Left-side Displacement of the Abomasum in Dairy Cows at Pasture In Australia

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Aust Vet J 68:140-142 (1991)

Introduction

Left-side displacement of the abomasum (LDA), which causes illthrift and reduced milk production, is a common and economically important disease in the high production systems of the northern hemisphere. Epidemiological studies have shown the disease to have a complex, multifactorial origin. Hoffsis and McGuirk (1986) and Blood and Radostits (1989) have summarized the pattern of risk factors emerging from those studies. Major risk factors have been identified as impending or recent parturition, high production and heavy grain supplementation. Affected cattle are usually in older age groups and of large frame. Lack of exercise, associated with housing in winter, and concurrent disease are also thought to predispose to the condition. Conclusive evidence for genetic predisposition has not been found although there is some support for a genetic influence (Martin 1972; Lunebrink 1974; Stober *et al* 1975). Moderate to severe ketonuria is always present (Blood and Radostits 1989). The syndrome in the southern hemisphere, where cattle are predominantly pasture fed, has not been described in detail although case reports exist (Rees 1963; O'Shea 1965; Malmo 1976; Hawkins *et al* 1986).

Materials and Methods

The Study Environment

The investigation was conducted in the Macalister Irrigation Area (MIA) in East Gippsland, Victoria, Australia from 1 June 1989 to 1 April 1990.

The MIA is a dairying area with approximately 450 dairy farms and 60,000 dairy cows. Most farmers aim to have their cows calve within a period of 6 to 8 weeks beginning in late winter (August) so that peak milk production can be attained at the time of maximum pasture availability in spring (October).

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Lactating dairy cattle in the area graze irrigated perennial ryegrass and white clover pastures and approximately 50% of farmers supplement their cows with small amounts (0.5 to 3.0 kg) of grain at milking time. Most cows are removed from the milking routine approximately 2 months before they are due to calve. The non-lactating period occurs from May to July at a time when winter pasture growth is minimal. Pasture hay is fed to maintain body condition.

Approximately 70% (320) of herds in the area are tested for milk production (Anon 1989) at least every 2 months. Farmers provided data on herd and cow butterfat (BF) production, age of cows and breed. Herd replacements were usually progeny of bulls from proven high producing blood-lines. Many of the blood-lines were imported from overseas, particularly from the USA and Canada.

Case Herds and Cows

From the start of the 1989 calving season, survey forms were completed every time a cow was diagnosed as being affected with LDA. Information was sought on age, breed, size, grain supplementation, date of calving, pedigree, concurrent disease, butterfat production of cow and herd, size of herd and 3 items of clinical information, namely resting heart rate, ketonuria, and diarrhoea.

The cows with LDA were reported by farmers who observed them to be sick and/or having lower than expected milk production. Diagnosis of LDA was based on the detection of a viscus positioned in the upper left flank area. In most cases, the displaced abomasum was sufficently filled with fluid and gas for it to be detected by resonant "pinging" sound during auscultation-percussion and a fluid splashing sound during auscultation-ballottement.

Ketonuria was measured using semi-quantitative urine test strips* or tablets+. Size was assessed visually. Thirty of the 32 herds in which cows affected with LDA occurred, had regular tests of milk production. This allowed an assessment of the production capability of 18 cows with LDA that had completed at least one lactation. Because 2-year-old cows with LDA became affected during their first lacation, assessment of their productivity in a previous lactation was not possible.

Survey forms were completed for 37 of 40 cows af-

* *Ames Multistix, +Ames Acetest Reagent Tablets, Miles Australia Pty Ltd, Mulgrave, Victoria*

fected with LDA and the following results and discussion relate only to those 37 cows. In 35 cows, the diagnosis was confirmed at surgery. The standing, right flank, omentopexy technique (Turner and McIlwraith 1982) was used. The 2 remaining cows were culled. Cases of LDA were diagnosed on 32 farms, 5 of which had 2 affected cows. Clinical signs were not recorded for 2 affected animals.

Control Herds and Cows

The mean size of the 320 herds tested for production was 145 ±65 milking cows. Randomly selected herds (100) which had been tested for production, and cows (800, 8 per herd) provided estimates of herd and cow productivity in the MIA. Mean cow butterfat production (MCBF) for each herd was 174 ±29 kg/yr (100 herds). Mean production index‡ (PI) was 104 ±14 (800 cows).

The 2 major grain merchants for the area were asked to examine their records and provide an estimate of the percentage of farmers in the MIA supplementing their herds with grain during the late winter-early spring period of 1989, when most of the cows with LDA became affected. Both merchants estimated between 60 and 70%. This agreed with estimates supplied by local dairy extension officers and advisors. A particularly severe winter had forced more farmers than usual to feed a grain supplement.

