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The efficacy of an ivermectin/closantel injection against experimentally induced infections and field infections with gastrointestinal nematodes and liver fluke in cattle

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Abstract

Three studies were performed to test the efficacy of an ivermectin/closantel injection (200 μg/kg^{-1} ivermectin and 5 mg/kg^{-1} closantel) in cattle. Two were experimentally induced infections of *Ostertagia ostertagi*, *Cooperia oncophora* and *Fasciola hepatica* in calves, and the third had natural field infections in cattle with several species of gastrointestinal nematodes and *F. hepatica*.

In the two studies with artificial infections, four groups of 8 calves were used. All calves were infected with metacercariae on Day 0. Infection with the nematodes took place on Day 33 in groups 1 and 2 and on Day 54 in groups 3 and 4. Treatment was given to calves of group 1 on Day 63 and to calves of group 3 on Day 84. Calves of groups 2 and 4 served as untreated control groups. Calves of groups 1 and 2 were sacrificed on Day 84, calves of groups 3 and 4 on Day 105.

The field study was carried out on a commercial farm in the Netherlands. Six groups of cattle were used. Groups A and B consisted of 10 parasite free calves, introduced to the farm and grazed for four weeks on pastures naturally infected with gastrointestinal nematode larvae and liver fluke metacercariae. Group C were the farmers own calves (15), group D heifers (10), group E dry cows (6) and group F milking cows (20). Treatment was given to animals of group A, C, D and E 10 weeks after housing of group A and B. Animals of groups B and F served as untreated controls. Calves of groups A and B were sacrificed 14 days after treatment.

The efficacy of the treatment was calculated on basis of the post-mortem fluke and nematode worm counts in the first two studies and on a combination of post-mortem fluke and nematode worm counts and faecal egg output in the field study.

In the two experimental studies, the efficacy of the treatment against *F. hepatica* was 99.2% and 94.5% for 9-week-old flukes and 98.4% and 99.5% for 12-week-old flukes. For *O. ostertagi* in both studies efficacy was 100% and against *C. oncophora* in both Groups 1 efficacy was 84.9% and 99.0% and in Groups 3 85.0% and 99.4%. In the field study, based on the post mortem fluke and nematode worm counts in groups A and B, efficacy against *F. hepatica* was 98.4%, *O. ostertagi* 100%, *C. oncophora* 99.4%, *C. punctata* 100%, *Nematodirus helvetianus* 60.8%, *Trichuris* spp. 100% and against larval intestinal nematodes 100%. The results of the faecal examinations 14 days after treatment confirmed the post-mortem results with 100% reduction of egg output for *O. ostertagi*, *C. punctata*, *Trichostrongylus* spp. and *Trichuris* spp. and low egg output of *C. oncophora* and *N. helvetianus*.

Keywords: Ivermectin; Closantel; *F. hepatica*; *O. ostertagi*; *C. oncophora*; *C. punctata*; *N. helvetianus*; *Trichostrongylus* spp

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1. Introduction

Helminth infections in cattle cause serious economic losses in all regions of the world and the cattle industry still relies heavily on the use of anthelmintics to alleviate the infections of gastrointestinal nematodes and liver fluke that are the most important. For the control of these infections, a range of nematocides and flukicides are available, but the number of combinations to treat both nematode and trematode infection is limited. This paper reports on the activity of an ivermectin/closantel combination to enable treatment of both simultaneously, since ivermectin is a very effective anthelmintic for the treatment of nematode infections (Benz et al., 1989), and closantel has high activity against liver flukes and blood-sucking nematodes (Guerrero, 1984; Fairweather and Boray, 1999).

To investigate the efficacy of a single dose of an ivermectin/closantel injection for the treatment of liver fluke and gastrointestinal nematode infections, three studies were performed. Two were experimentally induced infections in which the efficacy was measured by the reduction in helminth counts after treatment. The third was a field study with natural infections in which the efficacy was measured by reduction in faecal egg output in all stock on the farm and in helminth counts in tracer calves.

2. Materials and methods

2.1. Studies 1 and 2: experimental infections

All activities in these studies were approved by the Animal Use Committee of Norbrook Ltd. Two comparable experiments were carried out, one in Northern Ireland, the other in the Netherlands. In each study, four groups of eight calves (Friesian X) approximately six month old were used. A first grouping of 2×16 was allotted after weighing on the basis of descending weight with the objective that the average weight of each group was within a similar range. Prior to the start of the study, faecal samples were taken to ascertain that all calves were free from parasitic nematode and trematode infection. For nematode egg counts, a modified McMaster method with a sensitivity of 25 and for liver fluke egg counts a sedimentation method with a sensitivity 5 was used. Faecal cultures were made according to the method of Roberts and O'Sullivan (1950). Larval identification was done according to Borgsteede and Hendriks (1974). The experimental design of the induced infection studies is shown in Table 1.

In both studies all calves were infected with 500 metacercariae of *Fasciola hepatica* (Compton Paddock Laboratories, Newbury, Berks., U.K.) on Day 0. On Day 33, one group of 16 calves was infected with 10,000 infective larvae of both *Ostertagia ostertagi* and *Cooperia oncophora*. Pure isolates of these species were used. Those in study 1 originated from the Veterinary Laboratories Agency, New Haw, Weybridge, UK), those in study 2 from the Universities of Gent (Belgium) (*O. ostertagi*) and Utrecht (The Netherlands) (*C. oncophora*).

On Day 54, the same infective dose was given to the other 16 calves. On Day 61, the first group of 16 calves was divided into Groups 1 and 2. Allocation was done on the basis of the nematode faecal egg count with the objective that the average count of each group was within a similar range. On the same day, calves of group 1 were weighed to enable accurate calculation of the volume of the ivermectin/closantel injection for each animal. Calves of group 1 were treated on Day 63 by subcutaneous injection in the neck (200 $\mu g/kg^{-1}$ ivermectin and 5 mg/kg^{-1} closantel). The same procedure was followed on Day 82 and 84 for the other 16 calves (Groups 3 and 4).

Table 1
Design of the two studies with experimentally induced infections with *Fasciola hepatica* (500 metacercariae), *Ostertagia ostertagi* (10,000 L3) and *Cooperia oncophora* (10,000 L3) in calves ($n = 8$ per group)

Group	Treatment	Nominal dose rate	Treatment day	Day of slaughter
1	Ivermectin/closantel injection	200 μg/kg ivermectin and 5 mg/kg closantel (1 ml/25 kg BW)	Day 63 (=9 weeks following fluke infection (=Day 0) and 30 days following nematode infection (=Day 33))	Day 84
2	Untreated controls	NA	NA	Day 84
3	Ivermectin/closantel injection	200 μg/kg ivermectin and 5 mg/kg closantel (1 ml/25 kg BW)	Day 84 (= 12 weeks following fluke infection (=Day 0) and 30 days following nematode infection (=Day 54))	Day 105
4	Untreated controls	NA	NA	Day 105