



## Review Article

# Streptococcus equi in Equine: Diagnostic and Healthy Performance Impacts

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## ABSTRACT

Although the strangles disease of *Streptococcus equi* was discovered many decades ago in 1,251 by Jordanus Ruffus, it has still remained a major frequently diagnosed infection in horses all over the world. The *S. equi* subspecies pathogen is known to be often resistant to antibiotic treatment, and it makes the antibiotics inefficient; hence, this review was conducted to study how the disease can be managed. The age-long sign of this infection is the oozing of pus through the mucous and skin membranes. Affected horses lose appetite, develop fever, and become depressed, which result in them losing weight and becoming lethargic, reducing their physical activity especially when they are being raised for athletic and sport purposes. This article reviews various solutions proffered by several researchers about the healthy performance impacts of *S. equi* in equine.

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## 1. Introduction

The strangles disease is a highly contagious upper respiratory infection in horses. This infection is communicable and transmitted from animal to animal through direct contact and also through inhalation. Contact with the discharge from an infected animal will transmit this disease. The strangles disease is a zoonotic disease and can be transferred from infected animals to human beings. Hence, there is a need to take utmost caution when dealing with horses, especially horses diagnosed with the strangles disease. The accompanying signs of this disease include the following: fever, depression, and retropharyngeal lymph node enlargement that

often results in respiratory inconvenience. To forestall its spread during an outbreak, it is paramount that we detect the carriers first because if they are not detected early and attended to, complications arising from this negligence can lead to the unchecked spread of abscessation [1]. The age-long sign of this infection is the oozing of pus through the mucous and skin membranes. Affected horses lose appetite, develop fever, and become depressed, which result in animals losing weight and becoming lethargic, reducing their physical activity, especially when these animals are being raised for athletic and sport purposes [2].

There has been a disparity between the efficacy of antibiotic treatments in the laboratory and the real-life clinical administration, and hence, further investigation to find lasting and more effective treatment is required [3].

Although the strangles disease was discovered many decades ago in 1,251 by Jordanus Ruffus, it has still remained a major frequently diagnosed infection in horses all over the world. The *Streptococcus equi* subspecies pathogen is known to be often resistant to antibiotic treatment; it makes the antibiotics inefficient [4]. It is a well-known fact that the detection of *S. equi* can fail in more than 40% of horses infected with the strangles disease; hence, there is a need for better, improved, and optimal techniques for diagnoses of this infection. This article aims to review the impact of

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*Streptococcus equi* on equine healthy performance and solutions proffered to address this challenge, thereby enhancing equine performance.

## 2. Symptoms and Clinical Signs

The first sign noticed in a strangles disease–infected animal is fever, causing an increase in the animal's body temperature, and then catarrh in the upper respiratory tract; this manifests in the huge abscess as evidenced by mucopurulent nasal discharge and acute swelling with subsequent abscess formation in submandibular and retropharyngeal lymph nodes. The name “strangles” came into existence because affected horses sometimes were suffocated and choked by expanded supersized lymph nodes that clogged the airway. The severity of disease varies much from animal to animal, which is solely dependent on the current immune status of the animal. In older horses, mild strangles is exhibited, characterized by discharge from the nostrils, tiny swellings filled with pus, and short duration of disease stay and spell, whereas the younger horses will mostly develop serious and large lymph node abscessation that later opens up and ejects its contents. Fever is the first clinical sign, and it lingers right from the growth of the abscess until maturity. Infected animals often lose their appetite and have lean long necks as a result of anorexia.

Efforts taken by the infected animal to ingest food and water are often accompanied with reflux of the ingested food from the nostrils. These animals also experience depression and some become lethargic during the period of this infection, which are the common signs. Pharyngitis, rhinitis, and laryngitis might likely occur as a result of the infection and worsen the condition of the nares, which starts as serous and quickly becomes mucopurulent then purulent, and finally opens and drains. Accumulation of purulent exudates might lead to noisy breathing. The *S. equi* can be isolated from the purulent ocular discharge. Swelling of the animal limbs and the lymph nodes is a vital sign (Fig. 1).

