Rev. Bras. Reprod. Anim., Belo Horizonte, v.39, n.1, p.164-172, jan./mar. 2015. Disponível em www.cbra.org.br

Metritis and endometritis in high yielding dairy cows

Metrite e endometriose em vacas de leite de alto rendimento

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Abstract

Dairy cows have shown a steep increase in milk production, which is unfortunately characterized by a dramatic decline in reproductive performance. In these modern high yielding cows authors worldwide mention a higher number of puerperal problems, such as retained placenta, acute metritis and abnormal vaginal discharge. All of which are known to negatively influence reproductive capacity of these animals. Cows affected by retained placenta and/or acute metritis are furthermore at a significantly higher risk of other typical 'dairy cow diseases' such as acetonaemia, displaced abomasum and cystic ovarian disease. It is therefore important that the management of the cows during the transition period should be optimized in order to prevent cows from these disease complexes. Furthermore, during the immediate postpartum period, cows should be looked after properly in order to identify animals that are affected by clinical uterine disease as soon as possible so that treatment should not be delayed. High numbers of cows are furthermore reported to suffer from clinical and subclinical endometritis, both giving rise to significant problems to get in calf. At the moment, there is a lot of debate concerning both the diagnosis as well as the first choice treatment of cows suffering from clinical and subclinical endometritis. Therefore, also for these diseases prevention is far more effective than treatment.

Keywords: (endo)metritis, dairy cow, fertility, milk production.

Resumo

Vacas de leite tem mostrado um aumento marcante na produção de leite, que infelizmente é caracterizado por um declínio dramático no desempenho reprodutor. Com relação a estas vacas de leite modernas de alto rendimento autores ao redor do mundo mencionam diversos problemas de puerpério, como placenta retida, metrite aguda e descarga vaginal anormal. Todos estes conhecidamente afetam a capacidade reprodutora destes animais. Vacas afetadas por placenta retida e/ou metrite aguda estão também em maior risco de outros tipos de "doenças de vacas de leite" como acetonaemia, abomaso deslocado e doença de ovário cístico. É importante, portanto, que o gerenciamento de vacas durante o período de transição deve ser otimizado para prevenir vacas contra estas doenças complexas. Além disto, durante o período pós parto imediato deve haver o cuidado apropriado das vacas para identificar animais afetados por doença uterina clínica assim que possível para não atrasar o tratamento. Um alto número de vacas sofrem de endometriose clínica e subclínica, ambos levando a problemas significativos para reproduzir. No momento há muito debate com relação ao diagnóstico e também ao primeiro tratamento de vacas sofrendo de endometriose clínica e subclínica. Portanto, a prevenção destas doenças também é muito mais eficiente do que o tratamento.

***Palavras-chave**: endometrite, fertilidade, metrite, produção de leite, vaca leiteira.*

Introduction

Before milk production starts, cows have to calve while each calving is followed by a peak in milk production. This standard 'cow knowledge' clearly illustrates why reproduction is still of paramount importance in the modern dairy industry. The more calvings a cow will go through during her herd life, the more peaks of milk she will produce and hence the higher her life time production will be.

Recent studies both in the US as well as in Europe have indicated that in the last 35 years, the genetic potential for milk production in Holstein Friesian cows has increased by over 3000 kg per lactation, resulting in an actual genetic increase of about 100 kg/year. This is, however, only a part of the (success) story. The genetic potential for milk production sets the upper limit which an individual cow can achieve. How close she actually comes to reaching that limit is determined by the management conditions under which she has to produce.

During the last decades these conditions have been improved tremendously. There have been improvements in feeding practices, in the control and prevention of diseases and in other management practices such as housing and veterinary management practices such as claw trimming. All together, these improvements have contributed to the actual level of milk production, which on many farms has gone above 10.000 kg per

Recebido: 16 de março de 2015
Aceito: 11 de abril de 2015

lactation (of 305 days).

Clearly, the aggressive genetic selection together with the fine tuning of the management has proven to be very successful. However, this has not been without costs. When dairy farmers are currently asked what the principal health problems are that their business will face in the near future, they invariably mention subfertility, mastitis and lameness. These diseases are known to be multifactorial and dependent on management practices to a large extent.

In the present paper we will focus on the uterine diseases since these are generally regarded as being among the most prevalent and hence the most important with regard to the worsening of the reproductive parameters.

