

# Canine Reproductive Diseases

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In general, dogs rarely have reproductive , and most pet owners are concerned with preventing reproduction rather enhancing it. However, for today's serious breeder of pure-bred dogs, there are an amazing variety of reproductive diseases and problems that can occur. For the veterinarian to treat the problems, a complete history and physical examination, as well as a reproductive history and evaluation of the reproductive tract, must be performed.

## INFERTILITY IN THE STUD DOG

When dealing with infertility, both the dog and the bitch must be considered. Ninety percent of infertility is due to poor breeding management, such as breeding at the wrong time or not breeding often enough; additionally, the male could have poor sperm quality. Acquired infertility is very common in the dog-if more than a couple of months have passed since the dog's last litter, he may now be infertile. Illness before, during, or after breeding could explain why the bitch did not conceive; likewise, a fever or other illness can adversely affect semen production, and it takes about 60 days for the sperm cells to regenerate after such an insult. A breeding soundness examination can be conducted to evaluate the stud dog; it typically includes a general physical examination and an in-depth examination of the external genitalia. Abnormalities such as severe arthritis or spinal problems may not allow a dog to mount. Hormonal diseases such as Cushing's disease can also reduce fertility. The penis and prepuce should be examined for irregularities, such as a persistent frenulum, growths, or inflammation of the prepuce (posthitis), that may prevent normal intromission. The os penis should be palpated for fractures. Abrasions or lacerations on the penis may bleed during coitus, causing blood to be in the semen. The prostate should be palpated via the rectum; inflammation of the prostate (prostatitis) may be painful and can prevent the dog from finishing mating or make him appear to have a lowered libido. White blood cells (WBCs), red blood cells, and bacteria from the prostate may damage sperm viability. Also, an infection in the prostate can potentially ascend to cause an infection in the testicles (orchitis). The scrotum, testicles, and epididymides are also palpated. The size of the testicles correlates with the amount of sperm seen on collection of an ejaculate: Small, soft testicles are often associated with poor semen quality, greatly enlarged testicles suggest an infection, and lumps in the testicles are suggestive of tumors. Scrota[ abnormalities, such as dermatitis, may adversely affect sperm quality.

An ejaculate of semen should be collected and evaluated for color, volume, total and progressive motility, concentration, and shape (morphology), and the total number of normal sperm should be calculated. There are three distinct outcomes of a breeding soundness examination: (1) normal sperm parameters, (2) abnormal sperm parameters,

and (3) no sperm seen in the ejaculate. Volume varies with the amount of prostatic fluid collected but is generally 2 to 20 ml. Sperm motility should be evaluated immediately, and normal dogs should have 75% to 80% progressively motile sperm (i.e., sperm that are moving in a forward direction). A sample of the sperm should be prepared for microscopic evaluation. It is important that the shape of the sperm be evaluated so that the total number of normal shaped progressively motile sperm inseminated is known, as only these will fertilize an oocyte or egg.

Sperm concentration (number of sperm/ml) can be determined by using a special sperm cell-counting device (called a densimeter) or other methods. The total number of sperm in the ejaculate is calculated by multiplying the concentration by the volume; normal is about  $10 \times 10^6$  sperm/lb of body weight. Therefore a small dog can be expected to produce about  $20 \times 10^6$  sperm ejaculate and a large dog about  $70 \times 10^6$ . Infertility is very rare in dogs with normal semen parameters. Management problems and bitch infertility should be considered when sperm findings are normal.

If abnormal sperm parameters are found, the dog should be rechecked in 2 to 3 months to see if the problem is transient. The veterinarian should be informed of any recent illness and any medications (especially anabolic steroids) that the dog has received. Although the actual cause for abnormal sperm parameters is often never found, possible causes, including inflammation of the scrotum, testicular neoplasia, trauma, and brucellosis, should always be ruled out. Inflammation of the scrotum can cause a high scrotal temperature that is deleterious to sperm production. An ultrasound of the testicles can be performed to evaluate for testicular neoplasia, as some tumors of the testicle are not palpable. This problem can be treated—a unilateral castration of the affected testicle often restores normal sperm parameters. If no inciting cause of the sperm abnormalities can be found, the case becomes very frustrating for both the owner and the veterinarian.

