



## Transfusion Therapy

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Garden State Veterinary Specialists is a distribution center for the Eastern Veterinary Blood Bank. This is a privately owned blood bank located in Maryland. They are the only FDA inspected veterinary blood bank as well as the only blood bank that uses licensed veterinarians exclusively to draw blood and examine each animal before donation. Their donors are 100% healthy volunteers who are screened closely for infectious diseases.

GSVS stocks canine packed red blood cells, fresh frozen plasma, and cryoprecipitate for distribution to area practices. Our emergency staff is always ready to discuss your transfusion needs and to help you choose a blood component that is right for your patient.

Component transfusion therapy, rather than whole blood administration, is the preferred approach for transfusions in our patients. Component therapy enables us to tailor the blood product to the problem it is being used for, eliminate waste of valuable banked blood, and prevent volume overload in our smaller patients.

**Packed red blood cells (PRBCs)** are often the first line of defense for the majority of our patients requiring "blood". If increased oxygen carrying capacity in a fairly euvoletic patient is your goal, PRBCs are the blood product for you. Using PRBCs rather than whole blood focuses therapy for an anemic patient where it needs to be, and delivers more red cells per ml than you would get from whole blood. A simple dosing formula for PRBCs is as follows:

10 mls/kg of PRBCs will raise the PCV by 10%  
(i.e., 1 ml/kg will raise the PCV by 1%)

To compare, it takes 20 mls/kg of **fresh whole blood (FWB)** to raise the PCV 10%. PRBC transfusions are a much more efficient way to raise a patient's PCV. Theoretically, the risk of transfusion reaction may be minimized, since there are fewer novel proteins to which the patient can mount a response.

Indications for PRBC transfusions include a clinically symptomatic anemia from blood loss, increased destruction, or decreased production of red cells. PRBCs are prepared by centrifuging whole blood. The red blood cells are forced to the bottom of the bag, and the plasma is placed in a separate bag. Preservative solution is added to the PRBCs to extend their shelf life. PRBCs must be given through a filter. Remember that calcium-containing fluids (i.e., LRS) will coagulate blood components. If patients are on LRS prior to transfusion, the line must be flushed with 0.9% saline.



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**Fresh Frozen Plasma (FFP):** Fresh frozen plasma is plasma that has been separated from the red blood cells and frozen within 8 hours of collection. It has a shelf-life of one year. After one year, it is considered frozen plasma. FFP contains all the clotting factors and plasma proteins. It does not contain platelets (these are removed along with the red blood cells during processing).

FFP is generally used to provide clotting factors to an animal that has a coagulopathy such as rodenticide ingestion, liver failure, or DIC. It is a poor choice of fluid to treat hypoalbuminemia because the amount of plasma needed to raise a patient's albumin level is significant. To raise a patient's albumin level by 1 gm/dl would take approximately 25 mls/kg of plasma. If you need colloid support, a synthetic colloid such as hetastarch should be considered.

The dose of FFP depends on the underlying disease process. It is usually around 6-10 mls/kg. FFP is usually given over 3-4 hours.

**Frozen Plasma (FP):** With time (or if there was a delay in processing the sample) the labile clotting factors decrease and FFP becomes Frozen Plasma (FP). FP has decreased levels of VIII, V, von Willebrand's factor, antithrombin, and fibrinogen. FP still contains adequate levels of factors II, VII, IX and X so it can be a useful product in treating anticoagulant rodenticide intoxication.

**Cryoprecipitate:** Cryoprecipitate is produced from fresh frozen plasma. It contains concentrated amounts of von Willebrand's factor, fibrinogen, fibronectin, and factors VIII:C and XIII. It is used to treat patients who are deficient in these factors such as patients with von Willebrand's disease or Hemophilia A. The dose of cryoprecipitate is one unit per 10 kgs body weight.

*Administration of Fresh Frozen Plasma, Frozen Plasma and Cryoprecipitate*

Plasma should be placed in an incubator or warm water bath with a temperature no higher than 37° C (99° F). If using a bath, protect the entry ports from moisture by wrapping the unit in plastic (we use a plastic bag). Warmer temperatures will destroy or precipitate clotting factors. Do not remove plasma from the carton until thawed.

All blood products should be infused through blood administration filters to remove microprecipitates. When transfusing very small animals or neonates, an in-line filter connected to a conventional IV extension set may be used to avoid wasting blood products in the line.

We generally start slowly and increase the rate if the patient does not have reactions. You should not exceed 4 hours in giving blood products. If you are using a fluid pump to deliver the plasma, check with the manufacturer to make sure the pump is OK to use.

