RISKS AND CONSEQUENCES OF USING THE TRANSPORTAL TECHNIQUE IN RECONSTRUCTING THE ANTERIOR CRUCIATE LIGAMENT: RELATIONSHIPS BETWEEN THE FEMORAL TUNNEL, LATERAL SUPERIOR GENICULAR ARTERY AND LATERAL EPICONDYLE OF THE FEMORAL CONDYLE

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ABSTRACT

Objective: Define a security zone to avoid possibles vascular and ligamentar complications during anterior cruciate ligament reconstruction. Methods: Arthroscopic reconstruction using the transtibial and transportal technique in cadaver knees was performed followed by dissection and measurement of the distance between the femoral tunnel and the proximal attachment of the lateral collateral ligament and the femoral tunnel and the lateral superior genicular artery. Results: The measure of the analysed distances show us an aproximation between the major branch of the lateral superior genicular artery and the femoral insertion of the colateral lateral ligament and the femoral tunnel during the transportal technique. Conclusion: We realize that the use of technical ship it to arthroscopic ACL reconstruction has a higher probability of injury to the lateral geniculate artery and insertion of the lateral collateral ligament, promoting post-surgical complications such as instability of the knee, osteonecrosis of the femoral condyle and ligamentização graft.

Keywords – Anterior Cruciate Ligament; Surgical Procedures, Minimally Invasive; Arteries; Femur

INTRODUCTION

The anterior cruciate ligament (ACL) is one of the main structures of the knee and is responsible for anteroposterior and rotational stabilization[1]. It proximal insertion is in the medial surface of the lateral femoral condyle and its distal insertion is in the anterolateral depression of the intercondylar fossa of the tibia[1] and is composed of two band: the anteromedial band and the posterolateral band[2,3]. Recreational or professional sports activity requires good knee function, and greater participation in sports among the general population exposes these individuals to increased risk of injury, and ACL lesions are very common. Surgical treatment is usually considered to be the best therapeutic option for knees with a deficient ACL, and this results in approximately 100,000 reconstructions per year in the United States[4].

Clinical and biomechanical studies have provided better understanding of this ligament in relation to joint dynamics and have contributed towards improvements in reconstruction operations seen over recent years. Arthroscopic reconstruction of the ACL is a commonly performed and successful orthopedic surgical procedure, and there is considerable variety in the techniques and materials used. The objective of surgical treatment is to reestablish knee stability, enable a return to sports activity and, over the long term, avoid joint osteoarthrosis[5,6].

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Among the techniques used for ACL reconstruction, the one most commonly performed is the transtibial technique, in which the femoral tunnel is produced using a guide introduced via the tibial tunnel, thus resulting in a verticalized and isometric bit non-anatomical position for the neoligament[7]. Studies have shown that there is great difficulty in achieving a horizontalized position for the femoral tunnel[8,9] by means of the transtibial technique. Non-anatomical reconstruction of the ligament is considered to be the cause of some poor results from this surgery, such as persistence of rotational instability, which has stimulated development of techniques that would favor anatomical positioning for the neoligament[10]. The option of reconstructing both bands (anteromedial and posterolateral) has been shown to be effective[10-13], but frequent technical difficulties, longer duration of the operation and greater cost of the fixation materials have been among the limitations on popularization of this technique.

Performing reconstruction by means of a transportal technique has been shown to be an option when it is possible to combine anatomical reproduction of the ligament (by means of independent positioning of the femoral and tibial tunnels) with the practicality of single-band reconstruction of the knee[14]. The neoligament results in a horizontalized position, thus providing greater anteroposterior and rotational stability[15,16] and biomechanical performance[16-18], and minimizing occurrences of future osteoarthrosis[5,6].

With a horizontalized and distal position for the femoral tunnel, its entry point is located at the center of the femoral footprint, at the midpoint between the insertions of the two bands in the ACL or at the site of the posterolateral band of the native ligament[19]. Horizontalization of the femoral tunnel resulting from the transportal anatomical technique[20] exposes the guidewire of the femoral tunnel to an anatomical region of the lateral femoral condyle that is usually not approached[21]. This region contains the main artery feeding the lateral femoral condyle and one of the main vascular branches of the popliteal artery: the lateral superior genicular artery[22,23]. Furthermore, the lateral epicondyle of the femur is close to this region, and this is the site of proximal insertion of the lateral collateral ligament and the tendon of the popliteal muscle. The risk of injury to the structures close to the lateral cortex of the femur may lead to significant complications[24].

The aims of the present study were to measure and compare the mean distance between the center of the tunnel in the lateral femoral condyle and the lateral epicondyle and main branch of the lateral superior genicular artery, while performing ACL reconstruction in cadaver knees by means of the transtibial and transportal techniques, and to be able to define the risk of injury to the structures studies and the possible consequences of such risks.

METHODS

This project was analyzed and approved by the Ethics Committee of the Federal University of São Paulo.

We used three knees from cadavers for studying the lateral femoral condyle, and these knees were presented with the distal 20 cm of the femur and the proximal 20 cm of the tibia. Firstly, all the arteries present at the extremities were identified and ligated using cotton thread, so that only the proximal and distal regions of the popliteal artery (the only one without an obstructed channel) would function as an entry and exit point for the contrast applied to the knees.

We introduced injections of non-transparent liquid silicone contrast in association with red stain through the popliteal artery in order to identify and measure the structures under examination. We performed arthroscopy on the knees in an appropriate laboratory using appropriate instruments. The entire ACL was damaged and resected, and then we introduced guidewires into the femur using the transportal and transtibial technique, thus simulating the exit point of the tunnels that are generally used (Figures 1 and 2).

The third phase of the study consisted of dissection of the joints. With the transtibial and transportal guidewires still in place, a lateral route was constructed and dissected down to the deeper layers of the posterolateral compartment, in order to view the entire length of the lateral superior genicular artery, from its start in the popliteal artery and the definition of the lateral epicondyle and structures inserted there (Figure 3).

The distance from the femoral tunnel to the proximal insertion of the lateral collateral ligament and the distance from the femoral tunnel to the main branch of the lateral superior genicular artery were measured and compared between the different techniques for ACL reconstruction that were examined.