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Theileriosis in sheep in the region of Van: Clinical and haematological findings, diagnosis, treatments and transmitters

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Abstract: T. ovis and T. hirci have rarely been diagnosed in the erythrocytes of sheep although, Theileria (T) spp commonly known to infect cattle. However, presence of theileriosis in sheep in this region has not been reported before. In the present study, animal materials used were the sheep brought to the Veterinary Teaching Hospital of the University of Yüzüncü Yıl. Blood smears and smears from lymph nodes were made for diagnosis. In the present study, two sheep had theileriosis alone, 1 had both theileriosis and babesiosis, 1 had both theileriosis and anaplasmosis and 5 had all theileriosis, babesiosis and anaplasmosis together being a total of 9 sheep. Diagnosed species were T. hirci, Babesia (B) ovis, and Anaplasma (A) ovis. Haemoglobunuria was present in the animals that had also babesiosis except those in the early stages. Lymph nodes were also swollen in the sheep that had theileriosis. Tick species seen on the infected animals were Rhipicephalus (R) bursa, R. sanguineus, R. turanicus and Hyalomma (H) anatolicum excavatum.

Keywords: Theileriosis, Sheep.

Van bölgesi koyunlarında theileriozis: Klinik ve hematolojik bulgular, teşhis, tedavi ve kene türleri

Özet: Theileria (T) türlerinin yaygın olarak sığırları enfekte etttikleri bilinmesine rağmen T. ovis ve T. hirci hayvanların eritrositlerinde nadir olarak teşhis edilmektedir. Ancak bölgemizde koyunlarda theileriozis'in varlığı daha önce rapor edilmemiştir. Bu çalışmanın materyalini Yüzüncü Yıl Üniversitesi Veteriner Fakültesi Hayvan Hastanesine getirilen koyunlar oluşturdu. Kan ve lenf sıvısından frotiler yapılarak hastalığın teşhisi konuldu. Bu çalışmada incelenen toplam 9 koyundan 2 koyun sadece theileriozisle, 1 koyun hem theileriozis hem de babeziozisle, 1 koyun hem theileriozis hem de anaplazmozisle, 5 koyunun ise theileria, babesia ve anaplazma ile enfekte oldukları teşhis edildi. Teşhis edilen türler T. hirci, Babesia ovis ve Anaplasma ovis olarak belirlendi. Hastalığın erken dönemi hariç babeziozisin de bulunduğu vakalarda hemoglobinuri de mevcuttu. Theileriozisin bulunduğu tüm hayvanlarda lenf yumruları büyümüştü. Enfekte hayvanların üzerinden toplanan kene türleri ise Rhipicephalus R) bursa, R. sanguineus, R. turanicus ve Hyalomma (H) anatolicum excavatum olarak teşhis edildi.

Anahtar Kelimeler: Theileriozis, Koyun.

INTRODUCTION

Although, *Theileria* (T) *spp* commonly known to infect cattle, sometimes *T. ovis* and *T. hirci* have also been diagnosed in the erythrocytes of sheep. Theileriosis is classified as two entities; malignant and benign because the two are immunologically distinct. Benign ovine theileriosis, a mild and nonfatal form of theileriosis, is caused by *Theileria* (T) *ovis*. Malignant theileriosis is an acute infectious but noncontagious disease of sheep and goats and is characterised by fever, icterus and enlargement of lymph nodes and is caused by *T. hirci* sporozoan transmitted by ticks (1, 2). *R. spp* and *Hyalomma* (H) *anatolicum* are suspected vectors of *T. hirci* (1, 3). Veterinarians diagnose malignant theileriosis on evidence of typical signs and lesions and upon identification of the parasites in stained blood, lymph node, or spleen smears (4). *T. ovis,* a causative agent of benign theileriosis, has been described as an omnipresent parasite causing an infection with mild clinical reactions in sheep (2). It was reported from almost all regions of Turkey except from eastern Anatolia. *T. hirci,* a causative agent of

malignant theileriosis, was reported from goats in Central, Eastern and South Eastern Anatolia. (5).

Although several workers reported tick-borne diseases from several parts of the world, there isn't much report on theileriosis in sheep. Theileriosis is usually missed out by veterinarians when the sheep also infected with other tick-borne diseases apart from theileriosis. In the present study, clinical and haematological findings, diagnosis, treatments and tick species that theileriosis transmitted by them were aimed to investigate. The relationships between tick species and mix infections were also analysed.

