MANAGEMENT OF THE BREEDING STALLION

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Introduction
Evaluation of the reproductive system in a stallion for a fertility examination should assess whether he has the physical and mental faculties necessary to deliver semen containing viable spermatozoa and no infectious disease to the mare's reproductive tract at the proper time to ensure establishment of pregnancy in a reasonable number of mares mated per season. The evaluation needs to assess libido, mating ability, any congenital defects that may be transmissible to offspring as well as quality of semen ejaculated. The results of the examination should be recorded in a systematic and accurate manner.

Identification
Accurate and detailed identification of any stallion which is the subject of a fertility examination is vital. Name, age, breed and the colour and markings should be checked against a passport. This description should be included in the report.

History
As detailed a history as possible should be collated. Historical information important to a fertility examination includes his breeding, present use (performance, racing or breeding) results of previous fertility examination, body condition, illnesses, injuries, any drugs administered and vaccinations. Important historical reproductive information includes the number of mares mated each season, the number of pregnancies, the fertility of the mares he mated and the performance of any other stallions on the stud farm. If the stallion is an active breeding animal it is important to know the frequency with which he was being used and the last time he ejaculated.

The best measurement of a stallion’s fertility can be made by examining the pregnancy and foaling rate of a large number of mares bred to that stallion under optimal conditions. However, this is not always available and is in any case not available for some 9 to 12 months during which time his fertility can change.

Physical examination
Evaluation of the general body systems is an important part of the examination. Deficiencies in the general body systems such as lameness, breathing problems or impairment of sight can affect fertility and use as a breeding stallion.

Physical examination of reproductive tract
External genitalia
The urethra, penis and prepuce should be routinely examined thoroughly by direct manual palpation and any palpable or visual lesions recorded. Where problems are suspected, ultrasound and endoscopy may also be useful. The scrotum and its contents (testes and epididymes) should be palpated in their entirety. The scrotum should be thin and elastic with a distinct neck. The skin is smooth and hairless and any lesions in the scrotal skin should be noted. The testicles in the stallion are located horizontally and both testes and epididymes should be of the same size and freely moveable. The prominent tail of the epididymis is located on the caudal pole of the testicle. The testes should be oval, smooth and regular with a slightly turgid texture. Flabby or hard testes are potentially poor producers of sperm. The position of each testis within the scrotum can be determined by palpation of the epididymis. Rotation of the testis through 90’ to 180’ can occur.
with no clinical signs and no apparent effect on fertility. Measurements of the length, width and height of each testis are made along with total scrotal width, using callipers or ultrasonography. Total scrotal width of mature, fertile stallions should be greater than 8 cm. Testicular size is highly correlated with daily sperm output (DSO). If the number of sperm collected does not approximate with the calculated number of sperm produced by the testes of a given size, this may suggest non-representative semen samples or testicular degeneration. A sample should be re-evaluated.

Internal genitalia
Examination of the internal genitalia is difficult unless suitable examination facilities are available and the veterinary surgeon is experienced in what to palpate. The internal genitalia can be examined by manual palpation and or ultrasonography per rectum. The size and consistency of the internal genital organs should be noted.

Bacteriological swabbing
Several bacteria can be transmitted by sexual contact. In many cases the stallion shows no signs of infection and is not affected in any way i.e. is purely a carrier. The prepuce, penis and distal urethra are normally colonised with a variety of environmental bacteria. These bacteria help to prevent overpopulation of the external genitalia with potentially harmful microorganisms. There should not be a heavy pure growth of any one bacterial species. Stallion venereal diseases have been the subject of a previous presentation.

Assessment of libido
Sexual behaviour should be evaluated by bringing the stallion into contact with a mare in oestrus and the reaction of the stallion to the mare should be noted. The intensity of the reaction also known as libido is dependant on mating experience, management and in some cases on season. Typically a normal stallion that has never mated a mare will take a longer time to mount, however, he will display good libido. On the other hand a stallion that has had a negative previous experience might show no interest in the mare or in mounting. A normal stallion should show interest in the mare, and drop the penis within 1-2 min of exposure to a quiet mare in standing heat. He should gain an erection and will try to mount within the first 3 min. Once he has mounted properly he should have several (5-8) intravaginal thrusts, followed by 3-5 short thrusts synchronous with ejaculation, urethral pulsation and flagging of the tail. He should not withdraw before ejaculation is complete.