The absence of sperm in the ejaculate (azoospermia) can have three possible causes: (1) the dog's testicles are not making sperm, (2) the testicles are making sperm, but the sperm cannot get out because the epididymides are blocked, and (3) the testicles are making sperm (which can get out), but a complete ejaculate was not collected. When there are no sperm in the ejaculate, the fluid can be tested for alkaline phosphatase, which is made by the epididymides. A high level of alkaline phosphatase indicates that epididymal fluid was collected. If epididymal fluid was collected and there are no sperm, it is likely that the testicles are not producing sperm. A low level of alkaline phosphatase indicates that the epididymis is blocked or that a complete ejaculate was not obtained. In this case, repeated samples should be collected and an estrous bitch can be used as a teaser to obtain an ejaculate. A careful palpation and ultrasonography of the epididymides should be performed to detect any abnormalities. If the azoospermia persists, a testicular biopsy can determine whether the testicles are producing sperm; however, this procedure is rarely performed. The biopsy procedure itself may severely damage the testis, and it does not seem to matter whether the testes are producing no sperm or sperm are being produced but cannot get out—neither condition is treatable.

## **INFERTILITY IN THE BITCH**

The most important aspect of evaluating infertility in the bitch is the history. The main purpose of the history is to ascertain if there is a problem with cyclicity, management, or

the stud dog or if the apparent infertility is actually pregnancy loss. There are basically two types of bitches: those that cycle normally and those that do not.

### **The Bitch with Normal Cycles**

Bitches that cycle normally generally have a 5 to 10 month interestrus interval. The quality of the breeder's history depends on the quality of the breeder's records. Most breeders have a pretty good idea of what is going on, but it often takes careful questioning to bring it out in an orderly, understandable manner. The purpose of the veterinarian's questions (see box on this page) should be to find out whether the bitch was bred at the right time.

A general physical examination of the bitch, an examination of the vulva, and a digital examination of the vestibule and caudal vagina should be performed.

Vestibular strictures may prevent normal intromission by the penis and cause an outside tie (i.e., when the bulbus glandis engorges before entering the vagina and is thus too large to fit through the vulva) or may cause the bitch so much pain that she will not allow breeding. Vaginal anomalies including a persistent septum (a band of tissue dividing the vagina into two parts), segmental aplasia (a missing portion of the vagina), or a persistent hymen may be present. Such problems can sometimes be surgically corrected. Although not of much importance themselves, the presence of abnormalities in the vulva, vestibule, or vagina may suggest irregularities in the remainder of the reproductive tract.

Exploratory abdominal surgery (laparotomy) or contrast radiography may help assess abnormalities in the more cranial portions of the reproductive tract (e.g., cervix, uterus, oviducts, ovaries). Vaginal prolapse may preclude normal penetration by the male. Vaginal hypertrophy (enlargement of the vaginal floor) may occur during estrus and interfere with natural mating. A culture may be taken from the vagina, but results are essentially meaningless in the absence of clinical signs of vaginitis (discharge, odor). Aerobic bacteria may be cultured from the vagina of all normal bitches, and *Mycoplasma* is present in 80% of normal, fertile bitches. Other than *Brucella canis*, any organism cultured in the absence of clinical signs is considered a normal inhabitant of the vagina. The only bacterium that would indicate a cause of infertility on vaginal culture is *B. canis*; however, *B. canis* requires special culture conditions. Many stud dog owners require vaginal cultures prior to breeding because they are concerned particularly about *Mycoplasma*; they hope to prevent infertility in the stud dog by preventing him from mating with an infected bitch. However, *Mycoplasma* is a normal inhabitant in 70% to 80% of dogs and bitches, and treating a perceived "infection" in an infertile dog does not restore fertility.

