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PERIPARTURIENT DISORDERS IN DAIRY COWS

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Introduction

The economic climate in the dairy industry requires producers to operate efficiently to remain competitive. Attention to details and understanding of reproduction, metabolism, digestive functions, milk secretion, and all aspects of husbandry are essential. To be successful, producers must minimize reproductive failure because reproductive performance affects the quantity of milk produced per cow per day of herd life, the number of potential replacements needed to maintain a constant herd size, and the longevity of the cow in the herd. In practice, this translates into well-designed programs of herd health, milking, feeding, and reproductive management that minimize involuntary culling of problem cows by maintaining healthy, profitable cows. The purpose of this review is to focus on the interrelationships of various periparturient disorders in dairy cows and highlight their collective impact on reproductive performance, milk yield, and predisposition to other diseases.

Periparturient Health

The term "periparturient" stems from the word "parturition" and the prefix "peri," which literally but vaguely means "around." This phase generally includes the dry period and the first 3 to 4 weeks after calving. The milk-secreting and future reproductive capability of the dairy cow is related to periparturient events. Parturition is one of the most critical stages of the reproductive cycle and is a period of significant death rate, as well as potentially severe debilitating injury to dam and newborn calf. Future efficiency of reproduction and milk yield can be affected adversely at this time. Therefore, major efforts should be directed toward minimizing health problems that generally arise during the periparturient period.

Keeping cows healthy is one of the most important steps in maintaining good fertility and efficient milk yield. Healthy cows produce more milk, rebreed sooner, and have lower culling rates than their unhealthy herdmates. An example of the reproductive performance of healthy cows from eight dairy herds is illustrated (Table 1). Healthy cows were first bred at about 70 days, had conception rates greater than 55%, had fewer than 100 days open or 382-day calving intervals, and were culled at rates less than 12%. Good sanitation and a herd-health program designed to maintain healthy cows was essential to this achievement. Studies have shown that herd health programs return added profit to dairy producers, even though veterinary costs per cow increase. Some of the periparturient disorders that are described below can be prevented and/or reduced by careful management and cooperation between veterinarian and producer.

Table 1. Reproductive performance of healthy dairy cows

Trait	First lactation	Later lactations
No. cows	69	134
Days to first estrus	50	55
Days to first service	68	70
Conception at first service, %	59	71
Days open	95	84
Services per conception	1.6	1.4
% culled	4.4	11.2
% culled for reproduction	1.5	4.7

Source: Adapted from Oltenacu et al. 1984. J. Dairy Sci. 67:1783.

Dystocia or Calving Difficulty

Incidence of dystocia is about 6% (Table 2). While dystocia is primarily a function of the size of the calf and pelvic area of the dam, other factors related to the calf, dam or sire, nutrition, season, disease, and endocrine aspects are implicated.

Calving difficulty is increased with large birthweight calves, male calves, twins, malpresentations, stillbirths, heifers and young cows, lack of energy consumed during the dry period, and fall and winter months of the year.

The implications of dystocia on disease, culling, milk yield, and reproduction are many. Dystocia generally increases the risk of retained placenta, metritis, culling, death, milk fever, and cystic ovaries. Cows that have had dystocia have longer calving intervals and produce less milk during the first month of lactation. Cows that require surgical delivery of a dead calf at parturition generally experience a 5 to 9% loss in milk yield.

Twinning

Twinning occurs about 3% of the time in dairy cattle (Table 2). Factors that alter the rate of twinning include breed, season, cow family, age, and inbreeding. Twinning increases with age of the cow, during fall and spring months, and in certain cow families, where daughters of twinning cows will produce more twins themselves than daughters of cows that never twinned.

Cows that bear twins have increased risk for stillbirth, retained placenta, metritis, displaced dystocia, abomasum, culling, aciduria and ketonuria. Subsequent reproductive performance is impaired as calving intervals are prolonged and milk yield is decreased slightly after birth of twins.

