The Rate of Subsequent Surgery and Predictors After Anterior Cruciate Ligament Reconstruction: Two- and 6-Year Follow-up Results From a Multicenter Cohort

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Am J Sports Med 2013 41: 1534 originally published online May 30, 2013
DOI: 10.1177/0363546513490277

PODCAST 5-in-5

The Rate of Subsequent Surgery and Predictors After Anterior Cruciate Ligament Reconstruction

Two- and 6-Year Follow-up Results From a Multicenter Cohort

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Background: Subsequent surgeries have a profound effect on patient satisfaction and outcome after primary anterior cruciate ligament reconstruction (ACLR). There have been no prospective studies to date describing the rate and predictors (surgical and patient variables) of all subsequent knee surgeries at short-term and midterm follow-up along with analyses of surgical and patient variables that are associated with subsequent surgeries.

Purpose: To report the rate and predictors of all subsequent surgeries at short-term and midterm follow-up along with associated patient variables.

Study Design: Case-control study; Level of evidence, 3.

Methods: A total of 980 patients (540 male) were prospectively enrolled in a Multicenter Orthopaedic Outcomes Network (MOON) cohort from January 2002 to December 2003. The 2- and 6-year follow-up information for subsequent procedures was obtained. Operative reports were obtained, and all procedures were categorized.

Results: One hundred eighty-five patients underwent a subsequent surgery on the ipsilateral leg (18.9%) and 100 on the contralateral knee (10.2%) at 6-year follow-up. On the ipsilateral knee, there was a 7.7% rate of ACL revisions, a 13.3% rate of cartilage procedures, a 5.4% rate of arthrofibrosis procedures, and a 2.4% rate of procedures related to hardware. For the contralateral knee, there was a 6.4% rate of primary ACL ruptures. Younger age at the index surgery and the use of allografts were predictors (risk factors) for subsequent surgery. Revision ACLR, female sex, body mass index, and surgical exposure were not significant predictors.

Conclusion: At 6-year follow-up, 18.9% of patients who had undergone ACLR underwent subsequent surgeries on the ipsilateral knee. The rates between an ipsilateral ACLR graft versus a contralateral normal ACL tear were similar (7.7% vs 6.4%, respectively). Younger age and the use of allografts were risk factors for subsequent surgery.

Keywords: anterior cruciate ligament reconstruction; subsequent surgery

Anterior cruciate ligament (ACL) injury is a common athletic injury, and ACL reconstructions (ACLRs) are also common, with an estimated 175,000 to 200,000 procedures occurring annually in the United States alone.[13,16]

Subsequent surgeries, on the ipsilateral and contralateral leg, affect patient satisfaction and outcome after ACLR. In addition to effects on patient outcome, there is a significant cost associated with subsequent surgeries, and the rate of these procedures needs to be known for patient education as well as future quality and comparative effectiveness analyses.

A meta-analysis of prospective studies looking at the rate of ipsilateral grafts and contralateral ACL ruptures at a minimum of 5 years after ACLR found that the ipsilateral ACL graft rupture rate ranged from 1.8% to 10.4% (pooled percentage of 5.8%) and that the contralateral injury rate ranged from 8.2% to 16.0% (pooled percentage

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One or more of the authors has declared the following potential conflict of interest or source of funding: This study was funded by the National Institutes of Health/National Institute of Arthritis and Musculoskeletal and Skin Diseases, grant numbers 5R01 AR053684 (to K.P.S.) and 5K23 AR052392-05 (to W.R.D.), and the Center for Education and Research on Therapeutics (Agency of Health Research and Quality), grant number 5 U18-HS016075 (to R.G.M.). Dr Spindler has received unrestricted educational funds from Smith & Nephew and DonJoy. Dr Wright has received research funds from Smith & Nephew and National Football League Charities.

The American Journal of Sports Medicine, Vol. 41, No. 7
DOI: 10.1177/0363546513490277

of 11.8%).[19] Predictors of these injuries could not be determined.

The Knee Anterior Cruciate Ligament, Nonsurgical Versus Surgical Treatment (KANON) study[8] showed that additional surgeries after ACLR are commonplace. At early follow-up, there were equivalent knee outcome scores between the early ACLR group (surgery within 10 weeks) and the group undergoing structured rehabilitation plus optional delayed ACLR. However, 23 of 62 patients in the rehabilitation group opted for delayed ACLR, and there were more meniscal procedures in the rehabilitation group (50 vs 40, respectively). The early ACLR group had more subsequent procedures (13 vs 4, respectively); however, they had almost double the length of follow-up from ACLR. Further data on the cost-effectiveness of both strategies, as well as the long-term effects of subsequent procedures after ACLR, are needed (R.C. Mather, et al, unpublished data, 2012).

