Culling and Laminitis: Real Herds, Real Cows, Real Deaths*

Arden J. Nelson, *DVM, Diplomate ABVP-Dairy;* **Marguerita B. Cattell,** *DVM, MS, Diplomate ABVP-Dairy, 5410 Augusta Trail, Fort Collins, CO 80528-9185*

Abstract

Four New York dairy herds, ranging in size from 518 to 2007 cows, were studied. The overall culling rate was 27.6% and ranged from 15.6% to 42.9%. Cows with a history of laminitis lesions were culled during the current lactation at a rate 1.77 times higher than cows with no laminitis lesions. A history of laminitis in the current lactation significantly increased the likelihood of culling due to foot and leg problems, reproduction, mastitis, low production and other reasons. Overall, laminitis was associated with 9.8% of culling in the entire herd and 43.5% of culling among cows with a history of laminitis.

Résumé

Quatre troupeaux laitiers de l'état de New York, d'une taille variant entre 518 et 2007 vaches, ont été étudiés. Le taux de réforme dans l'ensemble était de 27.6% et variait entre 15.6% et 42.9%. Les vaches présentant des lésions de fourbure étaient réformées durant la lactation en cours à un taux 1.77 plus élevé que celui des vaches ne montrant pas de telles lésions. Le fait d'être atteint de fourbure durant la lactation en cours augmentait de façon significative la probabilité de réforme associée à des problèmes d'onglon et de patte, de reproduction, de mammite, de faible production et d'autres raisons. En tout, la fourbure était associée avec 9.8% des réformes dans le troupeau entier et 43.5% des réformes chez les vaches pour lesquelles on a rapporté de la fourbure.

Introduction

Acidosis and laminitis constitute perhaps the most costly dairy production disease in the United States. Historically, mastitis has been the leading economic disease of milking cows. It is possible that the prevalence of laminitis lameness exceeds mastitis (Appendix A). A recent unpublished study of foot lesions in 815 slaughter cattle in the southeastern US showed the presence of laminitis lesions in 84% of the hind feet examined from cull dairy cows. Studies on the incidence of lameness in the US are rare, as are diagnosis-specific data.

In England and Wales, a study of 21,000 dairy cows in 185 herds showed the incidence of lameness to be 25% per year. This was estimated to cost English dairymen $1,762 (£1,175) per hundred-cow herd.[11] In a study that evaluated lameness in 31 first-lactation heifers in Scotland, 70% to 100% of the animals suffered from sole and white-line lesions during the –4 to +32 weeks of lactation.[6] An English study which looked at data from 10,427 cows in 63 herds reported an average 33.6% incidence of lameness. Cost of a single case of lameness due to solar disease was calculated at $588 (£392.21).[3]

Lameness incidence ranged from 9% to 49% (overall 26%) in a study of 13 Dutch dairy farms that also looked at the interaction between lameness and reproduction.[2] When 2435 cows that calved across three years were studied, only sole ulcers were associated with a significant difference in 270 days-in-milk (DIM) production. Cows with sole ulcers had an increase of 376.2 lb (171 kg) of milk production. Sole ulcers represented 31.5% of all lameness in this study. All lameness prolonged the interval from calving to first service by an average of 3.4 days. For rear-leg lameness, the interval increased by 2.9 days, and the interval was increased by 4.6 days when a foreleg lesion was present.

In an English study of 13,680 cows in 90 herds, lameness was calculated to cost the dairyman $637 (£424.92) per cow each year.[5] Lameness occurred in 18.7% of the cows in this study, while cases totaled 28.1%. Individual herd level incidence ranged from 1.7% to 34.4%, and total cases per hundred cows ranged from 1.7 to 51.4. Total controllable disease cost was estimated to be $9,450 (£6,300) per hundred-cow herd per year.

In contrast to the above studies, lameness occurred far less frequently in Israeli dairy herds.[1] Records from more than 95% of dairy cattle in Israel (221,572 head) showed the incidence of lameness to be 2.75%. Hoof lesions accounted for 25% of lameness. The production loss associated with lameness ranged from 1,760 to 4,400

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lb per lactation. The pattern of loss was a steady, long-lasting decline.

In a study of New York herds, culling ended 1449 (18.7%) of 7763 lactations analyzed.[7] Median days from calving to culling were shortest for injury (134 days) and udder problems (127 days), followed by lameness at 151 days. Of all culling, 42% occurred in the first 120 days of lactation, but 74% of culling due to lameness occurred during this high-production period. Cows with lameness were 1.7 times more likely to be culled than cows that were not lame, which was exceeded only by downers (3.5), teat injuries (2.7), mastitis (2.0), abortion (1.9) and left-displaced abomasum(1.8).

