REPRODUCTIVE REVOLUTIONS
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Infertility in the Stud Dog

Any male who achieves less than 75% pregnancy rates when being bred to bitches of known fertility, with adequate breeding management and ovulation timing, should be evaluated for possible infertility. These dogs may have a history of prior normal fertility followed by a decline in fertility *or* consistently poor fertility. There may have been an episode of fever or malaise in the past few months or a history or potential use of performance enhancing drugs. There may be a history of bloody discharge from the penis or pain on ejaculation. A complete physical and reproductive examination is indicated in any dog suspected of fertility issues.

Causes of infertility can be categorized as follows: 1) infectious or inflammatory; 2) physical/anatomic 3) traumatic; 4) immune mediated; 5) chemical; 6) behavioral; 7) genetic or chromosomal; 8) endocrine (hormonal); 9) neurologic; 10) neoplastic (tumors); or 11) metabolic.

Infection or inflammation may be localized to one area of the reproductive tract or may be more generalized. Infection may start in one location and gradually spread to other portions of the reproductive system. The testes, epididymides (the tubules that store sperm prior to ejaculation), spermatic cords (testicular artery and vein and the vas deferens), prostate, penis and/or prepuce may be affected. The prostate is the most common location for inflammation in the male. Bacteria commonly associated with infection include *Staphylococcus*, *Streptococcus*, *Escherichia coli*, *Proteus*, *Pseudomonas*, *Brucella canis*, *Pasteurella*, *Ureaplasma* and *Mycoplasma* species. Herpes virus may directly affect the reproductive system, while other viruses may affect the fertility of the male through their secondary effects (fever or immune mediated disease).

Infection of the prostate may be acute or chronic. Acute prostatitis is usually associated with fever, depression, pain in the lumbar region (especially with ejaculation, urination, defecation, or locomotion) and/or bloody penile/preputial discharge. Palpation of the prostate typically reveals enlargement (often asymmetric) and pain. Chronic prostatitis is usually not accompanied by fever or depression and may manifest as less aggressive breeding behavior, decreased semen concentration due to incomplete ejaculation, diminished fertility due to alterations in the ejaculate rendering it less fertile and/or chronic, or intermittent, bloody penile/preputial discharge. The prostate may or may not be painful on palpation, but it is typically enlarged (often asymmetrically) and/or irregular. Blood in the ejaculate is common with many types of prostatic disease, not just with inflammation.

Infection of the testes (orchitis) or epididymides (epididymitis) may be manifest by swelling and/or pain in these structures. With chronic inflammation, the affected tissue may become very firm while the surrounding or adjacent tissues become soft from secondary degeneration. Inflammation may cause an increase in the temperature in the scrotum which can result in derangements of sperm production and function.

Treatment of infection usually requires appropriate antibiotic therapy. In some cases, long term antibiotic therapy will be necessary. In cases where the inflammation is chronic, antibiotic therapy may be inadequate to resolve the inflammation, and in cases where the testicle or epididymis are affected, removal of the affected gonad may result in resumption of normal function of the remaining testicle.

Physical causes of infertility include anatomic defects that may be congenital (present since birth) or acquired. Missing segments of the reproductive tract may result in complete lack of sperm if they occur on both sides (bilateral) or decreased sperm counts if only one side (unilateral) is affected. Plugs of sperm (granulomas) may block the ejaculatory tract from the epididymides through the vas deferens and may occur on one or both sides in single or multiple locations. Sperm plugs may be treated with multiple and frequent collections, administration of prostaglandin prior to collection, steroid or non-steroidal anti-inflammatory therapy; however, these treatments are seldom successful.

Obesity often results in excessive amounts of intrascrotal fat deposition and this can cause overheating of the testes. Weight reduction should be encouraged in obese dogs. Accumulations of fluid in the scrotum may result in alteration of the regulation of the temperature of the scrotum and thereby result in testicular degeneration. Fluid may accumulate as a secondary result of peritonitis (inflammation in the abdomen) and leakage of fluid through the inguinal rings, inflammation in the scrotum or trauma (hemorrhage). In these cases, the primary cause of the disorder must be treated.

