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INTRODUCTION

The morbidity and mortality of bitches and queens and their offspring at parturition is significantly reduced by optimum veterinary care. Usually, the patient's history already indicates that a parturition disorder may be present. If dystocia is confirmed during physical examination, the cause of dystocia, the general condition of the dam and the fetal number and vitality are the cornerstones of the decision whether medical management or surgical therapy is indicated. Due to the scientific progress in veterinary medicine, especially in veterinary anesthesia, a caesarean section (CS) is the treatment of choice in a wide variety of conditions. Medical management of dystocia is only indicated if expulsion of all fetuses is possible via the birth canal without delay. Even if expulsion of the foetuses via the birth canal is principally possible, conservative obstetric treatment does not always succeed in delivering all foetuses. Most bitches and queens presented with dystocia end up having a CS. Surgical intervention is mandatory if relative or absolute foetal oversize, uterine torsion or rupture or obstruction of the birth canal is present, and also if medical therapy fails. Moreover, a CS is indicated if maternal or foetal well being is compromised, as it usually is the most efficient treatment with the lowest risk, especially if more than one foetus remains to be delivered. In order to keep anaesthesia time as short as possible, preparations for CS and care of the newborns are made prior to anaesthetic induction. One should choose an anaesthetic protocol one is familiar with and which meets the special needs of the dam and foetuses. Whether an ovariohysterectomy is performed at the time of the CS depends on the findings during surgery and on the owner’s request.

ESTIMATION OF PARTURITION DATE

In the cat, 94 % to 97 % of all deliveries take place between the 61st and 69th day of gestation, mean gestation length is 65 days. In the dog, gestation length is even more variable and may range from 57 to 71 days after first breeding. This is because estrous behaviour of the bitch may not be most obvious at the time of ovulation and because canine spermatozoa are able to stay fertile in the female genital tract for up to 7 days. Large litter sizes are associated with a shorter gestation period. To diagnose dystocia or to perform a planned CS (on day 63 after ovulation), the parturition date should be estimated reliably.

Parturition date in the bitch can be accurately predicted if the date of ovulation is known: from the initial rise in preovulatory progesterone concentration, gestation length is 64-66 days. If ovulation timing has not been performed, the first day of cytological diestrus and therefore whelping date (51-60d later) can be reliably estimated by daily cytologic examination of vaginal smears. If the date of ovulation in the bitch or the date of copulation in the cat is unknown, estimation of parturition date using ultrasonography or radiology is recommended. Kittens with a skull diameter of 2.5 cm and a body diameter of 4 cm at the level of the liver are considered to be mature. In the bitch the rapid decline in serum progesterone in the final 24 hours prepartum causes a transient rectal temperature drop (1° C or more) and is a reliable predictor of impending parturition. In most bitches but not in the cat this temperature drop can be recognized by monitoring rectal temperature two to three times daily.

DIAGNOSIS OF DYSTOCIA

Dystocia is defined as the inability to expel the fetus through the birth canal without assistance. The incidence is around 5 % overall, but reaches almost 100 % in some dog breeds and 20 % in some cat breeds. The following questions should be answered if dystocia is suspected: - Maternal well-being; first and last breeding date (Bitch: determination of optimum breeding date); - Age of the dam (risk of uterine inertia and singleton pregnancy increases with increasing age of the dam); - Breed (brachycephalic breeds have a higher risk of dystocia); - Confirmation of pregnancy (number of fetuses: in singleton and twin pregnancies dystocia is much more common); - Number and course of previous parturitions (higher risk of dystocia in primiparous animals); - Previous history of dystocia or of pelvic trauma; - Diseases during pregnancy; - Signs of beginning parturition (bitch: drop in rectal temperature); - Vaginal discharge (green vaginal discharge in the bitch and brown-reddish vaginal discharge in the queen indicate the beginning of placental separation, hemorrhagic vaginal discharge is a sign of genital tract injury, foul smelling vaginal discharge indicates a neglected birth); - Passage of fetal fluids or straining; - Are there any neonates already delivered? When was the last one born?; - Were any drugs given to the dam during pregnancy or parturition?
Indicators of dystocia in the bitch before delivery of the first puppy are:
- More than 68 days from day of last breeding, no signs of impending parturition.
- More than 24-36 hrs from rectal temperature drop, no signs of impending parturition.
- Rectal temperature has returned to normal, no signs of impending parturition.
- Passage of fetal fluids before onset of abdominal straining.
- Persistent abdominal straining for more than 30 minutes without delivery of a puppy.
- Intermittent abdominal straining for more than 4 hrs without delivery of a puppy.
- Green vaginal discharge (beginning of placental separation).

Indicators of dystocia after delivery of the first puppy are:
- More than 2 hrs pass between the birth of two puppies.
- Persistent abdominal straining for more than 30 minutes without delivery of a puppy.
- Abnormal vaginal discharge: foul smelling, hemorrhagic.
- Presence of a puppy stuck in the birth canal.
- Maternal compromise (persistent whining or crying, abnormal posture, apathy, tremor, dyspnoea).

Indicators of dystocia in the queen before delivery of the first kitten are:
- More than 69 days from day of last breeding, no signs of impending parturition.
- Intermittent abdominal straining for more than 2 hrs without delivery of a kitten.
- Sanguineous vaginal discharge.
- Passage of fetal fluids before onset of abdominal straining.
- Persistent abdominal straining for more than 5 minutes without delivery of a kitten.
- Indicators of dystocia after delivery of the first kitten:
  - More than 2 hrs pass between the birth of two kittens.
  - Queen does not take care of her offspring.
  - Persistent abdominal straining for more than 5 minutes without delivery of a kitten.
  - Abnormal vaginal discharge: foul smelling, hemorrhagic.
  - Presence of a kitten stuck in the birth canal (a kitten which protrudes from the vulva should be delivered within 5 min.).
  - Maternal compromise.

