Return to Full Duty After Anterior Cruciate Ligament Reconstruction: Is the Second Time More Difficult?*

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ABSTRACT

Anterior cruciate ligament (ACL) injuries occur repeatedly in Special Operations Forces (SOF). In this study, we sought to determine whether military patients requiring a second (i.e., revision) ACL reconstruction in the same knee had a lower rate of return to full duty and greater chance of medical discharge versus those undergoing first-time (i.e., primary) ACL knee surgery. A single-institution, retrospective analysis of surgical records and medical board data of active duty members during a 4-year period identified 19 revision and 169 primary ACL cases, respectively. Measured end points were rate of return to full duty in each group and odds ratio (with 95% confidence interval) for medical discharge. Our results showed that 17 (90%) of 19 revision ACL patients returned to full duty at a mean of 7.5 ± 2.3 months. Two patients did not return to full duty and were medically discharged at 12 and 13 months, respectively. Meanwhile, 155 (92%) of 169 primary ACL patients returned to full duty (mean 7.3 ± 2.3 months), and 14 patients were medically discharged (mean 8.5 ± 2.8 months). Patients in the revision group were only 1.30 times (odds ratio) (95% confidence interval, 0.2726–6.2229) more likely to be medically discharged than patients in the primary group. Overall, the majority of revision ACL surgeries were successful. The period of limited duty was slightly longer after revision ACL surgery. Return to full duty was seen at a similar rate as primary ACL surgery, and the odds of medical discharge were statistically similar. The results are useful in counseling SOF members who might need to undergo revision ACL surgery.

Introduction

Knee injuries are the most common musculoskeletal injuries in Naval Special Warfare Operators[1] and the second most common in Special Boat Units.[2] Anterior cruciate ligament (ACL) tears comprise a high percentage of the knee injuries in the Special Warfare community due to the unique physical demands of the job. Although the true incidence of ACL injuries in SOF is unknown, a population study among all Servicemembers between 1997 and 2003 calculated ACL injury rates as ranging from 2.29 to 3.79 cases per 1,000 person-years.[3] Although most active duty members undergo primary ACL (P-ACL) reconstruction to resume their military career, the current literature shows that surgery is not successful in the long term in as many as 25% of cases.[4-11] A recent study noted that more than 16% of cadets who had P-ACL surgery before enrolling at United States Military Academy West Point experienced clinical failure of the surgery at an average of 1.5 years after matriculating.[12] It is likely that most of these Servicemembers will need a revision ACL (R-ACL) reconstruction to remain on active duty.

There has been a heightened interest in the civilian sector regarding the success of R-ACL. Historically, clinical results after R-ACL are inferior compared with those after P-ACL.[13-18] Several authors have compared their results of R-ACL with their own historic control group of P-ACL patients and have consistently found less favorable results in their R-ACL patients versus their P-ACL patients.[19-24] To date, there are no previous studies examining the success rate of R-ACL surgery in the military. The current study analyzes the outcome with regard to medical discharge after R-ACL surgery in a group of military patients and determines the odds of medical discharge compared with that for P-ACL surgery. Based on the majority of clinical results reported in the literature, we hypothesized that the R-ACL surgery group would have a lower rate of return to duty and higher odds of medical discharge versus the P-ACL surgery group. The results would be useful in counseling SOF members who might need to undergo R-ACL surgery.

Methods

Data

The local institution review board approved the design of this retrospective study. Nonclinical administrative data

Note: *Work performed at the Bone & Joint Sports Medicine Institute, Naval Medical Center, Portsmouth, Virginia.

were collected from two databases and cross-matched for analysis. The first set of data were surgical operative reports from 2002 to 2005 at a single military treatment facility with a main Current Procedural Terminology code of 29888, Arthroscopy, knee, ACL repair/reconstruction. These data were stratified into the P-ACL group and the R-ACL group based on the surgeon's description of the main procedure and diagnosis. Patient identifiers of name, age, and Social Security number from the operative reports were then cross-matched with the database from the Navy medical board online triservice tracking system (MEDBOLTTS) to identify which patients were placed on a temporary limited duty board (LIMDU) during the perioperative period. The subjects identified comprise the population to be studied.

Exclusion criteria were non-active duty patients, age younger than 18 years at the time of surgery, multiligament surgery, osteotomy, meniscal or chondral transplantation, and any surgery in which ACL reconstruction was not listed as the main procedure. Subjects never placed on a LIMDU board and those placed on LIMDU or medically discharged for diagnoses unrelated to ACL injury were excluded to reduce confounding factors. No direct patient contact or clinical follow-up was involved.

Surgeries

The ACL reconstructions were performed by several orthopedic surgeons at a tertiary care, military medical institution. All surgeries were done arthroscopically. For both primary and revision cases, either an autograft or allograft tendon was used to reconstruct the ACL, depending on the surgeon's preference for each individual case. All patients underwent a structured rehabilitation program postoperatively that could be modified by the surgeon based on intraoperative factors (e.g., meniscal repair) or patient factors (e.g., age, level of understanding, compliance, etc.).

