ISSN: 2469-5718

Quinn et al. Int J Sports Exerc Med 2019, 5:137
DOI: 10.23937/2469-5718/1510137
Volume 5 | Issue 8
Open Access

International Journal of
Sports and Exercise Medicine

CASE REPORT

Treatment of Direct Head of the Rectus Femoris Injury with PRP Therapy in a Division I Basketball Player

Matthew Quinn, BS*, Nicholas Lemme, MD, Phillip Salko, MD and Ramin R. Tabaddor, MD

Warren Alpert Medical School of Brown University, USA

***Corresponding author:** *Matthew Quinn, MS, Warren Alpert Medical School of Brown University, 222 Richmond Street, Providence RI 02903, USA, Tel: (401) 863-2149*

Introduction

The Rectus Femoris (RF) is the most commonly injured quadriceps muscle and is second only to the hamstring in prevalence amongst lower extremity injuries occurring in athletes [1-3]. For most high-level athletes, injuries involving these anatomical structures takes an average of 38 days for return to sport [4]. Platelet Rich Plasma (PRP), is an orthobiologic that is commonly used in the treatment of musculoskeletal injuries. PRP acts as a catalyst in the healing process by using the patient's own blood to provide supraphysiologic levels of growth factors and cytokines directly to the site of injury [5]. While the lack of standardization in PRP preparations has kept it from garnering robust high quality study results, many smaller studies and meta-analyses have produced statistically significant results demonstrating the efficacy of PRP therapy in the management of injuries to various structures such as the rotator cuff, gluteus medius, and patellar tendon [6,7]. The topics of leukocyte concentration in PRP preparations and the efficacy of single vs. multiple injections are two areas currently being investigated throughout sports medicine literature that may both improve outcomes and help with standardization efforts.

Case Report

A 20-year-old Division I collegiate basketball player with a previous medical history significant for recurrent left patellar tendinopathy presented to us after sustaining an injury to his left thigh that occurred while jumping during a basketball game. Physical examination was performed two days later and revealed a diffusely swollen and engorged left thigh. There was a noticeable defect of the mid to proximal quadriceps along the RF at the musculotendinous junction anteriorly. He experienced tenderness along the musculotendinous junction of the rectus, the mi substance of the quadriceps, and the quadriceps tendon. No palpable defect of the quadriceps tendon was appreciated. Patient was able to obtain and maintain a straight leg raise. There was a 1+ effusion at the left knee. Patient had full Range of Motion (ROM) and strength about the knee. Magnetic Resonance Imaging (MRI) revealed a grade II acute to subacute tear of the RF DH, as well as a partial myofascial tear of the proximal posterolateral RF with associated perifascial subcutaneous edema.

The patient immediately began working with the athletic training staff to begin a standard rehabilitation program focused on rest, re-establishing full range of motion, and building functional strength. Nine days after the initial injury, the patient was seen for a PRP injection. The timing of this injection was dictated by the team's in-season national travel schedule and the availability of an appropriately qualified provider. Using the Arthrex Autologous Conditioned Plasma (ACP)® Double Syringe System, 15cc's of blood were obtained from the antecubital fossa and centrifuged at 1500 rpm for 5 minutes, per Arthrex® protocol and the platelet concentrate was isolated into its own syringe. Per manufacturers published data, the resulting PRP is a Leukocyte-Poor Preparation (LPP) with 2.4 × increase in platelets, 0.54 × increase in White Blood Cells (WBC), and 0.06 × increase in neutrophils (NE). Under ultrasound

Citation: Quinn M, Lemme N, Tabaddor RR, Salko P (2019) Treatment of Direct Head of the Rectus Femoris Injury with PRP Therapy in a Division I Basketball Player. Int J Sports Exerc Med 5:137. doi.org/10.23937/2469-5718/1510137

Accepted: August 20, 2019; **Published:** August 22, 2019

guidance, the quadriceps was injected with 2 cc of 1% lidocaine in areas of hypoechoic disruption just superficial and lateral to the RF. A 20-gauge needle was then used to inject 3 cc of ACP with visible flow through the fascial disruption at the RF. The patient was instructed to rest, take appropriate pain medication, and continue with gentle ROM exercises under the supervision of his athletic trainers.

Over the next two weeks, the athlete experienced significant improvements in both his pain and functional ability. Clinical examination 15 days after PRP injection demonstrated full strength about the hip and knee, resolution of the palpable proximal defect, and a mild decrease in hip extension. He was sent for repeat imaging that day to radiographically confirm interval improvement and clear him for progression to full activity. At this time, MRI revealed a near complete resolution (> 90% decrease) of the grade II myotendinous junction strain of the direct head. Additionally, the hematoma had decreased by 80% and the surrounding perifascial edema had completely resolved. Given an otherwise benign clinical examination and significant improvement on imaging, the patient was cleared to begin a Return to Play (RTP) protocol under the supervision of his athletic trainer. Over the course of the next three days, the patient demonstrated the ability to perform sport specific drills and activities without limitations or symptoms and was therefore cleared for return to full activities.