Importance of uterine diseases

Although it is very difficult to compare these data with those from earlier studies because of possible (historical) differences in the use of the terms 'endometritis' and 'metritis', it is clear that the overall incidence of uterine diseases in high yielding dairy cows has increased over time (Table 2). Besides the recurrent discussion about the definition of the words 'endometritis' and 'metritis', this large variation is also due to the differences in the diagnostic methods to classify uterine infections. The use of modern techniques such as ultrasonography and the examination of endometrial aspirates for presence of inflammatory cells has obviously caused a steep increase in the reported incidence of endometritis.

Analyses of fertility data from local AI centres revealed that the prolongation of the calving interval was mainly due to a prolongation of the interval from parturition to first insemination. Due to the inability of the farmers seeing their cows in heat at the moment they should inseminate them (Opsomer et al., 2000b).

The main negative results of this decline in fertility are longer and hence 'inefficient' lactations and an increase in the number of cows that are culled for reproductive reasons. The significant waste of sperm and the retarded increase of young stock are also important contributors to a significant loss of income.

So why has reproductive performance declined so precipitously? This has proven to be a very difficult question to answer (Vanholder et al., 2006). However, a recurring theme is that for cows to reproduce successfully, a clean and healthy uterine environment is essential. Indeed, the uterus not only influences the resumption of normal ovarian cyclicity to a large extent, but also has to promote sperm transport and finally has to undergo considerable changes to support pregnancy.

Retained placenta

The placenta is normally expelled within 6h of expulsion of the calf. Although there is still some variation in the definition of retained placenta (RP), most studies define retention of fetal membranes as a condition in which the cow fails to release the placenta 12 to 24 h after parturition. The latter is also regarded as the time point where treatment is needed. The incidence of RP is between 2 and 5% but can be significantly increased when there is an increase in the number of twins, dystocia or in case there are certain infectious diseases such as bovine viral diarrhea (BVD) endemic in the herd. Although RP is not regarded as a disease per se, this phenomenon has historically received a lot of attention since it is a paramount risk factor for metritis and concomitant clinical diseases. Negative consequences related to RP are: delayed uterine involution, increased time to first insemination, increased number of services per pregnancy, decreased pregnancy rates and increased days open. Furthermore, RP has been associated with a significantly increased risk to suffer from clinical diseases like metritis, endometritis, ketosis and even mastitis. Overall, this impaired situation brings costs to the farmer by decreasing fertility and increasing culling rates, while also a significant decrease in milk production has been mentioned in most but not all studies.

Cows have a cotyledonary placenta, the fetal cotyledons being stringently attached to and enveloping the maternal caruncles, together forming the placentome. The interconnection between the fetal and maternal tissues is further spread by cotyledonary villi and subsequently microvilli at the cotyledon-caruncle interface. The processes leading to normal separation and delivery of the placenta are multifactorial and already begin before calving (Beagley et al., 2010). Since collagen links the interface together at several sites, its breakdown is likely to be a key factor in placental separation.

In addition to the drastic changes in the hormonal environment around parturition (decrease in progesterone, increase in estrogens and prostaglandin levels), that favor enzymatic breakdown of the cotyledon-caruncle linkages, activation of the maternal immune response against the fetal membranes has been attributed an important role in the final loosening process of the placenta.

In cows in which the placenta is expelled in a favorable time frame following calving, an increased leukocyte chemotaxis and activity have been demonstrated.

Strong uterine contractions facilitate the final mechanical expulsion of the afterbirth, although the full role of uterine contractions in the placental separation process is still a matter of debate.

Risk factors for retained placenta

Numerous risk factors have been associated with RP, most of them referring to abnormalities during parturition like abortion, twinning, induced parturition, shortened gestation, dystocia, fetotomy and caesarean section. Also nutritional imbalances like deficiencies such as Vitamin E and selenium or others leading to immunosuppression (e.g. metabolic diseases like ketonemia) together with infectious agents like BVD. Most of these viruses can provoke abortions or can cause a placental inflammation with concomitant swelling and oedema at the site of the villi and microvilli finally leading to problems to separate.

