Research Summaries I

Beef Cattle and General

Moderator - Don Hansen, DVM

Effects of Postnatal Implanting With A Commercial Growth Promotant on Bovine Uterine Development

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Abstract

Clinicians investigating heifer infertility have associated implanting hormonal growth promotants in neonatal calves with subsequent reproductive failure. Specifically, controlled studies have shown that heifers implanted with zeranol (Ralgro®) at birth have significantly decreased pregnancy rates as yearlings. It has long been established that neonatal animals of several species, exposed to exogenous steroid hormones and zenobiotics, undergo various alterations in the development of their urogenital tracts. For example, human female fetuses exposed to diethylstilbestrol (DES) in utero have an increased risk of uterine and cervical neoplasia as women. Could such developmental alterations occur in implanted heifers?

This study was designed to investigate the effects of 100 mg progesterone and 10 mg estradiol benzoate (Synovex® C) implanted in neonatal heifers on the reproductive tracts of the same animals as adult, 15-month-old heifers. Four groups of five heifers per group were implanted either at birth, 21 days of age, 45 days of age (the earliest on-label dose), or not implanted (controls). The heifers were allowed to develop until 15 months of age, when they were slaughtered while in the luteal phase of a synchronized estrus cycle, and their uterine tissues were examined. The results will be discussed as well as potential implications for beef heifers in this presentation.

Implanting heifers with hormonal growth promotants at birth or in the early neonatal period has decreased pregnancy rates of mature heifers in some studies. The mechanisms of infertility associated with implanting heifers have not, to our knowledge, been investigated. This present study was undertaken to test the hypothesis that adult bovine uterine structure and function are affected by neonatal exposure to exogenous hormones as delivered by a commercial growth promotant implant containing 100 mg progesterone and 10 mg estradiol benzoate (Synovex® C).

Of four groups of crossbred beef heifers (N=5 heifers/group), three were implanted at different ages (Group 1 - birth; Group 2 - 21 days of age; Group 3 - 45 days of age), and Group 4 served as unimplanted controls. At 15 months of age (±17 days) all heifers were slaughtered 12 days after estrus synchronization to insure that all were in the luteal phase of the estrous cycle. The uterus and cervix were removed at slaughter and trimmed. Each excised uterus was flushed with 20 ml of sterile normal saline for determination of uterine luminal total protein content. A middle section from each uterine horn was removed, fixed, and stained for analysis of histoarchitecture. Cross-sectional myometrial and endometrial areas were measured using computer-assisted analysis. Endometrial gland density was estimated stereologically by determining the frequency with which cross-hairs on an ocular grid intersected endometrial glandular epithelium in three sections (ten random fields/section) from each uterine horn.

All data were subjected to analysis of variance and are reported as least squares means ±SE for Groups (1), (2), (3), and (4), respectively. Uterocervical weights (g±13.9) were: (1) 113.7, (2) 123.5, (3) 101.3, and (4) 173.9 (Trt<control, P<.01). Cross-sectional myometrial areas (mm^2±8.5) were: (1) 123.7, (2) 141.8, (3) 111.3, (4) 162.7 (Trt<control, P<.01). Cross-sectional endometrial areas (mm^2±2.7) were: (1) 29.9, (2) 32.4, (3) 37.7, and (4) 45.4 (Trt<control, P<.01). Endometrial gland densities (hits/mm^2±48.6) were: (1) 172.2, (2) 380.3, (3) 328.2, and (4) 486.9 (Trt<control, P<.01). Uterine luminal flush total protein contents (mg/flush±.72) were: (1) 2.80, (2) 2.92, (3) 2.30, and (4) 4.98 (Trt<control, P<.01; Trt 1 & Trt 2 vs Trt 3, N.S.; Trt 1<Trt 2, P<.01).

Implanting heifers at birth, 21, or 45 days of age

decreased utero-cervical weight, myometrial and endometrial cross-sectional areas, density of endometrial glands, and the amount of uterine luminal total protein at 15 months of age. The alterations in uterine tissues demonstrated in this study are associated with age at implanting. The commercial implant used in this study (Synovex® C) is approved for use in heifers intended for breeding at no earlier than 45 days of age. The results of this study emphasize the importance of following label recommendations.

Pelvic Growth and Dystocia in Holstein X Hereford Heifers

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Abstract

Growth of the pelvic area and relationship to external pelvic measurements was monitored in 129 Holstein X Hereford heifers fed an all forage diet. Pelvic area increased at a rate of .27 ± .20 cm²/day from 10 to 16 months and a rate of .13± .13 cm²/day from 16 to 22 months ($p < .01$). A moderate correlation between pelvic area and external pelvic measures (body weight, height at hooks or pins, distance between hooks and hooks to pins) was noted ($R^2 \leq .15$ - .38, $p < .01$) and the relationship did not change with age. In 76 of these heifers, pelvic area was measured within 24 hours of calving. From 22 months to calving, pelvic area increased at the rate of 1.15± .88 cm²/day. This was 7 times greater than the rate observed from 16 to 22 months (.13± .13 cm²/day). While pelvic area at calving had a significant correlation to pelvic area measured prior to calving ($p < .01$) correlations were low to moderate (R=.29-.52).

The influence of pelvic area and calf birth weight on incidence of dystocia were modeled with both logistic regression and discriminant analysis techniques. Neither was superior, both correctly predicting 72% of cases. While ratio of pelvic area at calving to calf birth weight significantly ($p < .01$) influenced the incidence of dystocia, pelvic area measured at any time other than calving was not associated with dystocia ($p > .05$). The low correlation between pelvic area at calving and precalving measurement was due to the high degree of variation noted in pelvic growth. As a result, we were unable to predict dystocia by measuring pelvic area prior to calving.

Introduction

The two most important variables influencing dystocia are pelvic area and calf birth weight.[1-7] Many early studies used multiple regression to model dystocia. Dystocia is a categorical trait which violates many of the assumptions of multiple regression.[6] Discriminant analysis techniques are superior to multiple regression for categorical traits such as dystocia, and can accurately predict as high as 85% of cases.[6] It has been suggested that the size of calf a heifer can deliver can be determined at breeding,[8] yet in a clinical trial, pelvic area at breeding had no predictive value for dystocia.[9] Furthermore, not all trials have shown pelvic area to have a significant influence on dystocia.[10,11]

Few have studied the growth of the pelvic area in first calf heifers, in particular the change immediately prior to calving. The objectives of this study were to monitor the growth of the pelvis in heifers and determine the relationship between pelvic area, calf birth weight, and dystocia. Our hypothesis was that variation in growth among and within heifers will reduce the correlation of pelvic area at calving to pelvic area measured at other times. As a result, pelvic area measured prior to calving may not be a significant determinant of dystocia, whereas pelvic area at calving is a determinant of dystocia.

Materials and Methods

Data were collected on 129 Holstein x Hereford heifers beginning at 10 months of age until calving at 23 months of age. The heifers were maintained at the Lancaster Agricultural Research Station. No grain supplements (only forages) were fed to the heifers from 12 months of age until calving. All heifers were in good body condition throughout the study. The heifers were bred by artificial insemination with semen from a single Angus sire for the first two services of the breeding season. This sire was selected for artificial insemination due to the low expected weight of his calves (expected progeny difference was -1.3 Kg for calf birth weight). Another Angus sire was then exposed to the heifers for a third natural service.