

Case Report

Case Report: Platelet Rich Plasma Injection Used as Treatment of High-Grade Partial Pectoralis Muscle Tear in Division I Football Player

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Abstract

This case report describes a collegiate football player diagnosed with a high-grade partial pectoralis major tear, patient outcome after non-operative management using platelet-rich plasma injections, and a detailed description of the rehabilitation program used in this case. The purpose of this article is to describe a newer option for the management of this injury and give context to clinical decision-making in this setting.

Keywords: Pectoralis Major Partial Tear; Platelet-Rich Plasma (PRP); Eccentric Strengthening

Introduction

Pectoralis Major (PM) full thickness ruptures are relatively uncommon, but now total over 200 cases reported with well over half of these reported after the year 2000 [1-3]. Over 50% of complete PM ruptures are related to weightlifting; in particular, the eccentric load of bench press, incline press or chest flies [3,4]. The evidence for surgical repair of full-thickness tears of the PM is convincing, even for delayed repair [3-6]. Carek et al. (1998) reviewed the existing literature and suggested surgical intervention for pectoralis ruptures in high level athletes. Zeman reported five patients with complete PM ruptures treated nonsurgically were left with strength deficits significantly limiting their athletic activity [7].

In comparison, there is not extensive depth in the medical literature regarding the treatment of high grade partial PM tears in high-level athletes. Non-operative treatment has been advocated for partial tears [3]. There is one article from 1990 detailing the outcome of 3 cases of partial rupture treated non-operatively, all three returned to full function but this was at 4-7 years post injury [8]. Using PubMed and SportDiscus database searches with various combinations of keywords “partial”, “pectoralis”, “major”, “tear” and no results were found in the last 20 years detailing functional return of high-grade partial pectoralis major tears within one year.

Anatomy

The fan-shaped pectoralis major is an adductor, internal rotator and flexor of the arm. It has two divisions: superiorly, the clavicular head originating from the medial clavicle; and inferiorly, the sternal head originating from the distal sternum, first 6 ribs and the aponeurosis of the external oblique muscle. The PM tendon inserts on the lateral lip of the bicipital groove of the proximal humerus. The PM also has muscle fibers of different lengths, unusual in the human body. In a detailed functional analysis, Wolfe et al. describe the mechanical disadvantage of the inferior sternal head portion when the humerus is in extension during bench press. They posit that disadvantage as an explanation for the majority of pectoralis injuries occurring during bench press [9].

Platelet-Rich Plasma

Platelet-rich plasma (PRP) has been in use for several decades, with recent literature supporting its use in treatment of lateral epicondylitis [10], patellar tendinopathy [11], hamstring injury [12] to name just a few musculoskeletal problems. Multiple systems with different protocols for obtaining the platelet-rich plasma fraction exist, but a common definition for PRP is increased platelet concentration (usually 5-6x) over patient baseline. PRP is typically prepared in 3 steps: obtaining blood by peripheral blood

draw, centrifugation in a manner that separates plasma leading to a platelet-rich fraction, and finally injection of the PRP. There are a number of variables in the preparation of PRP such as number and timing of centrifugation cycles, debate about the benefits of including leucocytes and erythrocytes, and whether activation of platelets using bovine thrombin or calcium is used.

Case History, Exam and Imaging

A National Collegiate Athletic Association Division I offensive lineman presented 5 hours after experiencing acute pain while bench pressing during pre-season workouts. The patient was lowering the bar after a maximal load (his personal best) when he felt a painful pop in his left nondominant chest and anterior shoulder. He denied numbness or tingling of his left upper extremity. He reported no other symptoms. He had no history of prior left upper extremity or chest wall injury.

Initial examination revealed a visual deformity of the left anterior axilla with loss of symmetric contour. There was a palpable defect of the pectoralis major tendon, with the maximal area of tenderness at this defect. His left shoulder range of motion was significantly restricted due to pain. He had pain with active adduction of the humerus against light manual resistance. His distal neurovascular status was normal. Ecchymoses along the chest wall and tracking down the bicipital region were subtle on first examination but obvious by 1 week, although extensive tattooing did somewhat obscure the extent of ecchymoses. The patient was placed in a shoulder sling for comfort after initial evaluation.

Plain radiographs the day of injury revealed no acute bony changes. A small ossification was noted inferior to the glenoid and was likely from remote injury. An MRI later that day (approximately 12 hours after injury) showed a high-grade sternal head pectoralis major tear at the musculotendinous junction [Figures 1-2]. A musculoskeletal radiologist estimated an 80% tear, commenting on visible inferior sternal head fibers only. 2.5cm retraction of the sternal head of the PM was noted. The tendon itself was observed to be intact. A low-grade intramuscular tear of the clavicular head was also noted. Ultrasound performed 1 week later

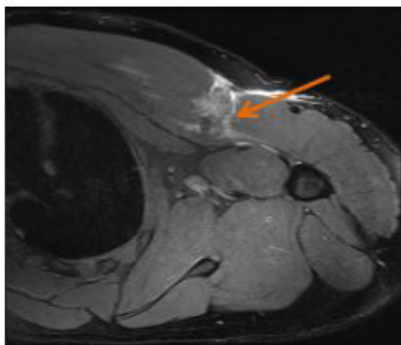


Figure 1: Axial MRI showing pectoralis tear.



