

Multi-Ligamentous Knee Injury in Sports Involving Concomitant Anterior Cruciate Ligament and Patellar Tendon Disruption: A Review of Case Reports

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Background: Injury to the anterior cruciate ligament (ACL) is one of the most common orthopedic injuries in the United States, while injury to the patellar tendon (PT) is less common. A combined rupture to the ACL and PT is consequentially uncommon and increases the difficulty of a correct initial diagnosis. The purpose of this paper is to critically appraise the current peer-reviewed literature regarding multi-ligamentous knee injuries (MLKI) in sport. **Methods:** A systematic review was undertaken to identify all relevant peer-reviewed articles regarding MLKI from March 1980 to January 2015. All articles pertaining to simultaneous rupture of the ACL and PT were included for review. **Results:** A total of 27 cases presented in 15 articles were used. Findings suggest that the combination of a palpable gap over the PT, a positive Lachman test, inability to complete terminal knee extension, and a superior position of the patella are clinical examination markers for a possible MLKI involving the ACL and PT. **Conclusion:** Simultaneous rupture to the ACL and PT is incredibly rare within the sport population, making diagnosis and treatment of such injury challenging. A thorough examination of the extensor mechanism of the knee is important in making the proper diagnosis. **Key Words:** patellar tendon, anterior cruciate ligament, repair

KEY POINTS

- ▶ Combination ligamentous injuries can pose challenges during immediate evaluation.
- ▶ To date, there is no gold standard surgical intervention for these injuries.
- ▶ Over 35 years there have only been 27 documented cases of these injuries.

Injury to the anterior cruciate ligament (ACL) is one of the most common orthopedic injuries in sport; some estimate that more than 200,000 ACL injuries occur annually in the United States.¹ A complete rupture of the patellar tendon (PT) is

a relatively uncommon finding. Further, simultaneous rupture of both the PT and ACL is extremely rare. Few published studies have examined the prevalence and incidence rates of acute PT rupture in sport. Häggglund et al. reported a prevalence rate of 2.4% and incidence rate of .12 injuries/1,000 hr² in elite-level European soccer. The rarity of a combined rupture of the ACL and PT consequently makes a definitive initial diagnosis difficult, increases the risk of erroneous diag-

noses, and makes treatment options more difficult due to the absence of a gold standard approach.

Currently, the only available research literature regarding multi-ligamentous knee injury (MLKI) is comprised of low level of evidence case studies. The purpose of this article is to synthesize and critically appraise the evidence regarding MLKI, specifically ACL and PT simultaneous rupture. We aim to (1) identify all current research articles pertaining to ACL and PT simultaneous ruptures, (2) distinguish surgical intervention options, and (3) determine clinical recommendations for assessment and treatment.

Search Strategy

An initial search was conducted on the PubMed electronic database for peer-reviewed articles in English with no specific timeframe. Keywords relating to “simultaneous rupture”, “anterior cruciate ligament” and “patellar tendon” were used. A manual search of reference lists of all relevant articles was conducted secondary to locate additional articles.

Eligibility Criteria

Criteria for article inclusion included: (1) a study population included individuals with a diagnosis or history of MLKI, and (2) the studies were published in English language peer-reviewed journals. Due to the scarcity of articles relating to MLKI, an exclusion criterion was not established.

Study Selection

The search process identified only two articles. Both articles were screened and read by two authors (first and second authors) for content relevance. After review of the content, authors hand searched both articles’ reference lists for all relevant articles pertaining to MLKI. A total of 17 published, peer-reviewed articles were included in the final analysis.

