REPRODUCTIVE EMERGENCIES FOR THE NON-THERIOGENOLOGIST

Armi Pigott, DVM, DACVECC
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Dystocia, post-sterilization complications, infection, and physical injuries are among the most common reproductive system complaints resulting in emergency presentations to veterinarians. Some are relatively minor while others may be dramatic or life-threatening. A few of the most common emergencies are reviewed below.

DYSTOCIA. AKA "SHE HASN'T HAD ANY PUPPIES YET!!!"

Determination of fetal age and timing for parturition

Normal gestational length is 65 +/- 2 days in dogs and cats, calculated from the date of the LH surge. In dogs the most accurate method to determine the expected parturition date is calculated from the LH surge. Expected parturition can also be estimated from the date of breeding (approx. 58-71 days after breeding) but is much less accurate. In cats the breeding date is a reliable estimate of fetal age/predictor or parturition date, but is often unknown.

Fetal age can be estimated in several ways. The mineralized fetal skeleton can be identified on radiographs from approximately day 57 onward. Looking for the pelvis, all 13 ribs, fetal teeth (typically a line of dense mineralization in the jaw bones) and the distal extremities can help determine if the puppies are nearing the parturition date. In cats looking for the fetal teeth, calcaneus, and phalanges is helpful as these structures all mineralize near the end of gestation. In both dogs and cats the teeth are usually the last structure to mineralize.

Fetal death can be identified in the bones of the skull start to collapse or are otherwise deformed, if there is gas accumulation within the uterus or in or around the fetus (in the blood vessels, heart, body cavities), or when the fetus is curled tightly in a ball or has the hind limbs in hyperextension.

Ultrasound can be used to assess the fetus for signs of stress. The fetal heart rate is an excellent indicator and most clinicians with basic ultrasound skills can identify the fetal heart rate. The normal fetal heart rate is 2-3 times greater than the maternal heart rate - typically 220-240 bpm. The generally accepted rule is a fetal heart rate >190 is normal, and that lower rates, especially when prolonged (more than a few minutes) or sustained, indicate fetal stress and emergent C-section is indicated. Uterine contractions over a fetus will cause a transient drop in the fetal heart rate, but it should return to >190 within 1-2 minutes and remain normal if there is no fetal stress. Increased echogenicity of fetal fluids (passage of meconium or hemorrhage into fetal membranes from early placental separation) is also an indicator of fetal stress and indication for emergent C-section.

Medical management of dystocia

Medical management is indicated when the dam is healthy, the labor has not been prolonged, and the cervix is confirmed open either by visual evaluation or prior delivery of a fetus, the fetal size is appropriate for a vaginal delivery, and fetal heart rates are above 190 bpm. Medical management is also generally appropriate is there is only one fetus remaining after an otherwise unremarkable labor and delivery, or when the one remaining fetus is confirmed to be dead. Medical management is inappropriate in cases of obstructive dystocia, and is unlikely to be successful if there are more than 1 fetus in the uterus due to maternal or uterine fatigue.

Examine the dam, if she is cardiovascularly unstable she should be resuscitated and then proceed to emergency C-section. If stable, determine the number of fetuses and assess for evidence of obstructive dystocia. If obstruction present proceed to mechanical interventions or C-section. If no obstruction evaluate fetuses with ultrasound to determine fetal heart rate. If fetal heart rates sustained <190 proceed to C-section. If heart rates >190 proceed with medical management. Obtain blood to evaluate (at the bare minimum) blood glucose and calcium (ionized preferred but total acceptable if ionized not available). Administer IV fluids if the dam is dehydrated, and administer calcium gluconate 25-50mg/kg (0.25-0.5ml/kg of 10% calcium gluconate) while monitoring the ECG to correct hypocalcemia (oxytocin cannot work without adequate calcium). Correct hypoglycemia (0.5g/kg dextrose IV) if present. Once the patient's calcium and glucose are normal and severe dehydration corrected, administer oxytocin. There are a wide variety of oxytocin doses in the literature, the author prefers an initial dose of 0.1U/kg IM. This dose can be repeated once 30 minutes later if necessary. Additional doses are not recommended. OBSTRUCTIVE DYSTOCIA IS AN ABSOLUTE CONTRAINDICATION TO OXYTOCIN ADMINISTRATION.

