Treatment of Complications of Laminitis

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1. Introduction

The complications that will primarily be covered in this lecture are those dealing with injury and sepsis to the sole and subsolear tissue in the acute and chronic laminitis case. Whereas "acute" has been commonly used to describe the laminitis case in which displacement of the distal phalanx is not detectable by radiographs, it is being used here as a temporal term indicating that the disease has only been occurring for several days. Similarly, the term "chronic" is used by the author to describe the laminitis case in which foot pathology related to the original laminitis event (or recurring events) has been ongoing for several weeks to years.

2. The Acute Case

The most common complications dealt with in laminitis cases are those related to excessive solear pressure due to a rapid displacement of the distal phalanx. The distally displacing distal phalanx not only puts excessive pressure on the keratinized sole, but also disrupts the underlying dermis, which contains the vascular supply for the solear epithelium and the innervation for the sole. In the severe, acute case of laminitis (most commonly either sepsis related or supporting limb laminitis), the distal phalanx may perforate the sole, most commonly immediately cranial to the apex of the frog. However, in cases of asymmetrical distal displacement of the distal phalanx (commonly termed "medial sinking" due to the fact that distal displacement of the medial aspect is much more common than the lateral aspect), the sole overlying the displaced aspect of the distal phalanx (commonly the medial sole) may be affected between the frog and hoof wall. In the acute case of laminitis, in which a rapid descent of the distal phalanx has resulted in perforation of the sole, both the perforation itself and the immense lamellar instability that led to the perforation are of great concern for treatment. The major concerns are attempting to neutralize the forces leading to the acute perforation, while also treating the injured region of the sole. A lateral and dorsopalmar radiograph are essential to assess the position of the distal phalanx. Solear perforation at the toe most commonly occurs with some degree of capsular rotation (divergence of the dorsal surface of the distal phalanx from the hoof wall) of the distal phalanx evident on radiographs. If phalangeal rotation (divergence of the dorsal surface of the distal phalanx from the normal phalangeal axis resulting in flexion of the distal interphalangeal joint) is also present, deep digital flexor tenotomy is commonly performed (more commonly in chronic cases) to decrease the tension the deep flexor tendon applies to the palmar/

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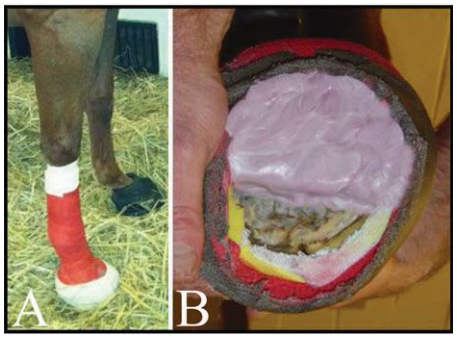

Fig. 1. Open sole cast application for acute perforation of the sole to improve weight bearing (A). Note that the foot impression material can be placed in unaffected sole and frog for support while affected regions can be left exposed for assessment and treatment (B).

plantar aspect of the distal phalanx. However, even in the case of capsular rotation with minimal phalangeal rotation, deep digital flexor tenotomy anecdotally helps some horses. Inferior check ligament desmotomy has been described as an alternative to deep digital flexor tenotomy both anecdotally and in case reports, but, to the author's knowledge, no in-depth study has been published on its efficacy for treatment of laminitis. Although many veterinarians maintain the foot in temporary shoes[a] (e.g., wooden shoe applied with screws and/or cast tape) in these cases, due to the marked instability of the lamellae in many of these acute cases, it is possible that therapeutic shoeing may not provide enough protection from the forces to which this weakened tissue is exposed. Both open sole half limb casts (Fig. 1) and foot casts have been applied in attempt to neutralize as much of the downward force as possible.[1]

3. The Chronic Case

Solear disease is a common complication in the animal with chronic laminitis also, and in the author's experience, is the most common cause of foot pain (vs laminar pain) in the long-term case of laminitis. It is not uncommon for the lamellae to be stable in the chronic case, but for constant injury to the sole and dorsodistal aspect of the distal phalanx to be causing pain due to both an abnormal orientation of the distal phalanx and the commonly thinned/compressed sole. With regard to solear disease in the intact sole (i.e., not perforated), the injury can range from subsolear bruising to seroma and/or abscess formation.

