Case Report


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ABSTRACT

This is the case of an 18-year-old male professional soccer player, an attacking midfielder, who presented acute-onset pain in his right thigh during a training match but continued playing and training until the end of the session. Two weeks after the initial symptoms, the athlete's pain increased after kicking the ball and stopping training. He came for consultation a week later with tenderness in his right thigh and impaired gait. A 3 cm gap in his right mid-quadriceps muscle and tenderness during resisted knee extension and leg raises with no hip or knee range of motion limitations were observed on physical examination. He was scheduled for magnetic resonance imaging (MRI) after the consultation, revealing an acute-on-chronic type 2A lateral muscle tear of the distal rectus femoris. A 2 ml seroma aspiration was performed five weeks after the initial injury with a subsequent intra-lesional 1 ml liquid leukocyte-rich platelet-rich plasma (LR-PRP) injection using intermittent ultrasound guidance within 5 min after preparation. The LR-PRP preparation was classified as 3 14–13–00 according to the Universal Coding System (UCS) by Kon et al. Nine physiotherapy sessions, including an initial assessment, were conducted over five weeks. The rehabilitation started with pulley exercises with hip flexion, tension arch, leg extension, and squatting with supporting exercises for core and hip strength, with a gradual increase in loading. As the player's symptoms improved, he started doing eccentric exercises such as the reverse Nordics and leg extension. He also followed a running program, gradually increasing speed to a full sprint without pain or irritation. The return-to-sports clearance consultation was conducted seven weeks after the injury, previously confirming satisfactory healing on an MRI. The patient was cleared after passing the Rehabilitation Department battery tests and physical examination. The patient was asymptomatic and had no complaints despite his right quadriceps gap, returning to competition nine weeks after injury. After a one-year follow-up, the patient remains playing at a competitive level, asymptomatic, with no reported reinjury. Adequate reporting of rehabilitation programs and PRP injection characterization is crucial for future research quality improvement and reproducibility.

Abbreviations: LR-PRP, Leukocyte-rich platelet-rich plasma; MRI, Magnetic resonance imaging; PRP, Platelet-rich plasma; UCS, Universal Coding System.
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The Case:
- This is the case of an 18-year-old male professional soccer player diagnosed with an acute-on-chronic type 2A lateral muscle tear of the distal rectus femoris, presenting with a 3 cm gap in his right mid quadriceps muscle and tenderness during resisted knee extension.
- A month after the initial injury, under ultrasound guidance, a 2 ml seroma aspiration was performed with a subsequent intra-lesional 1 ml liquid leukocyte-rich platelet-rich plasma injection (3 14–1 3–0 0 according to the Universal Coding System by Kon et al.).
- Nine physiotherapy sessions, including an initial assessment, were conducted over five weeks.
- The patient returned to competition nine weeks after the injury. After a one-year follow-up, the patient remains playing at a competitive level, asymptomatic, with no reported reinjury.

Lessons Learned:
- Rehabilitation, seroma aspiration, and a single leukocyte-rich platelet-rich plasma injection (Universal Coding System 3 14–1 3–0 0) might benefit acute-on-chronic grade 2A rectus femoris injury.
- Adequate reporting of rehabilitation programs and PRP injection characterization is crucial for future research quality improvement and reproducibility.

INTRODUCTION

Quadriceps injuries are professional soccer players’ third most common muscle injury [1]. They are more frequent (60%) in the preferred kicking leg and the rectus femoris, leading to a median absence time of 13 days [1–3]. Muscle injuries’ optimal treatment starts with an adequate diagnosis and classification, and most often improves following a conservative approach [2,4].

Conservative treatment focuses on preventing muscle weakness and atrophy with progressive and functional muscle loading [5]. Ultrasound-guided platelet-rich plasma (PRP) injections as an adjuvant to physiotherapy treatment for rectus femoris tears have not yet been standardized, and their use has scarcely been reported among professional soccer players [6–8]. However, a recently published comparative study in hamstring injuries showed that athletes with grade 2 hamstring strains treated with a combination of hematoma aspiration and PRP injection had a significantly shorter time to return to play and lower recurrence rates than conservatives (mean 23.5 vs. 32.4 days, <4% vs. 28.6%) [9].

