



Colostrum and plasma

as a source of passive immunity in foals



by Katarzyna Dembek DVM
 ■ photos by Katarzyna Dembek DVM

Failure of passive transfer in foals is a condition that can be devastating to the equine reproductive industry if allowed to go undiagnosed and untreated. Fortunately, this condition is easy to diagnose and is easy to treat as long as it is discovered within 24 hrs post partum. Foals with failure of passive transfer are more likely to develop septicemia, a life threatening bacterial infection, pneumonia, infected joints (septic arthritis), diarrhea and meningitis.

At birth, healthy foals have a fully developed immune system, ready to protect them from disease-causing bacteria and viruses (pathogens) however the antibodies concentration is not adequate. When an animal first has contact with a foreign substance, the body prepares a range of protein molecules (called immuno-globulins or antibodies) to attach to any infectious agent and inactivate it. IgG molecules are the predominant type in the blood and colostrum. The embryo later termed fetus spends 11 months in the sterile environment of dam's womb where it is surrounded by a system of membranes: placenta, amnion, chorion.

Colostrum and plasma

as a source of passive immunity in foals



1. Al Khalediah Equine Hospital
2. Al Khalediah paddock
3. Al Khalediah Equine Hospital
4. Colostrum administration
5. Colostrum administration
6. Plasma
7. Snap test
8. Plasma administration
9. Plasmapheresis

The primary function of the placenta is to promote the selective transport of nutrients, waste products, oxygen and carbon dioxide between the mother and the fetus. The mare's-(epitheliochorial) placental has six layers of tissue separating the maternal blood flow from the fetal blood flow. The immunoglobulins IgG are unable to penetrate these layers so the foal must rely on the adequate intake of good quality colostrum within a few hours of birth to provide essential antibodies.

Colostrum is the first portion of milk (3-7 liters) produced by the mare during the last 3 weeks of gestation. Colostrum provides antibodies (70g/L), vitamins, minerals, energy, protein, fats and works as a laxative to help the foal pass the meconium (first stool). The intestinal tract of the newborn foal is lined with special cells that are able to absorb colostrum IgG. Colostrum absorption is maximal during the first 6 hours of life and then gradually decreased until 24 hours. Unfortunately, the transfer of antibodies from dam to offspring does not always occur successfully and "failure of passive transfer" (FPT) is said to exist, as a foal's serum IgG level less than 4-8g/L.

Causes of FPT are variable and may result from maternal and foal factors:

Maternal factors

- Lack of colostrum
- Poor quality of colostrum
- Death of mare
- Leakage of colostrum before foaling
- Mare rejection of the foal

Foal factors

- Lack of colostrum intake
- Weakness
- Prematurity
- Congenital defects
- Stress

The immunoglobulin level in colostrum can be measured by the specific gravity which is directly proportional to the amount of IgG present. A specific gravity of > 1.060 is considered adequate for foal protection. There is an instrument called refractometer which measures directly the IgG concentrations (g/L) in colostrum.

Diagnosis of FPT

Many tests are available to detect low serum IgG concentration in foals. The simple blood test called the "SNAP test" is a semi-quantitative test that gives the range of immunoglobulin levels in the foals serum. Adequate passive transfer is considered over 8 g/l of immunoglobulins. Complete FPT is considered less than 4g/L. Partial FPT is between 4 and 8g/L. The advantage of this test is that it can be done on the farm and the results are known within 20 minutes. This allows the treatment for FPT to begin immediately if needed.

The most recent method to measure IgG level in foals is

the ARS Foal-IgG Test. This test although easy to perform requires expensive equipment, is more accurate than SNAP test and results are available within 10 min.

Treatment

When low serum IgG concentrations are detected before 12 hours of age, the foal can be treated with oral colostrum supplementation or commercial products. The commercial supplements do not have the broad spectrum of components that colostrum or plasma has.

Colostrum from mare's that have excellent specific gravities (>1.08) can be saved for foals that need colostrum, e.g. an orphan or a foal with FPT. It is safe to save about 200-250 ml of this high specific gravity colostrum. The milked colostrums can be placed into plastic containers and frozen. The container should be labeled with the name of the mare, the date and the specific gravity. It can be stored frozen up to 1 year.

