when patient is stable to minimize surgical risk
- Medical management
 - If animal intended for breeding, open pyometra

- Goal: improve condition of animal, remove source of progesterone, stimulate uterine contractions, eliminate infection
- Systemic antibiotics (see above)
- PGF_{2α} (Dinoprost) and PGF_{2α} analogs (e.g. Cloprostenol)
- Causes myometrial contraction, luteolysis
- Side effects (more common in higher doses): panting, salivation, vomiting, diarrhea, abdominal contractions, ataxia (starting 15 min and lasting up to 2 hours post injection), arrhythmias, anaphylaxis
- Dinoprost: 0.02-0.1 mg/kg SQ hours until uterine evacuation
 - 0.25-0.5 mg/kg SQ q 24 hours
- Cloprostenol: 1-5 mcg/kg SQ q 12-24 hours
- Recurrence rate of 20-77%
- Should be bred on next heat cycle to decrease risk of recurrence

B. Dystocia

Dystocia occurs when the parturition process doesn't progress in a normal fashion. It is reported to happen in ~5% of all dog parturitions and 3-6 % of all queens. There are various underlying causes which can be due to fetal and or maternal factors. Maternal causes are most common and include small pelvic size, abnormalities in caudal reproductive tract, uterine inertia (primary or secondary), malnutrition, uterine abnormalities or abnormal expulsion due to non- uterine causes. Uterine inertia is the most common problem. Fetal causes include oversized fetuses (relative to mothers' size or truly oversized), fetal malposition, fetal monsters or fetal death. Malposition is the most common fetal cause. Primary uterine inertia can be due to small litters (inadequate uterine stimulation), oversized litters (overstretching of myometrium), hypocalcemia, obesity, uterine infection, uterine torsion, trauma or environmental disturbances.

When to seek veterinary assistance:

- 1) Labor doesn't begin when expected based on calculated date (65 days from last breeding if no other information is known; could range from 55-72 depending on phase of cycle when bred) or temperature decrease (>24 hours from temperature decrease <37.8 C)
- 2) Mild contractions lasting >4 hours without a fetal delivery
- 3) 1 hour since fetal membrane ruptures without birth or effort
- 4) More than 2 hours elapsed between delivery of successive feti even if no contractions
- 5) 1 hour since rupture of fetal membranes and no expulsive efforts by dam or birth of neonate
- 6) Dam shows sign of distress
- 7) >30 minutes of strong abdominal contractions without delivery of fetus
- 8) Large amount of green/black discharge prior to delivery of first fetus
- 9) A lot of bloody discharge during labor at any time

Veterinary examination

- 1) Standard physical exam
- 2) Vaginal exam:
 - a. green vaginal discharge: placental separation
 - i. parturition should proceed within 2-4 hours
 - b. presence/position of fetus
 - c. cervix dilated
- 3) Ultrasound for fetal viability
 - a. HR should be 180-220 bpm
 - b. HR 150-170 poor viability and should be born within 2-3 hours
 - c. HR<150: immediate intervention needed
 - i. Occurs due to hypoxia
- 4) Abdominal radiographs
 - a. Can determine #, size, location, maternal pelvic morphology, fetal viability
 - i. Fetal death: gas within body cavities or surrounding fetal skeleton, collapsed fetal cranial bones, alteration in bones of axial skeleton

When to pursue medical management

- 1) Dam in good health
- 2) Labour has not been too protracted
- 3) Dilated cervix
- 4) No fetal stress seen on ultrasound
- 5) No obstruction or fetal oversize
- 6) Not too many fetuses left to deliver

Medical agents

- 1) Oxytocin
 - a. Myometrium has increased sensitivity during pregnancy and parturition
 - b. Small doses needed: 1-3U IM or SQ
 - i. Large doses can lead to prolonged contraction and fetal compromise due to blood flow abnormalities
 - ii. High doses (5-20 U) → prolonged/hypertonic contraction, uterine rupture, fetal death, placental separation, constriction of umbilical vessels or maternal vasodilation or hypotension
- 2) Calcium gluconate 10%
 - a. Works in cases that fail oxytocin, give injection before second oxytocin dose
 - b. In dogs: 10% calcium gluconate: 0.2 ml/kg IV slowly(10 min or slower) while watching ECG
 - c. In cats: 0.5-1 ml/cat IV
 - i. Very strong uterine contractions can occur
- 3) Soft gauze, sterile lube (using a soft red rubber catheter to put lube in the vaginal canal and around fetus), sterile gloves
- 4) Dark, quiet, warm area

