DISPLACED ABOMASUM: CLINICAL DATA AND EFFECTS OF PERIPARTAL FEEDING AND MANAGEMENT ON INCIDENCE

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INTRODUCTION

Incidence of displaced abomasum (DA) in dairy cows is at least 10 times higher in Wisconsin herds than in Sweden, even though average fat-corrected milk production levels are similar. In southern Wisconsin an incidence of 2.5-3.5% appears normal (Dr. Rhoda, personal communication, Evansville, WI).

Feed ingredient and breed differences may be associated with different incidence rates between countries. However, a preliminary investigation (Pehrson, unpublished) indicated that Wisconsin feeding and management practices during the peripartal period may be closely associated with the high incidence rate. The primary objective of the present study was to further evaluate this hypothesis (Trial B). A secondary objective was to collect clinical data with regard to occurrence of DA in the same geographic area (Trial A).

MATERIALS AND METHODS

Trial A

From each individual case of DA diagnosed during the period November, 1991 to March, 1992 practicing veterinarians in three Veterinary Service areas (Evansville, Oxford, Waupun) were asked to complete a survey questionnaire. Questions pertained to type of DA, age of the animal, date of breeding, date of calving, date of diagnosis, and occurrence of other peripartal diseases, twin births, or difficult delivery. Veterinarians returned 247 questionnaires completed with all or most of the requested data.

Trial B

A detailed questionnaire pertaining to peripartal feeding and management practices was sent to 499 producers in the same three Veterinary Service areas as in Trial A. Seventy-one of the questionnaires were returned and completed in a manner that allowed adequate evaluation following a telephone interview (n=27) or a farm visit (n=44). In 37 of the herds, last annual incidence of DA was >3.0% ($\bar{x}$=8.7; Range=3.2-21.7) and in 34 of the herds it was $\leq$3.0% ($\bar{x}$=1.0; Range=0.0-3.0). These herds were considered as High Incidence Herds (HIH) and Low Incidence Herds (LIH), respectively. All were Holstein herds.

In addition to routine data (number of cows, production parameters, type of stall, type of feed ingredients, type of feeding system etc.) and amounts of corn and total concentrates offered at calving, the following parameters were evaluated according to a 1 to 5 scale:

Social adaptation

1 = Extremely mild (dry animals housed together with lactating animals during at least 4 weeks before calving, and comparable).
2 = Mild (dry animals housed together with lactating animals 2-4 weeks before calving and most forages fed at inside mangers, and comparable).

3 = Moderate (dry animals housed together with lactating animals 1-2 weeks before calving and forages fed both at inside mangers and at outside bunk, and comparable).
4 = Tough (dry animals housed together with lactating animals after calving and forages fed both at inside mangers and at outside bunk, and comparable).
5 = Extremely tough (dry animals from another farm moved together with lactating animals after calving and most forages fed at outside bunk and bunk space limited, and comparable).

Change of forages close to calving
1 = Extremely mild (nearly no change).
2 = Mild (same types fed before and after calving and moderate changes in amounts, and comparable).
3 = Moderate (moderate changes in types and amounts, and comparable).
4 = Tough (significant changes in types and amounts made suddenly, and comparable).
5 = Extremely tough (most forages changed with regard to types and amounts, and comparable).

Change of concentrates before and at calving
1 = Extremely mild (small, gradual increase of concentrates during >2 weeks before calving, and comparable).
2 = Mild (gradual increase of concentrates during >1-2 weeks before calving, and comparable).
3 = Moderate (animals used to concentrates before calving and moderate increase in amounts at calving, and comparable).
4 = Tough (sudden increase of concentrates at calving, and comparable).
5 = Extremely tough (no concentrates fed before calving and sudden increase up to nearly maximal amounts at calving, and comparable).

Change of concentrates after calving
1 = Extremely mild (increased amounts on a daily basis over several weeks, and comparable).
2 = Mild (gradual increase over a 2 week period, and comparable).
3 = Moderate (moderate increase during the first week after calving, and comparable).
4 = Tough (from small amounts at calving to maximal levels within a few days, and comparable).
5 = Extremely tough (directly from nearly no concentrates at calving to maximal levels within a few days).

Daily amounts of long hay offered close to calving
1 = >16 lbs.
2 = 12-16 lbs.
3 = 8-12 lbs.
4 = 1- 8 lbs.
5 = 0 lbs.

"Fiber mat" effect close to calving (evaluated from the above mentioned parameters, from quality and form of forages and assuming a maximal daily dry matter intake of 25 lbs.)

1 = Very high.
2 = High.
3 = Moderate.
4 = Low.
5 = Extremely low.

