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### The evidence surrounding the role of parasites in intestinal disease

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Overview S.vulgaris Pequorum A.perfoliata Cyathostomiasis

### The threat of parasitic disease

- Exposure to complex mixture of parasites
- Heavy burdens common
- Anthelmintic resistance is an increasing concern

*Parasites which cause intestinal disease: A review of the evidence and recent developments*

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### The threat of parasitic disease

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### Overview

- Strongylus vulgaris
- Parascaris equorum
- Anoplocephala perfoliata
- Cyathostomiasis

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### Infarction due to S.vulgaris

Thrombi detectable in cranial mesenteric artery 21 days after experimental infection

L4 larvae migrate to the root of the cranial mesenteric artery

↓

Infarction

Photographs courtesy of D. Knottenbelt

Duncan, J., Pirie, H., 1975. The pathogenesis of single experimental infections with Strongylus vulgaris in foals. Res. Vet. Sci. 18, 82-93.

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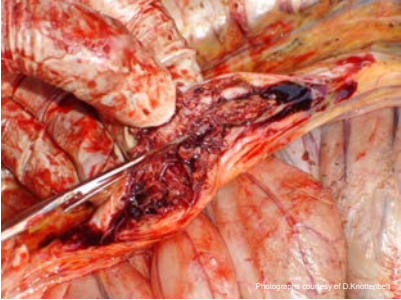
### Strongylus vulgaris

Photographs courtesy of D. Knottenbelt

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**Strongylus vulgaris**



Photograph courtesy of D. Kriesebeck

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**Strongylus vulgaris**

- The re-emerging parasite!
- **1960s/70s/80s**- Very important parasite, clinical cases common, prevalence 80-100%
- The primary target of all parasite control programs

Veterinary Parasitology 189 (2012) 161–167

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**Veterinary Parasitology**

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**Strongylus vulgaris (Looss, 1900) in horses in Italy: is it still a problem?**

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**Strongylus vulgaris**

- **1990s/2000s:**
- Reduction in prevalence
- Cyathostomins became the primary focus of parasite control
- Anthelmintic resistance to cyathostomins emerged in the 00s
- Reduction in anthelmintic use and targeted treatments

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**Strongylus vulgaris: The current situation**

- Sardinia 2011:
  - 100% of 46 horses had gross pathological lesions attributable to *S.vulgaris*
  - Larvae found in 39% cranial mesenteric arteries
  - Larval culture detection rate: 41%

Pilo, C., Altea, A., Pirino, S., Nicolussi, P., Varcasia, A., Genchi, M., Scala, A., 2012. Strongylus vulgaris (Looss, 1900) in horses in Italy: is it still a problem? Vet. Parasitol. 184, 161–167.

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**Strongylus vulgaris: The current situation**

- Denmark 2012:
  - 662 horses
  - Overall prevalence of 12%
  - Farm prevalence:
    - Selective anthelmintic use: 83%
    - No selective anthelmintic use: 39%

Nielsen, M.K., Vidyashankar, A.N., Olsen, S.N., Monrad, J., Thamsborg, S.M., 2012b. Strongylus vulgaris associated with usage of selective therapy on Danish horse farms—Is it reemerging? Vet. Parasitol. 189, 260–266.

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**The current conundrum**

- Are modern anthelmintic control programmes the reason why *S.vulgaris* is re-emerging?
- What should be our focus now?

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**Strongylus vulgaris associated with usage of selective therapy on Danish horse farms—Is it reemerging?**

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### Parascaris equorum

- Normally young horses
- Prevalence 31-61% (Austin et al 1990, Lind and Christensson 2009)
- 2 disease 'syndromes'
  - Acute due to intestinal obstruction
  - Chronic- lethargy, anorexia, poor weight gain

Austin, S., DiPietro, J., Foreman, J., Baker, G., Todd, K., 1990. Parascaris equorum infections in horses. *Compend. Contin. Educ. Pract. Vet.* 12, 1110-1118.  
 Lind, E., Christensson, D., 2009. Anthelmintic efficacy on Parascaris equorum in foals on Swedish studs. *Acta Vet. Scand.* 51, 45.