## 3. Detection and Diagnoses

Owing to the possibility of the disease spreading through inhalation, it is important to ensure early detection and diagnosis to avoid unnecessary casualties. The best assessment and detection methods of the causal agent or pathogen are polymerase chain

reaction (PCR) testing and usually culture of the *S. equi*. Detection of the pathogen is carried out in two ways:

- (1) Biochemical identification
- (2) Real-time PCR

An efficient way of diagnosis proved to be 90% accurate was put forward by Lindahl et al. [6]; swabs from the nostrils of infected animals were cultured by biochemical identification, and real-time PCR was also directly carried out in 57 horses of different breeds and ages from eight strangles disease outbreak. The results revealed that real-time PCR conducted directly on samples yielded/detected the largest number of infected horses positive for *S. equi* while biochemical identification was less efficient than real-time PCR, detecting 22 of 57 infected horses positive for *S. equi*. This investigation revealed the likelihood of detecting acute cases of strangles disease and taking precautionary steps to prevent the spread of it (Fig. 2).

## 4. Ranging and Management System

The management system of horses can determine their susceptibility to the strangles disease and also how long the animal has the infection, as findings have revealed that the pathogen cannot last long in the natural environment. Rapt attention should be given to the environment in which the animal feeds and stays as this may have an impact on the animal's health [8]. Findings revealed that the housing and management system engaged in housing horses affects their susceptibility and resistance to the pathogen. Horses that are strictly kept and fed in the stable are most susceptible to this infection, and these are mostly horses raised for sports and athletic purposes [9]. In accordance with the study by Weese et al. [10], the longevity and survival of the *S. equi* bacteria showed that the external outdoor conditions had negative impacts on *S. equi* survival, which was evidenced by the effect of sunlight on it. These findings of Weese et al [10] on the survival of the pathogen under external conditions are not unusual as it is common knowledge the susceptibility of bacteria to sunlight and removal of water. The study also noted that the natural presence of other organisms in the environment likely has an effect and a role to play in the weak and shortened survival of the *S. equi* as it has already been studied that the *S. equi* survival around other soil bacteria will be short owing to its susceptibility to bacteriocins produced by other soil bacteria [11].

### 4.1. Vaccination

Strong immunity is built by most infected animals during recovery from the disease, and this immunity could last for over five years and sometimes a decade [12,13]. This indicates that a high level of immunity against strangles infection can be biologically and naturally generated and activated in the animal to protect it from future infections.

### 4.2. Outbreak Control

The following steps and guidelines should be adhered to whenever an outbreak of strangle disease occurs:

- (1) In the event of an outbreak, ensure that infected horses are immediately separated and other horses are restricted from free ranging either within or outside the facility, taking proactive steps to follow necessary hygiene.
- (2) Horses infected with the strangles disease should be quarantined within a distinct marked area.

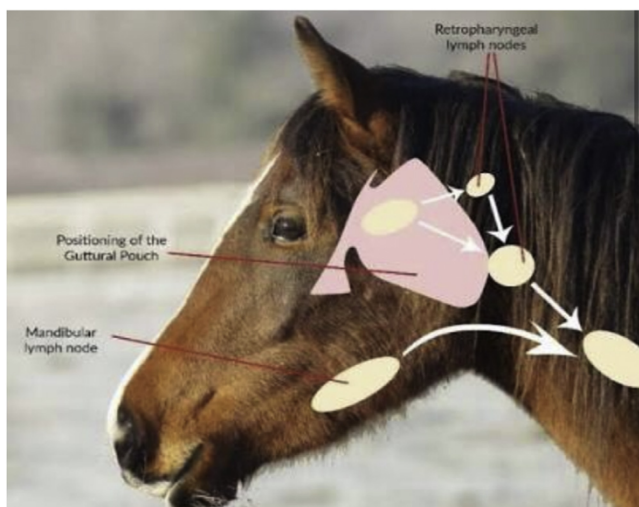


Fig. 1. Showing the position of lymph nodes and guttural pouches which are the anatomy affected by strangles; Vet Voice (2019) [5].

