Laminitis (founder) is an inflammation of the laminae within the hoof. It can be caused by concussive forces on the foot or alternatively, it can be the result of decreased blood flow to the laminae that leads to ischemia (decreased blood flow), necrosis (tissue death), and edema (swelling) of the laminae. The cause of the decreased blood flow is not currently known, but several pathophysiologic mechanisms have been proposed. These include vasoconstriction within the digit, microthrombosis (clotting), perivascular edema (swelling around blood vessels), constriction of veins, and shunting of blood away from capillaries in the laminae.

Whatever the cause, laminitis can be a devastating disease for the horse, and an immense source of frustration for its owner and the attending veterinarian. However, more and more is being learned about the disease, and with this additional knowledge it is now possible to more effectively treat horses affected with this condition than it was just a few years ago. In spite of these advances, much remains to be learned about this disease.

**Predisposing Factors**

A number of factors can predispose horses to laminitis. High on the list is improper dietary intake. Horses that are fed too much grain in their diet are especially at risk as are horses that are suddenly changed to a high energy legume diet. Additionally, some horses are prone to develop laminitis when they are allowed access to lush pasture, especially if that pasture contains a large amount of clover.

Horses undergoing a severe systemic illness are also predisposed to developing laminitis. Illnesses that fit this category are proximal enteritis (intestinal inflammation), obstructions and strangulations of the small intestine, colitis, diarrhea, pleuropneumonia, metritis (uterine infection), and septicemia (bacteria in bloodstream) or toxemia of any origin.

Excessive weight bearing on one limb will also predispose to laminitis. This occurs in cases of severe lameness or during the convalescent period after fracture repair. Additional causes include working unshod horses on hard surfaces, allowing animals to become overweight, trimming the hooves too short and using black walnut wood shavings for bedding. Other recognized causes of laminitis include treatment with large doses of glucocorticoids, hypothyroidism, feeding of a diet containing estrogens, and allergic reactions to certain medications.
Clinical Signs

Horses with acute laminitis will invariably show some degree of lameness that can vary from slight to severe. The front feet are more often involved than the rear feet because the horse supports approximately 60% of its body weight with the front limbs. Obel grades of lameness are used to determine the severity of laminitis in a horse. These grades range from Grade 1, where the horse shifts its weight on the front feet constantly, to Grade 4, where the horse must be forced to move and would prefer to remain recumbent. Horses with Obel Grade 2 or higher walk with a characteristic gait. Their hindfeet are positioned under their body so that some of the weight can be removed from the front feet. Additionally, the horse tries to land on the heels of the front feet and does not want to put pressure on the toes. Use of hoof testers reveals that these horses have increased sensitivity over the toes of the affected feet. Finally, the arterial pulses to the front feet are increased in strength and the feet are warm to the touch. In severe cases, there is a cavitation at the coronary band.

When laminitis has existed for some time, the condition is described as chronic laminitis. These horses have founder rings on the hoof wall, long toes, overgrown heels and flat soles. Further examination of the foot reveals a widened or deteriorated white line at the toe of the foot. Recurrent foot abscesses are also common in these horses.

Diagnosis

In addition to the clinical signs described above, lateral radiographs of the affected digit(s) are essential in the diagnosis and prognosis of laminitis. These radiographs can reveal rotation or distal displacement of the third phalanx (P-3). Sometimes both of these can occur simultaneously. Radiographs will also reveal any evidence of osteomyelitis or demineralization in P-3.

Treatment

The first line of treatment is to determine the cause of the laminitis and correct this condition if possible. Initial treatment may vary depending on the cause of the laminitis but may include intravenous fluid therapy, systemic antimicrobials, intravenous dimethyl sulfoxide (DMSO), anti-inflammatory drugs, and administration of mineral oil with a nasogastric tube.

Another goal of the therapy for laminitis is to decrease the inflammation within the foot and the accompanying pain being experienced by the horse. Nonsteroidal anti-inflammatory drugs (NSAID) are most often used for this purpose. These include phenylbutazone, flunixin meglumine and ketoprofen. Intravenous DMSO also has anti-inflammatory properties.

A major objective in the therapeutic plan is to improve blood flow to the laminae of the affected feet. Various drugs have been used in an attempt to accomplish this purpose. These include
acetylpromazine, phenoxybenzamine, isoxsuprine, pentoxifylline, aspirin and heparin. Varying
degrees of success have been experienced for each of these drugs.

More recently topical nitroglycerin and intravenous L-arginine have been used to promote
vasodilation and thus blood flow to the feet of affected horses. At this point, not enough horses
have been treated with these newer agents to draw any firm conclusions regarding their efficacy in
laminitis cases resulting from the different causes. However, some encouraging results have been
achieved in horses with grass-induced acute laminitis. Although there are no controlled studies
available to date that have evaluated these treatments in horses with naturally acquired laminitis,
numerous testimonials suggest a beneficial effect.

The therapeutic plan must also include some attempt to
prevent or limit further rotation and/or sinking of P-3. This is
accomplished by maintaining frog support through the use of
tomography or inferior check ligament desmotomy has been
performed on laminitic horses in an attempt to accomplish
this goal as has dorsal hoof wall resection. Which of these
methods is used is primarily a function of the experiences of
the veterinarian attending the horse. If severe destruction of
the laminae has occurred, there is no known method to
prevent rotation or distal displacement of P-3.

Another therapeutic goal is to prevent and/or treat abscesses
in the feet of a laminitic horse. Abscesses are more prone to
occur in the feet of a horse that has had rotation or distal
displacement of P-3. Dorsal hoof wall resection is effective in
preventing these abscesses or treating them once they have
occurred. However, many owners do not like the appearance
of the foot after dorsal hoof wall resection. In that case, the
same goal can be accomplished by drilling a series of holes
in the dorsal hoof wall to allow serum and other fluids to
escape from the hoof capsule. These holes can then be taped over or filled with sealant to prevent
their being a route for transfer of foreign material into the foot.

Special care must be given to the foot of a horse once it has passed the initial stages of acute
laminitis. This includes proper trimming and/or shoeing by an accomplished farrier. For this part of
the therapy, a team approach between the veterinarian and the farrier is most rewarding. Feeding
of methionine and biotin supplements has been recommended to promote more rapid growth of
healthy hoof tissue.

Good nursing care is essential for horses with chronic laminitis. Many of these horses will be
recumbent for many hours per day, which leads to the formation of skin abrasions and decubital
ulcers that must be addressed medically. Recumbent horses also must be encouraged to eat and
drink as many will not rise to do so on their own. If their feet have abscessed, then foot soaks
must be administered and foot bandages must be changed on a frequent basis. Finally, these
horses should be kept in a stall deeply bedded with a soft material such as wood shavings.
Prognosis

Establishing an accurate prognosis for a horse with laminitis has historically been extremely difficult because some horses respond favorably to therapy while others do not. Therefore, it is best to give a guarded prognosis. Factors affecting the eventual outcome of the horse include duration of acute laminitis, number of feet affected, amount of rotation or sinking of P-3, secondary abscessation, osteomyelitis of P-3 and the ability of owners to provide appropriate nursing care. Many of these horses require several weeks to months of intensive nursing care and can require treatment for their lifetime.

Future Considerations

At one time, it was believed that laminitis was a hopeless disease to treat and that the best course was to euthanatize the horse. This outlook is now beginning to change. Newer methods of treatment are showing encouraging results, and some horses are now being salvaged that would have been euthanatized previously. Hopefully, additional knowledge will allow even more horses to be successfully treated for this disease.