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Pectoralis Major Muscle Tear – Effectiveness Orthobiologic Nonoperative Treatment with Platet-Rich Plasma (PRP) Injections

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Abstract

Introduction

Pectoralis major muscle ruptures, once considered rare, are now more common, especially in young male athletes and weightlifters involved in high-intensity sports. This injury can significantly impair upper limb function, leading to pain, weakness, and potential disability. Exploring and understanding available treatment options, particularly the promising role of

orthobiologic therapies like PRP, is essential for optimizing recovery and achieving the best outcomes.

Purpose

The purpose of this review is to evaluate the effectiveness and the role of orthobiologic treatments such as PRP in enhancing healing and functional recovery for pectoralis major muscle ruptures.

Conslusions

The treatment of pectoralis major muscle ruptures requires a tailored approach that considers the injury's severity, the patient's activity level, and their goals. Nonoperative treatment can be effective for partial tendinous tears, muscle belly tears, muscle origin tears, and complete tendinous tears in sedentary individuals or when surgery is not feasible. Surgical intervention generally provides superior functional outcomes, particularly for athletes and those with complete ruptures. Orthobiologic treatments, such as ultrasound-guided PRP injections, provide a promising complement to conservative management, with potential benefits in pain reduction and accelerated functional recovery. Studies indicate that PRP-treated patients report higher satisfaction and better outcomes compared to those without PRP treatment. Nevertheless, many questions remain regarding the optimal formulation, dosage, and rehabilitation protocols for PRP. To fully understand PRP's effectiveness and refine its applications in sports medicine, more rigorous and long-term studies are needed. Additionally, further research is required to improve nonoperative treatment and rehabilitation protocols, ensuring optimal outcomes for all patients.

Key words: Pectoralis major rupture; Platelet-rich plasma, Sports injury, Return to sports, Ultrasound guided;

Introduction

The pectoralis major muscle, a large, fan-shaped muscle located in the upper chest, plays a crucial role in movements involving the upper limb, particularly in activities requiring pushing, lifting, and arm adduction.

Pectoralis major muscle ruptures, though once considered relatively rare, are becoming increasingly common, especially among young male athletes and weightlifters engaged in high-intensity sports like wrestling and contact sports [1,8].

Pectoralis major muscle rupture primarily affects young male weightlifters performing bench press exercises [2,10] The injury typically occurs at or near the humeral insertion during eccentric contraction under heavy load [11].

Clinical Presentation

The clinical presentation typically includes acute pain, swelling, ecchymosis, and diminished strength in the anterior chest wall, axilla, and arm [3,10]. Additionally, there may be asymmetry of the medial prominence of the muscle belly, which could indicate hematoma formation or a retracted muscle belly. The asymmetry may obscure the axillary fold. A palpable defect in the muscle belly may also be present, which can be accentuated by muscle contraction. This is best observed with the shoulder abduction and elbow flexion, in either internal or external rotation positions [3].

Diagnosis

Magnetic resonance imaging (MRI) is the gold-standard diagnostic tool for confirming the clinical diagnosis of pectoralis major muscle ruptures, as it provides detailed information on the location, extent, and differentiation between partial and complete tears [2, 3, 4, 6].

However, point-of-care ultrasound (POCUS) in the emergency department can expedite diagnosis and treatment, with high-frequency ultrasound providing clear visualization of the pectoralis major's anatomical structure, including its three-laminae arrangement and insertion [5,7,12]. Both MRI and high-resolution ultrasound are crucial in guiding clinical and surgical management decisions, as they accurately diagnose the extent and location of tears, distinguishing between partial and complete ruptures [13].

Nonoperative Treatment Approaches

Nonoperative treatment for pectoralis major muscle rupture generally involves a combination of rest, immobilization of arm in a sling or brace to minimize movement and allow the healing process to begin, physical therapy, pain management and gradual return to activity. The primary goal is to allow the muscle to heal while minimizing the risk of further injury.

Nonoperative treatments are typically considered for partial tendinous tears, muscle belly tears, muscle origin tears, complete tendinous tears in sedentary individuals, or when surgery is contraindicated. Invasive treatment is primarily considered for tears at the musculotendinous junction, intratendinous or humeral insertion tears, or bony avulsions [8,9]

Orthobiologic treatments, such as platelet-rich plasma (PRP) or autologous conditioned plasma (ACP), have shown promise in aiding the healing process for patients undergoing conservative treatment for musculoskeletal tears. PRP treatment, in particular, has demonstrated potential benefits in muscle injury recovery, including enhanced cellular proliferation, gene expression, and improved muscle regeneration compared to control groups [14].

