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STUDIES ON INDUCED CALVING IN CATTLE

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INTRODUCTION

The use of synthetic corticosteroids to induce premature calving in dairy cattle in New Zealand has been accepted and approximately 150 000 cows are now treated annually.

Corticosteroids used for induced calving can be divided into two categories depending on the time they take to induce calving (*i.e.*, short acting and long acting).

The short-acting drugs (betamethasone, dexamethasone and flumethasone), induced parturition in two to three days after administration. They have two major disadvantages. First, the number of animals which respond to the treatment varies markedly from herd to herd. Secondly, the animals that do respond have a high incidence of retained placenta (Welch, 1971).

The longer-acting drugs (*e.g.*, dexamethasone, trimethyl acetate) are widely used and are usually insoluble forms of the short-acting drugs. They induce calving approximately 15 days after injection (Welch *et al.*, 1973). However, this treatment has a major disadvantage in the number of calves born dead (17.1 to 44.6%, Welch *et al.*, 1973; 34%, O'Farrell and Crowley, 1974).

This paper reports on studies aimed at improving the technique used for induced parturition in the cow.

MATERIALS AND METHODS

Experiments I and II were carried out on pregnant cows in which the foetal calf was cannulated by the method of Hunter (1975).

Experiment I: The cortisol levels in the maternal and foetal blood of three naturally calving cows were determined by the method of Fairclough *et al.* (1975).

Experiment II: Two cannulated cows were given an intramuscular injection of 25 mg tritiated optipicortenol and the resulting blood radioactivity determined.

Experiment III: A field trial was carried out on 44 dairy farms and involved 875 cows of varying breeds and ages. The animals

for treatment on each farm were divided at random into four treatment groups:

- (1) Single injection 20-25 mg opticortenol.
- (2) Two injections 20-25 mg opticortenol 6 days apart.
- (3) Single injection 20-25 mg opticortenol followed by an injection of 20 mg betamethasone ("Betsolan", Glaxo) 8 days later.
- (4) Daily injections of betsolan starting at 1 mg per day and doubling every second day until calving or day 11.

RESULTS

EXPERIMENT I

The three cows all gave birth to healthy live calves within the normal gestational range for this breed.

The foetal cortisol levels were less than 10 ng/ml three weeks before parturition and rose to term reaching a peak of up to 80 ng/ml on the day of parturition (Fig. 1). The maternal levels were elevated initially owing to surgical stress but then fell to 10 to 20 ng/ml where they remained except for a small rise at parturition.

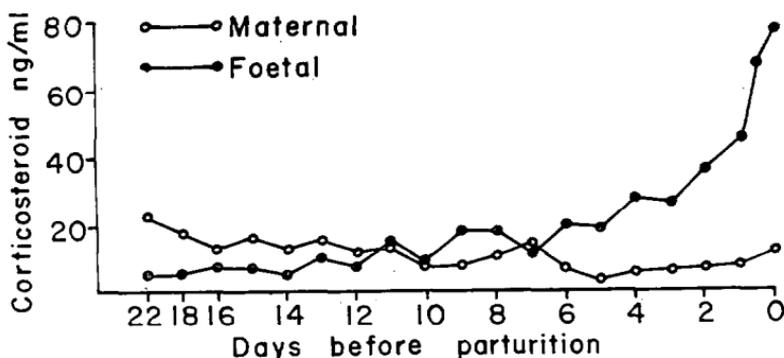


FIG. 1. Mean foetal and maternal blood cortisol levels.

EXPERIMENT II

The level of radioactivity in the maternal plasma of treated cows rose sharply, reaching a peak 2 days after injection and then fell to day 30 (Fig. 2).

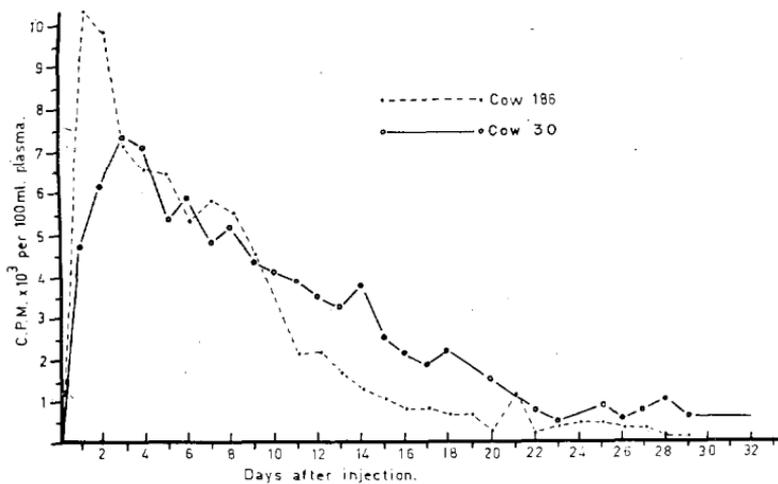


FIG. 2. Levels of radioactivity in the maternal plasma of cows injected with 25 mg tritiated opticortenol (specific activity 0.08 m Ci/mg).

EXPERIMENT III

Calf mortality was lowest in group 3 at 6% (Table 1). However, the mean interval from treatment to calving was not significantly different for each treatment. The animals in groups 1, 2 and 3 were induced approximately two weeks early while the animals in group 4 were induced three weeks early.

TABLE 1: RESULTS OF INDUCED CALVING TRIAL

	Group			
	1	2	3	4
No. of animals	204	205	198	264
No. of days between first treatment and calving (mean \pm S.D.)	11.5 \pm 4.1	9.8 \pm 3.6	10.0 \pm 3.5	8.8 \pm 3.2
No. of calves born	205 ¹	206 ¹	199 ¹	265 ¹
No. of calves born dead ..	25	29	12	25
Mortality (%)	11.2 ^a	14.0 ^a	6.0 ^b	9.4 ^b
Days early	13.8	13.8	14.8	22.0

¹ Includes one set of twins.

Within each row means with same letter do not differ, $P < 0.05$.

DISCUSSION

Liggins (1969) has shown conclusively that a functional foetal hypothalamic pituitary-adrenal axis was necessary for the initiation of parturition in the sheep.

In the cow it has been suggested from observations of naturally occurring cases of prolonged gestation, involving genetical defects of the foetal pituitary and adrenal glands, that a similar mechanism is involved.

The present data suggest, as in the sheep, parturition is preceded by a rise in the level of foetal plasma cortisol. When inducing premature parturition with synthetic corticosteroids in the cow an endeavour is being made to mimic this rise in corticoid level. It is apparent from the results of the radioactive opticortenol experiment that the plasma levels obtained are not ideal for induction of parturition. The cows calve 15 days after injection when the synthetic corticosteroid level is low and falling—a situation which is contrary to that found in the naturally calving cow.

This result led to three multiple injection regimes being tried in order to obtain a more desirable pattern of release which it was hoped would reduce the number of dead calves.

While the number of calves born dead in each of the multiple injection groups is lower than has been reported previously following induced calving with opticortenol, the number of calves born dead in the group receiving a single injection of opticortenol is similarly lower than previously reported.

This lower mortality may be explained by the fact that, in all treatments, the interval from first treatment to calving is shorter than expected for opticortenol alone. It was anticipated that the lowest calf mortality would occur in group 4 as the cortisol pattern in this group should have most closely resembled that of naturally calving cows; however, a slightly lower mortality was achieved in group 3. Because of the obvious impracticality of the group 4 treatment it would appear that the single injection of 20 to 25 mg of opticortenol followed 8 days later by 20 mg of a short-acting corticosteroid (group 3) offers the best method for inducing parturition in the cow.

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