There have been no prospective studies to date describing the rate and predictors (risk factors) of all subsequent surgeries at short-term and midterm follow-up. Our aim was to describe these from our Multicenter Orthopaedic Outcomes Network (MOON) prospective cohort study.

MATERIALS AND METHODS

Study Design

Nine hundred eighty patients were enrolled between January 2002 and December 2003 as part of a multicenter, prospective longitudinal cohort study. Institutional review board approval was obtained, and all patients who underwent ACLR at 6 sites were targeted for enrollment in 2002 and 2003.

Data Sources and Measurement

After documentation of informed consent, participants completed a 13-page questionnaire examining self-reported demographics, injury characteristics, sports participation history, comorbidities, and health status. Regarding the latter, the following validated instruments were included: Short Form (SF)–36[5,17]; International Knee Documentation Committee (IKDC)[9]; Knee Injury and Osteoarthritis Outcome Score (KOOS),[14] which includes the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[3]; and the Marx activity rating scale.[11] This was given to the patients before surgery and completed within 2 weeks of the surgery date. At the time of the index surgery, surgeons completed a 49-page questionnaire that included sections on history of the knee injury and/or surgery on both knees, findings from the general knee examination performed under anesthesia, recordings of all intra-articular injuries and treatments to the meniscus and articular cartilage, and the surgical technique used for ACLR. Classification of the general knee examination findings followed the recommendations of the updated 1999 IKDC guidelines. Surgeon documentation of articular cartilage injuries was recorded utilizing the modified Outerbridge classification.[12] Meniscal injuries were classified by size, location, partial versus complete tears, and treatment method (not treated, repaired, or extent of resection). Completed data forms were mailed from the participating sites to the data coordinating center. Data from both the patient and surgeon questionnaires were subsequently scanned and read with Teleform software (Cardiff Software Inc, Vista, California) using optical character recognition to avoid manual data entry, and the scanned data were then verified and exported to a database.

At 2- and 6-year follow-up, patients were asked if they had any subsequent surgeries on either knee. If they responded affirmatively, either on the questionnaire or by telephone, attempts were made to obtain the operative report. If an operative report could not be obtained but the patient reported an ACLR, surgery for infection, or total knee arthroplasty (TKA), these were recorded as such. If the patient reported any other type of procedure, patient accuracy in reporting exact procedures performed was less certain, and the procedure was recorded as "unknown." These 26 "unknowns" were included in counts as subsequent procedures but excluded from categorical analysis. Operative reports were obtained and read, and all procedures were categorized and recorded along with the surgical date. If multiple procedures were performed during surgery, all were recorded. Because one of our goals was to be able to assess individual procedures on future outcomes in a multivariate analysis, procedures were listed, not only whether the patient had any subsequent surgery. This will give future analyses additional depth, as some procedures would be expected to improve outcome over time, whereas others would likely result in long-term deterioration of patient-reported outcomes.

A diagram depicting the categories and subcategories of the subsequent procedures is shown in Figure 1. Articular cartilage procedures included chondroplasty, microfracture, autologous chondrocyte implantation, and osteochondral autograft transplantation. The meniscus categories included both meniscectomy and repair.

Data regarding simultaneous bilateral ACLRs, ACL avulsion repairs, or ACLR surgeries that included surgical procedures to the posterior cruciate ligament, medial collateral ligament, lateral collateral ligament, or meniscal transplants were excluded from analysis. Data from patients with a prior surgery of any type to either knee, including ACLR on the contralateral knee, were included.

