Treatment of Clinical Lungworm Disease in Calves with Topical Ivermectin

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Introduction

Parasitic bronchitis, caused by Dictyocaulus viviparus, is a serious disease of young cattle in Ireland. The severity varies within affected groups and diagnosis is usually based on clinical signs with confirmation by detecting lungworm larvae in dung or parasites in the lung at post-mortem examination (1). A topical formulation of ivermectin (IVOMEC Pour-on, MSD Agvet) has been shown to be highly effective in killing adult and immature lungworm. In addition it has been shown to prevent the establishment of new infections of lungworm for up to 28 days after treatment (2). Because of the serious effects of parasitic bronchitis it is recommended that measures be taken to prevent clinical disease, such as strategic early-season dosing using ivermectin at 3,8, and 13 weeks after turn-out (3). However not all farmers use this approach and treatment of clinical disease still occurs. In this trial a naturally occurring outbreak of parasitic bronchitis was used to compare the efficacy and prolonged activity of topical ivermectin to treatment with fenbendazole drench.

Materials and Methods

A group of calves was diagnosed to be affected by parasitic bronchitis upon clinical examination. This diagnosis was confirmed when 25 of 38 dung samples were found to be positive for lungworm larvae. Two of the most severely affected animals were sacrificed. Lung perfusion using a modified Inderbitzen technique (4) revealed the presence of 62 adult lungworm from one of these calves and 39 for the second. These results confirmed that lungworm were the major component of the respiratory disease in the experimental group.

All animals were scored for respiratory signs and weighed and had dung samples taken on the day prior to treatment. Animals of the same sex and respiratory signs score were ranked and paired by weight, then one animal from each pair was randomly allocated to each of the treatments: topical ivermectin at 500 mcg/kg, once topically or fenbendazole drench at 7.5 mg/kg body weight once orally. A total of 19 replicates were used, one of which was composed of a male and female of similar respiratory signs score. The treatment groups had a similar composition with respect to breed type and sex (Table 1). All of the animals remained together on the infected pasture and were examined weekly for 6 weeks. At each examination the animals were scored for signs of respiratory disease and dung samples were taken. Faecal samples were examined for nematodes by a Modified McMaster technique (5), and for lungworm larvae by a Baermann technique (5). Calves were weighed on Days -1, 14, 18 and 42. For statistical analysis faecal nematode and lungworm larval counts were transformed to

the natural logarithm of (count + minimum count possible for the technique) and for calculation of geometric means. The data for Days -1, 28, 25, and 42 were analyzed using a randomized-block analysis of variance with factors of replicate and treatment. Treatment means were compared with an F-test.

Table 1. Replicate and treatment group composition.

a. Replicates :

1	Females, Respiratory Score 2
2-9	Females, Respiratory Score 1
10-17	Males, Respiratory Score 1
18	Males, Respiratory Score 0
19	One Male, One Female, Respiratory Score 2

b. Treatment Group Composition

	Fenbendazole	Ivermectin
Sex		
Males	9	10
Females	10	9
Breed		
Friesian	12	13
Hereford X	4	4
Limousin X	2	2
Simmental X	1	0
TOTAL	19	19

Results

Clinical Signs. Some calves in the fenbendazole-treated group were noted to be infested with lice (species not identified), 7 days after treatment, and for this reason both groups were treated with topical deltamethrin. After an initial reduction in respiratory scores, calves in each group showed respiratory signs at 28 and 35 days after treatment. The signs in the calves in the ivermectin group were milder, and all were scored zero at Day 42. Two calves in the fenbendazole group were so severely affected that they had to be salvage-treated (on days 30 and 37, respectively) with topical ivermectin. One of these animals also required anti-bacterial and anti-inflammatory therapy.

Weight gain: Initial body weight and weight gain of trial animals is shown in Table 2. The ivermectin-treated group gained 4.1 kg more than the fenbendazole group during the course of the trial, though this was not statistically significant ($p>0.10$).

Table 2. Mean body weight gain of calves (Kg)

Day	Fenbendazole	Ivermectin
-1	146.6	154.7
-1 to 14	17.2	18.6
14 to 28	5.1	5.6
28 to 42	8.3	10.6
-1 to 42	30.6	34.7

Faecal Nematode Egg Counts: The data are summarized in Table 3. Once again, both groups responded to treatment initially. The fenbendazole group had increasing egg counts and incidence (Table 5) from Day 28 on. Significantly more eggs were present in the fenbendazole group on Day 28 ($p<0.05$), than in the ivermectin group. Faecal egg counts were delayed by 1 to 2 weeks in the ivermectin group as compared to the fenbendazole group.