Before a stallion can be considered a satisfactory breeding prospect he must be able to copulate normally i.e. he must develop an erection, mount without hesitation, insert the penis, provide intravaginal thrusts, and ejaculate.

Collection of semen
Most stallions can be easily collected artificially regardless of their age or their previous breeding method. The most convenient method for semen collection is the artificial vagina (AV). It must be remembered, particularly if the stallion has been sexually rested for some time, that unless semen quality is adequately stabilised, it is easy to overestimate or underestimate the quality of semen ejaculated.

Evaluation of semen
To ensure that the semen sample obtained is representative of the stallion’s sperm producing capability, it may require 2 to 10 days of daily collection before the output has stabilised. the key to determining the sperm production of a stallion is to determine his daily sperm output (DSO). The DSO is defined as the total number of morphologically normal progressive motile spermatozoa (TNM) produced in an ejaculate on a daily basis. DSO can be determined by collecting semen once per day over a period of 10 days and expressed as TNM per day. When a stallion has not been collected or mated for a considerable period, the total number of spermatozoa in the ejaculate will be high and so will the TNM. If he is collected every day, the total number of spermatozoa ejaculated per day will usually reach a constant level during the second
week of collection. At that point, you will know how many spermatozoa the stallion produces per day and, therefore, what you can rely on when calculating insemination doses likely to be possible for that particular stallion.

In general, to be classified as a satisfactory breeding prospect stallion must be free of undesirable potentially heritable defects, behavioural disorders and transmissible diseases; possess no physical traits that would interfere with mating ability, semen quality and spermatozoa output. There should be at least $1.1 \times 10^9$ live, morphologically normal spermatozoa for the stallion to be considered as having adequate fertility. Most stallions should be considerably in excess of this. The number of spermatozoa in a second ejaculate from a sexually rested stallion will usually approximate 50% of the number obtained in the first ejaculate.

**Specific Causes of Subfertility in the Stallion**

**Behavioural Dysfunction in the Stallion**

Dr Sue McDonnell is acknowledged as one of the world’s leading authorities on stallion sexual behaviour and has characterised sexual behaviour problems in stallions (McDonnell 2000). She lists several factors affecting stallion behaviour:

- **Season and Hormones**
  
The stallion is a seasonal breeder the control of which begins at the level pineal gland and melatonin secretion (Roser 2006). Melatonin secretion is increased as daylight decreases. This inhibits GnRH release. As daylight increases, endocrine events leading to maximum reproductive function are initiated. The stallion has an endogenous circannual cycle influenced by light levels. A stallion needs a period of short days followed by increasing light; otherwise libido and sperm production could decline overtime. This is relevant for those of us involved with breeding stallions sent from the northern to southern hemisphere. There is an excellent recent chapter on hormone regulation of reproductive function in the stallion: Roser, J.F. (2006) Endocrine Diagnostics and Therapeutics for the Stallion with Declining Fertility. In *Current Therapy in Equine Reproduction*. Eds. J.C. Samper, J.F. Pycock and A.O. McKinnon, Saunders Elsevier, 244-251.

- **Stimulus Mare**
  
The majority of stallions respond to any mare in oestrus. Other stallions show clear preferences for a particular mare or type of mare (McDonnell 2000). Virtually all stallions respond better to a mare in natural oestrus than a dummy mount or ovariectomised teaser mare. Many stallions respond more vigorously when provided with more than one stimulus mare (McDonnell 2000).

- **Sociosexual Environment**
  
Under feral conditions, bachelor stallions have low levels of testosterone whereas harem stallions have higher levels of testosterone (McDonnell 2000). Teasing and breeding can exert a positive influence on testosterone levels of stallions.

