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Equine Endocrine Disorders

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Everyone seems to be talking about Cushing's and, more recently, 'Insulin Resistance' and 'Equine Metabolic Syndrome.' What do these mean and, more importantly, why are they important? One answer is *laminitis*. While there are other symptoms of these diseases, such as a cresty neck, a pot-bellied appearance, a long haircoat that doesn't properly shed out, and excessive drinking and urination, these tend to be more benign issues. Other more serious problems are weight loss, muscle wasting, delayed wound healing, and higher susceptibility to infection. Laminitis, though, is extremely painful and debilitating, and can be a cause for euthanasia. Therefore, prevention is key!

1. CUSHING'S DISEASE

What is Cushing's?

We've all seen the typical "Cushingoid pony": older, hairy, sway backed, and often plagued with chronic laminitis. Cushing's, also called Equine Pituitary Pars Intermedia Dysfunction (PPID), is a disease most commonly caused by a benign tumor of the pituitary gland. This gland indirectly controls the body's release of cortisol, a steroid that, when properly regulated, is critical to almost every body system. When the body can no longer "turn off" the flow of cortisol, systemic effects are seen, including the classic sign of a long haircoat (hirsutism) that does not shed out, a weakened immune system, muscle loss, abnormal fat deposits, increased thirst (average horse drinks ~20-30 L/ day, PPID can consume up to 80 L) and increased urination, lethargy, excessive and inappropriate sweating (hyperhidrosis), infertility, and laminitis.

The typical age of onset in affected horses is over 17, but it has been seen very rarely in younger horses (7 years old is the youngest horse ever diagnosed with Cushing's). While PPID can affect any breed of horse, Morgan horses and ponies seem to be at greater risk. There does not appear to be any sex predilection.

Does my horse have Cushing's?

Diagnosing Cushing's can be a challenge. There are several tests that can be run, but none are foolproof. The best indication of PPID is hirsutism (inappropriately long hair coat) in an older horse, and this alone can be used for a diagnosis. The reason for testing an older hirsute horse, though, is to facilitate treatment, monitor progression of the disease, and make appropriate adjustments as his condition changes.

However, not all horses have this classic long hair coat, so making a true diagnosis is important. Early diagnosis and treatment may prevent the progression of clinical signs and the development of life-threatening infections or laminitis.

The most common diagnostics tests for PPID include the following:

1. Dexamethasone Suppression Test (DST): While considered the gold standard for diagnosis, this test requires the use of dexamethasone, a steroid which has been known to very rarely precipitate laminitis in at-risk horses. With this test, the first of two visits is in the evening, when one blood sample is taken, after which dex is given. A second sample is taken the next day, ~17 hours later, to evaluate the change in cortisol levels.
2. Thyrotropin Releasing Hormone Stimulation Test (TRH): This test is based on a potential increase in cortisol when TRH is given. PPID horses will have an increase within 30-90

minutes, while normal horses do not. In the past, TRH was very expensive and hard to find but decreasing cost and increasing availability is making this test more popular. Current research, though, is showing it to be less accurate than previously thought.

3. Diurnal Cortisol Rhythm Assay: Cortisol is known to have a rhythm, i.e. a change from morning to night. This test is based on the observation that suspected PPID horses have a loss of this rhythm. Two samples are taken, one in the morning and one in the evening, and cortisol levels are compared. Changes of less than 30% have been deemed positive for PPID, but there are significant limitations to this test. Normal horses have been shown to have changes of less than 30%, and for this test to be most accurate, samples should be taken at 8 am and then at least 12 hours later, which is often impractical for an ambulatory vet.
4. Endogenous Plasma ACTH Concentration Test (ACTH): This test uses a single sample to measure the amount of ACTH (adrenocorticotropin) in the blood. While convenient, large variation of plasma ACTH are seen in normal horses, meaning that a sample at an odd moment in time can make a normal horse look positive and a PPID horse look negative.
5. ACTH Stimulation: A variation of the above ACTH test has been developed and is turning out to be very promising. Since ACTH levels can vary greatly throughout the day, measuring the *change* in ACTH levels after giving a drug called domperidone is proving to be an accurate test without having to give a steroid. This test's limitations include relatively high cost and difficult sample handling.

In addition, many horses with Cushing's have concurrent insulin resistance (25-75%), and these horses are especially prone to laminitis. Therefore, we strongly suggest (and routinely run) a resting insulin level to use as an indicator of your horse's prognosis.

