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# CORRELATION BETWEEN MAGNETIC RESONANCE IMAGING AND PHYSICAL EXAM IN ASSESSMENT OF INJURIES TO POSTEROLATERAL CORNER OF THE KNEE

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## ABSTRACT

**Objective:** Evaluate the correlation between magnetic resonance imaging, clinical examination and intraoperative identification of posterolateral corner injuries of the knee. **Methods:** We compared the findings of physical examination under anesthesia and intraoperative findings as the gold standard for the posterolateral corner injury with the reports of the MRIs of patients who underwent reconstruction of the posterolateral corner. Thus, we evaluated the use of MRI for the diagnosis of lesions. **Results:** We found a sensitivity of 100% in lesions of the

anterior cruciate ligament (ACL), 86.96% in lesions of the posterior cruciate ligament (PCL), 57.58% in lesions of the lateral collateral ligament (LCL) and 24.24 % in tendon injuries of the popliteal muscle (PMT). **Conclusion:** Posterolateral corner injury is difficult to visualize and interpret; therefore, MRI imaging should not be used alone for diagnosis. **Level of Evidence II. Diagnostic Studies.**

**Keywords:** Knee. Magnetic resonance imaging. Physical examination.

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## INTRODUCTION

Injury to the posterolateral corner (PLC) is difficult to diagnose,<sup>1,2</sup> being a rare and isolated lesion, occurring in less than 2% of cases. The majority of lesions are embedded in a context of complex injuries of the knee, especially the anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL).<sup>2-4</sup>

The study of the posterolateral complex is gaining importance due to the complex instability caused by its injury and the greater chance of failure in the reconstruction of the anterior and posterior cruciate ligaments in the presence of non-identified associated injuries.<sup>4-10</sup>

The specific physical examination tests described to date for assessment of PLC lesion are "recurvatum and external rotation", "posterolateral drawer", "reverse pivot-shift" and "posterolateral rotation" (dial-test).<sup>11,12</sup>

Despite the description of several tests of physical examination for diagnosis of PLC lesions, in 72% of cases they are not identified in his initial presentation, which demonstrates the difficulty of clinical diagnosis. This difficulty is greatly

increased in association with lesions of the central pivot and medial collateral ligament.<sup>13</sup>

Thus, it is important to use additional tests for the diagnosis of posterolateral corner injury. The medical literature describes that MRI has an accuracy of up to 95% for identifying major injury PLC structures, namely, lesions of the lateral collateral ligament (LCL), popliteus muscle tendon (PMT) and popliteal-fibular ligament (LPF).<sup>14</sup>

Yu *et al.*<sup>15</sup> showed that for better visualization of the PLC structures, an oblique coronal T2 cut should be performed. LaPrade *et al.*,<sup>7</sup> in a protocol including in all cuts the fibular head, obtained high sensitivity for PLC lesions and reinforced the best view of LCL, PMT and LPF in the oblique coronal plane.

It is considered the gold standard for defining the presence or absence of PLC lesions the intraoperative identification of the damaged structures.

The objective of this study is to evaluate the correlation between MRI, clinical examination and intraoperative identification of the posterolateral corner injuries.

All the authors declare that there is no potential conflict of interest referring to this article.

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## MATERIALS AND METHODS

A prospective study of patients with ligament injuries at the posterolateral corner of the knee undergoing treatment with surgical reconstruction from February 2012 to August 2013 was performed. In this study, patients undergoing ligament injuries indicated for reconstruction of the lateral collateral ligament and of the popliteal muscle tendon have been included. Patients with vascular injury requiring repair or fractures near the knee associated to ligament injuries were excluded. The research project received the approval of the Ethics Committee of our Institution.

The evaluations were performed according to the sequence patients were seen at our service. All patients underwent MRI of the affected knee. This examination was performed at our institution or in another location, always a 1.5T scanner. (Figure 1) The patients had surgical indication based on the findings of the physical examination and magnetic resonance images, without evaluating the description of the exam report.

All patients underwent a second physical examination when anesthetized in the operating room for better evaluation of the injured structures and confirmation of the surgical plan. During operation structure injuries to be reconstructed were confirmed by direct visualization or by arthroscopy.

The posterolateral corner reconstructions were performed using a single femoral isometric point as recommended by Stanard *et al.*<sup>16</sup> and when associated lesions of the anterior cruciate ligament were found, the femoral unique tunnel technique was used as described by Angelini *et al.*,<sup>17</sup> reconstructing the lateral collateral ligament, the popliteal muscle tendon, and the popliteal-fibular ligament.

