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The Whelping Bitch and Paediatrics Mini Series

Session 1: Pre-natal Care and Whelping

Louise O'Dwyer MBA BSc(Hons) VTS(ECC) DipAVN (Medical & Surgical) RVN

Normal parturition and management of dystocia in dogs and cats

DOGS

Oestrus Cycle

- Anoestrus
- Pro-oestrus
- Oestrus
  - Ovulation
  - Fertile and fertilization periods
- Metroestrus/dioestrus/luteal phase)

Anoestrus

Anoestrus is the period of ovarian inactivity between the end of the luteal phase (or pregnancy) and the onset of the subsequent return to pro-oestrus. When the previous cycle has been a pregnant cycle, the early part of anoestrus encompasses lactation. The length of anoestrus exceeds the period of lactation such that bitches are not in pro-oestrus or oestrus whilst lactating.

The period of anoestrus is considered to be obligatory (following each luteal phase). It generally lasts a minimum of 7 weeks but averages 18-20 weeks (can vary between 1 month and 2 years).

The length of anoestrus may be influence by:

- Time of year; some bitches retain the primitive tendency for one period of pro-oestrus/oestrus a year, e.g. Basenji; in other breeds more bitches may enter pro-oestrus in spring than at other times

- Pheromones: bitches housed together often exhibit pro-oestrus/oestrus around the same time; it is thought that pheromones from one oestrus bitch may stimulate others;

- Unknown factors: the signal responsible for causing follicular growth in most bitches is still unknown.

Throughout anoestrus the reproductive tract is quiescent and the internal and external genitalia, including the mammary glands, are at their smallest observed size. The vaginal wall is relatively thin and is easily traumatized by digital collection of epithelial cells it is often assumed that basal hormonal concentrations persist throughout anoestrus, and whilst this is a convenient explanation, actually there are changes in the responsiveness of the pituitary gland as anoestrus progresses. Approximately 60 days before the next ovulation follicles may be detected within the ovaries. Relatively high concentrations of oestrogen can be detected in late anoestrus, from approximately 10-20 days prior to the onset of pro-oestrus. Although there is little detailed information it includes increased FSH pulse frequency, accompanied by FSH pulses and a less prominent increase in mean FSH concentration.

Pro-oestrus

Pro-oestrus lasts around 9 days, and is associated with stimulation of follicle development by FSH and LH, and the subsequent secretion of oestrogen from the granulosa cells of the follicle. Approximately two to eight follicles grow per ovary. These protrude above the margin of the ovary approximately 10 days before ovulation, when initially they are approximately 4mm in diameter. Follicle diameter increases to between 6 and 9mm just before the pre-ovulatory LH surge. Follicular oestrogen promotes increased vascularity and oedema of the reproductive tract, as well as an increased activity of the glandular epithelium. This leads to swelling of the external and internal reproductive tract, whilst within the uterus the mucosal capillaries leak at endothelial junctions resulting in passage of blood and plasma cells into the

uterine lumen. The clinical signs associated with pro-oestrus include enlargement and reddening of the vulval lips and the appearance of a serosanguinous vulvar discharge. There are also behavioural changes including increased attractiveness to male dogs (but will not normally allow coitus), increased urine marking and a tendency to roam. By definition the period of pro-oestrus includes sexual attractiveness but refusal to allow mating. Increased urination is seen (smaller quantities of urine more frequently) to disseminate pheromones produced by the vestibular mucosa. Clinical examination of the bitch may demonstrate enlargement and swelling of the virginal epithelial folds when viewed with an endoscope and increased oedema of the uterus when imaged with ultrasonography. There is also substantial epithelial cell proliferation induced by oestrogen and this is very significant within the vagina, where the mucosa changes from a cuboidal epithelium to a stratified squamous epithelium. Presumably this helps to prevent the vagina from being traumatized during mating but it is extremely useful because it enables monitoring of the stage of the oestrus cycle. Ovulation may occur towards the end of this period, but normally occurs during oestrus.