MATERIALS AND METHODS

Nine sheep and lambs aged between 6 months and 3 years old that were brought to the Animal Hospital of the University of Yuzuncu Yil were the materials of the present study. The animals were examined clinically after admission to the hospital. Pulsation, respiration, body temperature, condition of conjunctiva, lymph nodes and PCV values were obtained at first. When there were anaemia, hyperaemia, icter on conjunctiva, high body temperature, swollen lymph nodes and low PCV values; blood smears and smears from lymph node fluids were made. The smears were stained with Giemsa method and examined under microscope for the presence of *Theileria spp, Babesia spp or Anaplasma spp*. Ticks seen especially on the hairless areas of the animals were collected for the differentiation of tick species (6) and for to evaluate the relationship between tick species and diseases possibly transmitted by them.

RESULTS

The animals were brought to the hospital for their inappetence, weakness, live weight loss, in some cases can't stand up. Clinical and haematological findings of these animals are given in Table 1. All animals used in the present study had high body temperature, pulsation and respiration. Animals with mix infections had lower PCV values compared to the animals that had only theileriosis alone. Body temperatures were not significantly higher than normal in the beginning of infection. Haemoglobinuria was present in the animals that had also babesiosis except those in the early stages of the disease. Lymph nodes were also swollen in the sheep that had theileriosis. Two sheep had theileriosis alone, 1 sheep had both theileriosis and babesiosis and 1 sheep had both theileriosis and anaplasmosis after clinical and haematological examination in the present study. Five animals had all theileriosis, babesiosis and anaplasmosis together (Table 1).

Table 1. Clinical and some haematological findings of sheep which had either theileriosis or mix infected.

No	Temperature	Lymph node	PCV (%)	Conjunctiva	Haemoglobinuria	Disease(s)
1	40.5	swallen	32	Hyperemic	-	T
2	41.2	swallen	28	Normal	-	T
3	40.7	swallen	26	Hyperemic	-	T+A
4	38.7	swallen	15	Ichteric	+	T+B
5	41.3	swallen	26	Hyperemic	-	T+B+A
6	41.5	swallen	28	Hyperemic	-	T+B+A
7	42.0	swallen	19	Ichteric	+	T+B+A
8	41.8	swallen	11	Ichteric	+	T+B+A
9	41.1	swallen	15	Ichteric	+	T+B+A

(+) present, (-) absent, (A) anaplasmosis, (B) babesiosis, (T) theileriosis

Differential Diagnosis

Differential diagnosis was made on the basis of clinical, haematological findings and identification of the agents in the blood smears or in the smears obtained from lymph node fluid for schizont forms of *theileria* (Picture e). *Theileria* agents were diagnosed microscopically from their blood smears as their ring (Picture a), batone (Picture b) or comma form (Picture c,d). *Babesia* was diagnosed as their pear-shape (Picture b,d). *Anaplasma* was also diagnosed as their anaplasmoid forms (Picture d). The species diagnosed according to literature were *T. hirci*, *B. ovis*, *A. ovis* (7).

Treatment

For the treatment of theileriosis, buparvaquone was given. Diminazen aceturate and fenazon were given to the animals for the treatment of babesiosis. Oxytethracycline was used alone for the treatment of anaplasmosis. In mix infections, buparvaquone or diminazen aceturate and fenazon, oxytethracycline, vitamin B_{12}, iron preparations were also used. Fluid therapy was also applied in severe cases (PCV values 15% and under). Animals treated got well except those two sheep, which had theileriosis, anaplasmosis and babesiosis together and one sheep that had theileriosis and babesiosis.

Tick Species And Diseases Transmitted By Them

Tick species identified according to the literature (6) and diseases diagnosed in the animals are given in Table 2. Ticks were not seen on all the animals. Because the ticks may have been dropped from the animals after sucking blood from the sheep. Drugs against ticks may have also been used before applying to the hospital. Sometimes, two or three different tick species were also collected from the same animals

Table 2. Tick species, diseases diagnosed and the number of infected animals.

Animals infected with	Tick species (n = Number of infected animals)			
	R. bursa	*R. turanicus*	*R. sangiuneus*	*H anatolicum excavatum*
T	+ (n=1)	-	-	+ (n=1)
T + B + A	+ (n=1)	+ (n=2)	+ (n=1)	+ (n=1)

(+) = present, (-) = absent R = Rhipicephalus, H = Hyalomma, T = theileriosis, B = babesiosis, A= anaplasmosis

DISCUSSIONS

Although theileriosis most commonly seen in the cattle, sheep can also be infected by these parasites. Thus, clinical, haematological findings, diagnosis, treatments of the diseases and microscopic appearances of the culprits are important to put into context. Diagnosis of mix infections is especially important because theileriosis could easily be under mind in sheep.