Figure 2: Coronal MRI showing pectoralis tear.

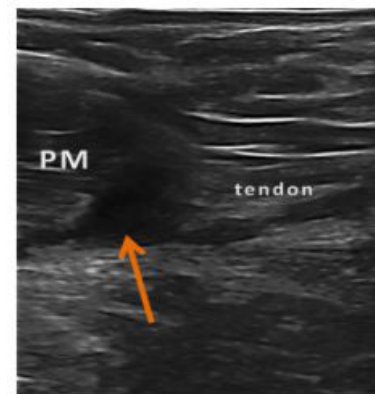


Figure 3: Ultrasound long-axis to pectoralis showing tear.

Treatment

Non-operative treatment was selected given the type of injury and the athlete's desire to try to play his final season of eligibility. Treatment options at that point were rest, physical therapy, percutaneous needle tenotomy and/or platelet-rich plasma injection (PRP). PRP treatment with rehab was selected, with full disclosure that while no conclusive evidence supported its use in this particular injury there was recent evidence supporting its use in other muscle and tendon injuries [12,13]. The rationale was to try a treatment that could possibly enhance his healing and decrease recovery time without adding any significant risk.

At that visit, 60cc of blood was drawn using antecubital venipuncture. The Harvest Smart Prep PRP system (Harvest Technologies, Plymouth, Massachusetts) was used to obtain the platelet rich plasma from this venous blood. The patient was then placed in the supine position with the left arm in slight abduction. The skin overlying the pectoral tendon and anterior shoulder was cleansed using chlorhexidine soap. Sterile gel and ultrasound probe covers were used after marking the ideal probe position and needle entry site with a surgical marker. The skin was anesthetized using 1% lidocaine without epinephrine avoiding the fascia or musculotendinous junction itself. Seven milliliters of platelet rich plasma

were then injected using a 21-gauge needle. Platelet activation was not used. Using multiple needle passes, small aliquots of injectate were administered into the musculotendinous junction and free edges of the tear upon each pass using ultrasound guidance. After the procedure, the patient was put in a sling for comfort for 3 days.

At five weeks status post injury, a repeat PRP injection using a smaller amount of injectate (~3ml) was performed in exactly the same manner as previously described. At that point, it was decided to wait 6-8 more weeks until full athletic participation to allow time for additional healing and to continue the advancement of our rehabilitation plan.

Detailed Rehabilitation Description

(see Table 1) Initial treatment following the PRP injection included modalities to relieve pain. The Game Ready (Cool Systems, Concord, CA), Light Force Laser (LiteCure Medical, Newark DE), Hivimat (Physiomed Elektromedizin AG, Germany), Normatec (Normatec Inc., Newton Center MA), and soft tissue work were all used depending on the clinical picture and level of discomfort. Strengthening exercises for the parascapular musculature began after the first 72 hours post-injection. Strengthening the posterior rotator cuff muscles, middle/lower trapezius, and rhomboids was added to help decrease the load on the PM during the initial healing stages. When the athlete was cleared to advance to concentric PM usage, he was given exercises in the SwimEx (Fall River MA) and performed internal/external rotation, abduction, adduction, horizontal adduction, and D1/D2 patterns. Different flotation devices were added with increasing resistance. Once the athlete was pain free with full range of motion in the pool (at approximately 2 weeks post injection), light eccentric exercises were introduced including wall/table pushups, manual resistance internal rotation at various angles of shoulder abduction, manual resistance adduction and horizontal adduction. Thera-Tube (Hygenic Co., Akron OH) and the TRX system (TRX, San Francisco CA) were then incorporated for stability work. The next step was to focus on sport-specific motions. Medicine balls and water balls were used to mimic a pass rush while the athlete focused on the eccentric phase (ball deceleration after the catch).

