Induction of Parturition in the Dairy Cow Using Prostaglandin F2a

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Prostaglandins are extremely potent "hormone-like" substances occuring naturally in a wide variety of tissues and biological situations. A Swedish scientist, von Euler, demonstrated that extracts of human semen could induce activity in various preparations of isolated smooth muscle. He further identified the active substance as a lipid soluble acid different from other substances known at that time to be capable of producing similar effects e.g. histamine and acetylcholine. Von Euler assumed that the substances originated form the prostrate gland and he suggested the name prostaglandin. It was not until some years later that Eliasson demonstrated that most seminal prostaglandin originates in the seminal vesicles and not in the prostate gland.

Chemically, prostaglandins constitute a class of naturally occuring 20-carbon unsaturated hydroxy fatty acids. Slight structural alterations of the molecule can bring about quite distinct biological effects. On both a structural and functional basis they fall into four main groups, A, B, E, and F.

Prostaglandins have a wide range of activity but their predominant physiological effect lies in their ability to provoke contraction and relaxation of smooth muscle in various sites in the body. By this action they exert a profound influence on the functions of the digestive, respiratory, and reproductive tracts as well as on the blood vascular system.

Prostaglandins, particularly those of the A series, have also been found in the central nervous system where they are thought to have a role in the transmission of impulses. They have also been shown to influence fat and carbohydrate metabolism, to be involved in the mediation of pain, the modulation of hormonal activity and many other diverse activities in the body. With the possible exception of the A series, prostaglandins appear to act locally rather than as a classical circulating hormone.

Relative to parturition, the cause - efect role of prostaglandin E and F has not been fully established especially as species differences also exist. A working model with an iterplay of foetal glucocorticoid steroid, an increase in maternal oestrogen and prostaglandin F2a and E and a reduction in maternal progesterone was suggested by Liggins in the sheep. (Fig. 1.) The foetal adrenal, possibly, provides the initial stimulas to PGF2a synthesis, followed by an explosive release of free oestrogen and more PGF2a as each stimulates production of the other. Finally, the oxytocic action of PGF2a on the myometrium might be dependent on an environmental containing low progestarone and high oestrogen levels.

What is known as that glucocorticoid steroids supplementing the foetal adrenal secretion; induce parturition in the bovine if the calf is alive; that PGE and PGF levels increase in amniotic fluid, maternal placenta, myometrium and blood at the time of parturition; that these increased levels have an oxytocic activity stimulating myometrial activity; that they have luteolytic effect probably on the placenta and can induce parturition even if the calf is not alive.

Parturition inducing agents, such as various glucocorticoid steroids, have been used in the bovine animal over the years for various reasons such s fear of dystokia in small heifers, in certain breeds such as Charolais and in old laminitic cows who are sluggish in their movements. Fear of damage to very engorged pre-partum pendulous udders; programmin calving/labour and pasture availability; and by us in conjuction with an efficient milk fever prevention programme involving the use of 1-alpha hydroxycholecalciferol (1a-OH-CC.) as previously described.

The above material, a synthetic analogue of the active metabolite of Vitamin D, 1-25 Di-hydroxycholecalciferol, takes 24 hours to be hydroxylated in the liver to become physiologically active. At the dosage of 350ug used by us it protects the cow against the physiological and pathological hypocalcaemia just before and at the time of parturition for 4-5 days. In order to avoid using more than 2 does of the material for economic as well as physiological considerations, we searched for a parturition inducing agent with minimal side effects such as calf mortality, retained

placenta and interference with the hypercalcaemic effect of 1a-OH-CC.

Flumethasone **(Fluvet, Teva, Israel)** was used both in conjunction with the second dose of 1a-OH-CC and 48 hours after that dose.

Dinoprost **(Lutylase, Upjohn, U.S.A.)** and K11941, a semi-synthetic Prostaglandin F2a **(Vetem, Milan, Italy)** were used in the first stage without 1a-OH-CC for comparision with Flumethasone for calving efficiency, placental retention and calf mortality.

Materials and Methods

14 cows of the Israell Fresian breed, 4th calver and upwards, were injected intramuscularly with 5mg. of Flumethasome 275-280 days post insemination. Eight of the animals received the material 48 hours after the second dose of la-OH-CC and 6 together with the second dose. la-OHCC was injected a second time 3 days after the first dose if the cow had not calved.

An additional 14 cows and 3 heifers of the same breed received 5cc Dinoprost intramuscularly (25mgm.) from term (270+5 days) until 16 days post-term. 19 cows and 8 heifers received 5cc K11941 intramuscularly under the same conditions. 12 cows served as controls.

Results

In the Flumethasone group parturition took place from 448 hours post-injection. (average 30 hours) All calves were born normally incedence of retained placenta was 64% and there was no interference with the hypercalcaemic effect of la-OH-CC.

In the Dinoprost group parturition took place from 8-48 hours post-injection (av. 30 hours), all calves were born normally, and 28% of the cows and none of the heifers retained their placenta.

In the Vetem group the time of parturition occurred 6-48 hours post-injection (av. 30 hours) all calves were born normally and 32% of the cows and 25% of the heifers retained their placenta.

16% of the control animals retained their placenta after normal parturition. All the animals in the retained placenta group were free of any uterine infection 4-6 weeks postpartum.

None of the animals injected with prostaglandin from both sources displayed any signs of discomfort such as dyspnoe, diarrhoea or irritation at the site of injection.

Discussion

All three products induced parturition effeciently at the same average interval post-injection; but the efficancy of Flumethasone depended on the presence of a live calf and the incidence of retained placenta is double that of the prostaglandin group. Furthermore previous experience with this product showed that the injection had to be repeated after 48 hours in a small number of animals before parturition took place.

The high indidence of retained placenta (57%) reported by **Plenderleith** using Dinoprost in heifers was not found by us. The time of injection nearer to term and a not too hasty assistance at the time of parturition could be the explanation for our results.

It appears that Prostaglandin F2a is a valuable drug for parturition induction in the bovine animal.

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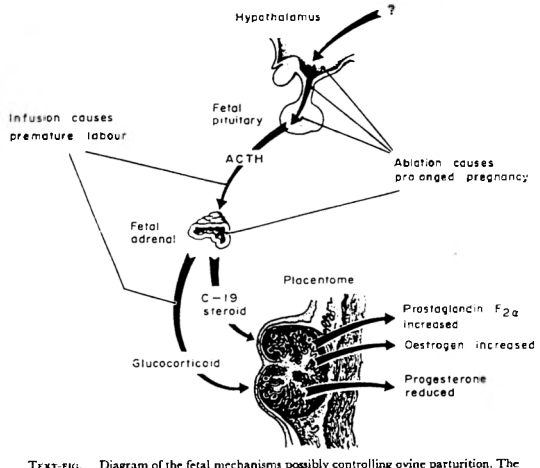
Steroids and prostaglandins in sheep parturition



TEXT-FIG. Diagram of the fetal mechanisms possibly controlling ovine parturition. The C-19 steroid pathway to placental oestrogen biosynthesis has not yet been established.