Literature Review

Table 1 summarizes the main features of the 17 articles included in the present review.³⁻¹⁹ According to this literature, 8 out of 27 cases reported a misdiagnosis of either the ACL or PT rupture. The difficulty in diagnosis of a simultaneous rupture is mainly due to intense knee pain and swelling characteristic of this condition.³ In cases where lesions to both the ACL and PT were

confirmed, a palpable gap was felt in the PT, a positive Lachman test was found, an inability to perform terminal knee extension was noted, and a superior position of the patella was confirmed.⁴

Magnetic resonance imaging (MRI) and radiography are the most important diagnostic imaging tools when this injury is suspected.⁵ The initial evaluation of this injury may be compromised due to pain, swelling, inability to extend the knee, and patient guarding. Radiographic investigation is very important in confirming the pathology, along with MRI, when there is suspicion of MLKI.⁶

According to Chow et al., no conclusion on the principle mechanism of injury has been made.³ The cases reviewed report a large variety of mechanisms along with diverse populations. Although a limited number of cases are available in the literature, Tsarouhas et al. reported that a sudden anterior tibial translation followed by an eccentric quadriceps contraction with the knee partially flexed seems to be the common injury pattern.⁷ When the ACL rupture occurs, the tibia moves forward, creating a loss of tension in the PT.⁸ This loss of tension leaves the PT more susceptible to injury and it is likely the ACL ruptures first followed by the PT. As more cases become published, a principle mechanism explanation may gain greater acceptance.

To the authors’ knowledge, 12^{8,9,12,13,15-17,19} other cases can be found in the current literature that treated this injury with a delayed surgical approach.⁹ Although a majority of the cases involved an immediate surgical intervention strategy to fix both the PT and ACL at the same time, due to the rarity of the injury no consensus regarding the most appropriate treatment intervention currently exists.⁶ A two-phase reconstruction allows the patient to recover knee range of motion and prevent contractures around the joint.⁹ Immediate repair of the ruptured PT is mandatory to restore the knee’s extensor mechanism.⁷ Kim et al. reported that simultaneous PT repair and ACL reconstruction carry the risk of causing additional damage to the already severely injured knee, resulting in joint stiffness and possible complications due to the different rehabilitation regimens.⁵

When the PT and ACL are treated together, the patient may be able to return to sport in a short amount of time, but during the postsurgical rehabilitation of the PT the leg must be kept at rest for a longer period of time, thereby increasing the risk of joint contracture in the case of a single operation.⁹ Rehabilitation for this injury is difficult due to the fact that the PT and ACL rehabilitation protocols have different strategies for the

TABLE 1 REPORTED CASES OF COMBINED ANTERIOR CRUCIATE LIGAMENT AND PATELLAR TENDON RUPTURES

Year	Sex	Age	Activity	Mechanism	Concomitant Lesions	Surgical Intervention
1980 ¹⁰	M	24	Basketball	Jumping for ball—landed with knee flexed and external rotation	MCL, MM	PT (no SI for ACL)
1991 ¹¹	F	25	Trampoline	Jumping on trampoline (no specific MOI)	MCL	Not reported
1996 ¹²	M	36	Soccer	Jumping for ball—landing and heard 2 pops	LM, MM, MCL	Simultaneous
	F	15	Long jump	Landing from long jump—heard 1 pop	Not specified	Delayed
	M	33	Skiing	Landing from ski jump—weight shifted posteriorly	MM, LM	Simultaneous
	M	20	Football	Twisted knee and heard a pop	LM, MCL	Not reported
	M	23	Motorcycle accident	Not specified	MM, LM, MCL	Not reported
	M	23	Football	Pushing sideways against opposing player	MCL	Delayed
1998 ¹³	M	26	Football	Twisting injury while foot planted	MM, LM	Delayed
2005 ⁸	M	31	Motorcycle accident	Not specified	MCL	Delayed
	M	31	Soccer	Twisted knee and fell	MCL	Simultaneous
	M	50	Bicycle accident	Not specified	LM	Simultaneous
2005 ¹⁴	M	30	Basketball	Twisting injury while landing from jump	LM	Simultaneous
2006 ³	M	23	Basketball	Jumping as shooting—no direct impact	MM, LM	Not reported
2007 ⁴	M	19	Football (RB)	Deceleration with foot fixed, knee flexed, tackled from behind	MM	Simultaneous
2008 ¹⁵	M	23	Rugby	Tackled	MCL, MM	Delayed
2011 ⁷	M	38	Martial arts	Direct kick to knee from PL to AM	MCL, LM	Not reported
2011 ¹⁶	M	47	Professional driver	Stepping down	MCL, MM	Delayed
2012 ⁶	F	36	Jump landing (not in sport)	Jumping from 4-ft deck landing flat on both feet	Not specified	ACL (no SI for PT)
2013 ⁹	M	36	Baseball	Sliding toward a fixed base with right knee flexed	MCL	Delayed
2013 ¹⁷	M	45	Skiing	Twisting injury	MCL	Delayed
	F	19	Dancing	Trampoline	MCL, MM, LM	Delayed
	F	18	Wakeboarding	Direct knee impact	MCL	Delayed
2014 ⁵	M	32	Baseball	Right leg planted with knee flexed—twisting injury	MCL, LM	Simultaneous
2014 ¹⁸	M	30	Soccer	Deceleration with foot fixed, knee flexed	Partial MCL	Simultaneous
2015 ¹⁹	M	32	Bicycle accident	Not specified	MCL	Delayed
	M	27	Soccer	Slide tackle from behind, knee twisting	MCL, LM	Delayed

