pISSN 1598-298X / eISSN 2384-0749
J Vet Clin 38(2) : 94-97 (2021)
https://doi.org/10.17555/jvc.2021.04.38.2.94

Journal of Veterinary Clinics
www.ksvc.or.kr

Computed Tomographic Findings of Navicular Syndrome in a Horse

Seyoung Lee, Eun-bee Lee, Kyung-won Park, Hyohoon Jeong, Tae-young Kang and Jong-pil Seo[1]

College of Veterinary Medicine and Veterinary Medical Research Institute, Jeju National University, Jeju 63243, Korea

(Received: February 16, 2021 / Revised: March 17, 2021 / Accepted: March 28, 2021)

Abstract : An 18-year-old warmblood gelding was presented to Jeju National University Equine Hospital with chronic bilateral forelimb lameness. Navicular syndrome was suspected based on clinical findings, the hoof test, palmar digital nerve block, and radiographic results. Computed tomography (CT) was performed under general anesthesia. Bone cysts, enlarged vascular channels, sclerosis, and enthesophytes were identified in the navicular bone on CT images. Mineralization in the deep digital flexor tendon was also observed. CT can be a useful diagnostic tool for identifying lesions of the navicular bone and adjacent structures in horses. The horse was treated with an intra-bursal injection of triamcinolone and gentamicin. Lameness started to improve two days later and the horse was sound after two months of the injection. CT enabled us not only to diagnosis of navicular syndrome but also to determine the degree and extent of the lesions.

***Key words* :** navicular syndrome, computed tomography, horse.

Introduction

Navicular syndrome is defined as intermittent chronic forelimb lameness related to pain from navicular bone and surrounding structures. It is one of common causes of chronic forelimb lameness in horses (7,9). Warmbloods, Quarter horses, and Thoroughbreds, especially geldings, have higher risks of being affected (7,9). The etiology of navicular syndrome is not fully understood (7,9). Previously, ischemic injury of the navicular bone was suggested as the cause of navicular syndrome (3,4). However, this theory could not explain the pathological changes indicating the absence of thrombosis and change in blood supply in some horses with navicular syndrome (6,12). Non-physiological biomechanical factors, that are not age-related, have also been suggested as the cause of navicular syndrome (7,9). There are several reports related to histopathology and gait analysis that back up the latter hypothesis (15,20,22). It is currently believed that the risk of navicular syndrome is also related to hoof conformation and hereditary susceptibility (7,9).

There are numerous diagnostic tests for navicular syndrome including hoof tests, palmar digital nerve block, radiography, and local anesthesia in the navicular bursa. However, most tests are not specific or sensitive (7,9,20). Local anesthesia in the navicular bursa showed high sensitivity but difficult to perform. Recently, advanced diagnostic imaging tools, including computed tomography (CT) and magnetic resonance imaging (MRI) have become available in equine medicine. CT and MRI show abnormalities that are not identified on radiography and ultrasonography, thus making CT and MRI superior diagnostics tools (7,9,12).

[1]Corresponding author.
E-mail : jpseo@jejunu.ac.kr

In this report, CT scanning was performed to determine the degree and the extent of the lesions in a horse who exhibited intermittent but chronic bilateral forelimb lameness. The purpose of this report is to report CT findings related to navicular syndrome in a horse.

Case

An 18-year-old warmblood gelding was transferred to Jeju National University Equine Hospital due to chronic bilateral forelimb lameness. The horse had been treated for hoof injury and undiagnosed lameness for a year and was usually responsive to systemic non-steroidal anti-inflammatory drugs (NSAIDs) and rest. The horse showed bilateral forelimb lameness prior to the referral. Navicular syndrome was suspected based on the horse's history, clinical signs, and the palmar digital nerve block and radiographic results.

On presentation, the body condition score (BCS) of the horse was 3/9. A dental examination was performed due to its decreased appetite, but no significant abnormalities were observed. Bilateral forelimb lameness was moderate to severe, particularly when standing up at stall. Occasionally, lameness was not apparent when walking in a straight line or a circle. An enthesophyte was observed at the lateral aspect of the right navicular bone on radiography (Fig 1B). CT was performed to determine the degree and extent of the lesions.

