

First Report of *Dictyocaulus arnfieldi* Infestation in a Horse in Mashhad, Iran

Kamran Sharifi ^{1*}, Hassan Borji ² and Peyman Milani ³

¹ Department of Clinical Sciences, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Mashhad, Iran

² Department of Pathobiology, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Mashhad, Iran

³ Private Veterinarian, Mashhad, Iran

Received: September 7, 2009

Accepted: May 30, 2010

Abstract

This article describes a case of *Dictyocaulus arnfieldi* infestation in a horse with signs of mild pneumonia in Mashhad zoo. In hematological examinations leukocytosis, neutrophilia with degenerative left shift; and in parasitological examination the first stage larvae of *Dictyocaulus arnfieldi* were detected in the feces. According to the authors' knowledge, this is the first report of *D. arnfieldi* infestation in Iran.

Keywords: *Dictyocaulus arnfieldi*, pneumonia, horse

*Corresponding Author: Kamran Sharifi
Email: sharifi.k@gmail.com
Tel: +985118788944
Fax: +985118763851

Introduction

Pneumonia can be caused by parasites in the horse. *Dictyocaulus arnfieldi* is the true lungworm found in the horses, belonging to the superfamily of Trichostrongyloidea. It has been reported from various parts of the world. (Bakirci and *et al.*, 2004; Feinstein, 1979; Fikru and *et al.*, 2005; Gothe and Heil, 1984) The natural host of the parasite is donkey, and comparably, large numbers of parasites can accumulate in the lungs of this host without clinical signs. Donkey can act as a reservoir for horses. (Beelitz and *et al.*, 1996). The parasite has also been isolated from 2 zebras (Ashizawa and *et al.*, 1980). It has a direct life cycle, and a prepatent period of approximately 12 weeks (Round, 1976a). Migrating *D. arnfieldi* (Cobbold 1884) is usually the etiological agent of parasitic pneumonitis in the adult horse, whereas *Parascaris equorum* is the most common etiological agent of parasitic pneumonitis in weanlings (Clayton, 1986). The present report describes a case of *D. arnfieldi* infestation in a 7-year-old stallion.

Case Presentation

The stallion was kept in a zoo in Mashhad metropolice, northeast of Iran as a recreational horse with minimal exercise, almost entirely used by people for riding and taking photos. There was a history of housing the stallion with five donkeys together for a limited period of time recently. The horse ration was consisted of alfalfa hay and barley grain. The owner complained about a chronic nonproductive cough that caused annoyance of the visiting people. The horse was examined in the zoo on April 2008.

A thorough clinical examination was performed. Additionally, blood and fecal samples were collected for hematological and parasitological examinations, respectively. The fecal samples were Baermannized for the detection of larvae and also, egg per gram (EPG) count was performed by floatation method. Fecal culture was also performed for

7 days at 25 °C for harvesting and diagnosis of larvae. The affected horses were treated with ivermectin (200µg/kg, P.O., Ivermectin 1%, Nasr Co., Fariman, Iran). Two weeks later, fecal samples were collected again to evaluate the response to treatment.

Results

On physical examination, the horse was in good body condition (fat), weighing around 400 kilograms, with a nonproductive cough, without nasal discharge. Rectal temperature was 38°C, heart rate 40 beats/min, and respiratory rate 40 breaths/min. The other clinical examination parameters were normal, except some crackles were auscultable over the topographic area of the lungs. On a clinical basis, bacterial pneumonia was considered as the first tentative diagnosis. Other probable tentative diagnoses were considered such as chronic hypersensitivity pneumonitis, chronic obstructive pulmonary disease, fungal pneumonia, immune mediated interstitial or vascular disease and unusual drug reactions, (Burks, 1998), as well as foreign body in the trachea.