Study Size

Sample size considerations guided variable selection to generate a model as complex as the data would allow without overfitting the data using the ratio $p = m/10$ as the minimum acceptable ratio for reliable models (p = number of parameters in model; m = effective sample size). To examine the association between subsequent surgeries and risk factors, a logistic regression model was used in which the

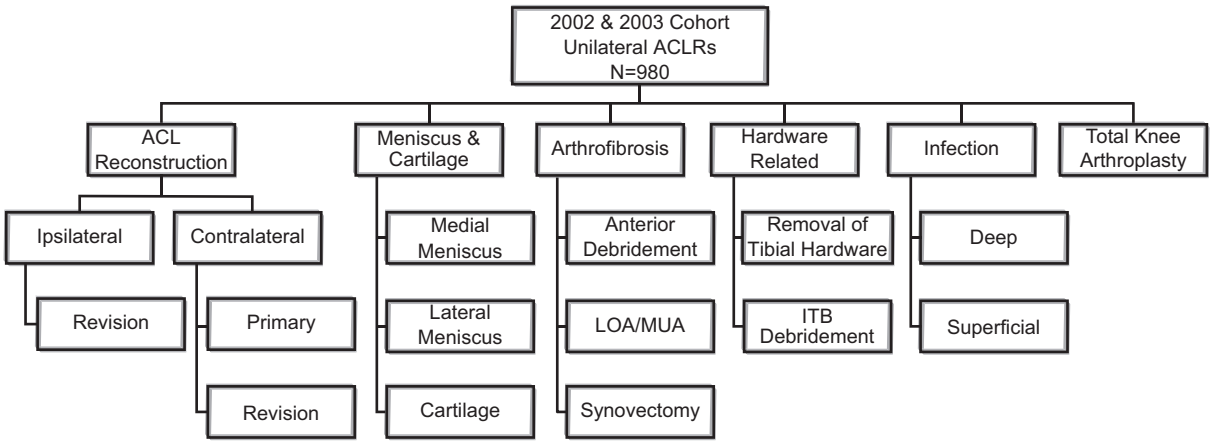

Figure 1. Branching diagram depicting the categories and subcategories of subsequent surgical procedures. Articular cartilage procedures included chondroplasty, microfracture, autologous chondrocyte implantation, and osteochondral autograft transplantation. The meniscus categories included both meniscectomy and repair. ACLR, anterior cruciate ligament reconstruction; LOA/MUA, lysis of adhesions/manipulation under anesthesia; ITB, iliotibial band.

dependent variable was the presence or absence of a subsequent surgery, and independent variables were age, body mass index (BMI), sex, graft choice (bone-tendon-bone [BTB], hamstring, tibialis), femoral fixation, surgical exposure, and allograft versus autograft. Interquartile range odds ratios (IQRORs), which demonstrate the effect of increasing a baseline variable from its first quartile to its third quartile, were calculated for continuous variables. We did not assume the linearity of covariate effects but only assumed smoothed relationships, using restricted cubic regression splines. Missing values of predictor variables were imputed using multiple imputations incorporating predictive mean matching and flexible additive imputation models as implemented in the *aregImpute* function available in the Hmisc package in R statistical software (http://biostat.mc.vanderbilt.edu/Hmisc). Statistical analysis was performed with free open-source R statistical software (www.r-project.org).

RESULTS

Nine hundred eighty patients enrolled in 2002 and 2003 were included in the study. Of these, 440 (44.9%) were female, and the median age was 25 years. Baseline patient characteristics stratified by patient sex can be seen in Table 1. Two-year follow-up information was obtained on 904 (92.2%) patients. Questionnaires were obtained on 845 patients with a mean follow-up of 112.5 ± 10.2 weeks. An additional 59 patients provided subsequent surgery information by telephone. Of the 76 patients that we were unable to obtain 2-year follow-up data on, 65 could not be reached, 6 refused further participation, 3 were incarcerated, and 2 had died. Six-year follow-up information was obtained on 905 (92.3%) patients. Questionnaires were obtained on 858 patients with a mean follow-up of 349 ± 17.4 weeks (6.7 years). Telephone follow-up was provided by 47 patients, of whom 3 had TKAs, and thus, questionnaires were not requested. From the 75 patients who did not provide additional surgery information, the number of those incarcerated and refusing to answer rose to 4 and 11, respectively. The number of deceased patients remained at 2. Fifty-eight could not be reached at this time point. Overall, over 95% of subsequent surgeries were verified by their operative records (on file in the MOON database).

A total of 888 (91%) index surgeries were primary ACLRs. The revision ACLRs were included, and revision was used as an independent variable in statistical modeling. Autograft tendons were used in 750 (77%) of the procedures. All baseline knee characteristics stratified by patient sex, including data on meniscus and ligament status at the time of the index surgery, are included in Table 2.

