

## Evaluation of Palmar Digital Nerve Block and Distal Interphalangeal Joint Analgesia in Lamé Horses Associated with Hoof Pain due to Sidebone Fracture

Kamran Sardari DVSc\*

*Department of Clinical Sciences, School of Veterinary Medicine,  
Ferdowsi University of Meshad, Meshad, Iran.*

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### Abstract

**Objective-** To determine if the pain of the third phalanx due to sidebone fracture in horses can be attenuated by analgesia of the distal interphalangeal joint and palmar digital nerve block.

**Design-** Clinical study.

**Animals-** Seven horses with unilateral forelimb lameness associated with hoof pain due to sidebone fracture.

**Procedures-** Seven mix breed show jumping horses were selected from horses with unilateral forelimb lameness. Selection of the horses was based on the results of radiographic examination for fracture of the sidebone, response to the palmar digital nerve block and analgesia of the navicular bursa. Horses examined at walk and trot. Flexion tests and hoof tester examination of the lame forelimb were positive. Dorsopalmar radiograph examination revealed sidebone fracture. No abnormality was seen in other parts of the limb in lateral view radiographs. The horses did not shown any improvement 10 minutes after analgesia of the navicular bursa but the lameness improved profoundly after palmar digital nerve block. The lameness score was graded by the scale described by American Association of Equine Practitioners.

**Results-** The lameness score was significantly reduced 5 minutes after palmar digital nerves block in walk and trot ( $P<0.05$ ). No significant difference was seen in walk and trot 5 minutes after distal interphalangeal joint analgesia ( $P>0.05$ ), but significant difference was seen in lameness grading 15 minutes after distal interphalangeal joint analgesia both in walk and trot ( $P<0.05$ ).

**Conclusion and Clinical Relevance-** It is concluded that pain arising from the third phalanx problem like sidebone fracture, should not be eliminated as a possible cause of lameness, when lameness is significantly reduced by diagnostic analgesia of distal interphalangeal joint or palmar digital nerves block.

**Key Words-** Horse, Lameness, Distal interphalangeal joint, Palmar digital nerves

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### \* Corresponding Author:

Kamran Sardari DVSc

Department of Clinical Sciences, School of Veterinary Medicine, Ferdowsi University of Meshad, Meshad, Iran.

E-mail address: [sardari@ferdowsi.um.ac.ir](mailto:sardari@ferdowsi.um.ac.ir)

## Introduction

There are many different lameness conditions that can originate from the distal limb in horses. Therefore, these structures should be carefully examined in animals suffering from foot pain.<sup>1, 2, 3</sup> An accurate diagnosis of the conditions that may affect this region largely depends upon the use of local anaesthetics and the interpretation of their effects.<sup>4, 5</sup> Sidebone is an ossification of the collateral cartilages of the third phalanx and lameness resulting from sidebone sometime happens in horses.<sup>6</sup> Meanwhile fracture of the sidebone usually causes lameness associated with hoof pain in horses.<sup>7</sup> Analgesia of the distal interphalangeal joint (DIP) and palmar digital nerves (PD) is commonly used diagnostically to localize pain originating from various regions within the foot of horses.<sup>1</sup> Results of diagnostic analgesia, however, can lead to misdiagnosis when assumptions are made regarding which structure are desensitized.<sup>5, 8</sup> Analgesia of the navicular bursa has been recommended to desensitize the navicular bone and bursa.<sup>9, 10</sup> As the PD nerves are closely associated with the navicular bursa, it has been speculated that analgesia of the navicular bursa may also alleviate lameness caused by solar pain.<sup>3</sup>

Most of the time diagnosis of the sidebone is made after radiological examination of the hoof. If sidebones are truly the cause of lameness, a PD nerve block at the base of the sesamoid on the affected side can relieve signs of lameness.<sup>11</sup> Although the PD nerves are commonly anaesthetized to ameliorate lameness caused by pain in the heel, recent studies showed that analgesia of these nerves also ameliorates lameness caused by solar toe pain<sup>12, 13</sup> and some other believe that the whole structure within the hoof can be desensitized by analgesia of the PD nerves.<sup>14</sup> As the DIP joint capsule makes contact with the palmar digital neurovascular bundle,<sup>15</sup> injection of the anaesthetic solution into the DIP joint is likely to desensitize the PD nerve below the level of the coronary band.<sup>12</sup> In addition, it has been shown earlier that anaesthetic solution can diffuse between DIP joint and navicular bursa. Therefore, the injection of anaesthetic solution into the DIP joint can desensitize both DIP joint and navicular apparatus.<sup>16, 17</sup> Since PD nerves are also closely associated with the navicular bursa,<sup>1</sup> anaesthetic solution can diffuse from DIP joint into the navicular bursa, and from the navicular bursa around the PD nerves.<sup>3, 14</sup> Therefore, after injection of anesthetic solution into the DIP joint it can diffuse around the PD nerves too.<sup>18</sup> Then the result of the analgesia of the DIP joint will be the same as injection of the anesthetic solution around the PD nerves. Nevertheless, this method takes more time in compare with injection of the anaesthetics solution directly around the PD nerves.<sup>3, 14</sup>