**Blood typing:** Risks of reactions to blood products are decreased by appropriate blood typing and cross-matching. Because red blood cell agglutination is the end point of blood typing and cross-matching, an animal that has autoagglutination cannot be cross-matched or typed. To check for autoagglutination, mix one drop of blood with one drop of saline on a glass slide. Check for gross agglutination as well as microscopic agglutination. Red blood cells that are agglutinating appear clumped together (like grapes). Red blood cells that have rouleaux formation appear stacked (like plates).

*Cats:* Cats MUST be typed or cross-matched prior to a transfusion. Cats have two major blood groups – A and B. Cats with type AB and type MiK antigens have been described. Cats have pre-formed antibodies to blood groups other than their own. This means that cats who are given blood products of the wrong type are at high risk for having a reaction to the transfusion. Amounts as small as 1 ml can cause a reaction. These reactions include hemolysis, shock and even death.

*Dogs:* Dogs have several blood groups. The major reactive one is Dog Erythrocyte Antigen (DEA) 1.1. Dogs do not have pre-formed antibodies and are generally able to tolerate an unmatched transfusion once. However, giving a DEA 1.1 negative dog blood that is DEA 1.1 positive, sets that dog up for reactions to DEA 1.1 positive blood in the future.

**Cross-matching:** This is a method to determine if donor blood is compatible with the recipient. Blood-typing helps increase the chance that blood is compatible, but dogs have several blood groups. Giving a DEA 1.1 positive dog blood that is positive for DEA 1.1 may still incite a reaction. A major cross-match is performed by mixing washed red blood cells from the donor with the plasma of the recipient. Cells are washed by suspending them in a buffered saline solution then centrifuging for 30 seconds. The supernatant is removed and the cells are resuspended. This procedure is performed 3 times. An equal volume of the donor red cell suspension and the recipient plasma is placed in a clean, glass tube. The cell/plasma mixture is incubated for 15 minutes then inspected for agglutination. The sample should be examined under the microscope as

well as grossly examined. A minor cross-match is performed by mixing washed red blood cells from the recipient with plasma from the donor. For complete directions on cross-matching, please contact GSVS.

**Transfusion Reactions:** With any transfusion, patients should be closely monitored for transfusion reactions. Screening of blood donors, blood typing, and cross-matching all decrease the chance of a transfusion reaction. However, it is not possible to 100% guarantee a disease-free product and reactions could occur. Immunologic, nonimmunologic, acute, and delayed transfusion reactions may occur. Clinical signs of immunologic and acute reactions include hemolysis, urticaria, anaphylaxis, hyperthermia, swelling or hyperemia of the face, scratching at the face, tachycardia, and tachypnea or vomiting. If these signs occur, the transfusion may either be slowed or stopped. Treatment for an allergic reaction is usually given. Management of individual transfusion reactions may vary, and generally depends on how important the transfusion is for the patient, considering both risks and benefits of continuing.

## Diagnosis and Treatment of Ocular Emergencies



**Petra A. Lackner, DVM  
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and "Denny"**

One of the most common presenting complaints is a "red and painful eye". This can be caused by a relatively minor disorder or could be the sentinel

for a vision-threatening process. It can be extremely challenging to differentiate the various diseases that might be associated with a red eye. The following steps describe a useful general routine to follow in the diagnosis of most ocular problems.

- Does the globe appear to be in a normal position/is the direction of gaze normal/is the size of the globe normal (compared to other eye)?
- Can the patient close the lids? Palpebral Reflex?
- Note presence and character of ocular discharge
- Are a menace response and direct and consensual

Nonimmunologic reactions include hypocalcemia (from citrate toxicity), sepsis, and volume overload. Clinical signs can include fever, tremors, seizures, dyspnea, tachycardia, and vomiting. Nonimmunologic reactions include transmission of infectious diseases. If there is concern for a nonimmunologic reaction, the transfusion should be stopped.

Delayed transfusion reactions can occur with red blood cell transfusions and generally manifest as hemolysis. This may occur anywhere between 3-7 days post-transfusion.

Temperature, pulse rate, respiratory rate and effort as well as overall patient comfort should be monitored during a transfusion. At GSVS, we use a transfusion monitoring form with each transfusion. We would be happy to provide you with a copy.

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**GSVS is a regional distribution center for the Eastern Veterinary Blood Bank.**

pupillary light reflexes present?

