Equine passive immune transfer trough colostrum

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Introduction

Foals at birth need colostrum, containing large amounts of immunoglobulins, to gain an adequate passive transfer for their early protection against infective factors; as no antibodies cross the placenta layers during pregnancy are produced by the foal in utero. All immunoglobulins classes, moreover IgG, IgG(T), IgA, IgM but also IgE are transferred from the mare to the young horse via colostrum (Wagner et al., 2006). Failure of passive transfer (FPT) is quite frequent and responsible for a large proportion of neonatal morbidity and mortality. Mammal colostrum concentration starts the last month of pregnancy, most in the last two weeks, as estrogens level drops down and progesterone rises (Smith et al., 1971; Jeffcott, 1974). About 100 g IgG as average are secreted per lactation and the greater concentration has been found in the first litre collected (Clément et al., 2000). It is commonly admitted that good quality colostrum contains not less than 60 g of Ig/l. 23% to 32% mares produce low quality colostrum (Higuchi et al., 1989; Genin, 1990; Leblanc et al., 1992). 6-8 hours after birth immunoglobulins concentration drastically drops down up to 80-85% and that is the reason of quick good quality colostrum sucking by newborn foal. Horse type and breed are known to have an influence on IgG concentration. Arabian and Quarter horse mares seem to have better colostrum quality than Thoroughbred and Standardbred (Leblanc et Tran, 1987). Haflinger show higher whey proteins amounts, 6 hours after delivery, than Arabian and Trotter, but drop down more rapidly already few hours after delivery, and so total proteins (Cividri et al., 2002). Age and rank of lactation, nutrition and body condition of mares, vaccination programs, season and temperature may be further colostrum quality variation factors. Colostrum IgS transfer mechanisms have been well studied in rats (Silim et al., 1990). Thanks to receptor mediated endocytosis mechanism in the immature epithelial fore guts cells, colostral globulins make their way toward the lymphatic system and finally reach the blood circulation (Kruse, 1983). This phenomenon could be enhanced by an increased fluidity of intestinal cell membranes, probably related to their longer fatty acid chain composition (Duvaux-Pontier et al., 2004). The absorption capacity of IgS is about 60% for healthy foals that could suck colostrum just after birth, even if colostrum quality is very variable between mares (Clément et al., 2002). Under standard breeding farm conditions, percentage of passive immunity failure varies from 3% to 22%; the chances for these foals to survive are extremely variable (0 to 80%) and strictly connected with quality of breeder and veterinarian supervision, quality of housing and microbial environment during the critical phase (Baldwin et al., 1991). Both the foal and the dam may be involved in FPT that can be due to poor colostrum quality, lack of colostrum ingestion, IgS intestinal poor absorption or for a combination of these factors. As for other species, in case of premature birth (less than 320 days of pregnancy) mammary gland is unable to concentrate IgS and gives poor quality colostrum (Jeffcott, 1974; Leadon et al., 1984; Leblanc et Tran, 1987). Prepartrurient lactation leading to early colostrum losses, observed in 16% to 22% of mares, is the main cause of FPT; reasons till now are unknown but could be associated with hormonal changes, twin pregnancies or placenta infections. Weak foals usually ingest less colostrum; sometimes the dam rejects her foal, especially primiparous ones; finally, in case of death of mare at birth or if neonatal isoerythrolysis is suspected, colostrum is not available for the foal. In order to be adequately immunized, the breeder must make sure that the foal ingests sufficient IgS amounts as early as possible after birth and within 12 hours. Most of equine deliveries occur during the night: providing assistance is difficult and so preivation of birth time as early weaning signs are variable between mares. Injections of micro doses of oxytocine to mares was sometimes used to induced parturition within 2 hours for mares that were about to foal and that mares that did not respond to injection, would not foal during the following night (Camillo et al., 1991). We failed however to demonstrate the effectiveness of this protocol on heavy breed mares. A specific protocol could be suggested to assess heavy type mare’s readiness for birth (Drogoul unp.): twice daily calcium concentration in mammary gland secretion is checked in all at term mares, using semi-quantitative calcium strips (Merckkoquant®). Mares are kept loose during day time and tied in stalls, close to one another (stress). Under these conditions, no mare lies down at night unless she is foaling. As a consequence, we are able to assist 100% of our mares. By the use of this procedure assistance is 100% assicured and foal mortality could be reduced over 10%. This method is available only for mares that produce colostrum before foaling. Very important is the early evaluation of colostrum quality. There is a close relationship between colostral IgG concentration and colostrum
specific gravity (Genin, 1990; Touboul et al., 1997; Chavatte-Palmer et al., 2002), which can easily assessed using a colostrometer, even if these empirical criteria are rather subjective (Chavatte et al., 1998). Normally it is recommended to collect 200-300 ml high quality colostrum (specific gravity more than 1.08) within 12 h from foal’s birth. A hyper immunization program was assessed milking systematically mares 1 hour after delivery and feeding all the foal with about 500 ml or more extra-colostrum (Drogoul 1994, unp.); none of the foals contracted navel infection or arthritis, whereas under field conditions 1/3 of other foals do. All the situations that generate expected transfer failure should be closely looked for and anticipated if necessary. Colostrum protein composition is not influenced by different diets and is very important to collect early information on mare’s colostrum quality. Maintaining a bank of good quality deep-frozen colostrum should be a routine practice. Colostrum could be collected with a milking machine under influence of oxytocine or not; the average first collection quantity varies from 300 ml up to 3 litres, or manually, about 250-500 ml, always after the first foal suckling. Samples must be frozen at - 20°C and could be used within less than 18 months; anyway the use of collected colostrum is suggested during the delivery season. The preparation of IgG powder includes ultra filtration, which selected IgG and did not seem to eliminate components that are important for absorption (Csapò et al, 1995; Kohn et al., 1989). Adequate technological processes could be also utilized to preserve colostrum, as heat treatments usually used for milk stabilization (Civardi et al., 2007). Whey protein, especially immunoglobulins, are very sensitive to thermal denaturation but with a thermal processing at 75°C for 10 minutes the biofunctional immunoglobulins properties were partially unaltered. The main problem of the colostrum bank is connected with the difficulty of organizing collections of enough quantity of a good quality one to allow industrial processing and commercialization (Drogoul et Brigand, 1996). Studies have tested bovine colostrum as an alternative to equine source of Igs (Genin, 1990; Leblanc, 1991; Holmes et Lunn, 1991). Bovine colostrum is easy to collect but Igs are moderately well absorbed, rapidly catabolized and their half-life is only 7 days. Equine seric IgG transfer has also been tested in foals but passive transfer is poor (Touboul et al., 1997; Chavatte-Palmer et al., 2002); also plasma supplementation per os is difficult and needs large intakes (6 litres per foal at least). Inducing lactation in non pregnant mare could be an interesting alternative for colostrum production; it has been successfully tested by Chavatte-Palmer et al., 2002. Colostrum and milk production seems to be less than what expected postpartum but open interesting perspectives in the use of barren mares as foster mares for orphan foals and colostrum storing (Daels et al., 2002). Some observations about serum Igs in mare’s blood during the last 2-3 weeks from scheduled delivery, in colostrum and in foal’s serum pointed out correlations between serum total proteins and IgG and between foal serum IgG amounts at 6 and 18 hours from birth and colostrum IgG at delivery (Orlandi et Curadi, 2006; Curadi et al., 2002), increasing the possibility of an early FPT forecast.

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References