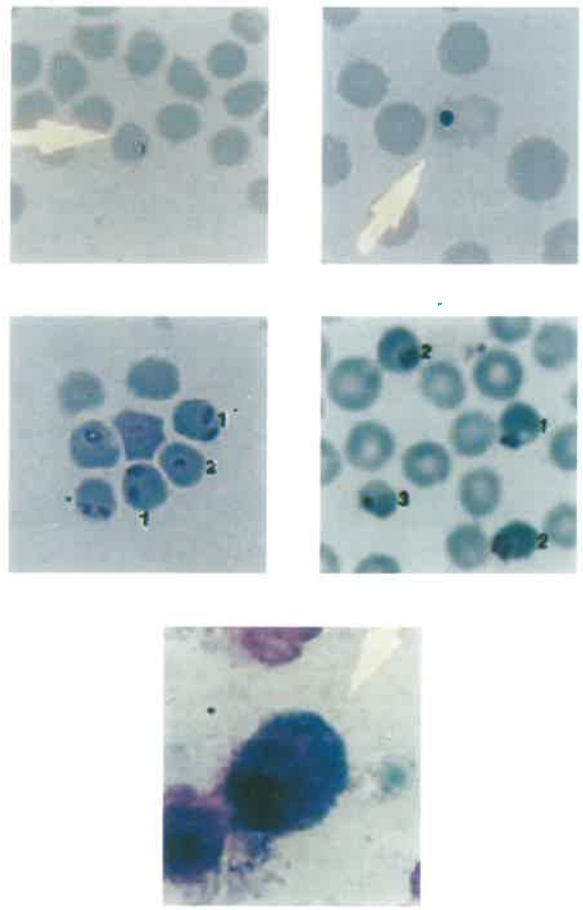
One of the most certain diagnostic procedures in these diseases is to demonstrate the culprit microscopically if possible. Serology can also be used for the diagnosis of the diseases (2, 3, 8, 9) and this strategy may well be better in an epidemiological survey. However, in the present study, serology could not be carried out. In clinical examinations, the best way for diagnosing these diseases are to take blood smears and smears from lymph nodes and investigate for the presence of these parasites in the lights of clinical signs. In early stages, smears made from lymph nodes for the diagnosis of schizont forms of theileria are also possible (10). In the present study, diagnosis of the diseases based on above criterions.

The density of the pathogens in the erythrocytes was also low in the animals with mild clinical symptoms. In contrast, the high density of the pathogens in the erythrocytes was seen in the animals with severe clinical signs. Similar relationships between severe clinical signs and high density of infection were reported by other workers (8). Rectal temperatures were also high in all sick animals except the animals in late stages of the diseases (case 4). Prognosis of the animals that had high pathogen density, low body temperature and had PCV values under 15% considered as bad. One of the sheep like it couldn't be cured in this study. Two animals with mix infection also died but we are not sure whether their owners applied our treatment or not. Hyperaemia and anaemia were the most commonly seen symptoms of conjunctive mucosea of the animals with theileriosis. Icter was also seen in the late stages of theileriosis. Haemoglobinuria were one of the clinical symptoms of the animals that had also babesiosis together with theileriosis. In mix infections, clinical symptoms of each disease could be seen.

R. sanguineus is the most widespread ixodid species, and although commoner in the warmer parts of the world, it survives in heated buildings in urban communities. *Hyalomma* are tough tick that survives where humidity is low. Even though, the *Hyalomma* tick species has been detected widespreadingly in this region (11, 12). Studies by some workers have shown that *Riphicephalus* tick species can transmit all *Anaplasma* (13), *Babesia* (4) and *Theileria* (3). Furthermore, *Hyalomma* species have also been reported to transmit *Babesia, Theileria* and *Anaplasma* (9, 14). Similarly, in the present study, *R. bursa, R. sanguineus, R. turanicus* and *H. anatolicun excavatum* species were the only tick species detected on the diseased animals. Most importantly, these tick species were seen in the animals that had either babesiosis, anaplasmosis or theileriosis. This means that these ticks may have been infected with these three parasites together. That is why in mix infections these tick species seen on the animals.

Conclusions

Although theileriosis most commonly seen in the cattle, sheep can also be infected by these parasites. Thus, this possibility always needs to be taken into consideration by veterinarians. Swollen lymph nodes should remind theileriosis. When *Rhipicephalus* and *Hyalomma* tick species seen on the animals, not only one disease should be thought, all three diseases must be taken into consideration. Mix infections may also occur, thus blood smears should be checked carefully in terms of all *Anaplasma*, *Theileria* and *Babesia*



Picture 1. Microscopic appearances of *Theileria, Babesia* and *Anaplasma* in the blood of sheep: (a) *Theileria hirci* (ring form), (b) *Theileria sp.* (batone form), (c) *Babesia ovis,* pear-shape (1), *Theileria hirci,* ring form (2), (d) *Theileria sp.* comma form (1), *Babesia ovis,* double pear-shape (2), *Anaplasma ovis* (3), (e)schizont form of *Theileria sp.* in the lymphocytes obtained from swollen lymph node

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