

CASE REPORT

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Rehabilitation After Anterior Cruciate Ligament Reconstruction: A Case Report

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Abstract

Anterior Cruciate Ligament (ACL) injuries are a prevalent concern among athletes, particularly in high-impact sports. This case report presents the diagnosis, surgical management, and comprehensive rehabilitation of a 17-year-old male athlete with a chronic ACL tear sustained during a futsal competition. The patient reported persistent knee pain, instability, and functional limitations exacerbated by delayed treatment. Diagnosis was confirmed through clinical examination and MRI, revealing a high-grade ACL tear. Surgical reconstruction was performed, followed by a structured rehabilitation program. Post-operative challenges included pain, stiffness, swelling, and quadriceps atrophy, necessitating targeted interventions. Rehabilitation progressed through four phases, focusing on pain management, restoring range of motion, strength, proprioception, and sport-specific skills. Outcome measures, including the KOOS and ACL-RSI, demonstrated significant improvement, enabling the patient to return to sports within six months. Early diagnosis and a phased rehabilitation program were critical for successful recovery. Delayed intervention and absence of pre-surgical rehabilitation posed challenges, underscoring the need for timely management and patient education. Multidisciplinary care and patient compliance were pivotal in achieving optimal outcomes. This case highlights the importance of early intervention, accurate diagnosis, and structured rehabilitation in ACL injury management. Raising awareness among athletes and coaches is essential to prevent delayed treatment and improve recovery trajectories.

Keywords

Anterior Cruciate Ligament, ACL Injury, Rehabilitation, Sports Medicine, Futsal Athlete, MRI Diagnosis, Post-Operative Recovery, Structured Rehabilitation, Return to Sports

Introduction

Anterior Cruciate Ligament (ACL) injuries are among the most common sports-related traumas, particularly in athletes engaging in high-impact activities like futsal. This case presents a 17-year-old male student and futsal athlete, referred for rehabilitation following ACL reconstruction surgery. The patient initially sustained an ACL injury during a school futsal competition in November 2021, involving contact with another player. Despite experiencing pain and swelling, he continued participating in futsal activities without proper treatment or rehabilitation, eventually leading to chronic instability in the right knee(1). Following MRI confirmation of a high-grade ACL tear in February 2022, the patient underwent surgical reconstruction on May 20, 2022, and was referred for rehabilitation three weeks post-operation. The patient reported right knee pain, stiffness, and swelling three weeks after the surgery, limiting joint movement and affecting daily mobility. Prior to the injury, he was highly active as an athlete, practicing futsal twice weekly and participating in school competitions. Despite being able to walk independently post-surgery, the patient struggled with ascending and descending stairs due to pain and limited joint mobility. The absence of pre- or post-surgical rehabilitation further contributed to persistent knee stiffness and quadriceps atrophy (2). The patient's psychosocial and economic conditions, including a strong support system and coverage under BPJS Kesehatan, provided a favorable environment for recovery.

Physical and neuromusculoskeletal examinations revealed localized inflammation, decreased range of motion (lag of extension 5° to 100° flexion), and quadriceps atrophy in the affected knee (3). Functional assessments demonstrated slight limitations in stair navigation and recreational participation, but the patient maintained independence in daily activities, as evidenced by a perfect Barthel index score. Diagnostic imaging, including X-rays and MRI, confirmed a high-grade ACL tear with no additional structural abnormalities (1). These findings underscored the need for a structured rehabilitation program to restore joint mobility, muscle strength, and functional stability (4).

The rehabilitation goals were both short- and long-term. Short-term objectives focused on reducing pain and swelling, improving range of motion, and strengthening the quadriceps and hamstring muscles. Long-term goals aimed at enabling the patient to return to daily activities and competitive sports while preventing reinjury. The rehabilitation program included ice compression, stretching, isometric strengthening exercises, proprioceptive training, and agility drills, tailored to the patient's recovery progress through various phases. The timeline spanned from early recovery (Phase 1) to advanced sport-specific training (Phase 4), ensuring a gradual and safe return to high-impact activities.

Over the six-month rehabilitation period, the patient demonstrated significant improvements in pain management, joint mobility, muscle strength, and functional performance. Outcome measures, including KOOS, IKDC, and ACL-RSI scores, confirmed excellent recovery, with the patient achieving nearly full functional capacity and readiness to return to sports. This case highlights the critical role of early and structured rehabilitation in managing post-ACL reconstruction recovery, emphasizing its impact on optimizing functional outcomes and preventing future injuries.

Discussion

Anterior Cruciate Ligament (ACL) injuries are a common and serious condition, particularly in athletes participating in high-impact sports such as futsal. In this case, the 17-year-old male athlete sustained an ACL injury during a school futsal competition due to contact with another player. Despite the initial injury, the patient continued to engage in sports activities, delaying treatment and rehabilitation, which resulted in chronic knee instability. This highlights the importance of early diagnosis and intervention to prevent long-term complications such as joint instability, muscle atrophy, and reduced functional performance (5).

