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Medical management of canine and feline dystocia

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Abstract

When dystocia is diagnosed in the bitch or queen, two forms of treatment exist: medical or surgical therapy. Medical management of dystocia has the advantage of aiding completion of the parturition process without surgery or anesthesia. However, since not all cases of dystocia can be managed medically, educated and careful decision making is required prior to instituting medical management in cases of dystocia. Improper medical treatment, especially when surgical management is clinically indicated, can result in compromise and even death of the dam and fetuses. This paper focuses on the decision making necessary prior to instituting medical management for cases of dystocia in both bitches and queens, and describes available therapeutics.

Keywords: Dystocia; Medical; Parturition; Oxytocin; Calcium

1. Introduction

The process of parturition in animals is divided into three stages. The first stage is characterized by inapparent uterine contractions and progressive dilation of the cervix. The duration is usually 6–12 h in the bitch, and somewhat shorter in the queen [1,2]. The bitch may exhibit restlessness, panting, anorexia, and nesting behavior. The queen may vocalize, show tachypnea and restlessness, and some will lie in the queening box and purr loudly [1]. In some bitches and queens, the first stage of labor can pass without overt clinical signs. The second stage of labor includes the process of fetal expulsion through a fully dilated cervix. The first puppy is usually born within 4 h of the onset of stage two labor, and subsequent births occur every 15 min to 2 h [2]. The queen usually has her first kitten within 1 h of the onset of stage two labor, and subsequent kittens every 10–60 min, but this is quite variable [1]. Parturition lengths of up to 42 h have been reported in the queen, but care should be practiced prior to declaring this normal [3]. The third stage of labor encompasses the time in which fetal membranes are expelled.

Dystocia, from the Greek ''dys'' meaning ''difficult, painful, disordered, or abnormal'' and ''tokos'' meaning birth, occurs when the parturition process ceases to progress normally. Differentiating normal parturition from abnormal parturition, or dystocia, may not always be straightforward. Since there are several causes for dystocia in the bitch and queen and not all of them are amenable to medical management, the patient's history and physical exam findings can be very helpful in diagnosing the problem.

The veterinary practitioner should attempt to identify and diagnose the cause of dystocia in bitches and queens, so that appropriate management can be instituted for the safety of the dam and the fetus or fetuses. Medical management of dystocia in bitches and queens typically involves one or more ecbolic agents, including oxytocin and calcium, along with physical manipulation of the vagina and assisted extraction of the

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fetuses once presented in the caudal pelvic canal. It is imperative that medical management of dystocia not be used in cases of obstructive dystocia.

2. Predisposing factors and causes of dystocia

Dystocia occurs in approximately 5% of all parturitions in dogs [4] and 3.3% [5] to 5.8% [6] of parturitions in queens. Dystocia may be caused by maternal or fetal factors, and in some cases, a combination of the two [7,8]. Maternal factors include small pelvic size, abnormalities of the caudal reproductive tract, primary or secondary uterine inertia, malnutrition, parasitism, other abnormalities of the uterus, and abnormal expulsion due to nonuterine causes [9]. Fetal causes include fetal monsters, true oversize fetuses or fetal oversize in relation to the maternal pelvis, fetal malposition or malposture, and fetal death. Cephalopelvic disproportion may cause dystocia in brachycephalic bitches [10] and in dolicocephalic and brachycephalic queens. Secondary uterine inertia, or uterine fatigue, may be a primary cause of dystocia or may occur secondarily during dystocia of another cause. If an obstructed birth canal has caused the cessation of uterine contractions and quiescence continues following the relief of the obstruction, the dystocia then is attributed to secondary uterine inertia [11]. Additional criteria for diagnosis of dystocia include failure of initiation of labor at the correct time, signs of maternal compromise, and signs of fetal compromise [12].

Maternal causes comprise most of the cases of dystocia in bitches and queens, with primary and secondary uterine inertia the most common maternal cause, and malpresentations being the most common fetal cause [6,13]. Primary uterine inertia can be classified as complete or partial [14]. When no signs of second stage labor have been detected and gestation has gone beyond its expected length, the inertia is complete [11]. Specifically in the queen, primary inertia can be confirmed only in the presence of gestation length exceeding 71 d from the first breeding [9]. Causes of primary uterine inertia in the bitch and queen have been associated with both small litters from inadequate uterine stimulation, to large litters from overstretching of the myometrium, hypocalcemia, obesity, uterine infection, uterine torsion, and trauma [8]. Environmental disturbance is also a factor in primary uterine inertia, and many bitches can delay parturition until they are alone, comfortable and in familiar surroundings [8].

