

Fellow Efficiency During Anterior Cruciate Ligament Reconstruction Improves Over Time, Yet Is Less Than Experienced Physician Assistant But With No Significant Difference in Patient-Reported Outcomes



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Purpose: To evaluate the intraoperative efficiency and patient outcomes of anterior cruciate ligament reconstruction (ACLR) assisted by a sports medicine fellow over the course of the academic year compared with an experienced physician assistant (PA). **Methods:** A single-surgeon cohort of primary ACLRs with either bone–tendon–bone autograft or bone–tendon–bone allograft (without any other significant time-consuming procedures such as meniscectomy/repair) were evaluated using a patient registry system over 2 years assisted by an experienced PA compared with an orthopaedic surgery sports medicine fellow. There were 264 primary ACLRs included in this study. Outcomes included evaluation of surgical time, tourniquet time, and patient-reported outcome measures. **Results:** The surgical efficiency of the fellow (as measured by surgical time and tourniquet time) improved over each academic quarter. Patient-reported outcomes between the 2 first-assist groups showed no significant difference over 2 years with both ACL graft groups combined. ACLRs assisted by the PA showed shorter tourniquet times by 22.1% and shorter total surgical times by 11.9% compared with the sports medicine fellows when both grafts were combined ($P < .001$). The surgical and tourniquet times (minutes) for the fellow (standard deviation of surgical time 19.5–25.0 and tourniquet time 19.5–25.0) did not average out to be more efficient in any of the 4 quarters of the year compared with the PA-assisted group (standard deviation of surgical time 14.4–14.8 and tourniquet time 14.8–22.4). Autografts showed more efficient tourniquet (18.7%) and skin-to-skin surgical times (11.1%) in the PA group compared with the fellow group ($P < .001$). Allografts showed more efficient tourniquet (37.7%) and skin-to-skin surgical times (12.8%) in the PA group compared with the fellow group ($P < .001$). **Conclusions:** The surgical efficiency of the fellow during primary ACLRs improves over the academic year. Patient-reported outcomes are similar in cases assisted by the fellow compared with an experienced physician assistant. Cases assisted by the PA were performed more efficiently compared with the sports medicine fellow. **Clinical Relevance:** The intraoperative efficiency of a sports medicine fellow objectively improves over the academic year for primary ACLRs but may not be as efficient as an experienced advanced practice provider; however, there appears to be no significant differences in patient-reported outcome measures between the 2 groups. This helps quantify the time commitment for attendings and academic medical institutions as the “cost of education” of trainees such as fellows.

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The use of physician assistants (PAs) and nurse practitioners (NPs) in medicine has grown over the past few decades with a high prevalence in orthopaedic surgery.¹ With the Association American Medical Colleges predicting a shortage of 120,000 physicians in the United States by 2030, the incorporation of PAs and NPs are likely to grow, with the U.S. Bureau of Labor and Statistics projecting 31% job growth for PAs and 26% growth for NPs from 2018 to 2028.²⁻⁵ While the popularity of Advanced Practice Providers (APPs) such as PAs and NPs across various fields of medicine is well documented, there is sparse literature affiliated with any clinical outcomes of care provided by these roles

nor any direct comparison to other providers such as residents or fellows despite they are commonly interchangeable surgical first-assist roles in academic medical centers. We looked to evaluate for any evidence of change in surgical performance over the academic year by the fellow evaluated by surgical time and tourniquet time. The proficiency progression of residents and fellows in the literature is limited on evaluating this by time and involving a specific sports medicine case like an anterior cruciate ligament reconstruction (ACLR).

The purpose of the study was to evaluate the intraoperative efficiency and patient outcomes of ACLR assisted by a sports medicine fellow over the course of the academic year compared with an experienced PA. We hypothesized that the proficiency of a fellow assistant would improve over time and that an experienced APP first assistant would demonstrate efficiencies equal or beyond that of a surgical fellow with similar patient-reported outcomes.

