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FOCAL POINT

Musculoskeletal and neurologic diseases, which are important causes of poor breeding performance in stallions, can be recognized and treated to prolong the stallion's breeding career.

KEY FACTS

- Recognizing the role of the musculoskeletal and neurologic systems as a common primary cause of poor breeding performance is crucial to successful evaluation and therapy, p. 1160.
- The most important steps in treating chronic back pain are to determine and treat the primary cause, p. 1162.
- The importance of weekly monitoring and the use of a good farrier for stallions with chronic laminitis cannot be overemphasized, p. 1163.
- Poor performance in breeding stallions is typically multifactorial and may involve the musculoskeletal, neurologic, and reproductive systems; behavior can also be a factor, p. 1166.

Effects of Musculoskeletal and Neurologic Diseases on Breeding Performance in Stallions

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Libido, mounting, thrusting, and ejaculatory dysfunctions represent major causes of poor breeding performance in stallions.^{1,2} Musculoskeletal and neurologic diseases account for up to 50% of these problems.² The stallion breeding soundness examination (BSE) does not routinely include a complete musculoskeletal and neurologic examination,^{3,4} and in our experience these systems are often overlooked when evaluating subfertile stallions. This article describes evaluation and therapy for stallions with poor breeding performance and summarizes findings in 25 horses presented for routine BSEs or for evaluation of specific libido or ejaculatory dysfunction for which musculoskeletal or neurologic disease was found to be the primary cause or a significant associated factor.

DIAGNOSTIC APPROACH

History

A complete history includes signalment, performance career, duration and details of breeding experience, presenting problem and associated details, medical history, medication, and nutrition. Information about the environment (including housing and breeding facilities [e.g., flooring, phantom]) and breeding protocol (semen collection technique, stallion handling) should also be collected.

Breeding Soundness Examination

The routine BSE includes general physical examination, examination of the

internal and external genitalia, evaluation of at least two ejaculates collected 1 hour apart, and evaluation of penile microflora. The procedure has been outlined by the Society of Theriogenology.⁴

Basic Lameness and Neurologic Examinations

Lameness and neurologic examinations are performed as described in Complete Musculoskeletal and Neurologic Examination.⁵⁻⁷ It is useful to observe the horse for lameness and neurologic signs while it is being teased and particularly during mounting, thrusting, and dismount. Specific findings that are suggestive of a musculoskeletal or neurologic problem include failure to couple squarely (Figure 1) and thrust with a smooth, rhythmic pelvic action; asymmetric hindlimb weight bearing and thrusting; failure to properly flex or use the neck and/or back; abnormal tail posture; anxious look in the eyes and/or atypical ear postures

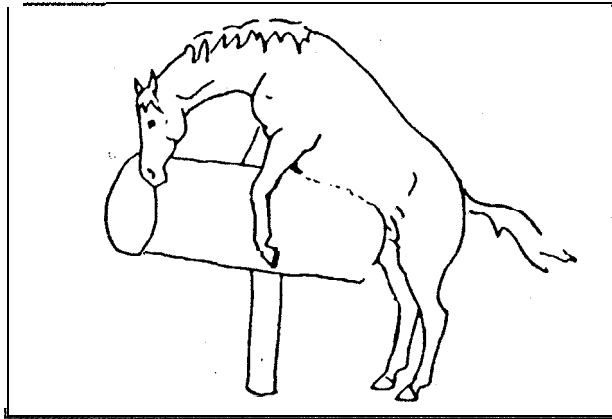


Figure 1A

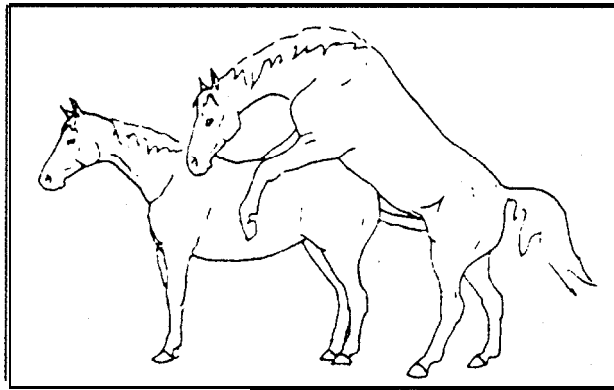


Figure 1B

Figure 1-(A) Good and (B) poor coupling positions.

suggesting discomfort or distraction; failure to grasp securely with the forelimbs; lateral instability; falling during thrusting or dismount; weak, thready, or irregular ejaculatory pulses (often variable from day to day); and fore- or hindlimb lameness after breeding.² Other common manifestations of musculoskeletal pain include reluctance to mount or dismount, early dismount, squealing during dismount, or savaging the mare or handler during or immediately after mounting (see Differential Diagnoses of Musculoskeletal Pain).