Table 2. Incidence of common periparturient disorders summarized from the literature

Disorder	Unweighted mean, %	Range	No. calvings	No. herds	No. references
Dystocia	5.8	0.9-13.7	40,828	218	8
Twinning	3.3	1.6-5.8	56,470	2,265	6
Stillbirth	4.1	1.4-6.3	45,835	2,264	4
Retained placenta	9.4	2.0-17.8	>55,000	>225	11
Cystic ovaries	12.3	3.0-29.4	>20,00	>196	9
Anovulation ¹	5.5	2.3-22.5	15,918	130	11
Reproductive tract infections ²	17.4	8.5-24.2	13,271	137	3
Metritis	21.3	10.7-36.4	>15,167	>60	5
Milk fever	5.9	1.4-10.8	40,568	161	6
Ketosis	5.4	3.5-7.4	4,249	63	2
Displaced abomasum	1.4	1.2-1.7	15,808	103	4
Mastitis	6.9	2.3-16.8	28,730	123	4
Abnormal health status ³	36.9	19.9-81.6	2,933	17	7

¹Delayed intervals to first postpartum ovulation longer than 4 wk postpartum.

²Variously combined specifically diagnosed infections of the reproductive tract.

³Includes cows with one or more disorders listed above.

Stillbirth

Occurrence of stillbirth is about 4% (Table 2). Stillbirth generally refers to birth of a dead fetus; however, a broader definition is often used to include calves found dead at calving (some of which may not have been truly stillborn). The highest risk for stillbirth is in heifers and young cows and may result from an oversized fetus, overly fat dam, and increased incidence of twinning.

Cows with stillbirths have increased risk for a prolapsed uterus, retained placenta, metritis, aciduria, and displaced abomasum. No evidence has been found for direct relationships between stillbirth and milk yield or reproductive performance.

Retained Placenta

Incidence of retained placenta is about 9% (Table 2). Retention of the placenta or fetal membranes for 8 to 12 hr and up to 24 hr in some studies is the definition generally used for retained placenta. Causes of retained placenta include deficiency of selenium, vitamin E, vitamin A, β -carotene, and protein during the late dry period. Increased placental retention occurs as cows age and at calvings

during warm seasons and periods of extreme heat stress. Occurrence of induced parturition, twinning, milk fever, ketosis, dystocia in heifers, and increased calving difficulty in all cows are associated with increased risk for retained placentas.

Retained placentae often lead to serious infections of the reproductive tract and increased risk for ketosis, displaced abomasum, culling and death. Milk yield following placental retention is slightly reduced in some cases, as well as reproductive performance. Calving intervals are prolonged and pregnancy rates are decreased. Much of these effects on reproduction are indirectly manifested through the increased rate of reproductive tract infections that follow placental retention.

Cystic Ovaries

Occurrence of cystic ovaries is about 12% (Table 2). This would include both types of cysts that predominate in dairy cows, the thin-walled or follicular cyst and the thick-walled or luteal cyst. Peak occurrence is between 31 and 60 days after calving, in which 47% of the diagnoses are made. Cysts are likely to occur in cows having a previous history for cysts. Although cystic ovarian disease has a low heritability in dairy cattle, its incidence has been reduced in Sweden by selecting against its occurrence in bull studs.

Incidence of cystic ovaries is increased with age, in winter months, during periods of high nutrient intake (early lactation), and especially when cows have a uterine infection. High milk yield does not cause cystic ovaries, which are more likely caused by an endocrine imbalance. Possible endocrine causes include the lack of LH and specific ovarian follicular receptors for LH and FSH, which bind the gonadotropins to growing follicles in preparation for final follicular maturation and ovulation.

Occurrence of cysts in cows increases the risk for culling and reduces reproductive performance by prolonging calving intervals and reducing conception rates. Milk yield appears to be higher in cystic cows compared with noncystic cows. However, when yield is adjusted for the length of the calving interval, a 2.5% loss in milk yield is observed. The increased yield is a result of prolonged lactation length in the absence of the negative effect of pregnancy on milk production.

Anovulation

Anovulation (prolonged intervals to first ovulation and estrus) occurs in about 5 to 6% of dairy cows (Table 2). Since most dairy cows first ovulate between 2 and 4 weeks after calving, any delay beyond 4 weeks is defined as delayed ovulation or anovulation. Anovulation declines in its incidence with increasing age. It is generally associated with poor general health of the cow, fatty liver, ketosis, uterine infections, and delayed uterine involution. Cows with the most negative energy balance (inadequate feed intake and large loss in body weight) and those prone to various metabolic diseases because of poor body condition are at risk for anovulation. Reproductive performance is impaired because cows are slow to begin estrous cycles, and, thus, have delayed conception and prolonged calving intervals. There is no reported effect of anovulation on milk yield.

