Contralateral Anterior Cruciate Ligament Rupture 11 Years or More Post ACL Repair With Either Hamstring Tendon or Patellar Tendon Autografts

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Contralateral Anterior Cruciate Ligament Rupture 11 Years or More Post ACL Repair With Either Hamstring Tendon or Patellar Tendon Autografts

Abstract

Background: Anterior cruciate ligament (ACL) injuries are common but devastating injuries. After ACL reconstruction there is an elevated risk of rupture to the contralateral ACL, and this risk may be increased over time with patellar tendon autografts. Does risk of rupture increase for the contralateral ACL 11 years or more after ACL reconstruction when using a patellar tendon versus a hamstring tendon autograft?

Methods: An exhaustive search of available medical literature was conducted using Medline-OVID, PubMed, and CINAHL using the keywords: anterior cruciate ligament, contralateral, rupture, and long term. Results were limited to human studies. Relevant article were assessed for quality using the GRADE criteria.

Results: Two studies met inclusion and exclusion criteria for this systematic review. One randomized controlled trial enrolled 64 patients who underwent arthroscopic anterior cruciate ligament reconstruction with either a hamstring tendon (HT) autograft or patellar tendon (PT) autograft and were followed for 11 years. After 11 years of follow-up, there were 6% (n=2) of patients with HT autograft ruptures and 12% (n=4) with PT graft ruptures. A cohort study of 180 patients underwent arthroscopic anterior cruciate ligament reconstruction with either a HT or PT autograft; they were followed for 15 years. After 15 years, patients receiving PT autografts (26% (n=23)) experienced twice as many contralateral ACL ruptures compared to those with HT autografts (12% (n=11)).

Conclusion: Hamstring tendon autografts appear to be superior to patellar tendon autografts with a reduced risk of contralateral anterior cruciate ligament rupture 11 or more years after ACL reconstruction.

Keywords: Anterior cruciate ligament, contralateral, 11 years, rupture, humans

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Anterior cruciate ligament, contralateral, 11 years, rupture, humans

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Contralateral Anterior Cruciate Ligament Rupture 11 Years or More Post ACL Repair

With Either Hamstring Tendon or Patellar Tendon Autografts

Brandon R. Cox

A Clinical Graduate Project Submitted to the Faculty of the
School of Physician Assistant Studies
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For the Masters of Science Degree, August 9, 2014

Faculty Advisor: James Ferguson, PA-C
Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography

[Redacted for privacy]
Abstract

Background: Anterior cruciate ligament (ACL) injuries are common but devastating injuries. After ACL reconstruction there is an elevated risk of rupture to the contralateral ACL, and this risk may be increased over time with patellar tendon autografts. Does risk of rupture increase for the contralateral ACL 11 years or more after ACL reconstruction when using a patellar tendon versus a hamstring tendon autograft?

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Keywords: Anterior cruciate ligament, contralateral, 11 years, rupture, humans
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To my wife and children: Thank you for your endless patience, love, and support. You are my joy and happiness and my driving force in difficult times.

To my parents: Thank you for helping me to succeed and for supporting me so that I could accomplish my goals.
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Table I: GRADE Quality of Assessment and Summary of Finding

List of Abbreviations

BPTB……………………………………………………Bone Patellar Tendon Bone graft
HT.............................................................................................................Hamstring tendon
ACL………………………………………………….…….… Anterior Cruciate Ligament
PT……………………………………………………….……..……….… Patellar Tendon
IKDC……………………...........................International Knee Documentation Committee
Contralateral Anterior Cruciate Ligament Rupture 11 Years or More Post ACL Repair With Either Hamstring Tendon or Patellar Tendon Autografts

BACKGROUND

Anterior cruciate ligament (ACL) injuries are common but devastating injuries. Patients who go through the excruciating task of ACL reconstruction never want to experience it again. 1 Patients suffer through months of painful physical therapy and are excluded from contact sports for at least 6 months. To a competitive football, basketball, or soccer player this can be a major set back. The last complication athletes want to experience after suffering through ACL reconstruction would be to do it all again. 2

In general, ACL reconstruction surgery is very successful and graft rupture rates are as low as 2% to 5.8%. 1-4 There is, however, an increased risk of rupture to the contralateral ACL after surgery. Contralateral ACL rupture rates have been shown to be similar to ipsilateral ACL graft rupture rates at two years or less, 3 but longer studies have shown contralateral ACL rupture rates to average 11.8% after five years. 4 This is a 2-6 times higher risk of rupturing the contralateral ACL as opposed to the ipsilateral ACL graft after five years. What is causing this dramatic increase over time?