Most herds in the area comprised mainly Holstein-Friesian cows with some Jersey and Holstein-Friesian/Jersey crossbred cows. An average herd comprised approximately 75% Holstein-Friesian types with 20% Holstein-Friesian/Jersey crosses and 5% Jerseys. Few herds in the district were entirely Jersey or Holstein-Friesian breeds. Two and 3-year-old cows were the predominant age groups, comprising 21% and 17% of the herds respectively.

In early lactation, an adult cow of average size and body condition for the district weighed approximately 450 kg. A small cow weighed approximately 330 kg at that stage of lactation, large cows 600 kg, and some very large cows 700 to 800 kg.

Statistical Methods

Chi-squared analysis, odd ratio and Student's t-test were used where appropriate to test differences between case and control data. Statistically significant differences were claimed if $P < 0.05$. Data are presented as mean ±standard deviation.

Results

The 37 cows with LDA represented approximately 0.06% of the dairy cow population. Their ages ranged from 2 to 10 years; 15 (40%) were 2-years-old, 4 (11%) were 3-years-old, and 18 (49%) were 4-years-old or older. Compared with the age distribution of cows in the control group it appears that 2-year-old cows were at significantly higher risk of developing LDA than older cows (Odds Ratio = 2.6, P = 0.006) (Table 1).

TABLE 1 Distribution of breed and age among cows with left-side displacement of the abomasum (LDA) and unaffected cows, and of grain supplementation among herds with and without cases of LDA in the Macalister Irrigation Area (MIA)

Risk factor	Cows with LDA	Unaffected cows	P value
Breed			
Holstein-Friesian	28	34,800	
Holstein-Friesian /Jersey crossbred	9	9,280	0.7
Jersey	1	2,320	
Age (yrs)			
2*	15[a]	9,740[b]	
3	4[c]	7,890[d]	0.01
3	18[e]	28,770[f]	
Grain supplement	Herds with cases of LDA	Herds without cases of LDA	
yes	20	262	0.9
no	12	156	

*The odds ratio of an LDA occurring in a 2-year-old cow compared to an older cow = $a(d+f)/b(c+e)$ = 2.6, P = 0.006

Twenty eight cows (75%) with LDA were classified as Holstein-Friesians, 9 (22%) as Holstein-Friesian/Jersey crossbreds and one (3%) Jersey, which reflected the general breed distribution in this area (Table 1).

All of the cows with LDA were predominantly pasture fed. In 12 herds (37.5%), 12 affected cows did not receive any concentrate supplementation. In 20 herds (62.5%), 25 of the affected cows were supplemented with grain during the early lactation period. The supplement was mainly crushed wheat and barley fed twice daily in the dairy shed during milking. The amount varied between 0.5 and 3.0 kg per day with most farmers feeding between 1 and 2 kg per day.

None of the cows with LDA received grain supplementation in the period before calving. The proportion of

‡ *Production Index (PI) is a measure of relative butterfat production within a herd. The average cow in a herd has a PI of 100. A cow with a PI of 128 produces 28% more fat than the average cow in the herd. Similarly, a cow with a PI of 96 produces 4% less fat than average. It is standardized for age, stage of lactation and calving date to make all cows in a herd comparable.*

herds with affected cows which were fed grain (62.5%) was similar to that (approximately 65%) in the district (Table 1).

In the previous lactation, production from cows with LDA varied widely (PI 88 to 134, BF 142 to 245 kg) as did herd size (70 to 629) and herd production (MCBF 158 to 251 kg). Most affected cows were average producers in their herds (mean PI 102 ±12) but came from significantly higher producing herds (mean MCBF 196 ±23 kg) (Table 2). Mean size of herds with affected cows was greater than herds in the control group but not significantly so (169±87 *versus* 145±65, P=0.13) (Table 2).

TABLE 2 Comparison of some potential risk factors between herds and cows with and without cases of LDA

Risk factor	Herds and cows with cases of LDA Mean ± sd	Herds and cows without cases of LDA Mean ± sd	P value
Herd size	169 ±87 (32)*	145 ±65 (320)*	0.13
Mean butterfat production of herd(kg/cow)	196 ±23 (32)*	174 ±29 (100)*	0.001
Production index	102 ±12 (18)+	104 ±14 (800)+	0.5
Butterfat production previous year (kg)	196 ±32 (18)+	NC	–

Figures in brackets indicate number of herds* or cows+
NC = not calculated

The number of cows with LDA in each of the size categories; small, average, large and very large was 7, 22, 8 and 0, respectively which probably reflects the distribution of size of cows in the MIA.

All but one cow with LDA was attended in the early lactation period. No cases were diagnosed before calving. Fifty percent were examined within 14 days of calving, 80% by 35 days after calving, and by 50 days all but one cow with LDA had been attended. The remaining animal was examined 163 days after calving but her history indicated that she had probably been affected soon after calving.