The most common abnormalities associated with the distal phalanx (DP) in the chronic cases is an aseptic pedal osteitis, where the solear margin of the displaced aspect of the DP (most commonly the toe region), seems severely mottled (Fig. 2B) due to constant bruising and inflammation. Given that these bony changes are commonly present in the chronic case with subsolear abscess formation, the clinician needs to determine whether there is actually a septic pedal osteitis present before considering curetting the DP. For septic osteitis to be present, a focal region of severe bony lysis should be identifiable on radiographs (Fig. 3A). If there is only a general "moth-eaten" appearance to the solear margin of the DP (Fig. 2), it is advisable to not curette the DP and concentrate on treating the subsolear sepsis.

When assessing the solear region, it can be difficult with an intact sole to determine whether there is an underlying seroma or abscess. It is always advisable to obtain radiographs (three views: lateral, dorsopalmar [0 degree], and 60 degree dorsopalmar/solear margin) before exploring the sole to 1) determine the position of the distal phalanx (i.e., is it immediately

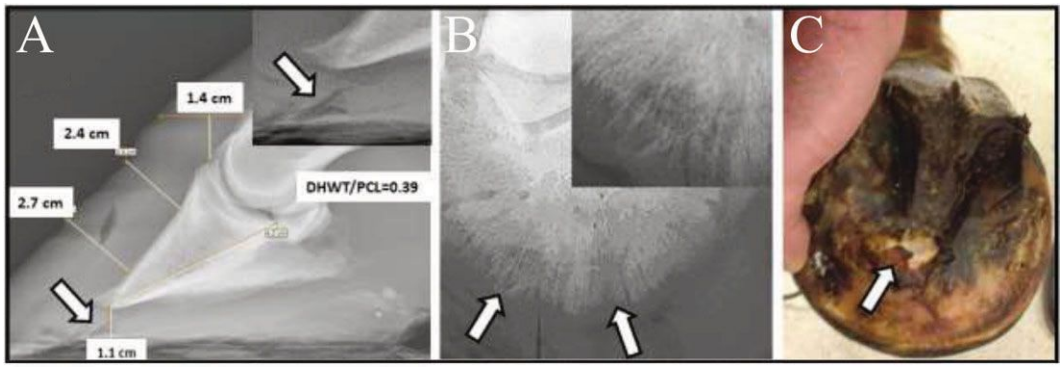

Fig. 2. A horse presented with a 7-day history of severe bilateral forelimb lameness with draining tracts on the solear surfaces of both feet. Radiographic measurements indicated a chronic distal displacement of the distal phalanx, and a focal lucency in the solear tissue immediately distal to the dorsodistal aspect of the distal phalanx (A, arrows in main image and magnified inset). Due to the somewhat diffuse nature to the bone resorption on the solear margin (B, arrows in main image, magnified inset), the bone was not curetted (deemed to most likely be aseptic resorption/"osteitis") and the feet treated only with soaks in a commercial chlorine solution until dry (C, arrow), at which time the lameness resolved.