Exercise	Wk 1	PRP	Wk 2	Wk 3	Wk 4	PRP	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
Pain Control	XXX		XXX	XX	X		XXX	XX	X					
ROM			XXX	XXX	XX		XXX	XXX	XX					
Isometrics				XX	XXX			XX	XXX					
Scapular Stability			XXX	XXX	XX		XXX	XXX	XX	X	XX	X	X	X
PM Strength														
Swim Ex				X	XX			X	XXX					
Int/Ext Rotation					XX				XX	XXX	XX	XX	X	X
Adduction					XX				XX	XXX	XX	XX	X	X
Abduction					XX				XX	XXX	XX	XX	X	X
D1/D2					XX				XX	XXX	XX	XX	X	X
Core Stability				X	XX		X	X	X	X	X	X	X	X
Eccentrics														
Theraband					X			X	X	XX	XX	XXX	XXX	XXX
Manual Resistance					X			X	X	XX	XX	X	X	X
Pushup variations				X	X			X	XX	XXX	XX	XXX	XXX	XXX
90/90 KB ER Hold										X	XX	XX	XX	X
Ball catch										XX	XX	XXX	XXX	XXX
Stability														
Rebounder									XXX	XXX	XXX	XX	XX	X
Body Blade									X	XX	XX	XXX	XXX	XXX
BoSu Ball									X	XX	X	XXX	XXX	XXX
Sport Specific														
Heavy Bag												X	XXX	XXX
Sleds												X	XXX	XXX
Weight Room								X	XX	XXX	XXX	XXX	XXX	XXX

X Low Focus
XX Moderate Focus
XXX High Focus

Table 1: Weekly Rehabilitation Schedule.

BoSu balls (BOSU, Ashland OH) were added to the pushups to work on proprioception and plyometric training. The final stage of rehabilitation at the start of week 11 had the athlete working on heavy bags and sleds to increase strength and stability for punching. Exercises were not progressed until the athlete could perform the task pain free through a full range of motion. As he completed each phase of rehabilitation, traditional weight room exercises were incorporated (latissimus pull downs, dumb bell bench press, seated rows etc). Once the athlete returned to full practice, he remained on a preventative program that included exercises for the PM, rotator cuff, latissimus, and trapezius musculature. These exercises were performed three times a week in addition to the normal weight room activities with the team.

Outcome

After approximately 12 weeks post injury, the athlete was cleared for full participation. He started in all of the 7 remaining games without complication. Despite a high level of academic interest, no imaging was done during the season. It was felt that further imaging would not change our management given the lack of symptoms. Post-season imaging or clinical follow up was not done as he left campus immediately after the season to participate in the NFL draft.

Discussion

The authors recognize that PRP injection is currently unproven to provide a better clinical or functional outcome over other traditional conservative treatment in pectoralis injury. The exact mechanism of effect has not been fully elucidated, but there is *in vitro* evidence of improving the microscopic structure of damaged tendons with PRP [14-16]. There are a number of recent studies looking at chronic tendinopathy and ligamentous injury with evidence supporting its use clinically [10,17-20]. Most applicable to our case, Cheatham et al. (2013) described a distal triceps partial rupture showing improvement and return to pre-injury activity 12 weeks following a PRP injection after failing a traditional course of physical therapy [13]. Their rehabilitation algorithm post-injection was two weeks of rest, then concentric strengthening until 6 weeks. They began eccentric strengthening at that 6-week point. The patients in Cheatham's study were discharged from physical therapy once they were lifting pain-free. In another study, Podesta et al showed significant improvement in elbow ulnar collateral ligament partial tears in overhead throwers, with 88% returning to pre-injury levels of participation after PRP injection and rehabilitation [21]. It should be noted that recommendations

for use of PRP based on review of the recent literature are varied; there are also clinical and basic science trials suggesting minimal or no benefit [14,22]. However, unlike the previous references for chronic ligamentous or tendinopathy, treatment of acute myotendinous tears with PRP have not been well represented in the literature. Furthermore, the various protocols and PRP systems have not been thoroughly evaluated in order to achieve consensus about platelet or leucocyte concentration for treatment of various musculoskeletal problems; nor has there been validation of the options regarding activation of platelets, addition of fat grafting, bone marrow aspirate or stem cells.

In our case, it seemed that the risk of progression of the pectoralis tear to full rupture was high once he returned to competition. Given Cheatham's experience using PRP following unsuccessful therapy for a triceps rupture, PRP injection seemed a reasonable and relatively low-risk addition to typical conservative management of our athlete. It is unknown whether this treatment increased the chance of success in return to play or in avoiding re-injury in the subsequent practices and 7 regular season games but our athlete did return at 3 months, which is earlier than most references expect [4,7,8]. Additionally, even with the assumption that the initial PRP injection provided benefit, it is unclear whether the second injection improved the outcome. Early studies involving PRP often had sequential injections, but recent thinking has put this practice into debate [23]. Ultimately, our decision was based on the growing evidence for using PRP treatment of partial myotendinous tears [16,17,19,22,24] as well as the specific demands of a collegiate football lineman leading us to believe it less likely to return to play without some intervention.

Clearly, the evidence for use of PRP is not sufficient to recommend this treatment as a first-line option for partial pectoralis tears; more study is needed. But this case offers one approach for this specific situation that resulted in a desirable outcome – the athlete returned to play without limitation and without reinjury.

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