Several short-term studies have looked at risk factors for this dramatic increase and have shown it to be due to several factors. Non-modifiable risk factors include: intercondylar notch width of the femur, gender, family history, hormonal differences. 5-8 Modifiable risk factors include: activity level after surgery, or graft type. 9,10 It is not unreasonable to assume higher levels of activity would lead to more ACL injuries. However, one risk factor worth investigating may be the use of either the hamstring
tendon (HT) or patellar tendon (PT) autografts. Does risk of rupture increase for the contralateral ACL 11 years or more after ACL reconstruction when using a patellar tendon versus a hamstring tendon autograft?

**METHODS**

An exhaustive search of available medical literature was conducted using Medline-OVID, PubMed, and CINAHL and the search terms; anterior cruciate ligament, contralateral, rupture, and long term. The search was then narrowed to include only human studies. The bibliographies of the articles were then searched for relevant sources. Articles were further screened for duplicate publications. Relevant articles were assessed for quality using the GRADE criteria for validity. 11

**RESULTS**

The search resulted in 29 articles, of which 27 were excluded, resulting in two articles that met inclusion criteria. One randomized controlled trial 12 and one cohort study. 13

**Leys et al**

A cohort study 13 was conducted to examine the clinical results and risk factors for re-injury 15 years after ACL reconstruction. Patients who presented with clinical ACL instability with at least a grade II Lachman and pivot-shift test, were offered ACL reconstruction. Inclusion criteria consisted of patients who underwent endoscopic ACL reconstruction with either PT or HT autografts between January 1993 and November 1994. Exclusion criteria were: any associated ligament injury requiring surgery, evidence of chondral damage or degeneration, previous meniscectomy, abnormal radiograph
results, abnormal contralateral knee joint, patients seeking compensation for their injury, and patients unwilling to participate in the research program, patients at the time of surgery needing removal of one third or more of one meniscus. \(^\text{13}\)

From January 1993 to April 1994, 333 patients were prospectively examined and underwent surgical reconstruction of the ACL using the PT autograft. From this group, 90 patients met inclusion criteria. After October 1993, the surgeon started using HT autografts and exclusively used HT autografts after April 1994. During the 6 month overlap period, 39 patients had surgery: 15 received the HT autograft and 24 received the PT autograft. The decision of which graft to use during this period was based on the initial consultation. From mid-October 1993 to November 1994, 372 patients underwent ACL reconstruction using the 4-strand HT autograft. From this group, 90 met inclusion criteria. \(^\text{13}\)

One surgeon performed all procedures for the study. \(^\text{13}\) In the PT group, the ipsilateral middle-third bone-patellar tendon-bone graft was harvested and the tunnel diameter was 1 mm greater than the measured bone block diameter with a range of 8-11 mm. In the HT group, a 4-strand gracilis and semitendinosus tendon graft was used, and the tunnel diameter equaled the measured diameter of the graft with a range of 6-9 mm. Fixation consisted of a 7 X 25-mm titanium cannulated interference screw for both femoral and tibial fixations. Both groups were treated with the same rehabilitation program, focused on achieving full extension by 14 days and full flexion and extension by 6 weeks post surgery. \(^\text{13}\)

Patients were assessed by an independent examiner before surgery and again at 6 and 12 months, annually for 5 years, and again at 7, 10, and 15 years. The International
Knee Documentation Committee (IKDC) form, Lysholm knee score, KT-100 arthrometer, Lachman test, goniometer, and radiographs were used to evaluate the participants.

