bowl and glomerular disease. Because albumin contributes 75 per cent of plasma colloidal osmotic pressure, hypoalbuminemia results in over hydration of the interstitium, edema, and exacerbates gastrointestinal (GI) fluid losses. Horses that have peripheral edema and a total plasma protein concentration of less than 4.0 gm per dl need plasma transfusion. Plasma protein concentrations of less than 3.0 gm per dl warrant plasma transfusion regardless of other signs.

When clotting factor replacement is the therapeutic goal, for example in warfarin toxicosis or disseminated intravascular coagulation, fresh or frozen plasma should be administered (6 to 10 ml per kg every 6 hours) until hemostatic data improves. Fresh plasma should be removed from RBC’s within 4 hours of collection, stored at 4° C, and administered in the first 24 hours. Fresh frozen plasma must be frozen to -18° C within 6 hours of collection and used within 1 year. Plasma that has been fully or partially thawed and refrozen should be considered devoid of clotting factors.

**UTERINE THERAPY WITH PLASMA**

One of the most promising treatments is the use of a mare’s own plasma as a uterine lavage. Many chronically infected mares may have lost the ability to eliminate contaminating organisms and infectious agents.

Plasma contains a large amount of various Ig’s and cellular immune components. The infusion of 500ml of the mare’s own plasma has shown some remarkable results in many infertile mares. The remaining concentrated RBC’s can be returned to the venous system.

**OVERVIEW OF EQUINE TRANSFUSION MEDICINE**

The need to transfuse blood or blood components often arises as an emergency, so the practitioner must be prepared to deliver the appropriate therapy. Separation of blood into cellular and plasma components facilitates specific replacement therapy. Currently whole blood and plasma are the most common transfused blood products in horses.

**BLOOD TRANSFUSION**

The total dose of blood necessary for transfusion can only be estimated. Blood volume of an adult horse is approximately 8% of body weight, thus a 500kg individual has 40L of blood. A decrease in PCV from 36% to 12% represents a loss of RBC of at least 27L of blood. A PCV of less than 12% is life threatening. Chronic anemia is better tolerated but a PCV of less than 10% always warrants transfusion.

Rejoining a loss of 27L would be impractical and inappropriate leading to volume overload. Replacing 20% to 40% of the deficit is generally adequate. The objective of a transfusion is merely a bridge to maintain oxygen-carrying capacity of blood for a few days so that bone marrow can respond. Between 7 and 10L of blood should be therapeutic in the examples given above and this volume can safely be taken from most adult horses. Up to 25% of an animal’s blood volume may be removed during one collection (10L in a 500kg horse) and this can be repeated in 30 days.

**BLOOD TYPE GROUPS**

At least 30 blood factors, such as erythrocyte antigens and alloantigens, have been identified in horses. These antigens have been grouped into seven blood systems by the International Society for Animal Blood Group Research: A,C,D,K,P,Q, and U. Based on the diversity of various antigenic combinations, there are approximately 400,000 possible equine blood types. Because an equine “universal donor” does not exist, a totally compatible blood transfusion is unlikely. In fact, a single transfusion of cross-matched blood results in alloantibody production in at least 50 per cent of recipients. These induced
alloantibodies can be of great consequence if a second transfusion is needed or if the recipient is a brood mare. Mares that receive transfusions should be tested for plasma alloantibodies in the last month of gestation to detect potential cases of neonatal isoerythrolysis, especially if the mare is negative for Aa or Qa.

Potential blood and plasma donors can be identified within a practice area before the need for these products arises. Donors should be healthy, vaccinated and negative for equine infectious anemia. The serum of potential donors should be screened for alloantibodies and their alloantigens should be characterized. Mares that have foaled and horses that have received blood or RBC contaminated plasma transfusions in the past are excluded as potential blood donors. Because alloantigens Aa and Qa are extremely immunogenic, Aa and Qa negative donors that are free of plasma alloantibodies are the best choices for blood donors to recipients of unknown blood type. Due to the high prevalence of these alloantigens, Aa and Qa negative donors are difficult to find among breeds of light horses. The risks associated with an initial transfusion of whole blood are minimal. If blood types are unknown, a donor that is genetically similar to the recipient is a natural choice, because RBC alloantigen patterns are generally homologous within light horse breeds, such as Thoroughbreds.

