Small Strongyles (Cyathostomes): Mystery and Myths

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A Parasite Profile

Introduction

Although the scientific understanding of small strongyles as they affect horses is increasing, much still remains to be learned. The significance of the different life stages of small strongyles is poorly understood. Also poorly understood are the effects of the immunological status of the horse and the external environment on the pathogenicity of small strongyles. While there are many hypotheses, relatively little has been documented in well-controlled studies about the effect of the inhibited small strongyles on the horse or the mechanisms by which they may cause disease.

The Bottom Line

Effective, broad-spectrum parasite control is a key component for maintaining optimal horse health. A parasite control program using EQVALAN® (ivermectin) brand products at approximately 8-week intervals provides highly effective, broad spectrum parasite control for adult horses.

- EQVALAN is highly effective against all lumenal and non-inhibited mucosal stages of small strongyles.
- Reduction of fecal egg counts begins within three days after a single treatment with EQVALAN. In several studies, fecal egg suppression was maintained for 8-10 weeks. (1) In another study, complete control has been shown to last for up to 84 days. (2)
- A history of recent anthelmintic administration was not significantly (p>0.05) associated with colic in horses. (3)
- Anthelmintic schedules designed to minimize fecal egg counts can be expected to decrease the risk of colic. (4)
- Long term clinical trials (a four-year trial reported in 1989 and a two-year trial reported in 1996) utilizing multiple dosing regimes of...
Related References:


TSB-99035

EQVALAN demonstrated continued efficacy and suppression of fecal strongyle egg counts and fecal larvae under field conditions.(1,5)

- EQVALAN remains the broadest spectrum equine parasite control product available (according to registered labeled claims) and is highly effective against all oral and gastric stages of the most common bot species; larval and adult stages of large and small strongyles, pinworms and lungworms; liver, lung, intestinal larval and adult stages of ascarids; larval stages of Habronema, and Draschia, and microfilariae of onchocerca; and adult large-mouth stomach worms, hairworms and intestinal hairworms.

Overview of Small Strongyles

The cyathostomes, small strongyles of horses, are overall one of the least understood nematode parasites of domestic animals. Over 40 species of small strongyles are known to exist; however, even using larval culture and identification tables it is difficult to speciate individual small strongyles. Therefore, these separate species are all grouped into a classification known as "small strongyles" or cyathostomes.

All small strongyles of horses have a direct life cycle. First and second-stage larvae are found in the fecal pat and the infective third larval stage translocates to the forage on pasture. Once ingested, the prepatent period of cyathostomes ranges from 5.5 to 18 weeks, but can be greatly extended by inhibition of larval development.(6) The amount of larval inhibition occurring at a certain point of time can vary widely, even in horses on the same pasture. The stimulus, or stimuli, which cause the inhibited larvae to resume development is still unknown. Thus, there is not yet an effective way to trigger or monitor this occurrence to scientifically quantitate the event. This dramatic variation of patency within and between the species of small strongyles, and the lack of knowledge regarding the inhibited phase, makes scientific investigation of inhibited larval forms of small strongyles extremely difficult, if not impossible.

Evaluation of Small Strongyle Infections

Post-mortem counts of inhibited small strongyle larvae are possible. Such counts are frequently used; however, the overall accuracy and clinical significance of the numbers obtained by these counts has yet to be determined. Assays of the inhibited larvae are possible using the mucosal transillumination method, but due to the variable rate of inhibition of larvae within different horses, direct comparisons between horses is of limited value. Inhibited larval counts can also vary dramatically from one section of intestine to another within the same animal.

More accurate determinations of anthelmintic activity is possible with developing
larvae, since larval development is more predictable. Post-mortem analysis of non-inhibited larval forms requires use of mucosal digestion and incubation which allows an effective enumeration of developing mucosal stages of small strongyles.

