



Differences In Return to Duty Rates Between QT and BPTB Autograft for ACLR in a Military Population

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Disclaimer

The views expressed are those of the authors and do not reflect the official policy of the Department of the Army, the Department of Defense or the U.S. Government.

The investigators have adhered to the policies for protection of human subjects as prescribed in 45 CFR 46.

I have no potential conflicts with this presentation.

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Introduction

- **80,086 ACL injuries in the US military between 2006-2018 (Aguero et al. 2022)**
- **Military members are required to perform at high levels and are often not able to self-limit their activities**
- **Numerous studies have found that ACLR with QT autograft has significantly decreased rates of donor-site morbidity when compared to BPTB autograft (Migliorini et al. 2020, Dai et al. 2021, and Komzak et al. 2021)**



Introduction

- **Following ACLR, military members are either returned to duty (RTD), given permanent profile restrictions, or medically discharged**
- **Previous military RTD studies have reported RTD rates from 69.6-92% following ACLR (Edwards et al. 1991, Cullison et al. 1998, Enad & Zehms 2013, Antosh et al. 2018)**
- **Cullison et al. (1998) found that the most common reason for medical discharge after ACLR with BPTB autograft was for anterior knee pain**



Purpose

The purpose of this retrospective cohort study was to determine whether there is a significant difference when comparing RTD rates in an active-duty military population that underwent ACLR with QT autograft versus BPTB autograft



Methods

- This study was a retrospective cohort study
- Population: Active-duty military who had undergone ACLR with QT or BPTB autograft at WBAMC, Fort Bliss, TX between July 1, 2014 and December 31, 2021
- Screening for subjects and data collection proceeded after IRB approval and data sharing agreements were in place



Methods

- Independent variable:
 - ❖ Type of graft (QT or BPTB autograft)
- Dependent variable:
 - ❖ RTD rates



Methods

■ Inclusion criteria:

- ❖ Active-duty military
- ❖ Age 18-60
- ❖ History of ACLR with QT or BPTB autograft that occurred while on active-duty at WBAMC

■ Exclusion criteria:

- ❖ Presence of a concomitant fracture of the injured knee
- ❖ Revision ACLR
- ❖ Multi-ligamentous knee injury
- ❖ ACLR occurred after December 31, 2021



Methods

- A two-sided, two independent samples Z-test was performed for comparing the RTD rates between the two graft types
- The odds ratio with corresponding 95% Confidence Interval using Logistic Regression analysis was performed to analyze the effects of covariates on RTD by graft type
- Fisher's exact test was used to compare rank and a two-sided, two independent samples t-test was used to compare age as a continuous variable
- A Chi-Square test was used to determine if there was a significant difference in the distribution of RTD (full RTD vs RTD with PP) between the two graft types
- $p < 0.05$ for significance; Statistical Analysis Software (SAS) version 9.4 (Cary, NC, USA) was used for statistical analysis



Results

- 152 patients were included in the study; 78 had undergone ACLR with QT autograft and 74 with BPTB autograft
- QT autograft: 67 patients (85.9%) returned to duty and 11 patients (14.1%) were referred for MEB
- BPTB autograft: 68 patients (91.9%) returned to duty and 6 patients (8.1%) were referred for MEB

TABLE 4.2. Comparison of Overall RTD rates by autograft type

Characteristic	RTD (n=135)	MEB (n=17)	Total	p-value
Graft Type				0.24
Quadriceps Tendon (QT)	67 (85.9)	11 (14.1)	78	
Bone-Patellar Tendon-Bone (BPTB)	68 (91.9)	6 (8.1)	74	



Results

TABLE 4.1. Patient Demographics, Surgical Characteristics and Return to Duty

Characteristics	Frequency	Percentage (%)
Gender		
Male	133	87.5
Female	19	12.5
Age		
Under 25 yrs	82	54.0
25-30 yrs	54	35.5
Over 30 yrs	16	10.5
MOS		
Combat	61	40.1
Noncombat	91	59.9
Rank		
Junior enlisted	78	51.3
Senior enlisted	57	37.5
Junior Officer	13	8.6
Senior Officer	4	2.6
Branch		
USA	145	95.4
USAF	6	3.9
USM	1	0.7
Tobacco Use		
Yes	36	23.7
No	116	76.3
Graft Type		
Quadriceps Tendon (QT)	78	51.3
Bone-Patellar Tendon-Bone (BPTB)	74	48.7
Meniscal tear		
Yes	100	65.8
No	52	34.2
Return to Duty		
Full Return to Duty	82	53.9
Return to Duty with PP	53	34.9
MEB	17	11.2
Age, Mean (SD)	24.9 (4.0)	



