Transection of the lateral and long digital extensor tendons in racehorses

CRB Elliott, JR Vasey and TM Russell*

Objective To report on the outcome of wounds to the hindlimb of racehorses, and horses with the intended use of racing, where both the long digital extensor (LoDE) and lateral digital extensor (LaDE) tendons had been completely transected.

Design Retrospective case series.

Methods Records of all horses admitted with hindlimb lacerations between 2002 and 2009 were examined for cases where both the LoDE and LaDE tendons in the hindlimb had been severed, and specifically in horses intended to be used for racing. Outcome was assessed via retrieval of race records and via telephone questioning of the owners.

Results In total, 589 records were retrieved and 34 horses met the inclusion criteria: 26 horses (76%) had proximal wounds that severed both the LoDE and LaDE tendons and 8 (24%) had more distal wounds, where the tendons were severed below the point at which they join; 14 horses (41%) were euthanased prior to discharge. Of the 20 horses discharged, 6 (30%) raced and 12 (60%) did not; 2 (10%) of the treated horses, both Thoroughbred colts, were in race training and showing no signs of lameness at the time of the study. Of the 34 horses presented for treatment, 18% went on to race.

Conclusions The prognosis for racing after transection of both hindlimb extensor tendons is poor. Clinicians may wish to consider these findings when formulating advice for clients regarding this injury in racehorses.

Keywords extensor tendons; laceration; racehorses

Abbreviations LaDE, lateral digital extensor; LoDE, long digital extensor tendon

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Follow-up information was obtained a minimum of 8 months and a maximum of 8 years post-injury, by telephone conversation with owners and/or trainers. Racing history was verified via access to the Australian Stud Book (Australian Jockey Club, Randwick, New South Wales, Australia) and Harness Racing Australia (Harness Racing Australia Inc., Melbourne, Victoria, Australia) official records. Wounds were assessed on presentation by a board-certified surgeon for extent

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The long digital extensor (LoDE) tendon and the lateral digital extensor (LaDE) extensor tendon course over the dorsal and dorsolateral aspects of the tarsus respectively, joining together on the dorsal aspect of the proximal third of the third metatarsus, to insert onto the extensor process of the distal phalanx.3 The extensor tendons of the hindlimb have no primary weight-bearing function, with their main role being passive resistance to flexion of the coffin and pastern joints.4 Wounds involving transection of the hindlimb extensor tendons are more common than those involving the forelimb extensor tendons.5–8 Despite often having extensive soft tissue damage, the degree of lameness with these injuries is usually minimal.9 Complete transection of both the LoDE and LaDE, or transection below where the two join, results in a characteristic dorsal ‘flick’ of the foot towards the end of the forward swing phase of the stride, just prior to placement of the hoof. ‘Knuckling’ over onto the dorsal aspect of the fetlock is usually seen in wounds where all extensor structures have been severed; however, some proximal wounds may have enough peritendinous fascial attachments present to prevent this from occurring.5 Knuckling may also not be seen in old wounds where extensive swelling and fibrous tissue development has already occurred, preventing the gliding mechanism of the tendons from functioning. Several retrospective studies investigating extensor tendon lacerations have demonstrated that the prognosis for return to soundness is favourable (62.5–82%), with a fair prognosis for return to athletic performance (48–59.7%).5–8 However, those studies were conducted in either mixed-use horse populations or populations comprising almost entirely sport horses.5–8 There has not been a retrospective study investigating this type of injury in racehorses.

We hypothesised that racehorses would have less likelihood of returning to a useful level of performance compared with recreational horses, and that the prognosis in these animals may be more guarded than that reported for other disciplines.

Materials and methods

The medical records of all horses that were presented to Goulburn Valley Equine Hospital between January 2002 and December 2009 were reviewed. Cases included in the study were those involving wounds to the dorsal aspect of the metatarsus with transection of both the LoDE and LaDE or transection below the point at which the two extensor tendons join. Only Thoroughbred and Standardbred horses, racing or being prepared for a racing career at the time of injury, were included. Data obtained included signalment, wound severity, structures involved, time to presentation, treatment methods and complications.

Follow-up information was obtained a minimum of 8 months and a maximum of 8 years post-injury, by telephone conversation with owners and/or trainers. Racing history was verified via access to the Australian Stud Book (Australian Jockey Club, Randwick, New South Wales, Australia) and Harness Racing Australia (Harness Racing Australia Inc., Melbourne, Victoria, Australia) official records. Wounds were assessed on presentation by a board-certified surgeon for extent
of soft tissue damage, degree of contamination and for evidence of compromised distal limb perfusion. Distal limb perfusion was assessed by a combination of palpating the digital pulse (present or absent), colour-flow Doppler (present or absent) and subjective assessment of distal limb warmth. The extent of any soft tissue damage was categorised by a board-certified surgeon as minimal, moderate or severe and the degree of contamination also categorised as minimal, moderate or severe. The time to presentation was categorised as less than 6 h, between 6 and 12 h, between 12 and 24 h, and more than 24 h.