Cows with LDA were the progeny of 21 sires. However, one sire, Murribrook Starlite Loyalty (MBSL) sired 9 (25%) of the cows with LDA, each on a separate farm. Seven of these were 2 years old. In 1986, when these 2-year-old cows were conceived, MBSL was used in less than 6% of the total inseminations and on 80 different farms in the area. If it is assumed that he sired 6% of the local population of 2-year-old dairy cows, the odds of a 2-year-old cow sired by him having an LDA are 13.7 times that of a 2-year-old cow sired by any other bull (Table 3). Only if

TABLE 3 Comparison of the number of 2-year-old cows with LDA sired by MBSL with the number of 2-year-old cows with LDA sired by other bulls

Risk factor	Cows with LDA	Unaffected cows*
MBSL	7[a]	756[b]
Other sires	8[c]	11,844[d]
Total	15	12,600

Odds ratio = ad/bc = 13.7, P < 0.0001
*Estimated total population of 2-year-old cows in the nMIA

MBSL has sired more than 22% of the 2-year-old cows in the MIA would the result not be significant (P > 0.05).

When 2-year-old cows sired by this bull were removed from the analysis testing for age predisposition, the high proportion of 2-year-old cows with LDA (25%) reflected the high proportion (21%) of 2-year-old cows in the population.

Ketonuria was absent in 12 (34%) of the 35 cows with LDA which were tested. Four (11%) of the affected cows displayed sudden onset of marked dehydration (>6% body weight), elevated heart rates (100 beats/min) and colic. Twelve (34%) of the affected cows had diarrhoea; 2 were subsequently found to have Johne's disease. Seven (20%) of the 35 cows with LDA which underwent surgery were found to have abomasal phytobezoars.

None of the cases were recorded as having other concurrent diseases, such as mastitis or metritis, at the time of examination but one cow had retained foetal membranes.

Discussion

This paper records that left-side displacement of the abomasum can occur in pasture fed dairy cattle. Contrary to expectation, high production, large size, increasing age, and concurrent disorders were not identified as essential or significant risk factors for the disease. Ketonuria was found not to be an essential clinical sign. Although supplementation with grain does not appear to be a risk factor for the occurrence of LDA in a herd, it is interesting to note that multiple cases occurred only in herds where supplementation was given.

The high prevalence of LDA in the early lactation period found in this survey has been a general observation (Hoffsis and McGuirk 1986; Blood and Radostits 1989).

There is evidence in this study for a genetic predisposition to LDA of a magnitude not found in overseas studies. This might be because other factors such as grain feeding or concurrent disorders have been overwhelming in those studies.

The only other risk factor identified was high herd mean cow butterfat production. The higher feeding levels

found in higher producing herds might be an explanation for this finding. However, based on local knowledge, the authors suspect that a bias caused by under reporting of affected cows in lower producing, less well managed herds has occurred. In any case, such a finding does not provide much insight into the cause of the disease and is not a factor to be avoided given the current low prevalence of LDA.

It would seem logical that an abomasal phytobezoar could cause partial obstruction leading to abomasal atony, filling with gas and displacement and this to be a major risk factor. However, a large but unknown number of cattle in this area carry abomasal phytobezoars (Pitt 1976). The relatively high proportion (20%) of phytobezoars found amongst the cows with LDA may simply reflect the proportion of cows in the population carrying phytobezoars.

The small proportion (11%) of affected cows with acute signs of elevated heart rate, dehydration and colic has been described previously (Blood and Radostits 1989), as has the large number of affected cows with diarrhoea (Wallace 1976).

LDA is currently of little economic improtance to Australian dairy farmers. This situation may change as dairy herds increase in productivity, particularly if production techniques from the northern hemisphere such as feedlotting, are adopted. As production increases it will become increasingly important that the genetic predisposition of sires to production related diseases, such as LDA, be monitored.

Summary

The presentation of approximately 40 dairy cows affected with left-side displacement of the abomasum (LDA) *per annum* in a cattle practice in East Gippsland, Victoria, Australia provided an opportunity to conduct a survey and case-control study of the disease in a grazing environment. The study, involving 37 dairy cows at pasture, revealed significant differences from the pattern of the disease occurring in the northern hemisphere where cows in older age groups, of larger frame size, higher production and fed high grain rations are at increased risk.

Affected cows were diagnosed over a 10-month period and represented approximately 0.06% of the dairy cow population. Most cases were diagnosed in the early lactation period. Evidence for a genetic predisposition was suggested by the discovery that one sire generated a disproportionately large number (9) of the cows with LDA. Although affected cows were average producers in their herds, being a member of a high-producing herd was a significant risk factor.

Acknowledgements

The authors thank Dr P Brightling and Mrs J Short of the Maffra Herd Improvement Co-operative for their assistance with the provision of control data and Mr G A Anderson and Dr A L Vizard for assistance with data analysis.

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