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Differentiation of navicular region pain from other forms of palmar heel pain

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Summary

Eighty horses with lameness referable to the palmar aspect of the hoof based on their response to palmar digital analgesia were divided into 2 groups based on their response to both distal interphalangeal and podotrochlear bursa analgesic injection. Horses that were profoundly improved by both analgesic blocks were considered to have navicular region pain (NRP) whereas, all other horses were considered to have other causes of palmar heel pain (PHP). Forty-two of 80 horses had NRP. The responses to various diagnostic tests such as hoof testers, distal limb flexion, and frog and toe wedge tests were compared between the groups. There was no difference in the responses between the groups. Comparisons were also made based on the results of scintigraphic examination of the foot. Scintigraphy was 71% accurate in differentiating NRP from PHP. The single most accurate diagnostic test was analgesia of the distal interphalangeal joint.

Keywords: horse, navicular disease, diagnostic techniques, scintigraphy, local analgesia

Differenzierung von Schmerz im Bereich der Hufrolle von anderen Formen von Schmerzen im palmaren Trachtenbereich

Achtzig Pferde mit Lahmheiten, die anhand positiver tiefer Palmaranästhesie im palmaren Hufbereich lokalisiert wurden, wurden je nach Reaktion auf die Hufgelenks- und Bursa podotrochlearis-Anästhesie in zwei Gruppen eingeteilt. Pferde, die auf beide diagnostischen Anästhesien deutlich ansprachen, wurden der Gruppe „Schmerz im Bereich der Hufrolle (navicular region pain)" zugeordnet, wohingegen alle anderen Pferde der Gruppe „andere Gründe für Schmerz im palmarenTrachtenbereich (palmar heel pain)" zugeordnet wurden.
42 der 80 Pferde hatten Schmerzen im Hufrollenbereich. Die Reaktion auf viele diagnostische Tests wie Hufuntersuchungszange, Beugeproben der distalen Gliedmaße und Keilproben wurden zwischen den Gruppen verglichen. Es gab keine unterschiedlichen Reaktionen in den zwei Gruppen. Die Resultate der szintigraphischen Untersuchung des Hufes wurden ebenfalls verglichen. Zu 71 % ließ sich damit der Schmerz im Bereich der Hufrolle vom Schmerz im palmaren Trachtenbereich differenzieren. Die einzige sehr zuverlässige Diagnosemethode war die Anästhesie des Hufgelenkes.

Schlüsselwörter: Pferd, Hufrollenerkrankung, Diagnosetechniken, Szintigraphie, Lokalanästhesie

Introduction

Many aspects of navicular disease including the pathogenesis, diagnosis and treatment are controversial, in part due to the fact that there is little agreement as to what characterizes this common disease (*Beeman* 1985, *Dyson* 1995, *Gibson* 1990, *Poulos* 1983, *Schebitz* 1964, *Trout* 1991, *Turner* 1989, *Wright* 1993). The diagnosis of navicular disease is usually based on history, clinical signs, response to palmar digital analgesia and detection of radiographic abnormalities. However, many recent reports suggest the unreliability of radiographic changes within the navicular bone (*Poulos* 1983, *Turner* 1986). This has led many clinicians to view this disease as a syndrome because of perceived non specificity of the history and clinical signs. Attempts have been made to characterize the clinical features of navicular disease and to utilize other techniques to improve the diagnosis (*Turner* 1989, *Wintzer* 1986, *Wright* 1993). However, the weakness of each of these studies is that they utilize the same non specific criteria and then assume these horses have navicular disease.
Recent research has shown that the sensory nerve supply to the navicular region is located in the impar and collateral sesamoidean ligaments (*Bowker* 1993, *Bowker* 1994). That implies that a horse that has pain emanating from the navicular bone region should be markedly improved by each of the following analgesic blocks, palmar digital nerve, distal interphalangeal joint, and the podotrochlear bursa. Since the only structures each of these regions has in common is the navicular bone and its surrounding ligaments, it follows that in order to conclusively diagnose navicular region pain, a horse should respond profoundly to diagnostic analgesia of each of these regions. Conversely, if a horse did not respond to analgesia of one of these regions it would indicate that pain was not from the navicular region.
Navicular disease was originally described as a lameness. It seems appropriate to assume that this lameness should be due to pain in the region of the navicular bone. The purpose of this clinical study was to record the clinical signs of horses presented for palmar heel pain, to determine which horses most likely had pain originating in the navicular bone region and which had other causes of palmar heel pain. Further to determine if these two groups could be differentiated on the basis of clinical signs only.