Abbreviations: M = male; F = female; MOI = mechanism of injury; PL = posterolateral; AM = anteromedial; MCL = medical collateral ligament; MM = medial meniscus; LM = lateral meniscus; PT = patellar tendon; SI = surgical intervention; ACL = anterior cruciate ligament.

two structures. Immobilization with a brace limiting range of motion is used in PT rehabilitation while ACL protocol calls for early mobilization for optimal rehabilitation results.⁶ These factors need to be considered with each patient before surgical intervention is undertaken. Modifications in the rehabilitation protocols must be made to accommodate the immobilization for the PT, but early weight bearing and passive range of motion can also be done.⁵

Conclusion

Simultaneous rupture of the PT and ACL is rare within the athletic population. Although a common mechanism has yet to be identified, after review of the literature, conclusions can be drawn that a forceful eccentric quadriceps contraction with a valgus or twisting load will cause excessive anterior tibial translation resulting in the simultaneous rupture or sequential rupture in a short span of time. Allied health care providers, especially athletic trainers and therapists, should pay close attention to mechanism of injury, as the mechanism for possible MLKI mimics that of a noncontact ACL mechanism. Following injury, the knee extensor mechanism should be thoroughly examined, as inability to test the knee extensor mechanism was a common element in patients who were misdiagnosed.

After review of all available literature regarding MLKI, the authors can conclude that a palpable gap over the PT, a positive Lachman test, an inability to complete terminal knee extension, and a superior position of the patella were all clinical markers of a confirmed ACL and PT simultaneous rupture. Twelve of the 27 cases reviewed had patients that underwent a delayed, two-stage surgical treatment approach, with most of the cases being published within the past 15 years. Although there is no gold standard surgical approach at this current time, the evidence from the past 15 years concludes that delayed, two-stage surgical intervention is the most appropriate choice for optimal outcomes. ■

References

1. Wilk KE, Macrina LC, Cain EL, Dugas JR, Andrews JR. Recent advances in the rehabilitation of anterior cruciate ligament injuries. *J Orthop Sports Phys Ther.* 2012;42(3):153–171. [PubMed doi:10.2519/jospt.2012.3741](#)
2. Häggglund M, Zwerver J, Ekstrand J. Epidemiology of patellar tendinopathy in elite male soccer players. *Am J Sports Med.* 2011;39(9):1906–1911. [PubMed doi:10.1177/0363546511408877](#)
3. Chow FY, Wun YC, Chow YY. Simultaneous rupture of the patellar tendon and the anterior cruciate ligament: a case report and literature

review. *Knee Surg Sports Traumatol Arthrosc.* 2006;14(10):1017–1020. [PubMed doi:10.1007/s00167-006-0048-3](#)