Reproductive Tract Infections and Metritis

Incidence of infections of the reproductive tract is about 17% and where metritis was specifically diagnosed, it occurred in about 21% of cows after calving (Table 2). These types of infections affect the vagina, cervix and uterus and could be diagnosed at any time after calving. Reproductive tract infections, and specifically metritis, increase as cows get older and tend to occur most often after summer and early fall calvings.

Several health problems increase the risk for uterine infections including milk fever, retained placenta, displaced abomasum, ketonuria, and aciduria. In addition, overly fat cows, twinning, stillbirth, prolonged gestations, induced parturition, and dystocia generally increase metritis.

Milk yield losses of 2 to 5% are reported for cows with reproductive tract infections. Reproductive performance is adversely altered because calving intervals are prolonged, fertility is reduced, and anovulation becomes more common (in cows with metritis). Reproductive tract infections and metritis increase the risk for displaced abomasum, ketonuria, and aciduria in cows that also have a retained placenta.

Milk Fever

Incidence of milk fever or parturient paresis is about 6% (Table 2). Occurrence of milk fever increases when high-calcium feeds are offered during the dry period. Older cows and all cows with high milk production are at greater risk for milk fever. In some cases, increased risk of milk fever is associated with metritis and retained placenta. Prevention of milk fever by feeding low calcium-containing feeds during the dry period is essential. Some studies suggest that feeding high protein early in the dry period, lower levels of phosphorus than calcium in the dry period, and lead feeding in the late dry period will prevent milk fever.

Milk fever generally increases the risk for dystocia, retained placenta, ketosis, and mastitis, and tends to increase calving intervals and slightly reduce milk yield (-.5%).

Ketosis

Reported incidence of diagnosed ketosis in dairy cows is about 5% (Table 2). Ketosis can occur as uncomplicated cases caused by feeding diets high in energy (glucogenic) or by underfeeding (marked negative energy balance). Ketosis also occurs as complicated cases where ketosis and one or more other diseases are diagnosed in combination. Cows with a previous history of ketosis or those having milk fever, displaced abomasum, or retained placenta are at increased risk for ketosis. Overfeeding and long dry periods of excess feeding that lead to overly fat cows increase cases of ketosis at and after calving. Although older cows have greater risk for ketosis, most studies conclude that high milk production is not a cause of ketosis.

A strong relationship exists between displaced abomasum and ketosis. It is difficult to determine which factor leads to the other. In addition, of those cows in one study with ketonuria (ketosis), 82% had at least one other concurrent problem, most of which was metritis, displaced abomasum, and retained placenta. Whereas conception rates may be reduced in ketotic cows, there is no evidence for a direct effect of ketosis on milk yield.

Displaced Abomasum

Displaced abomasum occurs in about 1.4% of dairy cows around calving (Table 2). About 26% of the time, it is diagnosed during the first 7 days after calving, with 63% and 82% of the diagnoses made by the end of the second and third weeks, respectively. Cows become more susceptible to displaced abomasum with increasing age, particularly if it occurred previously in earlier lactations. Except for high milk yield, many factors increase the risk for displaced abomasum including uncomplicated ketosis, twinning, stillbirth, retained placenta, metritis, aciduria, and ketonuria.

Milk yield in cows with abomasal retention is reduced by 1.4 to 9.8%. Limited research indicates that cows with a displaced abomasum have more risk for metritis, ketosis, and possibly reduced fertility as a result of various complications associated with abomasal displacement.

Mastitis

Occurrence of periparturient mastitis is about 7% (Table 2). About 45% of the cases of mastitis occur during the first 15 days after calving. Older cows are at increased risk for mastitis. However, of those cases diagnosed within 48 hr postpartum, first and second lactation cows were infected 1.4% of the time, whereas third or greater lactation cows were infected 3.4% of the time. Limited studies suggest that cows with ketosis and milk fever may be more susceptible to mastitis than healthy cows. High milk yield or the potential for high yield does not appear to increase the risk for mastitis. However, few data are available and are limited to clinical cases in which cows were either treated locally or systemically for mastitis. Subclinical cases, indicated by a possible intramammary infection or elevated somatic cell counts in milk, have not been well studied to determine the potential predisposing effect of high milk yield.

