FOETAL PLASMA CORTICOSTEROIDS AND THE INITIATION OF PARTURITION IN SHEEP

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Prolonged pregnancy following foetal hypophysectomy or adrenalectomy (Liggins, Kennedy & Holm, 1967; Drost & Holm, 1968) and premature parturition following injection of corticotrophin or corticosteroids into the ovine foetus (Van Rensburg, 1967; Halliday & Buttle, 1968; Liggins, 1968) implicate the foetal adrenal cortex in the initiation of parturition in sheep. Consequently, foetal plasma corticosteroid concentrations and corticosteroid secretion by the foetal adrenal should be greatly increased towards term. Observations during acute studies on anaesthetized sheep suggest this (Alexander, Britton, James, Nixon, Parker, Wintour & Wright, 1968), but there is no information about blood concentrations or secretion rates of corticosteroids in normal undisturbed sheep foetuses in utero.

We cannulated the carotid artery and the facial branch of the jugular vein of four single Merino foetuses with polyvinyl chloride tubing (o.d. 1.27 mm., i.d. 0.86 mm.) with the ewes under general anaesthesia (pentobarbitone sodium (20 mg./kg., i.v.) followed by halothane and oxygen). The catheters were brought to the exterior through the uterine incision and a separate stab incision in the flank of the ewe. Foetal blood samples (2–3 ml.) were drawn from the carotid catheter daily, followed by a sample from a jugular vein of the ewe. Plasma corticosteroid concentrations were determined by the protein-binding method of Bassett & Hinks (1969).

One lamb was born after a gestation of normal length and survived; parturition occurred 8–10 days early in the other three ewes. In these the foetuses were alive at the start of parturition, but two were dead when born.

Maternal corticosteroid concentrations were greatly elevated for several days after surgery, but subsequently were generally less than 2 μg./100 ml. (Fig. 1).

Corticosteroid concentrations in the foetal circulation bore little relation to maternal concentrations. Despite the stress of surgery, foetal corticosteroid concentrations were generally below 2 μg./100 ml. until 130 days gestation. However, commencing several days before birth, there was an increase in the plasma corticosteroid concentration of all the foetuses, unrelated to changes in maternal corticosteroid concentrations (Fig. 1). The highest concentrations, considerably above maternal levels, were reached at the time of birth. In the two lambs which survived birth there was a further temporary increase after birth. Corticosteroid concentrations in all foetuses at birth were similar to those of other newborn lambs (Bassett, Alexandre & Oxborrow, 1968). In contrast, no comparable changes in maternal or foetal plasma concentrations of growth hormone, insulin, glucose and fructose or in the percentage oxygen satura-
tion of foetal blood were observed (J. M. Bassett & G. D. Thorburn, unpublished).

The results presented indicate that increased foetal corticosteroid concentrations, comparable to those seen in acute studies (Alexander et al. 1968), also occur in foetuses in utero in conscious undisturbed ewes just before parturition and probably reflect increased foetal adrenal corticosteroid secretion as shown by Alexander et al. (1968).

These observations thus give additional support to the view that activation of the foetal adrenal cortex is involved in the initiation of parturition in the sheep.

Fig. 1. Plasma corticosteroid concentrations of four pregnant ewes and their chronically cannulated foetuses in utero. (Day of surgery (S); day of birth (B), two lambs were born on day 135.)

REFERENCES


