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Take Home Message—Underlying chronic disease can have profound systemic effects in horses, and can have insidious onset with signs that go unnoticed for some time unless objective measurements can be made.

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I. INTRODUCTION

The ‘poor doer’ primarily requires definition. Is there concern over the health of the horse, or is there a real or merely perceived performance issue? Has the horse experienced any loss of overall body condition, fat stores or muscle mass? Has there been a decrease in exercise tolerance or increased difficulty in performing tasks over time? If chronic underperformance is the issue, is the horse suited for the purpose for which it is being used? A retrospective study of 348 poor performing horses has been reported.1 Of horses considered deficient during training, racing or showing, approximately three-quarters had a diagnosable condition thought responsible. Conditions included cardiac issues, dynamic airway obstruction, lameness and exertional rhabdomyolysis.

II. PERFORMANCE REDUCING SYNDROMES

A comprehensive approach to diagnosis is necessary as poor performance in any individual may be the result of multiple conditions and therefore require sophisticated diagnostic equipment.

Lameness and Neurological Conditions

Lameness and neurological deficits will be considered together, although lameness is the most common cause of diminished performance, as these conditions can and do occur concurrently. Signs may be subtle and orthopedic lameness can appear similar to neurological disease. Ruling out a musculoskeletal condition contributing to the gait deficit by regional analgesia may be useful.

Cardiac Conditions (Structural and Functional)

Structural

Audible valvular regurgitation and ventricular septal defects (VSDs) are frequently found; however, importance is variable with performance and health affected in some cases but not others. In one study, 81% of racehorses had detectable murmurs that had no association with performance.2 Although horses have considerable cardiovascular functional reserve, any compromise to maximal cardiac output will certainly have a limiting effect on strenuous exercise.

Physiological flow or ejection murmurs result from systolic passage of blood through the great vessels, and these may increase post exercise. They do not affect performance. Mitral regurgitation; however, is likely to cause clinical signs, with lesions of the valve leaflets causing increased left atrial pressure and pulmonary hypertension which diminishes performance, and structural cardiac changes. Echocardiography is necessary to formulate a prognosis for performance and longevity. Tricuspid regurgitation conversely is both very common and seldom performance limiting. In most cases this lesion is static or very slowly progressive.

Ventricular septal defects may occur in apparently normal horses; however, echocardiography is essential to establish prognosis (number and location of VSD, size and shunt characteristics, ventricular changes and valvular regurgitation). Aortic valve insufficiency develops with maturity, being slowly progressive and well tolerated by the horse. Arterial pulse character is a meaningful indication of severity of aortic valvular regurgitation. Pulmonic valve
Cardiorespiratory Problems (Coexistent Cardiac and Respiratory Conditions)

Hypoxia during exercise caused by airway compromise may predispose the horse to a clinically relevant arrhythmia. In one study, horses with cardiac anomalies had arrhythmias alone, dynamic airway collapse with concurrent arrhythmias, and diminished post exercise contractility. Cardiac evaluation may therefore be indicated in cases of upper airway collapse confirmed by resting or dynamic upper airway endoscopy.

Respiratory Conditions (Structural, Functional, Infectious and Inflammatory)

Upper airway issues are common performance-limiting conditions in all disciplines and breeds. As the upper airway is responsible for the majority of airway resistance, any narrowing has profound effects on overall airflow. Tissue vibration and turbulent airflow are responsible for noise generation, although not all horses that generate noise have performance limitations. Noise present only on inspiration implies airway collapse, whereas during both phases of respiration a fixed obstruction should be suspected.

Muscle (Myopathy, Exertional Rhabdomyolysis and Storage Diseases)

Injury, overexertion and myopathies lead to performance limitation. Myopathies may be inherited, due to metabolic abnormalities, toxic in origin, or the result of an inflammatory stimulus. Presence can be suspected with elevations of muscle enzymes at rest or post exercise challenge. Muscle...
biopsies or genetic tests are required for definitive diagnosis in most cases. Serum electrolyte levels and fractional excretion of electrolytes may be useful in some cases.

**Poor Body Condition**

**Gastrointestinal**

Body condition incompatible with feeding levels may be due to gastrointestinal problems affecting digestion. Underlying metabolic/endocrine conditions should also be considered.

Loss of weight or inability to gain weight when presented with a high quality diet that is readily consumed in adequate amounts suggests malabsorption, maldigestion or catabolism. Malabsorption and maldigestion result from inflammatory or infiltrative disease processes affecting the intestinal wall. *Lymphocytic/plasmacytic enteritis* is characterized by significant infiltration of lymphocytes and plasma cells in the lamina propria of the gastrointestinal tract. *Granulomatous enteritis* results from lymphoid and macrophage infiltration involving the lamina propria, with plasma cells and giant cells also involved. *Eosinophilic enteritis* results from diffuse inflammatory cell infiltration of the small intestinal mucosa with eosinophils and lymphocytes occurs. Eosinophilic infiltration may occur in a wide range of other organs including liver, pancreas, lungs, mesenteric lymph nodes, the skin, oral cavity, and esophagus. In these cases the term multisystemic eosinophilic epitheliotrophic disease (MEED) is used. *Intestinal lymphosarcoma* can affect horses of any breed, sex, or age. However, reports vary widely, with some studies stating alimentary lymphoma primarily affecting young horses, with other reports finding older horses are more likely to be affected. Selective IgM deficiency has also been associated. In addition to primary intestinal neoplasia, metastasis from another site, often mediastinal lymphosarcoma, is common.