Trauma to the scrotum may result in damage to the reproductive tract and this can cause alterations in testicular function or sperm production and ejaculation, due to thickening of the scrotum, fluid accumulation within the scrotum (blood or serum), or bleeding within the testes or spermatic cords. Trauma to the penis may result in stricture (scarring) of the penis, prepuce or urethra, and thereby affect the ability of the dog to ejaculate normally.

Retrograde ejaculation is a condition where sperm are expelled, either partially or completely, into the bladder instead of out of the urethra. This condition is typically treated by administering medications which result in appropriate closure of the urethral sphincter just prior to breeding or collection. If these drugs fail to rectify the condition, the dog's bladder may be completely emptied (by catheterization) immediately prior to collection and then a small volume of semen extender is instilled into the bladder just prior to manual ejaculation. Then the bladder is re-catheterized immediately after ejaculation and the sperm/ejaculate recovered and immediately diluted in more semen

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extender prior to centrifugation to create a sperm pellet free of urine. Alternatively, the use of sperm gradients can be used to separate the sperm from the urine components. In some cases, this can result in successful pregnancies.

Immune mediated disease can affect sperm production if there is a breakdown in the blood-testes barrier resulting in antibodies being produced against the testicle which results in self-destruction. The presence of immune mediated thyroid disease may predispose a dog to immune mediated testicular disease because animals with one immune mediated disease are more likely to develop another one. Chronic inflammatory disease may result in antibody production and subsequent destruction of the testicular tissue. Currently, there are no treatments for immune mediated diseases; however with time, there may be some return to normal testicular function if the body can recover from the insult. If only one testicle is affected initially, hemicastration may allow the remaining testicle a chance to recover, however, in most cases of immune mediated disease, both testicles will eventually succumb to the same fate.

Exposure to environmental toxins or chemicals may affect sperm production. Use of some medications may adversely impact sperm production. Administration of anabolic steroids and some pesticides or insecticides can affect sperm production. Exposure to hormonal creams or patches (commonly used in human medicine) can result in derangement of hormone concentrations and abnormalities of sperm production. Removal of the drug or toxin will often result in return to normal sperm production, although the time frame may be variable depending on the drug or toxin involved and the length of the exposure.

Behavioral problems may result in alterations of libido, willingness to breed or failure to ejaculate. Behavioral causes may include fear or apprehension, inappropriate discipline for male behavior, virgin stud dogs (timid or lacking understanding of the breeding process), or the presence of a dominant bitch (territorial issues). Overuse of the male may result in decreases in sperm concentration when sperm stores are depleted or increased numbers of abnormal sperm, if immature sperm are ejaculated due to decreased storage times. Proper breeding management and use of positive reinforcement along with artificial insemination will usually overcome most behavioral abnormalities.

Genetic or chromosomal abnormalities commonly result in sterility; however occasionally individuals may be subfertile instead. There is no treatment for genetic or chromosomal defects at this time. Bloodlines related to these individuals should be evaluated carefully and removed from the breeding pool when appropriate.

Endocrine imbalance may occur involving the steroid hormones (testosterone, estrogen), the pituitary hormones (luteinizing hormone, follicle stimulating hormone), or other hormones (cortisol, prolactin). Testicular degeneration may result in decreased production of testosterone and increased production of estrogens. This may affect the male's libido. Decreased concentrations of testosterone will result in increased concentrations of LH and FSH. Cushing's disease and Addison's disease (diseases related to the adrenal glands) may result in alterations in cortisol production and these may in turn affect the production of hormones from the pituitary which can affect the hormones produced by the testes. Hypothyroidism has been shown to have no effect on sperm production or libido.

Depending on the cause of the imbalance, administration of hCG (human chorionic gonadotropin), GnRH (gonadotropin releasing hormone), anti-estrogens, clomiphene citrate or other hormone modifiers, may result in return to either partial or complete sperm production.

Neurologic disease can result in problems with ejaculation due to changes in nerve transmission. Injuries or disease involving the spine or vertebral column (disc disease, osteoarthritis, spondylosis) may prevent normal transmission of the nerve signals required during ejaculation or cause pain during the ejaculatory process. Treatment of the primary neurologic disease may result in normal ejaculation. Use of non-steroidal anti-inflammatory drugs, pain medications and nerve transduction modifying drugs (i.e. gabapentin) to treat these conditions may improve the dog's comfort and allow him to ejaculate or breed normally. If the dog is unable to mount the bitch, the use of artificial insemination may allow the use of the dog in a breeding program.