The hematological results were as follows: PCV 44 (normal range: 32-47%), Hemoglobin 15.9 (normal range: 11-17g/dl), RBC 8.96 (Normal range: $6.4-10 \times 10^6$), MCV 49 (normal range: 43-54 fl) MCH 17.7 (normal range: 15-19 pg) MCHC 36.1 (normal range: 34-37 g/dl), total white blood cells 17100 (normal range: 5200-13900/µl), adult neutrophils 12825 (normal range: 2200-7400/µl), Band neutrophils 171 (normal range: 0-100/µl), eosinophils 171 (normal range: 0-600/µl), lymphocytes 3591 (1100- 5300/µl), monocytes 342 (normal range: 0-900/µl), platelets $5.84 \times 10^5/\mu\text{l}$, total protein 6.7 (normal range: 5.5-7.3 g/dl), fibrinogen 300 (normal range: 100-500 mg/dl). The EPG was 130 eggs per gram of faeces. No *Parascaris equorum* eggs were observed on fecal examination. The first stage larvae of *D. arnfieldi* were diagnosed according to the observation of a terminal small spike (Figure

1). Larvae per gram (LPG) were 5. Other larvae which were harvested after fecal culture belonged to small strongyles. The larvae of *D. arnfieldi* were also isolated from another 9 years old horse in the same premise in the zoo, with neither an apparent history of exposure to donkeys nor overt clinical signs.

Discussion

In several studies, 50-80% of donkeys have been found infected with *D. arnfieldi* (Clayton and Duncan 1981; Klei, 1986). Before the advent of the anthelmintic, ivermectin, the prevalence of *D. arnfieldi* infection in horses in Kentucky at necropsy was approximately 11%, while it was 2% in live horses at the same time and at the same region, based on fecal examination (Lyons and *et al.*, 1985a; Lyons and *et al.*, 1985b). This difference may suggest the difficulty in antemortem diagnosis of *D. arnfieldi* in horses. However, patent infections have been found in horses, resulting in disease occurrence in closed herds with no exposure to donkeys or mules (Lyons and *et al.*, 1985b; Clayton and Duncan, 1981). Experimental reproduction of the infestation has been established in pony foals (Clayton and Duncan, 1981). These findings support previous reports of horse-to-horse transmission (Lyons and *et al.*, 1985a; Lyons and *et al.*, 1985b; Round, 1976b). The presence of migrating larvae and adult worms in the lung parenchyma and bronchi activate both the humoral and cellular immune systems and results in an immune-mediated bronchopneumonia, subsequently with release of IgE, infiltration of mast cells, and basophils leading to release of histamine and eosinophilic chemotactic factor (Mackay and Urquhart, 1979), with deleterious effects on both parasite and the surrounding respiratory cells, causing accumulation of mucopurulent exudate in the lumen. (Mackay and Urquhart, 1979; Nicholls and *et al.*, 1979) Direct damage by the adult parasites results in chronic catarrhal bronchitis with hyperplasia and thickened epithelium as well as focalz edema

and hemorrhage. Secondary immunosuppression and the colonization of secondary bacterial infections may occur (Burks, 1998). The lack of nasal discharge, normal temperature, good appetite and good body condition in both horses in our observation might be due to low parasite burden, and/or short course of the disease after exposure to donkeys. The diagnosis of *D. arnfieldi* infestation in horses may be somewhat difficult. The animals are not typically inappent or dull in the case of *D. arnfieldi* (Boyle and Houston, 2006) However, it has been reported that cough and dyspnea were always accompanied infected horses (Andersen and Fogh, 1981a). Hematological and serum biochemical results may be normal in horses with parasitic pneumonitis. However, if secondary bacterial infection occurs, inflammatory changes, such as a mature neutrophilia and hyperfibrinogenemia may be evident following parasitis pneumonitis. This feature may prompt the clinician to follow an antimicrobial therapy. From this viewpoint, some horses with parasitic pneumonitis may show some clinical improvement following antimicrobial treatment (Boyle and Houston, 2006), that may be misleading and be followed by the relapse of clinical signs. In this case, the horse may show leukocytosis and neutrophilia with regenerative left shift implicating a bacterial pneumonia. It seems that we should consider the possibility of concurrent bacterial pneumonia; however, secondary bacterial infections may occur by the presence of the adult parasites in the bronchi (Burks, 1998). Diagnostic confirmation of parasitic pneumonitis due to *D. arnfieldi* depends on several considerations. Bronchoalveolar lavage and transtracheal wash in order to harvest some mucus may reveal eosinophilic reaction that is most commonly found in cases of *D. arnfieldi* infestation in horses and may strongly implicate *D. arnfieldi* infestation. Normal eosinophil percentages of the total nucleated cell count in bronchoalveolar lavage fluid are $1.0 \pm 1.4\%$ (Mair *et al.*, 1987). In the

