

THERAPEUTICS IN MALE REPRODUCTION: SEMEN



BASICS

OVERVIEW

- Enhancing semen quality and fertility may involve treating the animal to produce better quality semen, or may involve manipulation of the ejaculate.
- A thorough breeding soundness examination (BSE) remains the basis for determining potential male fertility, identifying fertility problems, and developing a course of treatment.
- Ultrasound evaluation of scrotal contents and accessory sex glands is an invaluable tool.
- Testing for infectious diseases transmissible in semen, including bacterial pathogens, should always be considered.
- When evaluating bulls, a chute-side test for FAA (fertility associated antigen) is available as an aid in selecting sires who statistically average 16% higher pregnancy rates than deficient peers, when all other aspects of a BSE are identical.

INCIDENCE/PREVALENCE

- N/A

GEOGRAPHIC DISTRIBUTION

- Worldwide

SYSTEMS AFFECTED

- Reproductive

PHYSIOPATHOLOGY

- The male or semen can affect conception rate through the inherent quality and fertilizing ability of spermatozoa or through contamination of the uterus with infectious agents.
- Several diseases can be transmitted venereally to the female through the use of infected males in natural service or through the use of inadequately processed contaminated semen

HISTORICAL FINDINGS

- N/A

SIGNALMENT

- Males of all species or breeds selected for natural mating or entering a semen collection and processing center for cryopreservation and use for artificial insemination

PHYSICAL EXAMINATION FINDINGS

- Only health males should be used for breeding

GENETICS

- Some sperm abnormalities are genetic

CAUSES AND RISK FACTORS



DIAGNOSIS

DIFFERENTIAL DIAGNOSES

Non-treatable primary semen abnormalities

- Genetic, e.g. “dag defect” of sperm
- Testicular tumors or scarring caused by traumatic injury
- Testicular atrophy
- Rare unknown etiology (personal experience; a sire may pass a BSE and by all common analyses be producing good semen, fresh or frozen, but it is unable to create pregnancies).
- Infectious orchitis has a very poor prognosis but might be worth attempting treatment if diagnosed early

Non-treatable secondary semen abnormalities

- Infection with *Brucella* spp, *Tritrichomonas foetus*, *Mycobacterium paratuberculosis*, all of which can be transmitted in semen.

Treatable primary semen abnormalities

- Testicular bruising, if mild, may not cause permanent scarring, and fertility may return if treated with anti-inflammatories and allowing for a full spermatogenic cycle following recovery. Pendulous testicles are more prone to injury and frostbite, but are less sensitive to heat stress.
- Trace mineral deficiency. Knowledge of feed sources and local soil deficiencies where that feed is produced is important. Selenium, zinc, manganese and copper all play critical roles in testicular and epididymal function, and can be a problem both in deficiency and in excess. There is additional evidence that cobalt, chromium, magnesium, and nickel are involved as well.

Treatable secondary semen abnormalities

- Seminal vesiculitis is the most common infectious condition of the accessory glands in ruminants, and is of increased incidence in animals being fed grain. Neutrophils are abundant in the semen, along with a variety of possible bacteria.
- Heat stress that may completely shut down spermiogenesis becomes more likely as temperatures exceed 40°C. Almost all male animals will show severe but temporary effects for up to two months following temperatures near 45°C. A high fever due to systemic illness can have the same effect. Initially, sperm morphology will show a dramatic increase in bent tails; as heat increases heads separate from tails and semen becomes completely devoid of sperm as spermiogenesis quits. Predisposing factors include fat in the scrotal neck, testicles held close to the body, high humidity, lack of shade, and dark-colored hides. Tropically adapted breeds are more resistant and often produce better semen in warm weather, while European breeds produce better semen in cooler weather.

Treatable tertiary semen abnormalities (iatrogenic)

- Semen collection and handling in surroundings below about 21°C must be done with care. Cold shock will create bent or coiled tails and “jerky” motility, along with decreased fertility. The collection vessel should be pre-warmed and covered immediately prior to use with an insulating jacket. A 50ml centrifuge tube can be modified to make a warm-water jacket by drilling a hole in the cap to tightly accommodate a 10ml collection tube, and then dipping the drilled cap in a rubber coating compound. Another common error is using bacteriostatic lubricating jelly in the artificial vagina, which contains spermicidal chlorhexidine, or washing rubber AV liners in anything other than plain liquid soap; other soaps contain compounds toxic to sperm that may soak into the rubber. The author prefers to sterilize the liners immediately after rinsing with 99% isopropanol.