4. Futch LA, Garth WP, Folsom GJ, Ogard WK. Acute rupture of the anterior cruciate ligament and patellar tendon in a collegiate athlete. *Arthroscopy.* 2007;23(1):112.e1–112.e4. [PubMed doi:10.1016/j.arthro.2005.07.030](#)
5. Kim DH, Lee GC, Park SH. Acute simultaneous ruptures of the anterior cruciate ligament and patellar tendon. *Knee Surg Relat Res.* 2014;26(1):56–60. [PubMed doi:10.5792/ksrr.2014.26.1.56](#)
6. Wissman RD, Vonfischer N, Kempf K. Acute concomitant anterior cruciate ligament and patellar tendon tears in a non-dislocated knee. *J Clin Imaging Sci.* 2012;2:3. [PubMed doi:10.4103/2156-7514.93035](#)
7. Tsarouhas A, Iosifidis M, Kotzamitelos D, Traios S. Combined rupture of the patellar tendon, anterior cruciate ligament and lateral. *Hippokratia.* 2011;15(2):178–180. [PubMed](#)
8. Costa-Paz M, Muscolo DL, Makino A, Ayerza MA. Simultaneous acute rupture of the patellar tendon and the anterior cruciate ligament. *Arthroscopy.* 2005;21(9):1143. [PubMed doi:10.1016/j.arthro.2005.05.028](#)
9. Chiba K, Takahashi T, Hino K, et al. Surgical treatment of simultaneous rupture of the anterior cruciate ligament and the patellar tendon. *J Knee Surg.* 2013;26(Suppl. 1):S40–S44. [PubMed](#)
10. Baker BE. O'Donoghue's triad plus patellar tendon rupture. *N Y State J Med.* 1980;80(9):1436–1437. [PubMed](#)
11. Rae PJ, Davies DR. Simultaneous rupture of the ligamentum patellae, medial collateral, and anterior cruciate ligaments. A case report. *Am J Sports Med.* 1991;19(5):529–530. [PubMed doi:10.1177/036354659101900522](#)
12. Levakos Y, Sherman MF, Shelbourne KD, Trakru S, Bonamo JR. Simultaneous rupture of the anterior cruciate ligament and the patellar tendon. Six case reports. *Am J Sports Med.* 1996;24(4):498–503. [PubMed doi:10.1177/036354659602400415](#)
13. McCormack RG, Dryden PJ. Simultaneous rupture of the anterior cruciate ligament and patellar tendon. *Clin J Sport Med.* 1998;8(4):307–308. [PubMed doi:10.1097/00042752-199810000-00009](#)
14. Chiang AS, Shin SS, Jazrawi LM, Rose DJ. Simultaneous ipsilateral ruptures of the anterior cruciate ligament and patellar tendon: a case report. *Bull Hosp Jt Dis.* 2005;62(3-4):134–136. [PubMed](#)
15. Shillington M, Logan M, Watts M, Myers P. Complex knee injury in a rugby league player of the patellar tendon, anterior cruciate and medial collateral ligaments, with a medial meniscal tear. *Inj Extra.* 2008;39:327–328. [doi:10.1016/j.injury.2008.05.004](#)
16. Koukoulas NE, Koumis P, Papadopoulos A, Kyparlis D, Papastergiou SG. Acute, simultaneous tear of patellar tendon and ACL: possible mechanism of injury and rationality of the two-stage surgical treatment. *BMJ Case Rep.* 2011;2011 [doi:10.1136/bcr.2011.4178](#)
17. Mariani PP, Cerullo G, Iannella G. Simultaneous rupture of the patellar tendon and the anterior cruciate ligament: report of three cases. *J Knee Surg.* 2013;26(Suppl. 1):S53–S57. [PubMed](#)
18. Gülabi D, Erdem M, Bulut G, Sağlam F. Neglected patellar tendon rupture with anterior cruciate ligament rupture and medial collateral ligament partial rupture. *Acta Orthop Traumatol Turc.* 2014;48(2):231–235. [PubMed doi:10.3944/AOTT.2014.3149](#)
19. Brunkhorst J, Johnson DL. Multiligamentous knee injury concomitant with a patellar tendon rupture. *Orthopedics.* 2015;38(1):45–48. [PubMed doi:10.3928/01477447-20150105-06](#)

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