Comparison of the fetal survival rate in heifers after the transfer of an embryo surgically to one uterine horn and non-surgically to the other

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Summary. When transfer of Day 7 embryos was surgically to the horn ipsilateral to the CL and non-surgically to the contralateral horn, fetal survival rate was 85 and 35% respectively. After non-surgical transfer to the ipsilateral and surgical transfer to the contralateral horn, fetal survival rate was 20 and 30% respectively.

Introduction

The non-surgical transfer of bovine eggs to the uterus of unmated recipients (Sreenan, 1975) or to the contralateral horn of previously inseminated recipients (Boland, Crosby & Gordon, 1975) has resulted in a disappointing fetal survival rate. By contrast the fetal survival rate after surgical transfer has been high (Rowson, Moor & Lawson, 1969; Sreenan & Beehan, 1974). A within-animal comparison of the two methods was therefore undertaken to elucidate the factors involved.

Materials and Methods

Embryos were collected from heifers at Day 7 after mating (oestrus = Day 0); most were collected surgically by the method described by Newcomb & Rowson (1975), the rest by a non-surgical technique (Newcomb, Christie & Rowson, 1978). Embryos were transferred to a total of 40 Hereford crossbred heifers, 15–18 months of age, which were in oestrus synchronously with the donors. Oestrus was detected by twice daily observation and was naturally occurring in some and prostaglandin induced (500 µg cloprostenol: Estrumate, ICI Ltd) in others.

After a fasting period of 24–48 h, anaesthesia was induced with thiopentone sodium and maintained with a halothane/nitrous oxide/oxygen gas mixture. The uterus was exposed by mid-line ventral laparotomy and one embryo was transferred to the tip of a uterine horn (7 cm from the uterotubal junction) with a Pasteur pipette. The recovery and transfer medium used was phosphate-buffered saline (Whittingham, 1971) with 0.025 mg kanamycin/ml instead of penicillin. After closure of the incision, recipient heifers were laid in left-flank recumbency and another embryo was transferred non-surgically to the opposite uterine horn. A sterile Cassou insemination gun (0.25 ml straw) ensheathed in sterile nylon film was passed into the vagina and when it was adjacent to the external cervical os the nylon sheath was retracted. The insemination gun was then advanced into the uterus and the embryo placed in the vicinity of the intercornual ligament. The surgically inserted embryo was placed in the uterine horn ipsilateral to the corpus luteum in 20 heifers (Group 1) and in the horn contralateral to the corpus luteum in 20 heifers in Group 2. Heifers which returned to oestrus were palpated per rectum from about 42 days after the oestrus before surgery and diagnosed as non-pregnant if no amniotic sac could be detected. Other heifers were slaughtered between 42 and 65 days after oestrus and the surviving fetuses were recorded.

Results

As shown in Table 1, a high pregnancy rate was obtained in Group 1 but there was a marked difference in the survival rate of embryos transferred by the two methods ($\chi^2 = 10.42$; d.f. 1; $P < 0.005$).
Table 1. Fetal survival in cattle after surgical or non-surgical transfer of a Day-7 embryo to each uterine horn in relation to the side of the corpus luteum

<table>
<thead>
<tr>
<th>Group 1— surgical transfer to ipsilateral horn, non-surgical to contralateral horn</th>
<th>Group 2— non-surgical transfer to ipsilateral horn, surgical to contralateral horn</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of heifers</td>
<td>No. pregnant (%)</td>
</tr>
<tr>
<td>20</td>
<td>17 (85)</td>
</tr>
<tr>
<td>20</td>
<td>7 (35)</td>
</tr>
</tbody>
</table>

* 1 degenerate fetus excluded.

In Group 2 fetal survival rate in both horns was low ($\chi^2 = 0.53; \text{d.f.} 1; P > 0.1$). The number of fetuses surviving in the horn ipsilateral to the corpus luteum was significantly greater in Group 1 than in Group 2 ($\chi^2 = 16.94; \text{d.f.} 1; P < 0.001$) and the total number of fetuses surviving in Group 1 was also significantly higher than in Group 2 ($\chi^2 = 10.02; \text{d.f.} 1; P < 0.005$). Surgically transferred embryos in Group 2 (contralateral horn) showed a significantly lower survival rate compared with surgically transferred embryos (ipsilateral horn) in Group 1 ($\chi^2 = 12.38; \text{d.f.} 1; P < 0.001$). Three of the pregnancies in the contralateral horn of Group 2 were associated with a viable and one with a degenerate fetus in the ipsilateral uterine horn.

The interval to return to oestrus in the Group 2 heifers was much longer than the usual 21-day cycle ($52.1 \pm 5.0$ (s.e.m.) days).

Discussion

The pregnancy rate after a surgical transfer to the horn ipsilateral to the corpus luteum (Group 1) was similar to that reported by others (Rowson et al., 1969; Sreenan & Beehan, 1974). The non-surgical transfer of an embryo to the contralateral uterine horn did not therefore impair the pregnancy rate obtained with the surgically transferred embryos. These findings were anticipated by and lend further support to the results of studies involving sham non-surgical transfers (Dziuk, Donker, Nichols & Petersen, 1958; Tervit, 1973; Seidel, Bowen, Homan & Okum, 1975; Brand et al., 1975), which suggest that neither infection nor embryo rejection are the cause of the low fetal survival rate after non-surgical transfer.

The high pregnancy rate obtained from the ipsilateral surgical transfer of embryos did not appear to influence greatly the survival rate of embryos transferred non-surgically to the opposite horn. Although there were nearly twice as many non-surgically transferred embryos which survived in Group 1 than in Group 2, suggesting that there may have been some support from the surgically transferred embryo in the ipsilateral horn in Group 1, this was not a significant effect ($\chi^2 = 1.46; \text{d.f.} 1; P > 0.1$).

The fact that only two fetuses survived in the contralateral horns of Group 2 heifers without a viable or degenerate fetus in the ipsilateral horn and the low total fetal survival in the contralateral horn strongly supports the findings of Newcomb & Rowson (1976) and of Sreenan (1976) which showed that few embryos survive when transfers are made solely to the contralateral uterine horn. Del Campo, Rowe, French & Gintner (1977) reported that embryos transferred surgically at Day 6 to the contralateral uterine horn of heifers (subsequently treated with progesterone between Days 13 and 23) were capable of maintaining the corpus luteum when examined after slaughter on Day 24. Although the observation of oestrus is not an absolutely reliable criterion, the data on the intervals to

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return of oestrus in Group 2 suggest that embryo death after surgical transfer to the contralateral uterine horn occurs some time after the expected time of luteal regression, an observation compatible with the findings of Del Campo et al. (1977).

It is difficult to define the cause of the poorer survival of non-surgically transferred embryos in Group 1 when the survival of surgically transferred embryos within the same animals was so high. However the placement of the embryos by the two methods was quite different. The non-surgically transferred embryos were seldom placed further into the uterine horn than the intercornual ligament whereas surgically transferred embryos were placed near to the tip of the uterus. From the work of Sreenan & Beehan (1976) and Newcomb et al. (1977) site of transfer does not appear to be important. It may be concluded therefore that the transfer method itself is in some way responsible for the poor fetal survival rate after non-surgical transfer.

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References


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