Numerous studies have mentioned an association between RP and hypocalcemia. Hypocalcemia has been mentioned to predispose cows to dystocia due to lower uterine contractions during the expulsion faze. Although uterine atony caused by hypocalcemia may interfere with the final step of placental delivery, the direct role of calcium in placental separation is not clear. More recent studies mention cows having lower peripheral Ca-levels to be more at risk to suffer from clinical metritis even without an increase in the number of clinical hypocalcemia cases. Authors therefore suggest cows having lower Ca-levels to suffer from a decrease in immunity.

Treatment and prevention of retained placenta

Traditionally, the treatment of choice for RP has been the intra-uterine application of antibiotics eventually in combination with attempts to manually remove the afterbirth. However, both of these treatments have been a controversial issue for many years.

Nowadays there is a general consensus that an attempt may be performed to remove the afterbirth. Removing the placenta by slightly pulling the placenta is allowed (e.g. in cases of uterine atony where the loose placenta was retained because of a lack of uterine contractions). Individually peeling of each cotyledone from its caruncle has however been shown to cause microtraumata in the uterine mucosa which may be followed by a more easy entry of bacteria into the bloodstream finally leading to a higher risk to suffer from an toxic metritis (Bolinder et al., 1988).

Possible negative interactions between the locally applied drugs and the uterine defense mechanisms, the questionable efficacy of the antibiotics in the rather specific intra-uterine environment and the lack of knowledge concerning the duration of antibiotic residues in the milk all have attributed towards a skepticism against the intra-uterine application of antibiotics. In some studies it was found that cows intra-uterinely treated with antibiotics did show a reduced incidence of postpartum fever during the first 10 days after calving, although no benefits could be found in the later incidence of endometritis nor in their future reproductive performance. Due to the lack of evidence to further sustain locally applied antibiotics, more recent studies tested the effect of systemic treatments with antibiotics that had shown to give rise to intra-uterine levels above the MIC of the most frequently encountered intra-uterine bacteria. Conclusion of these studies is that blanked systemic treatment with antibiotics of all cows suffering from RP did not show any advantages compared to a selective antibiotic treatment of cows having a temperature >39.5°. So, systemic antibiotic treatment is believed to be beneficial for the treatment of RP cows where fever is also present, although none of the studies showed a significant positive effect on the future reproductive performance of the cows (Drillich et al., 2003, 2006, 2007). The remark should furthermore be made that the number of trials that had included a real control group (i.e. cows suffering from RP with fever that were left untreated), is very limited due to reasons of animal welfare.

The most commonly used hormone products for treatment of RP are prostaglandins and oxytocin. These products contribute to uterine contractions, and could therefore potentially be effective in treating RP caused by uterine inertia. However, no studies have been able to demonstrate beneficial effects of the curative or preventive treatment of cows with regard to RP incidence, resolution or improvement of future reproductive performance.

Since vitamin E and selenium improve the cows' antioxidant capacity and are able to increase chemotaxis and hence leukocyte numbers at the fetomaternal junction, they may contribute to the normal expulsion of fetal membranes. A meta-analysis that looked at 44 studies comparing RP incidence in cows treated with vitamin E and untreated cows found that overall vitamin E supplementation decreased the incidence of RP (Bourne et al., 2007), although the benefits of supplementation did depend on whether cattle had marginal or adequate serum vitamin E before supplementation.

Few field trials exist that specifically address the effect of transition cow management in terms of nutrition and cow comfort on the incidence of RP. There is a general belief that 'good practices' in terms of transition cow management enhance the cows' general health status and immunity and therefore lower the incidence of RP. Reducing the negative energy balance, guaranteeing an sufficient supply of vitamins and minerals, sustaining an efficient mineral house holding are among the most important items to pay attention at. Reducing the amount of stress around the moment of parturition by minimalizing the number of changes in housing and grouping and minimalizing the changes in ration are also very important.

Metritis and endometritis

There is a general consensus that almost all dairy cows experience bacterial contamination of the uterus in the immediate postpartum period. Because of this and because it is required for the regular postpartum repair of the endometrium, uterine inflammation is regarded as a normal and even a necessary component of the involution process. However the growth of pathogenic bacteria may overcome innate immune defences, or the severity or duration of the inflammation may impair rather than enhance fertility, leading to postpartum reproductive tract inflammatory disease.