The present study was undertaken to verify the earlier findings and hypotheses with regard to the possibly far-reaching of intrasynovial analgesia and nerve block in the equine foot. The assessment of the above hypotheses was evaluating by analgesia of DIP joint and PD nerve block in clinically lame horses associated with hoof pain due to sidebone fracture.

## Material and Methods

### *Horses and Clinical Examination*

Seven mix breed show jumping horses (aged 7-11, average 8.4 years) were selected from horses referred to Teaching Clinic of the Faculty of Veterinary Medicine, Ferdowsi University, for evaluation of forelimb lameness of 10 days up to 3 months duration. Horses were examined at walk and trot on a hard surface, in a straight line and on a circle. Flexion tests (distal limb) of the affected forelimbs were positive. All horses were showed solar pain

by hoof tester examination and profoundly improved by PD nerve block. The horses selected for this study showed sidebone fracture in dorsopalmar radiographic examination, but no abnormality in the other parts of the distal limb were seen in lateral radiographs. Selection of the horses for this study was based on the radiographic examination for confirmation of the fracture of the sidebone, response to the PD nerve block and analgesia of the navicular bursa.

### *Experimental Set-up*

The horses selected for this study did not shown any improvement 10 minutes after analgesia of the navicular bursa but the lameness improved profoundly after PD nerve block. To inject to the navicular bursa, a 20 gauge, 10cm disposable spinal needle was used. Horses were not sedated, but a twitch was used. After desensitization of the skin, the needle was inserted midway between the bulbs of the heel, immediately proximal to the coronary band, with the limb positioned in a Hickman's block. The position of the tip of the needle was checked by radiography. A volume of 3.5 ml of 2% lidocain HCl, (Pastor Institute, Iran), was injected into the bursa. Ten minutes afterward the horses were recorded on videotape at the walk and the trot. The gait of each horse in walk and trot was observed and videotaped, before and after of the palmar digital nerve block. Palmar digital nerve block was performed by injecting 1.5 ml of lidocain HCl, around both PD nerves of the lame limb near the palmarolateral and palmaromedial border of the deep digital flexor tendon just proximal to the edge of the cartilage of the third phalanx. Five minutes afterward, the horses were evaluated for response to stimulation of the palmar area above the hoof, and horses videotaped in walk and trot. One week later, the dorsal pouch of the DIP joint of the lame forelimb was injected with 6 ml of 2% lidocain HCl. Correct needle placement was confirmed by observing the flow of synovial fluid in the needle hub. Five and 15 minutes after administration of the drug, analgesia was checked by applying pressure with the tip of a ball-point to the coronary band. Then, the horses were recorded again on videotape 5 and 15 minutes after DIP joint analgesia. No anti-inflammatory drugs were used from 10 days before starting the study. Two independent investigators without knowing the limbs under study scored the videotapes using an adaptation of the American Association of Equine Practitioners (AAEP) scale for lameness evaluation.<sup>19</sup> (0=Sound; 1=Lameness difficult to detect and inconsistent; 2=Lameness difficult to detect, but consistent; 3=Lameness consistently detectable on a straight line; 4=Obvious lameness with marked head nodding).

### *Statistical Analysis*

The statistical software, SPSS Version 9.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for analysis. The means of the groups were compared using a non-parametric paired Sign test. Differences were considered statistically significant when  $P < 0.05$ .

## **Results**

Injections around the PD nerves and into the DIP joints were done without any problem. Six hours after PD nerves block, local oedema were seen in four horses at the site of injection and disappeared after 24 hours. Lameness score was high at the trot before injection of lidocain HCl around the PD nerves and significantly reduced 5 minutes afterward ( $P < 0.05$ ) (Table 1). The difference was even greater at the walk (Table 2). Lameness score was also high at the trot and walk before injection of lidocain HCl around the PD nerves and reduced 5 minutes

afterward significantly. ( $P>0.05$ ) (Table 1). Fifteen minutes after DIP joint analgesia, significant reduction of the lameness at the trot was seen ( $P<0.05$ ). At the walk, the lasting lameness after application of the local anaesthetic was significantly different to the preliminary situation (Table 2).

