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Review Article

A Review on Retention of Placenta in Dairy Cattles

Jemal Jabir Yusuf

School of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Jimma University, Ethiopia
***Corresponding author:** jemal.jabir44@gmail.com

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ABSTRACT

The release of fetal membranes postpartum is a physiological process and involves loss of fetomaternal adherence, combined with contraction of uterine musculature and is usually accomplished within 6 hours of calving. Retained placenta is failure of the placenta to be expelled within 6-24 hours post calving. Such retention creates a number of problems by allowing microorganisms to grow inside the uterus causing inflammation, fever, decreased milk yield, and longer calving intervals. The prevalence of RFM appears to be varying from country to country or place to place, year to year and breed to breed. Potential risk factors for retention of placenta include infectious diseases, managemental system, nutrition, hereditary, hormonal, maternal immune system, twining, cow's body weight, calves' birth weight, age, and parity. Cows with retained placenta are reported have higher incidence of metritis and lower conception rates. The economic losses due to retained placenta in dairy cattle existed as a consequence of longer calving interval, delayed post-delivery service interval, reduced conception rate, infertility, loss of milk production, the costs of veterinary service and drugs. Commonly used hormone in treating RFM is prostaglandins and oxytocin. Systemic use of antibiotics is believed to be beneficial in RFM cases where fever is present. Current evidence does not support manual removal as an effective treatment for RFM. The control of retained placenta needs to focus on the control of causative factors. Approaches to prevent occurrence of RFM in cattle include cow comfort, proper immunization and careful nutritional management (mineral supplementation), particularly during the transition period.

Key words: Retention of placenta, Metritis, Delayed removal

INTRODUCTION

A fetal membrane is an essential organ for prenatal transfer of nutrients and oxygen from the dam to the fetus (Emtenan *et al.*, 2011). Retention of fetal membranes from 6 to 24 hours post parturition is defined as retained placenta (Swiefy, 2003). Retained placenta is failure of the placenta to be expelled within 12 hours post calving (Taylor *et al*., 2010). It normally drops within short time post partum (within 8 hrs of parturition), if it is retained up to 12 hrs then it is called as delayed removal and if retained for more than 24 hrs of parturition then it is called as 'Retention of placenta' (ROP). Such retention creates a number of problems by allowing microorganisms to grow inside the uterus causing inflammation, fever, weight loss, decreased milk yield, longer calving intervals and may result in an open cow during the next year and if the infection is so bad the animal may actually die (Rooh *et al.*, 2013).

Retained placenta may cause great economic losses to farmers as cows suffering from bacterial infection may developed and thus reduce production and reproduction (Moreki *et al.*, 2012). Retained placenta causes considerable economic losses in the herd due to decreased milk production, treatment cost and decreased market value of the animal and this can be a serious setback to the progress of the herd (Ahmed *et al.*, 2006).

Several trials of interventions after calving have attempted to reduce the incidence of retained placenta. For instance, Oxytocin has long been advocated to expel the placenta after delivery. Antibiotics like Penicillin or Oxytetracycline once per day for 3-5 days may decrease bacterial complication resulting from retained placenta (Risco and Hernandez, 2003). Most of the developing countries rely partly on traditional herbal medicine for treatment and control of animal diseases. In the rural areas where modern medicine is inaccessible to farmers, ethno veterinary medicine is often used to expel retained placenta in livestock (Moreki *et al*., 2012).

Most lately data (LeBlanc, 2008) worn on RP, metritis, and endometritis as diseases of immune function in the transition period, which begin at least two weeks prepartum. A number of vitamins and trace minerals are involved in the antioxidant defense system and a

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deficiency of any of these nutrients may depress immunity in transition cows (Spears and Weiss, 2008). Thus, the principle for prevention is to optimize peripartum immune function, principally through management to encourage feed intake in the transition period. Maintenance of normal uterine physiology by good nutritional management during dry and transition periods is important to reduce the incidence of RP (Emtenan *et al.,* 2011). Therefore, the aim of this paper is to review literatures on retention of fetal membranes in dairy cattle and to disseminate relevant information.

