Surgical Management of Penetrating Wounds to the Equine Foot

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Penetrating wounds involving the foot of the horse can pose a diagnostic and treatment challenge because of the serious nature of this type of injury. Although superficial puncture wounds that do not penetrate corium are many times successfully managed conservatively with local drainage and medical management, deep puncture wounds of the foot require more aggressive surgical debridement for a successful outcome. Author’s address: Equine Referral Service, P.O. Box 9083, Rancho Santa Fe, CA 92067. © 1999 AAEP.

1. Introduction
There is no predilection for puncture wounds of the foot in horses based on age, breed, sex, or type of activity that the affected horse is involved in. Careful inspection of the foot for a puncture tract is essential if a foreign body is not present. Penetrating wounds of the coronary band can be overlooked if the hair is long in this region or if wound drainage or local swelling is not yet present. Local digital pressure around the coronary band is very helpful in localizing a coronary band puncture wound. Trimming the bottom of the foot and paring away superficial layers of horny tissue will usually reveal a puncture tract, especially if it is more than a few hours old.

2. Diagnostic Radiography
A radiographic study of the foot should be done to help confirm the findings of the physical examination. At least two views taken at right angles to each other should be taken with the probe in place to give the best three-dimensional information. A contrast study can yield similar information by injecting the contrast agent into the puncture tract. A radiographic examination without a concurrent physical examination may fail to reveal the presence of nonmetallic foreign bodies such as wood or glass. The lateromedial and palmaroproximal-palmarodistal oblique projections are most useful for identifying abnormalities of the navicular bursa.

3. Surgical Debridement
Deep puncture wounds of the foot that penetrate the corium require surgical debridement. For punctures in the toe and quarter regions, a hoof knife should be used to remove at least 1–2 cm of the sole around the site of the puncture. The horny tissue of the bar should also be removed when the puncture is in the heel region. When the wound penetrates the solar corium but does not contact the distal phalanx, the affected corium can be excised with a scalpel. If there is osteomyelitis of the distal phalanx, abnormal bone should be exposed by sharp dissection and removed by curettage.

For wounds involving the frog and its sulci, the cornified tissue overlying this area and the adjacent bar must be removed. A sterile probe should be inserted into the wound so that the entire tract can...
be identified for removal during surgery. If the
wound involves only the digital cushion, a tapered
core of tissue that includes the tract should be
removed with a scalpel.

Wounds penetrating the deep digital flexor tendon
should be approached in a similar manner, because
they usually enter the foot through the frog or
adjacent sulci. The central one-half to two-thirds
of the frog should be removed by sharp dissection
extending through the digital cushion to expose the
deep digital flexor tendon. The flexor tendon can be
distinguished from the digital cushion by its firm-
ness and regular orientation of fibers. If the probe
does not penetrate the tendon or if there is any
question as to whether the navicular bursa was
penetrated, an incision in the long axis of the deep
digital flexor tendon should be made, separating tendon
fibers to allow exposure of deeper structures. If a
probe is not used, the surface of the tendon should be
examined for an area of discoloration and the affected
section of tendon removed by sharp dissection. All
necrotic or devitalized tendon should be removed, and
sampling for bacterial culture and antibiotic sensitiv-
ity testing should be performed. Curettage of the
cartilage and subchondral bone should remove any
necrotic and infected tissue.

If more than 12 h has elapsed since the injury
occurred, the navicular bursa may be filled with
fibrin clots that have walled off exudate and interfere
with drainage. To rule out this possibility, a physi-
ological solution can be used to irrigate the bursa
under pressure, thus helping to free the fibrin clots
and allowing drainage of exudate.

After the navicular bursa has been exposed, the
distal ligament of the navicular bone should be
evaluated. If the ligament is involved, there is a
possibility that the coffin joint may also contain
septic exudate. This can be determined by introduc-
ing a needle into the coffin joint proximal to the
coronary band and evaluating the synovial fluid by
observation and cytological examination. Another
means of determining involvement of the coffin joint
is by using a physiological solution to distend the
joint via the arthrocentesis site. If fluid leaks from
an opening in the navicular bursa or the synovial
cytology is abnormal, concurrent lavage of the coffin
joint is warranted. If there is difficulty determining
whether the coffin joint is involved, joint lavage with
one or 2 l of a physiological solution should be
performed as a precautionary measure.

The navicular bursa and the digital sheath do not
normally communicate; however, when infected, the membrane that separates them may
break down. When there is distention of the digital
sheath, lavage is recommended.

After debridement and lavage are complete, gauze
sponges soaked with povidone-iodine solution should
be tightly packed into the wound, and a waterproof
foot bandage should be applied before the tourniquet
is released. This will assist with local hemostasis
and help prevent the formation of excessive local
tissue edema.

In some chronic cases, the amount of deep digital
flexor tendon involved is enough to cause concern
over removing too much of the affected tendon and
predisposing it to rupture. However, if necrotic
tendon tissue is not debrided, it will continue to act
as a nidus for ongoing infection and result in a
wound that will not heal. The same concerns are
valid for the distal ligament of the navicular bone.

If the flexor surface of the navicular bone has been
traumatized and subchondral bone is exposed or if
the injury is chronic with established infection of
bone as well as adjacent soft tissues, the use of an
autogenous cancellous bone graft is warranted. The
graft should be packed tightly into the tendon
and bony defect. This will allow a scaffold for new
blood vessels to invade the area and effectively
enhance the local immune system’s chances of resolv-
ing the local infection.

Puncture wounds at the level of the coronary band
can be managed in similar fashion to those just
described. There is usually a small separation of
the coronary band adjacent to the puncture. At this
point, the hoof wall should be removed with a hoof
knife. A blunt probe and intraoperative radiographs
aid in locating the deep aspect of the wound. Any
undermined hoof wall must be removed.

4. Summary
Horses treated with appropriate surgical debride-
ment within 4 days after the injury have a better
chance at a successful outcome than horses not receiv-
ing appropriate treatment by this time. Horses that
have a hind leg affected are more likely to return to
their previous activities. When the deep flexor ten-
don is punctured or the structures surrounding the
navicular bursa are involved, the prognosis is more
guarded.

The most common mistake made in the manage-
ment of this type of injury is a conservative approach
to the treatment of the puncture wound, especially if
it involves the deep flexor tendon or the structures
adjacent to the navicular bursa. Deep puncture
wounds of the foot should be handled on an emer-
gency basis with appropriate diagnostic imaging to
confirm the extent of the injury followed by surgical
debridement of affected tissues. Adjunct medical
management with systemic antiinflammatory and an-
timicrobial agents along with appropriate local wound
management is the preferred method of manage-
ment for this type of injury. Conservative manage-
ment can be successfully used to manage this type of
injury when superficial; however, when the puncture
wound is deep, medical management is only tempo-
rarily effective. Delay of surgical debridement and
drainage of the wound may adversely affect the
prognosis.