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# MEASUREMENT OF OVULATION RATES BY LAPAROSCOPY AND EFFECTS ON REPRODUCTIVE PERFORMANCE

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## SUMMARY

In 1974 and 1975, 40 and 50 ewes, respectively, from each of six flocks of approximately 100 mixed-aged ewes (Romney, Coopworth and Perendale) were laparoscoped 3 to 12 days after mating. In addition, 10 ewes drawn from each flock were repeatedly laparoscoped in 1974 and early 1975 (mean number of operations per ewe = 20), and then mated in 1975 and their reproductive performance recorded. The single laparoscopy at mating had no effect on returns to service, percentage of ewes failing to lamb, or the percentage of ewes with single, twin or triplet lambs in the flocks. The ewes that were repeatedly laparoscoped had more returns to service than those which had only one examination (26% *v.* 5.4%), but there were no other significant differences in their reproductive performance.

## INTRODUCTION

IN THE PAST the *in vivo* examination of internal organs of domestic animals has required surgery which may affect the subsequent performance of the animal, as is the case with measuring the ovulation rate in sheep by laparotomy (e.g., Cutten, 1970). With the advent of fibre light optics using a cold light source, the *in situ* observation of the reproductive organs with minimal manipulation has been made possible. There have been many reports on the use of laparoscopes in domestic animals, including sheep (Roberts, 1968), goats (Dukelow *et al.*, 1971), pigs (Wildt *et al.*, 1973) and cattle (Wishart and Snowball, 1973). This paper reports on the use of laparoscopy for determining ovulation rates in ewes, and its effect on their subsequent reproductive performance.

## MATERIALS AND METHODS

### EQUIPMENT AND SURGICAL PROCEDURE

The components of the equipment used are shown in Fig. 1. Ewes were fasted for 12 to 24 hours prior to laparoscopy. A

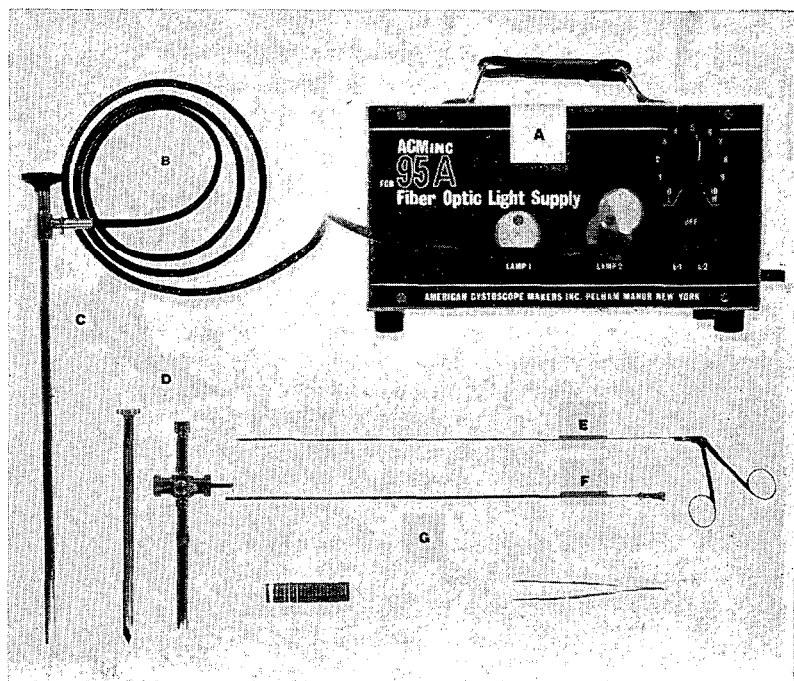


FIG. 1: *Laparoscopic equipment — light source (A), fibre optic bundle (B), laparoscope 9 mm diameter (C), trochar and cannula (D), forceps (E), probe (F), Michel clips and applicator (G).*

tranquillizer (acetyl promazien) was given approximately 15 minutes before surgery, and the ewe belly crutched. The ewes were then placed in a laparotomy cradle (Lamond and Urquhart, 1961); a local anaesthetic (xylocaine) was injected 3 to 4 cm either side of the mid-ventral line just below the udder, and this area was scrubbed, washed with 70% ethanol, and sprayed with a disinfectant. A small incision was made at the sites of injection of the local anaesthetic to facilitate puncturing of the abdominal wall with the laparoscope trochar and manipulating probe or forceps. In all operations the cradle was tilted to an angle of 30 to 40° from the horizontal (head of the ewe down) and the laparoscope inserted through the incision on the left-hand side of the midline. The abdominal cavity was inflated with CO<sub>2</sub>. After examination of the ovaries, the instruments were removed, the abdomen deflated, and the incisions dusted with antibiotic powder and closed with Michel clips.