- **Management and Training**
  
Many aspects of sexual behaviour are learned. If excessive and inappropriate discipline of the stallion was/is used during the stallion’s training for a performance career, this can prevent normal sexual behaviour in the breeding shed. Such stallions may be aggressive or have poor libido. Handling of competing stallions should be consistent and firm, but not aggressive. In certain countries there is widespread use of an oral progestagen, altrenogest (Regumate, Intervet) to colts in training and performance stallions. The effect on behaviour has not been critically studies and published work is sceptical of any benefit on behaviour (Miller et al 1997). These latter authors also reported no effect on stallion sperm quality or quantity whereas others have reported a decrease in sperm output and testicle size following altrenogest treatment (Brady et al 1997).

Inappropriate management in the breeding shed or semen collection area can also cause behavioural problems. Care must be taken to avoid:

1. use of irritating soaps
2. overuse
3. use as teaser only
4. incorrect artificial vagina preparation and use
Poor Libido
This is the commonest behavioural disorder in stallions. It may be straightforward to remedy such as prolonged teasing under conditions that give maximal (safe) arousal. This is particularly important for slow-starting novice stallions. Management solutions as discussed above offer the best approach (prolonged teasing, natural oestrus mares, minimal distractions and established routine in the breeding shed.) Poor libido can be associated with low circulating levels of testosterone and/or luteinising hormone. Stallions with low concentrations of these hormones can have good libido Some therapies have been suggested, but their use is largely empirical.

1. GnRH has been suggested as a ‘cure-all’ for stallions with idiopathic subfertility, but scientific support for this is poor or even non-existent (Roser 2006). Native GnRH (50 µg 2 and again 1 hour before breeding) is the dose suggested. Roser (2006) points out that low levels of GnRH have not been reported in the stallion so questions how giving more GnRH will improve fertility. A recent study has demonstrated that GnRH therapy during the nonbreeding season improved sexual behaviour (Sieme et al 2004).

2. Although not a hormone, the anxiolytic drug diazepam given by slow intravenous injection at a dose rate of 0.05 mg/kg about five minutes before breeding is useful for stallions appearing anxious about the covering process.

Failure to Attain or Maintain an Erection
This rare in stallions with normal libido. In most cases the cause is related to damage to the erectile tissue of the penis. Breeding accidents, kick injuries or drug-related paralysis are common causes. Rarely the cause may be psychological.

Ejaculatory Dysfunction
This can involve a failure to mount and/or thrust properly. Causes can be neurological, vascular or orthopaedic disease. Painful hindlimb joints or musculoskeletal back pain are the commonest causes in the author's experience. Management can include weight loss, good footing in the covering shed, reducing the height of the dummy mare (for stallions in an AI programme) or even semen collection on the ground.

Causes of non-ejaculatory coitus may be psychogenic possibly due to overuse of the stallion, poor handling or an unsuitable covering environment.

Treatment involves initially instituting management changes to ensure maximum arousal: exposure to one or more mares in natural oestrus in a quite relaxed environment. It can be helpful to increase positive stimulation of the penis by the application of hot towels to the base of the penis. If using an artificial vagina, increasing the pressure and temperature can be useful.

Blocked ampullae can also cause ejaculatory failure in the absence of any obvious libido problems. This condition was first described by Varner and others (2000) where certain stallions have abnormal retention of sperm within the duct system. They coined the term ‘sperm accumulation syndrome’ (spermiostasis). The retained sperm undergo degenerative changes The ejaculate from affected stallions has no sperm or contains clotted, concentrated semen (> 500 million/ml) with sperm with low motility and many detached heads (Watson 1997). Transrectal ultrasonography of the accessory glands may show dilation of the lumen of one or both of the ampullae. If the ejaculate contains no sperm, alkaline phosphatase levels should be determined in the collected fluid. The epididymis and testis secrete high levels of alkaline phosphatase. This distinguishes absence of sperm secondary to ejaculatory failure from a primary azoospermia associated with the testis.