CLINICAL EXAMINATION
At initial presentation, a thorough general and obstetric examination is performed, including evaluation of blood samples for hematocrit, serum protein, glucose, urea and, if indicated, calcium and other parameters. Abnormalities are corrected preoperatively. The vaginal exploration is performed digitally with sterile gloves and vaginoscopically. This provides information about width and lubrication of the birth canal, relaxation of the vagina and sometimes about fetal disposition. If palpation ("feathering") of the dorsal vaginal wall triggers an episode of involuntary straining, uterine inertia can be excluded as cause of dystocia. The fetus often becomes palpable after the induction of abdominal contractions, and possible malpresentations can be diagnosed. If the fetus is out of reach, the abdominal wall can be lifted with one hand. If the cause of dystocia cannot be determined by palpation of the vaginal vault, examination of the birth canal using a vaginoscope or pediatric proctoscope with a large diameter is performed. Diagnostic imaging provides further information: Radiographic images (two radiographic planes!) give information about the number of fetuses, the developmental stage, abnormal presentation, position or posture and fetomaternal proportion. To determine fetal viability, fetal heart rate is evaluated ultrasonographically (above 200 beats per minute).

MANAGEMENT OF DYSTOCIA
If dystocia is diagnosed, surgical intervention is required in 60 to 80 % of cases. Medical management of dystocia is only indicated if the the birth canal is fully dilated and faulty fetal disposition, absolute or relative fetal oversized, and birth canal constrictions or malformations can be definitely excluded. Moreover, medical treatment may only be considered if the dam and her offspring are in good general condition (fetal heart rate > 180 beats per minute). If more than two fetuses remain to be delivered, the authors recommend CS. One treatment protocol for medical management of dystocia is: Fluid therapy with Lactated Ringer’s solution (10 ml/kg/hr, for small patients 2.5 % of glucose may be added) followed by administering a tocolytic agent (denaverin 20-60 mg/animal). About 20 minutes later a warmed substitute for fetal fluids is instilled intrauterinely using a soft rubber catheter (volume instilled should not exceed the estimated volume of one fetus) and 1-2 IU oxytocin / animal is injected intramuscularly. If necessary, application of oxytocin can be repeated once to twice 20 to 30 minutes later.

When performing a CS, preoperative stress-free stabilisation and oxygennation of the dam, adequate anaesthesia, quick and efficient preparation of the surgical site, the surgical procedure itself, resuscitation of the newborns and postoperative care of the dam are prerequisites for success. Depending on the condition of the dam, administration of antibiotics, glucose or calcium gluconate may be indicated. If possible the dam is positioned in lateral recumbency and the surgical site (from xyphoid to pubis) is prepared before anaesthetic induction. Please avoid iodine containing antiseptics as their bitter taste may prevent the neonates from suckling. When choosing an anaesthetic protocol, the foetal sensitivity to drugs as well as the exceptional physiological situation of the dam have to be considered. One protocol for routine CS is: sedation only if necessary with buprenorphin 7-14 μg/kg i.m./i.v., induction with propofol 2–4 mg/kg i.v. to effect, maintenance with isoflurane/sevoflurane and O₂, and analgesia only after delivery of the foetuses with fentanyl (CRI 5–10 μg/kg/hr, bolus administration: 0,5–1,5 μg/kg to effect!).

RESUSCITATION OF THE NEONATES
After placing the neonate on a warm and dry towel, an assistant removes the residues of the foetal membranes, clears the upper airways from fluid by suctioning and rubs the neonate until it is dry. Intensive rubbing stimulates respiration. Swinging of the neonates to remove fluid from the airways is not recommended any more since it may cause cerebral haemorrhage. Immediately after delivery puppies or kittens often show an irregular breathing pattern. Gentle mouth-to-mouth or mouth-to-nose resuscitation can be applied if the neonate does not start to breathe on its own. If a heart beat can be detected, resuscitation should be performed for at least 30 minutes. A compromised heart rate indicates hypoxia. Tissue oxygenation can be improved by providing oxygen. The umbilical cord is ligated 0.5-1 cm distant to the abdominal wall. A short clinical examination, focusing on respiratory pattern, umbilicus, birth injuries or obvious malformations (cleft palate) as well as evaluation of maturity, flexor reflex and swallowing reflex should be performed. Perineal massage stimulates urination and defecation as well as respiration, allowing evaluation of patency of urinary and intestinal tract. Birth weight of the neonates is recorded. If the dam has received drugs before delivery which can be antagonized, antagonists are administered i.v. / i.o. or s.c. to puppies/kittens with impaired general condition. If signs of asphyxia are noted, central analeptic agents may be helpful (Doxapram 1–5 mg s.c.). In addition to resuscitation, early energy supply is important to avoid the hypothermia-hypoglycemia-dehydration-syndrome. Glucose 5% can be given subcutaneously (3–5 ml/100 g) or perorally (1–2 ml/100 g) if the swallowing reflex is present.

POSTOPERATIVE MANAGEMENT

To encourage suckling by the neonates, the teats are cleaned with warm water to remove all traces of surgical scrub. The dam is extubated in sternal recumbency as soon as the swallowing reflex has returned. The tube is carefully inspected for remnants of gastric contents, which would require antibiotic therapy for at least five days. As soon as possible, the neonates should be allowed to nurse under supervision since they possess little glycogen stores and the time span allowing intestinal absorption of immunoglobulins is limited. Neonates with low birth weight should suckle at the caudal teats, since these usually produce more milk than the cranial ones. When the dam is fully awake and has accepted her offspring, the newborns can be left in her custody.

References available from author upon request