A study of veterinary records of 39,727 Finnish Ayrshire cows that calved in 1993 showed that for lame cows, risk of culling during that lactation was 1.2 to 12 times greater than that of cows with no history of laminitis, depending on the stage of lactation when lameness occurred.[8] The overall cull rate in this study was 31.6%. Three diseases—lameness, teat injuries, and mastitis—had the highest odds ratios for culling. Risk of culling during the disease period was higher for lameness than for any other disease. During the first 60 days of lactation, lame cows were six to 12 times more likely to be culled than cows that were not lame.[9]

Materials and Methods

A retrospective cohort analysis was performed on herd lameness and culling records from four New York dairy herds. Cows were housed in modern freestall barns with herringbone or parallel parlors. Mature equivalent projected production levels ranged from 23,904 to 26,275 lb, and averaged 25,499 lb per cow annually. Cows averaged 45 months of age (Table 1).

For more than two years encompassing the analysis period, these herds had followed a system for recording foot lesions (Appendix A) and culling. Herd records were used extensively for consulting and management information, with frequent discussions regarding attention to details of continued and systematic recording of data. Hoof lesion information from all source documents were stored in Dairy Comp 305™. Lesion data were generated from routine foot trims and clinically lame cows attended by the trimmer, dairy staff or veterinarian. Nomenclature describing foot lesions was discussed and common terms were established when consultation with the herds began.

The study compared culling during the current lactation of cows with recorded laminitis lesions to cows with no recorded laminitis lesions (Table 2). Subjects were cows with current lactation data in the herd management data file, therefore the analysis included records from all active cows and from all cows culled during the previous 365 days. Laminitis lesions for this study included sole hemorrhage, sole ulcers, sole abscesses, false soles, separated soles and white-line abscesses.

Table 1. Herd data on study herds from New York State.

Herd ID	Current herd size	305ME lb/cow/yr	Age of cows, months
A	2007	23904	45
B	939	26164	42
C	789	25654	44
D	518	26275	49
Average	*1063*	*25499*	*45*

Results

Total culling rate was 27.6%. The incidence of laminitis lesions was 13.9% of cows in current lactation. Cows with laminitis lesions were 1.77 times more likely than cows without lesions to be culled in the current lactation (Table 3). The excess relative risk for culling among cows with a history of laminitis was 77% greater than cows without lesions. Attributable risk of

Table 2. Culling rate and incidence of laminitis lesions in four New York dairy herds.

		Cows with laminitis lesions			Cows with no lesions		
Herd ID	No. cow records	Total no.	No. culled	% culled	Total no.	No. culled	% culled
A	2397	239	53	22.2	2158	337	15.6
B	1231	165	100	60.6	1066	333	31.2
C	672	183	116	63.4	489	210	42.9
D	766	115	40	39.8	651	208	32.0
ALL	*5066*	*702*	*309*	***44.0***	*4364*	*1088*	***24.9***

Table 3. Relative risk ratios for culling due to laminitis lesions.

Herd ID	Relative risk ratios for culling of lesion cows versus non-lesion cows	Confidence intervals
A	1.42 *	(1.10-1.84)
B	1.94 *	(1.67-2.26)
C	1.48 *	(1.27-1.72)
D	1.09	(0.83-1.43)
ALL	***1.77 ****	*(1.60-1.95)*

*Significantly increased risk (p =.05).

cows exposed to laminitis lesions for culling was 43.5%. In other words, 43.5% of laminitis cows were culled for reasons attributable to laminitis.

Of cows culled for foot and leg problems, 10.1% were associated with a history of having laminitis lesions. For reproduction, 20.4% of the culling was due to laminitis history; for other (unspecified) reasons, 18.5% of the culling was due to laminitis lesions; and 17.1% of the culling for low-production was attributable to laminitis. Overall, laminitis was associated with 9.8% of culling in the herds (Tables 4-7).

Discussion

The increased risk of culling due to laminitis in these herds was comparable to increased risk attributed to all lameness in a previous study.[7] No studies were identified that examined the risk of culling specifically because of laminitis. Our study did not determine the risk of culling by stage of lactation or from time of diagnosis.

This study included records from the current lactation for all cows with records generated in the year prior to data collection. Records were not selected for duration

Table 4. Recorded culling reason for cows with laminitis lesions.

Herd ID	No. cows	Feet, legs	Repro.	Mast.	Health	Death	Abort.	Low prod.	Other
A	239	6	3	21	4	7	1	3	8
B	165	5	15	7	4	4	8	11	46
C	183	16	30	26	13	5	4	22	0
D	115	6	7	4	1	4	2	4	12
ALL	*702*	*33*	*55*	*58*	*22*	*20*	*15*	*40*	*66*

Table 5. Recorded culling reason for cows with no-laminitis-lesions.

Herd ID	No. cows	Feet, legs	Repro.	Mast.	Health	Death	Abort.	Low prod.	Other
A	2158	37	11	133	52	61	4	12	27
B	1066	20	30	38	18	24	66	56	81
C	489	41	41	37	6	57	8	18	2
D	651	14	37	28	24	37	9	13	46
ALL	4364	112	119	236	100	179	87	99	156

Table 6. Relative risk of culling associated with laminitis history by reason.

	Feet, legs	Repro.	Mast.	Health	Death	Abort.	Low prod.	Other
RR	**1.83***	**2.87***	**1.53***	1.37	.69	1.07	**2.51***	**2.63***
CI	1.25-2.68	2.11-3.92	1.16-2.01	.87-2.15	.44-1.09	.59-1.92	1.76-3.59	1.99-3.47

Example: RR for repro. culling = rate of repro. culling among laminitis lesion cows / rate of repro. culling among cows without laminitis lesions.