3. Deciding when to institute medical management

Veterinary assistance should be sought by bitch and queen owners in case of the following: (1) labor does not begin when expected, based on the temperature decrease or calculated due date; (2) stage two labor lasts more than 4 h without a fetal delivery, (3) more than 2 h have elapsed between delivery of successive fetuses, (4) the dam shows signs of illness or distress, (5) more than 30 min of strong abdominal contractions without delivery of a fetus, (6) a substantial amount of green-black discharge prior to delivery of the first fetus, or (7) a prominent bloody discharge at any time during labor [12].

The physical examination should include an initial careful vaginal examination, which may not be possible in queens or some toy breeds due to their small size. The presence and character of vaginal discharge, if present, should be noted. A greenish vaginal discharge is an indication of placental separation if noted prior to the delivery of the first fetus, and dystocia should be suspected if parturition does not proceed within 2–4 h [3]. Abdominal palpation may also be helpful in assessing uterine size and number of remaining fetuses. The bitch or queen should be assessed for signs of maternal compromise, including sepsis.

If there is no fetus present in the vaginal canal, the next step is to assess intrauterine fetal viability via B-mode or Doppler ultrasound to determine if medical management is an appropriate consideration. Ultrasound is an excellent diagnostic aid in the management of dystocia, as fetal viability, malformations, fetal distress, and placental integrity can be assessed. Fetal heart rates of 140–160 beats/min suggest poor viability of pups not delivered within the next 2–3 h, and fetal heart rates of less than 140 beats/min indicate that immediate veterinary intervention is required [15]. This occurs because in conditions of hypoxia, the fetal heart rate slows, which is unlike adult dogs with hypoxia [16]. Normal fetal heart rate in the cat, which is stable over the duration of pregnancy, averages 228.2 ± 35.5 beats/min [17]. Radiography is also a valuable tool in cases of dystocia to help determine the number, size, location and viability of the individual fetal structures, the maternal pelvic morphology, and the general abdominal status [18]. Possible signs of fetal death include the presence of gas within body cavities or surrounding the fetal skeleton, overlap or collapse of fetal cranial bones, or alterations of the spatial relationships among bones of the axial skeleton [19].

Medical treatment is indicated for relieving dystocia if the dam is in good health, labor has not been unduly protracted, the cervix is dilated, fetal size is consistent with the likelihood of vaginal delivery, and no fetal stress is evident on ultrasound examination [9]. Medical management is contraindicated when any cause of birth canal obstruction is present. Since medical therapy causes powerful uterine contractions, uterine rupture is a potential complication if medical management is improperly used. Medical therapy may also be contraindicated when several fetuses are left in utero at the time of diagnosis, since maternal and uterine fatigue are a concern, particularly if the dam is slow to respond to the treatment. The agents most commonly used in medical management include oxytocin and calcium gluconate.

4. Medical agents used in the treatment of dystocia

4.1. Oxytocin

Oxytocin is a nine amino acid peptide hormone that is produced endogenously by hypothalamic neurons. Upon depolarization, the hypothalamic neurons cause oxytocin release directly from nerve terminals located in the posterior lobe of the pituitary [20]. Oxytocin is then stored as neurosecretory material in the posterior pituitary until it is released into the bloodstream. Oxytocin alters transmembrane ionic currents, increasing the sodium permeability of uterine myofibrils, causing the myometrium to produce sustained uterine contraction [21]. Studies in humans have also shown that oxytocin mobilizes intracellular stores of calcium and causes influx of extracellular calcium in myometrial cells in vivo [22,23].

The sensitivity of the myometrium to oxytocin is increased during pregnancy and at parturition, and plasma oxytocin concentrations in bitches are higher and more variable during the expulsive stage of parturition than during late pregnancy [24]. It has been shown that a rise in plasma oxytocin secretion coincides with the first labor contractions [25]. Myoepithelial cells are another target organ for oxytocin, and stimulation of these cells causes contraction and milk ejection. There is evidence that oxytocin acts as a neurotransmitter in the central nervous system and plays roles in maternal behavior, sexual behavior, yawning, memory and learning, tolerance and dependence mechanisms, feeding, grooming, cardiovascular regulation, and thermoregulation [26]. Oxytocin is also produced by the large luteal cells of the corpus luteum and is involved in luteolysis [20].

Synthetic oxytocin is available in veterinary medicine and can be administered via various routes, including intravenous, subcutaneous, and intramuscular. Buccal absorption [21] is possible, but absorption is not possible after per os administration, since the peptide hormone is quickly destroyed in the stomach. Oxytocin is not bound to plasma proteins and is catabolized by the kidneys and liver, with a circulating half-life of 5 min [21]. Synthetic oxytocin potency is standardized according to its vasopressor activity in chickens and expressed in USP Posterior Pituitary Units [27]. One unit (U) is equivalent to approximately 2.0–2.2 mg of pure hormone.

