



Fibular Head–Based Posterolateral Reconstruction of the Knee

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The purpose of this article is to present the author's experience with fibular head–based surgical procedures for the treatment of posterolateral instability of the knee. The surgical techniques presented are the biceps tendon transfer procedures, and the fibular head–based figure of 8 posterolateral reconstruction using free grafts. Each of these techniques is combined with capsular repair or posterolateral capsular shift or both procedures in all cases. The decision points for surgical technique selection, the surgical technique itself, the postoperative rehabilitation, and the outcomes of these surgical procedures are presented, including a comparison of the biceps tendon procedures with the free graft procedure. Oper Tech Sports Med 23:321-330 © 2015 Elsevier Inc. All rights reserved.

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Introduction

The purpose of this article is to present the author's experience with fibular head–based surgical procedures for the treatment of posterolateral instability (PLI) of the knee. The surgical techniques presented are the biceps tendon transfer procedures, and the fibular head–based figure of 8 posterolateral reconstruction using free grafts. Each of these techniques is combined with capsular repair or posterolateral capsular shift or both procedures in all cases. The decision points for surgical technique selection, the surgical technique itself, the postoperative rehabilitation, and the outcomes of these surgical procedures are presented, including a comparison of the biceps tendon procedures with the free graft procedure.¹⁻⁴

Classification

The function of the posterolateral corner (PLC) structures of the knee is to resist varus stress, to resist posterior tibial translation near full extension, and to resist external tibial rotation. The important structures responsible for

posterolateral stability include the complex interaction of the fibular collateral ligament, the popliteus tendon, the popliteo-fibular ligament, the midlateral capsule, and the posterolateral capsule. The goal of posterolateral reconstruction surgery is to correct the abnormal patterns of motion about the knee by eliminating axial rotation, varus, and hyperextension instability.⁵⁻⁷

Overall, 3 types of PLI of the knee may be encountered: A, B, and C.⁸ These 3 types of PLI are determined by physical examination, and correlating the physical examination findings with the intraoperative findings. PLI includes at least 10° of increased tibial external rotation compared with the normal knee at 30° of knee flexion (positive dial test and external rotation thigh foot angle test), and variable degrees of varus instability depending on the injured anatomical structures.^{5,9-11} PLI Type A has increased external rotation only, resulting from attenuation of the popliteofibular ligament, popliteus tendon, and posterolateral capsule. PLI Type B presents with increased external rotation, and approximately 5-10 mm of increased lateral joint line opening with a soft end point to varus stress at 30° knee flexion compared with the normal knee. This occurs with attenuation or minor avulsion of the popliteofibular ligament, popliteus tendon, fibular collateral ligament, and midlateral and posterolateral capsules. Hyperextension compared to the normal knee may or may not be present. PLI Type C presents with increased tibial external rotation, varus laxity with no discernible end point, and

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hyperextension compared with the normal knee. This occurs with major avulsion or disruption of the popliteofibular ligament, popliteus tendon, fibular collateral ligament, midlateral and posterolateral capsules, and often includes disruption of one or both cruciate ligaments.

The physical examination varies depending on the type of PLI. All types of PLI demonstrate increased external rotation compared with the patient's uninjured knee; however, the degree of varus laxity varies depending on the severity of injury to the involved structures. Multiple physical examination tests should be used to determine the classification of pathologic motion because this determines the surgical treatment.^{6-8,10-13}

Surgical Treatment Principles

The surgical treatment principles of posterolateral reconstruction include the following. Peroneal nerve decompression and neurolysis are performed in each case, and the peroneal nerve is protected throughout the procedure. It is essential to identify the abnormal planes of instability, and to correct and eliminate the abnormal tibial external rotation, varus laxity, and hyperextension external rotation recurvatum. The midlateral and posterolateral capsules must always be addressed by either primary repair, capsular shift, or a combination of the 2.^{1-3,14-21} Primary repair of all injured structures when possible combined with posterolateral reconstruction is more successful than primary repair alone.^{22,23}