*Significantly increased risk (p =.05).

Table 7. Attributable risk of laminitis exposure to culling by reason for reasons with significantly elevated risk.

	Feet, legs	Reproduction	Mastitis	Low production	Other	All reasons
AR-T #	10.1%	20.4%	6.7%	17.1%	18.5%	**9.8%**

AR-T # is the Attributable Risk Total. Example: 20.4% of all cows culled for reproduction are culled because of laminitis.

of time from laminitis diagnosis. Cohort studies should exclude records that do not incorporate an appropriate time lag from exposure to laminitis diagnosis, to outcome, culling or record completion. The mean duration of this time lag is not known, but has been estimated from "very short"[9] to an average of five months.[7] Future studies should account for this factor. Inclusion of cows with shorter duration in this study likely underestimates the risk of culling due to laminitis.

Conclusion

Total culling in study herds increased by 77% in laminitis-lesion cows as compared to cows without lesions. Within herds, the culling rate increased by 9% to 94% when cows had laminitis lesions. The presence of laminitis lesions increased the likelihood of culling cows for reasons other than lameness. Laminitis played a significant role in all culling, increasing the culling rate by 9.8% in these herds. There was an association between a history of laminitis and culling because of reproductive failure, mastitis, low milk production and other culling reasons.

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Descriptive spatial analysis of the epidemic of bovine spongiform encephalopathy in Great Britain to June 1997

M. A. Stevenson, J. W. Wilesmith, J. B. M. Ryan, R. S. Morris, A. B. Lawson, D. U. Pfeiffer, D. Lin

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This was a spatial analysis of the epidemic of bovine spongiform encephalopathy (BSE) in Great Britain, based on agricultural census data collected between 1986 and 1996 and BSE case data collected up to June 1997. Kernel smoothing techniques were used to plot the distribution of BSE-positive cattle holdings per 100 holdings per square kilometer and the distribution of confirmed BSE cases per 100 head of cattle per square kilometer. In the early stages of the epidemic reported BSE cases were scattered widely throughout Great Britain, with no clearly identifiable focus. By June 1997, a statistically significant cluster of BSE-positive holdings was identifiable in the eastern part of the South west region of England. During the epidemic the highest densities of confirmed BSE cases per 100 cattle per square kilometer occurred in the greater part of the South west region of England and within Dyfed in the south west of Wales. In Wales, a small number of holdings experienced large numbers of confirmed BSE cases. In the South west region of England a large number of holdings experienced small numbers of confirmed cases. By June 1997, the distribution of BSE-positive holdings across Great Britain was largely determined by factors that influenced the amount of recycled infectious material they were exposed to.

Appendix A
Syn-apps rd

Foot Lameness Recording System

Key points

1. **Foot lameness comes in three flavors:** foot warts, foot rot and laminitis.

2. **Foot lameness is the MOST expensive disease** affecting your dairy herd.
   a. Most cost per case of disease (includes lost milk, treatment cost, reproduction loss, culling losses)

Disease	Milk Fever	Retained Placenta	Ketosis	Displaced Abomasum	Mastitis	Lameness
Cost per Case	$ 334	$ 285	$ 145	$ 340	$ 190	$ 340

Source = Dr. Chuck Guard, Cornell University. Costs include lost milk, culling, and treatment cost.

   b. Most cost per herd due to high incidence of lameness.

Disease	Milk Fever	Retained Placenta	Ketosis	Displaced Abomasum	Mastitis	Lameness
% of Herd Affected	3 %	10 %	5 %	3 %	20 %	33 %

   c. Cost per case x number of cows affected = total cost per year per herd

Example calculation

Displaced Abomasum
$ 340 per case x 30 cows (3% of 1000 cows) = $10,200
Mastitis
$ 190 per case x 200 cows (20% of 1000 cows) = $38,000
Lameness
$ 340 per case x 333 cows (33% of 1000 cows) = $ 113,220

3. **We must know what kind of lameness we have before we can effectively treat or prevent it!**
   a. The *Syn-apps rd* Dairy Comp 305 recommended lameness recording system records all normal hoof trims under the event called TRIM, while any lame cows and all cows trimmed that have hoof lesions will be recorded under the event called LAME.

Lameness type →	Laminitis	Hairy Foot Warts	Foot Rot
Dairy Comp Code	A	W	T

   b. Laminitis in the right rear claw will be recorded under the event lameness remark entry as RRA (RR = right rear foot, A = laminitis).

   c. Foot wart on the left rear foot will be recorded as LRW (LR = left rear foot, W = wart)

   d. Foot rot in the left front foot will be recorded as LFT (LF = left front foot, T = foot rot).

   e. This system provides for recording of the diagnosis of lameness in a fashion that allows sorting of lameness by the remark entry.

   f. Therefore, we can know if foot rot or warts or laminitis is the problem we need to manage...and ALL LAMENESS CAUSES ARE MANAGEABLE.