Methods

After institutional board approval, a retrospective study was performed using a prospectively collected database of patients who underwent an ACLR (Surgical Outcome Systems; Arthrex, Naples, FL). The database included skeletally mature patients older than the age of 15 who underwent primary ACLR by the same attending surgeon (P.D.A.) performed between 2016 and 2020 first-assisted by either the same PA (S.M.H.) or an orthopaedic surgery sports medicine fellow. Inclusion criteria were skeletally mature patients older than the age of 15 years undergoing a primary ACLR. The assistant was based on the day they were scheduled to work with the surgeon. No residents were included. The PA had worked with the attending surgeon for 4 years before the investigated cohort. The fellows would start the academic year on August 1 and rotate in 6-week time blocks with various attendings until July 31 of the subsequent year before graduation. The study group was limited to isolated primary ACLRs. Patients were excluded if they were a revision ACLR or had concomitant procedures including meniscectomy, meniscus repair, lateral augmentation, other ligament procedure, or articular cartilage restoration procedures. Surgical skin-to-skin time (initial incision time to the last Steri-Strip (3M, St. Paul, MN) placed as recorded by the intraoperative nurse in the electronic medical record), tourniquet time, the month of surgery, and the first-assistant role were evaluated. Patients were sent patient-reported outcome measurement (PROMs) surveys preoperatively and at various points after surgery; 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and 2 years from surgery. Beginning 6 months after surgery, the surveys included visual analog scale (VAS), Knee Injury and Osteoarthritis Outcome Score (KOOS) Sport/Rec, KOOS symptoms, KOOS activities of daily

living (ADL), International Knee Documentation Committee (IKDC) subjective knee evaluation, Tegner, Lysholm, Single Assessment Numeric Evaluation (SANE) knee, and The Veterans RAND 12-Item Health Survey (VR-12) (physical), which would total 46 different survey/timepoint combinations. A minimum of 10 patient responses was chosen as a minimum to provide a comparison, but there were not enough responses from the fellow-assisted allograft group at 2 years. For this reason, PROM allograft comparisons by assistant were made at a maximum of 6 months after surgery, as that was the longest time point with at least 10 patients responding in that subset. Bone-tendon-bone (BTB) autografts and allografts were then subdivided and evaluated using the aforementioned parameters. VAS scores after 6 weeks were omitted, as we did not feel these were reflective of this type of surgery or were pertinent to the investigation. The surgical time and tourniquet times of both groups were then evaluated and subdivided by the time of the academic year and divided into quarters.

Statistical analyses were performed to assess differences across a sample of postsurgical and patient outcome measures between patient groups who underwent surgery assisted by a PA compared with those assisted by a sports medicine fellow. The Kolmogorov-Smirnov test for normality was performed to determine the normality distribution for the dependent variables. Results indicated that the surgical time variable met the criteria for normal distribution and an independent *t*-test analysis was performed. All other dependent variables were analyzed using Mann-Whitney *U* tests. A *P* value of $< .05$ was established as criteria for reaching statistical significance. All statistical analyses were run using the IBM SPSS Statistics for Windows, version 24, statistical platform (IBM Corp., Armonk, NY).

Surgical Technique

The techniques for graft harvest and surgical technique can vary by surgeon. The technique described is to provide a detailed explanation of how the tourniquet time and skin-to-skin time is accounted for during surgeries performed by the senior author (P.D.A.). For BTB autograft, the tourniquet is inflated and a longitudinal incision is made over the knee, starting at the inferior pole of the patella and going to the level of the tibial tubercle. The BTB graft is harvested and patella harvest site is backfilled with excess bone from the harvest. The patella tendon is repaired with 0 VICRYL suture (Ethicon, Somerville, NJ) in a simple interrupted fashion. The paratenon overlying the patella and patella tendon is repaired with 2-0 VICRYL suture in a running fashion. A diagnostic arthroscopy is performed involving all 3 compartments before the ACLR is begun. ACLR was performed using an antegrade partially

threaded rigid reamer for the tibial tunnel and a flexible reamer for the femoral tunnel via anteromedial portal (“Versitomic” by Stryker, Kalamazoo, MI). The graft is passed through the tibial tunnel and docked in the femoral tunnel. Interference screw fixation using absorbable screws (“Milagro” by DePuy-Mitek, Raynham, MA) is performed after tapping on both the femoral and tibial sides. Graft tension and lack of impingement are verified before the tourniquet is then released and the time is recorded. The periosteal tissues are then closed over the distal tibial tunnel aperture. The soft tissue is then closed sequentially with 0 VICRYL, 2-0 VICRYL, 3-0 MONOCRYL, and 3-0 PROLENE (Ethicon). Sterile Steri-Strips (3M) were applied. This is when the intraoperative nurse would consider “skin closed” which is marked in the surgical record and is used as the surgical “end” of the case. The graft is prepared by the first assistant on the back table while the attending initiates the arthroscopic portion of the case.