Oestrus

Oestrus in the dog will generally last around 9 days but there is some considerable variation in length between breeds. By definition this phase commences when the bitch will first readily allow coitus, and ends when the bitch refuses coitus. The vaginal discharge during this period will tend to be less copious and less haemorrhagic but again, this is not a constant feature and we can see some considerable variation, with some bitches having scant discharge throughout pro-oestrus and oestrus, and others having copious bloody discharge which persists after the end of oestrus

Ovulation

Ovulation will most commonly occur onwards the end of oestrus but laboratories have noted that, again there is some variation in the endocrine events, with ovulation occurring within a few days of the onset of pro-oestrus, and in some dogs it can take many weeks. What is apparent is that is that the time it takes for the follicle to develop can be variable and any of the following can happen:

- Ovulation may occur during a normal length pro-oestrus (as early as 5 days after commencing)

- Ovulation may occur as early as 7 days after the onset of pro-oestrus and the bitch may be in oestrus at this time

- Ovulation may occur as late as 30 days after the onset of pro-oestrus, the bitch is receptive at this time;

- Ovulation may occur as late as 30 days after the onset of pro-oestrus, the bitch is not receptive at this time.

In addition, the time of ovulation may not be consistent during successive seasons in the same bitch. Bitches release (ovulate) several eggs (oocytes) at each cycle; ovulations do not occur at the same time and this process usually takes around 72 hours. Most ovulations usually occur 48-72 hours after the plasma peak of lutenising hormone

Fertile/Fertilization Period

Because dog spermatozoa can live up to 7 days in the bitch, and because oocytes are not ready for fertilization until 2 days after ovulation, bitches which are mated by more than one dog can have mixed litters. The duration time that eggs (oocytes) are available to be fertilized (fertilization period) is very long in the dog compared with other species, and this can result in a large difference in the time that whelping commences when pregnancy length is calculated from the days of mating.

Luteal Phase

In many species there is an abrupt decline in sexual behaviour after ovulation, such that oestrus ends almost coincidentally with the post-ovulation rise in plasma progesterone. Following oestrus the early maturation stage of the luteal phase is termed metoestrus, and the later stage is termed dioestrus. However in bitch standing oestrus behaviour continues for approximately 7 days after ovulation and therefore concentional terminology which mixes behavioural and endocrine definitions becomes confusing. Technically, the luteal phase commences after ovulation and during this time progesterone concentrations continue to increase. Progesterone alters the characteristics of mucosal secretions and decreases smooth muscle excitability. It is also thought to slow the passage of ova in the uterine tubes, thereby delaying the entry of embryos, if present, into the uterus. Progesterone also 'closes' the cervix and prepares the uterine environment to facilitate support of the embryos. The rise in progesterone begins a few hours before or during the pre-ovulatory LH surge, and continues to increase to reach 10-25ng/ml by the end of standing oestrus (at approximately day 10). The progesterone profiles in the early luteal phase are identical in both pregnancy and non-pregnant bitches, and indeed unlike other species there are few differences in the remaining luteal phase whether or not the bitch is pregnant. Within the luteal phase, prolactin, LH and to some extent progesterone, are luteotrophic factors. Both prolactin and LH have a clear leuteotrophic actuib as early as week 2, and are required as luteotrophic factors from approximately day 25 onwards. Administration of prolactin inhibitors or suppressors of LH will terminate the luteal phase after day 25 in both pregnant and non pregnant dogs, although prostaglandin F (PGF) is luteolytic, it is not secreted in normal non-pregnant cycles. Exogenous administration of PGF or synthetic prostaglandins will terminate the luteal phase of pregnancy and non-pregnancy. Pharmaceutically the luteal phase can therefore be ended by both anti-leuteotrophic and luteolytic products. In clinical practice prolactin inhibitors (such as cabergoline (galastop) and bromocriptine and prostaglandins (LUTALYZE) are used alone or in combination to terminate pregnancy and to treat conditions that may occur during the luteal phase (e.g. pyometra)

Pseudopregnancy

False pregnancy is a common and normal occurrence, and every non-pregnant bitch will have some clinical signs of false pregnancy The clinical signs of false pregnancy of false pregnancy are caused by elevated plasma prolactin concentrations and classical signs include milk production and lactation, anorexia (but not weight loss), shivering, reluctance to leave the home, territorial aggression, nesting and mothering objects. Less common signs include minor changes in behaviour, sometimes described as 'irritability'. Signs usually occur 4-6 weeks after oestrus, but can occur at any time in some bitches. False pregnancy represents a primitive mechanism for bitches to nurture other pups in the dog pack when pro-oestrus/oestrus occurred once a year, i.e. when the pack exhibited synchronized breeding. The signs usually regress spontaneously after 10-30 days and in most bitches no medical treatment is required. Sometimes treatment is required if owners are unable to cope with the clinical changes in the bitch, if the signs are exaggerated (e.g. aggression) or is she develops mastitis.