All horses received the same treatment protocol. After being placed under general anaesthesia the wounds were aseptically prepared and irrigated with sterile Hartmann’s solution to remove gross contamination. Sharp debridement was used to remove necrotic and unviable tissue. A Water Pik (Water Pik Inc., Fort Collins, CO, USA) was also used to aid in debridement. Skin wounds were sutured using tension-relieving suture patterns. A sterile, non-adhesive primary dressing was placed over the wound and a half-limb bandage cast was applied. This was made by applying two layers of cotton wool to the skin and held in place using an elasticised bandage (Vet Wrap, 3M Corp., St Paul, MN, USA). A layer of Gypsona (BSN Medical, Mount Waverly, VIC, Australia) was applied over this, and then 4–6 rolls of 3–5-inch synthetic casting tape (DynaCast, Smith and Nephew, Mount Waverly, VIC, Australia) were applied, extending from the proximal metatarsus and including the hoof. The limb was cast in a normal weight-bearing position. All horses received prophylactic antibiotics of procaine penicillin (22,000 IU/kg IM twice daily; Bomacillin SA, Bomac, Horsby, NSW, Australia) and gentamicin sulfate (6.6 mg/kg IV once daily; Gentam 100, Troy Laboratories, Smithfield, NSW, Australia) for a period of 5 days, together with 10 days of phenylbutazone (2.2 mg/kg PO once daily; Bute Paste, Ranvet, Botany, NSW, Australia).

Statistical analysis

Data were analysed using the statistical program package WinPepi version 10.8 (School of Public Health and Community Medicine, Hebrew University, Jerusalem, Israel). Fisher’s exact tests were used to assess associations between the binary outcome variable (euthanased or treated; raced or did not race) and time to presentation, degree of soft tissue damage and degree of wound contamination. Fisher’s exact test was used to assess the exposure variable of breed and the outcome variable of raced or did not race. Values were deemed statistically significant when the two-tailed probability was $P \leq 0.05$.

Results

We retrieved 59 cases of wounds to the dorsal aspect of the cannon; 19 were not racehorses and were excluded from the study, as were 6 cases of lacerations to either the LoDE or LaDE individually. Of the 34 remaining animals, 20 (59%) were Thoroughbreds and 14 (41%) were Standardbreds: 15 (44%) fillies, 15 (44%) colts and 4 (12%) geldings. Of these, 26 (76%) horses had proximal wounds that transected both the LoDE and LaDE tendons and 8 (24%) had distal wounds with transection below the point at which the two extensor tendons join. The mean age of horses was 2.1 years and the median age was 1 year (range, 3 weeks–6 years).

The majority of wounds presented had either a moderate degree of soft tissue damage (44%) or a severe degree of soft tissue damage (41%). More than 50% of wounds presented were assessed as having a moderate degree of contamination. Time to presentation was relatively evenly spread across the four time categories (Table 1).

Of the 34 horses, 14 (41%) were euthanased prior to discharge: 6 fillies (43%), 6 colts (43%) and 2 geldings (14%); 13 (93%) of the horses euthanased had severed both the LoDE and LaDE tendons. Only one of the euthanased horses (7%) had severed the tendons below the point at which they join. The mean and median age of the euthanased horses was 1.7 years and 1 year, respectively (range, 3 months–4 years). Ten (29%) horses were euthanased on presentation as a result of factors that included the degree of soft tissue damage, the degree of wound contamination and compromised distal limb perfusion presenting as a cold distal limb, lack of palpable digital pulse and/or a lack of visible blood flow on Doppler ultrasound. Economic and time constraints were also contributing factors. Four horses (12%) were deemed to have questionable distal limb perfusion on presentation and so were bandaged and placed in temporary splints and re-evaluated 24 h later. All four horses were euthanased after re-evaluation showed them to have compromised distal limb perfusion.

The majority of euthanased horses had a severe degree of soft tissue damage (64%), with half having moderately contaminated wounds; 43% of the euthanased horses presented between 6 and less than 12 h after laceration (43%) (Table 1).