Mechanical interventions in dystocia

If the fetus is a normal size manual correction of dystocia by manipulation of the fetus in the dam can be successful with generous use of serial lube and careful manipulation of the fetus. The fingers and gauze are the safest instruments for fetal manipulation (for both the fetus and the dam). Grasp the fetus with gauze or towel and use a combination of gentle lifting and twisting movements to bring the fetus up and over the ischial arch. Time traction with maternal contractions. If a single fetus is stuck in the vaginal vault and cannot be successfully extracted using lube and manipulation an episiotomy can be considered. This can be performed under local, epidural, or general anesthesia. If a fetus cannot be delivered after a few minutes of manipulation, proceed to C-section.

Surgical treatment of dystocia

Over 60% of dystocias in dogs and cats require surgical intervention. Anesthetic protocols should be based on minimizing time from induction to delivery of all neonates, maintaining maternal airway, blood pressure, and support of uterine blood flow, and should have minimal effect on fetal survival. The uterus is already a low-oxygen environment, and any change in the dam that might further drop the oxygen delivery to the uterus and fetuses should be avoided. If possible, perform the surgical shave with the dam awake either standing or lying in lateral recumbency. Perform the pre-scrub (to remove visible dirt from the skin) prior to induction. Ensure the dam is volume-resuscitated and provide IV fluids to support circulation. Pre-oxygenate the dam, intubate her to ensure a patent airway and good oxygen delivery, assist ventilation if necessary (the gravid uterus will press abdominal contents against the diaphragm).

The ideal anesthetic drug protocol is very controversial and there are reports discouraging the use of essentially every drug you might choose. The clinician should use the techniques most familiar and successful for him or her. It may be best to avoid xylazine, medetomidine, dexmedetomidine, ketamine, thiopental, and methoxyflurane due to their significant effect on uterine blood flow.

Anticholinergic drugs prevent excess vagal tone during uterine contraction, and will help support the fetal heart rate (as well as the dam) during anesthesia. Because the fetal cardiac output is dependent on heart rate, it is necessary to prevent fetal bradycardia - use an anticholinergic. Opioids have many advantages, particularly they provide excellent pain control and are reversible. Short-acting opioids are preferred so the duration of action does not outlast the reversal agent. Propofol is advocated by many reproductive and anesthesia specialists. The key is to induce slowly. Rapid propofol induction will induce hypotension, bradycardia, and apnea - all detrimental to fetal survival. Inhalants should be minimized, at least until the fetuses are delivered. Isoflurane and sevoflurane are preferred over halothane. Both maternal tachycardia and bradycardia should be avoided during anesthesia, as should hypotension, hypoventilation, and hypoxia.

PYOMETRA

Most clinicians are familiar with the phrase “never let the sun set on a pyometra” and are also familiar with management of this disease. Reproductive specialists may provide options for attempting treatment without ovariohysterectomy in high-value breeding stock - the reader is referred to the open access article titled “Pyometra in Small Animals” by Hagman in the July 2018 volume of *Veterinary Clinics of North America: Small Animal Practice* for an in-depth review of the non-surgical options for pyometra. The remainder of the discussion here will focus on pearls for managing pyometra in dogs and cats.

Dogs with pyometra may present solely for vaginal discharge but most emergency presentations will involve systemic signs of illness. The most severely affected will be in septic shock and require extensive resuscitation. The cornerstone of sepsis management is source control, thus the animal should be aggressively resuscitated and proceed to surgery as soon as reasonable. In this systemically ill population the resuscitation proceeds as follows: IV access is established and blood collected for CBC, serum chemistry, electrolytes, and if available venous blood gas and lactate measurement. Hypotension is managed with IV fluid boluses (25cc/kg dogs; 15cc/kg cats; repeat up to 3 more times in the first hour to resolve hypotension). Patients who remain hypotensive despite aggressive fluids in the first hour of resuscitation should be supported with vasopressors. Norepinephrine is the vasopressor of choice for humans with sepsis and is the author’s choice for dogs and cats, however studies comparing vasopressor efficacy in dogs and cats with sepsis have not been performed. Hypoglycemia and electrolyte derangements should be identified early and corrected quickly. IV antibiotics should be initiated within 1-2 hours of presentation. The patients should proceed to surgery as soon as reasonable, as removal of the source of infection is necessary to control systemic signs.

