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Understanding thrush: An overview

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Abstract

In India, as per the 2019 Livestock Census, there are overall 0.55 million horses, ponies, mules, and donkeys, which has been reported a decrease in 51.9% from the previous census (20th Livestock Census, 2020). The majority of Equidae support rural communities in arid, semi-arid, and hilly areas, particularly in the foothills of the Himalayas, through transportation and draught. The remaining small population of equines are employed by the military, law enforcement, border security force, racing industry, and sports. Indian Army is exploiting equines mainly for transportation, casualty evacuation and ceremonial purposes. Equines are heavily build animals, among which limbs are the vital parts of musculoskeletal system which play a major role in the movement of the equines mainly performing functions of absorbing impact, bearing weight and providing thrust within which hoof contributes the major part. Complex structure of hoof is composed of outer hard keratinous part viz., sole, white line, inner wall, outer wall, bar, collateral grooves, frog, coronet band, periople and internal structure viz., pedal bone, navicular bone, short pastern bone, digital cushion, corium, lateral, ungual cartilage. Lameness in horses can be caused by a variety of conditions, the most frequent being canker and thrush. Poor hoof conformation and poor maintenance of hoof are the two main predisposing factors. This article mainly focuses on etiology, pathophysiology and advance treatment associated with thrush.

Keywords: thrush, hoof, degenerative tissues, Epsom salt, bar shoe, frog

Introduction

Thrush is a bacterial infection of frog and its sulci characterized by accumulation of dead keratin tissue which is reportedly seen as thick, foul smelling black and necro-malodorous discharge originating within the central or collateral sulci of frog (Baxter and Stashak, 2011; Dabareiner *et al.*, 2011) ^[4, 5]. In worst condition, according to Stashak (1996) ^[18], when left untreated cause involvement of deeper structure of foot viz., digital cushion, heel bulb region and even hoof wall causing sloughing off of the structure leading to permanent lameness.

Etiology and Pathophysiology

Any deviation affecting the overall health of frog are the elements forming etiology of thrush. Thrush is the destruction of a portion of the horse's hoof called the frog. Various notorious noncontagious keratolytic anaerobic bacteria and fungi has been ill reputed for the cause of thrush but among all *Fusobacterium necrophorum* and *Bacteroides* sp. are often isolated (Petrov and Dicks, 2013; Spencer and Dwight, 1994) ^[13, 17].

Thrush is a degenerative condition of the epidermal tissue of the frog generally caused by a bacterial infection. Horses with a long heel conformation that results in deep, narrow frog sulci when exposed to damp and unclean environmental conditions provides best environment for thriving of anaerobic bacteria (Kumar *et al.*, 2014) ^[10]. Since bacteria penetrates the outer horn and enter deep into the dermis, accumulation of debris cuts off the oxygen supply making the most suitable home for the growth of anaerobic bacteria.

Evidence of the disease commonly begins in the central sulcus of the frog and eventually spreads to the collateral sulci and main portion of the frog. Since animals fail to exhibit any sign of discomfort most of the time, it goes unnoticed and when left untreated, the infection can damage the sensitive structures of the hoof, including the frog and the digital cushion below it. This can cause prolonged infection and lead to lameness.

Potential Cause of Thrush

Hoof diseases are common in equines. A study conducted by Holzhauer *et al.* (2017) ^[8] revealed that 85% of the horses under observation had a foot disease of some kind when they were checked during routine hoof trimming. Equines are well shaped with hoof's natural self-cleaning mechanism. Frog is the widest part of the hoof. A large, healthy frog helps absorb concussions, shares load-bearing duties with the other palmar/plantar hoof structures, and functions as an expansion joint to keep the heels apart. Weight bearing ensures the frog's prolonged health by stimulating its natural physiology under normal circumstances. When the foot is loaded, a well-formed frog that occupies the region between the heels also facilitates a natural self-cleaning mechanism by expanding and clearing any collected dirt or debris from the frog sulci. An unhealthy frog is markedly smaller in size and recessed below the level of the ground surface of the hoof, thus creating a void in which debris can accumulate. Whether an animal is at a walk or a canter, its foot changes form when pressure is applied to the heel, causing it to expand and sink even further. When the sole flattens and loses its concave shape, the frog expands along with it until the unshod hoof touches the ground.