All parameters were evaluated separately for primi- and multiparous cows, but only herd averages are presented in Table 1 and 2.

RESULTS

Trial A

Of the 247 DA-cases 90.7% were diagnosed as left-sided (LDA) and 9.3% as right-sided (RDA). Of the 26 DA's diagnosed later than 2 months after calving 80.8% were LDA and 19.2% RDA, indicating a significantly ($P<0.05$) later occurrence of the RDA's.

Diagnosis of DA was 53.9% multiparous cows, 45.1% primiparous cows and 1.0% young bulls or heifers.

Diagnosis of DA was 80.4% within one month after calving, 3.8% during the dry period, 4.7% between one and two months after calving, and 11.1% later in lactation.

Of the 188 DA's diagnosed within one month after calving, 69.5% were reported to have been associated with other peripartal diseases, twin births or difficult delivery. Incidence in these 188 animals were: milk fever (3.8%), retained placenta (16.7%), ketosis (42.9%), twin birth (5.7%) and difficult delivery (9.5%).

The length of pregnancy was 276.7 ± 6.3 days ($\bar{x} \pm sd$) in 42 DA-cows diagnosed within one month after calving.

Trial B

The mean incidence rate of DA in all 71 herds was 5.0%. As in Trial A, the number of multiparous cows with DA was somewhat higher (148=51.4%) than that of primiparous cows (139=48.6%).

No significant differences were found between High Incidence Herds (HIH; >3.0%) and Low Incidence Herds (LIH; $\leq$3.0%) with regard to type of stall used. Thus, 89.2% and 88.2%, respectively, had tie or stanchion housing, whereas the remainder had loose housing systems.

Total mixed rations (TMR) were fed to 27.0% of HIH and 14.7% of LIH. This difference was not significant ($X^2=1.64$; $P=0.2$). However, when herds with >5.0% DA-incidence (n=32) were compared with herds with no DA's (n=16), the difference approached significance (28.1% and 6.2%, respectively; $X^2=3.09$; $P<0.1$).

Cows in LIH had a significantly higher milk fat content than cows in HIH, while no significant differences were found between the two types of herds with regard to herd size, milk production level, milk protein content, and amounts of corn or concentrates offered at calving (Table 1). However, a comparison between herds with a DA-incidence of >5.0% and those with no DA showed a significantly ($P<0.05$) higher milk production and larger herd size for >5.0% DA herds ($\bar{x}$=19070 vs. 17350 lbs. and 86.3 vs. 50.4 cows, respectively).

Table 1. Herd size, annual milk production level, milk fat content, milk protein content, and amounts of corn and total concentrates offered at calving in High Incidence Herds (HIH; >3.0% DA) and Low Incidence Herds (LIH; ≤3.0% DA). n=number of herds.

	Number of cows		Milk production lbs.		Milk fat %		Milk protein %		Corn lbs.		Total conc. lbs.	
	HIH	LIH	HIH	LIH	HIH	LIH	HIH	LIH	HIH	LIH	HIH	LIH
n	37	34	36	34	35	33	35	29	37	34	37	34
$\bar{x}$	87.1	74.1	18941	18380	3.72	3.82	3.19	3.21	9.2	7.6	10.5	8.9
S.E.	9.4	9.3	344	442	0.03	0.03	0.01	0.02	0.6	0.5	0.6	0.6
P value	n.s.		n.s.		P<0.05		n.s.		n.s.		n.s.	

There were significant differences between HIH and LIH with regard to degree of social adaptation, change of forages close to calving, change of concentrates before and at calving, and "fiber mat" effect. Animals in LIH were offered significantly more long hay, whereas no significant difference was found in the degree of change of concentrates after calving (Table 2). The differences in social adaptation, change of forages, and change of concentrates close to calving were even more pronounced in a comparison between herds with a DA-incidence of >5% and herds without any DA's, and also for primiparous versus multiparous cows.

Table 2. Degree of social adaptation, change of forages close to calving, change of concentrates before and at calving, change of concentrates after calving, long hay offered close to calving and "fiber mat" effect close to calving in High Incidence Herds (HIH; >3.0% DA) and Low Incidence Herds (LIH; ≤3.0% DA) according to a scale from 1 to 5, where 1 means extremely mild conditions, 2-4 moderate conditions, and 5 extremely tough conditions. n=number of herds.