Activity of an anthelmintic against adult small strongyles and developing larvae can be measured by fecal egg reduction and the duration of fecal egg count reduction. These egg count parameters are probably the most significant from a management standpoint. In temperate areas, larvae of small strongyles can overwinter, providing a source of infection for the following grazing season. However, the most important source of infective larvae is the eggs passed by horses sharing the same grazing area during the same grazing season.(7) Knowledge of the extent of activity of an antiparasitic will determine the frequency of deworming necessary to limit environmental contamination.

Clinical Signs
Published clinical reports and scientific studies illustrate that signs of small strongyle infection range from non-existent to quite severe,(7-9) and the pathogenicity is clearly not well-understood. In the past, clinical signs have been attributed to massive numbers of encysted larvae activating and continuing their development(8,9). A recent publication indicates that mucosal penetration by larvae and/or mucosal inflammation may contribute to the pathogenic effects which have traditionally been attributed to larval emergence.(10) Additionally, clinically healthy horses can be infected with tens or even hundreds of thousands of small strongylid worms.(9) Interactions of small strongyles with other parasites, nutritional status and other diseases could also play a role in their pathogenicity but have yet to be explored.

Clinical signs that have been attributed to small strongyle infections are weight loss, unthriftiness, failure to shed (rough hair coat), diarrhea and colic.(6,9) These clinical signs can be present during periods when there is no fecal egg shedding, making a definitive field diagnosis difficult. Diarrhea and colic are two of the more severe clinical signs attributed to small strongyles.

Diarrhea in horses has been reviewed in several publications.(11,12,13) These papers focused primarily on the attempt to determine a causative factor for specific cases of diarrhea in horses and ponies under dramatically differing management routines. Diagnosing the exact cause of diarrhea in these cases presented a major challenge, with many cases remaining undiagnosed. None of these papers included information about control animals under similar management, but without diarrhea, for comparison. Without this information, management of these animals could not be ruled out as a potential cause of diarrhea and questions still remain about a cause-and-effect relationship.

Colic in horses has also been examined.(3,4) These studies provided information about the factors predisposing horses to colic, including the effect of various anthelmintic schedules on the incidence of colic. It was shown that there was no correlation between recent administration of anthelmintics and incidence.
of colic\(^3\) as some have suggested. Additionally, one study, which focused on optimal deworming schedules, demonstrated that anthelmintic schedules timed to minimize fecal egg counts can be expected to decrease the incidence of colic\(^4\).

**Treatment**

Adult horses should be treated with EQVALAN at eight week intervals. Horses younger than one year of age should be treated with EQVALAN at six week intervals, beginning at 6-8 weeks of age.

Long term controlled comparisons of differing deworming protocols demonstrated reductions of fecal egg counts to near zero in adult horses treated bi-monthly with EQVALAN\(^1,5\). EQVALAN is highly effective against all lumenal and non-inhibited mucosal stages (adult and fourth-stage larvae) of small strongyles. Various levels of efficacy of EQVALAN against inhibited larvae have been reported in literature\(^14,15\). Regular use of EQVALAN provides the most complete parasite control available for horses.

**Conclusions**

Maintaining animal health and prevention of disease are the primary goals of veterinary medicine. Consistent and timely dosing with effective, broad-spectrum anthelmintics have been shown to reduce fecal egg output, limit pasture contamination and reduce the incidence of colic. Long term clinical trials utilizing sequential doses of EQVALAN, published in 1989 (four year trial)\(^5\) and 1996 (two year trial)\(^1\), demonstrated continued efficacy with suppression of fecal strongyle egg counts under field conditions. EQVALAN remains the broadest equine parasite control product available (according to registered label claims) and is highly effective against both oral and gastric stages of the most common bot species; larval and adult stages of large and small strongyles, ascarids, pinworms and lungworms; larval stages of *Habronema*, and *Draschia*, and microfilariae of *Onchocerca*; and adult large-mouth stomach worms, hairworms and intestinal threadworms.