Several papers have been written in which the definitions of uterine diseases encountered in cattle have been reviewed and articulated (Sheldon et al., 2006; Dubuc et al., 2010). Although there is still a lot of debate concerning the definitions of the encountered diseases and about the optimal way to diagnose these diseases, a rough summary is given underneath. The mentioned definitions mainly focus on the time of occurrence in relation to calving and on the clinical degree of the disturbance.

- Puerperal or acute metritis (also postpartum metritis, toxic puerperal metritis, septic metritis): Abnormally enlarged uterus, fetid watery red-brown discharge, signs of systemic illness (decreased milk yield, dullness or other signs of toxaemia) and fever (≥39,5°C), within 21 days after calving.
- Clinical metritis: abnormally enlarged uterus, purulent uterine discharge detectable in the vagina within 21 days after calving, no signs of systemic illness.
- Clinical endometritis: Purulent (>50% pus) uterine discharge detectable in the vagina, more than 21 days after calving, or mucopurulent (50% pus - 50% mucus) uterine discharge detectable in the vagina after 26 days after calving no signs of systemic illness, no fever.
- Subclinical endometritis: No clinical signs of endometritis, no purulent or mucopurulent discharge. Diagnosis based on cytology: >18% of neutrophils in uterine cytology samples collected 21-33 days after calving or >10% neutrophils at 34-47 days. This elevated number of neutrophils characterizes an inflammation of the endometrium that results in a significant reduction in reproductive performance, without any signs of clinical endometritis. Because this definition is based on the finding of an elevated number of neutrophils in the uterine lumen, the disease is sometimes referred to as 'cytological endometritis', although there still is some debate on the cut off levels used to come to the definition. Generally, persistence of PMNs in the endometrium in the absence of bacteria is accepted as the primary characteristic of subclinical endometritis.
- Pyometra: Accumulation of pus in the uterus, enlarged uterus, corpus luteum present.

Based on the above it is clear that metritis is generally referring to an infection of the cavity, lining and deeper layers of the uterus. Endometritis on the other hand is a localized infection of the lining of the uterus, which is inflamed with white pus mixed with mucus discharging from the uterus into the vagina. Therefore, metritis should be regarded as a more severe disease than endometritis, requiring a more urgent detection of the affected animals and a higher need for a systemic treatment to attack the infection and alleviate the generalized ill-health.

Cows with acute and clinical metritis should be generally examined for the presence of concomitant metabolic and infectious diseases like ketosis, displacement of the abomasum, mastitis etc, since these conditions are associated. Although cows with acute puerperal metritis appear clinically worse than cows with clinical metritis (systemically ill), both disturbances seem to have equal negative effects on further fertility.

In practice, the examination of the contents of the vagina for the presence of pus is the most useful procedure for diagnosis of uterine infection. Clinical endometritis for example is usually diagnosed by the evaluation of uterine discharge detected in the vagina with the aid of a speculum, the Metricheck tool or a gloved hand. When using either of these methods, care should be taken to clean the vulva to avoid introduction of contaminants into the vagina and to use lubrication. Manual vaginal examination does not cause uterine bacterial contamination, provoke an acute phase response or affect uterine diameter. When scoring the vaginal mucus, attention should be paid to both the character as well as the odour of the mucus. The character score is assigned between 0, clear translucent mucus; 1) clear mucus containing flocks of white pus; 2) exudate containing ≤50% white or cream pus; 3) exudate containing >50% white, cream or bloody pus (www.rvc.a-c.uk/endoscore/). The vaginal mucus odour score is scored 0 for no odour and 3 if a fetid odour is present. The character and odour scores are summed to give a general endometritis clinical score ranging from 0 to 6 reflecting the presence and even the semi-quantitative load of uterine pathogens (Williams et al., 2005). Furthermore, this general endometritis clinical score is prognostic for the likely success of treatment.

Subclinical endometritis should per definition be diagnosed using an endometrial cytobrush or a uterine lavage. This subclinical disease is defined by polymorphonuclear neutrophils exceeding >18% of cells counted in uterine cytology samples collected 21-33 days after calving or >10% at 34-47 days in the absence of clinical endometritis

Remarkably, most studies agree that at that time no pathogenic bacteria can be isolated. Therefore, the inflammation is presumably associated with recovery of the tissues after clinical endometritis, trauma or other

non-bacterial disease. Clearly, the incidence of this uterine disturbance is dependent on the cut-off used for diagnosis and the time after parturition, but has been reported to be in the order of 40%.