When low serum IgG concentrations are detected at 24 hours of age, intravenous plasma can be used to increase the foal's humoral immunity.

Plasma is the liquid phase of blood in which blood cells and platelets are suspended. Plasma consists of water, electrolytes and various proteins: albumins, coagulation factors and globulins including immunoglobulins which are responsible for the body's defense against infections.

*The commercially available plasma can be stored frozen for a year. The plasma is from universal donors (that lack antibodies that would react with the foal's red blood cells) and contains higher level of IgG than from a normal horse. An added advantage of the plasma is the ability to "hyper-immunize" it, which means that the donor horses are vaccinated to increase the proportion of specific antibodies in the plasma. The most popular is the plasma for prevention of *Rhodococcus equi*.*

The plasma harvesting from a local donor has the benefit of containing antibodies against locally important pathogens. There are 3 methods to obtain plasma: sedimentation, centrifugation and plasmapheresis.

The easiest method for plasma harvesting is sedimentation but it is also more labor intensive. Two to four liters of blood must be collected from the donor horse (preferably gelding, healthy, and vaccinated, without history of blood transfusion). This blood must stand for 5-8 hours allowing the red blood cells to settle out. The plasma must be siphoned in a sterile manner. It is difficult to collect the plasma without some red cell contamination which can cause adverse reaction. Red cell contamination could result in sensitizing the foal to certain blood types, which may cause a problem if the animal ever requires a blood transfusion at a later stage. If the foal is a filly and bred later in life it is possible that she could develop colostral immunoglobulins against her own foal's blood.

The most current and the safest method for plasma collection is plasmapheresis. The plasmapheresis is an automated system which involves collection of whole blood with extracorporeal filtration and re-infusion of the blood cells



Colostrum and plasma

as a source of passive immunity in foals



suspension.

The collection of plasma by the plasmapheresis involves sequential cycles of collection of the plasma and reinfusion of the red cell concentrate. The system automatically alternates between collection and reinfusion until the predetermined amount of plasma is collected. Compared to conventional whole blood collection automated plasmapheresis has an advantage of larger amount of plasma harvesting, in sterile manner without clinical side effect for donor horses and recipients.

Plasma transfusion

An intravenous catheter is placed in a foal for the administration of the plasma. Plasma should be infused through a filtered IV line in order to take out any fibrin, another component of blood. The rate of plasma administration is usually 1 liter per 45 min. The foal should be monitored for any side effects such as trembling and an increase in heart and breathing rate. The rate of plasma administration should be slowed down until these side effects stop. The amount of plasma needed depends on the initial level of immunoglobulins that the foal has and the quality of the plasma. Generally 1 liter of high quality plasma increases the IgG level in the foal blood approximately 2g/L. The antibodies concentration should be rechecked after transfusion to make sure that it reaches an adequate level >8g/L. If it is still low another dose of plasma should be administered.

Foals with septicemia usually require more than 1 liter of plasma. It appears that the immunoglobulins in these foals are used up more quickly in fighting the infection. It is important that the immunoglobulins are rechecked after 4-5 days. Additional plasma may need to be administered. Maternal antibodies has a half-life of 3-6 weeks, therefore, its concentration in the foal's blood gradually decreases and is almost undetectable by 5-6 months of age. As they disappear, the foal begins to make his own immunoglobulins. The foal reaches adult levels of immunoglobulins around 4 to 5 months of age.

It is important that horse owners that are interested in breeding be aware of the normal and abnormal conditions found in foals and mares in the post partum period. The early detection and treatment of FPT can prevent newborn foals from life threatening disease and decrease the cost of the treatment.

The plasma transfusion has been used as a prevention of FPT in the all foals at Al Khalediah Farm in 2008 with very good results. □

Info: Katarzyna Dembek DVM

E-mail: kasiad1pl@yahoo.com

Al Khalediah Equine Hospital - Saudi Arabia

"The author of this article is the Veterinary Surgeon at Al Khalediah Equine Hospital introducing plasmapheresis with positive results since 2007."