Tumors may occur in the testes (seminomas, Sertoli cell tumors, interstitial cell tumors, lymphoma, or teratomas) and affect sperm production by altering temperature regulation or becoming a space occupying lesion within the normal testicular tissue. Removal of the tumor by castration of the affected testicle is recommended to allow return of sperm production in the remaining testicle. The remaining testicle may compensate partially for the removal of the affected testicle, allowing sperm production to return to about 2/3 of the prior normal daily sperm output.

Prostatic disease may cause changes in semen concentration secondarily (due to pain) resulting in partial or complete ejaculatory failure or may affect motility or longevity through alterations in the seminal fluid composition. Cysts or tumors of the prostate may affect the nature of the prostatic fluid or may cause bleeding during ejaculation. Prostatic cysts may be drained via needle puncture or removed surgically if deemed to be affecting ejaculation or the ejaculate itself. Tumors of the prostate should be treated either medically or surgically (if chemotherapy is used, this will usually permanently affect sperm production, so semen should be frozen and stored if possible prior to treatment). It should be remembered that prostate neoplasia is more common in neutered vs intact males.

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Dogs with benign prostatic hyperplasia typically respond to treatment with finasteride, which inhibits a step in hormone conversion, to minimize the effects of testosterone on the prostate itself, without affecting the dog's circulating testosterone concentration, his libido or his sperm production.

Metabolic diseases, such as diabetes, renal and/or hepatic failure, may affect the reproductive system indirectly through their effects on multiple organ systems. These diseases should be treated based on standard medical therapy and then sperm production reassessed in 60 – 90 days following control of the metabolic disease. The heritability of any metabolic disease should be considered prior to using the male for breeding.

Infertility problems may be further classified in regards to libido and sperm numbers as: 1) dogs with normal libido and sperm in the ejaculate; 2) dogs with normal libido and no sperm in the ejaculate; and 3) dogs with decreased libido (with either normal or abnormal semen evaluations).

Dogs with Normal Libido and No Sperm in the Ejaculate

The complete lack of sperm in the ejaculate is called azoospermia. Causes of azoospermia include chronic testicular degeneration, prolonged chronic inflammation, genetic or chromosomal abnormalities, bilateral sperm granulomas, immune mediated disease, long term testicular neoplasia, behavioral problems, retrograde ejaculation or painful ejaculation.

Dogs with Normal Libido and Sperm in the Ejaculate

These dogs may be further classified into 3 categories: 1) decreased semen concentration (oligospermia); 2) decreased motility (asthenozoospermia); 3) dogs with decreased normal morphology (teratozoospermia). Any combination of these 3 categories may also occur. Common causes of these abnormalities include testicular degeneration, inflammation, unilateral sperm granulomas, immune mediated disease, neoplasia, behavioral problems, partial retrograde ejaculation, fever, painful ejaculation or metabolic disease.

Dogs with Decreased Libido

Endocrine imbalance may involve the inability of the testes to produce normal amounts of hormone or the inability of the brain (hypothalamus or pituitary gland) to respond to the hormones released from the testes. Testosterone (and its metabolites) is responsible for sexual behavior and secondary sexual characteristics. Common causes of decreased circulating testosterone include testicular degeneration, administration of certain medications, immune mediated disease, metabolic disease or neoplasia.

Investigation of infertility problems in the male should involve a systematic, step-wise approach, eliminating the most likely or common causes of infertility first and then moving on to less likely causes. A complete work-up may require multiple visits as each potential cause is ruled out. In some cases, a cause of the infertility may not be determined since some genetic, chromosomal and molecular causes have no diagnostic tests available.

Once a diagnosis is made, a management plan can be formulated to best utilize the dog. In light of all the potential problems, it is strongly recommended that semen be frozen for long term storage from all potential breeding prospects when they are young and fertile. Then if an untreatable condition arises, there is genetic material available for use in the breeding program.

Dr. Lopate is board certified in reproduction (Theriogenology). She co-owns and operates a reproductive specialty practice providing service to companion animals and horses. Questions regarding male fertility or other reproductive issues may be directed to Dr. Lopate at (503)982-5701, via email at info@reproductiverevolutions.com or on the web at www.reproductiverevolutions.com.