apparently absence of the evidence of the parasite, outbreak of the eosinophilic bronchitis in horses, and also a pony possibly associated with *D. arnfieldi* have been reported (Mackay and Urquhart, 1979, Church, 1983). The response to appropriate anthelmintic treatment is an alternative procedure for diagnosis. A history of commingling of horses with donkeys, and/or grazing in common pastures should be considered in the diagnosis of parasitic pneumonitis caused by *D. arnfieldi* in horses that show signs of respiratory disease (Boyle and Houston, 2006; Burks, 1998).

Finding *D. arnfieldi* larvae in the feces is not common, as it was a discrepancy between estimated prevalence rate of infestation at necropsy or antemortem diagnosis in Kentucky (11 vs. 2%) (Lyons and *et al.*, 1985a; Lyons and *et al.*, 1985b). However, patent infections have been found in horses, resulting in disease occurrence in closed equine herds with no exposure to donkeys (Andersen and Fogh, 1981).

The affected horses showed a good response to antihelmintic treatment. In the subsequent fecal examination two weeks later, both horses showed no evidence of *D. arnfieldi* larvae in their feces, as well as a high drop in EPG of other parasitic nematodes.

Up to the authors' knowledge, this is the first report of *D. arnfieldi* infestation in Iran. The *D. arnfieldi* infection in horses should be considered when horses show clinical signs of respiratory disease when commingled with donkey, or shared pastures with donkeys when they are not commingled apparently. The relapse of clinical signs in horses that was treated for a bacterial pneumonitis should arouse suspicion of parasitic pneumonitis. With the difficulty in *D. arnfieldi* Larvae capture in horse feces, it is highly advisable to transfer fecal samples in the vicinity of ice, because the loss of the parasite larvae has been reported insignificant in 4 ° C, but not at 16 and 20 ° C (Rode and Jorgensen, 1989) that might increase the chance of larval recovery in

feces. With the difficulty of larval isolation in feces, other methods of diagnosis, including bronchoalveolar lavage and/ or a good response of horses with signs of respiratory disease to antihelmintic treatment shouldn't be overlooked.

Acknowledgement

The authors wish to thank Dr. G.R. Razmi, (Faculty of Veterinary Medicine, Ferdowsi University of Mashhad) for consultation.



Figure 1. *Dictyocaulus arnfieldi* larva. The terminal spike is evident and the larva is about 480µm. (Lugol 10% staining, 400X)

References

- Andersen, S. and Fogh, J. (1981) Prevalence of lungworm, *Dictyocaulus arnfieldi*, in donkeys in Denmark. *Nordisk Veterinaer Medicin* **33**, 484-491.
- Ashizava, H., Usui, M., Horii, Y., Nosaka, D., Tateyama, S. and Owada, K. (1980) Two cases of lungworm infection in zebra. *Bulletin of the Faculty of Agriculture, Miyazaki University* **27**, 225-232.
- Bakirci, S., Irak, V.Y., En, E. and Karabacak, A. (2004) Parasites found by fecal examinations in horses in the Gemlik military stud farm. *Turkiye Parazitoloji Dergisi* **28**, 35-37.