There is only one episode of false pregnancy after each oestrus, but when hormone therapy is used in an attempt to control the signs, repeated bouts may occur.

Mating

Most bitches are mated 10-12 days after beginning of pro-oestrus. This usually gives satisfactory results even if the bitch is not ovulating at this time because:

- Sperm from a fertile dog can survive up to 7 days in the bitch, so that mating before ovulation can be fertile;

- Oocytes are ready to be fertilized until 2 days after ovulation, so that mating after ovulation may be fertile.

However,
- An inappropriate mating time is the most common cause of alleged infertility in the bitch;

- Repeated mating 24-48 hours apart increases the likelihood of conception

- Help in detecting ovulation time may be required when:
  - Bitches ovulate much earlier or later than average
  - Artificial insemination is being used
  - A dog with poor semen quality is being used; repeated mating may still be advantageous
  - A bitch is 'shy' and may need to be restrained during mating

- Ovulation time can be detected using vaginal endoscopy, vaginal cytology, or by measuring blood progesterone concentrations.

The appropriate stud to be used should be identified long before the onset of pro-oestrus to enable careful checking of health status information (hip scoring etc.)

Vaccination and disease status of individual and the kennel to be visited should be examined Despite what is expected by many breeders there is no point in routine haematological screening of the male or female, unless in a country where Brucella canis is important. It is most common for the female dog to visit the male.

Immediately before mating, it is helpful to clip long hair from around the vulva; the vulva may also be cleaned with water to reduce bacterial contamination, which may be flushed into the uterus at the time of mating. The bitch should be encouraged to urinate before being introduced to the dogs. Both the dog and bitch should be restrained using a long lead for control, but allowing play including mounting, before intromission.

Normal situation bitch and dog exhibit play behaviour when they are first introduced to each other and this may include mounting of the female. The dog may ejaculate a small volume of clear fluid during this play period or whilst he is trying to locate the vulva with his penis. This fluid is the first fraction of the ejaculate and does not contain sperm. It originates from the prostate gland and its function is to flush any urine or cellular debris from the urethra. The dog will continue to mount, thrust and dismount until his position allows the penile tip to enter the vagina. This is known as intromission. The dog will then achieve a full erection during which time the thrusting movements increase rapidly and the second fraction of the ejaculate is produced. This fraction is sperm rich. Once the thrusting has subsided the dog will turn through 180 degrees and dismount the bitch whilst his penis remains within the vagina. The dog and bitch will now stand tail to tail = this is called the copulatory tie. The tie is associated with the dog ejaculating the third fraction of ejaculate, which is again a clear fluid, and prostatic in origin, its purpose is to flush the sperm forwards towards the cervix into the uterus. The tie lasts an average of 20 minutes but varies as short as 5 mins and long as 60 mins.

Pregnancy

Gestation length in dogs solely based on mating dates can be extremely variable. This is due to the long oestrus period and oocyte survival time of the bitch, as well as the long survival time of canine sperm in the female reproductive tract. 'Apparent' gestation lengths may therefore vary between 57 and 73 days. The fertile period in the bitch is around 10 days (which equates to an oocyte survival time of three days plus a sperm survival time of seven days), whereas the fertilization period is much shorter at three days. This is further complicated by the fact that the canine oocyte is not ready for fertilization until two days after ovulation.

The hormones released around ovulation are similar to other species, with a rise in oestrogen followed by a luteinizing hormone (LH) peak that induces ovulation 48 hours later. Dogs are, however, unique in producing progesterone from follicles before ovulation and this can be

used to predict and monitor ovulation (Hewitt and England 2000). The actual gestation time in the bitch is about 63 days ±24 hours from ovulation or 61 days from fertilization. Large litters are born earlier and small breeds tend to have shorter gestation times. Progesterone starts to rise before ovulation, peaks in mid-pregnancy and decreases towards the end of gestation when it falls sharply 24 to 36 hours before parturition. This drop in progesterone coincides with a transient drop in body temperature lasting for eight to 12 hours, which is more marked in small breeds. Many breeders use this as indicator for impending birth.

If breeders have used ovulation testing to determine the optimum time of mating, gestation length does not vary much. Any bitch over 63 days' gestation should be monitored carefully for primary inertia or any other problems.