If the physical examination is normal and a management problem cannot be detected, the veterinarian may wish to follow the bitch through a complete cycle to ensure that she is cycling normally, has a normal rise in progesterone and normal luteal phase (evaluated by testing progesterone levels throughout the 2 months after the heat cycle), and, most importantly, was bred at the optimum time. Remember, the potential fertility of a bitch cannot be evaluated unless she is bred to a fertile male. Was the male impregnating other bitches that were bred around the same time as the one that failed to conceive? When was the stud dog's last litter? Was the stud dog sick in the 2 months prior to breeding this bitch? If a solid history of the male cannot be obtained, a

breeding soundness examination should be performed on the bitch. Management problems should be corrected, and an optimum breeding management program should be outlined with the help of a veterinarian. As mentioned, the best follow up is to have a veterinarian who is interested in canine reproduction follow the bitch through the next heat cycle. This, along with serial progesterone levels and serial vaginal cytology, will pinpoint the optimum time to breed the bitch.

The quality of the breeding can be important. A natural tie is the best guarantee of a successful in- semination. In cases of an outside tie, the tip of the penis can be held tightly by the handler just behind the glans and a fairly normal ejaculation should occur. Conception rates can be normal with outside ties. Artificial insemination is only as good as the person performing it. Although the technique is very simple in dogs, once the sperm is outside the dog, it is exposed to many insults including mishandling, toxins, cold or heat shock, and improper insemination techniques. Breeders should determine how experienced the inserminator is and what his or her pregnancy rate is; a good inseminator should have a pregnancy rate approaching that of natural breeding. Conception rates with chilled extended semen and frozen semen remain disappointingly low, and these are not recommended for bitches with infertility problems. If a bitch was bred with one of these methods and did not conceive, breeding should be tried again using fresh semen before suspecting that she has a fertility problem.

A possible but not well-documented cause of conception failure and/or pregnancy loss is subclinical uterine infection. Signs include vulvar discharge during diestrus and apparent embryo loss after a positive ultrasound. Treatment can include prophylactic antibiotics on the next heat cycle. Enrofloxacin is administered from the first day of bleeding until 1 week after the last breeding. Cephalexin is then administered until whelping. These bitches should have ultrasonograms to detect pregnancy 30 days after the last breeding.

### **The Bitch with Abnormal Cycles**

The bitch with abnormal estrous cycles may have no cycles, long interestrus intervals, or short interestrus intervals. A bitch that is less than 2 years old and not cycling may not have reached puberty yet. Some large-breed bitches do not have their first heat cycle until they are 2.5 years of age or older. Some medications such as progesterone, androgens, and glucocorticoids can interfere with cyclicity. A karyotype should be performed on any bitch over 3 years of age that has not had a cycle to determine if there is a chromosomal abnormality. If there is an abnormal chromosome, there is no hope for fertility.

Because some bitches do not show signs of heat that are recognizable to an owner, especially if no male dog is present, progesterone concentration should be determined. A high level (>2 ng/ml) indicates that she has been in heat within the last 2 months. The test should be repeated approximately 2.5 months later, by which time the progesterone level should have returned to baseline (<2 ng/ml). If progesterone is still high in the second sample, possible ovarian abnormalities (e.g., a luteal cyst or ovarian tumor) may be present; this can be evaluated by ultrasound or laparotomy. Luteal cysts are rare but could respond to prostaglandin therapy. Unilateral and nonmetastatic ovarian tumors can be removed, which could possibly restore fertility. Cushing's disease may cause

elevated progesterone levels and should be tested for in the bitch with persistently high progesterone levels.

A link between thyroid function and infertility is not clear, although there were reproductive problems in one kennel of hypothyroid dogs. Thyroid function can be tested; if the bitch is found to be hypothyroid, thyroid medication can be administered. However, if a bitch's infertility is due to hypothyroidism, she should not be used for breeding. If thyroid levels are normal, the veterinarian should have blood samples evaluated for luteinizing hormone (LH) and follicle-stimulating hormone (FSH) levels. If the levels are high, the bitch is not receiving feedback from the ovaries, which indicates gonadal dysgenesis or primary ovarian failure.

Long interestrus intervals (i.e., over 10 months) may be a normal variation, especially in larger and/or older bitches. There is no good way to bring a bitch into a fertile heat cycle, so the breeder will have to wait for her to cycle. Thyroid function can be checked as for the bitch with no cycles.