Materials and methods

This is a prospective study consisting of 80 horses presented to the University of Minnesota with lameness referable to the palmar hoof region. The horse's response to the following diagnostic tests were recorded: hoof testers examination over the sole, hoof tester examination over the frog, hoof tester examination across the heels, distal limb flexion, frog wedge test, toe wedge test, palmar digital (PD) analgesia, distal interphalangeal (DIP) joint analgesia, and podotrochlear bursa (PB) analgesia. Hoof testers were used in a fashion described by *Gibson* (*Gibson* 1990). The distal limb flexion was performed by flexing the lower limb until the horse showed a pain response, the pressure was reduced and the limb held in that position for 30 seconds and the horse trotted away. The test was positive if the lameness was exacerbated for a distance of 20 meters. The frog wedge test was performed by placing a block of wood under the palmar two-thirds of the frog, raising the opposite foreleg to cause full weight bearing on the block, holding the horse in this position for 60 seconds and trotting the horse away. A positive test resulted if the lameness was exacerbated for a distance of 20 meters. The toe wedge was performed in a similar manner except the block was placed under the toe. Palmar digital analgesia was performed by injecting 1.5 ml of mepivicaine HCL over the medial and lateral palmar digital nerves at the level of proximal aspect of the alar cartilage. All horses in this study were improved 90% or better by this injection. DIP analgesia was performed by injecting the dorsal pouch of the DIP joint with 6 to 10 ml. of mepivicaine, waiting 5 to 10 minutes and evaluating the lameness. The evaluation was then graded as no difference, improved but the lameness remains noticeable, or profound improvement (>80% improvement) in the lameness. The PB analgesia was performed by placing a 20 gauge 3.5 inch needle between the bulbs of the heel roughly parallel to the ground surface. After boney resistance was encountered a lateral radiograph was taken to check placement of the needle. Alterations of the needle were made if needed. Three ml of a 50:50 solution of mepivicaine and iohexol were injected into the bursa. A lateral radiograph was taken to confirm injection into the bursa. The lameness was evaluated 5 to 10 minutes after injection. The evaluation was then graded in a similar fashion as used for DIP analgesia.

Evaluation of distal limb blood flow was estimated by measuring the palmar foot temperatures before and after 15 minutes of submaximal exercise (*Turner* 1983). Horse's that did not show a 0.5°C increase in temperature after exercise were considered to have poor blood flow. Radiographic examination of both palmar hoof regions of the forelimbs was performed by taking 5 views of each foot. The views consisted of a dorso-60°C- proximal to palmarodistal (D60PrPD) of the navicular bone, a dorso-45°C-proximal to palmarodistal (D45PrPD) of the third phalanx, a lateral to medial projection, a horizontal dorso palmar projection, and a palmaro-proximal to palmaro-distal navicular bone projection. Projections were assessed for changes of the navicular bone including enlarged synovial fossa, enthesiopathy, cyst-like formations, or changes of the flexor cortical region. The cartilage on the flexor surface of the navicular bone was evaluated by podotrochlear bursa contrast radiography using a palmaro-proximal to palmarodistal projection after the PB was injected with contrast and local anesthetic. The metabolic activity of the third phalanx and navicular bone were evaluated by scintigraphic examination. Scintigraphy was evaluated qualitatively and the navicular region was compared relative to surrounding bones. Increased uptake was considered when more of the radiopharmaceutical was located in the navicular bone compared to the surrounding bones.

Horses that significantly improved with individual administration of DIP, PD, and PB analgesia were defined as having navicular region pain. All other horses were placed in the palmar heel pain category. Comparisons were made between the two groups for all measured parameters. For all diagnostic tests, sensitivity, specificity, accuracy, and positive predictive values for navicular pain were calculated.

Results

Of the 80 horses examined, 53% (42 of 80) were characterized as navicular region pain (NRP), while the remaining 47% (38 of 80) had some variation of causes of palmar heel pain (PHP). Of those 38 horses, 3 distinct groups were recognized based on the response to the analgesic blocks. Five of the 38 horses responded to the DIP block but had little or no effect from the PB block, 9 of the 38 horses responded to the PB block but had little or no effect from the DIP block. The remaining 24 horses had little or no effect from either the DIP or PB blocks.

Results of the diagnostic manipulative tests, the sensitivity, the specificity, accuracy, positive predictive value and differences between the 2 groups are recorded in Tab. 1.

For the purposes of this study, only those scintigrams that showed increased uptake in the navicular bone were considered positive. Also interpretation of the contrast radiography of the bursa was difficult since this is a new technique. A bursa was considered abnormal if a full layer of cartilage 1–2 mm thick could not be identified on the flexor surface or if the tendon surface of the contrast was not smooth or if the dye column was interrupted.

