



PLATELET RICH PLASMA

Its Place in Cranial Cruciate Ligament Repair

Ashkan Hakhamian, DVM, and Alan J. Schulman, DVM, Diplomate ACVS



Over the last few years, a variety of adjunct therapies have become more common in veterinary medicine.

The drive for these treatments stems from:

- Medical professionals seeking *more advanced* therapies for their patients
- Pet owners seeking *additional* therapies for classically “single treatment” diseases or conditions.

With the advancement and acceptance of adjunct therapies, such as acupuncture, stem cell therapy, platelet rich plasma (PRP) therapy, and various other

modalities, both practitioners and owners must decide which ones are most beneficial for their patients and pets, respectively.

For cranial cruciate ligament ruptures (CCLR) in small animal patients, the sole therapy has always been surgery. However, in our experience, we believe the use of PRP therapy is a potentially beneficial adjunct treatment to surgery. This article illustrates both the clinical benefits as well as limitations of therapeutic PRP use in patients with CCLR.

CONVENTIONAL TREATMENT

The usual protocol for initial therapy for muscle, ligament, and tendon injuries, including CCL tears, includes treating the injury with:

- **Rest, ice, compression, and elevation:** This combination prevents further injury and reduces pain, inflammation, and swelling, which en-

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courages healing. *These modalities conservatively treat the inflammation and subsequent pain, but do not result in repair of a tendon or ligament.*

- **Surgery—tibial tuberosity advancement (TTA), tibial plateau leveling osteotomy (TPLO), lateral suture, etc:** Countless articles discuss the proposed pathophysiology and biomechanical causation behind acute CCL injuries in dogs and cats.
 - » Proposed theories include steep tibial plateau angles, abnormal patellar tendon angles, abnormal immune responses, and genetic or breed predispositions
 - » *Since the majority of these theories rely on joint physics and mechanics, surgery to correct physical derangements within the stifle joint is considered decisive treatment for CCLR.*
- **Medications:** Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used to manage pain and inflammation prior to and after surgery.
- **Physical therapy:** Physical therapy is usually implemented when the acute stage of injury has subsided, typically after surgery.



Read **Early Rehabilitation: Modalities and Exercises**

(*Today's Veterinary Practice*, September/October 2012), available at todaysveterinarypractice.com, for specific information regarding physical therapy for CCLR postsurgical care.



INFLAMMATORY & HEALING PROCESS

Platelets play two important functions in addition to assisting with blood clotting after injury; they:

1. Bring white blood cells (WBCs) to the injured area to clean up the remains of dead and injured cells.
2. Release growth factors that are directly responsible for tissue regeneration.

When tissue is injured, the inflammatory response is triggered. This response stops the spread of infection and clears away damaged tissue. The inflammatory cytokines released in acute CCLR eventually lead to chemotactic recruitment of various healing cells, including platelets. However, tissue healing cannot take place until the inflammation process begins to subside. The fact that platelets play a role in both of these processes forms the rationale behind PRP treatment.

Platelets release growth factors and bioactive proteins that assist with tissue regeneration as well as inhibit the proinflammatory cytokines that are detrimental to the early stages of healing. It is for these reasons that PRP treatment has been promoted for tendon, ligament, muscle, and joint injuries, which are known to be slow to heal.

PLATELET RICH PLASMA THERAPY

PRP is defined as an autologous superconcentrate of platelets used to accelerate healing in injured live tissues; the superconcentrate platelet count is greater than the patient's whole blood platelet count.

This platelet-rich derivative of blood is obtained after a blood sample is withdrawn from a patient's vein, spun down in a special centrifuge, and separated from the other blood constituents after centrifugation with a specialized, multi-compartmentalized syringe. The red blood cells and WBCs are essentially removed, leaving the platelet-rich portion of the plasma.

Plasma containing this concentrated level of platelets provides an abundance of the previously mentioned growth factors, which can help stimulate the healing process. When PRP is injected into damaged tendons or ligaments, it is believed that the PRP stimulates cells in the tissue—along with new cells circulating in the blood—to bring even more new cells to the injured site.

Therefore, growth factors derived from platelets most likely:

- Initiate connective tissue healing and bone regeneration/repair
- Promote development of new blood vessels
- Generally stimulate the wound healing process by accelerating epithelial and epidermal regeneration.

Because the patient's own blood is used to make PRP—this is known as an autologous process—there is no risk of the treatment being rejected, as it might if the blood had been provided by a donor.

PRP THERAPY FOR CCL TEARS

Because surgical repair of CCLRs is needed to correct *physical* derangements within the stifle joint, it is our opinion that PRP therapy is *currently* not a viable sole option for ruptured ligaments, either partial or full. We believe PRP's therapeutic usefulness includes:

- Treatment of secondary inflammation, both from acute trauma to the ligament as well as in the post-operative period
- Promotion of tissue regeneration and repair.

We have treated a number of partial CCL tears with PRP alone as the sole method of therapy. While the ligaments initially seemed to heal and the dogs returned to good to excellent function, this success was short lived and lameness invariably returned.

PRP THERAPY: PUTTING IT IN PERSPECTIVE

Platelet-rich plasma (PRP) therapy certainly sounds as though it could be an exciting and readily available adjunct to treatment of many common musculoskeletal conditions of companion animals. When we review the theory and recognize that PRP is made in-house, using blood acquired from the patient itself, we ask ourselves: Could this be a safe, inexpensive, and effective treatment that any of us could apply?