The present case report aims to showcase a successful and satisfactory experience of ultrasound-guided seroma aspiration and PRP injection in an acute-on-chronic grade 2A rectus femoris injury of a professional soccer player with a detailed leukocyte-rich PRP (LR-PRP) composition and confirmed magnetic resonance imaging (MRI) healing.

The patient was informed that data concerning the case would be submitted for publication, and he provided written consent.

CASE REPORT

The present case was reported following the CARE guidelines [10] and the PRP universal coding system (UCS) by Kon et al. [11].

This is the case of an 18-year-old male professional soccer player, an attacking midfielder, who presented acute-onset pain in his right thigh during a training match but continued playing and training until the end of the session. Twelve days after the initial symptoms, the athlete’s pain increased after kicking the ball and stopping training. He came for consultation six days later with tenderness in his right thigh and an impaired gait (Table 1). He had no other relevant medical conditions or previous surgeries.

A 3 cm gap in his right mid-quadriceps muscle and tenderness during resisted knee extension and leg raises with no hip or knee range of motion limitations were observed on the physical examination. No visible hematoma was found.

He was scheduled for an MRI right after the consultation, revealing an acute-on-chronic type 2A lateral muscle tear of the distal rectus femoris according to the British athletics muscle injuries classification (Fig. 1) [12]. The patient was counseled about his condition and the different treatment options for his injury. He started a rehabilitation program 23 days after the initial injury, with the option of performing a hematoma aspiration and a LR-PRP injection to benefit from potential healing improvement if needed.

Physiotherapy assessment

The player reported anterior thigh pain with a numerical pain rating scale of 8/10 at the time of the injury, which persisted by 3/10. Aggravating factors were shooting (8/10), kicking long balls (7/10), and stretching (6/10). The patient was pain-free when walking but felt stiffness when running at the highest speed. On palpation, he had a 2/10 pain in the area, which was 14 cm long, starting 21 cm below the anterior superior iliac spine.

The most painful activity during assessment was an active straight leg raise (5/10), a 24% strength limb asymmetry, and 2/10 pain during hip flexion in the Thomas test position with a strength limb asymmetry surprisingly lower than 10% on the injured leg. Prone knee flexion was 125° on the injured leg compared to 155° on the contralateral, with 3/10 pain.

Physiotherapy program

Nine physiotherapy sessions, including an initial assessment, were conducted over five weeks. The rehabilitation started with pulley exercises with hip flexion, tension arch, leg extension, and squatting with supporting exercises for core and hip strength, with a gradual increase in loading. As the player’s symptoms improved, he started doing eccentric exercises such as the reverse Nordics and leg extensions. He also followed a running program two weeks after the LR-PRP injection, gradually increasing speed to full sprint without pain or irritation.

LR-PRP injection

A 2 ml seroma aspiration was performed 34 days after the initial injury, with a subsequent intra-lesional 1 ml liquid LR-PRP injection using intermittent ultrasound guidance within 5 min after preparation. The patient required two days of rest before resuming his physiotherapy.

For LR-PRP preparation, 52 ml of whole blood was collected by venipuncture from the antecubital fossa and mixed with 8 ml of anticoagulant citrate dextrose solution (ACD-A®), Citra Labs, USA) and immediately centrifuged using a closed double-spin system (Angel cPRP system®, Arthrex, USA) using a 10% hematocrit setting at 24 °C room...
Table 1
Timeline of clinical events in a professional soccer player's acute-on-chronic rectus femoris injury.