Blocked ampullae require vigorous massage per rectum (with suitable restraint). Oxytocin (10 to 20 lu) given by i/v injection just prior to collection may dislodge the obstruction. Once the obstruction has cleared, the ejaculate may contain sperm plugs or casts. Oxytocin should be continued until the ejaculates are largely free of sperm with detached heads. The stallion should then be maintained on a frequent ejaculation programme of at least five times per week.

There may also be specific ejaculatory problems due to failure of the neural ejaculatory mechanisms e.g. penile nerve damage or malfunction of the autonomic nervous system. If neural mechanisms are disrupted, the α-adrenergic agonist imipramine (500 – 1000mg) given orally may lower the ejaculatory threshold and induce erection and ejaculation. Imipramine is a human
antidepressant drug and can also be given intravenously at a dose rate of 2.2 mg/kg. Other treatments aimed at stimulating smooth muscle contractility by way of their α-adrenergic effects include:

- Xylazine given at a dose rate of 0.66 mg/kg by intravenous injection
- Prostaglandin F2α given at a dose rate of 0.01 mg/kg by intramuscular injection

(McDonnell 2000)

These drugs are by no means effective in all cases.

**Urospermia**

A specific form of ejaculatory failure is contamination of the semen with urine. This can be gross contamination with the obvious presence of urine: distinctive colour, smell and elevated urea and creatinine concentrations. Alternatively, contamination can be more subtle and poor sperm motility is the most noticeable feature. The cause of urospermia is unknown and affected stallions typically show no signs of systemic disease.

There are several possible causes:

- Neurological dysfunction
  - Cauda equine syndrome or EHV 1 infection
- Urinary incontinence
  - Urination during ejaculation: can be continuous or intermittent. Even small amounts of urine are detrimental to sperm motility

**Clinical Signs**

Libido and mating behaviour are typically normal and there are no characteristic signs other than infertility.

**Diagnosis**

Examination of the ejaculate

- Yellow colour
- Ammonia smell
- Calcium carbonate crystals on microscopic examination

Laboratory

- Urea nitrogen and creatinine concentrations
  - Can use test strip

**Treatment**

Collect semen immediately after urination. Can try using an open ended AV. Drug therapy has had poor results: oxytocin and bethanecol chloride have been tried.

**Haemospermia**

Blood in the ejaculate is not uncommon in stallions in heavy use. The red blood cells appear to be the cause of the problem, although the exact mechanism by which fertility is reduced is unclear. In many cases, sperm parameters are normal making diagnosis difficult.

**Causes**

- Infections: bacterial or viral urethritis; accessory gland infection
- Excessive dilation or trauma to urethral epithelium during ejaculation
- Rupture of the corpus spongiosum penis
- Trauma to the penis e.g. entanglement of penis with tail hair
- Neoplasia
- Cystic calculi in bladder
- Parasitic

**Diagnosis**

Depending on the amount of blood, there may be a change in the colour of the ejaculate. There may be pain at erection and ejaculation and this can make the stallion reluctant to breed. Sperm motility, morphology and numbers are not usually affected by the condition. Accurate diagnosis requires careful physical examination of the external surfaces of the penis and urethral.
process on both the erect and nonerect penis. If the source of the bleeding is not identified, endoscopic examination of the urethra and ultrasound examination of the internal genitalia should be performed. Differential diagnosis includes cystitis and bleeding from the remaining urinary tract.

**Treatment**

The approach to treatment will depend on the underlying cause. Treatment of urethritis and accessory gland infections requires systemic and/or local antibiotic therapy and the use of urinary acidifiers. Traumatic lesions require prolonged sexual rest for a minimum of several weeks.

**Poor semen quality**

In the absence of other obvious disease processes, the causes of poor seminal quality are poorly understood. Possible factors include:

- Drug administration
- Pyrexia
- Overuse
- Underuse
- Nutritional factors

**Treatment**

Management changes may be applicable. Attempts to treat subfertile stallions with hormonal methods have been largely unsuccessful. GnRH, hCG and steroids have been used, but evidence for any benefit is equivocal.