Why is diagnosis so hard??

The pituitary gland is seasonally regulated, with greater hormone production in the fall (generally accepted as being late July through early November). This probably occurs as a natural process to prepare horses and ponies for harsh winter conditions. Unfortunately for us this makes diagnosing Cushing's far less accurate in the fall, as well as suspect in the spring transition. The new ACTH Stimulation Test has been shown to have good accuracy even in these transition periods.

Another problem is that, while we all strive for early diagnosis of Cushing's, none of our diagnostic tests are especially accurate in the early stages of the disease. Early clinical signs of PPID can be subtle, and often overlap with the typical changes seen in an aging horse, such as muscle loss, a thicker hair coat, and slowly becoming more of a "hard keeper." Experts say that the first sign they use is loss of the muscles along the back (more severe than you'd expect in a healthy aged horse) and slow or incomplete shedding of the winter coat.

So…?

Currently, research is being conducted for an easy, conclusive diagnostic test. Until then, if a horse is suspected of having PPID but has a normal test, experts recommend repeating testing in 4-6 months (but avoiding the fall). Often, though, with baseline test results, we "treat empirically," i.e. assume the disease is present, start treatment, and see what response we get (usually within a 3-6 month period).

How do we treat?

Luckily, treating Cushing's is less complicated than diagnosing it, though it does require some diligence.

1. Management: Body clipping, correction of dental abnormalities, improved nutrition, and regular hoof care help keep your horse comfortable and decrease the symptoms of Cushing's. Note that many PPID horses are also insulin resistant to some degree, so careful monitoring of diet is very important (see below)!

2. Medical Treatment: The current drug of choice is Pergolide mesylate, a dopamine agonist. This is an oral medication given daily, and titrated to a dose tailored to your horse's needs.
3. Supplements: Some nutritional supplements have been shown to help horses with PPID and insulin resistance. For example:
   -*Chromium* may improve glucose metabolism and improve insulin sensitivity.
   -*Magnesium* may help horses with obesity related laminitis.

Monitoring is very important to getting the most out of your medical therapy! Often clinical signs improve before the endocrine test results become normal. Experts agree that the goal is to treat to a level to get improved clinical signs *and* normal test results.

What is my horse's prognosis?

Once present, Cushing's is a lifelong condition. However, PPID can be effectively treated with a combination of management factors and medications. Close patient monitoring and diligent follow-up can give your horse many more years.

2. INSULIN RESISTANCE

What is insulin?

Insulin is a hormone whose actions are widespread and profound on the body. Glucose is the food that cells need to survive, and insulin's main function is enabling glucose to enter into and 'feed' the cell. The pancreas releases insulin in response to elevations in blood glucose, such as after meals. When horses become insulin resistant ("IR"), it simply means that the cells no longer respond to the insulin, therefore preventing glucose from entering the cell.

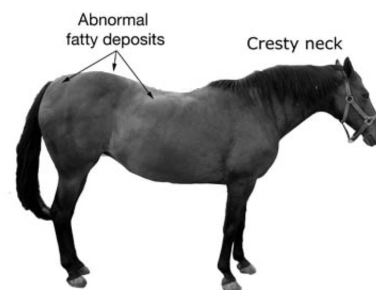
And what causes Insulin Resistance ("IR")?

Some horses are at a higher risk for IR, due to several possible factors:

1. Genetic predisposition: Morgans, Arabians, Pasos (Peruvian and Paso Fino), and ponies have a higher incidence of IR. This is most likely related to their ability to survive and thrive on limited diets and in harsher environments. However, all breeds can become insulin resistant.
2. High sugar and starch diet: A diet high in sugars and starches ("non-structural carbohydrates" /NSCs) leads to high blood glucose levels, which in turn leads to an increase in insulin. This insulin causes glucose (often too much) to flood into the cell. Once all this glucose, much of it unneeded, is in the cell, the cell has no way to let it out. What it can do, though, is make its membrane less sensitive to insulin, so next time a big dose of glucose hits the blood stream, the cell won't get flooded. Eventually, cells may lose their sensitivity to insulin to such an extent that the body can't produce enough insulin to get glucose into the cells. Then cells begin to starve, and muscle wasting results but the abnormal fatty deposits remain.
3. Inadequate activity: Horses have evolved to be active and moving the majority of the day. Being stalled or having limited activity along with the levels of grain and high quality hays that horses in previous generations did not have, precipitate a decrease in insulin sensitivity.
4. Obesity: The current thought is that "Fat is an organ," i.e. adipose tissue itself produces more than 100 substances that affect many vital body functions, including regulation of inflammation and insulin sensitivity. Note: while obesity is associated with IR, not all obese horses are IR, and not all IR horses are obese. It is simply considered a risk factor.
5. Cushing's: PPID causes high circulating levels of glucocorticoids. These steroids cause the body to lay down more adipose tissue (fat), which is directly related to a decrease in insulin sensitivity. Note: horses with Cushing's may or may not also be insulin resistant.

