Incidence of failure of immune passive transfer (FPT) in thoroughbred foals - Interest of a rapid diagnosis for FPT

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SUMMARY

The occurrence of complete or partial failure of passive transfer of colostral immunoglobulin to newborns induces low blood IgG concentrations in foals and renders them highly sensitive to infectious diseases. This prospective study was conducted on 190 thoroughbred newborn foals from a breeding farm in Turkey by determining blood IgG concentrations using a rapid, semi-quantitative test, the Snap Foal IgG test. The FPT incidence was 17.4% : 6.3% of foals presented total FPT with blood IgG concentrations below 4 g/L and 11.1% presented partial FPT with blood IgG concentrations between 4 and 8 g/L. Because of the precocious FPT diagnosis, colostrum could be orally administered for correcting foal immune status in a first attempt. Consequently, equine plasma perfusion has been reserved only for foals resistant to colostrum treatment.

Keywords : Failure of passive transfer - immunoglobulin G - thoroughbred foal - treatment.

Introduction

Although newborn foals are immunocompetent, they are immunologically naive because of the failure of immunoglobulin transfer through the placenta [6, 7, 9]. Immunoglobulin production begins when foals were exposed to antigens. But adequate concentrations of immunoglobulins can be only reached up to two months of age [6]. Consequently, infectious diseases are major cause of death in neonatal foals, and the passive transfer of maternal antibodies via colostrum constitutes the most effective defense for newborn foals against pathogens until their own immune systems completely developed [5]. Colostrum absorption is maximal during the first six hours after birth, and then decreases gradually until 24 hours [3]. FPT may be a contributory cause of serious neonatal infection and septicemia in foals for the first two months of life [9, 10].

Failure of passive transfer (FPT) is the lack of adequate maternal immunoglobulins in colostrum [5]. It may result from maternal and foal factors: premature lactation, insufficient production of colostrum, low quantities of immunoglobulins in colostrum, delayed onset of sucking by the foal, assimilation weak ingestion of colostrum or intestine deficiency for immunoglobulin [7].

The majority of mare’s colostrum immunoglobulins are the immunoglobulin G (IgG) [7]. Detection of low concentrations of IgG in the foal’s serum during the first 24 hours after birth allows diagnosis of FPT [8]. FPT is complete when IgG concentrations are below 2 g/L or 4 g/L, partial when IgG concentrations are between 4 and 8 g/L, and absent when IgG concentrations are above 8 g/L [1, 7]. It has been reported that the incidence of the PTF in foals range from 2.9 [8] to 24% according to world counties [2]. Previously, KALINBACAK and OR [4] reported that FPT prevalence was 16.7 % in Turkey.

Thus, early detection and treatment of FPT is important to reduce the risk of disease in neonatal foals [7]. As a new enzyme immunoassay for the semi quantitative measurement of foal IgG, the Snap Foal IgG test, was recently developed [9], the purpose of the present study was to determine the incidence of failure of passive transfer of immunity in foals by the Snap Foal IgG test on a breeding farm in Turkey.
Material and methods

ANIMALS

In the present study, a total of 190 thoroughbred foals, born on a breeding farm during 2003 breeding season in Turkey, were used. Blood samples were collected from jugular vein of foals into glass tubes with anticoagulant (Na-EDTA), between 6-12 hours old after birth.

IgG CONCENTRATIONS

SNAP® Foal IgG is an enzyme immunoassay designed to detect the presence of immunoglobulin G. In the SNAP®, calibration levels of polyclonal antibodies to equine IgG, has been spotted separately onto the device. Sample (no coagulated blood) and reagents are applied onto the surface of the membrane and flow through the bioactive spots. Equine IgG is captured by the immobilized anti-IgG antibodies on the sample spot. Enzyme conjugated polyclonal antibodies are then added, and bind to the captured equine IgG forming an antibody-IgG-antibody sandwich. After washing away unbound material from the membrane, an enzyme substrate solution is added. Subsequent color development (after 7 minutes) is proportional to the concentration of equine IgG captured. Comparison of sample spot allows to assess intervals of IgG concentration: < 4 g/L (Total FTP), 4-8 g/L (partial FPT), or >8 g/L (no FPT).

All foals with total FPT were treated by orally 1-2 L colostrum (specific gravity greater than 1060) : they were collected from donor mares, within 2 hours after parturitions. Commercially available lyophilized (freeze-dried) equine plasma (Equine Lyphomune®) was used for plasma transfusion from donor mares, within 2 hours after parturitions.}

Results

Among the 190 thoroughbred foals, total FPT was evidenced in 12 foals (6.3%) with serum IgG concentrations below 4 g/L, and partial FPT in 21 foals (11.1%) with serum IgG concentrations between 4 and 8 g/L. In the other horses (82.6%), the serum IgG concentrations were above 8 g/L.