For CT, the horse was placed in left lateral recumbency on a custom-made CT table under general anesthesia. The CT scanner (Aquilion Lightning, Canon; Otawara, Japan, 32 multislice CT) was operated in a helical manner. The scanning parameters were 120 kV, 250 mA, and 1 mm slice thickness. The horse was premedicated with detomidine hydrochloride 0.002 mg/kg IV (Detomidin®, Provet Veterinary Products Ltd.; Istanbul, Turkey), diazepam 0.03 mg/kg IV (Diazepam inj., Samjin pharm. Co., Ltd.; Seoul, Korea) and

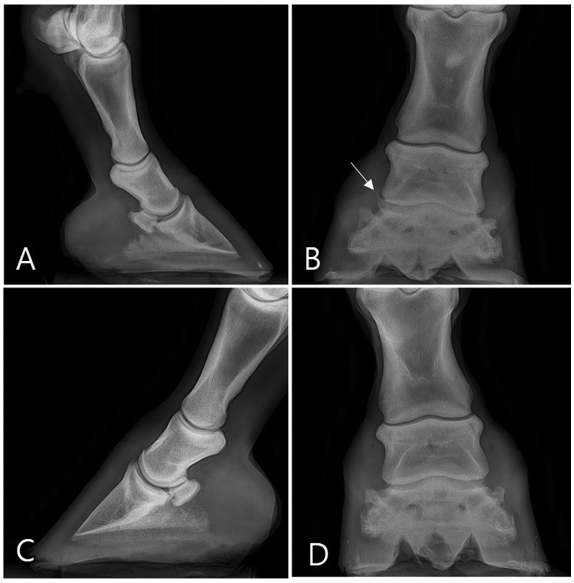

Fig 1. Radiographic images of the bilateral forelimb of the patient. (A) Lateral view of the right forelimb. (B) Dorsopalmar view of the right forelimb. Enthesophyte at lateral aspect of the right navicular bone (arrow). (C) Lateral view of the left forelimb. (D) Dorsopalmar view of the left forelimb.

ketamine 2.2 mg/kg IV (Ketamine 50 inj., Yuhan; Seoul, Korea) for anesthesia induction. Anesthesia was maintained with isoflurane (Ifran®, Hana Pharm. Co. Ltd.; Kyonggi-Do, Korea) with 100% oxygen. Sagittal and coronal axis images were reformatted, and three-dimensional (3-D) images were reconstructed with a slice thickness of 1 mm using an image viewer (Xelis; INFINITT Healthcare Co., Ltd.; Seoul, Korea). The DICOM images were evaluated with a window width of 394 HU and a window level of 108 HU for soft tissue; a window width of 1078 HU and a window level of 429 HU were used for bone.

An enthesophyte at the lateral and distal aspects of the right navicular bone was well-visualized (Fig 2C). Bone cysts, enlarged vascular channels and sclerosis of the navicular bone were identified in both navicular bones, but were more severe on the right side (Fig 2). Mineralization of the right deep digital flexor tendon (DDFT) was also identified in the dorsal aspect of the DDFT at the navicular bone level (Fig 2F). Abnormalities of the DDFT were not apparent but a