When to proceed to surgical management (Required for 60-80% of dystocia's)

- 1) No response to 2+ injections of oxytocin at 20-30 min intervals
- 2) Fetal heart rate <150 bpm (note heart rate may temporarily decrease during uterine contraction)
- 3) Uterine rupture or torsion
- 4) Abnormalities of the birth canal
- 5) Obstructive dystocia due to fetal malposition or size

Surgical preparation

- 1) Stabilize the dam: treat shock, dehydration and electrolyte abnormalities
- 2) Pre-clip and prep as much as possible to minimize anesthetic length
- 3) Surgeon scrubbed and ready when moving dam into OR
- 4) Determine if owners plan to re-breed

Anesthetic protocols

- 1) Pre-oxygenate
- 2) Use of agents that are reversible
- 3) Protect airway due to fact that they may have eaten recently
- 4) Medications
 - a. Avoid alpha-2 agonists, ketamine, thiobarbiturates, methoxyflurane
 - b. Good choices: short acting opioids, propofol (do not repeat boluses though because does cross placental barrier)
 - c. As little gas anesthetic as possible
 - d. Local blocks to decrease MAC
 - i. Infusion around incision line (2 mg/kg of lidocaine)
 - ii. Epidurals

Surgery

- 1) Tip dam towards surgeon to decrease pressure directly on vena cava
- 2) Uterine incision
 - a. Can be made in uterine body, 1 side or both sides
 - b. Neonate milked to incision
 - c. Do not have to remove every fetal membrane, they can pass naturally
 - d. Closure with absorbable suture
 - e. Administer oxytocin to help with uterine involution
- 3) En Bloc C-section
 - a. Ovarian and uterine arteries clamped, uterus and ovaries removed and passed to assistant to remove neonates
 - b. Must remove neonates within 60 seconds of clamping arteries

Remember that bradycardia in puppies is due to hypoxia so it is important that we get them breathing and supplement oxygen if needed. This can be done by ensuring the airways are clean with a bulb syringe, providing flow-by oxygen or if not breathing use a tight fitting mask to give breaths (keep neck straight to decrease air going into stomach), Jen Chung point (GV26), vigorous rubbing (including rubbing the hair backwards) and stimulating both the perineum and the umbilical cord.

Milk let down

- 1) Metoclopramide (0.1-0.2 mg/kg SQ or IM)
- 2) Phenothiazine tranquilizers (Acepromazine)
- 3) Oxytocin (0.5-2 U/dose every 2 hours SQ)
- 4) Encourage pups to nurse

C. Eclampsia

Eclampsia is a condition that occurs in lactating dogs and cats due to postpartum hypocalcemia. It most commonly occurs in young, small breed dogs that have large litters. Calcium is an electrolyte that is very important for maintaining muscle contraction, vascular tone and myocardial contractility. Low ionized calcium is seen on bloodwork. The underlying cause is unknown but thought to be due to parathyroid gland atrophy, poor dietary sources of calcium, loss of calcium through lactation and fetal drain of calcium during fetal ossification. Supplementing calcium during pregnancy may increase risk of eclampsia due to parathyroid atrophy and they lose their ability to regulate their calcium. Eclampsia can occur in a wide range of time after whelping with it most commonly occurring 3-4 weeks post whelping.

Clinical signs associated with eclampsia

- Tetany, trembling, twitching, shaking, stiffness, ataxia, panting, lethargy, GI signs, agitation, hyperthermia, dilated pupils, facial pruritus

Treatment:

- Calcium gluconate 10%: 0.5-1.5 ml/kg intravenously slowly to effect (over 10-20 minutes while monitoring heart rate or ECG, DOES NOT need to be diluted)
 - o Monitor for bradycardia and arrhythmias, slow infusion if present
 - o May take 30 min-1 hour to see resolution of signs
- Treat other signs that may be present including hyperthermia, dehydration and hypoglycemia
- Removing puppies if possible
- Oral supplementation of calcium carbonate: 25-100 mg/kg/day of elemental Ca⁺⁺
 - 200 mg elemental calcium = 500 mg of calcium carbonate
 - Should supplement if neonates continuing to lactate
 - Should supplement some of neonates feedings to decrease stress on dam
- May recur

D. Uterine and Vaginal Prolapse

Both uterine and vaginal prolapse are rare reproductive disorders in the dog and cat and they can be difficult to differentiate from each other. Sometimes the history can help you make the correct diagnosis.

