Effect of Ovariectomy on Pregnancy Maintenance and Parturition in Dairy Cows

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Abstract

Forty-one cows of three dairy breeds were ovariectomized by laparotomy at 48–268 days of pregnancy to determine the effects on gestation length and parturition. No differences existed between bilateral ovariectomy and removing only the ovary containing the corpus luteum (unilateral), nor did breed differences exist.

Twelve cows ovariectomized at 48–117 days of pregnancy aborted an average of four days after removal of the luteal tissue. Ovariectomy of eight cows at 139–174 days resulted in abortion an average of 23 days later. Twenty-one cows ovariectomized at 200–265 days of pregnancy terminated in 2–74 days (X = 33) at an average gestation length of 262 days. Based on previous history of these cows, the expected gestation length was 278 days. Of the 41 cows, 36 had retained fetal membranes and 26 fetuses or calves died prepartum. Calving difficulties due to partial cervical dilation and uterine inertia, and postpartum metritis were common. The corpus luteum of pregnancy appeared essential for maintaining pregnancy in the bovine prior to Days 165–180; thereafter, a viable fetus was sometimes maintained in the absence of the gland. However, the corpus luteum was essential during late pregnancy to prevent shortened gestations and abnormal parturitions, including retention of the fetal membranes.

The corpus luteum (CL) or an exogenous source of progesterone is essential throughout pregnancy in the rabbit, rat, sow, goat, and dog, but for less than full term in the guinea pig, mare, or primate (1). The effect of CL removal or ovariectomy on pregnancy maintenance in the cow, however, is inconclusive. Early experiments reviewed by Hammond (3) suggest that bovine pregnancy will be maintained following removal of the CL during the last one-half to one-third of pregnancy, but these experiments were each conducted with only two to six animals. McDonald et al. (5) removed the CL from five animals after 200 days of pregnancy; two of these aborted within eight days and the others carried their calves without treatment until exogenous progesterone injections were started 18–50 days after CL removal.

The present study was undertaken to further examine the effects of ovariectomy on pregnancy maintenance and parturition in dairy cows. A preliminary report has been made on a portion of these data (2).

Experimental Procedure

Forty-one cows of three dairy breeds were ovariectomized by laparotomy at 48–268 days of pregnancy. Of these, 20 were unilaterally ovariectomized, removing the ovary containing the CL. Sixteen were bilaterally ovariectomized and five were unilaterally ovariectomized (CL-bearing ovary) and the second ovary removed 21–35 days later.

All cows were observed twice daily for postoperative changes. Periodic rectal examinations of the reproductive tract were made and changes during pregnancy, parturition, and the post-parturient period recorded.
Results and Discussion

No differences were found in response to ovariectomy between breeds or between animals unilaterally ovariectomized, bilaterally ovariectomized, or twice operated. Therefore, all groups were combined for subsequent analysis.

Removal of ovaries containing luteal tissue at 48–117 days of pregnancy resulted in abortion two to nine days later (Table 1). One cow in this group was pregnant with twins and had a CL on each ovary. Removal of the right ovary on Day 52 had no discernible effect on either fetus, but both were aborted five days after removal of the left ovary and CL on Day 73. Seven of the 12 cows in this group retained the fetal membranes after abortion.

Seven cows pregnant 139–174 days at the time of ovariectomy aborted 3–25 days after CL removal (X = 11), with only one of them delivering a live calf. Another cow of this group terminated pregnancy 101 days after ovariectomy with a gestation period of 273 days and also delivered a live calf. All eight cows exhibited calving difficulty and all of them retained fetal membranes.

Six cows ovariectomized 200–210 days after insemination terminated pregnancy in 13–74 days. Three of the cows maintained pregnancy until 266–274 days and delivered live calves. All six cows retained all or part of the fetal membranes, and four of the cows had calving difficulties. Ovariectomy of 11 cows between Days 226 and 237 resulted in pregnancy termination in 4–59 days. Seven of the 11 cows delivered live calves at 238 to 286 days after breeding. All 11 had complete (nine cows) or partial (two cows) retention of the fetal membranes and nine had difficulty calving.

Four cows ovariectomized between Days 251–268 of gestation aborted in 2–21 days (X = 8). Calving difficulties and post-partum metritis were common in this study. The principal calving difficulty encountered was uterine inertia and a partial cervical dilation, so that manual traction to pass the calf through the cervix was generally required. Loss of amniotic fluids through the partially opened cervix before the calf could be delivered often resulted in dry delivery requiring application of additional lubricant. Pelvic dilation was usually adequate for the size of the fetus or calf delivered.

