Effects of Pregnant Mare's Serum Gonadotropin on the Incidence of Estrus and Pregnancy Rates in Ewes Synchronized with Controlled Internal Drug Release Devices or Sponges and Subjected to Laparoscopic Artificial Insemination During the Breeding Season

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INTRODUCTION

Artificial insemination (AI) is a useful technique for improving reproductive performance in ewes as well as providing a means to introduce new genetics. Many different techniques have been used for AI. However, direct uterine insemination with the aid of a laparoscope has become the "industry standard" for AI in ewes, because of the relatively high conception rates compared to other techniques (Gourley and Riese, 1990). Laparoscopic AI (LAI) requires the use of estrus synchronization and timed insemination techniques, for LAI otherwise would be virtually impossible from a labor stand-point.

Many methods have been developed for synchronization of estrus in sheep (Maxwell, 1984; Gordon, 1997), but the most successful have been based on suppression of the estruos cycle with synthetic progestagens (Robinson, 1965; Maxwell and Barnes, 1986; Gourley and Riese, 1990; Gordon, 1997; Redmer et al., 2001). Perhaps the most widely used technique is that reviewed by Gourley and Riese (1990) and Redmer et al. (2000, 2001). This technique uses a synthetic progestin implant (Synchro-Mate B [SMB]) to synchronize estrus along with pregnant mare's serum-gonoadotropin (PMSG) to stimulate ovarian activity. However, the recent unavailability of SMB has forced the investigation of other progestagen-based therapies used to synchronize estrus by our laboratory.

A study by Maxwell and Barnes (1986), presented a comparison between the CIDR device and the progestin sponge in combination with PMSG for the induction and synchronization of estrus for AI. The authors revealed that synchronization of estrus and fertility was similar with CIDR devices and sponges. However, the effect of PMSG on the incidence of estrus and rates of pregnancy were left undetermined.

Therefore, this study was conducted to determine the effects of CIDR devices or progestin sponges and an injection of PMSG on synchronization of estrus and pregnancy rates following LAI during the breeding season (September, 2001).

MATERIALS AND METHODS

Purebred Hampshire, Columbia, and Suffolk ewes (n=8-14/breed) were randomly assigned to one of four treatments (n=8-10/group; each consisting of all three breeds) in a 2 x 2 factorial design (CIDR or sponge and -/+ PMSG). At CIDR device (contains 0.3 grams progesterone; InterAg, Hamilton, New Zealand) or progestin-impregnated sponge (Chronogest®, contains 30 mg chronolone; Intervet, Cambridge, England) removal, ewes received one intramuscular (i.m.) injection of PMSG (Folligon, Intervet, Whitby, Ontario; 400 IU) or a vehicle (V). Vasectomized rams with markers were then penned with the ewes and estrus activity was recorded. Ewes were subjected to LAI 54-56 h after CIDR or sponge removal. Intact rams with markers were turned in with the ewes 10 days after LAI and rebreeding was recorded. Ewes were

evaluated for pregnancy 35-40 days after LAI by real time ultrasonography and only pregnancies resulting from LAI were recorded.

RESULTS

Data regarding synchronization of estrus, pregnancy rates to LAI, and estrous return rates are presented in Table 1. No differences were observed among treatments (P>0.10; chi-square test) for any of the variables measured.

Table 1. Percentages in estrus, pregnant, and rebred for ewes synchronized with CIDR devices or sponges then subjected to laparoscopic artificial insemination following pregnant mare's serum gonadotropin treatment during the breeding season*

Treatment	n	Ewes in Synchronized Estrus† (%)	Pregnancy Rate to LAI† (%)	Ewes Rebred† (%)
CIDR/V	9	100	33.3	55.6
CIDR/PMSG	10	90.0	60.0	20.0
Sponge/V	8	75.0	50	62.5
Sponge/PMSG	9	100	66.7	33.3
Total	36	83.3	52.7	41.7

*Estrus refers to the estrus after CIDR or sponge removal and PMSG treatment; pregnant refers to pregnancy diagnosed by ultrasonography at 35-40 days after LAI, and pregnant to LAI; rebred refers to breeding mark at next estrus.

†No differences were observed among treatments (P>0.10) for Ewes in Synchronized Estrus, Pregnancy Rate to LAI, or Ewes Rebred by Chi-square test.

DISCUSSION

A majority of the ewes (83.3%) came into estrus between 24 and 48 h following sponge or CIDR device removal and ewes in a synchronized estrus was similar across treatments. In a study by Maxwell and Barnes (1986), the majority of ewes came into estrus between 24 and 48 h after sponge or CIDR device removal, with 96% of all ewes in estrus at 48 h. They reported no difference between the two devices in time of detection of estrus. Contradictorily, Welch et al. (1984) and Harvey et al. (1984) claimed CIDR devices provided a better synchrony of estrus than sponges.

Treatment with CIDR devices and sponges provides a similar pregnancy rate to timed insemination by LAI in seasonally estrous ewes. Maxwell and Barnes (1986) reported similar fertility from natural mating and LAI following treatment with CIDRs and sponges combined with PMSG during seasonal estrus.