## EXPERIMENTAL ANIMALS

Ewes were drawn from flocks of mixed-aged ( $1\frac{1}{2}$ - to  $5\frac{1}{2}$ -year-old) Romney, Coopworth and Perendale ewes, established from commercial sources in 1972. There were two flocks of 100 ewes for each breed. Harnessed rams were joined with individual flocks for 51 days, and 40 and 50 ewes (1974 and 1975, respectively) were selected at random from those mated within the first 17 days of the start of mating, and laparoscoped 3 to 12 days after first mating. In addition, 10 ewes drawn from each of these flocks in 1974 were repeatedly laparoscoped through to April 1975 and then mated with entire rams for 52 days. The seasonal variation in oestrous and ovarian activity of these ewes was reported by Kelly *et al.* (1976). These ewes were slaughtered on days 57 and 58 after the commencement of mating, the reproductive tracts recovered and examined.

## RESULTS

### LAPAROSCOPIC EXAMINATION

With a team consisting of four technicians preparing the ewes, and one person using the laparoscope, 25 to 30 mature ewes could be examined per hour. Of the total of 1680 laparoscopic operations, only 3 resulted in death of the ewe. These deaths occurred during the early stages in development of the operative procedure, and were due to either internal infection of rupturing of internal organs with the laparoscope trochar.

Condensation on the lens of the laparoscope following its insertion into the abdominal cavity was an initial problem, but was overcome by heating the sterilizing solution for the laparoscope to 37 to 40°C. In some cases the layer of omental fat in the ewe was penetrated on insertion of the laparoscope, which obscured observation of the ovary. This was overcome by either slowly withdrawing the laparoscope and cannula until the omental fat fell away, or puncturing through the fat with the laparoscope. The latter technique was often used on the ewes that were repeatedly laparoscoped throughout 1974 and early 1975, when an average of 20 operations were performed on each ewe. When the ewes that were repeatedly laparoscoped were slaughtered, omental fat was found to have adhered to the left side of the abdominal wall in 35% (19/54) of the ewes. The adhesions ranged in size up to 15 cm long by 5 cm wide. There were no adhesions on the other side where the manipulating

probe or forceps had been inserted, which suggests that, if a smaller diameter laparoscope had been used for repeated examination of the ovaries, the number and size of adhesions would have been less than recorded. Minor adhesions of the ovary to the uterus, broad ligament or fallopian tube were noted in 17 ewes. In five other ewes the adhesions were more extensive, covering up to one-third of the ovary.

#### REPRODUCTIVE PERFORMANCE OF THE EWES

Neither breed of ewe nor year had any significant effect on the parameters recorded, and so the results have been pooled.

There was no significant difference in returns to service between ewes which were laparoscoped once and those which were not (5.4% and 7.2%, respectively), but following repeated laparoscopy in 1974-5 the number of ewes which returned to service increased to 26% ( $P < 0.001$ ). Only two of these ewes failed to become pregnant to the second or third mating. One of these ewes had gross adhesions of the reproductive tract to the abdominal wall, which could easily have affected tubal-ovarian motility and ovum entry into the fallopian tube.

TABLE 1: LAMBING PERFORMANCE OF EWES (POOLED RESULTS FOR 1974 AND 1975)  
(S.E. in parentheses)

					<i>Treatment</i> <sup>1</sup>		
					<i>L</i> <sup>2</sup>	<i>NL</i> <sup>2</sup>	<i>RL</i> <sup>3</sup>
No. of ewes	....	....	....	....	538	565	54
Mean number of lambs/ewe	....	....	....	....	1.37 (0.03)	1.41 (0.03)	1.26 (0.08)
% Ewes having:							
0 lambs	....	....	....	....	6.7 (1.2)	5.3 (0.9)	5.5 (3.1)
1 lamb	....	....	....	....	51.0 (2.2)	50.4 (2.1)	63.0 (6.5)
2 lambs	....	....	....	....	41.5 (2.1)	42.4 (2.1)	31.5 (6.4)
3 lambs	....	....	....	....	1.0 (0.4)	1.9 (0.6)	—

<sup>1</sup> L = laparoscoped. NL = not laparoscoped. RL = repeatedly laparoscoped.