**References**


2. FOI Summary for QUEST™ (moxidectin)


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**EQVALAN® (ivermectin)**

**Product Description**

Ivermectin is derived from the avermectins, a family of potent, broad-spectrum antiparasitic agents, which are isolated from fermentation of *Streptomyces avermitilis*.

EQVALAN® (ivermectin) Liquid is a clear, ready-to-use solution with each mL containing 1% ivermectin (10 mg), 0.2 mL propylene glycol, 80 mg polysorbate 80, 9 mg sodium phosphate monobasic monohydrate, 1.3 mg sodium phosphate dibasic anhydrous, 1 mg butylated hydroxytoluene, 0.1 mg disodium edetate, 0.2% benzyl alcohol and purified water q.s. ad 100%.
Disodium edetate, 3% benzyl alcohol and purified water q.s. ad 100%.

Product Indications
EQVALAN Liquid is indicated for the effective treatment and control of the following parasites or parasitic conditions in horses:

Large Strongyles:
- Strongylus vulgaris
  (adults and arterial larval stages)
- S. edentatus
  (adults and tissue stages)
- S. equinus
  (adults)
- Triodontophorus spp
  (adults)

Small Strongyles - including those resistant to some benzimidazole class compounds
- Cyathostomum spp
- Cylicocyclus spp
- Cylicostephanus spp
- Cylicodontophorus spp

Hairworms (adults):
- Trichostrongylus axei

Large-mouth Stomach Worms (adults): Habronema muscae

Bots (oral and gastric stages):
- Gastrophilus spp

Lungworms (adults and fourth-stage larvae):
- Dictyocaulus arnfieldi

Intestinal Threadworms (adults):
- Strongyloides westeri

Pinworms (adults and fourth-stage larvae):
- Oxyurus equi

Summer Sores caused by Habronema and Draschia spp cutaneous third-stage larvae.

Ascarids (adults and third-and fourth-stage larvae):
- Parascaris equorum

Small Strongyles - including those resistant to some benzimidazole class compounds
- Cyathostomum spp
- Cylicocyclus spp
- Cylicostephanus spp
- Cylicodontophorus spp

Dermatitis caused by neck thread-worm microfilariae, Onchocerca sp.

Dosage
EQVALAN Liquid for Horses is formulated for administration by stomach tube (nasogastric intubation) or as an oral drench. The recommended dose is 200 mcg of ivermectin per kilogram (91 mcg/lb) of body weight. Each mL contains sufficient ivermectin to treat 110 lb (50 Kg) of body weight:10 mL will treat an 1100 lb (500 kg) horse.

Administration
Use a calibrated dosing syringe inserted into the bottle to measure the appropriate dose, or pour the EQVALAN Liquid into a graduated cylinder for dose measurement. Use a clean syringe if accessing the bottle to avoid contaminating the remaining product.

Administration by stomach tube (gravity or positive flow): The recommended dose can be used undiluted or diluted up to 40 times with clean tepid water (see Notes to Veterinarian). Use tepid water to flush any drug remaining in the tube into the horse's stomach.

Administration by drench: For administration by this method, an undiluted dose is usually preferred. Clear the horse's mouth of any food material, elevate the horse's head, and using a syringe, deposit the appropriate dose in the back of the mouth. In order to avoid unnecessary coughing or the potential for material to enter the trachea and lungs, do not use excessive pressure (squirtling), do not use a large (diluted) dose volume, and do not deposit the dose in the laryngeal area. Increased dose rejection may occur if the dose is deposited in the buccal space. Keep the horse's head elevated and observe the horse to insure the dose is retained.

Suggested Parasite Control Program
All horses should be included in a regular parasite control program with particular attention being paid to mares, foals and yearlings. Foals should be treated initially at 6 to 8 weeks of age, and routine treatment repeated as appropriate. EQVALAN effectively controls gastrointestinal nematodes and bots.
treatment repeated as appropriate. EQVALAN effectively controls gastrointestinal nematodes and bots in horses. Regular treatment will reduce the chances of verminous arteritis and colic caused by *S. vulgaris*. With its broad spectrum, EQVALAN is well suited to be the major product in a parasite control program.

