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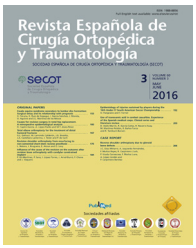

ORIGINAL ARTICLE

Revascularisation pattern of ruptured flexor tendon grafts in anterior cruciate ligament reconstruction: A histological study☆

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KEYWORDS
Anterior cruciate ligament;
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Abstract
Introduction: For successful anterior cruciate ligament (ACL) reconstruction, revascularisation and histological maturation are necessary, as their failure can cause graft rupture.
Purpose: The purpose of this study was to describe differences in the histological maturation of early failed plasty (less than 12 months after surgery) and late failed plasty (more than 12 months after surgery) in patients with re-rupture after ACL reconstruction with hamstring tendons.
Material and methods: A descriptive observational study was conducted on a consecutive series of 20 patients whose ACL reconstruction had failed. Graft biopsy samples were obtained during the revision surgery from the proximal, medial, and distal graft remnants. The samples were evaluated by light microscopy, and the vascularity and maturation of the samples were established by histological scoring.
Results: The most common aetiology of reconstruction failure (86.6%) was a specific event with non-contact mechanism. The patients with re-rupture of their ACL plasty less than 12 months after surgery had substance vessels that were less deep. The distal segment of the graft in those patients showed a delay in histological maturation with fewer collagen fibres.
Conclusion: In patients whose ACL grafts failed less than 12 months after surgery, a lower distribution of blood vessels and collagen fibres was found that were less ordered in the distal graft. These results indicate a delay in maturation, which leads to a higher risk of graft failure.

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PALABRAS CLAVE
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Patrón de revascularización de injertos de tendones flexores rotos en reconstrucción de ligamento cruzado anterior: un estudio histológico

Resumen
Introducción: Para la reconstrucción exitosa del ligamento cruzado anterior (LCA) son necesarias la revascularización y la maduración histológica del injerto. Fallos en este proceso pueden causar la rotura del neoligamento.
Objetivo: Describir las diferencias en la maduración histológica de plastias fallidas precoces (menos de 12 meses poscirugía) y tardías (más de 12 meses poscirugía) en pacientes con rerrotura de reconstrucción de LCA con tendones flexores.
Materiales y métodos: Estudio observacional descriptivo. Serie consecutiva de 20 pacientes con fallo en la reconstrucción de LCA con tendones flexores. Muestras obtenidas mediante biopsia de los remanentes del injerto (porción proximal, corporal y distal) durante la cirugía de revisión. Las muestras fueron evaluadas por microscopia de luz y la vascularización y la maduración fueron establecidas mediante un puntaje histológico descrito en la literatura.
Resultados: La causa más común de fallo de reconstrucción (86,6%) fue un evento identificable sin mediar traumatismo directo. Los pacientes con rotura precoz de la plastia del LCA presentaron vasos sanguíneos más superficiales en comparación con los con rotura tardía. El segmento distal del injerto en los pacientes con roturas precoces mostró una menor maduración histológica con menor número de fibras de colágeno.
Conclusión: En los pacientes que presentaron fallos en las reconstrucciones de LCA precoces (dentro de los 12 meses poscirugía) encontramos una distribución menor de vasos sanguíneos y fibras de colágeno en la región distal del injerto. Estos resultados indican un retraso en la maduración, pudiendo generar mayor riesgo de fallo del injerto.

Introduction

The anterior cruciate ligament (ACL) can be reconstructed using different types of graft, although 2 types are mainly used: flexor tendon (ischiotibial) grafts or bone-tendon-patella-bone (BTB)[1] grafts. Although the results obtained with these techniques achieve high success rates, there are still questions as to the time required for grafts to mature. This is of fundamental importance in determining when patients can resume their usual activities, as well as because of delays in the process that may give rise to high risks of failure of the surgery and repeat breakage of the LCA.[2]

Independently of the type of graft used, it must over time gain characteristics similar to those of the native ACL, in a process that is termed ligamentisation.[3] The original descriptions of this process were based on animal models with BTB[3] reconstruction, and all of the stages for other types of graft have yet to be characterised. Dissimilar results are reported, with times to maturity varying from 6 to 18 months after surgery. Outstanding stages that have been described within the ligamentisation process are ischaemic necrosis, revascularisation, remodelling and maturing, ending in a graft that is histologically similar to the LCA.[4,5] The most critical phase is probably graft revascularisation, given that histological and biomechanical maturity depend on this; The original studies described canine models in which graft vascularity originated in the infrapatella fat and rear structures of the joint, while current studies using magnetic resonance imaging (MRI) in reconstructed patients show that flexor graft vascularity stems from branches of the medial and inferior genicular arteries. The first part of the graft to be revascularised is the part within the joint, while those within the bones do so later.[6–8] This agrees with histological studies that evaluated ACL arthroplasties, which found that revascularisation within the joint occurs after week 24.[9] The authors are not aware of any study that has evaluated the vascularity present in the grafts of failed ACL arthroplasty, and we believe this question to be fundamental to determine the cause of the new breakage. To date this question has not been clarified, and it has been hypothesised to be due to a combination of biological, technical and traumatic factors.

This study aims to determine the histological pattern of graft maturing and revascularisation in 3 different segments of the broken arthroplasty (proximal, medial and distal) in patients with early primary ACL reconstruction failure (during the first 12 months after surgery), and late failures (after the first 12 months following surgery). We hypothesise that in patients with early failure there is a delay in the ligamentisation process.

Materials and methods

This is a prospective, observational, comparative and blind study (the latter regarding histological evaluation) of a consecutive series of 20 patients with breakage of ACL arthroplasty. Following approval by the Bioethics Committee of our institution, we identified patients with ACL arthroplasty breakage at least 6 months after the