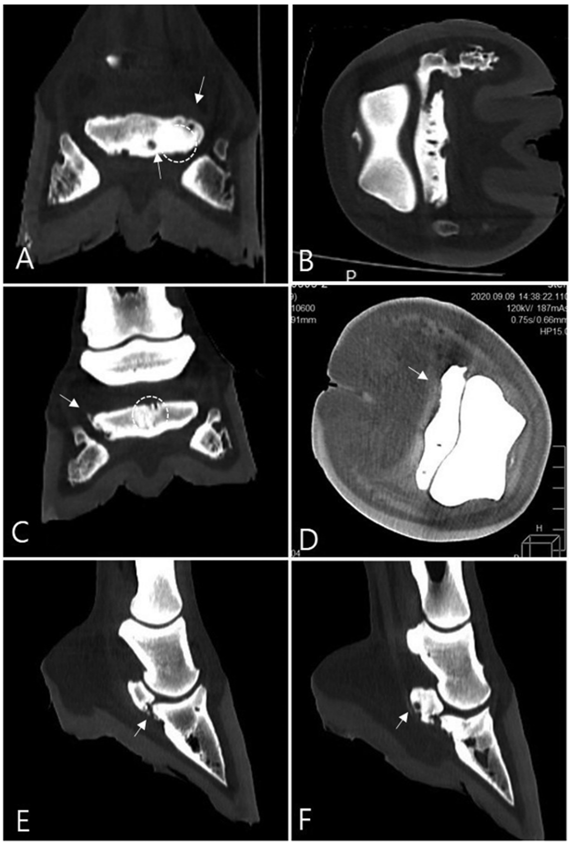

Fig 2. CT images of the right and left forelimbs of the patient. (A) Bone cysts (arrow) and sclerosis (dotted line) in the left navicular bone. (B) Enlarged vessel channels in the left navicular bone. (C) Enthesophyte (arrow) at the lateral aspect and sclerosis (dotted line) of the right navicular bone. (D) Focally hypodense lesion in the deep digital flexor tendon (DDFT) (arrow) of the right forelimb. (E) Enthesophyte at the distal aspect of the right navicular bone (arrow). (F) Mineralization in the right DDFT (arrow). Bone cyst and sclerosis in the right navicular bone.

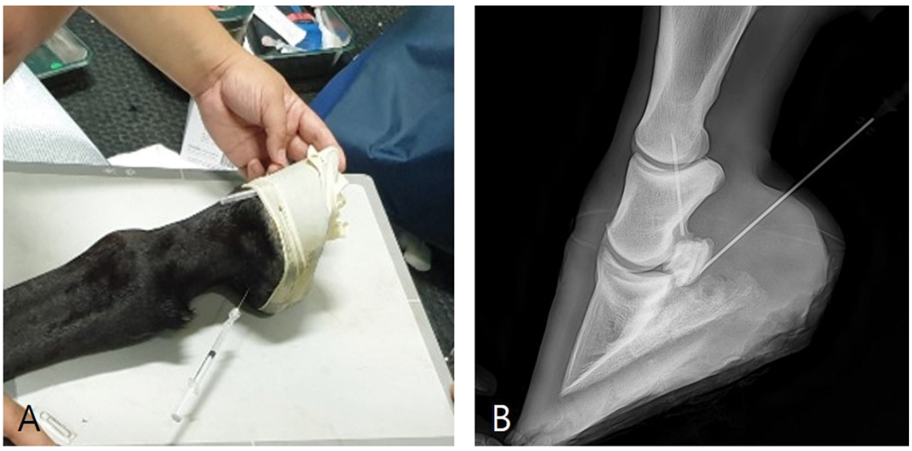

Fig 3. (A) Intra-bursal injection of the corticosteroid under aseptic conditions. (B) Accurate placement of the needle in the navicular bursa was confirmed by radiography.

focally hypodense lesion (Fig 2D) and irregular margin of the DDFT were observed on the right side.

After the CT scan, the horse was moved to a recovery room and given an injection of triamcinolone 8 mg (Triamcinolone 40 mg inj., Dongkwang Pharm. Co., Ltd.; Pyeongtaek-si, Korea) and gentamicin 40 mg (Gentamicin inj., Samu Median Co., Ltd.; Korea) in the navicular bursa aseptically. Radiography was performed for accurate placement of the needle (Fig 3). A bandage was applied to protect the injection site. Corrective trimming and therapeutic shoeing (egg-bar shoes and heel elevation) were also performed. The horse started to show improvement in lameness and was discharged two days later. The horse exhibited a good appetite with an improved BCS (5/9) and improved gait at two months after the injection.

Discussion

Navicular syndrome is a disease of horses characterized by pain from the navicular bone and surrounding structures. The insidious onset of lameness and the partially understood etiology of the disease made diagnosis rather complicated in the past. There are numerous diagnostic tests for navicular syndrome, but they are not specific or sensitive. Although hoof test examination is regarded as an essential tool when diagnosing the navicular bone, only 11% of horses diagnosed with navicular syndrome showed positive hoof-test responses over the middle-third of the frog in a previous study (21). The palmar digital nerve block, which is widely used, was shown to reduce lameness in 47.5% of horses with navicular syndrome (21), whereas 92% of horses with navicular syndrome showed improved gait after local anesthesia resulting from a navicular bursa injection (21). However, analgesia of the navicular bursa requires radiography and ultrasonography for accurate placement of the needle. Ultrasonography can also help identify soft tissue abnormalities but the quality of the images of the navicular bone area has limited value due to the keratinized hoof (9). Radiography is the most frequently applied diagnostic tool used to assess clinical features of horses with navicular syndrome. However, a greater than 40% bone density change is required for abnormality identification on radiography (2).

