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Case report

Peroneus longus tendon graft for anterior cruciate ligament reconstruction: A case report and review of literature

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ABSTRACT

Introduction: The anterior cruciate ligament (ACL) is one of the most frequently injured structures of the knee joint. Anterior cruciate ligament reconstruction (ACLR) provides surgical restoration of the injured ACL using the placement of graft material. The choice of graft is principal in providing optimal knee stability after surgery. Peroneus longus tendon (PLT) is an autograft modality that offers unique benefits for ACL reconstruction cases.
Presentation of case: We present a case of ACL reconstruction surgery using PLT graft in a patient with a confirmed ACL rupture. Assessment of post-surgical pain, knee stability, and ankle function were performed to determine functional outcome and donor site morbidity. The follow-up results revealed favorable recovery and improvement in all objective parameters.
Discussion: Post-operative biomechanical outcomes were evaluated using the International Knee Documentation Committee (IKDC) and the American Orthopedic Foot and Ankle Score (AOFAS) score. The use of PLT in ACL reconstruction established an excellent potential for its satisfactory result and comparable to other graft modalities in widely used evidence-based findings.
Conclusion: Peroneus longus tendon may be considered the first-option graft in ACL reconstruction as it indicated the absence of significant post-operative morbidity.

1. Introduction

The anterior cruciate ligament (ACL) is one of the most frequently injured knee joint structures, with an estimated incidence of 1.5% to 1.7% primary ACL cases per year in the general population [1,2]. Surgical reconstruction using a commonly originated graft from the patient's muscle (autograft) has become a widely performed procedure in management for an ACL injury to maintain the functionality and stability of the knee [3]. This procedure is minimally invasive as it is assisted by the use of arthroscopy. Autografts can be derived from several compatible muscles to maintain the strength and resistance of the original ACL structure. However, there is no consensus regarding the most appropriate graft choice to replace the injured ACL.

Patellar tendon (PT) graft is one of the most popular graft choices; however, it tends to cause pain on the anterior of the knee [4]. Hamstring tendon (HT) graft can be considered another best option because it provides better strength than PT; however, there is a varying muscle diameter in several individuals that leads to inefficient performance or even graft failure [4]. Additionally, HT graft may cause a significant decrease in strength at the original HT muscle site. Peroneus longus tendon (PLT) graft has been a preferred choice because of the various knee joint complications of the previously mentioned muscle graft. Furthermore, the advantage of PLT graft is that it does not cause secondary injury to the knee and its adjacent structures [5].

.Recent studies reported that PLT graft had maintained a potential better ACL substitute for its tensile strength and regeneration ability after being inserted post-surgery [4–6]. In this case, we performed a PLT graft and evaluated the clinical outcomes following the surgery. Informed consent was obtained from the patient for publication of this case report and images for medical education purposes. This case has been reported in line with the SCARE criteria [7].

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2. Presentation of case

The patient came to our outpatient clinic with complaints of knee instability on the right knee and pain in everyday activities, such as going upstairs or downstairs, knee buckling, and the inability to stand on

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the knee for long periods. Six years earlier, the patient had a history of a twisting knee injury while playing soccer. Previous medical condition and familial medical history was absent. On physical examination, Lachman's test and anterior drawer test were positive. Radiographic imaging did not show any fractures or dislocation. Magnetic Resonance Imaging (MRI) revealed anterior cruciate ligament rupture. Subsequently, we explained the ACL reconstruction and gained informed consent to perform ACL reconstruction using the PLT graft.

2.1. Surgical procedures

2.1.1. Peroneus longus tendon harvesting

We released the graft from the ipsilateral PLT by making a 2 cm longitudinal incision over the posterior border of the lateral malleolus. The superior peroneal retinaculum was evaluated until the posterolateral side of the PLT tendon was visible. We cut and sutured the distal part of the tendon (Fig. 1A). The proximal end was released by tendon stripper, with an approximated length of 4–5 cm proximally from the fibular head to prevent peroneal nerve injury. The tendon was separated from the muscle tissue to measure its length and diameter (Fig. 1B). The PLT graft was folded up in the middle to obtain two parallel muscle strands, named double-loop graft. In this patient, a double-loop graft was obtained with 8.5 mm in diameter and 13 cm in length.