For patients who elected to proceed with their ACLR using allograft tissue, allografts were prepared on the back table and were ready for placement/fixation before initiation of tunnel drilling. These grafts were prepared by the first assistant on the back table during the knee arthroscopy. The diagnostic arthroscopy was performed first. Incision time of the portal is the “surgical start-time” for allografts. Once the diagnostic arthroscopy was performed and it was time to initiate the reconstruction portion of the surgery, the tourniquet was inflated followed by an incision made over the proximal medial tibia for the tibial tunnel. The aforementioned ACLR was then performed with the tourniquet and “skin closed” times recorded as appropriate.

The role of the first assistant during these cases was identical and included preoperative patient setup, retraction as appropriate, graft preparation, leg manipulation, drilling of the tibial and femoral tunnels, femoral screw placement, wound closure, and application of the dressing and brace.

Results

Patient Characteristics

A total of 264 patients were included in the investigation, with the senior author (P.D.A.) as the single attending surgeon for all cases assisted by either a fellow or the same PA. In total, 186 primary BTB autografts were included (131 assisted by PA vs 55 assisted by fellow). In total, 78 primary BTB allografts were included (56 assisted by PA vs 22 assisted by fellow). No overall preoperative statistical difference between fellow and PA groups in age, sex, or body mass index was noted (Table 1). The average age for the PA-assisted autografts was 24.4 years old (range 15-45, standard deviation [SD] 7.1) versus fellow-assisted

Table 1. Patient Characteristics of Primary ACL Reconstructions (All Graft Types) by the First-Assist Role

Patient Characteristics			
	Physician Assistant	Fellow	<i>P</i> Value
Age, y, mean	30.7	31.4	.66
Sex, male, n (%)	83 (44%)	41 (53%)	.44
Sex, female, n (%)	104 (56%)	36 (47%)	.44
BMI, mean	24.5	24.2	.47

ACL, anterior cruciate ligament; BMI, body mass index.

autografts at 25.4 years-old (range 15-41, SD 7.5). The average age for the PA-assisted allografts was 45.3 years-old (range 34-62, SD 5.3) versus fellow-assisted allografts at 46.1 years-old (range 29-63, SD 6.9).

Presurgical PROMs Group Comparisons

The PROMs administered before surgery were compared between patient groups to determine whether any group selection bias existed. The global health measure chosen for this study was the VR-12. Presurgical group comparisons demonstrated no statistical differences between the PA-assisted group (average VR-12 score = 100.98) and the sports medicine fellow-assisted group (average VR-12 score = 92.15), $P = .327$.

The knee-specific PROMs measures chosen for this study also demonstrated no presurgical group differences (IKDC score, $P = .761$; Lysholm knee score, $P = .825$; KOOS symptoms, $P = .703$; KOOS Pain, $P = .396$; KOOS ADL, $P = .486$; and KOOS quality of life, $P = .172$).

Outcomes: Surgical Time (All Grafts)

The surgical skin-to-skin time and the tourniquet time were evaluated by quarter of the year with Quarter 1 starting on August 1, which is the beginning of the academic medical center year for fellows (Fig 1, Table 2). The surgical skin-to-skin and tourniquet times improved each academic quarter for the fellow. Longer surgical times were seen at all 4 quarters with the fellow compared with the PA. The skin-to-skin surgical time during quarter 1 (15.9-minute difference, $P = .02$), quarter 2 (15.8-minute difference, $P \leq .001$), and quarter 3 (12.1-minute difference, $P = .001$) showed statistically significant longer times with cases assisted by the fellow but improved quarterly. Quarter 4 showed no statistically significant difference between the 2 surgical assistant groups (4.4 minutes longer with the fellow group, $P = .20$) for skin-to-skin surgical time.