Short interestrus intervals may lead to infertility because the uterus does not have enough time to return to its normal size and shape (i.e., involute) after whelping or the previous heat cycle. The interestrus interval can be lengthened by treating the bitch with megestrol acetate\* for 32 days. Treatment should begin a few weeks before she is expected to come into heat. That expected heat cycle will not occur, and the bitch should come into a heat 4 to 6 months after the end of megestrol acetate treatment. The bitch can be bred on this cycle and may be fertile if shortened interestrus intervals were her only problem. Because megestrol acetate is a synthetic progestogen, its use may be associated with an increased risk of endometritis and pyometra, as would be seen with any endogenous or exogenous progestogen; however, the percentage of bitches affected is small.

Short interestrus intervals seem to relate to inadequate luteal phase. The progesterone level continues to rise after ovulation but drops to baseline after 1 month to 6 weeks. The normal luteal phase is 60 to 70 days. An inadequate luteal phase is documented by serial progesterone samples every few weeks throughout pregnancy. The progesterone level should remain above 4 to 5 ng/ml for 60 days. If documented luteal insufficiency exists, the bitch can be supplemented with progesterone in oil for 56 to 58 days after ovulation. Progesterone must be discontinued at that time to allow normal whelping.

Split heats occur when a bitch grows follicles on her ovaries and experiences the signs of proestrus (swollen vulva, vulvar bleeding, attractiveness to males) but does not progress into estrus and does not ovulate. The bitch's follicles will usually regress, and then she will come into a complete heat cycle with ovulation anywhere from 2 to 12 weeks later. Split heats are most common in a young bitch, especially at her first season, and are not considered to be associated with infertility when bred on the cycle in which ovulation occurs. Split heats must be differentiated from short interestrus intervals between two true heat cycles. A vaginal smear will show red blood cells and intermediate and superficial cells as would be expected during proestrus but in a split heat will not progress into an estrus smear (anuclear superficial cells). If vaginal smears are collected for a sufficient time, they will change to an anestrus smear characterized by parabasal cells and WBCs. The vaginal smears for true heat cycles with shortened interestrus intervals will progress normally.

## PERIPARTURIENT DISEASES

Periparturient diseases can be seen prior to, at the time of, and soon after whelping. One of the most common problems reported by breeders is false pregnancy or pseudocyesis. This condition occurs during the luteal phase (diestrus), which is the progesterone-dominated phase that all bitches experience after an estrus or a heat cycle. Because of the similarity between the hormonal profiles of pregnant and nonpregnant bitches, many of the changes seen in the pregnant bitch are also seen in the nonpregnant bitch. These physical changes include mammary gland growth, abdominal enlargement, and lethargy. In addition, if the progesterone level falls rapidly in the nonpregnant bitch, as would occur at whelping, the behaviors associated with parturition (nesting, lactating, "adopting" objects and trying to nurse them) may be seen. Generally, no treatment is needed or recommended; however, when necessary, such as in cases of destructive nesting behaviors, mibolerone or an antiprolactin agent such as bromocriptine may be used.

Abortion or resorptions can be caused by many different factors; even when the aborted fetuses and/or placentas are available for evaluation, the exact cause of pregnancy failure may not be understood. It is extremely difficult to accurately assess the number of abortions or resorptions because there is no way to confirm pregnancy during the first 4 weeks of gestation. Also, ultrasonography or radiography to detect pregnancy is not performed in most bitches unless there is a problem or suspected problem. In general, the causes of abortion/resorption can be divided into fetal defects, maternal problems, infectious diseases, and endocrine or hormonal causes.

Any defect in fetal development that is not compatible with life will result in abortion/resorption. Defects in the fetus can be caused by chromosomal abnormalities or major organ defects or can result from the use of medications that cause defects in the developing embryos (*called teratogens*). A wide variety of commonly used medications and chemicals can cause defects in the fetus, especially in early pregnancy.

Numerous infectious agents have been implicated in causing uterine disease, fetal death, and abortion. The bacterium *B. canis* is the only documented infectious agent that causes infertility, although other pathogens have been associated with absorption/resorption. This disease is spread by contact with infected body fluids and causes infertility, abortion, and stillbirth. Transmission of *B. canis* occurs readily across mucous membranes, allowing dogs to be infected by oral, nasal, conjunctival, or venereal exposure. Its presence in a kennel is disastrous; however, the estimated incidence of dogs and bitches infected with *B. canis* in the United States is 1 % to 6%.