**Mode of Action**
Ivermectin, one of the avermectins, kills certain parasitic roundworms and ectoparasites such as mites and lice. The avermectins are different in their action from other antiparasitic agents. This action involves a chemical that serves as a signal from one nerve cell to another, or from a nerve cell to a muscle cell. This chemical, a neurotransmitter, is called gamma-aminobutyric acid or GABA.

In roundworms, ivermectin stimulates the release of GABA from nerve endings and enhances binding of GABA to special receptors at nerve junctions, thus interrupting nerve impulses - thereby paralyzing and killing the parasite. The enhancement of the GABA effect in arthropods such as mites and lice resembles that in roundworms except that nerve impulses are interrupted between the nerve ending and the muscle cell. Again, this leads to paralysis and death.

The principal peripheral neurotransmitter in mammals, acetylcholine, is unaffected by ivermectin. Ivermectin does not readily penetrate the central nervous system of mammals where GABA functions as a neurotransmitter.

**Safety**
EQVALAN Liquid may be used in horses of all ages including mares at any stage of pregnancy.
Stallions may be treated without adversely affecting their fertility. These horses have been treated with no adverse effects other than those noted under **Notes to Veterinarian**.

**Warning**: Do not use in horses intended for food purposes.

**Precautions**
Caution: EQVALAN Liquid has been formulated specifically for use in horses only. This product should not be used in other animal species as severe adverse reactions, including fatalities in dogs, may result.

Refrain from smoking and eating when handling. Wash hands after use. Avoid contact with eyes. **Keep this and all drugs out of the reach of children.**

Store in a tightly closed container at room temperature.

Protect EQVALAN Liquid (undiluted or diluted) from light.

For customer service, contact Merial Customer Service, 4545 Oleatha Avenue, St. Louis, MO 63116.

**Environmental Safety**
Studies indicate that when ivermectin comes in contact with the soil, it readily and tightly binds to the soil and becomes inactive over time. Free ivermectin may adversely affect fish and certain water-borne organisms on which they feed. Do not contaminate lakes, streams, or ground water by direct application or by improper disposal of drug containers. Dispose of drug container in an approved landfill or by incineration.

**Notes to Veterinarian**
Swelling and itching reactions after treatment with EQVALAN have occurred in horses carrying heavy infections of neck threadworm microfilariae, *Onchocerca* sp. These reactions were most likely the result of microfilariae dying in large numbers. Symptomatic treatment may be advisable.

Healing of summer sores involving extensive tissue changes may require other therapy in conjunction with EQVALAN. Reinfection, and measures for its prevention, should also be considered.
Special consideration should be given to the effects or potential for injury from handling, restraint, and placement of the tube during administration by stomach tube. EQVALAN Liquid should be administered by drench if the risks associated with tubing are of concern. Due to the consequences of improper administration (also see Dosage and Administration), EQVALAN Liquid is intended for use by a veterinarian only and is not recommended for dispensing.

EQVALAN Liquid in 1 to 20 and 1 to 40 dilutions with tap water has been shown to be stable for 72 hours under the conditions recommended for the product (i.e., at room temperature, in a tightly closed container, protected from light). The diluted product does not promote the growth of common organisms. However, prolonged storage of the diluted product cannot be recommended, as the effects of possible contaminants and interactions with untested materials are unknown.

Package Information
EQVALAN Liquid for horses (Product 25877) is available in a 100 mL plastic bottle. Each bottle contains sufficient ivermectin to treat 10-500 kg (1100 lb) horses. Contents may be poured into a graduated cylinder for dose measurement. Alternatively, a clean syringe may be inserted directly into the bottle to draw off the appropriate dose.

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