Results

Table 4.3 Comparison of Patient Demographics and Surgical Characteristics in Patients who Returned to Duty (including those who RTD with PP) versus MEB

Characteristic	RTD (n=135)	MEB (n=17)	Total	p-value
Gender, n (%)				0.92
Male	118 (88.7)	15 (11.3)	133	
Female	17 (89.5)	2 (10.5)	19	
Age, n (%)				0.58
Under 25 yrs	74 (90.2)	8 (9.8)	82	
25-30 yrs	48 (88.9)	6 (11.1)	54	
Over 30 yrs	13 (81.2)	3 (18.8)	16	
MOS, n (%)				0.93
Combat	54 (88.5)	7 (11.5)	61	
Noncombat	81 (89.0)	10 (11.0)	91	
Rank, n (%)				0.47
Junior enlisted	66 (84.6)	12 (15.4)	78	
Senior enlisted	53 (93.0)	4 (7.0)	57	
Junior Officer	12 (92.3)	1 (7.7)	13	
Senior Officer	4 (100.0)	0 (0)	4	
Meniscal Tear				0.32
Yes	87 (87.0)	13 (13.0)	100	
No	48 (92.3)	4 (7.7)	52	



Results

Military Career Outcomes by Graft Type

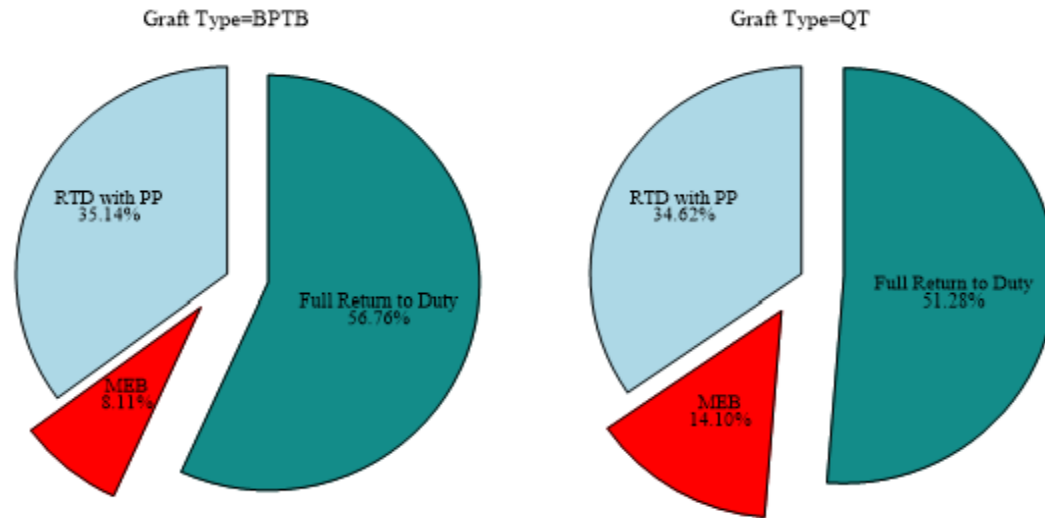


Table 4.5 Chi-Square analysis of RTD distribution between QT and BPTB autograft

Test Statistic	DF	Value	p-value
Chi-Square	2	1.4340	0.4882 ns



Discussion

- No significant difference in overall RTD rates between patients who had undergone ACLR with QT versus BPTB autograft
- No significant difference in the distribution of RTD (full RTD versus RTD with PP) between the two cohorts
- Findings are clinically significant and can serve as a prognostic tool to counsel soldiers and commanders
- Future research should include prospective or RCTs that include matched cohorts, defined follow-up periods, and a standardized method for assessing donor-site morbidity following ACLR