E. coli is the most common bacteria implicated in canine and feline pyometra although other organisms are also occasionally seen. Antimicrobial susceptibility patterns may vary regionally. Ideally each hospital would track culture results of pyometra cases and make informed antimicrobial choices based on local data. In the absence of local data, broad spectrum antimicrobial coverage with an emphasis on Gram negative organisms is recommended.

MASTITIS

Mastitis is a complication lactation that results in septic inflammation of one or more of the mammary glands and is most commonly diagnosed in the postpartum dam. It is rare to see before parturition. Early in the disease the dam may have mild mammary discomfort and firm palpable tissue within the mammary gland. She is usually afebrile, and may have discolored milk from teat orifices, but usually signs are quite subtle. Milk samples from the suspected gland will reveal degenerative neutrophils and bacteria.

As mastitis progresses the dam usually presents with fever, anorexia, depression, vomiting, and reluctance to nurse or lie down. She may stop mothering or snap at puppies trying to nurse. The affected gland(s) are enlarged, hot, painful, and usually have associated cutaneous erythema, edema, and inflammation. Milk is usually discolored and will have obvious microscopic evidence of infection. Dams with abscessed or gangrenous mastitis usually present septic.

To obtain a milk sample, aseptically clean the teat and skin with alcohol and express abnormal milk. The first drop should be discarded, and the next drops are directly swabbed and submitted to the laboratory. Ultrasound is useful to detect changes in echogenicity within mammary tissue, fluid associated with abscesses, and to define extent of affected tissue.

Septic animals should be admitted to hospital and resuscitated accordingly. Non-septic animals may still need admission for symptom control (pain and nausea) until able to tolerate oral medication and no longer requiring parenteral analgesia to remain comfortable.

The neonates may continue to nurse or may need to be weaned depending on age of the neonates and severity of the dam's infection. If the neonates will continue to nurse, drugs should be chosen accordingly. Generally, the dam may continue nursing neonates, even on the infected gland, unless the infected glands become too painful, abscessed or gangrenous, or the dam is receiving medication the neonates should not consume in milk.

Amoxicillin with clavulanate 14mg/kg PO q12h or cephalexin 20mg/kg PO q8h are good initial choices. Final antimicrobial sensitivity and clinical symptoms will dictate final antibiotic selection. If necessary, discontinue nursing and hand rear neonates to successfully treat the infection with other antibiotics.

Opioids are reported safe for lactating dams in the preoperative period and are expected to be safe also when managing mastitis. In an effort to avoid nursing neonates during peak drug levels, when possible, time nursing just before next dose. NSAIDS are controversial for nursing dams, but are very effective and indeed helpful for patients with mastitis. The current recommendation is cautious, short-term use.

Moist hot packing of affected glands softens mammary tissue and allows expression infected milk. Initially q4-6 hours apply a warm compress and express the milk from the affected gland. Timing can be extended as mastitis improves. If painful, apply a bandage or loose-fitting shirt to protect the gland from trauma and prevent nursing on the affected gland. When necessary, separate the dam from the litter during initial healing and only allow nursing with supervision.

Surgical debridement is indicated if there is necrotic, abscessed, or gangrenous mammary tissue.

PROSTATITIS AND PROSTATIC ABSCESS

Prostatitis and prostatic abscess are most common in intact males but may rarely occur in castrated males. Clinical signs may include hematuria, signs related to pain which may be general or manifest as back pain, abdominal pain, painful stiff gait, or general depression. Fever is an inconsistent finding. Transrectal digital palpation of the prostate will usually elicit pain in acute cases but not in chronic cases. The prostate is usually enlarged in acute cases but not chronic cases, and may be asymmetric, particularly if abscess is present. *E. coli* is the most common causative agent followed by other Gram negative then Gram positive organisms. Any opportunistic bacteria ascending the urethra can cause infection.

Benign prostatic hyperplasia (BPH) is a predisposing condition for both prostatitis and prostatic abscess. For dogs without valuable breeding potential castration and antibiotic therapy is the preferred treatment for prostatitis (abscess see below). Otherwise medical therapy for BPH should be initiated along with antibiotics.

