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SURGICAL MANAGEMENT OF HOLLOW HOOF SYNDROME WITH COMPRESSION SHOEING IN A GERIATRIC MARE

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ABSTRACT

Hollow Hoof Syndrome (HHS) is a condition of equine foot that causes the hoof wall layers to separate. This separation starts at the solar surface of the foot and works its way dorsally (upward) toward the coronary band, though it can be managed with proper medical and surgical care. A mare was presented in Veterinary Clinical Complex, LUVAS, Hisar (India) with a history of lameness in right forelimb since last four months. Clinical examination revealed significant increase in the size of hoof accompanied with hard tissue swelling at fetlock joint and also nodding of head during landing of the affected hoof on the ground. Physical examination of hoof revealed that the epithelium of sole was eroded and 3rd phalanx was present just below the punctured keratinized epithelium at the solar surface of hoof. Radiographic examination revealed increased distance between the hoof wall and 3rd phalanx moving towards the apex of hoof confirming the rotation of pedal bone. Palmer digital nerve neurectomy was done to relieve the pain and use of compressive therapeutic shoe leads to uneventful recovery of animal.

Keywords: Compression shoe, equine, hollow hoof syndrome, neurectomy

INTRODUCTION

In equine industry, hoof is of utmost importance because any abnormality in the hoof, reduces the utility of horse. The equine hoof is significantly affected by various pathological conditions such as hollow hoof syndrome (HHS) or white line disease (WLD). Hollow hoof syndrome occurs when the hoof wall becomes separated or cracked, usually due to unusual stress on the wall; within these cracks, bacteria and fungi are often found which leads to distortion of hoof capsule and make the hoof swampier and long with under-run heels. HHS continues to frustrate veterinarians and farriers due to diversity in its aetiology, diagnosis and treatment (Gerard, 2021). Hoof wall defects in horses are common but many of those detected present little danger to the individual horse. The problematic defects do often require specialized consideration (Moyer, 2003). As per the histopathological studies, HHS is recognized as separation of hoof wall from the attachment site of hoof (Rose *et.al.*, 1993; Dabareiner *et.al*., 2003), explaining the keratolysis process in basal hoof characterizing progressive separation in inner layer of hoof wall (Grady, 2002; Moyer *et.al.*, 2003). This keratolysis is characterized by the damage and the subsequent separation of the stratum

medium from the stratum internum. The pioneer organisms are sulphur reducing bacteria (Kempson, 2006; Grady, 2006), which cause the destruction of sulphur bonds between the keratin molecules, this leaves a visible blackening in the horn part of hoof. Although donkeys are susceptible to HHS but it may occasionally occur in all sizes, types and breeds of horses, especially those with poor quality hoof horn. A person should not confuse HHS with hoof wall separation diseases (HWSD) which is a genetic condition found in the Connemara pony breed. HHS is more commonly heard term for white line disease, a microscopic bacterial infection that enters the hoof wall/laminae junction via cracks, injuries or separation of the hoof wall, and then propagates very quickly in the non-oxygenated environment. Early detection may be difficult as there are no external signs visible on the hoof wall and the horse may show short periods of unexplained lameness during work. HHS can be a minor issue that requires virtually no maintenance beyond proper attention to trimming methods or it can be a serious problem affecting the vast majority of the white line of hoof.

MATERIALS AND METHODS

A thorough bred mare (black in color, height 160 cm and bodyweight around 450 kg aged 14 years specialized in jumping was presented in Veterinary Clinical Complex, Lala Laj Pat Rai University of Veterinary and Animal Sciences, Hisar (India) with a history of lameness in right forelimb since last 4 months due to the trauma that occurred during an obstacle jump. The affected forelimb was clinically examined using hoof testers and different fetlock flexion test. For haemato-biochemical examinations 5 mL blood sample was collected from jugular vein using aseptic sterile syringe in EDTA and serum vials using semi-automatic haematological and biochemical analyzers respectively. X-ray radiography includes both lateral and dorsal-palmer view of hoof was taken. Based on above examinations and observations, it was decided to perform palmer digital neurectomy to provide temporary relief to animal.

For Palmer digital neurectomy (PDN), the mare was put under general anesthesia wherein sedation was performed with xylazine hydrochloride @ 1.1 mg kg^{-1} body weight (bw) and butorphanol @ 0.2 mg kg^{-1} bw, intravenously. After 5 min the induction was induced with the help of ketamine hydrochloride @ 2.2 mg kg^{-1} bw and diazepam @ 0.5 mg kg^{-1} bw, intravenously. After induction, the animal was in lateral recumbency with affected forelimb on upside towards the surgeon's view. Three flap draping were used to perform surgery after asepsis and shaving of the palmer side of 2nd phalanx. Skin incision was executed with No. 23 blade in bared parker handle No. 4. The fascia and muscle tissues were retracted with tissue forceps to expose the nerve. Palmer digital nerve was severed after infiltering 1 mL 2% lignocaine hydrochloride to prevent neurogenic shock to animal. Maintenance of anesthesia was done with the help of xylazine hydrochloride @ 0.5 mg kg^{-1} bw and ketamine hydrochloride @ 1.1 mg kg^{-1} bw, intravenously. After PDN, skin and fascia were sutured in simple interrupted suture pattern.