Additional Examinations

Based on the combined findings of the examinations described above, additional tests may be indicated. For example, frame-by-frame analysis of videotaped breeding behav-

Complete Musculoskeletal and Neurologic Examination

Basic Lameness Examination

- Examination of front feet using hoof testers
- Flexion of front fetlocks and carpi at rest
- Palpation of neck, back, and gluteal muscles
- Hock flexion and hind fetlock flexion at rest
- Walk and trot in-hand
- Repeat flexion tests at a trot

Basic Neurologic Examination

- Overall muscular symmetry
- Facial nerves
- Flexion and extension of neck
- Circumduction while circling to left and right
- Walking a serpentine path
- Tail-pull test to left and right
- Backing and stopping

- Walking uphill and downhill

- Placing examination (i.e., place one front or hind foot in front of the other and observe whether the horse re-places its foot normally)

Additional Diagnostic Tests

- Ultrasonographic evaluation of the pelvic genitalia and aorta
- Hematology for creatinine phosphokinase (0 and 30 minutes postbreeding)
- Radiography
- Cerebrospinal fluid and serum evaluation for equine protozoal myeloencephalitis titers
- Scintigraphy
- Nerve blocking
- Video analysis of breeding behavior

ior can often provide useful insight into the specific area of pain or discomfort and can help to identify handling factors that enhance or impair performance. Ultrasonographic evaluation of the pelvic aorta is useful in cases of hindlimb weakness and pain. Aortoiliac thrombosis, which results in libido, erection, and/or ejaculatory dysfunction in breeding stallions,⁸ manifests as delayed ejaculation (multiple mounts and more than 12 thrusts); progressive hindlimb weakness and/or pain during thrusting resulting in "camping under" the mare or phantom; and difficulty backing up to dismount. Erection aberrations can include delayed or rapid tumescence or detumescence or loss of erection during thrusting.

THERAPEUTIC STRATEGIES

Our general approach involves formulating a specific plan, including pharmacologic therapy, acupuncture, corrective shoeing, changes in breeding management, specific behavior modification, and other management details such as exercise and nutrition. Our experience indicates that therapy is most likely to succeed when all options are considered and implemented simultaneously rather than individually. Other factors that must be taken into account include the history, breeding farm conditions, and availability of veterinary care. We generally include specialists in the fields of sports medicine, reproduction, and behavior in the planning process.

Differential Diagnoses of Musculoskeletal Pain

- Sore front or hind feet, including foot abscesses
- Laminitis
- Degenerative joint disease (fetlocks, carpi, stifles, hocks)
- Forelimb abrasions (carpal rub sores)
- Sore shoulder
- Sore neck
- Cervical vertebral malformation
- Equine protozoal myeloencephalitis
- Sore back
- Sore gluteals
- Aortoiliac thrombosis (hindlimb weakness, pain)
- Hindlimb weakness
- Nerve root injury
- Myopathy

**TABLE I
Medications Used in Horses with Musculoskeletal Disease**

Drug	Dose ^a	Route	Frequency
Phenylbutazone	2.2	PO, IV	BID
Flunixin meglumine	1.1	IV, IM	BID
Ketoprofen	1.1	IV	SID
Aspirin	15-100	PO	SID
Isoxsuprine	1.2	PO	BID
Methocarbamol	40	PO	BID
Sulfamethoxazole	12.5	PO	BID
Sulfadiazine	12.5	PO	BID
Pyrimethamine	1	PO	SID
Folate	0.5	PO	SID
Vitamin E	5000 IU	PO	SID
Polysulfated glycosaminoglycans	Variable	IM	Variable
Hyaluronic acid	Variable	IA, IV	Variable
Glucosamine and purified chondroitin sulfate	Variable	PO	Variable

^aUnless specified, doses are in mg/kg. BID = twice daily; IA = intraarticular; IM = intramuscular; IV = intravenous; PO = oral; SID = once daily.