Of the 20 horses treated, there were 9 (45%) fillies, 9 (45%) colts and 2 (10%) geldings; 13 horses (65%) had severed both the LoDE and LaDE tendons and 7 (35%) had severed the two extensor tendons below the point at which they join. Mean and median ages of the horses treated were 2.4 and 1.5 years, respectively (range, 3 weeks–6 years). All treated horses were deemed to have adequate distal limb perfusion on presentation.

Over half of the treated horses had wounds with a moderate degree of soft tissue damage. The majority (60%) of these wounds were moderately contaminated, with time to presentation evenly spread across the time categories (Table 1).

<table>
<thead>
<tr>
<th>Degree of soft tissue damage</th>
<th>Euthanased (n = 14)</th>
<th>Treated (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>5</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>9</td>
<td>4</td>
<td>0.016</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of contamination</th>
<th>Euthanased (n = 14)</th>
<th>Treated (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>7</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>5</td>
<td>5</td>
<td>0.89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time to presentation (h)</th>
<th>Euthanased (n = 14)</th>
<th>Treated (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6–12</td>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>12–24</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>&gt;24</td>
<td>1</td>
<td>4</td>
<td>0.66</td>
</tr>
</tbody>
</table>
Statistical analysis showed that horses that were euthanased on presentation had a higher wound severity category than the horses that were treated (P = 0.016). The degree of wound contamination (P = 0.89) and time to presentation (P = 0.66) did not significantly correlate with outcome (Table 1).

Follow-up information was obtained for all 20 treated horses. All horses were alive at the time of the study. Six horses (30%) went on to race, with an average of 8.2 starts and 0.83 wins (3 (50%) fillies, 2 (33%) colts and 1 (17%) gelding). Mean and median ages at the time of treatment were 1.3 years and 1 year, respectively. Two (33%) were Thoroughbred and four (67%) were Standardbred. Twelve horses (60%) did not subsequently race (6 (50%) fillies, 5 (42%) colts and 1 (8%) gelding). The mean and median ages of these horses at the time of treatment were 3 years and 1.5 years, respectively. Eight (67%) were Thoroughbred and four (33%) were Standardbred. Two of the treated horses, both Thoroughbred colts, were in training and showing no signs of lameness at time of the study. Of the Thoroughbred horses treated, 17% went on to race and 50% of the treated Standardbreds went on to race. This difference was not statistically significant (P = 0.16).

Four of the 20 horses (2 fillies, 1 colt, 1 gelding) had raced before the injury, with an average of 20.5 starts and 4.25 wins. None returned to a racing career. Mean and median ages at the time of treatment were 5.5 and 6 years, respectively.

Of the 12 horses that did not race, 42% had severe soft tissue damage and 42% having moderately contaminated wounds.

Of the horses that raced, 50% had a moderate degree of soft tissue damage and 50% had a moderate degree of contamination.

One of the horses currently in training had a wound with severe soft tissue damage and mild contamination, and the other horse currently in training had moderate soft tissue damage with moderate wound contamination.

The chance of racing did not significantly differ between wound severity category (P > 0.99) or degree of wound contamination (P > 0.99) in the 20 horses treated (Table 2).

Of the 34 horses initially presented, 18% went on to race.

### Table 2. Wound classification of treated racehorses

<table>
<thead>
<tr>
<th>Degree of soft tissue damage</th>
<th>Raced (n = 6)</th>
<th>Did not race (n = 12)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>2</td>
<td>5</td>
<td>0.99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree of contamination</th>
<th>Raced (n = 6)</th>
<th>Did not race (n = 12)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>2</td>
<td>3</td>
<td></td>
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<tr>
<td>Moderate</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
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<td>1</td>
<td>4</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Discussion

The results of this study suggest that a poor prognosis for racing soundness should be given when both the hindlimb extensor tendons are severed. The overall prognosis for racing was 18% for all horses presented, and 30% for treated and discharged horses. It should be noted that this prognosis increases to 40% if the two horses in training are included, but although these horses are expected to race by their respective trainers, the fact remains that, as yet, they have not.

Previous studies of the prognosis of extensor tendon lacerations have shown favourable results for return to soundness ranging from 62.5% to 82%, with a fair prognosis for return to athletic performance ranging from 48% to 59.7%. However, those studies were conducted in either mixed-use horse populations or populations comprising almost entirely sport horses. The studies have documented as many as 156 cases in a series, but when the criterion of transection of both the LoDE and LaDE or transection below the point at which the two extensor tendons join is applied, numbers fall significantly to between 8 and 79 cases. The present study of 34 cases is the second largest in case numbers fitting this criterion and the only study to focus solely on racehorses.