Disease Process For All Horses		Healthy	Incubation	Signs	Healthy
Infectivity	Non-Carriers		3-14 Days	3-8 Weeks	
		Susceptible	Latent	Infectious	Immune then Susceptible
	Carriers		4-7 Days	4-8 Weeks	Variable months or Years
		Susceptible	Latent	Infectious	
			4-7 Days	Months/Years	

**Fig. 2.** Model showing the strangles disease process and comparing infectivity of a typical strangles case and strangles carrier case. Model adapted from The Animal Health Trust (2016) [7].

- (3) To ensure that newly affected animals are quickly detected, temperature readings of the rectal area should be taken daily during outbreak to proactively identify and treat newly infected horses.
- (4) After bacteriological tests, infected horses should be kept in quarantine areas tagged “dirty” and the healthy ones separated in an area tagged “clean.”
- (5) Throughout the facility, high hygiene and sanitation levels and standards should be maintained and adhered to across the whole facility.
- (6) Lavage fluids and swabs should be routinely collected at weekly intervals for tests after recovery of animals that were prior infected.
- (7) Owing to the fact that the PCR has the ability to detect living and dead bacteria, positive PCR tests should be investigated further.

#### 4.3. Hygiene Measures

Tremendous attention should be dedicated to the maintenance of high hygiene standards during the disease outbreak to forestall further spread from infected horses to susceptible horses. The personnel attending to the infected animals should use specially assigned protective clothing and avoid dealing with susceptible horses just after dealing with the infected animals. In case where this is unavoidable, the susceptible animal should be cared for first. The equipment and all items engaged during the period of infection of animals should be disinfected thoroughly and set aside, and when the price of items is not a major issue, consideration should be given to the utter destruction of these items after the end of the outbreak [14].

All organic matter should be expunged by ensuring proper cleaning and cleansing of the facility. The feeding trough (feed and water) should be paid attention too during the cleaning. All organic waste and feed waste from infected animals should be disposed of in isolated locations. After the removal of these, such areas should be thoroughly disinfected. When disinfecting stables used by infectious horses ultimate care should be taken to ensure that infection is not spread through this means by ensuring items used in the cleaning of the infected animal's stable are not used in the healthy animals stable.

Pastures where infected animals grazed should be fallowed for at least four weeks after eradication of disease although there is no evidence of prolonged presence of the *S. equi* on the pastured used for grazing. Owing to the zoonotic nature of the *S. equi* infection, it is important that animal handlers, veterinary doctors, pathologists, and equine postmortem handlers take adequate care to avoid

contracting the *S. equi* from the infected animals. It should however be noted that the *S. equi* is host-adapted and its infection rate in humans is particularly low [14].

#### 4.4. Prevention

The prevention of the outbreak and spread of the strangles disease through quarantine and bacteriological screening is often difficult to be carried out in the absence of specific measures to cut down the potential of introducing the *S. equi* through subclinical carriers. Farm managers should always take into consideration the potential of the strangles outbreak and therefore maintain high standards of hygiene and sanitation across the farm. Wherever there is frequent movement and interaction of animals during breeding seasons and racing events, preventing the outbreak through screening is often very difficult [15].

If a new animal is being introduced, such animal should be isolated for about three weeks and screened during this period for *S. equi* by repeated nasopharyngeal swabs.

### 5. Treatment: Feeding and Antibiotics

Determining the right treatment for horses with the strangles disease is largely dependent on the severity and stage of the disease in the host [16]. Currently, there is a controversy over the treatment of strangles disease among veterinary doctors on the use of antibiotics or not. However, most cases of the strangles infection only require good rest and quality food, and the animal should be allowed to stay during the period of the infection. In acute cases where the animal is depressed, antibiotics can be administered to the infected animals, but it should be noted that treated animals are often likely to still be susceptible to further reinfection. Antibiotic treatment will prevent the synthesis of protective antigens and slow down the development of immunity against strangles disease in the animal [17], increasing the possibility of the infected animal being reinfected with the strangles disease once antibiotic treatment is stopped.