**Medical Management of Musculoskeletal Disease
Degenerative Joint Disease**

The most common drugs used in the medical management of pain in horses are nonsteroidal antiinflammatory drugs⁹ (NSAIDs; Table 1). We recommend initial treatment with oral phenylbutazone (tablet, paste, or granular form; 1.5 to 2 g twice daily for 4 to 5 days, then titrated to 1 g twice daily for an additional 5 to 7 days), which should be accompanied by a period of sexual and general rest if possible. In our experience this has been the most effective pain treatment, although improvement may not be immediate. If the treatment is helpful, the stallion can continue receiving low doses of phenylbutazone without it having a measurable effect on sperm production or testicular size.¹⁰ Treated horses should be monitored for signs of phenylbutazone toxicity, including colic, loss of appetite, diarrhea, dependent edema and mucosal ulceration, or renal disease.¹¹ On occasion, another type of NSAID (e.g., ketoprofen) may be helpful; flunixin meglumine and ketoprofen are also commonly used for initial treatment. Intraarticular medications such as corticosteroids, polysulfated glycosaminoglycans (Adequan[®], Luitpold Pharmaceuticals), or hyaluronic acid (Hylartin-V[®], Luitpold Pharmaceuticals) are useful in the management of degenerative joint disease; polysulfated glycosaminoglycans and hyaluronic acid (Legend[®], Bayer) can also be administered intramuscularly and intra-

venously, respectively. In addition, an oral preparation of glucosamine combined with purified chondroitin sulfate (Cosequin®, Nutramax Laboratories) may be used.

Chronic Back Pain

The most important steps in treating chronic back pain are to determine and treat the primary cause. Pain can be secondary to another musculoskeletal cause, a heavy breeding schedule, poor footing, poor shoeing, or some other problem that can be remedied. Chronic back pain may be best treated using acupuncture once weekly for 8 weeks and then every 3 to 4 weeks or as needed.¹² Acupuncture therapy may be combined with NSAID administration.^{12,13}

Laminitis

Although shoeing and trimming are important in the treatment of chronic laminitis, medication (phenylbutazone, flunixin meglumine, isoxsuprine, and aspirin) can also be useful in managing its associated pain.¹⁴ In addition to alleviating pain, aspirin may help prevent further thrombus formation; its relatively short half-life in the horse is its only drawback.¹¹ Treatment for chronic pain in horses has also included electroacupuncture, particularly in refractory cases.^{15,16}

Myositis

Myositis, evidenced by lameness, pain, sweating, firm muscles, and markedly increased serum creatinine kinase activities, can be the primary cause of poor breeding performance. For horses that have acute myositis accompanied by colic, anxious sweating, and very firm muscles in conjunction with increased serum muscle enzymes, it may be useful to 1) administer acepromazine (10 to 20 mg) intravenously to control anxiety; 2) administer balanced electrolyte solution (10 to 20 L) intravenously; 3) keep the horse confined to a stall; and 4) monitor its progress until the crisis is over. Methocarbamol may also be helpful in selected cases (Table 1). For horses with chronic myositis, it may be better to alter the diet to include low-quality hay and a reduced volume of high-carbohydrate feed; such horses should be placed on a diet consisting primarily of hay and high-quality, low-protein, low-carbohydrate feed.

Medical Management of Neurologic Disease

Breeding management of stallions with neurologic disease can be successful, but special precautions must be taken during collection of semen or breeding to protect the stallion, the mare, and the personnel working around the stallion. It is particularly important to have adequate footing and to ensure that the mare or phantom is properly positioned to lessen the risk of the stallion falling. Stallions with neurologic disease typically

have poor lateral stability. A mount mare that does not wiggle side-to-side is usually best for collecting semen from such stallions. If the mare does move side-to-side, providing lateral support at the stallion's hips can be helpful. A dummy mount may be better in these cases but typically elicits less vigorous thrusting than does a live mount mare.