Table 3. Faecal Nematode Egg Count. Geometric Least Squares Mean larvae per 25 grams based on a transformation of ln(Count +50).

Day	Fenbendazole	Ivermectin
-1	34.2	61.2
7	0.0	0.0
14	0.0	3.8
21	0.0	4.0
28	68.5	0.0
35	132.0	36.1
42	116.9	110.0

Respiratory Scores: The data are summarized in Table 4. Both groups responded to treatment initially and then experienced increased scores on Days 28 and 35. However the entire ivermectin group was scored normal on Day 42 whereas 4 of the 17 remaining control animals showed abnormal respiration.

Table 4. Mean Respiratory Score

Day	Fenbendazole	Ivermectin
0	1.05	1.05
7	0.0	0.0
14	0.0	0.0
21	0.0	0.0
28	0.26	0.26
35	0.26	0.16
42	0.21	0.0

Faecal Lungworm Counts: The data are summarized in Table 3 and Figure 1. Both groups responded to treatment initially. The fenbendazole group had increasing larval counts and percentage of animals positive starting at Day 28. Only one lungworm-positive sample was obtained from the ivermectin group throughout the course of the trial and all animals were negative at its termination on Day 42. The difference between treatment groups was statistically significant on Day 42.

Table 5. Summary of Faecal Lungworm Larvae Count. Geometric Least Squares Mean larvae per 25 grams based on a transformation of ln(Count +5)

Day	Fenbendazole	Ivermectin
0	19.6	15.9
7	0.0	0.0
14	0.0	0.0
21	0.0	0.0
28	2.8	0.0
35	2.9	0.2
42	3.9	0.0

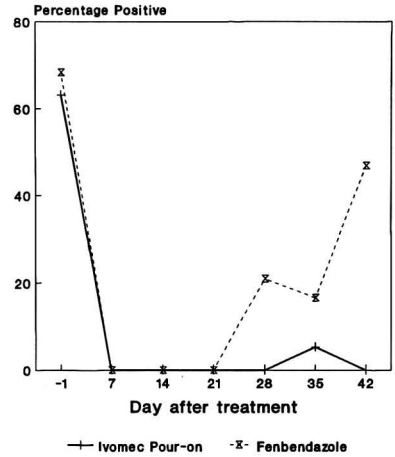

Figure 1. Percentage of animals in each group positive for lungworm larvae in the dung.

Discussion

Evaluation of prolonged activity after anthelmintic treatment is usually performed in animals artificially infected with a uniform culture of the parasite in question. This trial used calves which were naturally infected and which could be expected to have parasites of all stages. The dramatic reduction of lungworm larval output which persisted, in the face of continuing field challenge, for 42 days after treatment confirms ivermectin's high degree of efficacy and prolonged activity for at least 14 days. In contrast the fact that some of the group treated with fenbendazole began to excrete lung-worm larvae by Day 28 strongly suggests that either the treatment was not fully efficacious against all stages of lungworm or that the calves became reinfected very shortly after treatment.

Conclusions

Topical ivermectin was highly effective in the treatment of naturally occuring parasitic bronchitis under field conditions. Its prolonged activity as compared to fenbendazole provided practical benefits by preventing the recurrence of disease thus eliminating the need for re-treatment, and by reducing faecal output of lungworm larvae. At the end of the trial all of the the ivermectin group were negative for lungworm larvae in the faeces and had a respiratory score of zero. Of the fenbendazole-treated group, 47% had lungworm larvae in the faeces on Day 42, and 31% had abnormal respiration.

References

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Summary

The occurrence of a natural outbreak of parasitic bronchitis caused by Dictyocaulus viviparus on a commercial farm provided an opportunity to evaluate the efficacy and prolonged activity of topical ivermectin (IVOMEC Pour-on, MSD Agvet) in the treatment of this disease in comparison to treatment with fenbendazole drench. Calves of the same sex and respiratory signs score were ranked and paired by weight, and randomly allocated to each of the treatments to form 19 replicates. The animals remained on infected pasture and were examined weekly for 6 weeks.