General overview of the pathogenesis of uterine diseases

The dilemma of the postpartum cow

A remarkable feature of cattle is the almost constant bacterial contamination of the uterine lumen within the first 2 weeks after parturition. However, cows have always been said to be highly efficient in clearing away this contamination, in contrast to horses for example. Present-day, high-yielding dairy cows obviously have more problems and do not quite live up to this reputation. As a result, we now see more cows with puerperal problems, such as retained placenta, acute metritis, abnormal vaginal discharge (Table 1).

Table 1. Average incidence of puerperal disturbances on 9 high-yielding dairy herds in Belgium (Opsomer et al., 2000a).

Puerperal disturbance	Incidence (n=463)
Abnormal calvings	16%
Retained placenta	18%
Acute (endo)metritis	15%
Abn vag discharge	20%
Abn vag discharge	5%

At all times however, authors do agree that the incidence of chronic endometritis (=localised infection of the superficial lining of the uterus occurring >3 weeks after calving), is significantly dependent on the incidence of acute metritis (=infection of the uterine cavity, lining of the deeper layers of the uterus causing a sometimes life threatening disease shortly after calving). There is general agreement nowadays that up to 40% of animals have metritis within the first two weeks of calving, half of which (20% of calved cows) suffer from metritis with signs of systemic illness such as fever, and that in 15-20% of animals clinical disease persists for at least another three weeks causing the chronic uterine disease called clinical endometritis (Sheldon and Dobson, 2004). About 30 to up to 40% of cows have a chronic inflammation of the uterus without clinical signs (subclinical endometritis).

Table 2. Evidence of an increasing trend in the incidence of (endo)metritis based on a literature review.

Endometritis incidence	Year of the study	Authors
11%	1968	Tennant and Peddicord
10%	1977	Bouters and Vandeplassche
38%	1983	Oltenacu et al.
37%	1984	Markusfeld
20%	1986	Whitmore and Anderson
17% (clin) + 37% (subclin)	2002	LeBlanc et al.
53%	2005	Gilbert et al.

As uterine inflammation occurs in all cows during uterine involution, the factors responsible for failure to resolve the endometrial inflammation at the start of the breeding period seem to be critical. The latter clearly emphasizes the necessity to detect and treat animals suffering from endometritis, efficiently as soon as possible in order to avoid problems later on. On the average dairy farm however, disease detection is done by the veterinarian, but typically only during routine herd health checks. This means that in many cases, early warning signs of disease go unnoticed until such time that the disease is in its full clinical stage and becomes much more difficult to treat. As a result chronic endometritis may still be present at the moment cows should become pregnant.

Cows affected by retained placenta and/or acute metritis are furthermore at a significantly higher risk of other typical ‘dairy cow diseases’ as acetonaemia, left displaced abomasum and cystic ovarian disease. Large scale studies based on both American and European data showed, for example, that cows with retained placenta are 2.2 times more at risk of left displaced abomasum and 6.0 times more at risk of developing metritis. Metritis itself causes cows to be 2.0 times more at risk of ketosis; and ketosis makes cows significantly more sensitive to cystic ovarian disease and left displaced abomasum. Although there are some differences in the final numbers published among the different studies, there is an overall agreement that retained placenta and/or acute postpartum metritis is often if not always the key element in the disease history of recently calved high yielding dairy cows (Curtis et al., 1985; Correa et al., 1993; Peeler et al., 1994).

Although these relationships are clearly proven in large scale epidemiological studies, the underlying

pathogenesis has not yet been fully elucidated. In a number of studies it has been demonstrated that the killing activity of neutrophils in high-yielding dairy cows is significantly reduced around the time of calving (Hoeben et al., 2000; Fig. 1). This was further confirmed by *in vitro* studies in which a decreased killing activity of these cells was demonstrated when elevated amounts of ketone bodies were added to the culture medium. This finding probably explains the close relationship between infectious diseases and ketosis seen on present-day dairy herds.

Furthermore it has recently been shown that cows going off feed, is one of the most important risk factors for a left displaced abomasum after calving. In this case, the rumen is not able to act as a physical barrier against the gas filled enlarged abomasum which is hence able to change place in the abdomen. Cows suffering from acute metritis after calving have a distinct decrease in dry matter intake, which explains the remarkably high incidence of left displaced abomasum in these patients.