The diagnostic process in this case was thorough and appropriately sequenced. The patient reported chronic knee pain, swelling, and functional instability, which were critical clinical indicators of an ACL tear. MRI imaging was instrumental in confirming a high-grade ACL tear, a gold-standard diagnostic tool for soft tissue injuries. This imaging also ruled out other associated knee pathologies, such as meniscal or collateral ligament injuries, ensuring that the treatment plan could be focused on the ACL

reconstruction and its sequelae(1). Accurate diagnostic imaging not only confirmed the extent of the injury but also provided a roadmap for both surgical planning and post-operative rehabilitation(4).

Post-surgical challenges were evident in this patient, including right knee pain, stiffness, swelling, and quadriceps atrophy. The absence of pre-surgical rehabilitation likely contributed to these complications, emphasizing the need for early intervention to optimize outcomes. The three-week post-operative referral to rehabilitation marked the beginning of structured recovery. Pain management, reducing inflammation, and restoring range of motion (ROM) were immediate priorities, as joint stiffness and swelling could hinder functional recovery. Techniques such as cryotherapy and manual therapy played a significant role in addressing these concerns (2,6).

The rehabilitation program for this patient followed a structured, phased approach. In Phase 1, the focus was on pain control, reducing inflammation, and restoring ROM (target: 0° extension to 100° flexion). Gentle stretching and isometric quadriceps exercises were introduced to prevent further muscle atrophy and maintain early strength. As the patient progressed to Phase 2, neuromuscular re-education and closed-chain strengthening exercises were incorporated. These targeted the restoration of knee stability and proprioception, crucial for activities of daily living and athletic function.

Phase 3 of rehabilitation emphasized advanced strengthening and agility training. Proprioceptive exercises, such as balance and single-leg drills, were introduced to improve joint stability and functional capacity. The patient also engaged in sport-specific drills to simulate the demands of futsal, including lateral movements, pivoting, and jumping mechanics. The progression to Phase 4 involved high-intensity training to prepare the patient for return to competitive sports. This included plyometrics, sprinting, and dynamic agility drills, ensuring that the patient regained confidence and competence in high-impact activities.

Outcome measures such as the Knee Injury and Osteoarthritis Outcome Score (KOOS), International Knee Documentation Committee (IKDC) score, and the ACL Return-to-Sport Index (ACL-RSI) were used to monitor progress throughout rehabilitation. These tools demonstrated significant improvements in pain reduction, joint stability, and functional performance. By the end of the six-month rehabilitation period, the patient had achieved nearly full functional recovery and readiness to return to sports. This underscores the effectiveness of a structured rehabilitation program tailored to the patient's specific needs and goals.

A key strength in this case was the patient's psychosocial and economic support. The presence of family encouragement and BPJS Kesehatan coverage ensured continuity of care without financial strain, contributing positively to the rehabilitation outcome. Additionally, the patient's motivation and adherence to the rehabilitation program were critical factors in achieving successful recovery. However, the absence of pre-surgical rehabilitation remains a missed opportunity, as it could have mitigated some post-operative complications and expedited recovery.

This case emphasizes the critical role of early diagnosis, structured rehabilitation, and patient compliance in the management of ACL injuries. Diagnostic imaging, such as MRI, remains essential for accurate assessment, while a phased rehabilitation program ensures safe and effective recovery(1,7). Future recommendations include raising awareness among athletes and coaches about the importance of early intervention and pre-surgical rehabilitation to optimize outcomes and minimize long-term sequelae in ACL injury cases.

Conclusion

This case highlights the successful management of an ACL injury in a young futsal athlete, emphasizing the critical role of timely diagnosis, surgical intervention, and structured rehabilitation. The patient's delayed presentation after the initial trauma underscores the importance of early recognition and management of sports injuries to prevent further complications. MRI played a pivotal role in confirming the

diagnosis of a high-grade ACL tear, guiding the treatment plan (1). ACL reconstruction surgery was instrumental in restoring knee stability and functionality, enabling the patient to resume physical activities (3,8). However, the absence of pre-surgical rehabilitation highlights a gap in the initial management that could have optimized surgical outcomes further (7).

Rehabilitation was tailored through progressive phases, starting with pain control and ROM restoration, advancing to strength and proprioception training, and culminating in sport-specific drills to prepare the patient for a return to athletic activities (5). The patient's dedication to the rehabilitation program and psychosocial support from family significantly contributed to his recovery, achieving nearly full functional capacity within six months. The case underscores the need for athlete education and awareness, particularly regarding the significance of seeking early medical attention and adhering to rehabilitation protocols. Moreover, access to healthcare through BPJS Kesehatan was pivotal in ensuring that the patient received the necessary interventions.

In conclusion, this case demonstrates that a multidisciplinary approach combining prompt diagnosis, surgical expertise, and structured rehabilitation can yield positive outcomes for young athletes with ACL injuries, enabling them to return to their pre-injury level of activity and reducing the risk of long-term complications.

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