All dogs and bitches should be tested for brucellosis prior to breeding. The most common test (rapid slide agglutination) has a moderate false-positive rate. Therefore dogs testing positive on this test should have additional tests performed to rule out false-positive results. Dogs that still test positive should have blood cultures and lymph node aspirates performed.

The *B. canis*-infected, aborting bitch is highly dangerous to noninfected dogs. Aborted placental tissues and fluids contain huge numbers of the organism, which can rapidly spread through a kennel. The most important sources of infection include vaginal discharges, aborted materials, semen, and urine. The clinical signs of brucellosis are late-term abortions and stillbirths in females and inflammation of the epididymis

(epididymitis), inflammation of the testicles, and testicular atrophy in males. Dogs with brucellosis also can have arthritis, generalized lymph node enlargement, an enlarged spleen and/or liver, low-grade meningitis, and inflammation of the eye (uveitis); however, an infected dog may have no obvious clinical signs, illustrating the importance of regular testing of all breeding stock. The most common sign of brucellosis is abortion in an otherwise healthy bitch between days 45 and 59 of gestation, although the abortion can occur as early as day 30 or the bitch can deliver both living and dead pups. Surviving puppies are infected with the disease.

Treatment of *B. canis* is largely ineffective; because infected animals can shed the organism for more than 1 year after infection, it is recommended that dogs and bitches positive for *B. canis* be euthanatized. The only other alternative is to neuter or spay affected dogs, place them on long-term antibiotics, and separate them from other dogs, especially breeding animals. *B. canis* cannot be eliminated from the prostate of the male, although there has been limited success in clearing the organism from bitches. Additionally, breeders or owners who wish to keep animals that have tested positive for *B. canis* should be aware that human infections with this bacteria have occurred, albeit rarely.

At present there is no vaccine that protects against *B. canis*. Prevention depends on avoiding exposure to infected dogs and bitches. In the disease-free kennel, new arrivals should be tested and found to be negative prior to entry. Bitches should test negative within the month prior to breeding; stud dogs should ideally be bred only to bitches that have recently tested negative and should be tested before each breeding (preferable) or at least every 6 months.

Canine herpesvirus (CHV), a common cause of neonatal death, is also thought to be involved in infertility, abortion, and stillbirth in the bitch. Genital vesicles can be present in the nonpregnant bitch. Up to 80% of bitches will be seropositive for CHV, but very few have reproductive problems. Reproductive problems are seen only when a naive bitch is infected during the last 3 weeks of pregnancy or when pups are infected during the first 3 weeks of life. The transmission of CHV may be venereal, transplacental, or respiratory or by vaginal contact during birth. In pups, CHV causes a fatal disease characterized by generalized necrosis and bleeding. The disease is usually mild or subclinical in adults and consists of conjunctivitis, a serous or mucopurulent ocular and/or nasal discharge, and vaginal lesions that start as vesicles early in the course of the disease but then become circular and pock-like. Genital lesions usually disappear shortly after infection but may reappear at the onset of the next proestrus.

A CHV-infected bitch may have dead and/or mummified pups in the same litter as live pups. The placenta from a bitch infected with CHV is typically underdeveloped and has white-gray areas that range in size from very small to that of a grain of rice. Diagnosis of CHV is based on virus isolation, which requires fastidious sampling and culture techniques; a negative result may be due to inadequate technique rather than a truly negative tissue sample. No vaccine is available; the only recommendation is to expose naive bitches prior to breeding.

Other, less common causes of canine abortion include *Toxoplasma gondii*, *Mycoplasma*, and *Ureaplasma* infections. Toxoplasmosis is a rare cause of abortion. Cats are the definitive host; dogs become infected by ingesting infected cat feces or infected meat. Diagnosis is made by two serum samples obtained 3 weeks apart. A

fourfold increase in serum titer levels indicates toxoplasmosis infection. Prevention is accomplished by preventing exposure to cat feces and raw meat. *Mycoplasma* and *Ureaplasma*, which are normal organisms in the canine vagina, have been implicated in infertility, resorption, abortion, stillbirths, and neonatal death. It is difficult to establish a cause-and-effect relationship because 80% of normal bitches have a positive vaginal culture for *Mycoplasma*. Just because *Mycoplasma* can be isolated from a bitch that aborted does not mean that *Mycoplasma* caused the abortion. Because the organism is a normal inhabitant of the vagina, diagnosis of *Mycoplasma* abortion is, at best, tentative. *Mycoplasma*- and *Ureaplasma*-induced abortions are rare. Treatment involves the use of antibiotics for 10 to 14 days.

