PARAFILARIOSIS

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Introduction

Parafilariosis in domestic animals and game, results from infestation by filarids belonging to the genus *Parafilaria*. In South Africa cattle, African buffalo and horses are affected by *Parafilaria bovicola, Parafilaria bassoni* and *Parafilaria multipapillosa* respectively. Of these bovine parafilariosis is of the greater clinical and economic concern. It is an erosive disease of bovines with losses due to trimming and occasionally condemnation of carcasses at the abattoir, loss or decreased value of hides, the costs of preventative measures and treatment of clinical cases.

Buffalo parafilariosis was recently confirmed and is of significant importance in the Kruger national park complex. Parafilariosis has also been reported in various Asian buffalo species. Equine parafilariosis has been recorded from Asia, Africa, Europe and South America and in Britain it has only been recognized in imported horses. In South Africa it is only seen very sporadically. *Suifilaria suis* may infect pigs causing subcutaneous nodules and has been reported in South Africa but seems to be of very little importance.

These parasites infest the subcutaneous and intermuscular connective tissues, giving rise to cutaneous nodules and haemorrhagic exudates or “bleeding points” on the skin. Flies of the species *Musca* act as intermediate hosts with different species involved in different geographical areas. In horses it is transmitted by *Haematobia spp.*

Epidemiology
Bovine parafilariosis is widely distributed with clinical cases recorded from the African, Asian, American and European continents.

Vectors

The vectors for bovine parafilariosis in South Africa are the African Face Flies, which prefer to infest the face and particularly the area around the eyes and nose of cattle. The flies feed on secretions e.g. of the eyes and also on blood if the skin is broken. The most important species are *Musca lusoria*, *Musca xanthomela* and *Musca nevelli* whilst in Europe *Musca autumnalis* is involved.

The flies occur throughout the country but are most adapted to the following environmental conditions:

- **Rainfall**: 400 – 700 mm/yr
- **Frost**: less than 120 days/year
- **Mean annual temp**: 17.5 – 22.5 degrees C
- **Altitude**: 800 – 1200 meters above sea level.

In Southern Africa bovine parafilariosis has been reported to occur mainly in thornveld and bushveld areas such as the Limpopo Province, Zululand, Northern and Eastern Cape. It is widely distributed in Namibia (but with a low prevalence rate), common in Eastern Botswana and Swaziland and it is rare in grassveld areas. Buffalo parafilariosis has been reported from the greater Kruger national park complex in the Kruger and Sabi Sand game reserves.

Studies by Nevill (1985) at certain localities in the Limpopo province suggest that *Musca lusoria* may be the most prominent fly vector although this may vary between different geographical regions. The numbers of vectors peak between February and April, with mild reduction in numbers from winter to early summer.

*Musca lusoria* has been found to be abundant throughout most of the year and infected flies were recovered from July-March. This species seems to an effective vector in summer, however, it also seems to be important in transmission of *Parafilaria bovicola* during early spring. At this period populations of the other two vector species are low with numbers of *Musca xanthomela* remaining low throughout the year. Infected flies of this species were found only in spring and early summer, when many cattle had bleeding spots and abundant infective material was available. *Musca nevelli* appeared to be extremely few in number for 8-9 months in the year. As a consequence only 2 infected flies were recovered over 3 years of study during the period June-January. Between February and April numbers of this vector increase and the very large numbers of this vector species at this time, despite the fact that only a few cattle may be available with bleeding points, makes it a very important vector during the second half of summer.

More recent investigations were carried out by Keet et al (1997) into the occurrence of parafilariosis, caused by *Parafilaria bassoni* in buffalo in the great Kruger National Park
complex. Cases were mostly seen from November to mid March. *Parafilaria bassoni* seems to have a shorter life cycle and therefore a shorter pre-patent period compared to *Parafilaria bovicola*. Red-billed oxpeckers (*Buphagus erithrorhyncus*) play an important epidemiological role by removing dead skin and tissues, and enlarging the ulcerative lesions, in diseased animals. They probably also remove embryonated eggs at the same time.