Outcomes: Tourniquet Time (All Grafts)

Tourniquet times during quarter 1 (20.4-minute difference, $P = .06$), quarter 2 (16.2-minute difference, $P = .001$), and quarter 3 (12.8-minute difference, $P = .03$) showed longer times with the fellow cases than the PA cases (Fig 1, Table 2). Quarter 4 showed no

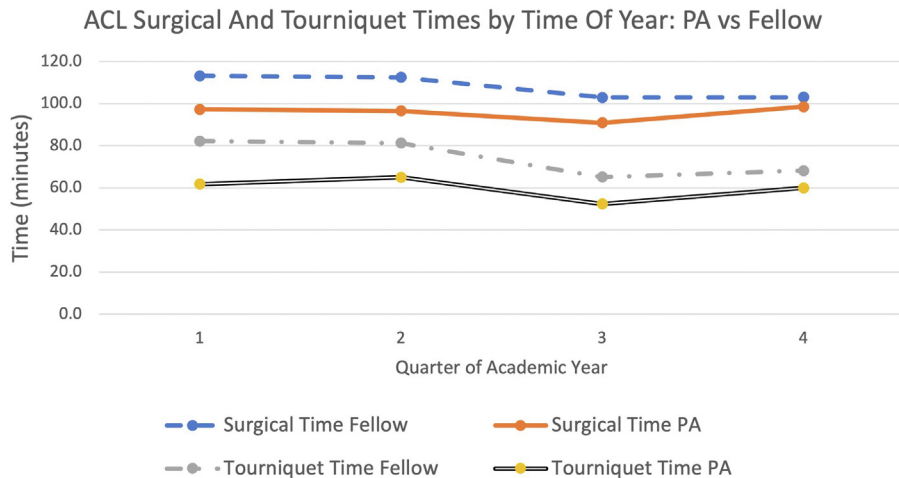


Fig 1. ACL surgical and tourniquet times by first assist role through quarters of the academic year. (ACL, anterior cruciate ligament; PA, physician assistant.)

statistically significant difference between the 2 groups in tourniquet time (8.2 minutes longer with the fellow group, $P = .14$). Longer tourniquet times were seen at all 4 quarters with the fellow compared with the PA.

When the autograft and allograft groups were combined, the surgical time for the PA was 11.9% shorter (11.4 minutes) compared with the fellow (95.5 minutes vs 106.9 minutes, $P \leq .001$). In the same combined graft group, the tourniquet time for the PA was 22.1% shorter (59.4 minutes vs 72.6 minutes, $P \leq .001$) (Fig 2, Table 3).

Outcomes: Tourniquet Time (BTB Autografts)

The tourniquet time average for the PA-assisted BTB autografts was 18.7% shorter (13.5 minutes) at 71.8 minutes (range 33-98, SD 7.9) compared to 85.3 minutes (range 68-117 minutes, SD 8.4) for the fellow-assisted autografts. The tourniquet time average for the PA-assisted allografts was 37.7% shorter at 29.6 minutes (11.2 minutes, range 22-51, SD 4.8) compared with a 40.8 minutes average (range 31-90 minutes, SD 13.3) for the fellow-assisted allografts. There was a statistically significant longer tourniquet time with the fellows using autograft ($P < .001$) and allograft ($P = .001$) tissue compared with the PA.

Outcomes: Surgical Time (BTB Autografts)

The surgical skin-to-skin average for the PA-assisted BTB autografts was 11.1% shorter (11.3 minutes) at 102.1 minutes (range 83-140, SD 10.4) compared with 113.4 minutes (range 92-135 minutes, SD 9.9) for the fellow-assisted autografts. The skin-to-skin time average for the PA-assisted allografts was 12.8% shorter (10.2 minutes) at 80.4 minutes (range 60-102 minutes, SD 8.5) compared with a 90.6 (77-122 minutes, SD 13.3) for fellow-assisted allografts. There was a statistically significant longer surgical skin-to-skin time with the fellows using autograft ($P < .001$) and

allograft ($P = .001$) tissue compared with the PA. A breakdown of first assist-roles by ACL graft can be found in (Table 4).