Noninfectious causes of abortion include inadequate luteal function, inadequate diet, and inappropriate administration of medications. Inadequate luteal function or a low progesterone level has not been well documented. Bitches with a history of repeated embryonic resorption, as detected by ultrasonography, have been found to have low progesterone levels in the second month of gestation. Progesterone levels should be above 4 ng/ml. Bitches can be tested for progesterone concentration, and those with low levels can be supplemented with progesterone in oil until 56 to 58 days after ovulation.

Bitches require carbohydrates in late gestation. Those fed a diet deficient in carbohydrates will have an increased incidence of stillbirths.

A wide variety of commonly used medications can cause resorptions and abortions; examples include griseofulvin, tetracycline, glucocorticoids, chlorpromazine, carbaryl, diazinon, and phenobarbital. Live vaccine viruses can also be teratogenic and should be avoided during pregnancy. In fact, all drugs should be avoided during pregnancy if possible.

Treatment of a bitch with impending abortion is limited to restricting activity, administering antibiotics, and making sure the progesterone level is adequate. A bitch that has recently aborted should be evaluated for signs of systemic disease and pyometra. Retained and dead fetuses can be diagnosed via ultrasonography and/or radiography. If retained pups are present, the treatment options are spaying or opening the uterus and removing the dead fetuses (uterotomy).

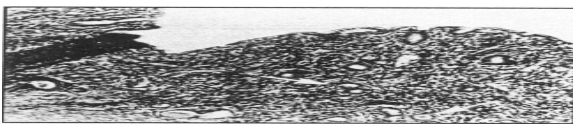


Figure 1. Microscopic section of a normal diestrus uterus. Note the presence of small glands in the endometrium (*arrows*).

## **CYSTIC ENDOMETRIAL HYPERPLASIA/PYOMETRA COMPLEX**

Pyometra is actually a hormonal disease in the bitch; although a bacterial infection is involved, it is the presence of progesterone and its effects on the uterus during diestrus that allow the infection to occur. Pyometra occurs most often during diestrus, the 60 to 70 day period after the heat cycle when the uterus is under the influence of progesterone (Figure 1). A function of progesterone is to quiet the muscular activity of the uterus and close the cervix. Cystic endometrial hyperplasia (CEH) usually precedes the



development of pyometra in older bitches, although pyometra can be seen in bitches of any age.

Under the influence of progesterone, the lining of the uterus becomes thicker with cystic areas due to an increase in size and activity of the endometrial glands, which exhibit secretory activity (Figures 2 and 3). The use of synthetic progestogens such as megestrol acetate have many effects that are similar to those of endogenous progesterone and can therefore contribute to the development of CEH. These combined actions of progesterone allow for an accumulation of secretions that permit bacterial overgrowth. A diagnosis of pyometra is made when the bitch has fluid in the uterus (demonstrated by ultrasonography) and an increased WBC count.

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calcium; thus the bitch is unable to meet a sudden need to remove calcium from her bones and her blood calcium level can become dangerously low, leading to the development of eclampsia. Also, diets high in legumes (soybeans) may tie up calcium and should therefore be avoided in the lactating bitch.

The mammary glands are highly modified skin glands located in two parallel rows along the ventral chest and abdomen. Dogs have four to six (usually five) pairs of glands. It is not uncommon to see a missing nipple or pair or asymmetrically placed nipples. Milk is produced from alveoli (secretory cells), which are arranged in clusters called *lobules*. The milk fills the alveoli and then is drained from the lobules through small ducts. A cluster of 8 to 22 large ducts drain to the outside at each teat.

Mastitis is an infection of the mammary gland that usually occurs within the first week postpartum. The bitch may be ill, have a fever, decreased appetite, and depression, and may not allow the pups to nurse. The affected gland is usually warm, firm, red, and painful. Milk from the infected gland is abnormal. Antibiotic treatment is based on culture and sensitivity of the affected gland. If necessary, the pups may be allowed to nurse but should be monitored for weight gain. If the pups develop diarrhea or fail to thrive, they should be removed from the dam and hand raised. If the pups are nursing, the veterinarian should be certain to use antibiotics that do not affect them. Occasionally, the mammary glands form abscesses that need to be surgically drained.