**Seasonal variation**

The disease occurs seasonally and bovine parafilariosis is mostly seen in spring and summer in Europe, and in tropical areas it is seen mainly after the rainy season. In South Africa it is at its most severe from August to January. Parafilariosis in buffalo has been reported to appear approximately a month later and clinical cases to disappear approximately a month earlier compared to bovine parafilariosis. Prevalence rates vary between geographical areas and it may be very high in some endemic areas, such as South Africa, with prevalence rates of 36% -50% reported for bovine parafilariosis. In the greater Kruger National Park complex prevalence rates of 34% were recorded for buffalo parafilariosis. Therefore there has been a prominence of published articles, by South African veterinarians, on the results of their investigations into the epidemiology of parafilariosis especially towards the end of the last century.

Carcass condemnations for parafilaria at Cato Ridge abattoir during 1980, 1981 and 1982 increased from 0.054 to 0.084 to 0.370 percent respectively and showed a marked biphasic seasonal trend peaking during October, November and December with a small secondary peak during June.

More recently articles were published on the first recorded cases parafilariosis in Germany (Hamel *et al* 2010), Belgium (Losson *et al* 2009) and the Netherlands (Borgsteede *et al* 2009)1,3,5. These articles focused mainly on confirming the presence of this condition in these countries, and in all three countries seemed to be isolated cases. Sweden has developed more significant problems and is now an endemic region. Following introduction into Canada the disease failed to establish itself and has been successfully eradicated.

Introduction of parafilariosis seems to mostly follow on the import of cattle from endemic areas into non-endemic areas. Spread of infection will then depend on various factors and most importantly on the presence of specific suitable fly vectors. It has been estimated in Sweden that one “bleeding” cow will act as a source of infection for three other animals.

**Life cycle and pathogenesis**

Eggs or larvae of the parasites are present in the exudates from bleeding points in the affected animal’s skin. These eggs and larvae are ingested by flies, in which they then develop to L3 within several weeks to months, depending on air temperature. Parasites are then transmitted when infected flies feed on the lacrimal secretions, or skin wounds,
of non-infected cattle. Several reports have shown the presence of larvae in the eye of hosts of different animal species, and the conjunctiva is considered a portal of entry for parasites to infect new hosts. Third stage larvae are deposited at these sites during feeding, followed by migration and development into the adult stages under the skin - approximately 5-7 months after infection.

Gravid adult female parafilaria puncture the skin to be able to lay their eggs. This results in the typical “bleeding points” with haemorrhagic exudates - the major lesion seen. The surrounding hair and skin then becomes matted and streaked with blood that attracts more flies to feed on these lesions. Individual lesions only bleed for a short period of time and healing of these lesions is usually rapid.

Nevill (1984) reported that the factors determining the predilection sites of *Parafilaria bovicola* during oviposition in cattle were undetermined. It was observed that the dorsal and lateral aspects of the body seem to be preferred with up to 74,4% of bleeding points seen in these regions.

**Clinical signs**

In bovines sites of infection, are predominantly on the shoulders, withers and thoracic areas, and in only 12% of cases were lesions also reported on the rump and loins. The principal clinical signs seen are very severe subcutaneous inflammation and oedema, which at meat inspection resemble subcutaneous bruising (early lesions). With chronicity it may develop a gelatinous greenish-yellow appearance and a metallic odour. In severe cases the discolouration may extend into the intermuscular fasciae and lesions have been found in sub-pleural, mediastinal and peri-renal tissues. Trimming of the carcass results in the loss of 70 to 370 g (average 210g) of tissue per lesion and the lesions per animal may vary from 2 to 4 (average 3) - (personal communication P.H. Mapham). In severe cases a forequarter, both forequarters or the carcass may be condemned.