PRP has been safely utilized in various medical fields for over two decades, effectively promoting natural healing in cases of non-healing injuries [15, 25]. As a therapeutic option for musculoskeletal pathologies, PRP offers both pain reduction and functional recovery [16, 26, 27].

Typically, PRP injections are administered under ultrasound guidance to precisely target the injury site or intramuscularly. Additionally, PRP administration can be combined with hematoma drainage to optimize treatment outcomes [28]. Studies have shown that patients with pectoralis major muscle tears receiving PRP treatment reported significantly better outcomes and higher satisfaction rates compared to those who did not receive PRP [17, 29].

Further research on other muscle and tendon injuries also presents promising results. For example, a combination of hematoma aspiration and PRP injection has been associated with a significantly shorter return-to-play time and a lower recurrence rate in athletes with grade 2 hamstring strains compared to those receiving conservative treatment [18]. PRP has also been shown to improve early tendon healing in patients with Achilles tendon ruptures [21, 24].

Despite the potential of PRP, several questions remain regarding the optimal formulation, dosage, and rehabilitation protocols [19]. More rigorous studies are necessary to fully understand PRP's effectiveness and its applications in sports medicine [19, 20].

Effectiveness of Nonoperative Treatment

Nonoperative treatment is generally recommended for partial tears and patients with medical comorbidities or older age [8,9]. However, studies indicate that surgical intervention yields superior outcomes for complete ruptures, with significantly better strength and satisfaction reported in patients undergoing surgery compared to those treated nonoperatively [22, 23]. Nonoperative patients often experience a loss of strength but can regain full range of motion [8]. Overall, while nonoperative management may be suitable for certain cases, surgical treatment is associated with better functional outcomes, particularly in athletes with total ruptures [23].

The choice between nonoperative and operative treatment for pectoralis major muscle rupture should be individualized, taking into account the patient’s goals, level of physical activity, and the extent of the injury [30]. While nonoperative treatment can lead to satisfactory outcomes, it is important to counsel patients on the potential for decreased strength and cosmetic deformity [23, 30].

Studies have shown that patients treated nonoperatively experience significant strength loss, with isokinetic testing revealing only 71% strength compared to the uninjured side [22]. In contrast, surgical treatment, especially when performed within 6 weeks of injury, results in better strength recovery, patient satisfaction, and overall outcomes [8, 22]. A comparative study found that surgically treated patients had 70% excellent outcomes, while nonoperatively treated patients had 50% fair and 40% poor outcomes [23].These findings strongly support surgical intervention for complete pectoralis major ruptures in athletes.

Further research, particularly long-term studies, is needed to better understand the implications of nonoperative treatment and to refine rehabilitation protocols.

Conclusion

The treatment of pectoralis major muscle ruptures requires a carefully tailored approach that takes into account the injury's severity, the patient's activity level, and their desired outcomes. Nonoperative treatment can be effective

for partial tendinous tears, muscle belly tears, muscle origin tears, and complete tendinous tears in sedentary individuals or when surgery is not feasible. However, surgical intervention generally provides superior functional outcomes, particularly for athletes and those with complete ruptures.

Orthobiologic treatments, such as ultrasound-guided PRP injections, offer a promising complement to conservative management. PRP has the potential to enhance healing and improve patient satisfaction, particularly in cases of pectoralis major muscle ruptures. It has been shown to not only alleviate pain but also accelerate functional recovery. Studies suggest that patients receiving PRP report higher satisfaction rates and better outcomes than those who do not.

Nevertheless, many questions remain regarding the optimal formulation, dosage, and rehabilitation protocols for PRP. To fully understand PRP's effectiveness and refine its applications in sports medicine, more rigorous and long-term studies are needed. Additionally, further research is essential to enhance nonoperative treatment and rehabilitation protocols, ensuring the best possible outcomes for patients.

Disclosure:

Authors' contribution:
Conceptualization: Mateusz Bieńko, Marta Rutkowska, Piotr Nowakowski. Formal Analysis: Magdalena Marchaj, Michalina Toborek, Tomasz Król, Natalia Niedziela. Investigation: Magdalena Marchaj, Anna Putra, Piotr Nowakowski. Supervision:, Karolina Bednarz, Natalia Niedziela, Karolina Korta. Validation: Magdalena Marchaj, Karolina Bednarz, Karolina Korta, Natalia Niedziela. Writing - Original Draft: Mateusz Bieńko, Marta Rutkowska, Piotr Nowakowski. Writing - Review & Editing: Michalina Toborek, Tomasz Król, Magdalena Marchaj, Karolina Korta.

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