Ultrasound examination is useful for determining the viability of puppies at a particular time. However, it cannot help to predict parturition or give any indication of primary inertia. Progesterone testing can be used to monitor the end of a pregnancy. ELISA kits for ovulation testing can be used to provide instant results and can be read in 'reverse' order to show the decline or absence of progesterone. Blood progesterone levels fall to less than 1 to 2 ng/ml before parturition commences in the bitch. A drop in blood progesterone indicates that the fetuses have matured, causing luteolyses of the corpora lutea and the beginning of parturition. If the blood progesterone level is still high (>3 ng/ml) and ultrasound examination confirms strong heartbeats, the bitch has not started to give birth and should be re-examined the next day.

The fact that the mating and subsequent gestation length can vary so much has led to the common belief that it is normal for bitches to carry litters for much longer than the usual benchmark of 63 days. Concerned breeders may be sent away by practitioners and told not to worry. Sometimes an ultrasound examination is performed to confirm that the puppies are alive and can be provided as further proof to wait 'a little bit longer'. When dealing with an apparently 'overdue' bitch, it is important to check that the animal is really pregnant, and also that mating dates and gestation length have been calculated correctly and whether ovulation testing has taken place.

PREPARATION FOR THE BIRTH

DOGS

Vaccinations should be up to date, preferably before mating. Failing that, vaccinations can be administered after the first three weeks of pregnancy. The worming regimen will depend on the animals worming status, but certain products (e.g., Panacur; Intervet/Schering Plough) can be used in the last 20 days of pregnancy to prevent migration of larvae to puppies.
In late pregnancy (≥40 days), the bitch will find it harder to eat enough to support the fetuses, especially when large litters or small breeds are involved. The animals should therefore be fed little and often. Many breeders will switch pregnant bitches to puppy food, which is higher in protein, has a sufficient calcium: phosphorus ratio and is more concentrated, and can also be fed during lactation. Calcium supplementation should be avoided as this may depress parathyroid function and prevent the mobilisation of calcium.

Bitches should be introduced to the whelping area at least two weeks before parturition. However, some animals may choose to go elsewhere and provisions should be made (e.g., paper and towels) to accommodate this. It is important for a whelping bitch to have a warm, calm and secure environment away from the buzz of every day life.

**NORMAL PARTURITION
DOGS**

First-stage labour

The end of pregnancy is marked by a drop in the level of progesterone and a rise in prolactin. Bitches become restless, more attached to the owner and seek seclusion.

This phase can last for two to three days. The beginning of first-stage labour is defined as the start of uterine contractions that will eventually open the cervix. The extent of cervical dilation cannot be examined digitally as the canine vagina is very long and narrow (around 25 cm in Labrador retrievers). However, on physical examination, palpation will reveal a relaxation of the vulva and vagina as well as the pregnant abdomen. Bitches will show signs of anorexia, intermittent panting, shivering and occasional vomiting. Obsessive nesting behaviour and vulval licking may also occur. First stage labour normally lasts between six and 24 hours, but can take up to 36 hours in nervous or primiparous animals. During pregnancy, the orientation of the fetuses within the uterus is distributed 50:50 caudally and cranially.

This changes during first-stage labour as each fetus rotates on its long axis, extending its head, neck and limbs to attain the normal birth position, which results in 60 per cent of pups being born in anterior and 40 percent being born in posterior presentation. The start of straining and the appearance of fetal fluid or a pup marks the beginning of second-stage labour.

Second-stage labour

As a pup enters the birth canal, the allantoamnion usually ruptures and clear fluid may be expelled from the vulva. Placental separation precedes the birth of the pup and a greenish–black discharge or uteroverdin may be seen. As the pup passes through the cervix, the neuroendocrine 'Ferguson's reflex' leads to the release of oxytocin and further straining. The pups have to be pushed upwards through the pelvic inlet and then downwards through the vagina and vulva. Pups can only be born normally in longitudinal presentation (i.e., with the axis of the pup and the bitch being parallel) and in a dorsal position (with the back of the pup uppermost). Although both posterior and anterior presentations are normal, posterior presentations can cause dystocia in the first pup. The posture of the pups can be with flexed or extended limbs. A breach birth means the pup is in a posterior presentation, with both hind limbs flexed forward so that only the tail can be seen or palpated. This does not always cause problems, but may be an issue in some cases.