These affected areas invariably have to be trimmed in the abattoir and additional economic loss is in the way of rejection or downgrading of the hides. Trimming of carcasses is potentially a significant cause of mass loss, which goes mostly unrecorded. With the privatization of the red meat industry data on carcass trimming and condemnation is no longer freely available in the public domain.

Lesions seen in African buffalo were very similar to those in bovines. Bleeding points or haemorrhagic perforation was observed from the beginning of November to the beginning of February. Secondary subcutaneous abscesses were seen from middle December to middle January and large cutaneous ulcers appeared from middle of January and healed by middle of March, leaving a conspicuous scar. Abscesses were not a common finding in buffalo. A difference seems to be that buffalo showed a higher percentage of ventrally distributed lesion compared to cattle (25,6% vs 7,8%). This finding may suggest that a wider spectrum of vectors may be involved in buffalo, preferring the ventral areas of the body.
Diagnosis

A diagnosis may normally be based on the presence of typical clinical signs. When laboratory confirmation is required embryonated eggs or microfilariae may be demonstrated in exudates. An ELISA technique has been developed in Sweden for the serodiagnosis of parafilariosis. It was shown to have a 95% specificity and 92% sensitivity. Infected cattle could be identified even before typical bleeding spots were seen clinically and may indicate the presence of sexually inactive parasites.

Sundquist et al (1989) found that a four to five month period is required in cattle to develop a positive titre. They also observed that to maintain a positive titre cattle have to be re-infected annually. This would allow for the continuity of the life cycle from one season to the other and hence a persistent positive titre.

In a study by Nevill, Williams and Zakrison (1987) a combination of blood spot incidence in October and serology in May was used to determine the true incidence of infection. They also found good agreement (79.7%) between the May and October ELISA results. Keet et al (1997) stated that it is not known how long a positive titre persists in buffaloes. In their study 25 of 71 (35.2%) male buffaloes tested positive and 37 of 113 (32.7%) females tested positive - a total of 62 of 184 (33.7%) animals that were examined. The youngest seropositive buffaloes were 2 years old. Twenty-three (12.5%) animals had suspicious readings and 99 (53.8%) buffaloes tested negative.

Treatment and control

Treatment and control of parafilariosis is difficult due the long prepatent period during which time drugs are thought to be ineffective. There are two basic approaches, which are firstly to kill the parasite in animals to be slaughtered, and secondly to reduce or eliminate transmission of parasites on the farm where the cattle are raised. Macrocytic lactones and nitroxynil are the predominant medications registered for parafilaria control. The former is given parenterally as a single dose whereas two doses of nitroxynil are required at an interval of three days.

Macrocytic lactones include the only compounds registered in South Africa for treating parafilariosis and are reported to reduce carcass lesion areas by more than 90% 70 days after treatment. The number and size of lesions seems to be markedly reduced in cattle slaughtered 50 days after treatment with invermectin. However, Swan et al (1991) found that a longer treatment-to-slaughter interval may be required to ensure optimum financial benefit from treatment. Soll et al (1984) found that lesion size and the weight of trimmings in mature cattle with patent infections were reduced by 57.6% and 77.7% respectively, 50 days after treatment, compared with corresponding reductions of 92.3% and 92.4% in cattle slaughtered 70 day after treatment.

It has been suggested that animals slaughtered more than 120 days after treatment may start to show increasing incidence of lesions again due to early larval stages, which could resist treatment, becoming mature worms.
Bleeding spots still occasionally occur in treated animals due to the long prepatent period of *Parafilaria bovicola*, and are probably as a consequence of survival of small numbers of worms rather than re-infection. Nevill, Williams and Zakrison *et al* (1987) observed that the persistence of bleeding spots on some treated cattle, together with a lack of data on the biology of the intermediate hosts, probably makes attempts to control the disease with anthelmintics alone economically unjustifiable. They found that good vector fly control over the entire period of *Parafilaria bovicola* transmission resulted in control of *Parafilaria bovicola* transmission on a farm for that season. *Parafilaria bovicola* may, however, survive for 2 years and therefore vector fly control should be continued for at least 2 years or until no further cases occur on the property.