Additionally, Crosby et al. (1983) reported similar fertility following mating of ewes synchronized with sponges and CIDRs and treated with PMSG during late anestrus.

Pregnant mare's serum gonadotropin has been used widely used in estrus synchronization programs in sheep (Maxwell and Barnes, 1986; Gourley and Reise, 1990; Redmer et al., 2000, 2001; Barrett et al., 2001). Typically, PMSG is used to stimulate ovarian activity during seasonal anestrous, and is usually used following estrous synchronization (Barrett et al., 2001). However, some potential short term and/or long term risk occurs with PMSG. Production of antibodies against PMSG may result in ovarian dysfunction, and over stimulation of follicular growth can result in production of multiple births in excess of two lambs (Redmer et al., 2000). Our objective was to determine if PMSG is necessary for the stimulation and synchronization of estrus during the normal breeding season. The results from the current study and previous studies (Redmer et al., 2000, 2001) have shown that PMSG has no significant effect on the percentage of ewes expressing a synchronized estrus or on the percentage of ewes conceiving to LAI.

In conclusion, results from the study herein indicate that incidence of estrus and fertility from LAI are similar following treatment with CIDR devices and sponges, and PMSG has shown to have no significant effect. It is important to note, however, that a larger scale study would be necessary to detect small but significant effects. Future studies regarding the optimization of procedures used to synchronize estrus in ewes both during and after the breeding season will provide improved pregnancy rates and overall success of these assisted reproductive techniques.

REFERENCES

Barrett, D.M.W., Bartlewski, P.M., and Rawlings, N.C. 2001. Ultrasound and endocrine evaluation of the ovarian response to a 12-day medoxyprogesterone sponge and single injection of pregnant mare's serum gonadotropin in ewes in seasonal anestrous. Biol. Reprod. 64 (Suppl. 1) p. 152 (Abstr. #117), 2001.

Crosby, T.F., Boland, M.P., and Gordon, I., 1983. Effect of progesterone/progestagen treatments on the induction of pregnancy in ewes during late anestrous. J. Anim. Sci. Suppl. 1, 471.

Gordon, I., Controlled Reproduction in Sheep and Goats, CAB International, 1997.

Gourley, D.D., and Riese, R.M. 1990. Laparoscopic artificial insemination in sheep. Vet. Clin. NA: Food Anim. Prac. 6:615-633.

Harvey, T.G., Johnson, D.L., Tervit, H.R. and Welch, R.A.S. 1984. Synchronization and artificial insemiation of ewes-techniques which ahve possible commercial application. Proc. New Zealand Soc. Anim. Prod. 44, 7-9.

Maxwell, W.M.C. 1984. Current problems and future potential of artificial insemination programs. In: Reproduction in Sheep (ed. D.R. Lindsay and D.T. Pearce), Australian Academy of Science and Australian Wool Corporation, Canberra, A.C.T., pp. 291-298.

Maxwell, W.M.C., Barnes, D.R. 1986. Induction of estrus in ewes using a controlled internal drug release device and PMSG. J. Agric. Sci., Cambridge. 106:201-203.

Redmer, D.A., Haugen, R.G., Stenbak, T.K., Arnold, D.R., Toutges, M.J., Berginski, H.R., Navanukraw, C., Limesand, W. Kirsch, J.D., Kraft, K.C., Bilski, J.J., Grazul-Bilska, A.T., Gourley, D.D., Riese, R.L., and Reynolds, L.P. 2000. Effects of gonadotropin treatment on incidence of estrus and pregnancy rate in ewes synchronized with

synchronized with Synchro-Mate-B (SMB) and subjected to laparoscopic artificial insemination (LAI) during the breeding season. Western Dakota Sheep Day. Report No. 41:93-96.

Redmer, D.A., Lopes, F., Choi, J.T., Arnold, D.R., Navanukraw, C., Limesand, W., Kraft, K.C., Bilski, J.J., Weigl, R., Haugen, R.G., Grazul-Bilska, A.T., Gourley, D.D., and Reynolds, L.P. 2001. Year 2: Effects of gonadotropin treatment on incidence of estrus and pregnancy rate in ewes synchronized with synchronized with Synchro-Mate-B (SMB) and subjected to laparoscopic artificial insemination (LAI) during the breeding season. Western Dakota Sheep Day. Report No. 42:1-4.

Robinson, T.J. 1965. Use of progestagen-impregnated sponges inserted intravaginally or subcutaneously for the control of the oestrous cycle in the sheep. Nature, 206, 39-41.

SAS. User's Guide, Statistics, 5th Edition., Statistical Analysis System Inst., Cary, NC. 1985.

Welch, R.A.S., Andrewes, W.D. Barnes, D.R., Bremner, K. and Harvey, T.G. 1984. CIDR dispensers for estrus and ovulation control in sheep. Proceedings of the 10th International Congress on Animal Reproduction and Artificial Insemination, Urbana, 1984, I, 354.