The pathogenesis of IR is related to which of the above categories your horse falls into, though most likely it is a combination of these factors that results in disease.

What does the typical IR horse look like?



IR horses all generally share the following issues: abnormal fatty deposits, especially along the crest of the neck, rump, and above the eyes, a voracious appetite, excessive drinking and urinating, and a severe propensity for laminitis.

IR is frequently first noted in horses between 4-12 years old and often isn't "acknowledged" and addressed until there is a laminitic episode.

Does my horse have IR?

Diagnosing insulin resistance is fairly straightforward. Given that most IR horses have high insulin levels in their blood, a single sample is measured for this insulin concentration. Insulin over 30 μU/ml is considered hyperinsulinemic and therefore diagnostic for IR. On rare occasions, this test is not sufficient, and another test (the combined glucose-insulin test) using multiple samples after giving dextrose can be performed.

So how do I treat IR (and help prevent laminitis)?

1. <u>Management</u>: the mainstay!
   A) Weight loss-- Pretty simple—**less feed, more exercise!**
      - Easy keepers can be placed on a diet of just hay and a vitamin/mineral supplement.
      - Horses without current laminitis issues should be on an exercise program. For horses that've been out of work for a long time, you should start slow, and work your way up.
      - For horses with current or previous laminitis, consult your vet (us!) to come up with an appropriate exercise program.
      - Monitor your horse's weight using a weight tape.

   B) Diet-- cut the carbohydrates (aka "sugars," "starches" "NSCs/non-structural carbs")
      - This includes pasture (see below), forage (hays), and grains/pellets ('concentrates').
      - Avoid all feeds with corn, oats, molasses, etc., which all have a very high sugar content. There are currently some very good <u>low NSC feeds</u> on the market today if your horse's weight can't be maintained on hay alone, or if you need something to "disguise" your supplements. (*See the list we've provided for suggestions)
      - Restrain yourself in doling out treats, even apples and carrots. These too are sugar rich.
      - Underweight or working IR horses that need more calories than can be provided by hay can be fed a low NSC/low starch concentrate plus beet pulp if needed, which is a low-starch way to add calories.
      - Supplementing Chromium and Magnesium to the diet has also been shown to increase insulin sensitivity.

   C) Pasture Management
      - *Pasture grass is one of the largest sources of sugar in a horse's diet.*
      - Any horse with IR should have restricted access to pasture, especially at times of rapid pasture growth, such as the spring and fall.
      - A good trick = when you start having to mow your lawn at home more, you should start holding your horse off of pasture.
      - Horses with a history of recurrent laminitic episodes should be restricted to dry-lot turnout.

- ♦ With a wide spectrum in the severity of IR, consult the vet (us!) for our turnout recommendations.

D) Proper hoof care

- ♦ Having a good relationship with your farrier is important. Letting your farrier know that your horse is insulin resistant and prone to laminitis will help him make informed decisions, as well as keep a closer eye on hoof changes associated with low-level laminitis.
- ♦ Just because your horse is IR doesn't mean he needs to be shod. Maintaining your horse with a balanced trim (re-done or re-set every 6-8 weeks), often with a short break-over, will make him less susceptible to founder.

2. Medical Treatment:
The utilization of levothyroxine, a synthetic thyroid hormone, is now being recommended for horses unable to be managed conservatively. In other words, if you're feeding practically nothing and on a good exercise program, yet still can't get your horse to lose any weight, this supplement is a good tool. Along with a controlled diet, it can be used temporarily to facilitate a decrease in body fat (and thus indirectly increases insulin sensitivity), and is then weaned away once your horse's target weight is met. It can also be used long term to directly enhance insulin sensitivity in more severely affected horses.