<table>
<thead>
<tr>
<th>Timeline (weeks)</th>
<th>Clinical event</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>First injury and initial symptoms</td>
</tr>
<tr>
<td>2nd</td>
<td>Second injury</td>
</tr>
<tr>
<td>3rd</td>
<td>First clinical assessment</td>
</tr>
<tr>
<td></td>
<td>Diagnostic magnetic resonance imaging shows the rectus femoris's initial injury with fiber disruption at the distal myofascial aspect. A fibrotic scar adjacent to the tear indicates an acute-on-chronic tear.</td>
</tr>
<tr>
<td>5th</td>
<td>Started rehabilitation</td>
</tr>
<tr>
<td>6th</td>
<td>Leukocyte-rich platelet-rich plasma ultrasound-guided injection</td>
</tr>
<tr>
<td>7th</td>
<td>Fourth physiotherapy session with significant symptom improvement</td>
</tr>
<tr>
<td>9th</td>
<td>Follow-up consultations and movement analysis testing</td>
</tr>
<tr>
<td></td>
<td>Started sports-specific training (including running)</td>
</tr>
<tr>
<td></td>
<td>Pain-free and optimal muscle strength symmetry</td>
</tr>
<tr>
<td></td>
<td>Magnetic resonance imaging follow-up shows almost complete tear healing, no muscle fiber gap, and scar tissue formation</td>
</tr>
<tr>
<td></td>
<td>Return to sports clearance consultation</td>
</tr>
<tr>
<td>12th</td>
<td>Returned to competition</td>
</tr>
</tbody>
</table>

Follow-up and outcomes

After four sessions, the player had no pain on handheld dynamometer testing but minor pain (1–2/10) in prone knee flexion stretching. After six sessions, the player had movement analysis testing and clinical assessment before starting sport-specific training four days later. After finishing his sport-specific training, the player had two more rehab sessions before discharge. The patient had a pain-free follow-up in the clinic seven weeks after the injury and optimal muscle strength symmetry.

A follow-up MRI was performed, showing scar tissue and muscle fiber edema adjacent to the posterolateral myofascial junction, compatible with a subacute/chronic injury with ongoing healing (Fig. 2). There was no evidence of an acute rupture of the fibers, and no hematoma or fluid collection. At this point, it was essential to allow the healing process to finish while protecting the athlete and restoring his flexibility. He continued doing a sport-specific physiotherapy program for another 2–3 weeks.

The return-to-sports clearance consultation was conducted 52 days after the injury. The patient was cleared after passing the Rehabilitation Department battery tests and physical examination by the Sports Medicine Physician. The patient was asymptomatic and had no complaints despite his right quadriceps gap, returning to competition 61 days after the injury. After a one-year follow-up, the patient remains playing at a competitive level, asymptomatic, with no reported reinjury. The patient had commented, feeling pleased with the treatment received, and feels that nothing could have been done better, and she appreciates all the therapeutic interventions received.

DISCUSSION

The main finding of this case report is that rehabilitation, seroma aspiration, and a single LR-PRP injection (UCS 3 14–1 3–0 0) might be beneficial in an acute-on-chronic grade 2A rectus femoris injury of a professional soccer player.

Despite the prevalence of anterior thigh muscle injuries in professional soccer players, the literature on implementing orthobiologics remains scarce. A survey conducted by Astur et al. [13] among Brazilian sports physicians and orthopedists revealed that 52% of the 168 participants considered it useful, and 42% implemented PRP in muscle injuries. However, current treatment algorithms for quadriceps muscle injuries do not consider its use [14,15].

Previous case reports on using PRP for rectus femoris injury have revealed satisfactory outcomes [4,16,17]. Olmo et al. [16] reported the case of a 28-year-old professional soccer player presenting with a severe avulsion of the proximal rectus femoris, who underwent two ultrasound-guided Endoret® (BTI Biotechnology Institute, Spain) plasma rich in growth factor injections at a 16-day interval and a criteria-based rehabilitation with a complete return to sport 115 days after injury, with no recurrences and a 76% participation in team matches at a three-year follow-up. Similarly, Pogliacomi et al. [4] reported a pain-free and full-strength recovery with a normal range of motion in a 39-year-old nonprofessional soccer player after rehabilitation and three ultrasound-guided PRP injections ten days apart at 90 days after injury. In both cases, satisfactory healing was confirmed on an MRI.