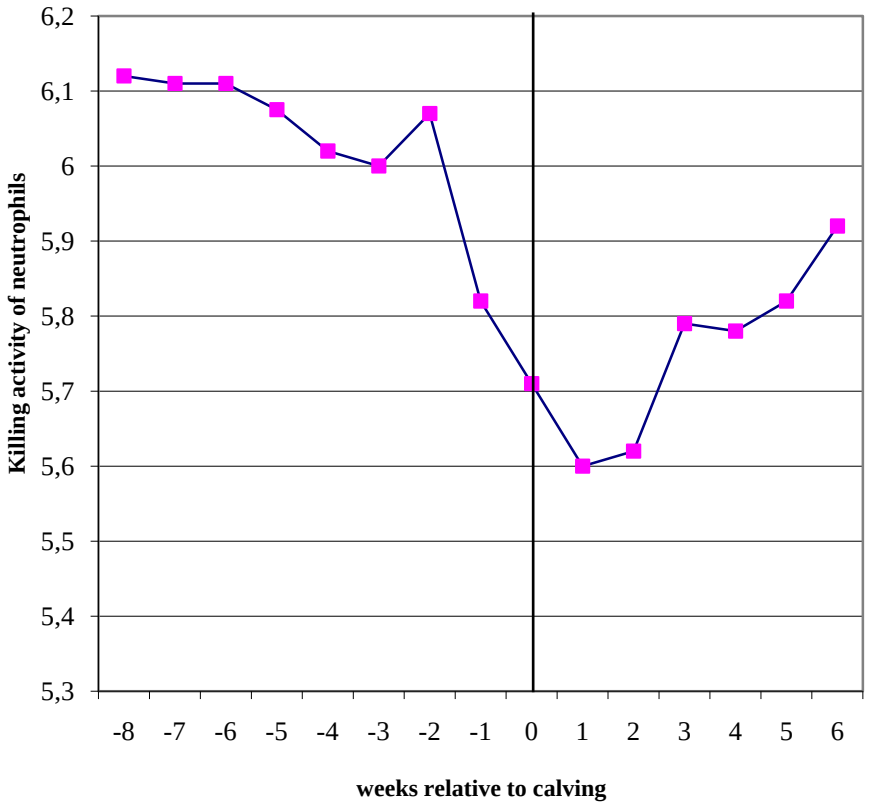

Figure 1. Killing activity of neutrophils around calving.

Pathogens associated with uterine infections

Numerous pathogens have been named to be involved in the postpartum uterine disease complex. *Escherichia coli* and *Trueperella pyogenes* are the most prevalent bacteria isolated from the uterine lumen of cows suffering from uterine infections. Also a range of anaerobic bacteria such as *Prevotella* spp, *Fusobacterium necrophorum* and *Fusobacterium nucleatum* have been isolated from clinically diseased cows. Since *E. coli* infections are mostly found during the first days or week after calving, this germ has been thought to pave the way for subsequent infections with other bacteria or viruses. Currently, there is a lot of research going on to find out whether there are typical E. coli strains bearing specific virulence factors involved. *T. pyogenes* often in combination with some of the above mentioned anaerobes, causes the most severe endometrial lesions.

Tissue trauma caused by dystocia most likely facilitates adhesion and invasion of the germs. Furthermore, the necrotic lochia that can be found following RP provides an excellent medium for bacteria. All these factors in combination with impaired immune mechanisms which is a characteristic phenomenon for modern high yielding dairy cows that are challenged by the sudden adaptation of establishing a new lactation.

Besides bacteria also Bovine herpesvirus 4 has been consistently associated with uterine disease after calving in cattle. This virus has been shown to be highly tropic for endometrial cells rapidly replicating and killing epithelial and stromal cells. This viral infection is often identified concurrent with bacteria that cause uterine disease.

Effect on further reproductive performance

Greater uterine bacterial contamination is associated with reduced ovarian follicular growth and function. Late resumption of regular ovarian cyclicity after parturition has, of course, long-term consequences for subsequent fertility. A comparison of ovarian activity in moderate yielding (4000-5000 kg milk per lactation) Friesian cows fed mainly grass and grasssilage in Ireland (Fagan and Roche, 1986), versus Belgian Holsteins producing 8000 to 9000 kg milk per lactation and fed high amounts of concentrates (Opsomer et al., 1998), revealed interesting differences. The Belgian cows not only had an increased number of puerperal disorders, but also a significantly elevated incidence of postpartum anoestrus, abnormal ovarian cycles and prolonged luteal phases (high progesterone for >20 days before breeding; Table 3).