Some of the fenbendazole-treated calves became re-infected with lungworm shortly after treatment since 21%, 17% and 47% of these animals had positive faecal larva counts on Days 28, 35 and 42, respectively. Reinfection was so severe in 2 animals that they required salvage treatment with topical ivermectin on Days 30 and 37, respectively, after the original treatment. In contrast, in the ivermectin-treated cattle, all post-treatment dung samples were negative for lungworm larvae until the end of the trial on Day 42, except for a single larva found on Day 35. None of the ivermectin group required re-treatment during the trial. Topical ivermectin was highly effective in the treatment of naturally-occurring parasitic bronchitis under field conditions. Its prolonged activity as compared to fenbendazole provided practical benefits by preventing the recurrence of disease thus eliminating the need for re-treatment, and by reducing faecal output of lungworm larvae.

Resumen

La aparición de un foco natural de bronquitis verminosa por Dictyocaulus viviparus en una explotación ganadera nos ofreció la oportunidad de avalar la efícacia e actividad prolongada de ivermectin en su formulación tópico (IVOMEC Pour-on, MSD AGVET) en el tratamiento de dicha enfermedad, siendo conparadas con un tratamiento com fenbendazole em formulación oral. Terneiros del mismo sexo e grado de signos clínicos respiratorias fueron agrupados por parejas según el peso y asignados al azar en dos grupos de tratamiento, formando de este modo 19 réplicas. Los animales permanecieron en el pasto contaminado y fueron examinados semanalmente durante seis semanas. Algunos terneros tratados con fenbendazole se reinfestaron luego despúes del tratamiento, porque el 21%, 17% e 47% fueron positivos a larvas en las heces a los días 28, 35 y 42 respectivamente. La reinfestación era tan severa en dos de estos animales que fue preciso un nuevo tratamiento a los días 30 e 37 posteriores al tratamiento original. En el grupo de terneros tratados con ivermectin , todos las muestras recogidas despúes del tratamiento y hasta el término de la prueba el día 42, fueron negativas a larvas de Dictycaulus viviparus., con la excepción de una sóla larva observada en las heces de un ternero al día 35. Ninguno de los animales de este grup requieró retratamiento durante la prueba. Ivermectin, en su formulación para uso tópico (IVOMEC Pour-on) fue altamente efícaz en el tratamiento de la bronquitis verminosa en condiciones de campo. Su actividad prolongado, en comparación con el fenbendazole aportó benefícios prácticos, evitando la reaparición de signos clínicos severos y necesidad de retratamiento, reduciendo el número de larvas del verme pulmonar en las heces.

Résumé

L'apparition naturelle de cas de Dictyocaulose (bronchite vermineuse dûe a D.v) dans une ferme a donné l'opportunité d'évaluer l'efficacité et l'activité prolongée de l'ivermectine pour-on (IVOMEC Pour-on, MSD Agvet)dans le traitement de cette pathologie comparativement au traitement fenbendazole par voie orale. Les veaux de même sexe présentant des symptômes respiratoires de même gravité furent assortis par paires selon leur poids puis assignés au sein de chaque paire à l'un des deux lots (lot traité à l'ivermectine pour-on et lot traité au fenbendazole per os) par tirage au sort soit au total 19 répétitions. Les animaux restèrent en permanence sur la pâture infestée et furent examinées chaque semaine pendant 6 semaines.

Certains veaux traités au fenbendazole subirent une réinfestation à D.v peu de temps après le traitement: 21%, 17% et 47% de ces animaux présentèrent un comptage larvaire fecal (lpg) positif respectivement aux jours 28, 35 et 42. La réinfestation fut si severe chez deux animaux qu'un traitement ivermectine pour-on fut instauré d'urgence aux jours 30 et 37 après le traitement initial. Les veaux traités à l'ivermectine pour-on n'ont quant à eux montré aucun prélèvement fecal positif (aucune larve de dictyocaule) et ce jusqu'à la fin de l'essai jour 42, exception faite d'une larve retrouveé au jour 35. Aucun des animaux du lot ivermectine pour-on ne nécessita un autre traitement.

L'ivermectine pour-on a prouvé sa haute efficacité sur le terrain dans le traitement de la Dictyocaulose. Son activité prolongée dans le temps (comparé au fenbendazole) a presenté des avantages pratiques. Elle previent la résurgence de la pathologie en rendant superflu tout traitement supplémentaire et réduit la production de larves de dictyocaules dans les feces.