Cervical Vertebral Malformation

Treatment of cervical vertebral malformation in adult horses can be challenging, and horses that undergo surgery may not be usable for several months.⁵ Medical treatment includes acupuncture and NSAIDs for alleviation of pain associated with breeding (Table 1). Proper management is extremely important and includes good footing, proper shoeing, proper positioning of the mare or phantom, ground collection of semen, and pharmacologic aids to ejaculation when necessary.^{1,3}

Equine Protozoal Myeloencephalitis

The management of horses with equine protozoal myeloencephalitis (EPM) is similar to that for cervical vertebral malformation; however, medical management includes the use of pyrimethamine and sulfadiazine or sulfamethoxazole administered on a daily basis for at least 60 to 90 days¹⁸ (Table 1). An occasional side effect associated with this therapy is anemia.¹⁸ Accordingly, daily oral administration of a folate supplement and vitamin E is advised.¹⁸ Recent work indicates this treatment does not significantly affect sperm production.¹⁹

Management and Pharmacologic Aids to Ejaculation

In general, management goals are to enhance sexual arousal, reduce any pain, accommodate musculoskeletal deficiencies, and maximize penile sensation¹ (see Management and Pharmacologic Aids to Facilitate Ejaculation). The management aids listed are simple, inexpensive, and easily implemented in most situations. They do require some client education in terms of developing patience and good stallion handling skills. Pharmacologic aids are aimed at boosting sexual arousal and lowering the ejaculatory threshold at the level of the genital smooth muscle.

Foot care is an important consideration in breeding stallions with musculoskeletal or neurologic problems. Some stallions will benefit greatly from corrective trimming and shoeing. It may be advisable to allow stallions that are unstable during mounting and thrusting to be left unshod to minimize the risk of injury to the mare, stallion (stepping on his pasterns or heels), and personnel. We recommend examining the feet at least every 4 to 6 weeks to ensure that they are in balance and shod

havior is sometimes mistakenly assumed to be the cause of poor breeding performance and is punished. Resulting penile injury and/or psychological inhibition of erection may exacerbate poor breeding performance.

SUMMARY OF CASES

We recently reviewed the case histories of 25 breeding stallions that were presented to the Widener Hospital, University of Pennsylvania, School of Veterinary Medicine, New Bolton Center between 1987 and 1998; the horses were presented for either routine BSEs or for evaluation of specific libido or ejaculatory dysfunction for which musculoskeletal or neurologic disease was the primary cause or a significant associated factor. A variety of breeds and performance types were included; horses ranged in age from 3 to 19 years, and all but one were experienced breeders. The duration of poor breeding performance ranged from less than 1 year to more than 10 years. Ejaculatory dysfunction was the primary problem in 24 of the stallions; the other horse's primary problem was intermittent failing during breeding. Additional problems included falling from the dummy during dismount (three stallions), reduced libido (nine stallions), and recurrent urospermia (two stallions).

The most common musculoskeletal findings were sore back (84%), lameness (64%), degenerative joint disease (40%), lameness after breeding (25%), myositis (12%; creatinine kinase range, 1000 to 44,000 IU/L [\pm 17,000]), and laminitis (12%). Aortoiliac thrombosis, cervical vertebral malformation, and EPM were diagnosed in 24%, 8%, and 4% of cases, respectively.



Figure 2A



Figure 2B

Figure 2—Stabilizing (A) the artificial vagina and (B) the hips to stop a stallion from advancing up the side of a dummy mount.

The most common medical treatment was NSAIDs (88%), followed by acupuncture (24%) and corrective shoeing (12%). Special breeding management techniques (92%) and administration of drugs to induce ejaculation (32%) were the most common management techniques employed and were necessary only during the crisis or intermittently thereafter in most cases. Special management techniques were continued indefinitely in six horses (28%).

Twenty-three (92%) of these stallions were successfully returned to breeding, and 21 of these were still breeding successfully 2 years later. The remaining two stallions were successfully completing the 1998 season when this article was written.

As mentioned, three stallions had laminitis. Stallions with this condition can typically continue breeding but require special attention to their weight, trimming, and shoeing. Their breeding performance can be expected to wax and wane with the episodes of laminitis.