Based on our 6-year data, on the ipsilateral knee, 185 patients (18.9%) underwent at least 1 subsequent procedure. Eighty-nine (9.1%) patients had 1 subsequent procedure, 57 (5.8%) had 2, 24 (2.4%) had 3, 9 (0.9%) patients had 4, 3 (0.3%) had 5, none had 6, 1 (0.1%) had 7, and 1 (0.1%) had 8 subsequent procedures. One hundred patients (10.2%) underwent at least 1 procedure on the contralateral knee by 6-year follow-up.

On the ipsilateral knee, the rate of surgical procedures was as follows: revision ACLR, 7.7%; medial meniscus procedures, 5.7%; lateral meniscus procedures, 3.7%; articular cartilage procedures, 3.9%; anterior debridement/Cyclops, 4.2%; tibial removal of hardware, 1.3%; iliotibial band debridement, 1.1%; and lysis of adhesions, 0.6%. The rate of procedures because of deep infections was 0.5%, with 2 patients having early infections (within 3 weeks, although 1 required multiple procedures) and 1 patient with a late infection (7 months) postoperatively; 2 of these were in tibialis allografts and 1 in a hamstring autograft.

TABLE 1
Baseline Patient Characteristics Stratified by Sex[a]

	Male (n = 540)	Female (n = 440)	Combined (N = 980)
Age at surgery, y			
25th percentile	18	17	17
Median	25	21	23
75th percentile	35	33	34
Baseline BMI[b]			
25th percentile	23.7	21.1	22.3
Median	25.8	23.0	25.0
75th percentile	28.7	26.3	28.0
Baseline Marx activity score[b]			
25th percentile	8	8	8
Median	12	12	12
75th percentile	16	16	16
Smoker, n (%)			
Never	418 (77)	355 (81)	773 (79)
Quit	54 (10)	39 (9)	93 (9)
Current	63 (12)	43 (10)	106 (11)
Unreported	5 (1)	3 (1)	8 (1)
Ethnicity, n (%)			
White	450 (83)	372 (85)	822 (84)
Black	37 (7)	32 (7)	69 (7)
Asian	16 (3)	15 (3)	31 (3)
Hispanic	3 (1)	6 (1)	9 (1)
Other	14 (3)	7 (2)	21 (2)
Unreported	20 (4)	8 (2)	28 (2)
Marital status, n (%)			
Single	315 (58)	296 (67)	611 (62)
Married	175 (32)	111 (25)	286 (29)
Divorced	13 (2)	13 (3)	26 (3)
Separated	6 (1)	2 (0)	8 (1)
Widowed	2 (0)	1 (0)	3 (0)
Unreported	29 (5)	17 (4)	46 (5)

[a]BMI, body mass index.
[b]There were 12 patients with unreported data.

TABLE 2
Baseline Knee Characteristics Stratified by Sex[a]

	Male (n = 540)	Female (n = 440)	Combined (N = 980)
Reconstruction type			
Primary	487 (90)	401 (91)	888 (91)
Revision	53 (10)	39 (9)	92 (9)
Graft type			
Autograft	406 (75)	344 (78)	750 (77)
Allograft	134 (25)	94 (21)	228 (23)
Both	0 (0)	2 (<1)	2 (<1)
Surgical exposure			
2-incision	181 (34)	128 (29)	309 (32)
Single-incision	359 (66)	312 (71)	671 (68)
ACL graft source			
BTB	276 (51)	193 (44)	469 (47)
Hamstring	169 (31)	174 (39)	343 (36)
Tibialis anterior	93 (17)	72 (16)	165 (17)
Achilles	2 (<1)	1 (<1)	3 (<1)
Medial meniscus			
Normal	321 (59)	290 (66)	611 (62)
Partial tear	44 (8)	28 (6)	72 (7)
Complete tear	175 (32)	122 (28)	297 (30)
Lateral meniscus			
Normal	303 (56)	257 (58)	560 (57)
Partial tear	53 (10)	55 (13)	108 (11)
Complete tear	184 (34)	128 (29)	312 (32)
MCL status			
Normal	480 (89)	406 (92)	886 (90)
Grade 1	28 (5)	14 (3)	42 (4)
Grade 2	30 (6)	15 (3)	45 (5)
Grade 3	2 (<1)	5 (1)	7 (1)
LCL status			
Normal	531 (98)	435 (99)	966 (99)
Grade 1	3 (1)	2 (<1)	5 (1)
Grade 2	5 (1)	2 (<1)	7 (1)
Grade 3	1 (<1)	1 (<1)	2 (<1)

[a]Values are expressed as n (%). ACL, anterior cruciate ligament; BTB, bone-tendon-bone; LCL, lateral collateral ligament; MCL, medial collateral ligament.