After surgery, MRI reports were compared to intraoperative findings and results of physical examination under anesthesia.



**Figure 1.** MRI image of left knee of a 21 year old patient with intra-operative posterolateral corner injury.

## RESULTS

Thirty-three patients, five females and 28 males with mean age of  $32.9 \pm 9.8$  years old (range 18-59) were included in the study. MRIs were performed on average  $7.8 \pm 3.8$  months after injury, with a minimum time of three months and maximum of 18 months. Regarding the mechanism of injury, 23 injuries were caused by motorcycle accident, four by car accidents, three falls from heights, one on sports practice, one for assault and one by run over.

Regarding injuries, all patients should have LCL and PMT injuries confirmed intra-operatively. Of these, 11 (33.33%) patients had associated injuries to only the posterior cruciate ligament (PCL), 11 (33.33%) had associated injury to only the anterior cruciate ligament (ACL) and 13 (39.39%) had associated injuries to ACL or PCL. No patient had lesion of the medial collateral ligament.

Of all the MRIs, 21 were performed at the Institute of Radiology, Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, and 12 were held in other services.

During the review of reports, we found 21 PCL diagnosed injuries, 23 ACL diagnosed injuries, 19 diagnosed lesions of the lateral collateral ligament, and 8 diagnosed lesions of the popliteal tendon.

Correlating the findings of physical examination under anesthesia and intraoperative findings with MRI reports, we found a sensitivity of 100% on ACL injuries, 86.96% in PCL injuries, 57.58% in LCL lesions and 24, 24% in PMT lesions.

## DISCUSSION

PLC is formed by a set of different structures, however, the current literature has identified the lateral collateral ligament (LCL), the popliteus muscle tendon (PMT) and popliteal-fibular ligament (LPF) as the three main structures responsible for the stabilization of this region.<sup>18</sup>

The clinical diagnosis of PLC lesions is difficult to achieve, even with the broad spectrum of physical exam maneuvers available to identify them.<sup>13</sup> Thus, imaging studies gain importance helping diagnosis.

These three structures have been assessed in dissection studies and their origins, insertions and studied dimensions, as well as their visualization by MRI, which has been recognized as an appropriate method for its assessment.<sup>14,15,18,19</sup>

However, we note that in clinical practice it is still difficult to diagnose injuries on such structures, even with MRI. Our work shows this difficulty of diagnosis in clinical and radiological practice within the current national scenario.

We believe that this disparity occurs in part because current studies on the accuracy of MRI for evaluation of PLC carry out specific protocols for the identification of such injuries, including coronal oblique and sequence views, with all cuts including the fibula head.<sup>14,15</sup> These protocols, however, are not followed in daily investigations of knee trauma. The advantage of performing oblique coronal slices is mainly recognized for identification of the intra-oblique articular part.<sup>14,15</sup>

Another reason for the disparity would be that all MRIs were done during chronic phase of the injury, which may reduce the tests accuracy. This situation has not been studied in the literature, since the existing studies include only acute cases or insufficient number of such cases for comparison.<sup>14,15,20</sup> Since lateral stretches most easily evolve with impaired compartment

on patients follow up due to a progressive loosening, lesions with little change in imaging may evolve with poor follow up outcome.<sup>21</sup> This situation differs from the medial compartment, that has better healing potential with conservative procedure.<sup>22</sup> In acute injuries, the presence of fluid in the region tends to facilitate diagnostics.

The results from our study show that, unlike the lesions of the central pivot of the knee, peripheral lesions are less diagnosed by imaging. This may be due to a greater number of structures overlying the lateral aspect of the knee, among which we can mention the iliotibial tract, anterolateral ligament, joint capsule and biceps tendon, all of them making it difficult to properly visualize lateral collateral ligament, and popliteus muscle tendon.<sup>23</sup> Finally, the lack of communication between the orthopedic sur-

geon who performed and evaluated the diagnostic hypotheses of patient's injuries and the radiologist who performed the examination report hinders targeting the exam and its investigation, decreasing the chances of a proper diagnosis.

Our study seeks to demonstrate the lack of correlation between data found in the current literature with national clinical practice regarding the diagnosis by imaging of posterolateral corner injuries.

## CONCLUSION

The injury of lateral collateral ligament is described in MRI reports in 57.5% of cases, and the popliteus muscle tendon in only 24.2%, and this cannot be the determining factor for surgical indication for reconstruction.

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