Fetal membranes were nearly always retained, but rarely did systemic illness result. However, post-partum metritis occurred in a large number of animals, especially in those with gestations longer than 200 days. Intrauterine antibiotic treatment was given and the fetal membranes could generally be removed with gentle traction by two to three weeks postpartum.

Results of this study are in general agreement with those of McDonald et al. (5, 6) up to the limits of their studies. McDonald et al. (5) removed the CL of pregnancy from three cows at 92–115 days and from five cows at 143–191 days. Without progesterone therapy,

### Table 1

<table>
<thead>
<tr>
<th>Days of pregnancy at ovariectomy</th>
<th>No. of cows</th>
<th>Days from CL removal to parturition</th>
<th>Gestation length (days)</th>
<th>No. of living calves</th>
<th>Cows retaining fetal membranes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48–117</td>
<td>13a</td>
<td>4</td>
<td>2–9</td>
<td>92</td>
<td>0</td>
</tr>
<tr>
<td>139–174</td>
<td>8</td>
<td>23</td>
<td>3–101</td>
<td>256</td>
<td>3</td>
</tr>
<tr>
<td>200–210</td>
<td>6</td>
<td>52</td>
<td>13–74</td>
<td>264</td>
<td>7</td>
</tr>
<tr>
<td>226–237</td>
<td>11</td>
<td>32</td>
<td>4–59</td>
<td>264</td>
<td>3</td>
</tr>
<tr>
<td>251–268</td>
<td>4</td>
<td>8</td>
<td>2–21</td>
<td>264</td>
<td>3</td>
</tr>
</tbody>
</table>

a Includes one twin-bearing cow. First CL removed on Day 52, second on Day 73.
b Includes one cow which retained part of the fetal membrane.
cows in the former group aborted in 4–13 days ($\bar{X} = 7$) and those in the 143–191-day group aborted in 5–32 days ($\bar{X} = 13$). In our study (Table 1), 20 cows ovariectomized before Day 180 aborted in 3–25 days ($\bar{X} = 11$). McDonald et al. (5) also removed CL from five cows pregnant 207–236 days. Two of these aborted in three and eight days, but the other three carried their calves until progesterone injections were started 24–50 days after surgery.

Tanabe (7) removed the CL of pregnancy from 154 cows between Days 30 and 180, to estimate the minimal levels of exogenous progesterone necessary to maintain pregnancy. Of the 28 cows not receiving progesterone, none had a viable fetus ten days after CL removal. Tanabe (8) also reported that removal of all luteal tissue from single or twin-bearing animals terminated pregnancy within ten days in all but one of the oil-injected controls. When one CL was removed from animals which had two, or when one-half of a single CL was removed, pregnancy was maintained in 25 of 26 animals until slaughter ten days later.

Of the 21 cows ovariectomized after 200 days in this study, only seven had gestation periods exceeding 270 days ($\bar{X} = 262$ days). Average length of previous gestations in this group was 278 days, with none less than 270 days. McDonald et al. (6) removed the CL from eight cows at 57–68 days and administered progesterone until 162–238 days of pregnancy. These cows calved at 254–282 days ($\bar{X} = 268$), with only one cow having a gestation longer than 270 days, and seven of the eight cows retained the fetal membranes. Five cows that received progesterone until 278 days of pregnancy calved normally at 278–283 days and expelled the fetal membranes (6). Johnson and Erb (4) also reported that fetal membranes were retained if progestin treatment was discontinued in ovariectomized heifers before Day 273 of pregnancy.

Conclusions

Work to date shows that luteal tissue or an exogenous progestin is essential for the main-

tenance of bovine pregnancy for at least 180–200 days. Thereafter, extraovarian sources of progesterone may be adequate in some cows to maintain a viable fetus, but the levels produced by these sources appear generally inadequate to support normal gestation length and normal parturition, including expulsion of the fetal membranes. The fetal membranes were retained in nearly all animals after CL removal or early hormone withdrawal. In addition, cervical dilation prior to parturition was subnormal and calving difficulties were common. Postpartum metritis was prevalent in ovariectomized animals and was usually severe. Calf losses in this study were excessive.

References