	Social adaptation		Change, forages		Change, conc. before		Change, conc. after		Long hay		"Fiber mat" effect	
	HIH	LIH	HIH	LIH	HIH	LIH	HIH	LIH	HIH	LIH	HIH	LIH
n	37	34	37	34	37	34	37	34	37	34	37	34
$\bar{x}$	3.03	2.53	2.43	1.94	2.98	2.37	2.09	1.90	2.95	2.31	3.45	2.32
S.E.	0.17	0.15	0.13	0.16	0.16	0.17	0.13	0.11	0.17	0.21	0.12	0.13
P value	P<0.05		P<0.05		P<0.01		n.s.		P<0.05		P<0.001	

DISCUSSION

Results from Trial A are generally in agreement with earlier data which indicates that 80–90% of all DA's are left-sided (1) and that about 80% are diagnosed within one month after calving (2). It appears that most of these early diagnosed cases originate during the peripartal period. However, the relatively large number of DA cases diagnosed later than 2 months after calving (11.1% of total material) indicates that DA is a disease which is not exclusively related to incidents occurring during the peripartal period.

There were more DA's diagnosed in mature cows than among primiparous cows. Assuming that only 35% of the cows in a typical herd are primiparous, and based on a normal total DA incidence in Wisconsin herds of 2.5-3.5%, the real DA incidence among primiparous cows in Trial A would have been 3.4-4.6% compared to 2.2-2.9 % among mature cows. This is contrary to other reports, where a higher incidence in mature cows has been reported (4).

About 70% of the cows with calving-related DA's also had other peripartal complications. Ketosis was reported in nearly half of the cows, probably in most cases secondary to DA. Incidence of milk fever seems not to have been higher than normal, whereas incidences of twin births, difficult delivery, and retained placenta were about twice the normal incidences, which according to Roberts (5) are 1-2%, 5% and 10%, respectively. An increased incidence of ketosis, twin birth and retained placenta in DA cows has been reported previously (4).

Length of pregnancy was at least 1.5 days shorter than reported by Roberts (5) for a normal Holstein population. Unfortunately, the number of cows for which length of pregnancy could be evaluated (n=42) was to small for investigating whether the increased incidence of retained placenta was simply related to a shorter than normal length of gestation.

DA incidence in Trial B was 5.0%, which was close to twice the normal incidence in the same geographic area. It seems reasonable that farmers with past or current DA-problems were more motivated to complete and return the questionnaire than farmers without problems.

The significantly higher annual milk production for herds with very high incidence of DA compared to zero incidence herds likely reflects differences in feeding intensity. This is supported by the trend toward higher level of concentrate feeding at calving in HIH. The significantly higher milk fat content in LIH may be related to the lower production in these herds. It has been reported previously that a high feeding intensity (high grain content and high ratio of concentrate/roughage) is one of the risk factors causing DA (6).

Cows in HIH had a significantly harder social adaptation period close to calving. They also received a significantly more abrupt change of both roughage and concentrate close to calving. These results confirm the hypothesis that management and feeding practices are crucial factors for calving-related DA. Bad practices will likely result in low feed dry matter consumption, and in low rumen fill at calving. If, in addition, the amount of long fiber offered to, or consumed by, the cow is too low, the "fiber mat" effect in the rumen will be reduced, as will possibly retention time of digesta in the rumen. All of these factors are accepted as being pathogenetically important for DA (3). With our criteria of evaluation, significance of the difference in "fiber mat" effect was stronger than for the other parameters.

When data from Trial B were used for one separate comparison between primiparous cows in HIH and LIH, and for another comparison between multiparous cows in the same types of herds, significance of the differences were stronger for primiparous cows concerning social adaptation, change of forages, and change of concentrates at calving. These results help explain the high DA incidence among primiparous cows. It also seems reasonable that primiparous cows may find peripartal changes more stressful than multiparous cows.

In conclusion, our results indicate that prophylactic measures to prevent DA should focus on achieving good rumen fill and high "fiber mat" effect at calving.

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SUMMARY

Trial A. Clinical data were obtained from 252 cases of DA in Wisconsin herds. Ninety–one per cent were left-sided, 80% were diagnosed within a month after calving, and 70% also had other peripartal problems. About 50% of the DA cows had ketosis. The incidence of milk fever among DA cows was normal, whereas the incidences of twin birth, difficult delivery and retained placenta were about twice those of a normal population.

Trial B. Peripartal management and feeding practices were evaluated in 37 Wisconsin herds with a DA incidence of >3.0% and in 34 herds with an incidence of $\leq$ 3.0%. Cows in the high incidence herds had a significantly harder social adaptation period close to calving. They also received a significantly more abrupt change in the amount of both roughage and concentrates offered at the same time. These results show that management and feeding practices around calving are crucial factors for DA. Bad practices will likely lead to reduced appetite, low rumen fill at calving, and therefore increased risk of DA.