There is no evidence to suggest that mastitis directly influences reproductive performance. Indirect effects are possible since cows with mastitis may have other associated problems, which when variously combined, may decrease health and reproductive performance. Cows with subclinical mastitis have decreased milk yield; however, more research needs to be done during the periparturient period to explain the interrelationships between mastitis, milk yield, and other diseases or disorders.

Abnormal Health Status

Many studies have examined the effects of variously combined health and disease factors (abnormal health status) that potentially interact with milk yield and reproductive performance. In those studies, many of the previous diseases or disorders cited above were considered. In total, the average incidence of cows with abnormal health is about 37%. This means over one-third of all cows suffer from at least one or more health problems during the periparturient period.

Any type of health problem increases the risk for culling or death by 2 to 5X. Cows in their first lactation are at greater risk to be culled than older cows. Milk yield in abnormal cows with poorer health is less (up to 3% less in a 305-day lactation), as well as having less fat during the first 50 days.

Reproductive performance of abnormal cows is reduced markedly. Table 3 illustrates the reproductive performance in one large herd in which cows with and without previous reproductive disorders were contrasted. Every reproductive trait was reduced, resulting in 21% of the abnormal cows never conceiving compared to only 6% of the normal cows. For cows conceiving, calving intervals were 24 days longer in abnormal than normal cows.

Table 3. Health status and reproductive performance in a large dairy herd

Trait	Normal	Abnormal ¹
No. cows	695	306
Calving to first estrus, days	59	62*
Calving to first service, days	64	66
Conception at first service, %	45	29*
Calving interval, days	373	397*
Services per conception	2.0	2.6*
Pregnancy rate, %	94	79*

Source: Stevenson and Call, unpublished data.

¹Cows were classified abnormal if one or more of the following were diagnosed: retained placenta, cystic ovaries, prolonged anestrus, twinning or uterine infection based on palpation or the presence of a purulent discharge at anytime, including breeding.

*P<.05.

Conclusions

A summary of the effects of various periparturient disorders on reproductive performance and milk yield of the concurrent lactation is shown in Table 4. All reproductive and metabolic disorders examined either directly or indirectly decrease reproductive efficiency, except mastitis. Milk yield was only

impaired significantly in cows that required surgical assistance at calving. However, there are marginal losses of milk yield as a consequence of retained placenta, metritis, or reproductive tract infections, or general, abnormal health status. Of the metabolic disorders, only displaced abomasum significantly reduced milk yield.

Most disorders occur as part of a complex, rather than appearing as a single abnormality. Cows with one disorder are at increased risk for other disorders, including many metabolic or reproductive ones. It also appears evident that actual milk yield or potential for high milk production does not predispose cows to increased risk for any disorder examined, except milk fever. This is encouraging, because milk fever may be the disorder that is most readily prevented by good dry cow management.

All research suggests that preventive measures that limit the incidence of one disorder may decrease directly or indirectly the risk and incidence of other interrelated problems. More research is needed to better understand the cause of these disorders, thus, allowing better designed preventive herd health measures to be adopted on the farm to improve the general health and overall productivity of dairy cattle.

Table 4. Suggested implications of various disorders on reproduction and milk yield during the lactation in which the disorder was detected

Disorder	Reproduction	Concurrent ¹ milk yield
Dystocia ²	Indirect decrease	First 30 d decrease
Twinning ²	Decrease	Slight decrease
Stillbirth ²	Indirect decrease	Unknown
Retained placenta	Indirect decrease	Possible -.4%
Cystic ovaries	Decrease	Possible -2.4%
Anovulation	Indirect decrease	No effect
Reproductive tract infections	Decrease	Possible -2 to 5%
Metritis	Decrease	Possible -3 to 5%
Milk fever	Indirect decrease	Possible -.5%
Ketosis	Indirect decrease	No effect?
Displaced abomasum	Indirect decrease	-1.4 to -9.8%
Mastitis	Unknown	No effect?
Abnormal health status	Decrease	Possible -3%

Source: Summarized from the literature.

¹Magnitude of decrease is shown if at least one study identified such a possibility.

²Surgical delivery associated with stillbirth decreased milk yield by 5 to 9%.