**Table 1: Mean of the lameness scores of seven horses in trot before and after analgesia of the distal interphalangeal joint (DIP) or palmar digital (PD) nerve block with lidocain HCl.**

Horse (Trot)	Before PD block & DIP analgesia	After PD block	After DIP analgesia ( 5 min)	After DIP analgesia (15 min.)
1	3.67	0.76	3.67	0.47
2	2.9	0.76	2.4	1.6
3	3.67	0.37	2.9	1.67
4	2.4	0.37	2.4	1.67
5	2.9	0	2.4	1.33
6	3.67	0.76	2.9	1.33
7	3.34	0.37	3.34	0.47
<b>Median</b>	<b>3.22</b>	<b>0.48*</b>	<b>2.8</b>	<b>1.22*</b>

\* Significant differences with before PD nerve block and DIP joint analgesia

**Table 2: Mean of the lameness scores of seven horses in walk before and after analgesia of the distal interphalangeal joint (DIP) or palmar digital (PD) nerve block with lidocain HCl.**

Horse (Walk)	Before PD block & DIP analgesia	After PD block	After DIP analgesia ( 5 min)	After DIP analgesia (15 min.)
1	1.67	0.33	1.67	0.67
2	1.9	0.33	1.4	0.67
3	1.67	0	1.9	0.33
4	1.4	0.33	1.4	0.67
5	1.9	0	1.4	0.33
6	1.67	0	1.9	0.33
7	1.34	0.33	1.34	0
<b>Median</b>	<b>1.65</b>	<b>0.18*</b>	<b>1.57</b>	<b>0.42*</b>

\* Significant differences with before PD nerve block and DIP joint analgesia

## Discussion

For many years, clinicians believed that a positive response to anesthesia of the PD nerves of lame horses localizes pain to the palmar third of the foot, including the palmar aspect of the DIP joint.<sup>20</sup> Easter found, however, that anesthesia of the PD nerves just proximal to the bulbs of the heel alleviated lameness caused by endotoxin-induced pain in the DIP joint, indicating that the PD nerves innervate the entire DIP joint.<sup>21</sup> This report corroborated an anatomical study that demonstrated that the dorsal branches of the PD nerves do not innervate the DIP joint.<sup>8</sup> According to the results of the studies by Sack and Easter, however, the dorsal branches of the PD nerves are unlikely to contribute much more than sensory innervation to the dorsal aspect of the coronary band and dorsal laminae of the foot.<sup>11, 21, 22</sup> At the present study significant reduction of the lameness was seen in both trot and walk after PD nerve block. This finding was obvious, because the PD nerves innervate most part of the third phalanx.

Local anesthetic solution, administered into the DIP joint, may desensitize subsynovial nerves that supply sensory fibers to the navicular bone and its collateral sesamoidean ligaments,<sup>17</sup> or

the PD nerves, which lie in close proximity to the palmar pouch of the DIP joint.<sup>24</sup> In addition, in a study using cadavers, Gough et al (2002) showed that local anesthetic solution may diffuse from the DIP joint into the navicular bursa.<sup>25</sup> A negative response to intra-articular analgesia of the DIP joint may not eliminate the navicular bone and its related structures as the source of lameness. At the present study, significant reduction of the lameness in both walk and trot were seen 15 minutes after analgesia of the DIP joint. This report corroborated another study, which demonstrated the anesthetic solution can diffuse for DIP joint around the PD nerves at the dorsal pouch of the DIP joint.<sup>17</sup> Diffusion of the anesthetic solution from the DIP joint to surrounding structures like PD nerves and navicular bursa need time.<sup>26</sup> The present study demonstrated that a positive block of the DIP joint not exclusively localizes the cause of lameness in the joint itself, or in the navicular apparatus. In fact, lameness caused by third phalanx pain in the heel region is likely to be attenuated significantly by analgesia of the DIP joint. These results corroborate in part with the results from a study in which it was shown that lameness caused by solar pain in the dorsal portion of the sole was significantly attenuated 10 min after analgesia of the DIP joint using 10 ml mepivacain HCl.<sup>12, 22</sup> Similar results were found in another study in which lameness caused by solar pain in the dorsal, but not the palmar, portion of the sole, was significantly attenuated at 10 min by analgesia of the DIP joint using 6 ml mepivacaine HCl.<sup>27</sup> The specificity of the effect of the administration of a local anaesthetic into the DIP joint or after local infiltration around the PD nerve with respect to the correct localisation of pain to specific areas of the foot has been questioned earlier.<sup>6</sup> Although analgesia of the PD nerves just proximal to the cartilages of the third phalanx is traditionally considered to desensitize only the palmar part of the foot, it is known that some horses with laminitis, pedal osteitis, or disease of the DIP joint will improve temporarily after this block. This is most likely due to the fact that branches of the PD nerves continue dorsally within the hoof capsule.<sup>23</sup> At the present study, it was shown that administration of local anaesthetic into the DIP joint caused significant analgesia of the third phalanx within the hoof, although complete abolishment of the lameness was not achieved in most cases. These results may be explained on the basis of the anatomical distribution of nerves within the digit. The structures that are innervated by the deep branches of the PD nerves include the DIP joint, the navicular bursa, the distal navicular ligament, the laminar corium, and the corium of the sole<sup>23</sup>. The DIP joint capsule is in contact with the PD neurovascular bundle<sup>15, 28</sup> and a local anaesthetic that is injected into the DIP joint is likely to desensitize the PD nerves below the level of the coronary band and consequently the structures innervated by them. Branches of the palmar digital nerves also run close to the navicular bursa<sup>6, 29</sup> therefore, injection of the anaesthetic solution into the DIP joint and diffusion of the drug from the DIP joint to the navicular bursa might desensitized the PD nerve branches at this level too.