Agalactia or lack of milk is rare in the bitch. There is no good treatment, and pups need to be hand fed or fostered to another bitch. Sometimes a nervous bitch will not allow nursing immediately postpartum; reassurance from the owner may be all that she needs. Tranquilizers may be useful.

Galactostasis is a noninfectious cause of mammary gland engorgement at weaning. Sometimes the mammary glands become large and painful, but the bitches are not ill and the WBC count is normal. Placing cold compresses on the glands and limiting the bitch's food intake may also help.

### **Questions for Breeders**

- When did the bitch come into heat for the first time?
- How often does she cycle?
- Does the bitch allow a male to mount and breed?
- How often is the bitch bred in a cycle?

- When did she stand for the male?
- When did she first refuse the male?
  - When was she bred in relation to these times?
- How was the time of breeding determined?
- Was ovulation timing performed by progesterone levels, luteinizing hormone levels, or serial vaginal cytology?
- How many times was the bitch bred?
  - When and why was it decided to stop breeding the bitch?
- Were brucellosis titers done on both the bitch and the stud dog within 30 days of breeding?
- How was the bitch bred (natural or artificial insemination)?
- If artificial insemination was used, what type of semen (fresh, chilled, frozen) and insemination technique (vaginal, intracervical, surgical) were used?
- Has the bitch been bred with a male that has successfully sired litters around the same time that this bitch was bred?
- Has the bitch produced any litters, abortions, and/or resorptions?
- If the litter was resorbed, how was pregnancy confirmed?
- Has the bitch even been treated for mismating?
- Has the bitch ever had pyometra, vaginitis, and/or abnormal vulvar discharge?
- Has the bitch ever had medication to delay or prevent a heat cycle?
- Do any other bitches in the kennel have reproductive problems?
- Do any other bitches in her line have reproductive problems?
- Does the bitch or the stud dog have any significant illness?
- Is the bitch or stud dog receiving any medication (including flea and tick control)?

## DEFINITIONS

**azoospermia**-absence of sperm in the ejaculate

**dysgenesis**---defective embryonic development

**epididymis**-the elongated, cord-like structure connecting the testes to the ductus deferens, used for transport and maturation of sperm

**karyotype**-the chromosome characteristics of an individual or cell line

**lochial discharge**-bloody vulvar discharge that occurs following birth

**metritis**-inflammation of the uterus

**necrosis**--death of a portion of tissue or an organ, resulting from irreversible cellular damage

**teratogenic**-referring to an agent that causes deformity in the developing fetus

**tetany**--a sustained muscular contraction caused by a series of stimuli repeated so rapidly that the individual muscle responses are fused; characterized by muscle spasms, cramps, and twitching

**vaginitis**-inflammation of the vagina, characterized by pain and a purulent, bloody, or watery discharge

**vesicle**-small, fluid-filled sac (similar to a blister)

## KEY FACTS

- Although relatively rare in dogs, an amazing variety of reproductive diseases and problems can occur. Providing the veterinarian with a complete reproductive history will assist in making a diagnosis.
- Although most infertility in stud dogs is related to poor breeding management, a breeding soundness examination can identify potential causes of infertility.
- Infertility in the bitch can be due to cyclicity problems, breeding management, or infertility in the stud dog; on the other hand, apparent infertility may actually be pregnancy loss.
- *Brucella canis*, the causative agent of brucellosis, can cause infertility, abortions, and stillbirths in dogs, and all dogs and bitches should be tested for brucellosis prior to breeding.
- Cystic endometrial hyperplasia-pyometra complex can manifest as open-cervix pyometra, which is responsive to medical treatment, or closed-cervix pyometra, in which case spaying is recommended.
- Several postpartum problems can occur, and some can cause serious illness; most are rare, but owners need to be attentive to the bitch after whelping to detect potential problems.

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Source: Pedigree Breeder Forum Magazine Vol. 8, No. 1, 1999 pages 15-24.