CT is becoming more available to veterinary medicine these days. In previous studies, CT images in horses with foot pain related to navicular syndrome showed several lesions: bone cysts, sclerosis, enthesophytes, enlarged vessel channels in the navicular bone, abnormalities in the tendon and ligament, mineralization in the DDFT, and fluid accumulation and synovial proliferation in the navicular bursa (17,19). In this case, we could find the lesions in the navicular bone and the DDFT similar to previous studies. In the present case, radiography only revealed an enthesophyte at the lateral aspect of the navicular bone, whereas the CT images clearly indicated various types of lesions both bone and soft tissue, including bone cysts, sclerosis, enlarged vascular channels, enthesophytes at the lateral and distal aspect of the navicular bone, and mineralization and a focally hypodense lesion in the DDFT.

It is thought that MRI is preferred for the diagnosing navicular syndrome due to its superior visualization of the associated soft tissue. In a previous study, lesions of the DDFT were the most common MRI finding in horses with foot pain (8). Comparisons of CT, contrast-enhancing CT (CECT), and low-field MRI (LFMRI) scanning results have been reported recently (16,17). These reports presented anatomic visualization scores and lesion identification capacity evaluations of CT, CECT, and LFMRI and showed that LFMRI had a higher anatomic visualization score of the DDFT than CT or CECT when evaluating at the level of the navicular bone (16). On the contrary, compared to LFMRI, CT and CECT identified more DDFT lesions (17). In a recent study, non-contrast-enhanced CT also showed moderate visualization of the DDFT and the anesthesia duration for CT and MRI were 15 min and 110 min, respectively (10). Taken together, these findings indicate that choosing CT over MRI is practicable when considering the duration of anesthesia and ability of CT to provide improved visualization of bone and soft tissue.

There have not been many recent changes in the treatment of navicular syndrome. Corrective trimming and therapeutic shoeing are the primary of the treatment approaches; however, systemic NSAIDs administrations and intra-synovial injections of corticosteroids are often used (7,9). There are also surgical options like neurectomy, desmotomy, and endoscopy. Most horses need a combination of treatments, and 65-75% of patients show good responses to treatments, while 40-50% of them remain sound for 1-2 years (13). Intra-bursal injection of a corticosteroid is usually indicated in the horses who have been unresponsive to other treatments (5). Following treatment, improvement of lameness has occurred within a week (5,18) and horse may return to their previous performance level two weeks later (1,5); however, the duration of their soundness is variable (1,5,17). The horse in the present study was treated with an aseptic intra-bursal injection of triamcinolone and gentamicin and the horse was sound at its two-month follow up but may need repeated medication considering of the multiple lesions observed on CT.

In previous studies, most of the patients showed good responses to intra-bursal injections of corticosteroids, but moderate to poor outcomes were shown in patients with erosion of the flexor surface of the navicular bone, DDFT adhesion to the navicular bone, scar tissue of the proximal navicular bursa, or multiple abnormalities on MRI (1,11). Pre-treatment duration of lameness appears to be related to treatment outcome. Horses with lameness for less than 6 months prior to treatment had better outcomes than those with longer periods do lameness (11). Therefore, earlier treatment is important for improving the prognosis for patients with navicular syndrome. In the present case, multiple abnormalities were identified on CT, which indicated the prognosis would likely be moderate to poor. Earlier CT scanning might help establish an earlier diagnosis and allow for timely treatment, resulting in a better prognosis for the horse.

This case report describes the first use of CT to evaluate the degree and extent of the lesions in the navicular bone and surrounding structures in a horse in the Republic of Korea. CT imaging revealed lesions that were not identified by radiography. CT can be a useful tool to diagnose navicular syndrome in horses.