After 15 years of follow-up, 17% (n=15) of patients with HT graft and 8% (n=7) of patients with PT graft experienced graft ruptures. ACL graft rupture was associated with gender and tunnel position. Men had a greater likelihood of graft rupture with an odds ratio (OR) of 3.2 (95% CI 1.1-9.4; P=0.032). Non-ideal tunnel position was more likely to rupture than ideal tunnel position with an odds ratio of 5.0 (95% CI 1.4-18; P=0.037). However, ACL graft rupture was not associated with the type of graft (OR, 2.1; 95% CI 0.8-5.8; P=0.146) or age less than 18 years (OR, 2.0; 95% CI, 0.6-6.3; P=0.258).

There were 34 contralateral ACL ruptures over the 15 years and there was a significant difference between the two grafts. There was a higher risk of contralateral ACL rupture in the PT group with 26% (n=23) and 12% (n=11) in the HT group with an OR of 2.6 (95% CI, 1.1-5.9; P=0.022). Patients less than 18 years of age presented with a higher odds ratio of contralateral ACL tear compared with older patients (OR, 4.1; 95% CI, 1.7-9.7; P=0.002). No significant difference between sex and contralateral ACL tears was found.

There was no difference between the two groups when comparing the incidence of any ACL injury to either the surgical knee or the contralateral knee with 29% (n=26) in the HT group and 32% (n=30) in the PT group.

The authors concluded that the HT group had better outcomes in patient satisfaction, symptoms, function, activity level, and stability compared to the PT group.
They also stated that the PT group experienced higher rates of osteoarthritis after 15 years. There is an increased rate of rupture associated with males, non-ideal tunnel position, age less than 18 and contralateral ACL tears.  

**Sajovic et al**

This randomized control trial compares the long-term outcome after ACL reconstruction with PT or 4-strand HT autograft. Exclusion criteria was applied to patients with associated ligament injury, previous meniscectomy, abnormal radiographs, abnormal contralateral knee joint, ACL reconstruction on the contralateral knee, those who did not wish to participate in the study or who required revision surgery during the follow-up period.

From June 1999 to March 2000, 64 patients met inclusion criteria and underwent ACL reconstruction performed by the same surgeon. Grafts were chosen with randomization into a PT or HT group according to operative registration list position (even number = PT, odd number = HT). Thirty-two patients in the HT group and 32 patients in the PT group underwent surgery. In the PT group, the ipsilateral middle-third bone-patellar tendon-bone graft was harvested and the tunnel diameter was 1 mm greater than the measured bone block diameter with a range of 9-11 mm. In the HT group, a 4-strand gracilis and semitendinosus tendon graft was used, and the tunnel diameter equaled the measured diameter of the graft with a range of 7-9 mm. Both groups were treated with the same rehabilitation program, which allowed immediate full weight bearing and full range of motion, with running at 8 weeks and contact sports at 6 months under certain conditions.
Unbiased observers not involved in surgery or rehabilitation assessed patients before surgery at 2 and 6 weeks, 3 and 5 months, and again at 5 and 11 years post surgery. The IKDC form, Lysholm knee score, KT-100 arthrometer, Lachman test, goniometer, and radiographs were all used to evaluate the participants.

After 11 years of follow-up, there were 6% (n=2) of patients with HT graft ruptures and 12% (n=4) with PT graft ruptures. There was no significant difference between the two graft groups in rate of ACL graft rupture (P= .673). There were, however, a total of 6% (n=2) in the HT group and 9% (n=3) in the PT group who tore their contralateral ACL after the 11-year follow-up. Even though the PT group had more contralateral ACL tears, there was no significant difference between the two groups and rates of rupture in the contralateral ACL.

The authors found excellent long-term results in the majority of ACL repairs independent of graft choice. However, the PT group had a significant difference in positive pivot-shift test (1+) and prevalence of osteoarthritis at 11-years follow-up. No significant difference was found in graft failure or contralateral ACL ruptures between HT or PT groups.

**DISCUSSION**

Overall, ACL graft and contralateral ACL ruptures are very rare with 94.2% and 88.2% survival rates respectively. But why is the contralateral knee, which has never been injured, affected at all? The risk of contralateral ACL injury is greater than the risk of first time ACL injury for persons who continue their same level of activities. There are many speculations as to why contralateral ACL injuries occur. Some argue it has to do with the intercondylar notch width of the femur. Others suggest it is due to gender,
family history, hormonal differences, activity levels, or graft type.\textsuperscript{13,17-19} In truth, it is probably due to several of those factors. One factor not well studied, however, is the long-term risk of contralateral ACL ruptures between hamstring tendon or patellar tendon autografts.