Uterine prolapse occurs most commonly during or immediately after parturition. Uterine prolapse usually occurs with predisposing factors but it can occur with normal parturition.

Predisposing factors can include tenesmus, dystocia, large litters, abnormal uterus, coughing and old age. Uterine prolapse can be complete (both horns) or partial (one horn). Uterine prolapse can lead to tearing of the uterine or ovarian artery and can cause these animals to be in hemorrhagic shock.

The goal of treatment is to correct the shock if present, replace the uterus and prevent infection.

To replace the uterus:

- If a simple case and animal isn't bleeding:
 - Anesthetize the patient, clean and lubricate the uterus
 - Hyperosmotic agents may be tried to reduce swelling
 - Manually reduce the uterus with digital pressure, a syringe cap, or a blood tube
 - An episiotomy may be necessary
 - It rarely recurs however, a purse string around the vulva in a bitch or a single mattress suture in a queen can be placed for 48 hours
 - 3-5 IU of oxytocin IM to facilitate uterine involution
- If uterine necrosis, abdominal hemorrhage or unable to be manually reduced:
 - Perform a laparotomy
 - Apply gentle cranial traction
 - Consider a hysteropexy

Vaginal prolapses occur near parturition as the progesterone concentration declines and the estrogen increases. Vaginal fold prolapses occur with greater frequency and occurs when there is edema in the vaginal mucosa during proestrus and estrus when estrogen is high. Brachycephalic breeds are most commonly affected and young animals appear to be predisposed.

There are a variety of treatment options depending on the severity and the amount of damage to the exposed tissue.

- Non-traumatized or ulcerated mild prolapses
 - "Wait and see"
 - Keep tissue clean and lubricated
 - Consider hyperosmotic agents to decrease swelling
 - Consider GnRH to induce ovulation and decrease estrogen production
 - Recurrence up to 100% on future cycles
 - Manual reduction
 - Recurrence up to 100% on future cycles
 - Purse string not recommended due to trauma to the tissue
 - Amputation
 - Should be performed when tissue is necrotic, doesn't respond to medical treatment, recurrence has occurred, condition is chronic

- Urethral catheter should be placed to prevent accidental trauma to urethra
- Episiotomy may need to be performed

E. Mastitis

Mastitis is normally a post-partum disease in the dam that occurs secondary to an ascending infection. This could be due to poor hygiene as well as puppies with teats traumatizing her mammary tissue. There can also be hematogenous spread if she is clinically ill with something else such as metritis. Usually mastitis is developed within the first 2 weeks post-partum with clinical signs including discomfort, pain swelling, bruising, fever, anorexia, lethargy, failure for puppies to thrive or be taken care of. If severe, it can also cause septic shock. Diagnostics you should consider include CBC and chemistry, cytology from the gland (note some bacteria and white blood cells can be normal in the tissue) and cultures. E.coli, Staphylococcus and Streptococcus are the most common bacteria. Treatment includes antibiotics (often Amoxicillin with clavulanic acid or cephalosporins are chosen), warm compresses to the mammary tissue as well as assuring that the hygiene in the area is being monitored and pain management. It is controversial as to whether the puppies should be weaned. If the dam is clinically stable and the puppies are doing well, it is ok to let them still nurse. If she is very compromised, if there is gangrenous mastitis or if the puppies are not able to continue to grow while nursing they should be weaned. You can also consider cabergoline (5 mcg/kg PO q 24 hours) to help decrease milk let down so that her milk will dry up. This should be considered if the puppies/kittens are being weaned. In the acute phase if it becomes gangrenous or an abscess develops, she should be treated locally for the abscess (lancing and flushing) with the other medical therapies and the cabergoline. In the acute phase, radical surgery is often not needed.

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