Limitations

- **Study design: retrospective**
- **Single-center study: 1st Armor Division, Fort Bliss, TX, different operating surgeons, longer overall follow-up for BPTB**
- **Military population: transient population, secondary gain associated with early separation or VA disability**
- **Medical record system transition: AHLTA to MHS Genesis**



Conclusion

- No significant difference in overall RTD rates between patients who had undergone ACLR with QT versus BPTB autograft
- No significant difference in the distribution of RTD (full RTD versus RTD with PP) between the two cohorts
- Findings are clinically significant and can be used to counsel soldiers and command teams that soldiers who received QT or BPTB autograft have a high likelihood to RTD



References

- **Aguero, Aubrey, J Irrgang, A MacGregor, S Rothenberger, J Hart, and J Fraser. “Sex, military occupation and rank are associated with risk of anterior cruciate ligament injury in tactical athletes.” *BMJ Mil Health* 0 (2022): 1-7.
<https://doi.org/10.1136/bmjmilitary-2021-002059>.**
- **Ajrawat, Prabjit, Tim Dwyer, Daniel Whelan, John Theodoropoulos, Lucas Murnaghan, Manoj Bhargava, Darrell Ogilvie-Harris, and Jaskarndip Chahal. “A Comparison of Quadriceps Tendon Autograft With Bone-Patellar Tendon-Bone Autograft and Hamstring Tendon Autograft for Primary Anterior Cruciate Ligament Reconstruction: A Systematic Review and Quantitative Synthesis.” *Clin J Sport Med* 31 (2021): 392-399. <http://dx.doi.org/10.1097/JSM.0000000000000765>.**
- **Antosh, Ivan, Jeanne Patzkowski, Adam Racusin, James Aden, and Scott Waterman. “Return to Military Duty After Anterior Cruciate Ligament Reconstruction.” *Military Medicine* 183 (January/February 2018): e83-89.
<https://doi.org/10.1093/milmed/usx007>.**



References

- Barie, Alexander, Thomas Sprinckstub, Jurgen Huber, and Ayham Jaber. “Quadriceps tendon vs. patellar tendon autograft for ACL reconstruction using a hardware-free press-fit fixation technique: comparable stability, function and return-to-sport level but less donor site morbidity in athletes after 10 years.” *Archives of Orthopaedic and Trauma Surgery* 140 (2020): 1465-1474. <https://doi.org/10.1007/s00402-020-03508-1>.
- Cullison, Thomas, Thomas O’Brien, Kathy Getka, and Scott Jonson. “Anterior Cruciate Ligament Reconstruction in the Military Patient.” *Military Medicine* 163, no. 1 (1998): 17-19.
- Dai, Wenli, Xi Leng, Jian Wang, Jin Cheng, Xiaoqing Hu, and Yingfang Ao. “Quadriceps Tendon Autograft Versus Bone–Patellar Tendon–Bone and Hamstring Tendon Autografts for Anterior Cruciate Ligament Reconstruction.” *The American Journal of Sports Medicine* (2021): 1-15. <https://doi.org/10.1177/03635465211030259>.
- Edwards, Kenneth, Antoni Goral, Robert Hay, and Thomas Kelso. “Functional Restoration Following Anterior Cruciate Ligament Reconstruction in Active-Duty Military Personnel.” *Military Medicine* 156, no. 3 (1991): 118-121.
- Enad, Jerome and Chad Zehms. “Return to Full Duty After Anterior Cruciate Ligament Reconstruction: Is the Second Time More Difficult?” *Journal of Special Operations Medicine* 13, no. 1 (Spring 2013): 1-6.