Outcomes: Patient-Reported Outcomes Measures (All Grafts)

The preoperative and postoperative PROMs including VAS, KOOS Sport/Rec, KOOS symptoms, KOOS ADL, IKDC subjective knee evaluation, Tegner, Lysholm, SANE knee, and VR12 (physical) were obtained (Table 5). The only preoperative PROM with a statistically significant difference ($P = .019$) was the Tegner scores of the PA group (4.6) were greater compared with the fellow group (3.6) when both grafts were combined but no statistically significant difference when the autograft group ($P = .054$) and allograft group ($P = .146$) were stratified individually. All other PROMs had no preoperative statistically significant preoperative differences.

Postoperatively, when autografts and allografts were combined, there were no statistically significant postoperative differences between the 2 groups across 46 PROM time points except for the 2-year KOOS Symptoms subscale ($P = .001$) where patients in the PA group (84.9 ± 12.6) were lower compared with the fellow group (92.3 ± 5.9). All other 45 of 46 (98%) time points showed no statistically significant difference

Table 2. Average ACL Surgical and Tourniquet Times by First-Assist Role Through Quarters of the Academic Year

Quarter	Surgical Times			Tourniquet Times		
	Fellow	PA	Difference, min	Fellow	PA	Difference, min
1	113.3	97.3	15.9	82.3	61.8	20.4
2	112.5	96.6	15.8	81.3	65.1	16.2
3	103.0	90.9	12.1	65.2	52.4	12.8
4	103.0	98.6	4.1	68.2	60.0	8.2

ACL, anterior cruciate ligament; PA, physician assistant.

Primary ACL surgical and tourniquet times by first-assistant role

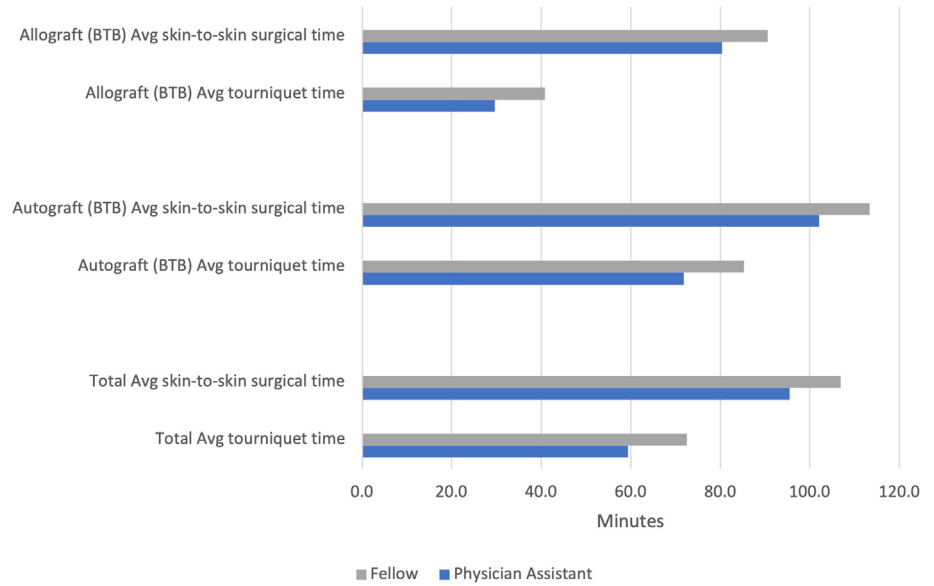


Fig 2. Average ACL reconstruction surgical and tourniquet times by role and graft type. (ACL, anterior cruciate ligament; BTB, bone–tendon–bone.)

between the 2 groups for both graft groups combined (Table 5).

Postoperative allografts showed no significant PROM differences across 24 test time points at 2 weeks, 6 weeks, 3 months, and 6 months between the PA group and fellow group except for a greater Tegner score with the fellow group (4.3, n = 11) at 6 months compared with PA group (3.4, n = 34, P = .03). All other (23/24, 96%) allograft surveys showed no statistically significant difference between the 2 groups for allografts.

Postoperative autografts showed no significant PROM differences across 45 PROM test time points between the PA group and fellow group except greater KOOS Symptoms score at 2 years in the fellow group (91.7 vs 85.0, P = .01). All other 45 of 46 (98%) time points showed no statistically significant difference between the 2 groups for autografts.