<sup>2</sup> Returns to service excluded.

<sup>3</sup> Slaughter data.

TABLE 2: RELATIONSHIP BETWEEN NUMBER OF OVULATIONS AND LAMBING PERFORMANCE OF EWES (POOLED RESULTS FOR 1974 AND 1975)  
(S.E. in parentheses)

					<i>No. of Recorded Ovulations</i>		
					1	2	3
No. of ewes	....	....	....	....	206	314	17
% Returns to service	....	....	....	....	5.3	5.1	11.8
% Ewes not returning to service with:							
0 lambs					(1.6)	(1.2)	(7.8)
					7.7	6.0	6.7
					(1.9)	(1.3)	(6.1)
1 lamb					83.6	30.9	26.7
					(2.6)	(2.6)	(10.7)
2 lambs					8.7	62.1	53.3
					(2.0)	(2.7)	(12.1)
3 lambs					—	1.0	13.3
						(0.6)	(8.2)

The lambing performance of those ewes that were laparoscoped once was similar to those that were not laparoscoped (Table 1). Ewes which were repeatedly laparoscoped had fewer lambs per ewe than the ewes in the other two groups, but the difference was not significant.

The lambing performance of the ewes that were laparoscoped once, related to the number of ovulations recorded for each ewe, is presented in Table 2. Of the ewes that were mated and held to service, 6.7% did not lamb. Twenty (3.9%) of the ewes had lambing performances higher than was predicted from the ovulation rate records. Seventeen of these ewes were recorded as having a single ovulation but lambled twins — 11 of like sex, 6 of unlike sex.

#### DISCUSSION

It is apparent that laparoscopy had only a very minor effect on the reproductive performance of the ewe. Apart from significantly more ewes returning to service in the repeatedly laparoscoped group, the percentage of dry ewes and distribution of lambing of the laparoscoped ewes were similar to those of ewes that were not laparoscoped.

In contrast, laparotomy can cause a substantial increase in the number of dry ewes (Lamond, 1963; Packham and Triffit, 1966; Cutten, 1970; Cumming, 1972). Also, handling of the

reproductive tract at or about mating during laparotomy may affect the survival of ova from multiple ovulations (Packham and Triffitt, 1966). There was no evidence of any affect of laparoscopy on the survival rate of ova in the multiple ovulating ewes. The partial failure of twin ovulations (twin ovulating ewes that gave birth to only one lamb) in 31% of the ewes was comparable with other published information gained from slaughter data (27% — Henning, 1939; 26% — Averill, 1955; 28% — Allison, 1975). The partial failure of twin ovulations in the repeatedly laparoscoped ewes was 21%.

There was a small error in the laparoscopic examination as a predictor of the maximum lambing performance of the ewes which was almost entirely confined to ewes with one recorded ovulation having two lambs. There are several possible explanations for this error including counting two corpora lutea close together as one, or identical twinning in some cases. However, failure to completely observe the ovary, and hence missing a corpus luteum, is the most likely explanation. This conclusion is supported by the fact that errors in 1975 were reduced by nearly 50% when a blunt probe was replaced by forceps which allowed greater manipulation of the reproductive tract.

There were few problems in the single laparoscopic examination. Occasionally a full bladder obscured the reproductive tract, but this was easily overcome by inflating the abdomen with more CO<sub>2</sub> which caused the ewe to urinate. Manipulation of the tract during laparoscopy was not affected by tract size, even in multiparous ewes. However, in operations made at later stages in pregnancy some rupturing has occurred when trying to manipulate the tract. Consequently, it would seem wise to perform a laparotomy if an examination of the ovaries is necessary after about day 30-40 of pregnancy. Ewe lambs were found to be the easiest and quickest on which to operate, because of the lack of significant amounts of omental fat and the smallness of the reproductive tract. Rates of examination of 40 ewe lambs per hour have been achieved. For laparotomy, the small size and consequent difficulty in exteriorization of the reproductive tract of young ewes increases the difficulty of the operation.

It is concluded that laparoscopic examination of the ovaries of sheep offers the research worker a rapid technique which has little or no effect on the reproductive performance of the ewe. The use of this equipment to measure ovulation rate at mating, both on the research station and the farm, should be useful in determining the reproductive efficiency of farmed animals.

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