Equine Navicular Syndrome

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I. Introduction

Navicular syndrome is a chronic and often progressive disease process involving the navicular bone and bursa, deep digital flexor tendon, and associated soft tissue structures composing of the navicular apparatus. This syndrome has long been considered one of the most common causes of forelimb lameness in horses.[28, 31] Although navicular syndrome is a common problem, it is not a modern issue. There has been documented evidence of navicular syndrome in fossilized equine navicular bone dating back to over 3.5 million years ago.[10]

The various different treatment options for navicular syndrome are just as numerous as the suggested causes for the condition. As newer theories regarding the cause and etiology of navicular syndrome have developed, so have other diagnostic and treatment modalities.[32]

There are three main theories for the development of navicular syndrome in horses. First is the “Vascular Theory” which supports the idea of alterations in blood flow to the navicular bone and surrounding tissues. Several studies show evidence of possible thrombosis of arterioles that supply the distal boarder of the navicular bone in clinical horses. This results in severe pain and ischemic necrosis.[3] Other ideas within the vascular theory have found evidence of hyperemia, rather than ischemia.[26]

The second is that of the “Biomechanical Theory” which supports the thought that improper conformation may have the majority of the effect on clinical navicular syndrome. This theory states that due to incorrect biomechanics, there is increased pressure placed between the deep digital flexor tendon and navicular bone, leading to degenerative changes such remodeling of the spongiosa below the flexor surface of the navicular bone, resulting in sclerosis. This process creates heel pain due to pressure of the flexor tendon against the navicular bone and further contraction of the deep digital flexor tendon. This is a cyclical process that eventually leads to bone remodeling and degeneration.[27]

Lastly, there is the "Osteoarthritis Theory," which is the oldest theory. This theory suggests that the bony changes associated with navicular syndrome are due to a process much like that of osteoarthritis or degenerative joint disease. These changes occur to the fibrocartilage of the flexor surface, subchondral bone, and medullary cavity of the navicular bone as well as the synovium of the navicular bursa. This is essentially the effect of abnormal weight bearing loads on normal structures or normal weight bearing loads on abnormal structures.[10]

The many theories regarding navicular syndrome reflect the large lack of understanding of the development of the disease. The pathophysiology of navicular syndrome is commonly researched and appears complex and multifactorial.

II. History and Presentation

Horses with navicular syndrome may present with an insidious onset of unilateral or, most often, bilateral fore limb lameness. Owners may often describe the lameness as transient or may see improvement with rest. Navicular changes have been documented in the hind limbs but are very uncommon. Chronically affected horses can be seen with contracted heels and an upright conformation of the distal limb due to contraction of the deep digital flexor tendon.[10]

While American Quarter Horses are overrepresented, navicular syndrome is also often seen in Thoroughbreds and Warmblood breeds. The most common age group of affected animals appears to be from ages 5-15 years.[10] This is likely due to the age at which horses are most active in their athletic career. Predisposing factors of navicular syndrome include horses with small, unbalanced hooves in relation to a large body frame, long toes and underrun heels, a negative palmar angle, and sheer heels (heels that move independently of each other), all of which can place more force on the palmar aspect of the distal limb.[10, 31]

III. Lameness Exam

The most common diagnostic tool to isolate heel pain in the horse is the palmar digital nerve block. This nerve block desensitizes the entire heel and sole, caudal hoof, and associated internal structures. It is not strictly diagnostic for navicular syndrome specifically, but only helpful in diagnosis of caudal heel pain. A transfer of lameness to the opposite forelimb is necessary for a tentative diagnosis of navicular disease. Other more invasive and less specific regional anesthetic techniques include the distal interphalangeal joint (DIPJ) block and the navicular bursa block. Horses with moderate to severe damage to the flexor tendons may not fully block to the palmar digital block.

IV. Diagnostic Imaging

Radiographs

Radiographs are one of the most important diagnostic tools when dealing with navicular syndrome. Although radiographs can provide us with a lot of information about bony change, they do not provide information about soft tissue structures. Thus, radiographic changes do not always correlate with the severity of lameness. Classic radiographic findings consistent with navicular syndrome include a combination of the following: Sclerosis or loss of corticomedullary junction, enthesiophyte formation at the suspensory of the navicular and/or impar ligament, calcification of the deep digital flexor tendon, thickening of the flexor cortex, flexor cortex lesions, and enlarged synovial envaginations. Radiographs are not only useful for assessing bone pathology, but also provide a significant amount of information regarding hoof balance, sole depth, toe length, and hoof-pastern axis.