Horses with imbalanced feet, improper trims (Abidina *et al.*, 2013) ^[2], and deep clefts linked to constricted heels are more likely to have thrush because these conditions facilitate the accumulation of debris and make it challenging to remove (Holzhauer *et al.*, 2017) ^[8]. Moreover, equine kept with restricted movement in confined boundaries reduces the natural mechanism of cleaning.

Proper shoe care can mitigate the impact of debris on the hoof capsule's normal biomechanics, which in turn promotes bacterial growth. While shoes may not have a significant effect on this mechanism in well-shod hooves, it is still important to may more concern while using wide-web or heart-bar shoes as they interfere with natural ventilation. Other contributing factors are poor stable hygiene management, long standing on soiled bedding, poor flooring with pits and poor ventilation system.

Clinical Signs and Diagnosis of Thrush

Lameness is typically imperceptible, but when it is, it can vary in intensity. Animals exhibiting sudden mild lameness accompanied by moist, dark colour discharge, smelling feet although not every smelly foot has thrush, blackish discharge. On visually assessing by farrier shallow depression (< 1cm) in central sulcus, presence of degenerative malformation in frog sulci, hoof tenderness and exhibition of painful response during cleaning of affected areas are evident.

The surface of the horn of the frog usually has a rough appearance, and bleeding often occurs when the frog tissue is incautiously touched with a hoof pick. Evident of lameness in severe form is mainly due to structural damage of sensitive tissue causing pain on manipulation. Depending on the severity of the infection, swelling in the lower limb is also reported.

Treatment of Thrush

Anaerobic bacterial infection is most predominant and these bacteria commonly rife in faeces and soil. The most crucial factor in the persistence of the anaerobic bacteria causing this illness in horses is their living environment.

Managerial Correction

Identification of predisposing cause and implementing the corrective majors to eliminate the cause should be the first

step. Maintain good stable hygiene with clean dry bedding and mucking out well. Compromising with the maintenance of good Hygiene management leads to such alarming medical condition. Prevention of condition like thrush can be easily achieved by keeping the horse in clean and dry environment.

It is recommended that the stable floor be constructed from non-slip concrete and even, provided that the shed is well cleaned and sanitized on a regular basis. Hooves need lots of firm and strong support, especially under the frog. They need a dry bedding but not so dry that it can cause cracks in the hoof wall where bacteria can cause infection. According to Holzhauer *et al.* (2017) ^[8], hoof condition started improving with regular cleaning and trimming of hoof and proper barn cleaning. Above all, they need a bedding that offers hygienic protection from the harmful bacteria and fungi that cause diseases like thrush. Bedding of wood savings like pine wood savings which is scientifically proven natural antibacterial resistance (Elina *et al.*, 2023) ^[6], straw, wood pellets and hemp bedding. Removal of any source or object causing the dampness of the living environment of horse be eliminated. Few preventive measures viz., vigorously brushing off with stiff brush and routine application of astringent in hoof, air drying and liming of the floor at least for 3-4 h in a day can be a cost- effective measure.

Hoof Care

Good condition and soundness of hoof can be achieved by maintaining routine corrective trimming of hoof. Over grown hoof, hoof with long heel conformation and unbalanced hoof should be given extra care. In long standing animals, trimming off the extra growth avoids accumulation of dirt. In case of presence of heel instability, the palmar aspect of the foot can be stabilized by a bar shoe. When heel is trimmed to the same plane as the frog, wall perimeter of healthy hoof should be round when animal is left barefoot.

Animals should be relocated to a dry, clean place after identification. On examination of foot, necrotic debris and undermined tissue are meticulously removed using a hoof knife and cleaned (Pollard *et al.*, 2019) ^[14]. On early stage of infection, frog area is found to be sensitive with noticeable bleeding.

The infected area of frog is washed with potassium permanganate solution (1:10000 dilutions), cleaning with disinfectants (iodine/tincture of iodine) and dried thereafter using clean cloth. If the infection is not deep-seated, topical disinfectant/astringent application along with regular wash with disinfectant may be sufficient to cure it in 7 to 14 days. Application of causative materials like as hydrogen peroxide, bleach, and copper sulphate should be avoided during the early stages of treatment as it may result in further tissue damage. Caustic products should be applied once the frog gradually starts to harden and keratinize.