Measured end points

Return to full duty was defined as the point where the patient was taken off LIMDU status and returning to their previous occupation specialty without physical restrictions. Medical discharge was defined as the point where the patient was placed on a Physical Evaluation Board (PEB) and was determined by the PEB convening authority of being unable to continue military service due to their physical condition. (Note: In rare cases, the convening authority may determine that the patient can return to duty on a permanent LIMDU with physical restrictions, but this situation was not encountered with our population during the study.) Time to return to full duty (or medical discharge) is defined as the number of months following surgery to reach that end point. The odds of medical discharge in each group is defined as (number of patients medically discharged)/(number of patients returned to full duty).

Statistics

Descriptive statistics are used to report average number of months (± standard deviation) required to return to full duty or to medical discharge. The odds ratio (with 95% confidence intervals [CIs]) for medical discharge was determined as the ratio of the odds of medical discharge occurring in the R-ACL group to the odds of it occurring in the P-ACL group. Post hoc power analysis ($p = .80$, $df = 30$, and moderate effect size of .50 with alpha probability set at .05) determined that at least 99 subjects in each group is required to significantly compare the groups directly. Therefore, statistical power was not fulfilled.

Results

A sample of 188 subjects met the inclusion criteria, stratified into 19 subjects in the R-ACL group and 169 subjects in the P-ACL group (Table 1).

Table 1 *Demographic Characteristics of Primary (P-ACL) and Revision (R-ACL) Groups*

	P-ACL	R-ACL
Total number of subjects	169	19
Age (mean ± SD), y	26.1 ± 5.1	27.5 ± 6.6
Military rank		
E1–E3	51	2
E4–E6	108	12
E7–E9	7	1
Officers	2	3

Seventeen (90%) of the 19 subjects in the R-ACL group returned to full-duty at a mean of 7.5 ± 2.3 months. Two subjects did not return to full duty and were medically discharged at 12 and 13 months, respectively. One hundred fifty-five (92%) subjects in the P-ACL group returned to full duty at a mean of 7.3 ± 2.3 months, whereas 14 subjects were medically discharged at a mean of 8.5 ± 2.8 months. Patients undergoing R-ACL surgery were 1.30 times (odds ratio) (95% CI, 0.2726–6.2229) more likely to be medically discharged than were patients who had P-ACL surgery.

When examined based on graft type, the breakdown of return to duty versus medical discharge for each specific graft in each group is illustrated in Table 2. To summarize, in the P-ACL group, subjects receiving an autograft tendon returned to full duty at a mean of 7.3 ± 2.2 months, whereas subjects receiving an allograft tendon returned to full duty at a mean of 6.9 ± 2.7 months (not

Table 2 *Results of Primary and Revision ACL Reconstruction based on Graft Type*

	P-ACL	RTD (mo)	PEB (No.)	R-ACL	RTD (mo)	PEB (No.)
Total number of subjects	169	7.3 ± 2.3	14	19	7.5 ± 2.3	2
Graft type Patellar tendon	91	7.5 ± 0.7	6	2	12.0 ± 0	0
Quadriceps	0	—	—	1	10.0	0
Hamstring	67	7.1 ± 1.8	6	6	6.1 ± 2.3	0
Allograft Achilles	3	7.5	2	5	6.7 ± 1.3	1
Allograft tibialis anterior	5	6.8 ± 3.9	0	4	7.0 ± 4.2	1
Allograft patellar tendon	3	6.0 ± 0	0	0	—	—
Allograft hamstring	0	—	0	1	10.0	0

Notes: RTD = mean ± SD number of months to return to full duty.
PEB = number of subjects resulting in PEB.

significant, $p > 0.8$). In the R-ACL group, subjects receiving an autograft tendon returned to full duty at a mean of 7.8 ± 4.2 months, whereas subjects receiving an allograft tendon returned to full duty at a mean of 6.8 ± 0.5 months (p = not significant).

Discussion

The primary purpose of this report was to describe the return to duty rates of R-ACL surgery in the military. No prior study has examined this issue; therefore, this study represents the first military study to investigate R-ACL reconstruction administrative outcomes. The strength of this study lies in the large number of active duty subjects collected at a tri-service military medical center. Although a focused study of the Special Operations community could not be achieved given the relative infrequency of R-ACL reconstructions in the military overall, we believe the administrative outcomes are generalizable to subsets within the military population, including the Special Operations community. The current report provides representative military data that can be used to formulate counseling and prognosis on patient outcomes and provide a framework for future research toward improving R-ACL reconstruction outcomes.