Little distinction has previously been made between wounds involving transection of just one extensor tendon and wounds involving the transection of both the LoDE and LaDE or transection below the point at which the two extensor tendons join. It seems self-evident that the prognosis for horses where the extensor apparatus had been completely lost would differ from those in which some degree of tendon continuity remains. One study reported that all of 4 horses with only partial tendinous disruption returned to original or intended level of use, whereas only 7 of 18 horses with total transection of the tendons did so. Although these numbers showed a trend, they were not statistically significant. Another study reported that 29 of 50 horses returned to athletic activity, although the disciplines involved were not specified, and only 8 of these cases involved transection of both tendons.

The level of athleticism required would be also expected to influence prognosis. One study commented that 17% of horses displayed gait abnormalities in work; this may be enough to preclude use as a racehorse, but be perfectly serviceable in a recreational horse. The same study reported an overall return to intended use of 59.7%; nevertheless, three of four racehorses did not return to the track because of lameness that was only apparent at high speed.

The current study showed a prognosis for racing of 30% in horses treated for wounds involving transection of both, or the combined, extensor tendons. If all horses, including those euthanased on admission, are taken into account, the overall prognosis for racing post injury is 18%, which is clearly less than previously published prognoses for this injury. It is interesting to note the difference in prognosis for Thoroughbred horses (17%) compared with that for Standardbreds (50%), although this was not statistically significant (P = 0.16). The trend may be associated with the different gaits required by the two racing disciplines.

A major difference between the current study and all previous studies is the relatively high euthanasia rate of 41% of horses presented.
Previous studies have either had low euthanasia rates of approximately 5–10%,5,7 or have not commented regarding euthanasia on presentation.2,6,8 The higher euthanasia rate is possibly a reflection of a greater severity of wounds encountered by the current study as compared with previous studies. All previous studies were conducted in the northern hemisphere where horses are managed less extensively than horses in Australia, possibly reducing their risk of injury associated with wire fences. The main clinical finding leading to the decision to euthanase in the current study was poor or absent distal limb perfusion because of extensive soft tissue damage. There is a probable relationship between increased severity of tissue damage on presentation and an increased likelihood of damage to vital structures such as the metatarsal artery. This is demonstrated in the statistically significant link between increasing degree of wound severity and increased likelihood of euthanasia on presentation (P < 0.05 or P = 0.016). We have noted that wounds or tourniquet-type injuries involving the lateral aspect of the limb are a risk for having perfusion issues, presumably because of damage to the greater metatarsal artery, which courses adjacent to the lateral splint bone.5 It is interesting to note that despite the current study having a higher euthanasia rate on admission, no horses were euthanased once treatment was administered. This is in contrast to previous studies in which horses were euthanased post-treatment because of wound sepsis6 and poor distal limb perfusion.5

Previous studies have used a range of treatment options, with many using several different treatments within the one study.2,5–8 Only one study found a relationship between treatment and outcome, finding that horses with completely sutured wounds were 2.6-fold more likely to return to soundness than those for which complete closure could not be attained.5 In the current study, primary closure of all wounds was based on accepted wound healing principles in order to provide the best chance of appropriate wound healing. Previous studies utilised primary closure far less frequently than the current study, with rates varying from 0% to 58% of wounds being sutured closed.2,5–8 It is interesting to note that in the current study only one wound dehisced and that horse did not go on to race. Most of the horses injured were weanlings or yearlings, which is perhaps a reflection of the flightiness of the immature animal. None of the horses that had raced prior to injury returned to racing. These were possibly retired because of their age (median, 6 years old), as all horses were alive at follow-up.

However, it must be considered that a major contributing factor for the higher euthanasia rate of the current study is likely to be that the racing industry places higher expectations and demands on horses with more time constraints and greater economic restrictions than other disciplines. The decision to treat or not treat a racehorse may be less emotionally-based than that of treating sport and recreation horses, and may be more often guided by analysis of the cost–benefit ratio. The poorer prognosis for racehorses, and those intended to be racehorses, with this type of injury may be at least partially because of the decisions made on behalf of their owners. Racehorses are required to achieve high levels of performance within a relatively short period of time and any major set back may lead to the horse being considered as not economically viable.

As hypothesised, this study demonstrates that racehorses have a poor prognosis for racing after sustaining wounds to the dorsal aspect of the metatarsus involving transection of both the LoDE and LaDE or transection below the point at which the two extensor tendons join. Racehorses in this study had a lower likelihood of returning to a useful level of performance when compared with recreation and sport horse populations in other studies, and advice given to owners and trainers by clinicians should be tailored accordingly.

References


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