Discussion

The RF consists of two discrete tendinous origins, the DH and Indirect Head (IDH). The DH originates from the anterior inferior iliac spine while the IDH arises from the superior acetabular ridge [2,8]. Distally, the RF joins the vastus lateralis, vastus medialis, and vastus intermedius to form the quadriceps tendon. The diarthrodial nature of the RF in addition to the high proportion of type II muscle fibers are intrinsic anatomical characteristics of the muscle that contribute to its high prevalence of injury in competitive athletics [1,2,9]. Generally speaking, RTP following a RF injury is largely determined by strain grade. RTP time can range from 15-79 days based on the severity of the injury [10]. In addition to strain grade, the location and associated radiographic findings have shown prognostic significance when that can further stratify expected RTP times [4]. In the case of our patient, the combination of proximal injury location, perifascial fluid, and changes noted on T1 weighted images indicated that his RTP would likely last approximately 35- 40 days. With the addition of LP-PRP to standard rehabilitation protocols, our patient's total RTP time was 27 days which equates to a 26.5% reduction in recovery time when compared to similar injuries.

Although treatment of tendinous injuries with PRP is an area of great scientific interest, there is very little consensus due to tremendous variability in administration. While its implementation remains an area of debate, PRP therapies have demonstrated efficacy in sports medicine primarily through the reduction of recovery time after sustaining tendon injuries [11,12]. From a basic science perspective, PRP is a means of delivering concentrated amounts of various growth factors that are crucial in the healing process as they reduce inflammation and promote injury healing. *In vivo* studies have demonstrated PRP's ability to influence healing through improved vascularity, decreased tendon repair time, improved fiber organization, and increased tensile strength [7]. Additionally, since PRP is prepared from autologous blood, it has the added benefit of posing nominal risk of adverse reaction to injection contents [11,13].

In an attempt to work towards standardization of protocols, two more recent areas of exploration have centered around the leukocyte concentrations in PRP preparations and the number of injections that should be administered. In regard to leukocyte concentrations, most data supports the use of Leukocyte Poor Preparations (LPP) in which the concentration of White Blood Cells (WBC), particularly neutrophils (NE) is reduced. The rationale behind the removal of these cell types stems from data that has shown that higher concentrations of leukocytes, more specifically NE, found in Leukocyte-Rich Preparations (LRP) may deliver more pro-inflammatory cytokines and proteases that inhibit tissue healing and delay recovery time than LPP [7,14]. This was supported by a publication from *Nature* in 2017 that showed superior outcomes in cartilage repair with LPP when compared to LRP and controls [14]. More recently, a meta-analysis from 2019 that found while both LRP and LPP groups fared better than controls, LP preparations were found to be equivalent or superior to LRP in rotator cuff tendon repairs [7]. In regard to a single vs. serial injections, current consensus is that the number of injections necessary for sustained improvement is dependent on individual characteristics, tissue type, and injury severity. Acute and subacute pathology may respond well to a single injection, whereas more chronic issues will likely warrant multiple administrations. For example, a meta-analysis from the American Journal of Sports Medicine showed that various types of tendinopathy showed statistically significant improvements when treated with a single intratendinous PRP injection done under ultrasound guidance [15]. Additionally, multiple Randomized Controlled Trials (RCT) have demonstrated excellent long-term outcomes from a single in the treatment of gluteal tendinopathy when compared to steroid injections and controls [6]. In the treatment of more chronic injuries, such as patellar tendinopathy, data suggests that patients garner the greatest benefit from multiple injections [16]. Similar results have been found in multiple RCTs exploring the use of PRP in the treatment of osteoarthritis [16-18].

The 26.5% reduction in the RTP time for this case

report may indicate that the LPP-PRP injection did in fact play some role in accelerating the healing process of our patient. If so, the greatest benefit in using the Arthrex Autologous Conditioned Plasma (ACP)® Double Syringe likely stemmed from the fact that it was a LPP that drastically reduced the NE concentration to approximately 0.06%. Given the acute nature of his injury and his clinical response to the first injection, it was appropriate to limit his therapy to a single injection. It is important to note that other factors, such as early detection and access to daily rehabilitation may have accelerated the recovery time. The patient was evaluated immediately after the injury by the training staff and received a comprehensive orthopedic exam only two days from the onset of symptoms. Additionally, he had daily access to sport specific athletic trainers that supervised his rehabilitation. Finally, his baseline level of muscular strength and conditioning as a high-level collegiate athlete may have aided in the acceleration of his healing process. These considerations may have been contributing factors to the success of PRP therapy and may make these results less generalizable to other populations. Now 2+ years since his injury, the patient continues to play basketball professionally in Europe.