Literature review

Placenta

The fetal membranes are made by the fetus and connect to the blood supply in the uterus and across the thin connection between the membranes of the dam and the membranes of the fetus (Emtenan *et al.,* 2011). The essential materials pass to the developing fetus. When the fetus is born the placenta normally detaches within short time and is expelled. That is why it is referred to as the "afterbirth" (Ball and Peters, 2004). The release of fetal membranes postpartum is a physiological process and involves loss of fetomaternal adherence, combined with contraction of uterine musculature and is usually accomplished within 6 hours of calving (El-Malky *et al.,* 2010).

Prevalence of placental retention

The prevalence of RFM appears to be varying from area to area, year to year and breed to breed. The incidence in cattle was ranged between 5.2 to 23.5% (Youngquist *et al.*, 2007). High prevalence of RFM was observed in cows with neonatal mortality (26.3%) and it could be recognized to absence of suckling behavior that stimulates oxytocine release that help placental expulsion (Noakes *et al.,* 2003).

In Ethiopia, the prevalence of retained fetal membranes in dairy cattle were studied by different authors and reported as 6.8%, 3.4% and 8.5% in Lowland, Midland and Highland areas of central Oromia, respectively (Jergefa *et al.,* 2009), 18.3% in Arsi Zone (Degefa, 2011), 3.14 in Jimma zone (Dirar *et al*., 2015), 9.3% in Tigray (Abraha, 2003), 16.8% in Mekele (Gebre-Mariam, 1996), 2.4-9.1% in Debre Zeit (Zewdu, 1989).

Causes of retained placenta

Infectious disease

Infectious disease causes of placental retention are behind the scope. Infectious diseases like Bovine Viral Diarrhea may cause RFM in cattle (Niskanen *et al.,* 1995). Brucellosis is a contagious bacterial disease of sexually mature animals and causing abortion and retained placenta (Aulakh *et al*, 2008; Kebede *et al.,* 2008)). The disease is clinically characterized by abortion in the last trimester and retained placenta in the female whereas orchitis and epididymitis in male (Radostitis *et al.,* 2000).

Managemental

Lack of exercise and hypocalcemia are the most frequent causes of decreased myometrium contractility. Stress (Transportation, rough handling, poor feed conditions, Isolation from group, Lameness,) results in elevated corticosteroids and increased risk of placental retention. Obesity may lead to dystocia and subsequent RP. Dairy producers have suggested that Poor health management in herds can predispose animal to retention of placenta (Fricke, 2001). In addition to this deficiency of antioxidant, vitamin E and selenium may decrease chemo taxis and leukocyte numbers at the fetomaternal junction, thus contributing to the retention of fetal membranes (Bourne *et al*., 2007). Over-condition and under condition as well as managemental defects and environmental factors can result in retention of placenta (Hayirli *et al.,* 2002).

Nutritional

Nutritional causes of RP are primarily due to the deficiency of feed during the last 6 to 8 weeks before calving specially when there is deficiency of content of minerals and vitamins in diet (Spears and Weiss, 2008). Heavy grain feeding may be associated with both higher milk production and increased risk of reproductive disorders such as dystocia, retained placenta, cystic ovaries, metritis other reproductive disorders (Grimard *et al*., 2006). Vitamin and mineral deficiency conditions such as selenium, vitamin E and vitamin A, B-carotene and disturbed Ca/P ratio can impair general immunity and may alter the competence of cellular self-defense mechanism and can increase the risk for placental retention and metritis (Ahmed *et al.,* 2009). High milking cows with a greater degree of negative energy balance prepartum and higher NEFA concentrations were more likely to suffer from RP (LeBlanc *et al.,* 2002). On the other hand, over-conditioned cows were shown to be more sensitive to retained placenta and subsequent infertility than cows with normal body condition scores (Badinand**,** 1984).

Hereditary

Recent study carried out on a herd of Friesian cows reared at Egypt reported that cows having blood group genotype BGKOZA'O' bred with sire have I' genotype dropped their placenta normally. While cows having BO3Y2AE.G'P' genotype bred with sire having genotype 12 showing high incidence of RP. On the other hand the most frequent alleles in serum proteins of cow with no retention of placenta were albumin (ALA), postalbumin (PalA) and amylase (AinB) gene markers, while the most frequent genetic alleles in serum proteins of cow with retained placenta were alpha globulin (Fa,A) and transferrin D (lID). Moreover, it was recommended to use the above mentioned genetic constituents of both dam and sir for breeding purposes (Ahmed, and Zaabal, 2009).