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### Parascaris equorum



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### Parascaris equorum



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### Parascaris equorum

- Increased risk of acute small intestinal obstruction following anthelmintic administration
- 72% had anthelmintic in preceding 24hrs (Cribb et al 2006)
- Most likely due to mass of dying worms
- Anthelmintic associated reduction in intestinal motility has been postulated

Cribb, N., Coté, N., Bouré, L., Peregrine, A., 2006. Acute small intestinal obstruction associated with *Parascaris equorum* infection in young horses: 25 cases (1985-2004). *N. Z. Vet. J.* 54, 338-343.

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### Treatment of ascarid impaction

- Enterotomy/resection and anastomosis
- Milking impaction into caecum
- Horses undergoing enterotomy appear to have lower long term survival (60% vs 27%)

Cribb, N., Coté, N., Bouré, L., Peregrine, A., 2006. Acute small intestinal obstruction associated with *Parascaris equorum* infection in young horses: 25 cases (1985-2004). *N. Z. Vet. J.* 54, 338-343.  
 Tatz, A.J., Segev, G., Steinman, A., Berlin, D., Milgram, J., Kelmer, G., 2012. Surgical treatment for acute small intestinal obstruction caused by *Parascaris equorum* infection in 15 horses (2002-2011): Surgical treatment for ascarid impaction in 15 horses. *Equine Vet. J.* 44, 111-114.

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### Prevention

Anthelmintic efficacy to *P. equorum* expressed as a % egg reduction in a faecal egg count reduction test

Ref	FBZ	PYR	IVR
Geurden et al 2013	100%	100%	45.5%
Laugier et al 2012	Not tested	Not tested	40-69%
Lyons et al 2008	84%	0%	0%

Geurden, T. et al 2013. Determination of anthelmintic efficacy against equine cyathostomiasis and *Parascaris equorum* in France: Anthelmintic efficacy against equine cyathostomiasis and *Parascaris equorum*. *Equine Vet. Educ.* 25, 304-307  
 Laugier, C. et al 2012. Prevalence of *Parascaris equorum* infection in foals on French stud farms and first report of ivermectin-resistant *P. equorum* populations in France. *Vet. Parasitol.* 195, 195-199  
 Lyons, E.T., et al 2008. Evaluation of parasitocidal activity of fenbendazole, ivermectin, oxbendazole, and pyrantel pamoate in horse foals with emphasis on ascarids (*Parascaris equorum*) in field studies on five farms in Central Kentucky in 2007. *Parasitol. Res.* 103, 287-291.

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**Management**

- Increase interval of worming to > 8weeks
- Preserve benzimidazoles for clinical cases
- Delay first treatment of foals to 60-70days

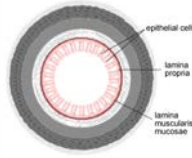
Reinemeyer, C.R., 2012. Anthelmintic resistance in non-strongylid parasites of horses. Vet. Parasitol. 185, 9–15.

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**Anoplocephala perfoliata**

- Significantly increased risk of colic when present
- Inflammation of the lamina propria around the ileocaecal junction