Multiple and appropriate radiographic views are important when trying to visualize navicular bone abnormalities. Due to the intimate relationship of the navicular bone with the middle and distal phalanx bones, superimposition can lead to difficulty interpreting images without appropriate views. Radiographic views to consider are lateromedial, dorsopalmar, a 65˚ dorsoproximal-palmarodistal oblique, and a 45˚ palmaroproximal-palmarodistal oblique (Navicular Skyline). Additional views can be taken if other pathology is expected including various oblique views of the distal phalanx, a 30˚ dorsopalmar view, and a solar margin view.

Radiographs are not only important in initial diagnosis, but also monitoring. Taking serial radiographs as changes are made to the hoof are important to be able to make appropriate recommendations and track progress.[10]

Ultrasound

Although less commonly utilized than radiography, ultrasound is an affordable, fast, and non-invasive method that can provide useful information for aiding in the diagnosis of navicular syndrome. One approach to visualizing the soft tissues of the navicular apparatus is between the heel bulbs. This location requires no special preparation and allows visualization of the proximal portion of the navicular bursa, the navicular bone, and the deep digital flexor tendon. Another approach is transcuneal (through the frog). This approach provides visualization of the navicular bone, impar ligament, distal phalanx, deep digital flexor tendon, and digital cushion. The hoof must be prepared by soaking the foot overnight as well as trimming away excess frog. Animals with severely recessed frogs may not be able to be appropriately imaged. Ultrasonography of the equine foot requires a high quality machine as well as human expertise in order to obtain and interpret useful images.[10]

Nuclear Scintigraphy

Nuclear Scintigraphy or "bone scan" is a highly sensitive but less specific method of evaluating bony change when compared to radiography.[10] This method of imaging uses a gamma camera to capture "hot" spots in the bone after a radioactive isotope is injected intravenously. Uptake of the isotope correlates with an increase in blood flow and osteoblast/osteoclast activity.[22,34] Nuclear scintigraphy has been proven useful in patients that have otherwise hard-to-isolate causes of pain, however, it requires very specialized facilities due to the radiation hazard and is typically costly.[10, 22]

Magnetic Resonance Imaging

Since MRI provides views in multiple planes, it has the highest sensitivity for detecting soft tissue lesions. Although very expensive, MRI permits the diagnosis of a variety of lesions involving different structures within the foot that cannot be diagnosed using other means, thus greatly enhancing our knowledge of the causes of foot pain

Navicular Bursoscopy

Bursoscopy is a useful tool for diagnosing navicular syndrome because it allows for visualization of the navicular bursa, flexor cortex, deep digital flexor tendon, and impar ligament. This is the only method that is not only diagnostic, but therapeutic, as debridement of the tendon lesion is also appropriate to perform at this time. It is suggested that early debridement and treatment may improve prognosis compared to conservative medical management. Requiring general anesthesia and expertise, bursoscopy is a costly and more invasive procedure.[10, 31]

V. Treatment

Conservative treatment

Medical management of navicular syndrome consists of many different modalities. It is important to find the right combination of therapies, as non-surgical management of navicular syndrome often requires a multifactorial approach. When initiating a treatment plan, it is important to keep in mind the severity of disease, the animal's age and workload, and the owners expected compliance to therapy. Some non-surgical treatment options may include rest, hoof balance and corrective trimming/shoeing, administration of systemic anti-inflammatories, bisphosphonates, hemorheologic medications, and intraarticular medications.

Rest

Rest is crucial in initial diagnosis as soft tissue healing will not occur with continued use. This is a large cause of treatment failure in many horses. Rest may consist of stall confinement, hand walking, or small paddock turnout. This is generally recommended for two to six months. The horse should be rechecked regularly and the plan be adjusted based off of progress.[10, 31]

Corrective Shoeing

Assessing hoof balance and providing adequate shoeing is necessary in order to treat any patient with navicular syndrome. If the hoof and its biomechanics are not addressed first, all other therapies will likely be ineffective. The goals and purpose of corrective shoeing are to address the hoof imbalance, correct the hoof-pastern axis, maintain a solid heel and protect the palmar aspect of the foot, and improve break-over. It is important to keep in mind that adjusting biomechanics and distal limb conformation cannot be correctly in one shoeing and should be attempted over several, 4-6 week cycles. [10, 31]

Hoof balance can be analyzed grossly or radiographically. The coronary band, the distal phalanx, and the DIPJ should be parallel to the ground. Both heel bulbs should be of equal height as improper hoof balance can place unequal stress on the navicular apparatus.