Discussion

According to this study no diagnostic test is pathognomonic for navicular pain. Distal limb flexion has been suggested by many authors to be of importance in the differentiation of navicular disease (*Gibson* 1990, *Turner* 1989, *Wintzer* 1986). In this study, 87.5% of the horses in the study responded to this test. This is in agreement with observations made by *Wintzer* and *Gibson* (*Gibson* 1990, *Wintzer* 1986). When the cases are grouped according to their response to diagnostic analgesia, the NRP group was positive in 88% of the cases while the PHP group was positive in 87%. This indicates that the test is good for exacerbating pain in the palmar hoof but does not help in the differentiation.

The frog wedge test is thought to exert pressure directly on the navicular bone similar to hoof testers but is thought to be more accurate because the horse's weight exerts the pressure rather than man made pressure (*Turner* 1989). We found that 75% of the horses in this study responded to this test. But 76% were from the NRP group and 74% from PHP group again indicating no difference.

The toe wedge test was positive in 45 of the 80 horses (56%). This is higher than that reported by *Wright* (*Wright* 1993). However, the test was of no help in differentiating pain. Fifty-five percent were positive in the NRP group and 58% were positive in the PHP group.

Hoof tester examination over the frog, is considered by some clinicians as almost pathognomonic for navicular pain (*Beeman* 1985, *Gibson* 1990). However in this study, hoof tester examination was found not only to be less sensitive than other manipulative tests for navicular pain but that other types of palmar heel pain were more likely to respond to the hoof tester examination over the frog than horses with navicular pain.

It is clear that the diagnosis of navicular disease must be made based on the response to diagnostic analgesia. Several reports have indicated that the response to these blocks in horses with navicular disease can be variable (*Bowker* 1995, *Dyson* 1995, *Turner* 1989, *Wright* 1993). But in those studies the definition of

Tab. 1: Frequency of positive results for horses suffering from navicular region pain (NRP) and horses with Palmar Heel Pain (PHP).

Diagnostic Test	NRP + 42	PHP + 38	Sensitivity %	Specificity %	Accuracy %	Positive Predictive Value %
Hoof Testers Sole	12 29 %	9 24 %	29	87	51	57
Hoof Testers Frog	19 45 %	19 50 %	45	50	48	50
Hoof Testers Heel	13 31 %	12 32 %	31	68	49	52
Distal Limb Flexion	37 88 %	33 87 %	88	13	53	53
Frog Wedge	32 76 %	28 74 %	76	26	53	53
Toe Wedge	23 55 %	22 58 %	55	42	49	51
Decreased Blood Flow	16 37 %	19 50 %	37	50	44	41
DIP Analgesia	NA	5 13 %	100	87	94	89
PB Analgesia	NA	16 41 %	100	59	80	72
Scintigraphy	34 80 %	15 40 %	80	64	71	67
PB Contrast	28 67 %	23 60 %	67	40	53	50

navicular disease either lacks specificity or the diagnostic criteria lacks specificity. This study defines the disease based on the location of pain, either the navicular bone and its surrounding ligaments (NRP) or other causes of pain in the palmar hoof (PHP). Taken individually the analgesic blocks have variable responses. Palmar digital nerve analgesia eliminated the majority of the pain in every horse in this study. Therefore, its sensitivity is 100% for NRP. However, sensitivity is an inappropriate assessment since the analgesic blocks were criteria for grouping in the study. Specificity of the analgesic blocks does provide interesting information. Palmar digital analgesia had a specificity for NRP of 0; whereas, DIP analgesia had a specificity of 87%, while PB analgesia has a specificity of only 59%. This indicates that the single most accurate diagnostic test for navicular pain is distal interphalangeal (DIP) analgesia. According to this study, if the horse's lameness markedly improves after the DIP analgesia there is an 89% chance that the horse has pain in the navicular region. This assumes that the horse also markedly improves with palmar digital analgesia as well. Based upon the evidence of this study it appears that if a horse responds profoundly to DIP analgesia, the horse either has DIP pain or navicular pain. This is in agreement with observations *Schebitz* made 30 years ago (*Schebitz* 1964). The podotrochlear bursa (PB) block which in the past was thought only to block the bursa appears to have more effect (*Dyson* 1995, *Turner* 1989, *Wright* 1993). Nine horses responded profoundly to PB analgesia but had little or no effect from DIP analgesia. This indicates that the navicular bone is not the source of pain. Further, scintigraphy indicated increased activity in the third phalanx in each of these cases. The palmar digital nerve comes in very close proximity to the bursa (*Bowker* 1995) and it seems likely that PB analgesia will either desensitize the navicular area or the solar surface, including the insertion of the deep flexor tendon, of the third phalanx.