Important risk factors for RP, such as gestation length and calving difficulty are genetically determined and have high heritability estimates (Bennett 2001 and Norman 2009). Therefore, RP is also heritable. Indeed, reported estimates of heritability of liability for RP range from 0.03 to 0.10 (Heringstad, 2010, and Benedictus *et al.,* 2012) have shown that major histocompatibility complex (MHC) class I compatibility between dam and calf increases the risk for RP in Meuse-Rhine-Yssel and Holstein cattle, respectively.

Hormonal

Placental separation occurs when fetal cortisol induces the production of the enzymes, 1 7-hydroxylase and aromatase in the placenta which favour oestrogen synthesis at the expense of progesterone synthesis (Emtenan *et al.,* 2011). Maternal plasma levels of oestradiol- 1 increase suddenly, while plasma levels of progesterone decline sharply immediately prior to parturition. It is supposed during the week before parturition, the level of estradiol reaches its maximum level to help the uterus to get rid of any remnant of fetal membranes. Therefore, a decreased level of estrogen may be indicated as a factor enhancing RP (El-Nemer and Emara, 2000). Spontaneous myometrial contractility is augmented by autocrine and paracrine release of PGF and parturition ensues. Disturbed endocrine function high progesterone and cortisol levels and low oestradiol level was traced in the blood cows with RP (Michal and Hanna, 2006). Increased progesterone level in RP may be due to failure of the placenta to produce specific steroidal enzymes that help in progesterone aromatization and its conversion to oestrogen (Ball and Peters, 2004).

Failure of maternal Immune Response

It is occurred due to failure of the maternal immune system to successfully degrade the placentomes at the end of pregnancy (Frazer, 2005). Maternal immunological recognition of fetal MHC class I proteins expressed by trophoblast cells triggers an immune inflammatory response that contributes to placental separation (De-Mouzon and Millo, 2006). This lymphocytic activation was suppressed at the foeto maternal interface alongside the pregnancy course to avoid rejection of fetal allograft where the trophoblast secretes interferon-tau (IFN- t) and both trophoblast and endometrium secrete prostaglandin E2 and the endometrial glands secrete serpins (uterine milk proteins), all of which inhibit lymphocyte activation to keep on the embryo not rejected by the dam (Hansen and Liu, 1996).

Failure of cotyledon-caruncle detaching mechanisms

The main cause of retained placenta is due to a lack of breakdown of the caruncle-cotelydon attachments after delivering the fetus (Martins *et al.,* 2004). The reasons could be due to infectious and/or noninfectious factors (Moizur 2013). Primary attention has been often directed to infectious causes, but non infectious factors probably account for 70% or more of the cases (Frazer *et al.,* 2005). Noninfectious causes are often multifactorial and are difficult to diagnose (Hanzen *et al.,* 1999).

Other factors

Other potential risk factor for retention of placenta are Twins, Cow's body weight, Calves' Birth weight, age, parity and repeatability (Gaafar *et al.,* 2010; Shwetha, 2013).

Twins

The occurrence of retained placenta in cows remained higher in twin birth than single (Gaafar *et al.* 2010. Similarly, twining birth is led to the high proportion of retained placenta (Deyab, 2000 cited in Gaafar *et al.,* 2010).

Cow's body weight

The percentage of retained placenta increases significantly with increasing live body weight of cows due to the increment in fat adipose tissues (Gabr *et al*., 2005; Gaafar *et al.,* 2010), which may result in trapping the steroid sex hormones.

Calves' birth weight

A significant increment of retained placental problem is happening with increasing fetal birth weight (Gaafar *et al* 2010). The reason could be due to pressure of the fetus on the placenta and fetal membrane (Deyab, 2000), so that the attachment between the cotyledons and the fetal membrane become stronger these consequent in occurrence of placental retention.

Reproductive Impact of Retained Placenta

Metritis

Retention of placenta and metritis are positively correlated. Cows with ROP had a significantly higher incidence of metritis than cows without ROP and also a significant difference was found between conception rates in cows with ROP and metritis (Youngquist and Threlfall, 2007). Retention of placenta results from the presence of decomposing placental tissues, which provide a favorable environment for bacterial colonization. Coliform bacteria and high concentrations of endotoxins present in lochia of cows with ROP are potent inducers of prostaglandins and cytokines, favoring development of uterine infections (Dohmen *et al*., 2005). Metritis result in decreased dry matter intake, and hence, multiparous cows with metritis in early lactation produce less milk than the healthy cows. This difference is greatest during the first 20 weeks of lactation (Wittrock *et al*, 2011).