Conclusion

RF injuries are quite common in athletes and can cause prolonged RTP times. PRP therapy has demonstrated efficacy in catalyzing recovery from musculoskeletal injuries and new evidence is emerging to support the use of LPP variants of PRP as a single or series of injections. In this case, a high-level athlete was able to return to competition in approximately 75% of the estimated recovery after receiving a LP-PRP injection in conjunction with standard rehabilitation practices. While it is important to continue exploring the impact of LPP PRP on various tissue types and injury patterns, providers should be encouraged to explore this adjunct therapy due to its potential to provide significant benefit while simultaneously posing minimal risk to patients after sustaining a musculoskeletal injury.

References

1. Bencardino JT, Rosenberg ZS, Brown RR, Hassankhani A, Lustrin ES, et al. (2000) Traumatic Musculotendinous Injuries of the Knee: Diagnosis with MR Imaging. Radiographics 20: 103-120.
2. Kerr R (2014) MRI of Rectus Femoris / Quadriceps Injury - Radsource.
3. Kassarjian A, Rodrigo RM, Santisteban JM (2012) Current concepts in MRI of rectus femoris musculotendinous (myotendinous) and myofascial injuries in elite athletes. Eur J Radiol 81: 3763-3771.
4. Rodrigo R, Santisteban J, Ortega R, Angulo F, Rodriguez M, et al. (2009) Predictive Value of MRI in Rectus Femoris Strain Injuries. Radiological Society of North America.
5. Baria M, Vasileff WK, Miller M, Borchers J, Flanigan DC, et al. (2019) Cellular Components and Growth Factor Content of Platelet-Rich Plasma with a Customizable Commercial System. Am J Sports Med 47: 1216-1222.
6. Fitzpatrick J, Bulsara MK, O'Donnell J, Zheng MH (2019) Leucocyte-Rich Platelet-Rich Plasma Treatment of Gluteus Medius and Minimus Tendinopathy: A Double-Blind Randomized Controlled Trial With 2-Year Follow-up. Am J Sports Med 47: 1130-1137.
7. Hurley ET, Lim Fat D, Moran CJ, Mullett H (2019) The Efficacy of Platelet-Rich Plasma and Platelet-Rich Fibrin in Arthroscopic Rotator Cuff Repair: A Meta-analysis of Randomized Controlled Trials. Am J Sports Med 47: 753-761.
8. Ouellette H, Thomas BJ, Nelson E, Torriani M (2006) MR imaging of rectus femoris origin injuries. Skeletal Radiol 35: 665-672.
9. Järvinen TA, Järvinen TL, Kääriäinen M, Kalimo H, Järvinen M (2005) Muscle injuries: biology and treatment. Am J Sports Med 33: 745-764.
10. Hallen A, Ekstrand J (2014) Return to play following muscle injuries in professional footballers. J Sport Sci 13: 1229-1236.
11. Paoloni J, De Vos RJ, Hamilton B, Murrell GA, Orchard J (2011) Platelet-rich plasma treatment for ligament and tendon injuries. Clin J Sport Med 21: 37-45.
12. Taylor DW, Petrera M, Hendry M, Theodoropoulos JS (2011) A systematic review of the use of platelet-rich plasma in sports medicine as a new treatment for tendon and ligament injuries. Clin J Sport Med 21: 344-352.
13. Yuan T, Zhang C-Q, Wang JH-C (2013) Augmenting tendon and ligament repair with platelet-rich plasma (PRP). Muscles Ligaments Tendons J 3: 139-149.
14. Xu Z, Yin W, Zhang Y, Qi X, Chen Y, et al. (2017) Comparative evaluation of leukocyte- and platelet-rich plasma and pure platelet-rich plasma for cartilage regeneration. Sci Rep 7: 43301.
15. Fitzpatrick J, Bulsara M, Zheng MH (2017) The Effectiveness of Platelet-Rich Plasma in the Treatment of Tendinopathy: A Meta-analysis of Randomized Controlled Clinical Trials. Am J Sports Med 45: 226-233.
16. Andriolo L, Altamura SA, Reale D, Candrian C, Zaffagnini S, et al. (2019) Nonsurgical Treatments of Patellar Tendinopathy: Multiple Injections of Platelet-Rich Plasma Are a Suitable Option: A Systematic Review and Meta-analysis. Am J Sports Med 47: 1001-1018.
17. Görmeli G, Görmeli CA, Ataoglu B, Çolak C, Aslantürk O, et al. (2017) Multiple PRP injections are more effective than single injections and hyaluronic acid in knees with early osteoarthritis: a randomized, double-blind, placebo-controlled trial. Knee Surg Sports Traumatol Arthrosc 25: 958-965.
18. Chouhan DK, Dhillon MS, Patel S, Bansal T, Bhatia A, et al. (2019) Multiple Platelet-Rich Plasma Injections Versus Single Platelet-Rich Plasma Injection in Early Osteoarthritis of the Knee: An Experimental Study in a Guinea Pig Model of Early Knee Osteoarthritis. Am J Sports Med 47: 2300-2307.