Second-stage labour can last from two to 12 hours and, in rare cases, up to 24 hours, depending on the number of pups and the progression of the birth. If a pup is born with the amniotic sac still intact, the bitch will usually try and break it by licking the pup but, if this does not happen, it should be broken by the person attending the birth. The umbilical cord is usually severed at the same time or ligated and cut to leave a 1 cm stump. There should be a familiar person with the bitch throughout the birth at all times. The animal should never be let out in the garden on its own (e.g., to urinate) and, when brought to the surgery, an additional person to the driver should be available, if at all possible. Strong, regular straining should produce a puppy within 30 minutes. The interval between births can be as quick as five minutes or can take several hours. It may be useful to notify the surgery if more than three hours have passed without the birth of a further puppy, as this will delay examination of the bitch.

Third-stage labour

Third-stage labour involves the expulsion of the placenta, usually within 15 minutes of the birth of a puppy. It is not unusual for several puppies to be born before thBitches should be discouraged from eating the afterbirth as it causes diarrhoea, which will contaminate the mammary glands and, subsequently, the puppies. Lochia, a greenish, non-odorous discharge, will occur for about three weeks following parturition, gradually decreasing in volume after the first week. Involution of the uterus should be complete after 12 to 15 weeks.

First-stage labour 6 to 24 hours (36 hours maximum)

Second-stage labour 2 to 12 hours (24 hours maximum)

Straining 30 minutes

Time between puppies 5 minutes to 4 hours

First signs of an abnormal parturition in dogs

■ Low progesterone levels, which indicate the need for a caesarean section
■ No signs of first-stage labour more than 63 days after ovulation
■ No signs of first-stage labour after a drop in body temperature 24 hours previously
■ Timings of the different stages of labour exceed normal parameters
■ Birth appears to start and then stops, with no signs of progression
■ Greenish–black discharge produced, but no puppy is expelled within four hours
■ Haemorrhage occurs at any stage
■ Rectal temperature is >39·5°C
■ Bitch stops eating and seems restless for more than 24 hours
■ Bitch looks unwell beyond the normal strains of giving birth

DYSTOCIA

Dystocia is defined as the inability to expel fetuses through the birth canal during parturition. This can be due to maternal or fetal factors that prevent delivery from taking place. Maternal factors typically consist of physiological myometrial failure (primary uterine inertia being the most common) or morphological obstruction of the birth canal. Fetal factors include oversized fetuses, malpresentations, malformations and fetal death. Primary uterine inertia and malpresentations are the first and second most common causes, respectively, of dystocia in dogs and cats. Some breeds have been reported to have a higher prevalence of dystocia. Congenitally narrowed birth canals are seen in brachycephalic and terrier breeds (e.g., bulldogs, Boston terriers and Scottish terriers) and the fetuses may have comparatively large heads, which predispose them to maternal–fetal disproportion. In cats, Siamese and Persian breeds appear to be predisposed to dystocia.

CLINICAL SIGNS

Dystocia should be suspected if: A definite problem is identified ■ (e.g., a fetus is lodged in the birth canal or a pelvic fracture has occurred);
■ Gestation is prolonged (>70 days) with no evidence of labour;
■ The animal's body temperature has dropped to <37·8°C and returned to normal with no evidence of labour;
■ There is a green vaginal discharge (indicating placental separation);
■ Foetal fluids are seen and two hours have elapsed without the expulsion of any fetus;
■ Strong and persistent contractions fail to result in the delivery of a fetus within 30 minutes;
■ Weak and infrequent contractions fail to produce a fetus within four hours;
■ More than four hours have elapsed since the birth of a fetus;
■ There are signs of systemic illness;
■ The animal appears to be in severe discomfort.

MEDICAL MANAGEMENT

If a fetus can be palpated in the birth canal, gentle manipulation should be attempted to encourage expulsion. If required, cautious traction can be applied in a caudoventral direction. Copious amounts of sterile lubricant should be applied digitally or infused around the fetus using a urinary catheter. Radiographs should be obtained for any animal experiencing dystocia. This can help to assess the number, size, location and position of the fetuses, as well as maternal pelvic morphology and possible abdominal pathology. Intrafoetal gas