When oxytocin is used properly and at reasonable doses, the incidence of toxicity is rare. Recent work has shown that repeated small doses (1–3 U administered intramuscularly or subcutaneously) are preferable to single, large doses which might cause prolonged contraction of the myometrium and fetal compromise or death as a result of disruption of blood flow to the fetoplacental units [14]. If these lower doses are used, overdoses are less of a concern. If oxytocin is administered in large doses, hypertonic contractions can lead to uterine rupture, placental separation, or fetal death. Since oxytocin has some minimal diuretic properties, water intoxication is possible if large doses are used for a prolonged interval [27]. Other potential negative effects of oxytocin administration include placental separation, constriction of umbilical vessels, and/or maternal vasodilation and hypotension [9].

A recent study indicated that low plasma oxytocin concentrations are a cause of primary inertia in bitches with normal serum calcium concentrations and aggravates the condition in bitches with low calcium levels [28]. This explains the interrelationship between oxytocin and calcium in the medical management of dystocia. The study also showed that only about one-third of the bitches responded to oxytocin alone [28], indicating that calcium may be very beneficial in many cases of dystocia in which medical management is appropriate.

When oxytocin has been used alone, doses have *historically* been reported as high as 5–20 U administered IM in the dog, and 2–4 U administered IM in the cat [3]. However, recent data suggest that doses as low as 0.5–2 U are more effective in increasing the frequency and quality of the contraction [29,30]. Initial doses of 0.1 U/kg are recommended and the dose can be increased incrementally to a maximum of 2 U/kg (never to exceed 20 U/dog in any breed) are recommended.

Most authors advocate oxytocin administration at 30–40 min intervals [9].

4.2. Calcium gluconate

Contraction of skeletal, cardiac, and smooth muscle cells (i.e. myometrium) results from the sliding together of actin and myosin protein filaments. The sliding of actin over myosin requires ATP and does not occur unless calcium ions are present [31]. In medical management of dystocia, it is plausible that whereas oxytocin increases the frequency of uterine contractions, the administration of calcium increases their strength [15]. Calcium therapy has been shown to work in cases where bitches have failed to respond initially with oxytocin alone, and is a helpful therapy in the medical management of dystocia [11]. A complicating factor is that many bitches with primary inertia have serum calcium concentrations that are similar to those with normal myometrial contractions, making diagnosis of hypocalcemia difficult unless ionized calcium is available diagnostically [32,33]. Several salts of calcium are commercially available, and 10% calcium gluconate is commonly used in bitches at a dose of 0.2 mL/kg IV or 1–5 mL per dog SC [9]. Since cardiac arrythmias are a potential side effect, if administering intravenously, care should be taken to deliver the medication slowly, with concurrent chest auscultation.

Calcium therapy is described for queens, but is used less frequently. Dosages reported include 0.5–1.0 mL per cat IV [3]. Calcium use in the queen is controversial, because of the very strong uterine contractions exhibited after administration [9].

4.3. Glucose

Some authors have proposed hypoglycemia as a cause of primary inertia, especially in toy breeds of dogs [4]. Others report that hypoglycemia is uncommon in canine dystocia [9]. One study [28] also reported that many bitches had hyperglycemia during dystocia, and this was thought to be secondary to high cortisol concentrations, which have been measured during normal labor in dogs [25]. Regardless, blood glucose is something that can be rapidly measured in most veterinary hospitals to determine if hypoglycemia is present and requires treatment.

5. Protocol for medical management of dystocia

In the bitch, many authors advise surgical intervention if two or more injections of oxytocin administered at 20–30 min intervals fail to cause fetal expulsion [7,11,8,34,35]. A suggested protocol has been published [9], and involves low-dose oxytocin that is used at 30 min intervals until all pups are delivered. If the interval between pups exceeds 30 min, calcium gluconate is added. If another oxytocin administration after calcium administration fails to cause fetal expulsion after 30 min, surgical intervention is indicated. In the queen, medical management of dystocia appears less successful, with less than one-third of the queens responding to medical treatment alone [36]. For this reason, it is possible that surgical intervention may be necessary for queens sooner than for bitches. One protocol published for medical management of dystocia in queens is to initially administer 2–4 U of oxytocin IV to induce uterine contractions [37]. If this fails, oxytocin can be repeated 20 min later after administering a slow IV infusion of 1–2 mL of 10% calcium gluconate. If no fetal expulsion occurs, the oxytocin can be repeated after giving 2 mL of 50% dextrose by slow IV infusion. Failure of this last treatment to advance parturition indicates surgical intervention is necessary.

6. Conclusions

Knowledge of predisposing factors and causes of dystocia in bitches and queens is imperative. Consideration of these factors and causes, along with a complete history and thorough physical exam, will aid the veterinary practitioner in deciding if medical management of dystocia is appropriate. Medical management is appropriate if the dam is in good health, labor has not been unduly protracted, the cervix is dilated, fetal size is consistent with the likelihood of vaginal delivery, and no fetal stress is evident on ultrasound examination. Medical agents used in the treatment of dystocia include oxytocin and calcium gluconate.

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