Surgical Timing

Surgical timing in acute PLI of the knee is dependent on the severity of the injury.^{1,2,8,10,11,24-31} PLI Type A presents with increased external rotation only, resulting from attenuation of the popliteofibular ligament, popliteus tendon, and posterolateral capsule. Surgical treatment of PLI Type A can usually be performed within 3-4 weeks of the initial injury. PLI Type B presents with increased external rotation, and approximately 5-10 mm of increased lateral joint line opening with a soft end point to varus stress at 30° knee flexion compared with the normal knee, and the varus laxity decreases as one approaches full extension. This occurs with attenuation or minor avulsion of the popliteofibular ligament, popliteus tendon, fibular collateral ligament, and midlateral and posterolateral capsules. Hyperextension compared with the normal knee may or may not be present. Surgical treatment of PLI Type B also can usually be performed within 3-4 weeks of the initial injury.

PLI Type C presents with increased tibial external rotation, varus laxity with no discernible end point, and hyperextension compared with the normal knee. This occurs with major avulsion or disruption of the popliteofibular ligament, popliteus tendon, fibular collateral ligament, midlateral and posterolateral capsules, and often includes disruption of one or both cruciate ligaments. PLI Type C is typically treated with a staged surgical procedure. Stage 1 is peroneal nerve decompression and neurolysis, and posterolateral primary repair and capsular procedure combined with posterolateral reconstruction within the first 10 days of the injury. Stage 2 is

cruciate ligament reconstruction approximately 4-6 weeks later.

The surgical timing scenario outlined here is a guideline that may need to be altered based on the condition of the patient's skin, nerves, blood vessels meniscus, articular cartilage, fractures, remote orthopaedic trauma, and other organ system trauma. The timing of the knee surgery is to be considered within the context of the patient's overall health and condition.^{1,2}

Surgical Decision Making

The surgical decision making concerning PLC surgery is dependent on the pathology at the time, and the planes of instability of the injured knee. In both acute and chronic cases, primary repair is performed when possible using suture anchors, suture through drill holes, or screws and spiked washers. Primary repairs are then augmented with a posterolateral reconstruction procedure, which has proven to be more effective than primary repair alone in PLI.^{22,23}

Split biceps tendon transfer is most successful in Types A and B PLI when local autogenous tissue is required.^{3,4,24-28,32-34} This method of reconstruction is applicable in both the acute and chronic clinical scenarios as long as the proximal tibiofibular joint is intact, the posterolateral capsular attachments to the common biceps tendon are intact, and the biceps femoris tendon insertion into the fibular head is intact.

Fibular head-based figure of 8 posterolateral reconstruction using allograft or autograft tissue is applicable in the acute and chronic situations, and with Types A and B, and some Type C PLI patterns. In the case of Type C PLI, there must be adequate midlateral and posterolateral capsules, and the absence of hyperextension.^{1-3,24,32,33}

Fibular head-based figure of 8 posterolateral reconstruction combined with a proximal tibia-based popliteus tendon bypass posterolateral reconstruction is used in both the acute and chronic clinical scenarios. In addition, this combined posterolateral reconstruction surgical procedure is used when there is disruption of the proximal tibiofibular joint, in PLI Type C when there are inadequate midlateral and posterolateral capsules, and when there is hyperextension compared with the normal knee demonstrated by the heel lift-off test.^{1-3,24,32,33}

Regardless of the posterolateral reconstruction surgical procedure chosen, the midlateral and posterolateral capsules are always addressed with primary repair of injured capsular tissues, a capsular shift procedure, or a combination of the 2 in both the acute and chronic situations. Failure to address the capsule results in residual posterolateral laxity. Lower extremity alignment is important for successful posterolateral reconstruction, and osteotomy is used as necessary.^{1-3,14,24,32-34}

Biceps Tendon Transfer Posterolateral Reconstruction

There are 2 types of biceps tendon transfer procedures described: the full biceps tendon transfer and the split biceps tendon transfer. Although the full biceps tendon transfer

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