Mastitis

Although the main economic impact of ROP seems to be decreased milk production, more days open, decreased milk volume, milk from treated cows withheld), the correlation between ROP and mastitis is controversial. However, the economic losses as a result of mastitis could be due to reduced milk production, discarded milk, reduced cow sale value, drugs and veterinary services. It is unhygienic to milk a cow with decomposing afterbirth hanging on it (LeBlanc *et al.,* 2002).

Economic consequences of retained placenta

Losses due to infertility and low milk production

In dairy cows retained placenta may be the cause of serious economic losses to the farmers as cows with retained placenta may develop bacterial infection and become ill and thus reduce production. Some may even die. Milk from cows with retained placenta is unfit for human consumption and therefore cannot be sold. The fertility of dairy cows is affected when most cows in the herd suffer from retained placenta. This causes a direct loss to the farmer due to delayed calving leading to a lengthy period between births (calving intervals) and hence low milk production. The retained fatal membrane causes considerable economic loss, especially when incidence exceeds the average of 5-10% (Joosten *et al.* 1987). The fertility of cows after retention of the placenta appeared to be affected. Generally, retention of placenta

has great influence on productivity. For instance, retained placenta had a significant negative effect on milk yield for several weeks after calving and there is considerable milk loss as a result of difficult of calving (Dematawewa and Berger, 1997).

Delaying post-delivery service interval

Placental retention is usually accompanied by delayed involution of the uterus (Peters and Ball, 1995), and adversely affects reproductive performance (Swiefy, 2003). Cows with reproductive disorders had longer intervals from calving to first service and to conception and required more services per conception and lower pregnancy rate and conception to first service (Shiferaw *et al.,* 2005). The period from parturition to the first service was longer in cows exhibiting retained placenta compared to normal ones (Gaafar *et al.,* 2010).

Reduce conception rate

Varies studies reported that the conception rate of cows presenting retained placenta were significantly lower compared to normally calved cows (Shiferaw *et al.,* 2005). The highest proportion of normal cows was conceived during the period from 61 to 90 days after parturition, while cows with retained placenta were conceived at more than 120 days after parturition (Gaafar *et al.,* 2010).

Longer calving interval

Retention of placenta and metritis may cause prolonged calving interval and permanent infertility. Calving interval remained longer in cows revealing retained placenta as compared to normal cows (Swiefy, 2003; Gaafar *et al.,* 2010). Similarly, the mean interval of calving was prolonged in the group of cows with retained placenta compared to the control group (Han and Kim, 2005). In general, the financial losses due to retained placenta in dairy cattle existed due to increased calving interval, increased culling rate, reduced conception rate, infertility, loss of milk production, the costs of veterinary service and drugs.

Treatment

There are few effective treatment options for RFM, where by choices tend to be based more on tradition than evidence. A variety of methods have been used in the treatment of bovine RFM, although the efficacy of many of these treatments is questionable (Beagley *et al.*, 2010).

Use of ecbolics and immunomodulators

Use of ecbolic like oxytocin helps in inducing myometrial contraction. It was evident that E. coli LPS plus oxytocin effectively reduced the uterine inflammation and infection. LPS is a potent secretagogue for a variety of inflammatory mediators and immune regulatory cytokines from endometrial cells and leukocytes (Maischberger, *et al.,* 2008). The failure to produce any systemic endotoxic responses after intrauterine infusion of E coli endotoxin confines that *E coil* LPS can be used safely without producing any adverse reaction in cattle (Nadja and William, 2007).

Hormones

The most commonly used hormone products in treating RFM are prostaglandins and oxytocin. PGF2α does not cause detachment of retained membranes, but can improve reproductive performance in the early postpartum cow due to uterokinetic effect (Youngquist and Threlfall, 2007). Oxytocin is the uterokinetic hormone of choice in the early postpartum cow and 20 IU, three to four times daily have been used for ROP (Youngquist and Threlfall, 2007). These hormones play a role in uterine contraction, and could be effective in treating RFM because of uterine atony (Laven *et al*., 1999). However, it is thought that uterine atony accounts for a very small percentage of retained placenta case and numerous studies have not supported their use as a general treatment for RFM (Drillich *et al.,* 2005).

