



Original Article

Radiographic study on the tibial insertion of the posterior cruciate ligament[☆]



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ABSTRACT

Objective: To establish the radiographic distances from posterior cruciate ligament (PCL) tibial insertions centers to the lateral and medial tibial cortex in the anteroposterior view, and from these centers to the PCL facet most proximal point on the lateral view, in order to guide anatomical tunnels drilling in PCL reconstruction and for tunnel positioning postoperative analysis.

Study design: Controlled laboratory study.

Methods: Twenty cadaver knees were evaluated. The PCL's bundles tibial insertions were identified and marked out using metal tags, and the knees were radiographed. On these radiographs, the bundles insertion sites center location relative to the tibial mediolateral measure, and the distances from the most proximal PCL facet point to the bundle's insertion were determined. All measures were calculated using the ImageJ software.

Results: On the anteroposterior radiographs, the mean distance from the anterolateral (AL) bundle insertion center to the medial tibial edge was 40.68 ± 4.10 mm; the mean distance from the posteromedial (PM) bundle insertion center to the medial tibial edge was 38.74 ± 4.40 mm. On the lateral radiographs, the mean distances from the PCL facet most proximal point to AL and PM bundles insertion centers were 5.49 ± 1.29 mm and 10.53 ± 2.17 mm respectively.

Conclusions: It was possible to establish a radiographic pattern for PCL tibial bundles insertions, which may be useful for intraoperative tunnels locations control and for postoperative tunnels positions analysis.

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[☆] Work developed in the Faculdade de Ciências Médicas e da Saúde de Sorocaba, Pontifícia Universidade Católica de São Paulo, Sorocaba, SP, Brazil.

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Estudo radiográfico da inserção tibial do ligamento cruzado posterior

R E S U M O

Palavras-chave:

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Objetivo: Estabelecer as distâncias radiográficas dos centros das inserções tibiais do ligamento cruzado posterior (LCP) até as corticais medial e lateral da tíbia, nas radiografias em anteroposterior, e desses centros até o ponto mais proximal da faceta do LCP, nas radiografias em perfil, para que possam orientar a criação de túneis anatômicos na reconstrução do LCP e para análise pós-operatória do posicionamento dos túneis.

Desenho: Estudo laboratorial controlado.

Métodos: Vinte joelhos de cadáveres foram avaliados. As inserções tibiais das bandas do LCP foram identificadas e demarcadas com marcadores metálicos e os joelhos foram radiografados. Nas radiografias determinamos a localização do centro de inserção das bandas relativa à medida mediolateral da tíbia e as distâncias do ponto mais proximal da faceta do LCP até o centro de inserção das bandas. Todas as medidas foram calculadas com o software ImageJ.

Resultados: Nas radiografias em anteroposterior a distância média entre o centro da inserção da banda anterolateral (AL) até a borda medial da tíbia foi de $40,68 \pm 4,10$ mm; a distância entre o centro de inserção da banda posteromedial (PM) até a borda medial da tíbia foi, em média, de $38,74 \pm 4,40$ mm. Nas radiografias em perfil as distâncias médias entre o ponto mais proximal da faceta do LCP e os centros de inserção das bandas AL e PM foram de $5,49 \pm 1,29$ mm e $10,53 \pm 2,17$ mm, respectivamente.

Conclusões: Foi possível estabelecer um padrão radiográfico das inserções tibiais das bandas do LCP que pode ser útil para o controle intraoperatório da localização dos túneis e para análise pós-operatória da posição dos túneis.

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Introduction

Anatomical positioning of the graft is a requisite for achieving a good result from posterior cruciate ligament (PCL) reconstructions.¹⁻³ Success in surgical treatments for PCL injuries is related to precise restoration of PCL anatomy.⁴ In a recent published paper, the anatomical location and measurements of the tibial insertions of the PCL were described.⁵

Improper positioning of the tunnels in PCL reconstruction may cause shortening or lengthening of the graft during knee flexion and, ultimately, failure.⁶

For the function of the reconstructed ligament to be normal, anatomical reconstruction of its anterolateral (AL) and posteromedial (PM) bands should be envisaged, given that biomechanical studies have shown that PCL reconstruction with a double band is superior to reconstruction with a single band.⁷⁻⁹

Correct demarcation of the insertion sites of the AL and PM bands of the PCL and the correlated radiographic images might assist in providing greater precision for surgical reconstruction of this ligament.¹⁰⁻¹²

Computed tomography is a potentially useful tool for evaluating the locations of bone tunnels, which even has the possibility of generating three-dimensional reconstructions,¹³ although their use in the operating theater is not possible.

Magnetic resonance is less effective for evaluating the positioning of the tunnels in cruciate ligament reconstructions, because interference screws or other metal artifacts used in graft fixation may interfere with image quality.¹¹

The aim of our study was to define the radiographic distances from the centers of the tibial insertions of the bands of the posterior cruciate ligament to the medial and lateral cortical bone of the tibia, on radiographs in anteroposterior view, and from these centers to the most proximal point of the facet of the PCL, on radiographs in lateral view, so that these might guide the creation of anatomical tunnels during operations and so that these might serve as analytical parameters for positioning bone tunnels after these operations.

Methods

The insertions of the AL and PM bands of the PCL were evaluated in 20 anatomical specimens from the knees of adult cadavers (11 right and 9 left knees). The specimens were not paired and their sex and age data were unknown. All the knees presented intact anterior and posterior cruciate ligaments and none of them showed any macroscopic signs of arthrosis.

Before the dissection, the specimens were fixed in 10% formol and were conserved in a mixture of 2.5% phenol, 2.5% formol and 1% sodium chloride. Following this, they were kept in liquid glycerin for 60 days.

We identified and isolated the tibial insertions of the AL and PM bands of the PCL and then resected them. The centers of the bands were determined from the intersection of the diameters of the height and width and were indicated by means of metal markers that were glued directly onto the bone, using special glue. Markers of different format were used for each band (Fig. 1).

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