3. EQUINE METABOLIC SYNDROME

What is EMS?

This disorder is defined simply as a syndrome of obesity, insulin resistance, and laminitis. Unfortunately, this can be a frustrating combination—IR horses need lots more exercise, and laminitic horses need lots less! This makes dietary management all the more critical.

The regime for treating EMS is multi-factorial: strict feeding for insulin resistance, proper shoeing to control laminitis, and supplementing minerals and thyroid to facilitate weight loss. Once an EMS horse is shown to be stable (no laminitic episodes), the vet can come up with an exercise program that looks at "the big picture."

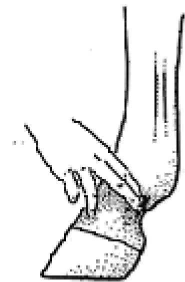
4. LAMINITIS

Why do Cushing's and Insulin Resistance cause laminitis?

This is the million-dollar question these days, and much effort and research is being put into finding a definitive answer.

What are the warning signs?

Most people can recognize the classic signs of acute laminitis: the horse has his front legs stretched out in front, is rocking back on his hind end, and is very reluctant to walk. The horse is probably showing signs of severe pain, including sweating and both a high heart and respiratory rate. There is also an extremely strong pulse felt in the artery running along the back of their pastern ('digital pulse').



Check the digital pulse on each side of the pastern.

Some other signs are less apparent but suspect for laminitis, whether an acute episode or a flare up of a chronic problem. These include constantly shifting weight from one front foot to the other (normal in the hind legs, abnormal in the front), rocking back on the hind end to walk, and especially to turn, and tenderness to walk on rocks or firm surfaces when this has not previously been an issue. A strong digital pulse can also be felt at this time.

Horses with chronic low-level laminitis or those who have previously foundered often have signs that aren't as obvious. It is especially important to recognize these more subtle signs because these horses are *extremely sensitive* to developing an acute and debilitating episode. Signs of chronic laminitis include difficulty turning or pivoting on one foot, a stiff or choppy gait in the front, and changes in hoof shape and hoof growth, such as 'founder rings' (distinctive rings in the hoof wall), widening and stretching of the white line, and divergent hoof wall growth.

If you know your horse is at risk, be aware of these signs and vigilant in noticing them. Prevention and early intervention are worth their weight in gold!

What should I do if I see these signs?

You already know what I'm going to say—Call the vet! *An episode of acute laminitis is an emergency!* Early intervention can prevent or minimize irreparable damage. Once the acute episode has been diagnosed and stabilized (or a case of chronic founder identified), the next step is to enlist the help of a knowledgeable and experienced farrier.

If you suspect your horse currently has low-level laminitis or has previous foundered, x-rays should be taken to diagnose and better manage your horse in the present, as well as in the unfortunate case of any future problem.

IN CONCLUSION

As today's horse population ages and horse owners are becoming more informed and aware, we are seeing an increase in equine endocrine disorders such as Cushing's, insulin resistance, and Equine Metabolic Syndrome. While there are still many unanswered questions about disease processes (why *my* horse?), diagnostics (can we *please* get a simple test for Cushing's?), and treatment (is there anything *else* I can do?), the veterinary community has made great strides in recognizing, treating, and preventing these serious diseases.

Low-starch/ Low-sugar/ Low-NSC feeds you can try:

Product	NSC %	Kilocalories/lb	Fed as
Purina WellSolve L/S	10 – 13 %	1150	Fed with hay
Purina WellSolve W/M	10 – 13 %	1000	Fed with hay
Triple Crown Lite	9.3 %	1150	Fed with hay
Triple Crown Senior	11.7 %	1546	Complete
Triple Crown Low Starch	13.5 %	1428	Fed with hay
Triple Crown Safe Starch Forage	9 %	1100	Forage- complete
LMF Low NSC Stage 1	8 – 11 %	1030	Fed with hay
LMF Low NSC Complete	8 – 11 %	1030	Complete
Buckeye Feeds Safe n' Easy Pelleted	12.5 %	1250	Fed with hay
Buckeye Feeds Safe n' Easy Textured	16 %	1420	Fed with hay

Beet pulp (plain, no molasses)	7-13 %	Calorie additive

Comparison:

"COB" feed:	NSC %
Corn	74 %
Oats	54 %
Barley	60 %

Carrots	39%

Visual presentation and these notes available on-line at www.tacomaequine.com