Currently, little is known regarding why some patients experience positive outcomes after R-ACL while others experience suboptimal results. It is possible that the patients who experience failure of P-ACL possess the greatest numbers of risk factors and fewest protective factors for ACL tears in general (of either the native ACL or of a graft used to reconstruct the ACL). If the percentage of patients who experience poor outcomes after R-ACL surgery is higher than those after P-ACL, this may be due to the phenomenon of the highest-risk individuals progressing from native ACL tear to primary reconstruction tear to revision reconstruction tear at higher rates than other groups. Because R-ACL is being performed more frequently in the United States, a multicenter study is currently under way by the American Orthopaedic Society for Sports Medicine to (1) determine independent risk factors at the time of R-ACL that are associated with quality of life measures, (2) determine predictors of patient-reported symptoms and functioning 2 years after R-ACL, (3) determine and compare risk factors, measured at the time of R-ACLR, that are associated with symptoms of osteoarthritis, (4) determine predictors of level of activity at 2-year follow-up for patients undergoing R-ACL, and (5) determine the independent factors/predictors of subsequent risk injury to the index ACL graft or the ACL in the contralateral knee.[25]

The current study focused on occupational disability in the form of medical discharge after R-ACL in military subjects without consideration of typical clinical outcomes. Our results illustrate similar medical discharge rates after P-ACL and R-ACL in our sample, and times required to return to full duty were also similar. The odds rate of medical discharge was not significantly higher for the R-ACL group. Therefore, our original hypothesis predicting poorer outcome for the R-ACL group was not proved, a point that has been seen in only one previous clinical report.[24] Because this was an administrative study and not a clinical study, all of the factors influencing eventual return to full duty or medical discharge were not examined. In addition to clinical factors (e.g., time from injury to surgery, associated meniscal or chondral injuries, associated comorbidities, actual physical demands of each subject's military occupational specialty), there are nonphysical factors that influence outcome (e.g., military rank and promotion status, seniority within one's unit, availability of previous position, etc.). Unlike other clinical studies that define strict criteria for return to play in sports after ACL reconstruction, the orthopedists at our military medical center had to consider each Servicemember's unique clinical and nonclinical/occupational situation in determining whether to return to

full duty. Obviously, a member of the SOF needs to return to a much higher physical workload than a clerical worker, so specific considerations would be required when returning to full duty postoperatively.

Graft type did not appear to demonstrate a difference in returned-to-duty rates across either subject group. There has been some research that suggests that revascularization and graft healing are slower in allografts than in autografts.[26] Interestingly, our data show similar return to full duty rates between autografts and allografts with P-ACL, but a trend toward returning to full duty on average 1 month sooner when undergoing allograft ACL reconstruction with R-ACL. (With the numbers involved, meaningful statistical analysis could not be concluded.) One possible explanation is that returning to full duty may have been influenced more by the R-ACL patient's subjective physical capabilities postoperatively. Because allograft reconstruction causes less morbidity to the knee versus autograft reconstruction (despite the longer healing time), these R-ACL subjects may have not felt as much pain when receiving an allograft for R-ACL as they did when receiving an autograft for their P-ACL and may have concluded that they were "recovering faster."

It is interesting to speculate whether our R-ACL subjects represent a prescreened group that exhibits intrinsic and extrinsic capabilities to return to full duty at a high rate after any surgery. For example, many of our R-ACL subjects had their previous ACL surgeries in the military health care system, and those who were medically discharged after a failed P-ACL reconstruction would not have been eligible to receive revision surgery in the military health care system. Therefore, those who were eligible to undergo R-ACL already knew how to return and stay on full duty after surgery. Special Operations Forces members would commonly fit into this scenario.

Our study has several limitations. Our retrospective data collection did not account for the effect of clinical factors (e.g., gender, concomitant injuries, presence of articular lesions or osteoarthritis, timing of P-ACL and R-ACL surgeries, injury severity, previous level of occupation) that are known to be associated with outcomes after P-ACL and R-ACL. Due to the smaller sample size of the R-ACL group, a Type II error (not measuring a difference when one may exist) can occur when interpreting the results. Return to full duty was presumed of all subjects not identified to undergo a medical discharge within 24 months postoperatively. Although full duty and medical discharge rates are often used as indicators of recovery within the military, neither is a valid measure of physical performance — thus, true clinical outcome may be oversimplified. Because contact follow-up was not performed, there is the possibility that some subjects with continued dissatisfaction may still have return to full duty and completed their military obligation while seeking further care later in the civilian health care system.

Summary

Due to the high physical demands of the SOF, ACL injuries occur repeatedly. A second ACL surgery may be needed for a Servicemember to resume his or her military career. The present study shows that in a military population at one hospital, most R-ACL cases were as successful as primary cases during the study period. The duration of limited duty was slightly longer after R-ACL surgery. Return to full duty occurred at a similar rate as P-ACL reconstructions, and the odds of medical discharge were also similar. The results are useful in counseling SOF members who might need to undergo R-ACL.

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