Antibiotics

The use of antimicrobial therapy in the treatment of ROP has demonstrated conflicting results (Peters and Laven, 1996). But systemic antibiotics are believed to be beneficial in RFM cases where fever was present (Risco and Hernandez, 2003). Systemic antibiotics alone are just as effective as systemic antibiotics combined with intrauterine treatment (Drillich, 2006). However, because of all febrile cows remain treated systemically,it is not clear whether the resolution of fever is due to the antibiotics or due to the cow's own immune defense mechanisms (Kulasekar *et al*., 2004).

Manual removal

Manual removal can result in more frequent and severe uterine infections, when compared with more conservative treatment and found that manual removal prolonged the interval from calving to 1st functioning CL by 20 days (Bolinder *et al.,* 2001). Additionally, intrauterine pathogenic bacteria were found in 100% of cows with manually removed RFM versus 37% of untreated cows at 3 weeks postpartum, and further 37% of treated versus 12% of untreated cows at 5 weeks postpartum. While current evidence does not support manual removal as an effective treatment for RFM, it is still commonly practiced (Goshen *et al,* 2006). The removal of an attached placenta causes damage to the endometrium and suppresses uterine leukocyte phagocytosis (Vandeplassche *et al.,* 1982**).** Both of which encourage bacterial invasion (Peters and Laven, 1996).

Prevention and control

The control of retained placenta needs to focus on the control of causative factors like abortions, premature calving, and calving difficulties. Good control of feeding and condition during the dry period and avoiding cows becoming overfat will also reduce the incidence of retained afterbirth. The herds with a history of selenium deficiency had a high incidence of RFM, and according to their suggestion supplementation of vitamin E and selenium can help to reduce placental retention (Allison and Laven, 2000) and Bourne *et al*. 2007) . The synthetic form of vitamin E (alpha-tocopherol acetate) was found to be more effective than the natural form of vitamin E (Bourne *et al.* 2007).

Approaches to prevent occurrence of RFM in cattle include cow comfort, and careful nutritional management, particularly during the transition period (Frazer 2005). Due to metabolic diseases uterine immunity is impaired

(Zerbe *et al.,* 2003). Thus proper nutrition in prepartum period is provided to avoid ROP and other metabolic diseases. Vitamin and mineral deficiencies can impair general immunity to minimize these conditions Vitamin E and Selenium should be supplemented (Bourne *et al.,* 2007). Supplementation with balanced vitamin and mineral mixture in prepartum period is considered a prophylactic step to avoid fetal membrane retention. Prepartum supplementation with antioxidants, vitamin E (DL -tocopherol acetate, 1100 IU) and Se (sodium selenite, 30 mg) by single I/M injection, at 3 week prepartum, is used as a prophylactic dose to avoid placental retention in cows (Gupta *et al.,* 2005). The infectious diseases like *brucellosis* can be prevented by proper immunization against specific infection.

Conclusion and recommendation

The negative effect of retained placentas is many in numbers. Cow with retained placenta have so many reproductive problems such as endotoxemia, endometritis, mastitis, thus resulting in elongated conception time, elongated calving interval, infertility, reduced milk production and others. Potential predisposing factors for happening of retention of placenta include infectious diseases, managemental system, nutrition, hereditary, hormonal, maternal immune system, twining, cow's body weight, calves' birth weight, age, and parity. Systemic use of antibiotics is believed to be beneficial in RFM cases where fever is present. Current evidence does not support manual removal as an effective treatment for RFM. The control of retained placenta needs to focus on the control of causative factors. Approaches to prevent occurrence of RFM in cattle include cow comfort, proper immunization and careful nutritional management, particularly during the transition period.

Based on above conclusion the following recommendations are forwarded

- The control of retained placenta needs to focus on the control of predisposing factors. Therefore, creation of awareness is required to farmers and other concerned stakeholder about the risk factors of RP and measures of prevention and control options.
- Careful nutritional management, particularly during the transition period and good housing management should be strongly recommended.
- The most important infectious diseases (like *brucellosis*) should be prevented through appropriate immunization against specific agent.

If any cases of reproductive problems and other complications confronted in the herds, early consultation of Veterinarian should be undertaken.

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