The presented case report highlights the potential role of rehabilitation and orthobiologics in acute-on-chronic rectus femoris injury, with returning to competition two months after injury. This is particularly important as this structural type of injury has been associated with a significantly higher absence in elite European soccer [3]. Moreover, contrary to previous publications [4,16,17], the implemented LR-PRP composition was carefully described. Studies have shown that orthobiologics studies do not adequately report PRP preparation and

Fig. 1. T2-weighted fat-suppressed magnetic resonance imaging of the right thigh shows the rectus femoris's initial injury of a professional soccer player with fiber disruption at the distal myofascial aspect with a 2.7 cm gap and a 5.0 ml intramuscular hematoma. A fibrotic scar adjacent to the tear indicates an acute-on-chronic tear. a) Sagittal view; b) axial view; c) coronal view.
Fig. 2. T2-weighted fat-suppressed magnetic resonance imaging of the right thigh of a professional soccer player two weeks after a leukocyte-rich platelet-rich plasma injection for an acute-on-chronic rectus femoris injury. There is almost complete tear healing, no muscle fiber gap, and scar tissue formation. a) Sagittal view; b) axial view; c) coronal view.

Fig. 3. Short-minimum information for studies evaluating biologics in orthopedics results on injectable orthobiologics for hamstring muscle injuries [23–28].

<table>
<thead>
<tr>
<th>ITEM</th>
<th>CHECKLIST ITEM</th>
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<tr>
<td>WHOLE BLOOD CHARACTERISTICS</td>
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<td>Whole blood platelet, differential leukocyte, and red cell analysis of all samples</td>
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<tr>
<td>PRP PROCESSING</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>PRP processing described sufficiently to enable replication (including commercial kit details and spin protocol)</td>
</tr>
<tr>
<td>14</td>
<td>Platelet recovery rate of protocol</td>
</tr>
<tr>
<td>15</td>
<td>PRP storage temperature and light exposure</td>
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<tr>
<td>16</td>
<td>Time between blood drawing, PRP processing, activation, and delivery</td>
</tr>
<tr>
<td>PRP CHARACTERISTICS</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>PRP format (for example: liquid, gel, or membrane)</td>
</tr>
<tr>
<td>18</td>
<td>PRP platelet, differential leukocyte, and red cell analysis of all samples</td>
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<tr>
<td>ACTIVATION</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Activation described sufficiently to enable replication (including volume and concentration of activating agent)</td>
</tr>
<tr>
<td>MODIFIED COLEMAN SCORE</td>
<td>79 66 88 31 66 85 61 64</td>
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<tr>
<td>TOTAL</td>
<td>7 0 5 2 2 3 0 3</td>
</tr>
</tbody>
</table>

Abbreviations: PRP, platelet-rich plasma.
characteristics to allow reproducibility of results, raising ethical concerns [8,18–20]. In a recent systematic review and meta-analysis by Seow et al. [21] on the use of PRP injections for hamstring injuries, including ten studies with a total of 207 muscle injuries, the authors found no difference between PRP injection with or without physiotherapy on the mean time to return to play or re-injury rates compared to no treatment or physiotherapy alone in a short-term follow-up. Nonetheless, only a study on the use of PRP injections for hamstring injuries, including ten studies [8,18–20] was 34.3% (Fig. 3). Future studies must aim to compare standardized rehabilitation and orthobiological injection protocols, following the current reporting guidelines for specific muscle injury types.

CONCLUSION

Adequate reporting of rehabilitation programs and PRP injection characterization is crucial for future research quality improvement and reproducibility.

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Author’s contributions

Conceptualization: PNDA. Data curation: TMF. Formal Analysis: PNDA, TMF. Investigation: PNDA, JGG, AAD, MBR, ML, TMF. Methodology: PNDA, TMF. Project administration: PNDA. Supervision: AAD, MBR, ML, TMF. Validation: AAD, TMF. Visualization: PNDA, MBR, TMF. Writing – original draft: PNDA. Writing – review & editing: AAD, MBR, ML, TMF.

Informed consent

The patient was informed that data concerning the case would be submitted for publication, and he provided written consent.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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None.

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