Ipsilateral subsequent surgeries stratified by 2- and 6-year follow-up are listed in Table 3.

Of the reconstructions, 671 were by single-incision technique, of which there was a 9.1% rate of revision ACLRs, a 15.1% rate of cartilage/meniscus procedures, a 6.3% rate of procedures for arthrofibrosis, and a 2.8% rate for hardware removal (Table 4). The 2-incision technique was used in 309 cases, and rates for these surgeries were 4.5%, 9.4%, 3.6%, and 1.6%, respectively.

For the contralateral knee, there were 63 primary ACLRs (6.4%) and 5 revision ACLRs. Contralateral subsequent surgeries by 2- and 6-year follow-up are listed in Table 5.

Logistic regression modeling demonstrated that subsequent surgery was associated with younger age at the index surgery (IQROR, 0.47; 95% confidence interval [CI], 0.32-0.71; $P = .0001$) and allografts (OR, 2.33; 95% CI, 1.14-4.78; $P = .0205$). It was not associated with revision surgery ($P = .73$), sex ($P = .37$), BMI ($P = .80$), exposure ($P = .79$), fixation ($P = .08$), or graft choice ($P = .60$). A plot showing the odds ratios for subsequent surgery by risk factor is shown in Figure 2. A partial-effects plot depicting the risk (odds ratio) of subsequent surgery based on age of the patient is shown in Figure 3.

DISCUSSION

This study examined the rate of subsequent procedures at 2- and 6-year follow-up after ACLR. At 6-year follow-up, 18.9% of patients who had undergone ACLR underwent subsequent surgeries on the ipsilateral knee. The rates for ipsilateral ACLR graft ruptures and contralateral normal ACL tears were similar (7.7% vs 6.4%, respectively). In a systematic review of level I and II studies in the literature, Wright et al[19] reported a 5.8% rate of graft ruptures and a 11.8% rate of contralateral ACL tears. While the ipsilateral rupture rate is similar, our study had a much lower rate of contralateral ACL ruptures. Shelbourne et al,[15] in a prospective cohort with a 5-year follow-up, had a 5.3% rate of contralateral ACL ruptures and a 4.3% rate of

TABLE 3
Ipsilateral Subsequent Procedures Stratified to 2- and 6-Year Follow-up[a]

	Overall	0-2 y	2-6 y	Median, mo
Revision ACL reconstruction	75 (7.7)	47 (63)	28 (37)	17.1
Cartilage/meniscus				
Medial meniscus	56 (5.7)	26 (46)	30 (54)	26.0
Lateral meniscus	36 (3.7)	23 (64)	13 (36)	15.6
Cartilage	38 (3.9)	18 (47)	20 (53)	26.4
Arthrofibrosis				
Anterior debridement	41 (4.2)	30 (73)	11 (27)	13.1
LOA/MUA	6 (0.6)	6 (100)	0 (0)	2.2
Synovectomy	6 (0.6)	4 (67)	2 (33)	18.2
Tibial removal of hardware	13 (1.3)	6 (46)	7 (54)	30.3
Iliotibial band debridement	11 (1.1)	10 (91)	1 (9)	5.6
Deep infection	5 (0.5)	5 (100)	0 (0)	0.9
TKA	3 (0.3)	0 (0)	3 (100)	82.9

[a]Values are expressed as n (%). Median time to follow-up is also reported. Percentages shown represent the number of each type of subsequent procedure performed divided by the number of ACL surgeries in the cohort. Thirteen ACL revisions and 2 TKAs were not confirmed by operative report. ACL, anterior cruciate ligament; LOA, lysis of adhesions; MUA, manipulation under anesthesia; TKA, total knee arthroplasty.