patterns and awkward fetal postures are the earliest signs of fetal death, while collapse of the spinal column, overlapping skull bones and intrauterine gas accumulation develop later. Fetal ultrasonography is more useful than radiography for assessing fetal viability, malformations and/or distress. In particular, deceleration of fetal heart rates and the presence of fetal bowel movements are indicators of severe fetal distress. If fetal or maternal obstruction is ruled out, medical management can be attempted. Oxytocin is a peptide hormone that increases the frequency and strength of uterine contractions by promoting the influx of calcium into myometrial cells. It also promotes postpartum uterine involution, aids the control of uterine haemorrhage and assists in the expulsion of retained placentas. Total doses of 5 to 20 iu in dogs and 2 to 4 iu in cats, administered intramuscularly, have traditionally been recommended. A dose of oxytocin that is too high may cause uterine tetany, in effective contractions and decreased fetal blood flow. More recently, doses of 0·5 to 2 iu have been shown to be effective in increasing the frequency and quality of contraction in the bitch (Davidson 2001). This dose can be repeated after 30 minutes if a fetus has not been expelled. If labour proceeds and a fetus is delivered, oxytocin may be given every 30 minutes to assist in the expulsion of the remaining fetuses. Administration of calcium gluconate should be considered if weak, infrequent contractions are noted, if the initial dose of oxytocin was non-productive or if hypocalcaemia has been diagnosed. Calcium gluconate (10 per cent) can be administered at a dose of 20 mg/kg, either subcutaneously or added to intravenous fluids and given slowly while the bitch undergoes electrocardiographic monitoring for arrhythmias. Finally, dextrose infusion can be initiated if hypoglycaemia is evident following haematological analysis. Medical management of dystocia has a reported success rate of 20 to 40 per cent and should not continue for more than six hours. Therefore, the decision to proceed to a caesarean section should not be delayed if the response to medical management is poor.

SURGICAL MANAGEMENT

Indications for surgical management
A caesarean section is indicated in cases of:
■ Complete uterine inertia;
■ Partial primary or secondary uterine inertia with a poor response to medical therapy;
■ Foetal oversize or malformation;
■ Maternal pelvic obstruction (e.g., fractures, masses);
■ Non-reducible malpresentations;
■ Past history of dystocia or caesarean section;
■ Foetal distress;
■ Systemic illness of the bitch/queen;
■ Suspected uterine torsion/rupture/prolapse or herniation.

In cases of confirmed fetal death and in bitches/queens of lesser breeding value, a hysterectomy is more appropriate than a caesarean section.

CATS

The heat or estrous cycle consists of five stages. These are proestrus, estrus, post - estrus, diestrus, and anestrus. Queens are polyestrous and seasonal, meaning they cycle continuously unless that cycle is broken by pregnancy, disease, or season. In the northern hemisphere, queens do not cycle when day length is decreasing, usually September through December. This effect is more marked as you move further away from the equator.

Proestrus is the stage where the queen is undergoing follicular development and starts to attract male cats. Queens, unlike bitches, do not exhibit vulvar swelling and exudation of vulvar discharge. Proestrus rarely is seen in queens; when the owner first notes that the queen is in heat, she usually is in oestrus.

Oestrus, or standing heat, is the stage where the queen allows the male to mount and breed her. Physical signs are minimal compared with those seen in the bitch. In one study of 187 oestrous cycles, scant transparent vulvar discharge was observed 54.1% of the time. Behavioral signs of oestrus in queens include monotonous yowling and assumption of the lordosis posture, where the forelimbs are pressed to the ground, the hindlimbs straightened,

the back arched, and the tail held to one side. Some queens also are more affectionate when in oestrus. Queens bred three or more times during oestrus usually are induced to ovulate. Length of oestrus varies from 2 to 19 days, with an average duration of 6 to 8 days. Studies disagree as to whether induction of ovulation shortens duration of oestrus in queens.

Post-oestrus

Post - estrus is the stage after an oestrus during which the queen was not induced to ovulate. Follicles regress and new follicles emerge such that the queen is again in oestrus in about 8 to 10 days.

Dioestrus

Dioestrus is the stage after ovulation has been induced, during which the queen is under the influence of progesterone. Successfully bred queens are pregnant during this stage. Queens that were induced to ovulate but are not pregnant will maintain the corpora lutea (CL) and progesterone production for an average of 40 days before lysing those CLs and returning to oestrus.

Anoestrus

Anoestrus is the stage of reproductive quiescence. There are no specific physical or behavioral changes. Seasonal anoestrus in queens lasts about 3 months, during the time of the year when day length is decreasing.