In acute prostatitis the blood-prostate barrier is damaged by the severe inflammation and drugs that would typically not penetrate can be quite effective for the early stages of treatment. Broad-spectrum penicillins or third generation cephalosporins may be good initial choices, however once the blood-prostate barrier heals therapy will need to be transitioned to a drug that can penetrate this barrier.

Currently the recommendation is to treat acute prostatitis for 4 weeks and chronic prostatitis for 6 weeks. Antibiotics that should penetrate the blood-prostate barrier once it has healed include trimethoprim, fluoroquinolones, macrolides, and chloramphenicol. The author prefers fluoroquinolone as they have broad spectrum activity against most common etiologic agents and minimal side-effect profile with long term use compared to some of the other options. Trimethoprim has good penetration and combination with sulfa does not seem to adversely affect penetration, however long duration therapy is associated with a much higher rate

of associated side effects (KCS, anemia, etc) than when used for other infections requiring shorter courses of therapy. Fluoroquinolone and trimethoprim are not effective against anaerobic infections. Macrolides such as erythromycin and tylosin diffuse very well into the prostate but have poor action against Gram negative bacteria - they should only be used once culture and sensitivity reports are back and confirm these are appropriate choices. Chloramphenicol attains good concentrations in the prostate and has good activity against many anaerobes. It is the author's choice for anaerobic prostatic infections.

Prostatic abscesses are typically diagnosed by ultrasound examination. Treatment for prostatic abscess is the same as treatment for prostatitis including addressing BPH. In addition active drainage of the abscess is recommended if the abscess is >1cm diameter either by surgical or percutaneous ultrasound-guided approach.

When draining under ultrasound guidance, as much of the fluid as possible should be drained to avoid leaking and contaminating surrounding tissues. The animal should be sedated and given reasonable analgesia. An 18-20 gauge needle is connected to an IV fluid extension set and 30cc syringe. The needle is advanced into the abscess and the fluid drained by applying gentle suction on the syringe. Attach additional syringes to the system as needed. Fluid is submitted for aerobic and anaerobic culture and sensitivity testing. Omentalization is the current preferred surgical technique for prostatic abscesses.

PARAPHIMOSIS

Paraphimosis is the inability of the dog to retract the non-erect extruded penis into the preputial sheath. Causes include arousal without erection, neurologic disease, fracture of the os penis, balanoposthitis, constriction at the preputial orifice by a hair ring or scar tissue, abnormal penile swelling (trauma, neoplasia, malicious strangulation), and entrapment of the penis outside the prepuce during detumescence. The exposed tissue becomes ischemic, dries, and becomes damaged/excoriated. Diagnosis is by visual inspection.

Patients presented late in the course of disease with necrotic, severely desiccated, or severely traumatized penile tissue will require penile amputation. Patients presenting early without severe tissue damage can be managed conservatively.

At presentation, clean gross debris off the penis with room temperature to lukewarm tap water or saline and apply a lubricant to prevent desiccation of the exposed penile tissue. For cooperative dogs, the author prefers to administer oral analgesics and light sedatives during the initial assessment (usually gabapentin 10mg/kg and trazodone 5mg/kg PO, plus an NSAID if not contraindicated). For dogs that present early without severe engorgement of the extruded segment applying a cool compress, generous lubrication, and gentle manipulation is usually sufficient, and tolerated on oral medications. Dogs presenting later or with severe engorgement will usually require heavier sedation. Clinicians should use a protocol with which they are comfortable and successful. The author prefers to include a short-acting opioid such as fentanyl just prior to beginning to manipulate the penis. Application of 50% dextrose or liberally coating the penis with sugar to reduce edema is advocated by some. Patients with severely engorged extruded segments are going to require compression of the engorged tissue to successfully reduce the segment. Begin as above by cleaning and lubricating the exposed segment. Grasp the exposed segment in a fist and squeeze applying firm steady pressure taking care not to break the os penis. Alternatively, tightly wrap the penis with a compressive wrap (roll gauze) beginning at the glans and moving toward the base. Set a timer for 5 minutes, remove the wrap or release the fist, and attempt to reduce. If unsuccessful, lubricate the extruded segment and repeat. The engorged segment of penis is often very painful - adequate analgesia and sedation will increase patient tolerance and success. If unsuccessful after several attempts, surgical widening of the prepuce may be necessary.