References

1. Bell CD, Howard RD, Taylor DS, Voss ED, Werpy NM. Outcomes of podotrochlear (navicular) bursa injections for signs of foot pain in horses evaluated via magnetic resonance imaging: 23 cases (2005-2007). J Am Vet Med Assoc 2009; 234: 920-925.
2. Buttler JA, Colles CM, Dyson SJ, Kold SD, Poulos PW, Puchalski S. General principles. In: Clinical radiology of the horse, 4th ed. Wiley Blackwell. 2017: 1-40.
3. Colles C. Navicular disease and its treatment. Equine practice 1982; 4: 29-36.
4. Colles CM, Hickmam J. The arterial supply of the navicular bone and its variations in navicular disease. Equine Vet J 1977; 9: 150-154.
5. Dabareiner RM, Carter GK, Honnas CM. Injection of corticosteroids, hyaluronate, and amikacin into the navicular bursa in horses with signs of navicular area pain unresponsive to other treatment: 25 cases (1999-2002). J Am Vet Med Assoc 2003; 223: 1469-1474.
6. Doige CE, Hoffer MA. Pathological changes in the navicular bone and associated structures of the horse. Can J Com Med 1983; 47: 387-395.
7. Dyson SJ. Navicular disease. In: Diagnosis and management of lameness in the horse, 2nd ed. Saunders, Elsevier. 2010: 324-342.
8. Dyson S, Murray R. Magnetic resonance imaging evaluation of 264 horses with foot pain: the podotrochlaear apparatus, deep digital flexor tendon and collateral ligaments of the distal interphalangeal joint. Equine Vet J 2007; 39: 340-343.
9. Eggleston EB, Baxter GM. Navicular region/ Palmar foot. In: Adams and Starshak's Lameness in Horses, 7th ed. Wiley Blackwell. 2020: 439-462.
10. Jones ARE, Ragle CA, Mattoon JS, Sanz MG. Use of non-contrast-enhanced computed tomography to identify deep digital flexor tendinopathy in horses with lameness: 28 cases (2014-2016). J Am Vet Med Assoc 2019; 254: 852-858.
11. Marsh CA, Schneider RK, Sampson SN, Roberts GD. Response to injection of the navicular bursa with corticosteroid and hyaluronan following high-field magnetic resonance imaging in horses with signs of navicular syndrome: 101 cases (2000-2008). J Am Vet Med Assoc 2012: 241: 1353-1364.
12. Pool RR, Meagher DM, Stover SM. Pathophysiology of navicular syndrome. Vet Clin North Am Equine Pract 1989; 5: 109-129.
13. Rijkenhuizen ABM. Navicular disease: a review of what's new. Equine Vet J 2006; 38: 82-88.
14. Sampson SN, Schneider RK, Gavin PR, Ho CP, Tucker RL, Charles EM. Magnetic resonance imaging findings in horses with recent onset navicular syndrome but without radiographic abnormalities. Vet Radiol Ultrasound 2009; 150: 339-346.
15. Trotter G. The biomechanics of what really causes navicular disease. Equine Vet J 2001; 33: 334-336.
16. Vallance SA, Bell RJW, Spriet M, Kass PH, Puchalski SM. Comparisons of computed tomography, contrast enhanced computed tomography and standing low-field magnetic resonance imaging in horses with lameness localized to the foot. Part 1: Anatomic visularisation scores. Equine Vet J 2012; 44: 51-56.
17. Vallance SA, Bell RJW, Spriet M, Kass PH, Puchalski SM. Comparisons of computed tomography, contrast enhanced computed tomography and standing low-field magnetic resonance imaging in horses with lameness localized to the foot. Part 2: Lesion identification. Equine Vet J 2012; 44: 149-156.
18. Verschoten F, Desmet P, Perermans K, Picavet T. Navicular disease in the horse: the effect of controlled intrabursal corticoid injection. J Equine Vet Sci 1990; July/August: 316-320.
19. Widmer WR, Buckwalter KA, Fessler JF, Hill MA, VanSickle DC, Ivancevich S. Use of radiography, computed tomography and magnetic resonance imaging for evaluation of navicular syndrome in the horse. Vet Radiol Ultrasound 2000; 41: 108-116.
20. Wilson AM, McGuigan MP, Fouracre L, MacMahon L. The force and contact stress on the navicular bone during trot locomotion in sound horses and horses with navicular disease. Equine Vet J 2001; 33: 159-165.
21. Wright IM. A study of 118 cases of navicular disease: clinical features. Equine Vet J 1993; 25: 488-492.
22. Wright IM, Kidd L, Thorp BH. Gross histological and histomorphometric features of the navicular bone and related structures in the horse. Equine Vet J 1998; 30: 220-234.