As soon as FPT was diagnosed, all foals with total FPT (table I) received oral administration of colostrum and serum IgG concentrations were again evaluated. In 7 foals, IgG concentrations were comprise between 4 and 8 g/L after treatment, markedly increased and reached 8 g/L in one foal, whereas they stayed below 4 g/L in the 4 other foals. When colostrum administration did not achieve to restore blood IgG concentrations, perfusions with equine plasma were realized, and this second treatment succeeded in increasing IgG concentrations up to 8 g/L in one foal, and up to 4 g/L in the 3 other newborns. Foals with partial FPT were not treated by colostrum administration or equine IgG perfusion because the infection risk is relatively low when IgG were comprised between 4 and 8 g/L.

Discussion

Immune FPT does not directly induce clinical sign but it constitutes an important risk factor for neonatal infections. According to environmental and management factors, some foals would present clinical signs of infections whereas not the others.

Incidence of FPT in foals considerably varies from 2.4% to 24% [8]. More recently, FPT occurrence determined in USA was 13.3%, in United Kingdom 15%, in Australia 10% [7, 9] and in Turkey 16.7% [4]. In this study, 17.4% of thoroughbred foals from a breeding farm have presented total (6.3%) or partial (11.1%) FPT. These differences can be related to the various methods used for serum IgG measurement. Single radial immunodiffusion (SRID), zinc sulfate turbidity test, latex agglutination and enzyme immunoassay are quantitative and accurate tests, but they require 18-24 hours for incubation period [8]. However, methods for serum IgG quantification in clinical practice must be easy to perform, provide rapid and accurate results and present low cost [7]. Because foals absorb colostral immunoglobulins in the first 24 hours after birth [4], it is necessary to precociously diagnose FPT for allowing rapid treatments.

Failure of passive transfer immunity in foals can be prevented by oral colostrum administration in the first 6 to 12 hours after birth [5]. To raise the blood IgG concentrations, sufficient IgG amounts must be administered within the first 24 hours, prior to gut closure. The success of the FPT treatment depends on conditions surrounding the birth, the initial IgG concentrations, the age of the foal and the environment to which the foal is exposed [3]. Consequently, if FPT is diagnosed within 6 to 12 hours after birth, treatment with oral colostrum administration will begin immediately and will be successful for correcting immune status. If the detection of FPT is delayed, the correction of immune status will require costly intravenous perfusion of equine immunoglobulins [3].

The IDEXX laboratory has recently developed a new enzyme immunoassay, the Snap Foal IgG test, for semi-quantitative measurement of serum IgG in foal. PUSTERLA et al. [9] reported that the Snap Foal IgG test is easy to perform and results were obtained within 10 minutes. This test allows the detection of IgG concentrations above 8 g/L with accuracy of 89% and below 4 g/L with accuracy of 80% [7].

Using this test, we were able in this study to detect total or partial FPT in foals within 6 to 12 hours after birth and to

<table>
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<th>TFPT (IgG&lt;4g/l)</th>
<th>PFPT (4g/l&lt;IgG&lt;8g/l)</th>
<th>No FPT (IgG&gt;8g/l)</th>
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<tbody>
<tr>
<td>At birth</td>
<td>12 (6.3%)</td>
<td>21 (11.1%)</td>
<td>157 (82.6%)</td>
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<tr>
<td>After colostrum</td>
<td>4</td>
<td>7 + 21</td>
<td>1 + 157</td>
</tr>
<tr>
<td>After plasma perfusion</td>
<td>0</td>
<td>3 + 7 + 21</td>
<td>1 + 1 + 157</td>
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Table I.—Number of foals (and percentage of foals) with total failure of passive transfer (TFPT), or partial failure of passive transfer (PFPT) or no failure of passive transfer (no FPT), and the effects of colostrum administration and the equine plasma perfusion on blood IgG concentrations of foals with TFPT.
immediately administer colostrum orally to hypogammaglobulinic newborns. Serum IgG concentrations exceeded 4-8 g/L in 8 of 12 (75%) colostrum treated foals. FRANZ et al. [3] reported that intravenous quantities of Lyphomune® (10 g/15 kg of body weight) in four of six thoroughbred foals with FPT immediately after birth induced increases of serum IgG concentrations up to 4 g/L 6 hours later. In our study, equine plasma perfusion (Equine Lyphomune®) was realized when oral colostrum administration did not correct sufficiently serum IgG concentrations in foals with total FPT. With this second treatment, IgG concentrations exceeded 4 g/L in all treated foals.

In conclusion, with the use of the Snap Foal IgG test, precocious detection of total or partial FPT within 6 to 12 hours after birth was achieved in 17.4% thoroughbred foals from a breeding farm. The rapid diagnosis of FPT conducted to immediately treat FPT foals with oral colostrum administration in a first attempt and to reserve equine plasma perfusion only to foals, which have not responded enough to colostrum treatment. Consequently, disposition of simple and rapid measures of serum IgG concentration in newborns has allowed a real choice in the foal treatment and a reduction of therapeutic cost.

References