

DURATION OF RETAINED FETAL MEMBRANES AND SUBSEQUENT FERTILITY IN DAIRY COWS

Nancy E. Halpern¹, Hollis N. Erb², and R. David Smith³
Departments of Clinical Sciences¹, Preventive Medicine²,
and Animal Science³
NY State Colleges of Veterinary Medicine^{1,2} and of
Agriculture and Life Sciences³
Cornell University
Ithaca, NY 14853

Received for publication: November 21, 1984

Accepted: February 15, 1985

ABSTRACT

Lactations from 1,111 heifers and 2,493 cows were evaluated for the effects of the duration of retained fetal membranes on subsequent fertility. Cows or heifers with metritis, ovarian cyst, both metritis and cyst, or neither were evaluated in separate strata in order to control for the effects of parity, metritis, and cyst on fertility.

Duration of retention had no effect on fertility if an animal had metritis or cyst. There was a suggestion that retained fetal membranes in heifers free of metritis and cyst decreased conception rate at first service. In multiparous cows free of metritis and cyst there was a significant decrease in conception rate at first service when retention exceeded 5 days, and delays of +18 days to 1st service and +57 days to conception when retention exceeded 7 days.

Keywords: retained fetal membranes, fertility, cows

INTRODUCTION

The effects of retained fetal membranes on the subsequent reproductive efficiency of dairy cows remains a controversial issue. Some reports document reduced fertility among cows with retained fetal membranes (1,2), but there are many studies which indicate that retention does not significantly alter fertility (3-7). These discrepancies are better understood when one considers the

Reprint requests: Dr. H.N. Erb, Preventive Medicine, NYSCVM, Cornell U., Ithaca, NY 14853. Research supported in part by Research Grant No. 59-2361-0-2-073-0 from the US Department of Agriculture.

THERIOGENOLOGY

variability among studies with regard to: types of herds included, definitions of "retained fetal membranes", sample sizes, reproductive parameters evaluated, medical treatments used, and the effects of confounding periparturient disease (which often were not considered when analyzing the effects of retained fetal membranes on fertility).

Results of several studies indicate that cows with retained fetal membranes have an increased incidence of metritis and that metritis does significantly affect subsequent fertility (1,3,8,9). Erb et al. in a companion study to this found that retention directly increased days open by 8 days independent of metritis and cystic ovary; there was an additional indirect effect of 9 and 21 more days open when the retention was followed by metritis and cyst (8), respectively.

This study evaluated the effects of the duration of retained fetal membranes, in days, on time to first service, conception at first service and days open. Because metritis and ovarian cysts have a significant effect on fertility, we controlled for the effects of these diseases by stratifying the analyses. In addition, the data from primiparous and multiparous cows were analyzed separately since fertility and disease incidence vary with age (3,10,11).

MATERIALS AND METHODS

Source of data - Data are from an on-going epidemiologic project in 33 Holstein dairy herds located in and around Ithaca, NY. The project has been described in detail elsewhere (8). The herds were members of the New York Dairy Herd Improvement (DHI) Cooperative, received regularly scheduled monthly or semi-monthly reproductive herd health visits from the Ambulatory Clinic of the New York State College of Veterinary Medicine and used artificial insemination (AI) almost exclusively in the milking herd. The herds had estimated transmitting ability of 100 ± 514 (mean \pm SD) kg and mature equivalent milk production of $8,090 \pm 1,675$ kg. During the study, each herd was visited monthly by a technician who obtained health and reproductive information from DHI, herd health, and AI records. The technician also questioned the herdsman regarding calving and culling events during the preceding month. All lactations begun between March 1, 1981 and January 31, 1983 were eligible for inclusion in the analysis.

Description of data - Lactation records were excluded if data were missing for diagnoses of metritis, cystic ovary, retained fetal membranes (each yes/no) or for duration of retention (0 to x days). Metritis and cyst diagnoses either were made by Ambulatory clinicians and explicitly entered in the herd health records or were inferred from a record of intrauterine infusion (metritis) or hormonal treatment (cyst). "Metritis" included metritis, endometritis, and pyometra. "Metritis" diagnoses could be made at any time between calving and conception, although the explicit statement of metritis tended to be made postpartum, and endometritis tended to be inferred from treatments at breeding soundness examinations or at breeding. Microbiologic cultures were rarely attempted and were not considered in classifying data for this study. Retained fetal membrane diagnoses were based on asking the herdsman if a cow "cleaned" or "passed her placenta" on the day she calved. If she did, she did not have retained membranes and duration of retained membranes was coded as 0 days. If the placenta wasn't passed on the day of calving, the herdsman was asked how many days elapsed until it was passed. Duration was time-censored (may

THERIOGENOLOGY

have been longer than recorded) because the number of days was as of the day of the interview. However, the censoring should have been random, infrequent, and of few days (since the median duration recorded was only 3 days).