For treatment, a customizable compression shoe was made specifically for the hoof of animal to distribute the weight more on heel as compared to the hoof apex and sole area. Between the sole and shoe medical grade silicon was filled in along with the clay to absorb the direct force of ground as well as provide extra-cushioning. Clay exerted pressure on the 3rd phalanx and helped in withholding the bone to its normal anatomical position. The post-operative pain and infection was managed with the help of NSAID phenylbutazone @ 1-2 g 450 kg^{-1} intramuscularly along with antibiotic dicrysticine @ 25000-40000 IU kg^{-1} bw intramuscularly and gentamicin @ 6.6 mg kg^{-1} bw, intravenously.

RESULTS AND DISCUSSION

Clinical and visual examination revealed the nodding of head during landing of affected limb on the ground along with the shifting of body weight on the counter limb. Physical palpation of the right forelimb disclosed increase in pulse rate and heat in digital arteries of the lower metacarpal area. There was debilitation of solar surface of hoof (Fig. 1) which led to the characteristic camped in front (Fig. 2) position of mare during standing. Haemato-biochemical studies revealed increase in total leucocyte count going upto 37000/cumm and alkaline phosphatase activity reached upto270 IU/L. Kidney function tests and liver function tests were within normal range. A considerable amount of pain was noticed after using hoof testers on the sole area of hoof although, all horses do not show positive reaction on hoof tester, so it is necessary to check the sole by visual identification after trimming the hoof (Redding *et.al.,* 2012). X-ray radiography revealed increased distance between hoof wall and 3rd phalanx moving towards hoof apex along with considerable number of periosteal changes seen at level of Ist and 2nd phalanx (Fig. 3). There was reduction in pain after palmer digital diagnostic nerve block with 22-gauge needle infiltration of 4 mL 2% lignocaine hydrochloride which confirmed the presence of abnormality in the hoof. Palmer digital neurectomy was done to relieve the chronic pain and installation of compression shoe on the debilitated hoof to maintain the biomechanical conformation of hoof.

Fig. 1: Debilitation condition of hoof solar surface of the affected mare

Fig. 2: The affected mare showing camped in front

Fig. 3: Radiograph showing increased distance between dorsal distal parietal surface of distal phalanx and hoof capsule (A/P view & lateral view)

Fig. 4: Incision on the skin and refract the fascia

Fig. 5: Expose and excision of nerve

Fig. 6: The use of clay and medical grade silicon in shoe

The goal of treatment in this case was to maintain the stability of distal phalanx on the hoof surface, controlling pain and restoring the relationship between the hoof capsule and distal phalanx. Palmer digital neurectomy (PDN) revealed that after installation of compression shoe on the hoof, the animal was able to bear and distribute weight properly on right forelimb thereby leading to the uneventful recovery of animal. The timing of treatment is very crucial in hollow hoof syndrome. Foot problems are the most common cause of lameness, and accurate knowledge of foot anatomy before performing "hands on" approach to appreciate fully the problems that may be encountered (Turner, 2003). In this case, the condition of hoof was very deteriorated due to the unavailability of proper treatment in field. In last stage of HHS pain management is most crucial to tackle these cases. To prevent the displacement of 3rd phalanx from the hoof wall, first examine the area where the horse gives more pressure to prevent pain. Every horse needs a specific shoe according to its anatomic confirmation. The WLD is worldwide spreading hoof disease regardless of age, sex, breeds and although it is likely caused by keratin favoured bacteria, keratin soluble mycete, therefore onychomycosis is found in 10% of WLD in horse, and although it aggravates WLD, considering the characteristic nature of hoof, it is not convincing that bacteria or micro-organic culture is useful in diagnosis (Kuwano *et al.,* 1999; Oke *et al.,* 2003; Floyd *et al.,* 2007). Palmar digital neurectomy (PDN) is commonly performed for chronic degenerative conditions involving the posterior half of the foot. Various surgical techniques have been developed so as to reduce the postoperative complications, including painful neuroma formation, regeneration of transacted nerve, and incomplete desensitization of the heel or navicular area from aberrant branches (Hardy *et al.,* 1992).

A thorough examination and assessment of equine foot is an essential part of both the physical and lameness evaluations. Use of compression or derotation shoe for 3rd phalanx rotation was effective technique to minimize the distance between hoof wall and 3rd phalanx and pain. Palmer digital neurectomy is a useful technique for the management of pain in chronic laminitis cases. The outcome of surgery and installation of compression shoe depended upon the condition of hoof and the rotation of 3rd phalanx. With the help of proper shoeing and weight distribution strategy, one can stop the sequelae of hollow hoof syndrome and alleviate the sufferings of animal.

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