TABLE 4
Subsequent Procedures by Surgical Approach (Single-Incision vs 2-Incision) and Graft Type (BTB vs Hamstring vs Tibialis Anterior)[a]

	Single-Incision (n = 671)	2-Incision (n = 309)	BTB (n = 469)	Hamstring (n = 343)	Tibialis Anterior (n = 165)
Revision ACL	61 (9.1)	14 (4.5)	19 (4.1)	21 (6.1)	35 (21.2)
Cartilage/meniscus	101 (15.1)	29 (9.4)	49 (10.4)	40 (11.7)	41 (24.8)
Arthrofibrosis	42 (6.3)	11 (3.6)	17 (3.6)	21 (6.1)	15 (9.1)
Hardware	19 (2.8)	5 (1.6)	5 (1.1)	13 (3.8)	6 (3.6)

[a]Values are expressed as n (%). Numbers shown are the number of each type of surgery in the cohort. Percentages shown represent the number of each type of subsequent procedure performed divided by the number of surgeries of each type in the cohort. ACL, anterior cruciate ligament; BTB, bone-tendon-bone.

TABLE 5
Contralateral Subsequent Procedures Stratified to 2- and 6-Year Follow-up[a]

	Overall	0-2 y	2-6 y	Median, mo
Primary ACL reconstruction	63 (6.4)	25 (40)	38 (60)	27.3
Revision ACL reconstruction	5 (0.5)	2 (40)	3 (60)	34.5
Cartilage/meniscus				
Medial meniscus	39 (4.0)	19 (49)	20 (51)	24.5
Lateral meniscus	26 (2.7)	10 (38)	16 (62)	26.4
Cartilage	21 (2.1)	8 (38)	13 (62)	29.6

[a]Values are expressed as n (%). Median time to follow-up is also reported. Percentages shown represent the number of each type of subsequent procedure performed divided by the number of ACL surgeries in the cohort. Fourteen of the primary ACL reconstructions and 1 of the ACL revisions were not confirmed by operative report. ACL, anterior cruciate ligament.

ipsilateral ACL ruptures. These rates are similar to our findings, and the contralateral rate is equivalent to the ipsilateral rate, as in our study. In a previous publication of 235 patients at 2-year follow-up in this patient population, there was a 3.0% rate of ruptures in both the ipsilateral and contralateral knee.[18] By 6-year follow-up, this rate had more than doubled. While the results of this study are comparable for ACL ruptures, these surgeries only account for a portion of subsequent procedures postoperatively, with this study being one of the first to describe these other procedure rates. Our analyses were focused on predictors by the 6-year follow-up; however, knowing the time to when the procedure occurred is useful information to patients as well as helps to determine the cause of this event after ACLR.

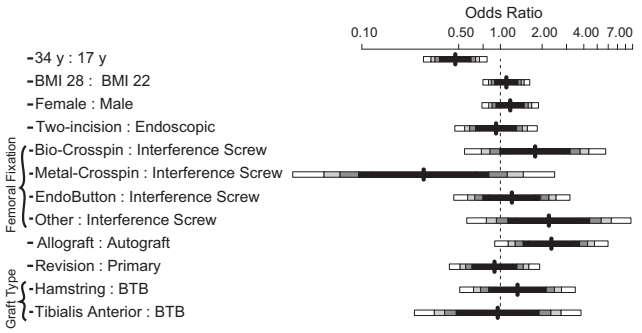

Figure 2. Plot depicting the odds ratio for subsequent surgery. For age, it is the ratio of subsequent surgery at 34 versus 17 years of age, and body mass index (BMI) is for 28 versus 22. All femoral fixation devices are as compared with interference screws (IS) and grafts (tibialis anterior and hamstring [HG] are both compared with bone-tendon-bone [BTB]).

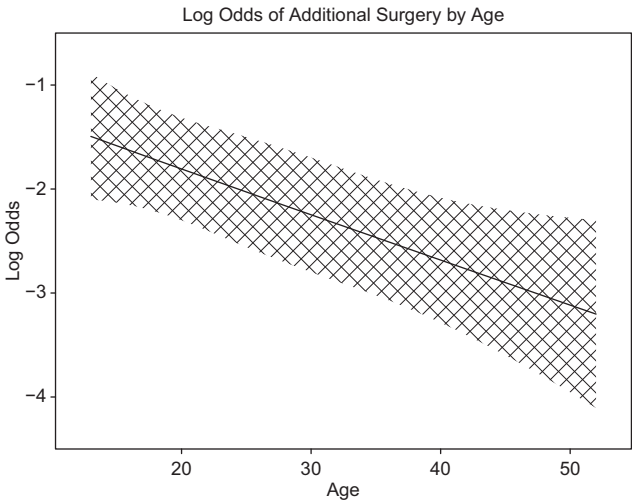

Figure 3. Chart depicting the risk for subsequent surgeries based on age.