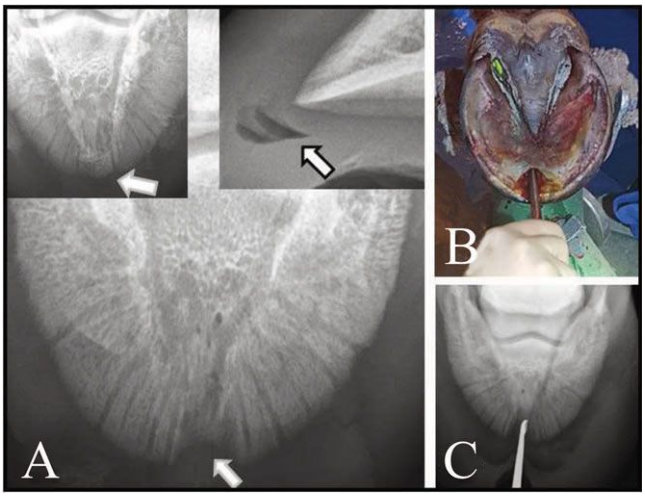

Fig. 3. A focal lucency noted on the dorsal aspect of the distal phalanx (A, arrow) in a chronic laminitis case with recurrent abscesses rupturing at the coronary band. Note the lack of the same lucency on the opposite foot (A, left inset, arrow) indicating that this is not normal anatomy for this horse (i.e., a crena), and the presence of gas lucency only at the toe (A, right inset, arrow) again indicating this region to be affected. The affected bone was curetted in the standing horse through an existing defect in the sole (B) under radiographic guidance (C).

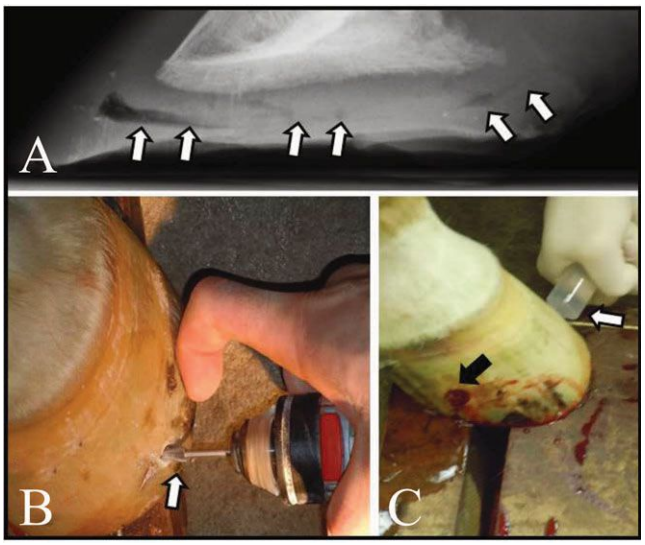

Fig. 4. Note the presence of gas density throughout the sole between the distal phalanx and ground surface of the sole (A, arrows) indicating an extensive (commonly termed "underrun") abscess. The abscess cavity was accessed through the hoof wall (B) to obtain a dorsal access/drainage point, leaving the sole intact. The abscess could then be flushed (C, white arrow) under pressure with saturated Epsom salts (C, fluid can be seen exiting an opening on the opposite hoof wall through which a sequestrum was removed (black arrow).

above the solear surface), 2) assess for existing abscesses, and 3) assess the health of the margin of the distal phalanx. On radiographs, the abscess cavity usually cannot be visualized until drained (the purulent material is a similar density as tissue). If abscesses have established drainage at some point (commonly through "graveling out"/exiting at the coronary band), gas can commonly be observed on radiographs (white arrows in insets in Figs. 2A and 3A [right inset], and white arrows in Fig. 4A).