When assessing the hoof-pastern axis, the phalanges should be aligned and the angle of the dorsal hoof wall should be parallel with the angle of the pastern. In addition, a line that bisects that middle of the cannon bone should touch the ground at a weight-bearing portion of the heel. A negative palmar angle at the pastern increases the stress on the navicular region.

When it comes to correcting a negative palmar angle, multiple techniques can be used. This includes shortening the toe, setting the shoe back so that it is centered over the DIPJ and supporting the heel, and/or adding a wedge shoe or pad. [10, 31, 33] Easing break over can be done by adding a shoe with a small curve at the point of the toe, or by rounding the end of the toe with a rasp.

Anti-inflammatories

Anti-inflammatories are a mainstay of navicular syndrome therapy and are used to decrease pain in inflammation associated with the various pathology.[23] The most common pain medications used are non-steroidal anti-inflammatories (NSAIDs). Some horses may only need NSAIDs during initial treatment while others may need to receive medication throughout life. Non-specific cyclooxygenase (cox) inhibitors such as phenylbutazone or flunixin meglumine show good efficacy but are prone to causing specific side-effects with long term use. Common side effects include right dorsal colitis, gastrointestinal ulcers, and nephrotoxicity and must be closely monitored with continuous use. Cox-2 selective NSAIDs such as firocoxib have decreased side effects due to the receptor selectivity, however, nephrotoxicity is still reported.[8, 25] One study comparing the clinical efficacy of oral phenlybutazone (non-selective cyclooxygenase inhibitor) and oral firocoxib (highly selective cyclooxygenase inhibitor) controlling osteoarthritis in horses found no statistical difference between the two drugs.[7]

Osteoarthritis Modulators

The use of osteoarthritis modulators has been a highly debated topic in human and veterinary medicine. While effectiveness for some of these compounds, for example, glucosamine and chondroitin, has been proven and documented, it had led to confusion about specific product efficacy in severe disease. Several products are available for use, such as sodium hyaluronate, which is administered intravenously, polysulfated glycosaminoglycans, which are administered intramuscularly, and glucosamine and chondroitin, which is administered orally. As structure modifying agents, glucosamine and chondroitin are developed to promote the restoration of the intra-articular environment and prevent pain from inflammation and osteoarthritis. In summary, these products are meant to slow the progression of the deterioration of cartilage that results in osteoarthritis, stimulate cartilage synthesis, and counteract inflammation.[5]

Intra-articular Medications

Intra-articular medications are often used due to their local effect on pain and inflammation when injected into a joint. Commonly used drugs include corticosteroids such as methylprednisolone acetate and triamcinolone acetonide. Studies have shown evidence of diffusion of drugs, such as corticosteroids, into the navicular bursa when originally injected into the DIPJ. This offers potential for a better response in horses with diffuse pathology.

Sodium Hyaluronate has been shown to have an anti-inflammatory effect in joints in addition to increasing the synovial fluid viscosity. It is often used in combination with a steroid when injecting the DIPJ. Results from one study showed that 80% of horses that were no longer responding to traditional therapy in the form of corrective shoeing, systemic anti-inflammatories, and injections into the DIPJ, were sound 2 weeks post-navicular bursa injection with a sodium hyaluronate and steroid combination. The mean duration of soundness was approximately 4.5 months.[31]

A newer method of treatment that is becoming increasingly popular in equine veterinary practices for treating osteoarthritis in various joints is interleukin-1 receptor antagonist protein (IRAP). This inhibits the activity of interleukin-1, which has a major role in the process of the osteoarthritis cascade. IRAP is a naturally occurring protein that occupies receptors on the cartilage membrane.[14] This blockage of matrix metalloproteinases and cytokines (IL-1) reduces the damaging effects on the cartilage by preventing inflammation and cartilage damage that results in degenerative joint disease and osteoarthritis.[11, 12, 13, 21] The use of IRAP in navicular syndrome horses is still currently under investigation but is stated by many practitioners that injecting IRAP into the navicular joint and/or navicular bursa has promising effects.

Hemorheologic Drugs

Isoxsuprine hydrochloride is a beta agonist that acts as a peripheral vasodilator and has historically been used in treating navicular syndrome. Isoxsuprine hydrochloride can decrease blood viscosity as well as platelet aggregation in other species but its role in treating equine navicular syndrome has conflicting results. One study stated that oral isoxsurpine did not increase blood flow to the equine distal limb.[15] On the other hand, a clinical trial that evaluated the clinical efficacy of this drug for treating horses diagnosed with navicular syndrome did report a decrease in lameness for varying lengths of time.[30] With that said, isoxsuprine hydrochloride is a possible treatment method for horses with navicular syndrome although the exact mechanism is unclear and the benefit appears to be unpredictable.