2.1.2. Lavage, drilling, inserting

The visualization in assisted-arthroscopy confirmed the ruptured ACL (Fig. 2). We performed lavage and drilled on ACL foot print femoral bone (femoral tunnel preparation), followed by drilling tibial bone (tibial bone preparation). The double-loop PLT graft was inserted and fixated through the femoral tunnel (Fig. 3A) using EndoButton CL® (Smith & Nephew, Andover, MA). Fixation was also performed onto the tibial tunnel with an interference screw (Smith & Nephew, Andover, MA) (Fig. 3B).

2.2. Rehabilitation and evaluation

Following the surgery, we recommended rehabilitation protocol by applying knee immobilization at 0° extension and periodically increase until 90° flexion in the first week. After discharge, the patient used a brace that was set on the flexible range so that the patient could begin the active and passive range of motion exercise.

We evaluated the clinical outcomes using the visual analogue scale (VAS) pain scale, International Knee Documentation Committee (IKDC), and American Orthopedic Foot and Ankle Score (AOFAS) scores. The follow-up results revealed favorable recovery and improvement in all objective parameters. Subjective and objective pain was absent at the 6-months follow-up compared to the score of 4–5 pre-surgery. At 10-months post-operative follow-up, the IKDC assessment was 100%.

The AOFAS assessment was 100% at 12-months follow-up and the patient presented good ankle motoric power with no complaint regarding the ankle function. The range of motion for both ankle

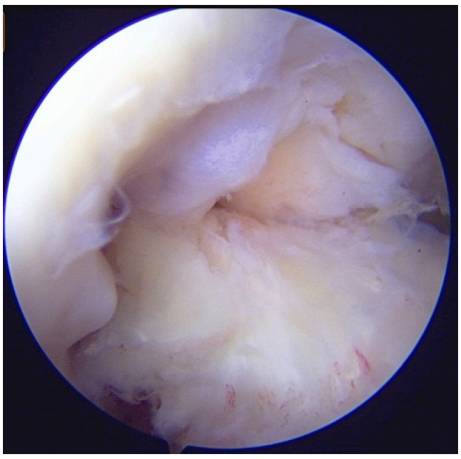

Fig. 2. Visualization of ruptured ACL.

eversion and first ray plantar flexion were not limited. The patient was unstable before surgery on the anterior drawer test, and Lachman's test indicated a score of +3. Post-operatively, the patient had negative results on Lachman's test and anterior drawer test.

3. Discussion

Anterior cruciate ligament reconstruction (ACLR) is the most common surgery to restore the injured ACL using the placement of graft material. The choice of graft is the most crucial operative plan consideration. The appropriate graft helps to prevent re-injury or re-rupture incidents and provides optimal knee stability. Mohtadi et al. reported that HT graft and bone patella tendon bone (BPTB) are related to post-operative complications, including anterior knee pain and stiffness [8]. In our study, we used PLT graft to replace the injured ACL. Surprisingly, the diameter of the PLT graft was 8.5 mm, which was larger than the ideal in diameter so that the reconstruction could be performed rapidly. Magnussen et al. stated the ideal minimum graft diameter of 7 mm is best to avoid revision surgery [9]. Other studies affirmed that a graft diameter of no less than 8 mm is the acceptable range for reconstruction [10,11].

Comparative studies on the use of HT and PLT grafts showed no significant differences between the pre- and 1-year post-surgery, based on the IKDC, modified Cincinnati, and Lysholm Knee Scoring Scale. The PLT graft was considered more superior because it provides larger graft diameter and less thigh hypotrophy with excellent ankle function based on AOFAS and Foot and Ankle Disability Index (FADI) [12,13].

Bi et al. compared the use of single-bundle anterior half of PLT vs. semitendinosus tendon. At the 2-year follow-up, the study found no differences between both groups in the VAS scale, IKDC score, pivot shift test, and KT-1000. Besides, the AOFAS score in the PLT group was more excellent than the semitendinosus tendon group. This finding concluded

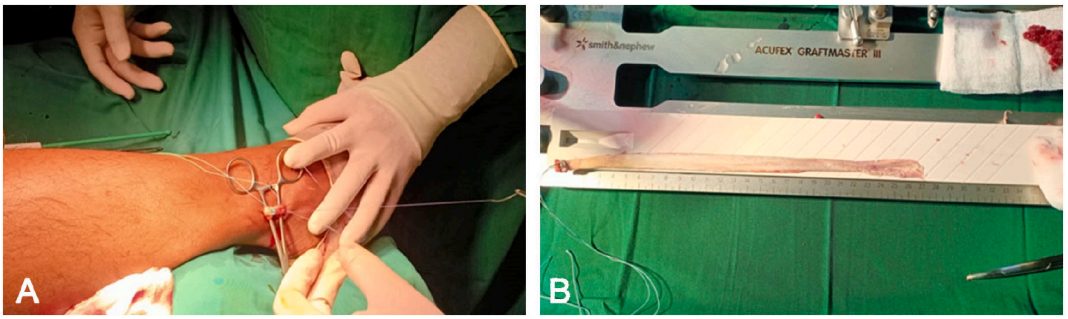

Fig. 1. A: Ipsilateral PLT graft harvesting; Fig. 1B: Measuring and suturing the double-loop graft (length was 27 cm before double-loop).