The primary goal of the author in cases of abscessation is to not only remove all offending debris and organisms, but to remove all moisture from the affected area (i.e., result in a "dry" lesion). It is common in chronic laminitis cases to have an extensive area of the sole affected by an abscess (Fig. 4A). In these cases, it is unlikely that immersion of the foot (i.e., in Epsom salts) will satisfactorily reach all areas in these cases or will result in removal of all moisture from the affected area. In the author's opinion, it is important to establish multiple small openings to allow both drainage and active lavage of the abscess. If there is a thinned area which, upon palpation, is suspected of containing fluid (i.e., either seroma or abscess), the author will make a small entry (approximately 3–4 mm), assess any exudate, and probe the affected area to determine the size of seroma or abscess (a nerve block may be necessary to provide analgesia for probing the region). Another similar-sized opening can be made at a distant margin of the undermined pocket, and a syringe tip, catheter, or teat cannula inserted to flush with saturated Epsom salts (300–400 mL) once to twice a day. If there is a large undermined area affected by an abscess which is apparent on radiographs (Fig. 4A) but the sole is still intact, the abscess can be accessed through the hoof wall (Fig. 4, B and C). The advantages of accessing through the hoof wall are 1) the ease in protecting the openings (i.e., with tape), 2) no pressure will be placed on the region during weight bearing, and 3) extensive shoeing (i.e., with a pad or treatment plate) are not necessary to protect the area. With slightly larger openings to the area, the additional soaking of the affected foot/feet in commercial chlorine-related compounds[b], more commonly used for white line disease, can result in a rapid response. These compounds kill the offending organisms while also drying out the affected areas (a critical aspect of treating the affected foot), providing a much more rapid response than traditional foot soaks. In many chronic cases with subsolear abscessation in which a solear perforation is already present, the use of soaks with a chlorine compound are commonly all that is necessary. If the horse is severely lame on the one digit in the laminitis case, there is always a concern that laminitis may recur in the opposite limb now bearing the majority of the weight. In these cases, an open sole cast (Fig. 1) can be used, allowing lavage of the affected area while usually improving the lameness due to the support the cast provides.

In addition to approaching the subsolear injury directly, it is also important to address the abnor-

Fig. 5. Application of a plastic shoe[a] in a case being treated for sequestrum removal from the distal phalanx.

malities in the digit that predisposed the sole to injury. This will include therapeutic trimming and shoeing, and possibly surgical techniques such as deep digital flexor tenotomy. These techniques have been recently covered at AAEP and will not be covered in detail in this presentation.

In the horse in which subsolear abscessation recurs in the same general region (either with solar drainage or rupturing/"gravelling" at the coronary band) even with the above therapies, septic pedal osteitis should be suspected. In addition to a focal lucency in the solar margin of the distal phalanx (Fig. 3), one or more bony fragments may be visible within the lucency. Surgical debridement of the region is required in these cases. Although easier to perform under general anesthesia, most cases can be treated in the standing horse with local anesthesia. If the surgery is to be performed standing, the author commonly has the foot scrubbed then soaked in a commercial chlorine compound[a] immediately prior to surgery. If there is a drainage tract in the foot, either a curette or probe is placed in the tract and radiographs are taken to gauge the depth and angle at which the distal phalanx should be curetted. Similar to that described for subsolear abscesses, if the sole is intact, it is preferable to approach the sequestrum through the hoof wall (Figs. 4, B and C). This is again a large advantage due to ease of access for further therapy (either irrigation or application of antiseptic-soaked gauze sponge), and ease of protection (only tape needed vs a removeable shoe or treatment plate). The other advantage is extremely rapid healing.

If a solear defect is present and needs to be protected between treatments, the author prefers taping on a temporary plastic shoe, most commonly using a commercial shoe[a] and, taking one of the wedges off the shoe (Fig. 5). For many veterinarians and owners, it is easier to remove (and reapply) the taped-on shoe daily than to work with the bolts on a treatment plate.

Acknowledgments

Declaration of Ethics

The Author has adhered to the Principles of Veterinary Medical Ethics of the AVMA.

Conflict of Interest

The Author has no conflicts of interest.

Reference and Footnotes

1. Bras RJ, Belknap JK. The use of casts in equine laminitis. In: Belknap JK, Geor RJ, eds. Equine laminitis. Ames, IA: Wiley Blackwell; 2017; 377–381.

[a]NANRIC Ultimate, NANRIC, Lawrenceburg, KY 40342.
[b]CleanTraxi, Equine Technologies, Inc., Sudbury, MA 01776.