CBC/BIOCHEMISTRY/URINALYSIS

- Recommended for all males entering a semen collection and processing centres

OTHER LABORATORY TESTS

- Serology to detect diseases potentially transmissible in semen.
- Culture for pathogenic bacteria (i.e. *Tritrichomonas foetus*, *Campylobacter fetus* in bulls)
- Trace mineral analysis of blood or tissue biopsies

IMAGING

- Ultrasonography is a very useful diagnostic tool when evaluating accessory glands and testicles. A mild hydrocele may not be readily palpable, but evident on a scan. On smaller ruminants, a 5 MHz equine rectal probe tied to a small round-ended rod can be carefully guided rectally (under sedation) to evaluate the accessory glands. Normal testicular parenchyma has a finely mottled “beach sand” appearance, and the rete testis is a distinct white line in the center. Inactive parenchyma (as in heat stress) has a more coarsely mottled appearance with areas less echogenic than normal, and the rete testis will at some point be very difficult to see, having no sperm within. Areas of scarring or calcification, particularly common in older rodeo bulls, are dense echogenic spots.

OTHER DIAGNOSTIC PROCEDURES

- N/A

PATHOLOGIC FINDINGS

- N/A



TREATMENT

THERAPEUTIC APPROACH

Enhancing primary semen quality

- Feed the animal for maximum reproductive function. Appropriate feeds, free of mold contamination; minimal grain to minimize seminal vesiculitis; and consideration of trace mineral, vitamin, and omega-3 fatty acid supplementation is important. A true deficiency may not be completely rectified in terms of improved semen quality for many months.
- Avoid an overweight sire! Best fertility tends to be in animals that, if anything, are “lean and mean”. Exercise is important.

Enhancing secondary semen quality

- Semen extenders serve the purpose of enhancing longevity while retaining fertility, whether in chilled or frozen semen programs. The quality of extender ingredients and their preparation and handling throughout processing is critical. Use at least reagent-grade chemicals, and in the case of the cryoprotectants (usually glycerol), the highest biochemical reagent grade. The water used should be both deionized and prepared by reverse osmosis.
- Bacteria and trichomonads survive the freeze-thaw process along with the sperm. Antibiotics are almost always included in extenders and are usually required when semen is to be shipped internationally. The common ruminant combination of lincomycin, spectinomycin, gentamicin, and tylosin does not seem to be harmful to sperm, and addresses most of the organisms likely to be found in semen. However, the ability of the antibiotics to kill sensitive organisms relies on time; dose, mechanism of action, the replication rate of the organism, and duration of contact with the antibiotics prior to freezing.
- Antibiotics might be used systemically to treat orchitis or seminal vesiculitis, based on culture, sensitivity, and the tissue distribution of the antibiotic considered. Penetration of the seminal vesicles is difficult for many antibiotics. Administration of DMSO (5%) intravenously along with antibiotic administration helps in glandular penetration.
- Frequent ejaculation and pre-ejaculation massage of infected seminal vesicles are used to help eliminate infectious material out of the glands, and thus encouraging the production of fresh fluid which “draws” systemically administered antibiotics into the cavity.
- Think outside the box. Occasionally one runs into sires whose semen looks fine, but does not freeze well at all. The author once worked with a bull that had been to two large collection centers unsuccessfully, and ended up producing viable straws using a cream-gelatin extender sometimes used with cooled stallion semen (modified by adding the 7% glycerol level required by bulls).

SURGICAL CONSIDERATIONS AND TECHNIQUES

- Surgical excision of the seminal vesicles has been used to treat bulls with seminal vesiculitis



MEDICATIONS

DRUGS OF CHOICE

- See above

CONTRAINDICATIONS

- Appropriate meat withdrawal times must be followed.

PRECAUTIONS

- N/A

POSSIBLE INTERACTIONS

- N/A



FOLLOW-UP

EXPECTED COURSE AND PROGNOSIS

- Depends on the diagnosis

POSSIBLE COMPLICATIONS

- N/A

CLIENT EDUCATION

- Client should be aware of the health requirements for movement of semen if custom freezing from specific males is considered
- Client should be educated about venereal diseases

PATIENT CARE

- N/A

PREVENTION

- N/A



MISCELLANEOUS

ASSOCIATED CONDITIONS

- N/A

AGE-RELATED FACTORS

- N/A

ZOONOTIC POTENTIAL

- N/A

PREGNANCY

- N/A

BIOSECURITY

- N/A

PRODUCTION MANAGEMENT

- See above

SYNONYMS

- N/A

SEE ALSO

- Breeding in Soundness Examination: Small Ruminants
- Breeding Soundness Examination: Bovine
- Brucellosis
- Campylobacter
- Orchitis / epididymitis
- Seminal vesiculitis
- Trichomoniasis

Suggested Reading

Cheah, Yunsang, Yang, Wanxi. Functions of Essential Nutrition for High Quality Spermatogenesis. *Advances in Bioscience and Biotechnology*. 2011;2:182-197.

Thibier, M., Guerin, B. Hygienic Aspects of Storage and Use of Semen for Artificial Insemination. *Animal Reproduction Science*. 2000;62:233-251.

Morrell, Jane M., Wallgren, Margareta. Alternatives to Antibiotics in Semen Extenders: A Review. *Pathogens*. 2014;3(4): 934-946.

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