**Diseases of the Testes**

**Testicular Hypoplasia**

- Usually hereditary, rarely acquired
- Testes small and soft on palpation
- No effective treatment
- Irreversible

**Testicular Degeneration**

This is the most common cause of male infertility across the species (Jubb et al 1985). Usually acquired following thermal injury, production of antisperm antibodies or exposure to toxins.

**Diagnosis**

There is often considerable delay in deterioration of semen quality. The commonest changes in the sample are low sperm numbers, poor motility and morphological abnormalities. There may be a high percentage of immature germ cells in the ejaculate.

The endocrine profile may show normal testosterone concentrations, high gonadotrophin concentrations and a blunted testosterone response to hCG administration. Recently inhibin has proved a useful marker, being lower in subfertile stallions (Metcalfe 2006). There is a reduction in the size of the testicles and on palpation affected testes feel soft and flabby. The condition can be unilateral or bilateral. In the later stages of the disease, the testes become smaller and of firm consistency. The epididymis may appear disproportionately large. On ultrasound examination, there is testicular fibrosis and/or calcification with speckled echogenic material throughout the parenchyma.

A testicular biopsy is necessary to differentiate between testicular degeneration and hyperplasia. The biopsy reveals mineralization and fibrosis with thinning of the germinal epithelium. There is a reduced germ cell to Sertoli cell ratio.

**Treatment**

The condition causing the insult must be recognised and removed. In the acute case treatments include:

- Cold hosing to restore normal testicular temperature
- Anti-inflammatory drugs
- Heni-castration where condition is unilateral
- GnRH
Prognosis

Guarded as in many cases, the condition progresses to infertility and recovery is not possible.

The enormous economic impact of the subfertile stallion has been excellently highlighted by Blanchard (2006) who has produced the following example to stress the importance of maximising reproductive efficiency of the stallion.

| Influence of 2 (40%, 60%) Theoretical Pregnancy Rates per Cycle (PR/Cycle) on Number of Covers Required to Complete 3 Oestrous Cycles of Breeding & Seasonal Pregnancy Rate (SPR) for a Stallion Mated to 100 Mares by Natural Cover |
|--------------------------------------------------|-----------------|
| Fertility Achieved per Cycle and per Season with Theoretical 40% PR/Cycle* Lower Theoretical Fertility |
| 100 mares bred 1st cycle x 40% PR/cycle=40 mares pregnant on 1st cycle of breeding |
| 60 mares bred 2nd cycle x 40% PR/cycle=24 mares pregnant on 2nd cycle of breeding |
| 36 mares bred 3rd cycle x 40% PR/cycle=14 mares pregnant on 3rd cycle of breeding |
| Total mares pregnant after 3 cycles of breeding |
| No. barren mares |
| Total no. Covers for season |
| 100 covers |
| 60 covers |
| 36 covers |
| 78 |
| 22 |
| 196 |
| Higher Theoretical Fertility |
| 100 mares bred 1st cycle x 60% PR/cycle=60 mares pregnant on 1st cycle of breeding |
| 60 mares bred 2nd cycle x 60% PR/cycle=24 mares pregnant on 2nd cycle of breeding |
| 36 mares bred 3rd cycle x 40% PR/cycle=9 mares pregnant on 3rd cycle of breeding |
| Total mares pregnant after 3 cycles of breeding |
| No. barren mares |
| Total no. Covers for season |
| 100 covers |
| 40 covers |
| 16 covers |
| 93 |
| 7 |
| 156 |

Assuming only 1 cover is required per oestrus, and all pregnancies result in production of viable foals, the lower level of fertility would result in 40 extra covers throughout the season, yet produce 15 fewer foals (i.e. 15 more barren mares)

*Number of mares bred per cycle x theoretical PR/cycle=number of mares pregnant

Further Reading


References