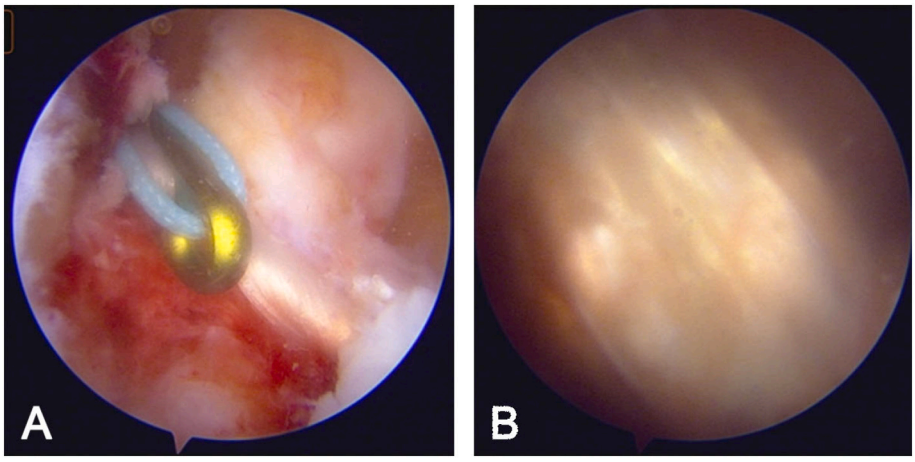

Fig. 3. A: Insertion of the PLT graft from the medial tibial tunnel to lateral femoral tunnel (at 10 PM); Fig. 3B: The ACL graft was inserted as in normal position. Object viewing was observed arthroscopically through an anterolateral portal.

that PLT graft provides greater strength and relatively safe for reconstruction [14].

The assessment on ankle plantar flexion and foot eversion muscle strengths showed normal function. A report on ACLR using anterior half PLT graft showed no complications in ankle and foot post-surgery [15]. Another study revealed enhancement on knee functionality based on the Lysholm and KT-3000 arthrometer scores, leaving no ankle functionality differences based on AOFAS score [16]. Both studies support the excellent improvement on the knee stability parameters and objectively presented no major ankle joint complications as found in our case.

A comparative study of the ankle eversion and first ray plantarflexion strength on the donor site vs. contralateral site at 6-month post-surgery revealed no significant differences. Furthermore, the FADI and AOFAS scores at the donor site were excellent [17]. These findings were similar to our patient, who could perform tip-toe walking with no ankle and foot function limitation after reconstruction. He et al. concluded that the PLT graft is suitable as an autograft harvested outside the knee to avoid the complication of quadriceps-hamstring imbalance that may occur after harvesting the graft from the knee [18].

Regardless of all the advantages of PLT grafts in ACL reconstruction, the graft preference was decided based on various clinical considerations by the surgeons. In achieving an excellent result, the consideration of the appropriate graft usage depends on many factors, including the associated meniscal and ligament lesions, high or low demand patient's activities, medical condition or comorbidities, pre-surgical status, patient decision, and the post-operative rehabilitation protocol [19].

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4. Conclusion

Peroneus longus tendon (PLT) is a promising graft in ACL reconstruction. It is considered the first-option graft in ACL reconstruction as it demonstrated the absence of significant post-operative morbidity regarding biomechanical inconveniency to the ankle donor site. Nevertheless, further research comparing the grafts in future clinical settings is still needed to gain an optimal function and stability of the knee.

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Ethical approval

Ethical approval was not required in the management of the patients in this report.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Author F contributes to the study concept or design, data collection, analysis, and writing the paper. Author AEW and GNWA contribute to the study concept or design, analysis and interpretation, mentorship external to the core team, and experts for the case and research activity planning including the execution of surgical treatment.

Research registration

Not applicable.

Guarantor

AEW and GNWA are the guarantors of the submitted article.

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Declaration of competing interest

The authors report no declarations of interest.

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