Discussion

This study shows the progressive improvement in surgical time for a fellow as they progress in their

surgical skills and affirms our hypotheses. Patient-reported outcomes did not vary based on the first assistant or graft type. This cohort evaluation documents the surgical efficiency of fellows and a PA first assistant in a single uncomplicated orthopaedic procedure during a 4-year period of time throughout the course of an academic year. The surgical efficiency of various role groups has not been well documented in academic medicine. There has been an increasing interest in various methodologies of how to measure surgical proficiency of trainees for knee surgery including written examinations, virtual simulators, and dry models; however, correlation to actual surgical (intraoperatively and postoperatively) results is lacking.⁶⁻⁸

The role of APPs in academic medical institutions has grown steadily over the past several decades. Despite the growing popularity of APPs,⁹ there is a lack of literature documenting outcomes or use of APPs in various

Table 3. Standard Deviation of ACL Reconstruction Between Fellow and PA Between Surgical and Tourniquet Times

Quarter	Surgical Time		Tourniquet Time	
	Fellow (SD)	PA (SD)	Fellow (SD)	PA (SD)
1	25.0	14.8	25.0	20.7
2	19.5	14.4	19.5	14.8
3	23.6	14.6	23.6	22.4
4	20.2	14.6	20.2	21.6

ACL, anterior cruciate ligament; PA, physician assistant; SD, standard deviation.

Table 4. Average ACL Reconstruction Surgical and Tourniquet Times by Role and Graft Type

	Physician Assistant	Fellow	P Value
Total avg. tourniquet time	59.4	72.6	<.001
Total avg. skin-to-skin surgical time	95.5	106.9	<.001
Autograft (BTB) avg. tourniquet time	71.8	85.3	<.001
Autograft (BTB) avg. skin-to-skin surgical time	102.1	113.4	<.001
Allograft (BTB) avg. tourniquet time	29.6	40.8	.001
Allograft (BTB) avg. skin-to-skin surgical time	80.4	90.6	.001

ACL, anterior cruciate ligament; BTB, bone–tendon–bone. Bold font indicates statistically significant.

Table 5. Primary ACLR PROMs (All Grafts Combined) by First-Assist Role

	Physician Assistant	Fellow	<i>P</i> Value
VAS			
Preoperative	1.31	1.79	.08
2 wk	2.99	2.85	.61
6 wk	1.20	1.38	.32
Marx			
Preoperative	11.18	10.45	.36
1 y	7.79	7.78	1.00
2 y	7.92	9.50	.22
KOOS Pain			
Preoperative	78.03	75.61	.28
3 mo	83.88	82.71	.48
6 mo	88.24	88.82	.75
1 y	92.43	91.23	.50
2 y	93.33	95.52	.20
KOOS Symptoms			
Preoperative	72.15	70.65	.56
3 mo	74.89	76.23	.49
6 mo	82.36	83.39	.63
1 y	84.20	87.39	.12
2 y	84.94	92.26	.001
KOOS ADLs			
Preoperative	87.21	84.28	.24
3 mo	90.68	91.07	.76
6 mo	95.41	95.31	.93
1 y	97.91	97.70	.79
2 y	97.75	98.94	.10
KOOS Sports and Rec			
Preoperative	39.96	36.59	.46
3 mo	34.37	34.75	.94
6 mo	55.72	56.08	.94
1 y	76.05	76.63	.90
2 y	82.44	89.83	.11
KOOS QOL			
Preoperative	37.63	35.23	.45
3 mo	46.77	47.74	.72
6 mo	54.53	58.87	.23
1 y	67.16	65.43	.65
2 y	76.35	80.21	.45
IKDC Subjective			
Preoperative	54.16	53.20	.68
3 mo	54.00	54.38	.84
6 mo	67.85	69.16	.56
1 y	79.45	80.51	.68
2 y	85.19	89.22	.24
Tegner			
Preoperative	4.60	3.64	.02
3 mo	3.38	3.32	.82
6 mo	4.34	4.16	.58
1 y	5.92	6.00	.85
2 y	5.96	6.00	.95
Lysholm			
Preoperative	70.01	70.66	.81
3 mo	74.89	75.88	.65
6 mo	83.26	85.54	.30
1 y	89.64	90.14	.77
2 y	92.13	94.60	.19
SANE			
Preoperative	48.97	47.63	.75
3 mo	60.15	61.34	.69
6 mo	74.03	72.45	.62
1 y	85.64	82.93	.42