Pre-Breeding Evaluation

General information

A complete physical examination should be performed. Vaccinations should be current and the animal should be tested or treated for internal and external parasites. Feline leukemia testing should be performed on all group-housed and breeding animals, and feline leukemia vaccination should be discussed. Some advocate testing of all cats for feline coronavirus and only housing and breeding positive animals with positive animals, to prevent the spread of this ubiquitous virus and potentially decrease incidence of feline infectious peritonitis (FIP). Because heritability of susceptibility to FIP may be high, some advocate removing positive cats from breeding Programs. Cats have two blood type antigens, A and B. Type A cats have natural weak antibodies to the type B antigen; type B cats have natural strong antibodies to the type A antigen. If a type B queen is bred to a type A tom, she may produce type A kittens who will undergo hemolytic crisis when they ingest her colostrum, which will contain her strong anti - A antibodies and destroy their red blood cells. For this reason, all breeding cats should be blood typed before breeding and like bred to like. Blood types vary by breed; Persians and some British breeds have greater prevalence of type B cats in their population than other breeds.

Clinical implications

Much of pre-breeding evaluation for cats is preventative, promoting wiser breed pairings and housing of animals in the cattery.

Neonatal Isoerythrolysis

Aetiology

Cats have two main blood types, A and B. Cats with type A red blood cell (RBC) antigens have weak anti - B antibodies; cats with type B blood have very strong anti - A antibodies. These antibodies develop naturally, not requiring prior transfusion or pregnancy as exposure. If a type B queen is bred by a type A tom, she may produce kittens who are type A. When those kittens ingest colostrum, the strong anti - A antibodies ingested will lyse their RBCs, precipitating a haemolytic crisis.

Clinical signs

Affected kittens are icteric and anaemic and may slough the tip of the tail and extremities as blood flow to those areas is compromised. Kittens demonstrate tachypnoea and tachycardia, and haemoglobinuria, and may die acutely. Clinical signs usually appear within the first days of life.

Diagnosis

Neonatal isoerythrolysis usually is diagnosed on the basis of clinical signs and age at which they appear.

Treatment

Kittens should be removed from the queen if they are less than 1 day of age and still capable of taking up antibodies across the gastrointestinal (GI) tract as they ingest the queen's colostrum. They can be placed back on the queen at 2 to 3 days of age as they are no longer capable of absorbing those large proteins across the GI tract at that point in development. Transfusion may be required. The goal is to provide the kitten with RBCs to permit delivery of oxygen to tissues until they can build up a store of their own RBCs. Because the dam's antibodies do not attack her own RBCs, she is a good source of RBCs for transfusion to the kitten. Other alternatives include transfusion of washed type B blood cells or transfusion from a donor that has been cross - matched with the kitten. All donors should be negative for feline leukemia virus and feline immunodeficiency virus. Recommended administration regimen for blood products is 10 to 20 ml/kg over a 4 hour period, via an intravenous or intraosseous catheter. Mortality rate is high. Prevention is preferred to treatment. All cats should be blood - typed before being used for breeding and like bred to like. There also is variation by breed; virtually all domestic short – haired cats are type A. The type B blood type is most common in the Devon Rex, Cornish Rex, and British Shorthair breeds. Likelihood of incompatibility of mating is estimated at 14 to 25% for Persians and Abyssinians. Umbilical blood from kittens also may be used for blood typing, before those kittens are allowed to nurse from the dam.

Queening

Normal queening occurs in three stages. Stage I of labour is the long stage during which the cervix dilates. The queen acts restless, may show nesting behavior, pants, is often inappetent, and may vomit.

Stage II is active contractions and passage of the fetuses. A small volume of clear, tan, or slightly blood–tinged fluid may be passed before any kittens are born. Once active contractions are seen, a kitten should be born within 4 h; if the queen is pushing hard constantly, a kitten should be passed within 30 min. No more than 2 h should be allowed to pass between kittens. Kittens may be passed within the amniotic sac or the sac may rupture as the kitten passes through the birth canal. At birth, the queen should tear open the sac, if present, and vigorously lick the kitten to stimulate respiration.

Stage III is passage of the placentas. Stages II and III often alternate. Placentas should be passed within about 15 min of passage of a kitten. The normal feline placenta is olive green to greenish - brown in color due to pigmentation in the marginal hematomas on the edge of the placenta. The queen may try to eat the placentas; this is an atavistic behavior that serves to keep the den clean to avoid attraction of predators, and the placentas have no nutritional or therapeutic value. Queening usually occurs at night and may be prolonged compared with whelping in the bitch; queens have been reported to give birth to live kittens over several calendar days.

Dystocia

Aetiology

Incidence of dystocia, or abnormal queening, is reported as 3 to 6%. The risk of dystocia is increased in brachycephalic breeds and in some doliocephalic breeds. Dystocia is best defined by comparison with normal queening.