Pentoxifylline and propentofylline are also used. In a study evaluating the efficacy of propentofylline in horses with navicular syndrome, researchers reported an overall decrease in lameness scores in those who received the drug.[17] An early study regarding pentoxifylline stated that oral administration of pentoxifylline had no effect on equine blood flow [15] whereas a more recent study concluded that the drug does provide a therapeutic effect.[18] The differences in the results could possibly be dose-dependent and should be kept in mind when using these drugs.

The bioavailability of both drugs is poor in horses. Assuming the vascular theory has a component in navicular syndrome, these drugs may be helpful but data is lacking.

Bisphosphonates

Bisphosphonates work by inhibiting bone resorption by decreasing osteoclast activity. Since resorption of the navicular bone seems to be a large component of navicular syndrome, these drugs have showed promising effects in normalizing bone metabolism, protecting bone integrity, and decreasing clinical lameness. These drugs accumulate within bone and are released over months to years. Products include clodronate injection,[6] given intramuscularly at three different locations on the animal, and Tildren, given intravenously. It is important to monitor for signs of colic after administering these products as that is a commonly recognized side effect.

Shockwave

Focused extracorporeal shockwave therapy focuses energy at the location of the probe and generates shockwaves. These shockwaves promote neovascularization, bone remodeling, and analgesia. There are conflicting reports about its effects in managing equine navicular syndrome.[2, 10, 20]

It is important to keep in mind that horses performing in recognized show circuits such as United States Equestrian Federation (USEF) or Fédération Equestre Internationale (FEI) may have regulations on the amount and type of pain medication present and may test for detectable levels in the blood. Regulations may also include shockwave withdrawal and intra-articular injection withdrawals. By understanding the discipline and sport that your patient participates in, as well as horse show guidelines, you can better develop treatment plans and set alternative modalities in place around competition time.[1, 9]

Surgical Treatment

While surgical therapy can include desmotomy of the collateral (suspensory) ligaments of the navicular bone and bursoscopy (as previously mentioned), palmar digital neurectomy (PDN) is more commonly performed when medical therapy is ineffective.[4, 10, 24] This involves removing a portion of the medial and lateral palmar digital nerve to desensitize the palmar one-third aspect of the hoof, its internal structures, and the entire sole. PDN is considered a palliative procedure as it only alleviates pain associated with navicular syndrome rather than prevention or treatment of the pathology itself. There are many techniques to performing a palmar digital neurectomy including the guillotine method, cryotherapy, perineural capping, and CO2 transection. All of these methods share a common goal of providing atraumatic transection of the nerve to minimize the likelihood of painful neuroma formation. Research has shown that the guillotine method provides the longest period of desensitization and least chance of neuroma formation when compares to perineural capping and CO2 transection.[31]

Postoperative care

Postoperative care is vital in providing good success with this procedure. Horses should be strictly confined and provided controlled hand walking for 4 weeks. Support bandages should remain while the horse is stalled. The cornerstone of a successful neurectomy with minimal complications (including neuroma formation) is post-op confinement, appropriate bandaging, and an atraumatic procedure. [10, 31]

VI. Prognosis

Navicular syndrome is a complex disease process that has a variety of signs and clinical severities. Due to the variability associated with the disease, prognosis is often hard to predict.

Clinical analysis of long term resolution of lameness after a PDN procedure varies. Reports indicate that up to 92% of horses were in work 1 year after surgery.[19] An additional report states that 74% of horses were sound 1 year after surgery,[19] however, only 63% remained sound after 2 years.[16] Additional long-term complications associated with a PDN include failure to alleviate lameness due to accessory branches of the palmar digital nerve, DDFT rupture, luxation of the DIPJ, and deep hoof infections. Lameness recurrence is most commonly associated with reinnervation or neuroma formation. Painful neuromas may be managed with surgical excision or perineural infection of Sarapin and triamcinolone acetate.

VII. Conclusion

Due to the complexity and back of understanding of equine navicular syndrome, there is currently no “gold standard” for treatment. The response to various different therapies indicates that horses diagnosed with navicular syndrome may be experiencing pain from multiple different sources. Several of these therapies improve lameness to some degree for certain amounts of time. It is important to communicate with your client that treatment is geared towards pain relief rather than preventing damage or stopping pathology. The most ideal way to help horses with this condition is by concentrating on maintaining a proper hoof balance through corrective shoeing, maintaining correct conformation, and properly utilizing anti-inflammatory medication.[31]

Resources:

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