Current Literature

While we respect and value the opinion of these authors and others who describe good outcomes with this therapy, we must remember that these accounts are anecdotal. There are a few encouraging reports regarding PRP therapy in small groups of research dogs with acutely-induced injuries to healthy ligaments and short-term (weeks) follow-up.¹ However, there is, as yet, no evidence-based clinical data in canine patients that has evaluated the use or efficacy of PRP therapy.

What about other species? This treatment has become popular in horses with ligament and tendon injuries, but to date the few published studies include only small numbers of animals (7, 9, or 13 horses) and no control groups.^{2,3,4} In humans, more data are available, but recent analysis suggests that adjunct therapy with PRP does not confer significant improvement in clinical outcomes over standard ACL reconstruction procedures.^{5,6,7}

Further Studies

With regard to application of PRP therapy, several steps of the process require additional study, including:

- **Preparation:** Volume of blood used, specific platelet separation instruments and techniques, and use of platelet activators
- **Administration:** Injection location, timing, and dose
- **Patient:** Breed and size, phase of injury (ie, acute traumatic injury versus chronic rupture outcomes), and concurrent disease (eg, obesity, hyperadrenocorticism) considerations
- **Outcome measures:** Duration and type (MRI, clinical scores) of follow-up and documentation of any adverse events.

Final Assessment

The risks of PRP therapy appear to be relatively low in dogs with CCL injuries, but preparation of PRP involves attention to detail and special equipment. Good prospective studies comparing injuries treated with and without PRP are needed to determine whether it significantly changes clinical outcomes in humans, horses, and small animal patients.

*Lesley G. King, MVB, Diplomate ACVECC, ACVIM (Small Animal Internal Medicine),
& ECVIM (Companion Animal)*
Editor in Chief

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Without surgical correction of the underlying conformational defect, PRP alone was unable to provide successful long-term treatment of the injured CCL.

In our practice, the use of PRP has been directed toward Achilles tendon injuries; cruciate ligament injuries; complicated fractures and delayed bone healing; and degenerative joint disease of the shoulder, elbow, hip, knee, and ankle.

- The number of injections performed depends upon the severity and type of condition being treated.
- Our protocol is to extract 15 mLs whole blood from the patient, which yields 3 to 5 mLs of PRP after centrifugation and careful extraction.
- Depending on patient size, all or part of the PRP is injected within the affected area, with caution taken to avoid overwhelming the joint and causing postoperative discomfort and swelling.

Depending upon the condition being treated, the patient may require a local anesthetic or sedation for administration of PRP. Using our protocol, PRP is administered as an intra-articular injection immediately following surgery for CCLRs and similar ailments, which results in limited additional invasiveness for the patient and minimal added cost to the client.

The use of NSAIDs is not recommended during PRP therapy as they may diminish the success of the procedure by interfering with the initial inflammatory reaction induced by the platelets.

Abundant research is still required regarding use of PRP therapy for CCLRs.

- For example, whether it makes a difference to administer PRP intra-articularly, within the infrapatellar fat pad, into collateral ligaments, or into the injured ligament's insertion site remains to be elucidated.
- In addition, the dose of PRP is yet to be fully studied. It is difficult to compare studies when different numbers of platelets are administered and different PRP preparation techniques are used.

IN SUMMARY

While PRP therapy offers a promising solution to accelerate the healing of bone, muscle, tendon, ligament, and joint conditions, there is no one standard protocol. Patients with CCL injuries should still be

treated surgically, with PRP considered an adjunct therapy. PRP injections may be combined with a physical therapy program, acupuncture, and/or class IV laser therapy to enhance the success of surgical treatment.

It is our subjective impression that patients that receive postoperative PRP injections have significantly less evidence of long-term osteoarthritis. This is our assessment after tracking lameness scores during follow-up examinations as well as radiographically monitoring osteoarthritic changes years after surgery. However, more objective studies are ongoing in our hospital. ■

CCL = cranial cruciate ligament; CCLR = cranial cruciate ligament rupture; NSAID = nonsteroidal anti-inflammatory drug; PRP = platelet rich plasma; TPLO = tibial plateau leveling osteotomy; TTA = tibial tuberosity advancement; WBC = white blood cell



Ashkan Hakhamian, DVM, is a specialty trained emergency/critical care clinician and a small animal surgery resident at Animal Medical Center of Southern California. His clinical interests include emergency surgery, vehic-

ular trauma, snake bites, causes of vomiting, and rare small animal diseases. Prior to pursuing his DVM from Colorado State University, he performed undergraduate research in the UCLA Cardiology Department. After graduation from Colorado State, Dr. Hakhamian pursued several years of advanced training in small animal emergency medicine, internal medicine, and surgery at veterinary specialty centers in New York and Arizona.



Alan J. Schulman, DVM, Diplomate ACVS, is the owner of Animal Medical Center of Southern California. His surgical specialties lie in orthopedic, neurologic, and reconstructive surgery, but he performs a broad

spectrum of thoracic, cardiovascular, and soft tissue surgery for his general practice and referral clients. Dr. Schulman has authored numerous journal articles and textbook chapters and lectures locally, nationally, and internationally. He received his DVM from Cornell University and completed his internship and surgical residency in Los Angeles.