Historically, thrush was treated with amalgamation of several chemical substances viz., bleach, formalin or formaldehyde, copper sulphate, Stockholm tar and hydrogen peroxide have been used. Others have recommended foot soaks in chlorine bleach (30 mL of bleach in 5 L of water). Several other caustic materials have been suggested, including a combination of phenol, tincture of iodine, and 10% formalin, Kopertox solution (Fort Dodge, Fort Dodge, Iowa, United States), or methylene blue, however, they do carry the risk of causing additional harm to healthy tissue and delaying the healing process.

Numerous studies have demonstrated the efficacy of treating advanced stages of thrush with readily accessible triple sulfate

powder. Strong vascular endothelial growth factor (VEGF) is present in copper sulfate, which stimulates angiogenic responses at the site of injury (Voelker, 2000; Sen *et al.*, 2002) [19, 16]. Ferric sulfate has a potent astringent action in addition to being an efficient hemostatic agent (Azargoon *et al.*, 2011) [3]. Epsom salt, or magnesium sulfate, has a strong hygroscopic salt that aided in the removal of debris and degenerative tissues. When combined these all properties synergistically act in curing the degenerative infection in hoof. Kumar *et al.* (2014) [10] reported successful healing of frog with total 8-10 application of triple phosphate powder containing equal amount of ferrous sulphate, copper sulphate and magnesium sulphate (triple phosphate) in packed bandage. The frog grooves were clearly visible after treatment.

Salt containing magnesium sulfate has long been used to treat hoof infections. Since Epsom salts have a hygroscopic quality that aids in the debridement of dead tissue, they encourage blood flow to the hoof and speed up the healing process. Thrush in horses has been successfully treated with a variety of combinations of magnesium sulfate and supportive antibiotics, including gentamicin, amoxicillin, oxytetracycline, trimethoprim sulfa, sulphadimidine, enrofloxacin, and polymixin B. O'Grady (2018) [12] and Qaisar *et al.* (2024) [15] reported successful recovery of thrush with soaking the infected hoof in epsom salt solution till three weeks. Further packing and bandaging the cleft of frog with antiseptic or astringent soaked cotton gauze will help in eliminating the infection quicker.

The application of *Phythium oligandrum* for the treatment of thrush has been suggested from a recent study conducted by Načeradská *et al.* (2017) [11] and Qaisar *et al.* (2024) [15], which reported a successful method for curing hoof-thrush. *Phythium oligandrum*, also known as Ecosin, is essentially a fungus that functions as a myco-parasite for over 50 species, including some bacterial activity. Gabrielova *et al.* (2018) [7] stated it releases hydrolytic enzymes to break the life cycle of bacteria and fungi. Ecosin tablet 3g was dissolved in 02 L of luke warm water. This was allowed for 20–30 minutes. The affected hoof was completely cleaned and disinfected before being submerged in the bucket with the ecosin solution for 20 minutes. The hoof was allowed to dry naturally. Treatment was repeated three times a week for three weeks. Animal treated with ecosin powder were found to be healed early as frog growth after 4-5 treatments were evident.

In addition, a wide range of commercial products, such as Grooms Hand Deep Thrush Gel, Equiderma Thrush, Vetericyn Equine Hoof Car, Absorbine® Hooflex Thrush Remedy, Therazure, Kopertox (copper naphthenate) ® Water-Resistant Horse Thrush Treatment, and others, are easily accessible for treating thrush.

Conclusion

Many methods have been proposed for the treatment and resolution of thrush. Nevertheless, none of these will be very useful until the frog's health and structural integrity are enhanced. Horses diagnosed with thrush have a fair chance of making a full recovery if given the right care. It's critical to treat thrush infection as soon as possible to stop it from penetrating further into the hoof tissues. Health of the frog can't be improved and, consequently, the thrush can't be resolved without using appropriate farriery. Good farriery should be emphasized as the main strategy for preventing this condition, keeping in mind that prevention is always preferable than cure.

Conflict of Interest

Not available

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