The lactations were divided for analysis into eight mutually exclusive subsets. Lactations with both metritis and cyst recorded during the lactation, lactations with either metritis or cyst but not both, and lactations with neither were separate subsets. This stratification was done to control for the effects of metritis and cystic ovary on fertility. The subsets were separated additionally by parity into 1st lactations (primiparous heifers) and later lactations (multiparous cows). Two 1st lactation subsets (metritis plus cyst; cyst only) each had only one case of retained fetal membranes and could not be analyzed. The analyses were therefore done on six mutually exclusive (but not all-inclusive) subsets.

Three fertility measures were examined: days from calving to 1st service, conception at 1st service (yes/no), and days from calving to conception (days open). Conception was based on veterinary pregnancy check or subsequent calving, and not on non-return to service. Lactations didn't have to have complete data for all three fertility measures, therefore the sample size (and power to detect real differences) varied depending upon the fertility measure studied. However, lactation records that did not include a breeding within 200 days of calving were excluded from all analyses.

Data analysis - The numbers of days that membranes were retained were collapsed into frequency classes; we always kept at least two classes to compare to zero days. Given the latter restriction, we tried where possible to have >20 records in each class.

Conception at 1st service was analyzed by chi-square test with all duration classes within a stratum being compared simultaneously. Frequency histograms showed that days to 1st service and days open did not fit a Gaussian (symmetric and unimodal) distribution, so these outcomes also were analyzed by a non-parametric test. The test used was Dunn's modification of the Kruskal-Wallis test, in which each non-zero duration class in turn was compared to the 0 days duration class (12).

RESULTS AND DISCUSSION

The incidences of retained fetal membranes, cysts and metritis are described in Table 1. Note that cows and heifers with retentions had four times more metritis than all records in general. The apparent differences in incidence rates between 1st and later parities and, for metritis, between all records and those with retentions support our decision to stratify the analysis. Because these incidence rates are similar to those reported previously (3,10), we believe this represents a typical population of commercial dairy cattle.

There were no differences in fertility between records with any duration of retention and records without retention, if the record included metritis or cysts (Tables 2 and 3). However, some differences were seen in the records that were free of metritis or cyst. Results for the primiparous heifers that didn't have metritis or cyst are suggestive ($P=0.14$) of an effect of retention of any duration in decreasing conception rate at first service (Table 2). There were no other effects of retained fetal membranes on subsequent fertility in the 1st calf heifers.

THERIOGENOLOGY

The analyses for multiparous cows free of metritis and cyst revealed effects on each measure of fertility in cows with the longest retentions (Table 3). If a cow didn't have metritis or cyst but retained >5 days, conception rate decreased (P=0.06) to 27%. Retention of >7 days tended to delay first service by

TABLE 1 - Incidence rates of disease per 100 calvings.^a

Parity	Incidence rate per 100 calvings		
	Retained fetal membranes	Metritis	Cystic ovary
primipara (n=1,111)	4.0	9.8 (45.2) ⁰	4.2
multipara (n=2,493)	11.1	12.8 (40.9)	10.8 (13.0)

^a33 Holstein herds; Ithaca, NY; lactations begun March 1981 through January 1983. ⁰Incidence rate per 100 calvings with retained fetal membranes.

18 days (P<0.10 Table 3), and delayed conception by 57 days (P<0.05 Table 3), when compared to cows that did not have retained membranes.

Therefore, there appears to be a decrease in subsequent fertility in cows who retain their fetal membranes for several days, even if they do not experience metritis or ovarian cyst during the same lactation. These data likewise suggest that if a cow or heifer retains her membranes for <5 to 7 days, then her reproductive efficiency is not affected directly (although she is still at increased risk of metritis and cyst). We recognize that some variables for which we did not control may also have influenced subsequent fertility; these include silent heats, the effects of various medical treatments, and the farmers' decisions to delay breeding because of various diseases.

There are practical implications of our results. First, a cow who passes her placenta within about a week of calving has the same prognosis for fertility (if she avoids other diseases) as the cow who cleans the day of calving, but she should be observed closely for metritis and cystic ovary. Second, a cow who retains her placenta more than a week may warrant special management to overcome a poorer prognosis for fertility. Such a cow would, for instance, be a good subject for a prophylactic trial of prebreeding fertility examination, special heat detection aids, or even drug therapy to induce estrus.

Our data suggest that effects of retained fetal membranes on subsequent fertility are confounded by duration, parity, and presence or absence of other diseases. This confounding may explain some of the uncertainty in the literature regarding the effects of retentions.