(continued)

Table 5. Continued

	Physician Assistant	Fellow	<i>P</i> Value
2 y	88.03	90.11	.47
VR-12 Physical			
Preoperative	44.28	42.97	.31
6 mo	50.04	49.58	.70
1 y	53.48	53.66	.87
2 y	55.09	54.27	.50
VR-12 Mental			
Preoperative	51.61	52.89	.38
6 mo	55.11	54.51	.72
1 y	55.13	56.12	.52
2 y	55.48	57.92	.17

ACLR, anterior cruciate ligament reconstruction; ADL, activities of daily living; IKDC, International Knee Documentation Committee; KOOS, Knee Injury and Osteoarthritis Outcome Score; PROMs, patients-reported outcome measures; QOL, quality of life; SANE, Single Assessment Numeric Evaluation; VAS, visual analog scale; VR-12, The Veterans RAND 12-Item Health Survey.

Bold font indicates statistically significant.

subspecialties, including potential benefits or drawbacks. The interaction and influence of these provider roles on residents and fellows have been investigated in several settings, but none involving orthopaedic surgery and none specifically within sports medicine. Studies generally have shown a positive influence of APPs on residents and fellows, including reduced workloads, improved resident–patient coordination, and contribute to continuity of care.¹⁰⁻¹² Despite the use of the APP professions in subspecialties like orthopaedic surgery, most literature evaluating the clinical outcomes of APPs is focused on primary care.¹³⁻¹⁶ Publications on PAs first-assisting in orthopaedic surgery have been limited and predominantly related to orthopaedic trauma surgery, particularly focusing on institutional efficiency and costs but little on clinical outcomes or comparison to residents/fellows.^{17,18} Some studies have investigated various procedures with the outcome distinguished by first assistant experience (mainly resident vs fellow) as the differentiating factor related to surgical times¹⁹⁻²¹ or clinical outcomes^{22,23}; however, they did not document specifically any quarterly progressions if applicable. A PubMed search involving ACL surgery or ACLR with “physician assistant” or “nurse practitioner” yielded no surgical studies at the time of this article. This study can help quantify some of the “cost of education” for both the attending as well as the academic medical institution. This “cost of education” for the attending surgeon has multiple variables in a teaching environment but there is little to compare the same attending surgeon when they are providing education to a trainee to when they are simply executing the surgical case. This can be used to better quantify production of the attending if they are or are not involved in trainee teaching. Further, it goes to show that patient outcomes are not significantly altered based on who is first assisting the case.

Limitations

In this cohort, we compared the fellows with one specific PA who is familiar with the surgeon and intraoperative processes. It is understood that skill sets and intraoperative familiarity from one provider type to another can vary and thus the data should be used as an example but not necessarily the rule for having a PA act as a surgical fist assist. As this is a retrospective cohort, there could be a perceived bias. As these were considered all primary cases and thus straightforward, cases were booked on patient requested days. An individual fellow, given the 6-week rotations, will not spend as much time with the attending as the PA, which may influence efficiency. This study did not directly measure the extent of the teaching or fellow interaction, which explains the difference in surgical efficiencies. A relatively low volume of long-term follow-up responses by fellow-assisted allograft reconstructions would have allowed for an improved breakdown of PROMs via graft type. In addition, we elected to include chondroplasty as a concomitant procedure, as this is a common procedure that typically can take seconds to less than 1 minute and thus would not likely significantly alter the overall times of the surgery. Other complicating factors between ACL surgeries could also be no standardization between groups for degree of chondral degenerative disease.

Conclusions

The surgical efficiency of the fellow during primary ACLRs improves over the academic year. Patient-reported outcomes are similar in cases assisted by the fellow compared with an experienced PA. Cases assisted by the PA were performed more efficiently compared with the sports medicine fellow.

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