The use of insecticide-impregnated ear tags has also been recommended for vector control.

**Conclusion**

Certain parts of the country has had good rainfall seasons over the past few years which are highly favourable for insect vector propagation which may coincide with a higher incidence of vector borne diseases overall. This was clearly illustrated by recent outbreaks of diseases such as Rift Valley Fever and African horse sickness, which are state controlled and notifiable diseases, attracting far more media attention. In contrast the onus may therefore be resting more on all large animal practitioners to keep their clients informed of the potential economic losses which may be incurred should a higher incidence of parafilariosis be seen due to far more favourable prevailing epidemiological circumstances.

**References**


5. Losson B, Saegerman C 2009 First isolation of *Parafilaria bovicola* from clinically affected cattle in Belgium. *Veterinary Record* **164**: 623-626


11. Reineke R K 1983 *Veterinary Parasitology*. Butterworths, Durban


Multiple Choice Questions

1. Parafilariosis in African buffalo is caused by:
   a. *Parafilaria bovicola*
   b. *Parafilaria bassoni*
   c. *Parafilaria multipapillosa*
   d. *Parafilaria bovis*
   e. *Parafilaria buffelii*
2. Which one of the following is probably the most important vector of bovine parafilariosis in SA?

a. *Musca domestica*
b. *Musca nevelli*
c. *Musca autumnalis*
d. *Haematobia sp.*
e. *Musca lusoria*

3. Which one of the following statements is INCORRECT?

a. Eggs and larvae are not present in exudates of bleeding points.
b. Eggs and larvae are ingested by fly vectors.
c. Transmission can occur via the conjunctiva.
d. Parasites develop to L3 stage in the vector.
e. L3 migrate and develop into adult stages under the skin.

4. Which one of the following statements is NOT TRUE about ELISA serological tests?

a. 4-5 months are required to develop a positive titre in bovine.
b. Cattle have to be re-infected annually to remain seropositive.
c. The ELISAS has a 95 % specificity in bovines.
d. The ELISAS has a 92 % sensitivity in bovines.
e. Titres in buffalo persist for life.

5. Which statement is correct about the clinical signs seen in parafilariosis?

a. Lesions are seen predominantly in the shoulders, withers and thoracic areas in cattle.
b. Bleeding points are not usually seen.
c. Abscesses are the most common finding in buffalo.
d. Buffalo did not show a high percentage of ventrally distributed lesions.
e. Bleeding points are seen from the beginning of March.

6. Which of the following is TRUE about treatment of parafilariosis?

a. Ivermectin is registered for use in lactating animals.
b. Treatment is not affected by the long prepatent period.
c. Lesions will disappear 7 days post treatment.
d. Treatment is ineffective against immature worms.
e. Following ivermectin treatment 90 % of lesions may persist.

7. Long term control of parafilariosis can best be achieved by:
8. a. occasional fly control only.
b. effective fly control for at least 2 years.
c. fly control in conjunction with vaccination for heartwater.
d. biannual treatment with macrocytic lactones.
e. using insecticide impregnated ear tags.

8. In Southern Africa parafilariosis is rarely seen in:
a. the Limpopo province bushveld.
b. the Kwazulu Natal bushveld.
c. eastern Botswana.
d. Swaziland Lowveld.
e. highland grassveld.

9. Which statement is MOST CORRECT?
a. Numbers of *M. xanthomela* are high throughout the year.
b. Numbers of *M. lusoria* are the lowest amongst all the vectors.
c. *M. lusoria* are prevalent throughout most of the year.
d. *M. nevelli* is abundant throughout the year.
e. The total number of vectors in July and August.

10. The optimum annual rainfall for vectors is:
a. 4-7 mm per annum.
b. 800 -1700 mm per annum.
c. 40 -70 mm per annum.
d. 700 - 1400 mm per annum.
e. 400 -700 mm per annum.