Use of the podotrochlear bursa contrast study has provided new information regarding the flexor cartilage, the presence of adhesions between the deep flexor tendon and navicular bone, and possible tendon damage. Adhesions between the deep flexor tendon and navicular bone were seen as space occupying lesions in the dye column across the flexor surface of the bone. In each of the cases that this was noted the horse had navicular pain. Tendon damage was noted when the dye filled small defects in the tendon. This finding was found only in the palmar heel pain group of horses. Flexor cartilage damage was evidenced by the loss of cartilage on the flexor surface. This finding was noted equally in horses's with navicular pain and the group with other causes of palmar heel pain. This suggests that flexor cartilage erosion is probably of little consequence or at least highly variable in causing navicular bone pain.

Scintigraphy has been shown to be an excellent imaging method to help identify navicular disease (*Trout* 1991). Even though this study confirms that scintigraphy is useful in the diagnosis of navicular pain it is not pathognomonic. Scintigraphy must be cautiously interpreted. Thirty-six percent of the PHP horses showed increased uptake of the radionuclide within the navicular bone and 20% of the NRP horses did not have increased uptake. This indicates that there can be navicular region pain without increased navicular bone remodeling and that navicular bone remodeling is a component of some cases of PHP.

Reduced circulation has been considered a component of the pathogenesis of navicular syndrome (*Colles* 1979, *Turner* 1983). A unique method to determine qualitative differences in the blood flow has been used by determining pre and post exercise skin temperatures in the region of the pastern (*Turner* 1983). Horses with normal circulation will show at least a 0.5°C temperature increase after exercise. Horses with decreased circulation will not show this temperature change. This study has shown that decreased blood flow is more commonly associated with PHP rather than NRP. Logically, poor blood flow to the foot should affect the entire foot rather than the navicular bone. This agrees with the one clinical study which occluded the blood supply to the navicular bone and did not result in lameness.

This study has helped to show that the clinical findings associated with navicular region pain are similar to those seen in horses with palmar heel pain. The clinician should be able to differentiate navicular bone pain from other causes of palmar heel pain, using appropriate nerve blocks. The more accurate or the more specifically that cases are defined, the better conclusions one can draw from a clinical series of cases. The poor definition of cases explains in part the high variability of treatments for navicular disease. Further, it is logical to assume that the more precise the diagnosis can be made that better therapeutic and prognostic decisions can be made.

References

Beeman, G. M. (1985): The diagnosis of navicular disease (navicular syndrome). Proc. Am. Ass. Equine Pract. 31, 477–486.

Bowker R. M. and *Rockershouser, S. J.,* et al. (1993): Immunocytochemical and dye distribution studies of nerves potentially desensitized by injections into the distal interphalangeal joint or the navicular bursa of horses. J. Am. Vet. Med. Ass. 203, 1708–1714.

Bowker R. M. and *Rockershouser, S. J.,* et al.(1994): A silver-impregnation and immunocytochemical study of innervation of the distal sesamoid bone and its suspensory ligaments in the horse. Equine Vet. J. 26, 212–219.

Bowker R. M. and *Van Wulfen K. K.,* et al. (1995): Nonselectivity of local anesthetics injected into the distal interphalangeal joint and the navicular bursa. Proc. Am. Ass. Equine Pract. 41, 240–242.

Colles, C. M. (1979): Ischaemic necrosis of the navicular bone (distal sesamoid bone) of the horse and its treatment. Vet. Rec. 104, 133–137.

Dyson, S. J. (1995): Comparison of responses to analgesia of the navicular bursa and intra-articular analgesia of the distal interphalangeal joint in 102 horses. Proc. Am. Ass. Equine Pract. 41, 234–239.

Gibson, K. T. and *Stashak T. S.* (1990): The steps in diagnosing navicular syndrome. Vet. Med. 12, 168–176.

Poulos, P. W. (1983): Correlation of radiographic signs and histologic changes in navicular disease. Proc. Am. Ass. Equine Pract. 29, 241–255.

Schebitz, H. (1964): Podotrochlosis in the horse. Proc. Am. Ass. Equine Pract. 10, 49–62.

Trout, D. R. and *Hornhof, W. J.,* et al. (1991): Soft tissue- and bone-phase scintigraphy for diagnosis of navicular disease in horses. J. Am. Vet. Med. Ass. 198, 73–77.

Turner, T. A. and *Fessler, J. F.,* et al. (1983): Thermographic evaluation of horses with podotrochlosis. Am. J. Vet. Res. 44, 535–539.

Turner, T. A. and *Kneller, S. K.,* et al. (1986): Radiographic changes in the navicular bones of normal horses. Proc. Am. Ass. Equine Pract. 32, 309–313.

Turner, T. A. (1989): Diagnosis and treatment of navicular syndrome in horses. Vet. Clin. N. Am. Equine Practice 5, 131–144.

Wintzer H.-J. (1986): Equine Diseases. Verlag Paul Parey, Berlin. 228–231.

Wright, I. M. (1993): A study of 118 cases of navicular disease: clinical features. Equine Vet. J. 25, 488–492.

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