- It is helpful to turn off the light and to use a focal light source (Finoff transilluminator/Otoscope/ 0 diopter setting on direct ophthalmoscope)
- Are the conjunctival and/or the scleral vasculature injected?
- Is corneal edema present? Corneal vascularization (deep/superficial), corneal infiltrates, corneal pigmentation, fibrin plug?
- Is the anterior chamber formed? (use slit on direct ophthalmoscope)
- Presence of absence of aqueous flare/hyphema/hypopyon/foreign body
- Clarity of lens
- Appearance of fundus (use focal light source and an indirect lens or direct ophthalmoscope at red 2-4 setting)

- Appearance of optic nerve
- Schirmer Tear test (in red, uncomfortable eyes without obvious epiphora)
- Fluorescein stain
- Intraocular pressure measurement

### **Glaucoma (acute vs chronic, primary vs secondary)**

The acute form of this disease is often missed if only one eye is affected since the patient's vision will be minimally compromised. A typical presentation is an acutely blind animal with a chronic glaucoma in one eye and acute glaucoma in the fellow eye.

Chronic glaucoma can be recognized by the presence of buphthalmos, lens subluxation, variable corneal edema, corneal striae, a cupped and/or demyelinated (dark) optic nerve, a hyperreflective retina and, in rare cases, retinal detachment. Buphthalmos as a rule precludes the possibility of regaining vision, unless the patient is a puppy, a cat, a Chow Chow or a Shar Pei. The patient may have a history of having intermittent vision problems. This can be characteristic of pressure spikes which gradually completely destroy the optic nerve and result in blindness. Glaucoma itself is a disease of the optic nerve. In general, cats do not develop acute glaucoma. The most common cause for glaucoma in the cat is chronic uveitis.



drainage of aqueous humor (uveitis, neoplasia, sequelae to trauma).

### **Treatment of acute glaucoma:**

#### ***If IOP>40 mm Hg***

- Mannitol – 0.5 g/lb IV over 20 minutes (this can be a large volume), withhold water for 4 hours and re-introduce gradually; check IOP 1-2 hours later; this can be repeated once
- Oral Carbonic Anhydrase Inhibitor (Methazolamide=Neptazene) 2.5 mg/kg po TID X 24h, then BID

- Topical Carbonic Anhydrase Inhibitor (Trusopt 2%, Azopt 1%)-1 drop TID
- Topical beta-blocker (Timoptic 0.5%)-1 drop BID
- Topical Anti-inflammatory (Econopred 1%, if fluorescein negative)-1 drop QID
- Topical Prostaglandin Analog (Xalatan 0.005%) 1 drop QD. This causes extreme miosis. Xalatan can dramatically lower IOP in some cases of primary glaucoma used as a single agent
- Oral prednisone (anti-inflammatory dose)

#### ***If IOP < 40 mm Hg:***

As above, but skip Mannitol; check IOP in 2 hours, if no change, use Mannitol at that time.

In order to achieve control of intraocular pressure and to maintain vision, cyclophotoablation is recommended (Laser surgery). Depending on the case, placement of a shunt may need to be considered.



### **Treatment of chronic glaucoma**

Methazolamide 2.5 mg/kg po BID  
Trusopt 2% TID  
Timoptic 0.5% BID

Chronic glaucoma is best treated surgically, unless the eye is comfortable and the pressure is in the normal range (15-25 mm Hg). Surgical options include enucleation, evisceration with placement of an intrascleral prosthesis or an intravitreal Vistide injection. It is important for the owner to realize that, even though their pet cannot see, glaucoma can still be very painful (like a chronic migraine) and therefore needs to be treated.

### **Secondary glaucoma:**

This most often is secondary to anterior uveitis causing blockage of the iridocorneal angle with cellular debris and/or obstruction of aqueous flow to the angle by forming peripheral anterior synechiae between the iris and the cornea.

In uveitis, the iris surface becomes very "sticky" due to the formation of pre-iridal-fibrovascular membranes (PIFM's). The iris therefore can form anterior (PAS) or posterior synechiae. While the anterior synechiae obstruct flow from the anterior chamber to the ciliary cleft,

posterior synechiae limit flow of aqueous humor from the posterior to the anterior chamber. If posterior synechiae are present 360 degrees around the pupillary margin, iris bombé will result.

Outflow of aqueous can also be limited by hyphema and ocular neoplasia. Most cases of secondary uveitis are difficult to manage medically; if outflow is completely obstructed, surgical management is indicated.

As a general rule, 75% of all glaucoma patients with chronic glaucoma will eventually require surgical management of their disease.

A relatively common cause of glaucoma in the Terrier breeds is an anterior lens luxation. This is a primary disease condition in these dogs. The prognosis for vision can be quite good as long as the luxation is recognized early. An intracapsular lens extraction is the treatment of choice.



### 2. Corneal laceration/perforation +/- lens capsule rupture

This is another common emergency. The classic history involves some form of "cat claw vs. dog eye" encounter. The curve of the claw can result in relatively minor corneal damage with significant injury to the lens. Any sharp trauma needs to be evaluated for potential damage to the lens. If there is a full-thickness defect in the cornea, it is important to note whether or not the anterior chamber is formed and whether there is active leakage of aqueous humor.