Maternal causes of dystocia include uterine inertia, inadequate size of the birth canal, and abnormality of the pregnancy. Uterine inertia can be primary (no propulsive uterine contractions) or secondary (muscle fatigue after unproductive uterine contractions). Primary uterine inertia may be associated with hypocalcemia and may have a hereditary component. Primary uterine inertia is the most common reported cause of dystocia in queens. Secondary uterine inertia usually occurs in the presence of obstruction preventing passage of a kitten into the birth canal. Inadequate size of the birth canal may occur in very small queens. An example of abnormality of pregnancy is uterine torsion, which is uncommon.
Fetal causes of dystocia include fetal oversize and abnormalities of presentation, posture, and position. Fetal oversize may be absolute (normal birth canal, oversize kitten) as in small litters, or relative (part of kitten too big to fi t through normal birth canal) as in kittens with hydrocephalus. Presentation is defined by what part of the kitten first enters the birth canal. Cranial presentation (muzzle and extended forelimbs presenting to the birth canal) and caudal presentation (tail and extended rear limbs presenting) are normal. Examples of abnormal presentations include breech (tail and flexed limbs presenting) and transverse (spine presenting). Position is defined by disposition of the extremities relative to the body. An example of abnormal position is neck flexed to the side. Brachycephalic breeds of cat are at increased risk of dystocia compared with mesocephalic breeds. Other disorders associated with dystocia are prolonged gestation (more than 71 days from the last breeding), and abnormal vulvar discharge (green discharge prior to the birth of any kittens is indicative of placental separation).

Clinical signs

Queens in labor may look tired but should not appear systemically ill. Disorientation, vomiting, and aggression all are abnormal during active labor in queens. Normal vulvar discharge may be clear, tan, or slightly blood - tinged. It should not be purulent or frankly hemorrhagic, and should not be green if no kittens have been passed.

Diagnosis

History findings suggestive of dystocia are prolonged time limits (longer than 24 h of Stage I labor; more than 4 h since onset of Stage II labor or more than 30 min since onset of active, repetitive contractions; more than 2 h between kittens), overtly abnormal presentation of a kitten, or appearance of systemic illness, or abnormal vulvar discharge from the queen. A brief but complete physical examination should be performed. Radiographs permit assessment of the number and size of kittens remaining in the uterus. Viability cannot be determined accurately from radiography alone; signs of fetal death (gas within and around the foetus, collapse of the skull and axial skeleton) may not appear for up to 24 h after fetal death.

Abdominal ultrasound is best used to determine viability by assessment of fetal heart rate. Normal fetal heart rate should be about twice that of the queen. Fetal heart rate less than 170 bpm is indicative of fetal distress.

Treatment

Queens that appear healthy, have no evidence of fetal death or distress, and no apparent cause for dystocia may benefit from being left alone in a dark place with minimal observation for a time before any other measures are undertaken. Most queens give birth at night unattended. Overzealous observation and assistance from owners or veterinary professionals may slow parturition. Manipulation of kittens with abnormal presentation or position is difficult

in queens because of size restrictions. It is easy to dislocate joints and pull skin off of kittens while attempting manipulation. Instruments should not be used. Oxytocin therapy is appropriate if radiographs have demonstrated normal size and likelihood that the kittens can pass through the birth canal. Doses of 0.5 to 2 IU can be given intramuscularly at 20 - to 30 - min intervals for no more than three doses. Repeated doses do not promote continuing uterine contractions because the uterus becomes refractory to oxytocin therapy as receptors fill on the myometrium and do not readily dissociate. Oxytocin increases frequency of uterine contractions; calcium increases strength of uterine contractions. Queens carrying kittens that are in distress, that are carrying kittens too large to pass through the birth canal, or that are non - responsive to oxytocin therapy should undergo Cesarean section. In one study of 1056 births, 8% resulted in C - section

Cesarean section

Cesarean section (C - section) is indicated if obstructive dystocia is present, if the queen is exhibiting primary or secondary uterine inertia, if medical therapy for dystocia has been unproductive, or if fetal heart rate is less than 170 bpm (see Chapter 78). Concurrent ovariohysterectomy (OHE) should be offered to the owner. The primary advantage is that the queen will not have to undergo another anesthetic episode for OHE in the future. The disadvantages are an increased risk of hemorrhage and hypovolaemia. Milk production will not be altered by concurrent OHE. The queen should be prepared for surgery to the greatest extent possible before any anesthetic medications are administered.