It is concluded that our results and those from other studies indicate that the diagnostic anaesthesia of the DIP joint and PD nerves has rather slight specificity. So, pain arising from the third phalanx problems like sidebone fracture, should not be eliminated as a possible cause of lameness, when lameness is significantly reduced by diagnostic analgesia of DIP joint or PD nerves block.

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## ارزیابی تاثیر بیحسی اعصاب کف دستی و مفصل بین بند انگشتی پائینی در اسبان مبتلا به لنگش بدلیل درد در ناحیه سم ناشی از شکستگی بال بند سوم انگشت

دکتر کامران سرداری

گروه علوم درمانگاهی دانشکده دامپزشکی، دانشگاه فردوسی مشهد، مشهد، ایران.

**هدف:** تاثیر بیحسی اعصاب کف دستی و مفصل بین بند انگشتی پائینی بر درد سم ناشی از شکستگی بال بند سوم انگشت.  
**طرح:** مطالعه درمانگاهی

**حیوانات:** هفت راس اسب مبتلا به لنگش در اندام حرکتی قدامی ناشی از شکستگی بال بند سوم انگشت.  
**روش کار:** هفت راس اسب مورد استفاده در مسابقات پرش بدلیل لنگش در یکی از اندامهای حرکتی قدامی جهت مطالعه حاضر انتخاب شدند. لنگش اسبان فوق در حالت قدم و یورتمه مورد ارزیابی قرار گرفت. تست خمش اندام حرکتی مبتلا به لنگش در تمامی اسبان مورد استفاده مثبت ارزیابی و شکستگی یک بال بند سوم انگشت در رادیوگرافی پشتی کف دستی روئیت شد. در اسبان انتخاب شده جهت مطالعه حاضر علامت غیر طبیعی دیگری در رادیوگرافهای جانبی انجام شده مشاهده نگردید. انتخاب اسبان فوق بر اساس مطالعه رادیوگرافی و تائید شکستگی یکی از بالهای عرضی بند سوم، پاسخ به بیحسی اعصاب کف دستی و بورس استخوان نایکولار بود. لنگش در اسبان فوق هیچ تغییر قابل مشاهده ای ده دقیقه پس از بیحسی بورس نایکولار نشان نداد ولی بهبودی قابل توجه ای پس از بیحسی اعصاب کف دستی مشاهده گردید. لنگش بر اساس روش پیشنهادی انجمن دامپزشکان اسب امریکا ارزیابی و درجه بندی شد.  
**نتایج:** درجه لنگش در اسبان مورد مطالعه پنج دقیقه پس از بیحسی اعصاب کف دستی کاهش معنی داری را نشان داد ( $P < 0.05$ ). کاهش معنی دار درجه لنگش پنج دقیقه پس از بیحسی مفصل بین بند انگشتی پائینی مشاهده نشد ( $P > 0.05$ ), اما پانزده دقیقه پس از بیحسی مفصل بین بند انگشتی کاهش معنی دار درجه لنگش مشاهده گردید ( $P < 0.05$ ).  
**بحث و نتیجه گیری:** از مطالعه حاضر می توان چنین نتیجه گرفت که لنگش ناشی از درد در ناحیه بند سوم انگشتان مانند شکستگی بال عرضی این استخوان، در صورت بهبودی لنگش اسب پس از بیحسی مفصل بین بند انگشتی پائینی و یا اعصاب کف دستی باید مد نظر قرار گیرد.

**کلید واژگان:** اسب، لنگش، مفصل بین بند انگشتی پائینی، اعصاب کف دستی