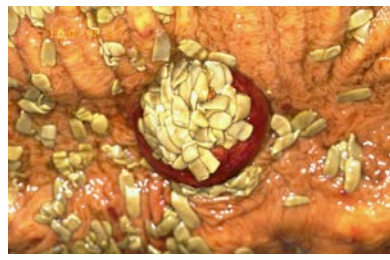


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**Tapeworms and colic**

- ileal obstruction

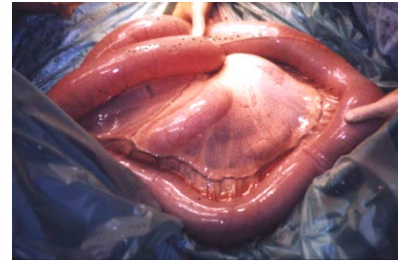


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**Tapeworms and colic**

- Ileal impaction

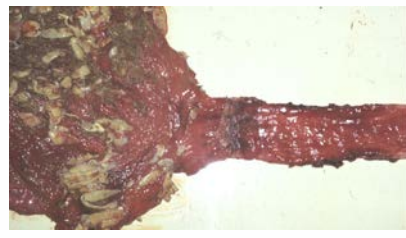


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**Tapeworms and colic**

- ileal rupture

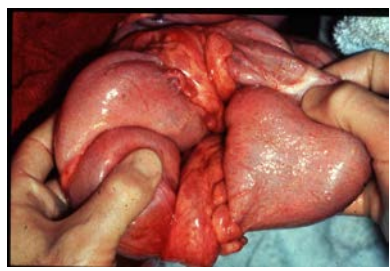


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**Tapeworms and colic**

- Caecocolic intussusception



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**A.perfoliata- Diagnosis**

- Faecal flotation- Good sensitivity only if tapeworm burden is high
- ELISA- Potential for false positive due to persistence of high antibody titres
- For both diagnostic techniques there is conflicting evidence between the infection intensity and incidence of colic- may reflect sensitivity of tests rather than true reflection of relationship.

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**Cyathostomiasis**




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**Cyathostomiasis**

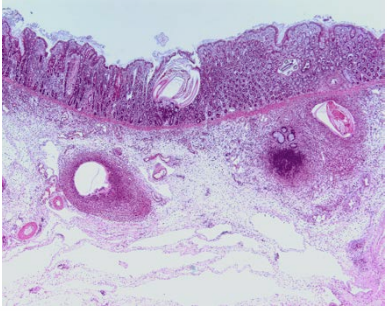
- Mortality rate of up to 50% in clinical cases of larval cyathostomiasis
- Marked inflammatory reaction during mucosal penetration and reemergence



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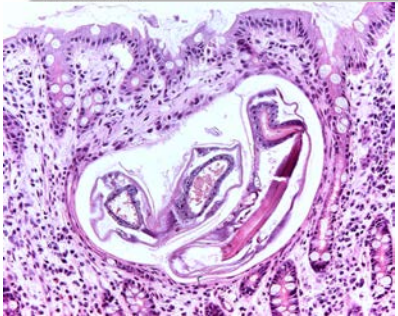
**Cyathostomiasis**



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**Cyathostomiasis**



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**Cyathostomiasis**

Current diagnosis:

- Baermann technique
- Larval culture

The problem with diagnosis:

- Disease caused by larval stage
- Diagnosis currently limited to patent infection- after the damage has been done
- Pre patent period prolonged
- Pre-patent diagnostic tests would be of immense benefit to equine health.

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### Cyathostomiasis

- PCR ELISA (Hodgkinson et al 2003)
- Reverse line blot assay (Cwiklinski 2012)

Both require an egg shedding adult worm.....

Cwiklinski, K., Kooyman, F.N.J., Van Doorn, D.C.K., Matthews, J.B., Hodgkinson, J.E., 2012. New insights into sequence variation in the IGS region of 21 cyathostomin species and the implication for molecular identification. *Parasitology* 139, 1063–1073.

Hodgkinson, J., Lichtenfels, J., Mair, T., Cripps, P., Freeman, K., Ramsey, Y., Love, S., Matthews, J., 2003. A PCR–ELISA for the identification of cyathostomin fourth-stage larvae from clinical cases of larval cyathostomiasis. *Int. J. Parasitol.* 33, 1427–1435.

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### Cyathostomin diagnosis: The future

- A cyathostome specific antigen has been identified (McWilliam et al 2010)
- It has been evaluated in an indirect ELISA
- More work needs to be done to make the ELISA quantitative

McWilliam, H.E.G., Nisbet, A.J., Dowdall, S.M.J., Hodgkinson, J.E., Matthews, J.B., 2010. Identification and characterisation of an immunodiagnostic marker for cyathostomin developing stage larvae. *Int. J. Parasitol.* 40, 265–275.

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### Acknowledgements

- Professor Derek Knottenbelt
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