Early detection and treatment of the animals that exude the earliest clinical symptoms of the infection could be an effective means of managing the disease outbreak in farms and racing stables. Antibiotics might render the bacteria inactive in the lymph nodes for a short period; however, bacteria cause boils and abscesses as soon as the antibiotics are discontinued.

Administering antiinflammatory drugs may improve the animal's behavior and outlook by eliminating fever and abscesses, and this ultimately leads to improved appetite. In rare cases, infected horses do require intensive support therapy, intravenous fluids, and tracheostomy, and if this is the case, such animals should be

administered systemic antimicrobial medications to forestall secondary bacterial infections of the lower respiratory tract.

Just as diets play a significant role in the health of all living things, so it does in the health of horses. It plays a major role particularly at the onset and the management of many general diseases in horses. Horses that are especially raised for sporting activities are fed a different diet from those that are raised for general activities and recreation in which case the diet consisted primarily of fibers which remained a staple diet daily for the horses and varied only in the type and quality once in a while [18]. Reverse is the case in this modern time where the horse's diets are primarily made up of starch mixed with varying amounts of roughage. Variation in the quality and type of feed they receive may likely predispose these horses to a few challenges. Modern-day feeding systems are usually associated with the challenges within the stomach-intestinal tract. For instance, sudden switch in diet has been pointed out as a major risk factor that causes abdominal pain (colic) in horses [19]. The risk appears to multiply up to 14 days after a diet change [20]. The frequent ingestion of a large amount of starch, usually grain, has for a long time been found to lead to colic, abdominal bloat, diarrhea, toxemia, and laminitis. It has also been discovered that diet is a contributing factor to various intestinal diseases in horses such as salmonellosis and clostridiosis [21].

Sporting and racing activities have now caused a shift in feeding and housing practices, with the focus being on realizing a high level of athletic performance from horses. These has many adverse effects on the horses; some of these include heightened incidence of disease and infections. Some of these diseases can be directly connected to feeding systems and dietary composition, whereas in others cases, the diet composition is a significant aiding factor.

Breeding practices that aim to select particular enhanced traits for the sake of sports have ultimately adversely caused a bias in selection of horses with enhanced genes within varying breeds. Specific diet practices and systems are required to achieve these levels of high performance required from these horses with mutated genes. With feeding regimes and systems, there is a lack of certain nutritious elements in the diets fed to the horses, which predisposes them to diseases such as hyperkalemic periodic paralysis, nutritional secondary hyperparathyroidism, and selenium caused by a lack of vitamin E.

Swerczek [22] established that overly nutritious diets worsened the state of strangles disease—infected animals and suggested that high-protein diets can be eliminated or reduced in their feeding arrangement while encouraging feeding with more roughage.

## 6. Medications for Therapy

Depending on the area of the body where the infection is domicile, penicillin is commonly viewed as the preferred choice for the treatment of nonpneumococcal streptococcal disease, while other drugs are considered depending on the ease of drug administration. It has been put forward by many veterinarians anecdotally that animals with the strangles disease have recovered better when administered trimethoprim-sulfadiazine treatment. Although there is a proof that trimethoprim-sulfadiazine treatment did not entirely eradicate *S. zooepidemicus* infection in animals, the study did not reveal its effectiveness against *S. equi*. The *S. equi* reacts quickly to penicillin, and hence, it is the preferred antibiotic. The *S. equi* is not resistant to penicillin; its effect is quick in clearing the abscess.

## 7. Complications Associated With Sequin Infection

A series of complications can arise as a result of the strangles disease, which occur in the following ways:

- (1) Complication can arise when the infection spreads from the head area to the neck and to other parts of the horse's body.
- (2) Agalactia
- (3) Immune-mediated processes, including purpura hemorrhagica and myopathies.

## 8. Conclusion

The focus of breeding, feeding, and managing equine in recent times has been maximizing growth and athletic and healthy performance for sporting and recreational reasons, and this has left horses more susceptible to strangles disease by *S. equi*. However, further investigation should be carried out to find out more about the effects of the environment on *S. equi*.

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