Infectious agents can also cause inflammatory bowel disease (IBD). In younger horses, *Lawsonia intracellularis* is implicated. Found within the crypt epithelial cell cytoplasm, proliferative enteropathy results. Affecting foals and weanlings, *Rhodococcus equi* infection can lead to malabsorption and diarrhea secondary to mesenteric lymphadenopathy.

Catabolism results from the energy demands of an underlying disease process that may be infectious, inflammatory, or neoplastic. Chronic pain can raise stress hormone levels leading to catabolism. Underlying metabolic derangements may be suggested by body conformation (e.g. Cushing’s disease, insulin resistance).

The presence of diarrhea may indicate infectious, infiltrative or inflammatory disease processes underlying the colic signs. Chronic Salmonellosis with persistent inflammation, even if regional, may lead to intermittent abdominal pain. Medication usage (antimicrobials, NSAIDs) may cause colonic inflammation and therefore pain. IBD may lead to chronic or intermittent diarrhea with or without concurrent abdominal pain.

The presence of an inflammatory leukogram may suggest abdominal abscessation, peritonitis or adhesion formation. Disturbances in serum chemistry may reflect inflammation, dysfunction or obstructive lesions of the liver (SDH, AST, GGT, bile acids, hypoalbuminemia) or kidney (creatinine, BUN, hypoalbuminemia). Evaluation of peritoneal fluid should accompany all investigations of gastrointestinal disease as a cause of poor condition. The presence of increased protein, increased cellularity, or signs of sepsis, suggest an inflammatory or infectious process within the peritoneal cavity.

Absorption studies are useful indicators of the integrity of the small intestinal wall. Inflammatory and infiltrative disease has been shown to delay or curtail absorption of sugars. However, delayed gastric emptying may affect the absorption curve so the horse must be fasted prior to testing and any delay in gastric emptying will affect results. Glucose, while commonly used, is metabolized in the gut wall and degrades rapidly following collection in standard blood tubes. It is useful for stall-side testing. A sugar that does not naturally occur and is not metabolized to any extent, D-xylose, can also be given; however, assay is no longer readily available.

Biopsy of the rectal mucosa has been practiced as a proxy for histological lesions in the large colon. Intestinal neoplasia can in some cases be detected by this means. Other infiltrative and inflammatory diseases are similarly possibly detectable in this fashion. This is a relatively low-yield diagnostic technique that requires a degree of skill to perform.

The presence of mineral dense opacities in the large colon can be detected in smaller fasted horses. These include sand and enteroliths. The utility of radiology is constrained by the size of the horse, radiological technique available and scatter inherent in imaging a large dense area of the horse. Often the presence of enteroliths can be only suspected due to their outline against colonic gas.

Larvicidal dewormers: the presence of encysted cyathostomes (small strongyles) has been well reported as a cause of colonic inflammation. Diagnosis is challenging as the infection is not patent. As demonstrated experimentally, administration of corticosteroids (dexamethasone 0.1 mg/kg, q 24 h, IM) in conjunction with fenbendazole (10 mg/kg, q 24 h, PO) will allow maturation of encysted parasites improving susceptibility to treatment and diminish inflammatory changes.

Hepatic disease may be responsible for poor condition. Routine biochemical screening may be confirmatory although significant pathology may not be represented. Functional liver testing (bile acids) may be necessary, and biopsy required for definitive diagnosis and prognosis.

**Renal Conditions**

Both acute and chronic renal conditions may lead to decreases in body condition as a result of inappetence or catabolism.
Signs suggestive of renal disease (anemia, polyuria, polydipsia, uremic breath) prompt further investigation (urinalysis, serum creatinine, BUN, electrolytes, fractional electrolyte excretions, urinary enzymes). Investigation should include ultrasonography of both kidneys to assess size, uniformity of shape, presence of abnormal masses (tumors, cysts) and the content of the renal pelvices (sediment, calculi).

Neoplasia

Neoplasia can be difficult to diagnose in the horse due to its insidious onset in many cases. Tumor location may be obscured by abdominal size, ultrasonographic appearance may be equivocal, and if diffuse in nature biopsy may not be readily available. Rectal examination may be inconclusive unless the tumor is within reach and can be conclusively differentiated from surrounding structures. Furthermore, cytology of peritoneal fluid may be inconclusive as sarcomas do not shed cells readily. Bone marrow aspiration is essential to definitively diagnose cases of hematological neoplasia. Ultrasonographic signs include presence of aberrant tissue masses or abnormal consistency of abdominal organs, and thickening of the intestinal wall. A glucose absorption test with a delayed or depressed peak is supporting evidence for an infiltrative intestinal process consistent with lymphoid neoplasia.

USEFUL ADDRESSES AND LINKS

Kansas State University College of Veterinary Medicine
Immunology service
http://www.vet.k-state.edu/depts/dmp/service/immunology/index.htm

University of Minnesota Equine Center Neuromuscular Diagnostic Laboratory
http://www.cvm.umn.edu/umec/lab/
http://www.cvm.umn.edu/umec/lab/biopsy_instructions/home.html

REFERENCES