References

- Geib, Timothy, Walter Shelton, Raymond Phelps, and Lauren Clark. “Anterior Cruciate Ligament Reconstruction Using Quadriceps Tendon Autograft: Intermediate-Term Outcome.” *Arthroscopy: The Journal of Arthroscopic and Related Surgery* 25, no. 12 (December 2009): 1408-1414. <https://doi.org/10.1016/j.arthro.2009.06.004>.
- Han, Hyuk Soo, Sang Cheol Seong, Sahnghoon Lee, and Myung Chul Lee. “Anterior Cruciate Ligament Reconstruction Quadriceps Versus Patellar Autograft.” *Clin Orthop Relat Res* 466 (2008): 198-204. <https://doi.org/10.1007/s11999-007-0015-4>.
- Hurley, Eoghan, Manuel Calvo-Gurry, Dan Withers, Shane Farrington, Ray Moran, and Cathal Moran. “Quadriceps Tendon Autograft in Anterior Cruciate Ligament Reconstruction: A Systematic Review.” *Arthroscopy: The Journal of Arthroscopic and Related Surgery* 34, no. 5 (May 2018): 1690-1698. <https://doi.org/10.1016/j.arthro.2018.01.046>.
- Kim, Sung-Jae, Praveen Kumar, and Kyung-Soo Oh. “Anterior Cruciate Ligament Reconstruction: Autogenous Quadriceps Tendon-Bone Compared With Bone-Patellar Tendon-Bone Grafts at 2-Year Follow-up.” *Arthroscopy: The Journal of Arthroscopic and Related Surgery* 25, no. 2 (February 2009): 137-144. <https://doi.org/10.1016/j.arthro.2008.09.014>.



References

- Komzak, Martin, Radek Hart, David Nahlik, and Robert Vysoky. “In vivo knee rotational stability 2 years after the ACL reconstruction using a quadriceps tendon graft with bone block and bone–patellar tendon–bone graft.” *Archives of Orthopaedic and Trauma Surgery* 142 (2022): 1995-1999. <https://doi.org/10.1007/s00402-021-04195-2>.
- Lund, Bent, Torsten Nielsen, Peter Fauno, Svend Erik Christiansen, and Martin Lind. “Is Quadriceps Tendon a Better Graft Choice Than Patellar Tendon? A Prospective Randomized Study.” *Arthroscopy: The Journal of Arthroscopic and Related Surgery* 30, no. 5 (May 2014): 593-598. <https://doi.org/10.1016/j.arthro.2014.01.012>
- Migliorini, Filippo, Jorg Eschweiler, Yasser El Mansy, Valentin Quack, Markus Tingart, and Arne Driessen. “Quadriceps tendon autograft for primary ACL reconstruction: a Bayesian network meta-analysis.” *European Journal of Orthopaedic Surgery & Traumatology* (2020): 1-11. <https://doi.org/10.1007/s00590-020-02680-9>.
- Mouarbes, Dany, Jacques Menetrey, Vincent Marot, Louis Courtot, Emilie Berard, and Etienne Cavaignac. “Anterior Cruciate Ligament Reconstruction A Systematic Review and Meta-analysis of Outcomes for Quadriceps Tendon Autograft Versus Bone-Patellar Tendon-Bone and Hamstring-Tendon Autografts.” *The American Journal of Sports Medicine* 47, no. 14 (2019): 3531-3540. <https://doi.org/10.1177/0363546518825340>.



References

- Mouarbes, Dany, Louis Dagneaux, Matthiew Olivier, Vincent Lavoue, Enrique Peque, Emilie Berard, and Etienne Cavaignac. “Lower donor-site morbidity using QT autografts for ACL reconstruction.” *Knee Surgery, Sports Traumatology, Arthroscopy* 28 (2020): 2558-2566. <https://doi.org/10.1007/s00167-020-05873-1>.
- Perez, Jose, Christopher Emerson, Carlos Barrera, Dylan Greif, William Cade II, Lee Kaplan, and Michael Baraga. “Patient-Reported Knee Outcome Scores With Soft Tissue Quadriceps Tendon Autograft Are Similar to Bone–Patellar Tendon–Bone Autograft at Minimum 2-Year Follow-up.” *The Orthopaedic Journal of Sports Medicine* 7, no. 12 (2019): 1-6. <https://doi.org/10.1177/2325967119890063>.
- Riaz, Osman, Adeel Aqil, Ashim Mannan, Fahad Hossain, Mubusher Ali, Gautam Chakrabarty, and Graham Radcliffe. “Quadriceps Tendon-Bone or Patellar Tendon-Bone Autografts When Reconstructing the Anterior Cruciate Ligament: A Meta-analysis.” *Clin J Sport Med* 28, no. 3 (May 2018): 1-9. <http://dx.doi.org/10.1097/JSM.0000000000000451>.



Thank You