Table 3. A comparison of postpartum reproductive parameters based on measurement of progesterone in milk twice weekly in two different studies using moderate yielding Friesians (Fagan and Roche, 1986) or high-yielding Holsteins (Opsomer et al., 1998).

Results of studies based on prog analysis	Traditional herds (Fagan and Roche, 1986)	High-yielding herds (Opsomer et al., 1998)
No. of cycles	448	463
Normal cyclical patterns (%)	78	53
Delayed cyclicity (%)	7	21
Temp cessation of cyclicity (%)	3	3
Prolonged luteal phase (%)	3	20
Short cycles (%)	4	0,5
Other irregular patterns (%)	4	2,5

Large scale progesterone monitoring projects carried out in the UK over the last 30 years, have confirmed these striking data. Furthermore, a high number of puerperal disorders is significantly associated with an elevated number of postpartum aberrations of ovarian cyclicity, leading to an increased number of cows not seen in heat at the moment farmers should inseminate them.

Overt infection of the uterus will not only influence ovarian cyclicity (Sheldon et al., 2002), but also disrupt the establishment of pregnancy, both by the physiological presence of pus, as well as altered immune responses that are essential at the interface between the endometrium and the embryo. In this context, we can refer to cows discharging small amounts of pus in their mucus around the time of oestrus and insemination. While these cows are not clinically ill, they need veterinary attention be-cause they may often end up as repeat breeders. Although it is quite obvious that pus reflects the presence of bacterial infection, in the majority of cases these small amounts of pus are just the remainders of the neutrophils which cleaned the uterus of bacterial contamination.

Based on the above it is clear that difficulties during calving (dystocia), and immediately there after (e.g. retained placenta) predispose cows to endometritis and subfertility. Hence, all authors agree that the calculation of the total costs associated with uterine infections consists of a composition of both direct (such as treatment costs and the direct decrease in milk production), and indirect costs (such as increased number of inseminations, prolongation of the calving interval and increased culling rate). That's why depending on the source, calculated losses caused by puerperal disorders and endometritis vary between 160 to 420 Euros per case with an average of 292 Euro.

Although a lot of authors mention that cows with puerperal disorders are at a significantly higher risk of other diseases, such as left displaced abomasum and ketosis, studies focusing on economic losses caused by endometritis often do not mention this. Therefore, it is clear that the figures mentioned are a serious underestimation of the real losses farmers have to face.

Prevention

A basic principle in veterinary medicine is that the earlier one can diagnose an abnormability and provide care, the faster that animal will return to a normal state of health. In the past, cows with endometritis were often identified too late, leaving little chance for a successful outcome once care was administered. Cows with chronic endometritis displaying pus in their discharge at the time of insemination illustrate this reasoning well. In this context, it is absolutely without any doubt that the management of cows with uterine health problems should be based on a preventive approach rather than another disappointing curative one. This preventive approach definitely needs to include an early identification and treatment of cows with puerperal metritis in the postpartum period. Careful clinical examination of animals at risk is strictly necessary in order to detect affected animals in time. This should then be followed by a prompt and effective treatment.

A further challenge for the future is to clearly determine all risk factors for metritis, and design prevention and control programmes to reduce the disease's incidence.

One of the already well known risk factors is a retained placenta. Prevention of this problem is therefore very important in order to reduce endometritis post partum. A correct nutrition during the dry off period and a normal calving process under hygienic conditions are the paramount factors in the prevention of placental retention.

Conclusion

This article focuses on the importance of the immediate post-partum period in high-yielding dairy cows. To get through this period with minimal disease impact, it is highly advisable to follow a pre-established fresh cow programme. It is clear that the greater the cow's genetic ability to produce milk, the greater the need for proper adjustment of the multiple factors that will allow her to better express her genetic potential. A pre-established fresh cow programme is, however, not the only variable that will help to solve the equation! Reliable procedures that can catch problem cows as soon as possible in order to get them treated with efficacious drugs before serious harm has occurred are at least as important!

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