TABLE 2 - Breeding performance in primiparous heifers after various durations of retained fetal membranes.^a

Diagnosis during lactation of metritis cyst	No. days membranes retained	1st service			days to conception			
		n _i	median days postpartum	pb	% conception	n _i	median days postpartum	pb
yes no	0	83	82	-	41	62	106	-
	1-5	12	80	>0.85	50	10	91	>0.90
	>5	7	69	>0.20	57	5	70	0.10
no no	0	836	73	-	56	714	86	-
	1-5	15	72	>0.15	33	10	82	>0.50
	>5	8	66	>0.35	25	5	81	>0.50

^a33 Holstein herds; Ithaca, NY; lactations begun March 1981 through January 1983. ^bDunn's modification of Kruskal-Wallis test, each duration class compared to zero days, P 2-tailed and unadjusted for multiple comparisons (P=0.10 significantly only at alpha=0.20). ^cChi-square test, 2 df.

THERIOGENOLOGY

TABLE 3 - Breeding performance in multiparous cows after various durations of retained fetal membranes.^a

Diagnosis during lactation of metritis cyst	No. days membranes retained	1st service			days to conception				
		n _i	median days postpartum	P _b	% conception	n _i	median days postpartum	P _b	
yes	0	37	86	-	37	0.38	25	104	-
	1-5	11	82	>0.80	11	0.36	5	71	>0.14
	>5	7	93	>0.55	7	0.14	6	128	>0.12
yes	0	169	77	-	169	0.42	131	87	-
	1-3	46	75	>0.90	47	0.40	39	107	>0.76
	4-5	20	70	>0.30	20	0.30	17	99	>0.77
no	>5	29	74	>0.40	29	0.28	20	88	>0.42
	0	198	86	-	199	0.39	142	103	-
	1-5	13	86	>0.80	13	0.23	8	110	>0.38
no	>5	4	88	>0.60	4	0.75	4	102	>0.94
	0	1813	72	-	1819	0.52	1543	87	-
	1-2	26	70	>0.75	26	0.46	20	74	>0.36
no	3	46	77	>0.25	46	0.59	39	92	>0.93
	4-5	30	70	>0.40	30	0.40	21	107	>0.24
	6-7	30	74	>0.65	30	0.27	22	100	>0.33
>7	14	90	<0.02	11	0.27	12	144	<0.01	

^a33 Holstein herds; Ithaca, NY; lactations begun March 1981 through January 1983. ^bDunn's modification of Kruskal-Wallis test, each duration class compared to zero days, P 2-tailed and unadjusted for multiple comparisons (P<0.01 in bottom row is significant at alpha = 0.05 but not necessarily at alpha = 0.01). ^cChi-square test; 2,3,2, and 5 df (df = number classes - 1).

TherIOGenology

REFERENCES

1. Erb, R.E., Hinze, P.M., Gildow, E.M. and Morrison, R.A. Retained fetal membranes - The effect on prolificacy of dairy cattle. *J. Am. Vet. Med. Assoc.* 133:489-496 (1958).
2. Pelissier, C.L. Dairy Cattle breeding problems and consequences. *TherIOGenology.* 6:575-583 (1976).
3. Dohoo, I.R. and Martin, S.W. Disease, production and culling in Holstein-Friesian cows. IV. Effects of disease on production. *Prev. Vet. Med.* 2:755-770 (1984).
4. Gwazdauskas, F.C., Bibb, T.L., McGilliard, M.L. and Lineweaver, J.A. Effect of prepartum selenium - vitamin E injection on time for placenta to pass and on productive functions. *J. Dairy Sci.* 62:978-981 (1979).
5. Moller, K., Newling, P.E., Robson, H.J., Jansen, G.J., Meursinge, J.A. and Cooper, M.G. Retained foetal membranes in dairy herds in the Huntly District. *N.Z. Vet. J.* 15:111-116 (1967).
6. Muller, L.D. and Owen, M.J. Factors associated with the incidence of retained placentas. *J. Dairy Sci.* 57:725-728 (1974).
7. Palmer, CC: Clinical studies on retained placenta in the cow. *J. Am. Vet. Med. Assoc.* 89:59-68 (1932).
8. Erb, H.N., Smith, R.D. and Oltenacu, P.A. Path model of reproductive disorders and performance, milk fever, mastitis, fertility, milk yield, and culling in Holstein cows. *J. Dairy Sci.* (accepted).
9. Sandals, W.C.D., Curtis, R.A., Cote, J.F. and Martin, S.W. The effects of retained placenta and metritis complex on reproductive performance in dairy cattle - A case control study. *Can. Vet. J.* 20:131-135 (1979).
10. Erb, H.N. and Martin, S.W. Interrelationships between production and reproductive diseases in Holstein cows. Age and seasonal patterns. *J. Dairy Sci.* 63:1918-1924 (1980).
11. Thompson, J.R., Pollak, E.J. and Pelissier, C.L. Interrelationships of parturition problems, production of subsequent lactation, reproduction, and age at first calving. *J. Dairy Sci.* 66:1119-1127 (1983).
12. Hollander, M. and Wolfe, D.A. Nonparametric Statistical Methods. John Wiley & Sons, New York, 1973.