Subsequent surgery was associated with younger age at the index procedure. This is consistent with the findings of Shelbourne et al,[15] who found that the rate of subsequent injuries to the ACL was age dependent: 17% for patients younger than 18 years, 7% for patients aged 18 to 25 years, and 4% for patients older than 25 years. Patients who rupture their ACL at a younger age may be more active, be less compliant with postoperative instructions, or have a genetic predisposition to collagen disruption affecting ACL retear rates as well as meniscal and collagen damage.

Multivariable modeling showed that the use of allografts was associated with subsequent surgeries (OR, 2.33), while there was not a statistically significant association between the rate of subsequent surgery and revision surgery, BMI, female sex, graft choice, surgical exposure, or femoral fixation. This was the only modifiable risk factor identified.

Lyman et al,[10] using a database of all hospital admissions and ambulatory surgeries in New York state, found a subsequent surgery rate of 6.5% for either knee at 1 year. Of these, 28.7% underwent another ACLR, 28.0% underwent lysis of adhesions, 24.5% underwent meniscectomy, and 18.8% had another knee procedure. The reason for the subsequent knee surgery was infection in 11.8% of the cases, a pathological patellar condition in 1.6%, and a variety of indications including knee pain and complications from a previous surgery in 5.4%. Predictors of subsequent knee surgery included being female, having a concomitant knee surgery, and being operated on by a lower volume surgeon. Differences in predictors of subsequent surgery between studies may be attributed to the differences between the data sources as well as the fact that the data in the New York state system only listed laterality in the minority of cases.

In a retrospective study of an administrative database for active-duty soldiers who underwent ACLR with up to 9-year follow-up, 12.7% underwent reoperations after their index procedure.[7] Of these, 2.3% underwent surgery on their lateral meniscus, 4.9% on their medial meniscus, and 4.5% on the cartilage. The rate of reoperations for the soldiers who did not undergo ACLR was 32.6%. Anterior cruciate ligament reconstruction led to a 56% reduction in surgery on the lateral meniscus and a 42% decrease in reoperations on the medial meniscus and overall reduced the risk of subsequent reoperations by 66%.[7] Their results were consistent with our findings for meniscal and cartilage procedures and document the occurrence of subsequent procedures in soldiers after ACLR and those who do not undergo ACLR. With knowledge about how these individual procedures affect outcome, we will be able to conduct cost utility and comparative effectiveness studies for these patient groups.

The 0.5% infection rates in this study are similar to those previously reported in the literature. Benner et al[4] reported an infection rate of 0.35% in BTB grafts taken from the ipsilateral knee and 0.14% in grafts taken from the contralateral knee. Barker et al,[2] in a retrospective cohort study of over 3000 patients, found a 0.58% infection rate overall, 0.44% in allografts, 0.49% in BTB autografts, and 1.44% in hamstring autografts.

Some studies have reported higher reoperation rates in female patients overall.[6,10] Shelbourne et al[15] reported a higher incidence in female patients in the contralateral knee. Our study is consistent with others in the literature that did not find a difference between male and female patients in subsequent reoperation rates.[1,7]

Limitations of this study include that 7.7% of patients were lost to follow-up, and procedures were only stratified if an operative report was obtained. While more than 95% of the operative reports were available, these percentages may underestimate the true rate of subsequent procedures. Additionally, this study only looked at reoperation rates at 2 and 6 years, not reinjury rates.

CONCLUSION

This is the first prospective study to analyze both rates and predictors of subsequent surgery and predictors after

ACLR at short-term and midterm follow-up in a prospective, multicenter cohort. In summary, at 6-year follow-up, 18.9% of patients who had undergone ACLR underwent subsequent surgeries on the ipsilateral knee. The ipsilateral ACLR graft versus contralateral normal ACL tear rates were similar (7.7% vs 6.4%, respectively). Younger age at the index surgery and the use of allografts were predictors (risk factors) for subsequent surgeries. Revision ACLR, female sex, BMI, and surgical exposure were not significant predictors.

CONTRIBUTING AUTHORS

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ACKNOWLEDGMENT

The authors thank the following Vanderbilt University research staff and faculty for their tireless efforts on this specific dataset and/or for editorial assistance on this article: John Shaw, Suzet Galindo-Martinez, C. Thomas Dupont, Zhouwen Liu, Laura J. Huston, and Lynn S. Cain.

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