Leys et al\textsuperscript{13} study, presents strong evidence suggesting the PT group is twice as likely to be associated with contralateral ACL injuries than surgeries performed with the HT at 15 year follow-up. The authors noted the PT group had declined in function and scored lower than the HT group over time. They believed this decrease in function could lead to patients relying more on the contralateral knee and therefore increasing the likelihood of ACL injury.\textsuperscript{13} The Sajovic et al\textsuperscript{12} study also showed more contralateral ACL injuries in the patellar tendon group ($n=3$) than the hamstring group ($n=2$) but failed to show a significant difference between grafts. This is likely due to the small number of patients who experienced such injuries.

Even though the Leys et al\textsuperscript{13} study showed strong evidence of contralateral ACL rupture in the PT group, there were some limitations to the study. One limitation was the lack of randomization. The surgeon performed only PT autograft repairs in the first half of the study and then began to offer PT or HT autografts to patients between October 1993 and April 1994. After April 1994, the surgeon used HT autografts exclusively. The type of graft for the 39 patients who had surgery in the 6 month overlap was based only on the initial consultation. This may have lead to a strong bias as the surgeon was changing surgical techniques and treatment regimens mid-study. This also may have affected the results of the HT early in the study as the surgeon was perfecting his technique.
In Sajovic et al,\textsuperscript{12} the author admitted one of the limitations to the study may have been a small sample size. The lack of patients could have led to the overall elevated IKDC results.\textsuperscript{12} Another limitation to the Sajovic et al\textsuperscript{12} study was the lack of concealment after randomization. Concealment and blinding in surgical studies is frequently a difficult task. The observers who perform the clinical examinations can easily identify the graft used by simply looking at the surgical scars and patients also know the group to which they are assigned. (See Table I)

Even though both studies had their limitations, both also had their strengths. The Sajovic et al\textsuperscript{12} study, lacked concealment but limited bias by randomizing recipients and graft type. The Leys et al\textsuperscript{13} study, lacked randomization but had three times the participants as the Sajovic et al\textsuperscript{12} study. Both studies are also important because they are the few long-term studies with data on contralateral ACL ruptures demonstrating the differences between HT autografts and PT autografts.

As stated before, several studies have looked at short-term risks of contralateral ACL rupture after ACL reconstruction but have failed to identify a significant difference between graft type.\textsuperscript{3,17,20} Hopefully, these short-term studies will continue their research and follow up in years to come to give us a better outlook on ACL graft choice and the long-term effects. This would give more evidence to prove or disprove hamstring tendons to be a better choice for ACL reconstruction with a lower risk of contralateral ACL rupture.

**CONCLUSION**

Hamstring or patellar tendon autografts both have good long-term results. However, hamstring tendon autografts seem to be superior to patellar tendon autografts in
several ways after 11-years. Larger studies with long-term follow-up are needed to soundly conclude that ACL reconstruction with patellar tendons increase the risk of contralateral ACL rupture after 11 years or more.

References


Table I: GRADE Quality of Assessment and Summary of Finding

<table>
<thead>
<tr>
<th>Studies</th>
<th>Design</th>
<th>Limitations</th>
<th>Indirectness</th>
<th>Imprecision</th>
<th>Inconsistency</th>
<th>Publication bias likely</th>
<th>Effect size</th>
<th>Quality</th>
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<td>Cohort</td>
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<td>No serious imprecision</td>
<td>No serious inconsistencies</td>
<td>No bias likely</td>
<td>Large&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sajovic et al</td>
<td>RCT</td>
<td>Serious limitations&lt;sup&gt;b&lt;/sup&gt;</td>
<td>No serious indirectness</td>
<td>Serious imprecision&lt;sup&gt;b&lt;/sup&gt;</td>
<td>No serious inconsistencies</td>
<td>No bias likely</td>
<td>Not Large</td>
<td>Moderate</td>
</tr>
</tbody>
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<sup>a</sup>Effect size is larger than an OR of 2

<sup>b</sup>Lack of blinding and small number of participants with the contralateral ACL rupture