Aortoiliac thrombosis was the primary factor in poor breeding performance for two stallions. Both are Standardbreds with full books of mares by artificial insemination. They continue to be successfully managed (for several years now) using a combination of controlled daily exercise to stimulate collateral circulation, proper positioning of the mare, collection of semen under ideal conditions, a thrice-weekly breeding schedule, phenylbutazone to maintain comfortable breeding, and use of pharmacologic aids to ejaculation (gonadotropin-releasing hormone, imipramine) when needed.^{8,20}

Six stallions had cervical vertebral malformation, and

three of these had markedly greater difficulty breeding immediately after being exercised. They all experienced an apparent worsening of their condition with each subsequent breeding season and typically required progressively greater assistance to continue breeding, depending on the nature of the cause and the degree of recovery.

One horse was diagnosed with EPM, which appeared to stabilize with complete or nearly complete alleviation of clinical signs. The subsequent breeding season proceeded with normal breeding behavior, semen quality, and fertility.

In several of these cases, a musculoskeletal problem was judged to be primarily manmade. For example, the first episode of falling during breeding for one stallion was associated with a change in dummy cover and footing around the dummy. Four stallions had sore backs as a result of improper positioning on the dummy mount; in all cases the stallion was allowed to advance up the side of the dummy mount during breeding so that its back was markedly curved during thrusting. Also, in each of these cases an extra long dummy was made specifically to accommodate this behavior. The habit was immediately and easily corrected by positioning the artificial vagina against the dummy at the rear (Figure 2A) and keeping the stallion squarely behind the dum-

my by having an assistant put gentle pressure on the hips of the horse (Figure 2B).

Management changes that did not address the primary musculoskeletal or neurologic problem appeared to complicate and worsen the problem in several other cases. For example, extremely vigorous manipulation of the artificial vagina in an attempt to stimulate ejaculation in one stallion (whose primary problem was most likely a sore back) created the additional complicating problems of penile and stifle abrasions and scrotal edema.

Several of the stallions were obese and unfit. Managers typically further restricted exercise as breeding problems developed on the assumption that the horse needed rest.

An interesting observation in two Quarter Horse stallions in this clinical population was the complicating factor of sore front and hind feet in association with undersized shoes designed to fashion small feet. We recommended that these stallions be either shod full or left unshod, which markedly improved breeding performance.

CONCLUSION

A reasonable percentage of cases of poor breeding performance can be attributed to primary musculoskeletal or neurologic causes. Such stallions are often presented for or with additional signs of psychologic sexual behavior dysfunction. In our experience, these signs often confound the evaluation and diagnosis of primary physical causes of poor breeding performance. Sorting out other components, such as stallion inexperience, footing, artificial vagina conditions, dummy mount, or mare factors, is often difficult. Most of the stallions diagnosed with and treated for musculoskeletal problems typically can maintain adequate performance for many years with well-designed management plans and minimal medication.^{1,2,10,17,21,26} A team approach to the evaluation and therapy for these horses is successful and time- and cost-efficient. The professional fees for evaluation and therapy of this population of referral cases at our facility was typically less than \$700, which is less than a single breeding fee for most of the stallions.

Many of the musculoskeletal and neurologic problems represented in this clinical population were not immediately evident on traditional lameness examination alone. Therefore it is our opinion that examination during breeding is important when evaluating poor breeding performance in stallions. If the clinician is inexperienced or feels uncomfortable performing such an evaluation, the services of a breeding specialist (either through an on-farm consultation or evaluation of a

videotape of the stallion during breeding) can be invaluable. Although a primary physical cause of poor breeding performance may be identified, it is important to remember that successful therapy usually requires treatment of the secondary psychological component of the problem.

Repeated examinations before and after breeding and before and after a course of analgesics are often useful. Once a treatment is determined to be effective, it is advisable to wean the medication to the least effective dose to minimize the risk of side effects.

In summary, poor breeding performance in stallions often represents a combination of musculoskeletal, neurologic, behavioral, and management factors. A common theme in the history of affected stallions is treatment of selected factors with no or limited success, often for a period of years. It is our opinion that successful evaluation and treatment include simultaneously recognizing and addressing all of these components.

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