- Beelitz, P., Gobel, E. and Gothe, R. (1996) Endoparasites of donkeys and horses kept together in Upper Bavaria: range of species and intensity of infestation. *Tier arztliche Praxi* **24**, 471-475.
- Boyle, A.G. and Houston, R. (2006) Parasitic pneumonitis and treatment in horses. *Clinical Techniques in Equine Practice* **5**, 225-232.
- Burks, B.S. (1998) Parasitic pneumonitis in horses. *Compendium on Continuing Education for the Practicing Veterinarins* **20**, 378-383.
- Church, S. (1983.) Eosinophilic bronchitis associated with suspected *Dictyocaulus arnfieldi* infection in a pony. *Australian Veterinary Practitioners* **13**, 65-66.
- Clayton, H.M. (1986) Ascarids: recent advances. *Veterinary Clinics of North America, Equine Practice* **2**, 313-328.
- Clayton, H.M. and Duncan, J.L. (1981) Natural infection with *Dictyocaulus arnfieldi* in pony and donkey foals. *Research in Veterinary Science* **31**, 278-280.
- Feinstein, R.E. (1979) *Dictyocaulus arnfieldi* in donkeys in Neuquen Province, Argentina. *Revista Militar de Veterinaria* **26**, 125-128.
- Fikru, R., Reta, D., Teshale, S. and Bizunesh, M. (2005) Prevalence of equine gastrointestinal parasites in western highlands of Oromia, Ethiopia. *Bulletin of Animal Health and Production in Africa* **53**, 161-166.
- Gothe, R. and Heil, H.G. (1984) Intestinal parasites and lungworms of donkeys in Germany: age-related evaluation of prevalence of infections and specific composition. *Deutsche Tier rztliche Wochenschrift*, **91**, 144-145.
- Klei, T.R. (1986) Other parasites: recent advances. *Veterinary Clinics of North America, Equine Practice* **2**, 329-336.
- Lyons, E.T., Tolliver, S.C., Drudge, J.H., Swerszek, T.W. and Crowe, M.W. (1985a) Parasites in lungs of dead equids in Kentucky: emphasis on *Dictyocaulus arnfieldi*. *American Veterinary Research* **46**, 924-927.
- Lyons, E.T., Tolliver, S.C., Drudge, J.H., Swerszek, T.W. and Crowe, M.W. (1985b.) Lungworms (*Dictyocaulus arnfieldi*): prevalence in live equids in Kentucky. *American Journal of Veterinary Research* **46**, 921-923.
- Mackey, R.J. and Urquhart, K.A. (1979) An outbreak of eosinophilic bronchitis in horses possibly associated with *Dictyocaulus arnfieldi* infection. *Equine Veterinary Journal* **11**, 110-112.
- Mair, T.S., Stokes, C.R. and Bourn, F.J. (1987) cellular content of secretions obtained by lavage from different levels of the equine respiratory tract. *Equine Veterinary Journal* **19**, 458-462.
- Nichilis, J.M., Clayton, H.M., Duncan, J.L. and Buntain, B. (1979) Lungworm (*Dictyocaulus arnfieldi*) infection in donkeys. *Veterinary Record* **104**, 567-570.
- Rode, B. and Jorjensen, R.J. (1989) Baermannization of *Dictyocaulus* spp from faeces of cattle, sheep and donkeys. *Veterinary Parasitology* **30**, 205-211
- Round, M.C. (1976) Lungworm infection (*Dictyocaulus arnfieldi*) of horses and donkeys. *Veterinary Record* **99**, 393-395.

اولین گزارش آلودگی اسب با دیکتیوکولوس آرنفیلدی در مشهد

کامران شریفی^۱، حسن برجی^۲، پیمان میلانی^۳

^۱ گروه علوم درمانگاهی، دانشکده دامپزشکی دانشگاه فردوسی مشهد؛ مشهد، ایران

^۲ گروه پاتوبیولوژی، دانشکده دامپزشکی دانشگاه فردوسی مشهد؛ مشهد، ایران

^۳ دامپزشک بخش خصوصی؛ مشهد، ایران

پذیرش نهایی: ۱۹/۳/۹

دریافت مقاله: ۱۸/۶/۱۶

چکیده

در اردیبهشت ماه ۱۳۸۷، یک راس نریان، که قبلاً با چند راس الاغ در یک جایگاه قرار داشت، با علائم سرفه های خودبه خودی و متناوب در باغ وحش مشهد معاینه شد. برای آزمایش های خون شناختی و انگل شناختی نمونه های خون و مدفوع تهیه شد. نتایج آزمایشگاهی لکوسیتوز، نوتروفیلی همراه با انحراف به چپ جبرانی، و همچنین لارو مرحله ی اول دیکتیوکولوس آرنفیلدی در مدفوع را نشان داد. تاکنون آلودگی به این انگل در ایران گزارش نشده است.

واژگان کلیدی: دیکتیوکولوس آرنفیلدی، پنومونی، اسب