Evaluation of Canine Sperm and Management of Semen Disorders

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KEYWORDS

• Male • Dog • Sperm • Fertility

KEY POINTS

- A thorough assessment of semen quality in the dog includes evaluation of sperm motility, concentration, morphology, and membrane integrity.
- The use of computer-assisted sperm analysis tools allows consistent, objective, repeatable analyses.
- Pharmacologic therapy and dietary supplements may improve fertility.
- Proper husbandry and stud dog management maximizes fertility.

INTRODUCTION

The stud dog is half the equation when evaluating potential causes of infertility in a canine breeding. Assessing male fertility is often the first step because of the ease of obtaining a semen sample for analysis. Unfortunately, the results of routine laboratory tests may not always correlate with actual fertility. The most accurate method of assessing male fertility is insemination of a fertile female; however, this is time consuming and not practical for small breeding operations. The realistic evaluation is completed with an appropriate assortment of laboratory tests.

The three main areas to consider in evaluation of canine semen quality are (1) total sperm count; (2) viability, assessed as motility, progressive motility, live/dead ratio, and acrosomal membrane integrity; and (3) morphology. Once a problem has been identified, appropriate management and intervention may help to improve fertility in a particular stud dog.

OVERVIEW OF SEMEN ABNORMALITIES

Quality of semen reflects the health of the seminiferous tubules, epididymis, prostate, and the dog's general health. Sperm morphology, in particular, is determined by the seminiferous tubules and to a lesser extent by the epididymis.[1]

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Spermatogenesis is the process through which spermatogonial stem cells undergo mitotic and meiotic divisions to become spermatids. This process occurs in the seminiferous epithelium. Spermiogenesis is the process, occurring in the lumen of the seminiferous tubules, through which spermatids undergo multiple cytologic transformations and mature into spermatozoa. The stages of spermatogenesis and spermiogenesis occur at specific locations within the seminiferous tubule. Aberrations of the testicular environment at any of these stages can result in the production of abnormal sperm and possible infertility (**Table 1**).

Significant maturational changes also occur as sperm pass through the efferent ductules and epididymis. It is in these areas that sperm develop the capacity for motility, the acrosomal membrane forms, the cytoplasmic droplet migrates distally and is shed, and some defective sperm are eliminated.[1] The most important functional changes occur in the efferent ductules and caput epididymis; sperm collected from these areas are not capable of fertilization. Sperm obtained from the cauda epididymis are capable of fertilization.[1] Sperm are stored and remain viable for a period of time in the cauda epididymis before ejaculation.

PHYSICAL EXAMINATION

Complete physical examination of the stud dog should be performed, to include palpation of testicular consistency, measurement of testicular width, visual examination of the penis and prepuce, palpation of the prostate per rectum, and ultrasonography of the prostate and testes, if indicated. Normal testicular consistency approximates a peeled, hard-boiled egg. It is common for one testis to be slightly larger than the other. A typical testis-to-epididymis size ratio is appreciated with experience; change in this ratio may indicate testicular atrophy or epididymal swelling. Any heat, swelling, pain, or dermatitis associated with the testes and scrotum should be noted.

LABORATORY EVALUATION OF SEMEN

Accurate semen analysis requires knowledge of the appropriate tools and tests to use, and evaluation of as many parameters as possible. Instructions for performing common procedures, such as semen collection, slide preparation for bright field microscopic motility and morphology evaluation, and use of a Neubauer hemacytometer, are not described. The reader is referred to previously published literature for details of these techniques.[2,3]

Semen evaluations have traditionally been performed manually; however, more recently computer-assisted sperm analysis (CASA) systems have become popular.[4] CASA systems are automated systems combining computer and microscope hardware and software to provide objective analysis of semen parameters. The initial development of CASA systems nearly 40 years ago was driven by the needs of commercial breeding operations and research laboratories to reduce the influence of human variability in semen analysis.[5] CASA systems offer rapid and accurate assessment of total motility; progressive motility; multiple other velocity parameters; concentration; and, in some systems, morphology.

The earliest CASA systems, CellSoft (CRYO Resources Ltd, New York, NY) and Hamilton-Thorne (Hamilton Thorne, Beverly, MA), and, more recently, SpermVision (MOFA Global, Verona, WI), are photometers. They function by obtaining multiple digital images of a field of sperm cells in rapid succession, identifying individual sperm cells, and tracking those sperm across frames to assess motility.[5] Semen samples are analyzed at a standard dilution, allowing the CASA system to calculate concentration of the raw sample.