**Anterior lens luxation**



**Melting Corneal Ulcer**

- No ointments -they will cause severe uveitis if they get into the anterior chamber
- E-collar & cage rest
- No neck leads
- Fluoroquinilone antibiotic drops q 2 h
- Atropine drops TID-QID
- Systemic antibiotics
- Systemic anti-inflammatories
- Systemic anti-inflammatories
- Refer for surgical management (repair corneal laceration +/- phacofragmentation)

### 3. Corneal ulcer/melting ulcer/descemetocoele

A thorough history is important. A defect in the cornea should heal within a few days; if this does not occur, there has to be an underlying cause for example: foreign body, KCS, basement membrane disease, trichiasis/distichiasis/ectopic cilium, lagophthalmos, infection, systemic disease, concurrent topical steroid treatment.

When a fluorescein stain reveals an epithelial defect, the following need to be assessed:

- Size and depth of ulcer
- Presence of vascularization and length of vessels/superficial vs. deep
- Presence of infiltrates
- Ocular discharge
- Ocular pain (blepharospasm)
- Pupil size (reflex uveitis)
- Vision



**Descemetocoele**

Application of a topical anesthetic will often make examination of these eyes easier; however, these anesthetics are also toxic to the epithelium, so only use them sparingly and never therapeutically.

If a descemetocoele is present, there will be a central clear area without stain uptake surrounded by a "donut" of fluorescein stain. There often will *not* be a "bulging forward" of Descemet's membrane. Surgical repair will involve the placement of a rotating conjunctival pedicle graft. If the descemetocoele is less than 2-3 mm in diameter, a primary closure may be possible. If surgery is not an option, intensive medical management is the next choice. Treatment at home would be as in the hospital with a follow-up visit recommended in 1-2 days.

A melting corneal ulcer can be recognized by a gelatinous corneal consistency around the ulcer and severe corneal edema. Aggressive medical management is the key to initial treatment for these ulcers. These ulcers can melt away the entire cornea and can result in loss of the eye within 24 hours. It is recommended to "pre-treat" them with antibiotics prior to surgery (conjunctival graft), since there often is very little "normal" cornea to suture to when these patients first present to the hospital.

A deep stromal corneal ulcer can be treated on outpatient basis as long as it does not appear to be infected and is not an impending descemetocoele.

- Topical broad-spectrum antibiotic QID
- Atropine BID-TID to achieve mydriasis (as long as glaucoma is not suspected)
- E-collar
- Systemic NSAID



**Proptosis**

### 4. Proptosis

This is a common emergency especially in brachycephalic breeds after various types of trauma. Often some form of neck restraint/injury is involved or they can occur in association with general head trauma. The following are signs which would, in my opinion, preclude replacement of the globe and leave enucleation as the only viable option:

- Rupture of 3 or more extraocular muscles
  - Scleral rupture/severe compromise to the integrity of the globe
  - Complete avulsion of the optic nerve
- I would replace the globe, but give an unfavorable prognosis for vision in these situations:
- Mydriasis/unresponsive pupil
  - Chronicity
  - Hyphema

In general, it is rare for these patients to regain vision; usually the result will be a non-painful, cosmetic globe as a "best case" scenario. A lateral strabismus will likely be present due to avulsion of the medial rectus muscle.

The goal in replacement of the globe is to draw the lids over the eye rather than to push it into orbit-the orbit will likely be filled with a hematoma-a lateral canthotomy will help with this.

Moisturize the cornea and put Atropine ointment and a broad-spectrum antibiotic ointment onto the cornea prior to "closure" (see below).

Clip and clean area around eye->copious irrigation with saline->remove all debris and hair (if the hair around the eye is very long and the proptosis is not severe, the lids can be pulled over the globe using the hair as a "handle".)

Use 3-0 or 4-0 nylon suture over plastic stents (IV extension tubing works well) in a horizontal mattress pattern; ensure that the upper lid is penetrated 3 mm or so away from the margin and then emerge at the grey line (where the Meibomian gland openings are) of the lid margin. Repeat the procedure with the lower lid.

In general, 2-3 stents are sufficient. Never penetrate the palpebral conjunctiva, since this will result in suture contacting the cornea causing ulceration. I do not leave an opening near the medial canthus for topical medications, since these patients are often painful around the head that medicating them is often impossible. Instead, I would recommend a systemic antibiotic and analgesic.

Also: E-collar; recheck in 7-10 days for suture removal



### Referral Policy

Patients treated at Garden State Veterinary Specialists must be referred by their veterinarian. The patient will only be treated for the condition for which they were referred, no routine procedures (i.e., vaccinations, prophylactic heart-worm testing) are performed on any patients of the hospital.

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