BLOOD COLLECTION

Strict asepsis should be observed during the collection, separation, and administration of blood. An area over the donor’s jugular vein should be clipped and prepared with three alternating povidone-iodine and alcohol scrubs prior to venipuncture. Blood should be collected via a large-gauge indwelling catheter or non-disposable needle and drawn into a receptacle held below the level of the donor’s heart. During collection, the blood container can be gently rocked to ensure adequate mixing with the anticoagulant. Plastic blood collection bags are superior to glass collection containers because they do not activate platelets or clotting factors, are less subject to breakage, and are less likely to induce RBC damage. Because 1 liter of blood weighs approximately 1 kg (2.21 lb) the collection bag can be weighed during and after collection to estimate the volume of blood obtained. (A 4 liter bag, J-520F, is available from JorVet.)

Acid-citrate-dextrose (ACD) and sodium citrate are the best anticoagulants for therapeutic blood products. Citrate prevents blood clotting through calcium binding, thereby inhibiting calcium-dependent steps in coagulation. Sodium citrate solution is used primarily for the collection and storage of plasma. The dextrose in ACD provides an energy substrate for RBC glycolysis, so ACD is preferred for transfusion of whole blood or RBC’s. Fifteen mls of ACD are needed for every 100 mls of collected blood, and 10 mls of sodium citrate is used for every 90 mls of blood.

Although evacuated bottles containing the appropriate volume of anticoagulant are commercially available their capacity is only 500 mls. This makes them cost prohibitive for equine use.

Concentrated RBC’s are appropriate therapy in many cases. This will help reduce the chances of volume overload. Equine RBC’s will settle out from plasma in 1 to 2 hours. The RBC’s can be removed by gravity flow or other techniques such as the use of transfer blood bags. (JorVet J-520TD 1 liter transfer bag.)

PLASMA THERAPY

The administration of maternal RBC’s can be a life-sustaining measure for foals with neonatal isoerythrolysis. One or more washings of the RBC’s in normal (0.9 per cent) saline is recommended in order to remove residual plasma erythrocyte antibodies (alloantibodies). Human hospitals and blood banks will often provide these services to veterinarians on an emergency basis, but inquiries should be made to these facilities prior to need.

Failure of passive transfer in foals over 24 hours of age is the most common indication for plasma transfusion. Since foals are agammaglobulinemic at birth, those that fail to absorb sufficient colostral immunoglobulins are at risk of developing sepsis. Recent studies indicate that most normal foals have serum IgG concentrations in excess of 800 mg per dl. Concentrations of IgG below 900 mg per dl are insufficient in foals with other risk factors for the development of sepsis. Healthy foals with IgG concentrations between 400 and 800 mg per dl that are raised in clean, relatively stress-free environments may not require plasma transfusion. As a general rule, foals with complete failure of passive transfer need 2 to 4 liters of intravenous (IV) plasma over a 2-to-4 day period. The volume of plasma needed depends on the size of the foal, the degree of hypogammaglobulinemia, the IgG content of the infused plasma, and the health of the foal. One 900 ml bag of plasma (containing 1.0 gm per dl IgG or more) should provide at least 9 gm IgG. Because of individual foal variation in disposition of infused IgG and varying IgG concentrations in the infused plasma, the foal’s IgG concentration should be rechecked within 24 hours, and further transfusion performed if necessary. The monitoring of serum IgG is especially critical in septic foals, because degradation and utilization of IgG are accelerated in these patients.

Acquired hypoaublinemia in horses is another indication for plasma therapy. Significant losses of protein, especially albumin, often accompany inflammatory