Cureus
Part of SPRINGER NATURE

Open Access Original Article

One-Year Functional Outcomes Following Arthroscopic All-Inside Anterior Cruciate Ligament Reconstruction Using a Quadrupled Hamstring Autograft

Review began 10/26/2026
Review ended 11/01/2026
Published 11/05/2026

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DOI: 10.7759/cureus.119154

Sai Vishwanath Mudigonda [1], Jayanth S.N. [1], Divakar Reddy K. [2], Praveen Sodavarapu [3], Adinarayana Kashyap Tadikonda [1]

1. Orthopaedics, CMR Institute of Medical Sciences, Hyderabad, IND 2. Orthopaedics, Medicover Hospitals, Hyderabad, IND 3. Orthopaedics, Medicover Hospitals, Visakhapatnam, IND

Corresponding author: Adinarayana Kashyap Tadikonda, kashyap.adi.15@gmail.com

Abstract

Background

All-inside anterior cruciate ligament (ACL) reconstruction uses femoral and tibial sockets with cortical suspensory fixation. Serial assessment of knee function and pain can characterize postoperative recovery. This prospective study evaluated functional outcomes and pain through one year after all-inside ACL reconstruction using a quadrupled hamstring autograft.

Methods

This prospective, single-center observational cohort study included 20 patients who underwent all-inside ACL reconstruction using a quadrupled hamstring autograft performed by a single surgeon. Patients were evaluated preoperatively and at four, eight, 12, 24, and 52 weeks using the International Knee Documentation Committee (IKDC) Subjective Knee Form, Lysholm knee score, and visual analog scale (VAS) for pain. Within-patient changes from baseline were estimated with 95% confidence intervals (CIs) and assessed using paired t-tests with Holm adjustment across 15 baseline comparisons. Exact signed-rank tests were performed as sensitivity analyses, and Friedman tests assessed changes across all six evaluations.

Results

The mean age was 32.15 ± 8.76 years, and 14 patients (70%) were male. At 52 weeks, the mean Lysholm score increased from 51.40 ± 4.25 to 90.35 ± 2.30, the mean IKDC score increased from 49.15 ± 8.73 to 87.50 ± 2.04, and the mean VAS pain score decreased from 8.17 ± 0.70 to 0.60 ± 0.31. Corresponding mean changes were 38.95 points (95% CI, 36.89-41.01), 38.35 points (95% CI, 34.54-42.16), and −7.57 points (95% CI, −7.98 to −7.15), respectively; all Holm-adjusted $P < 0.001$. Two superficial graft-harvest-site infections were documented during early follow-up.

Conclusion

Patient-reported knee function improved, and pain decreased through one year after all-inside ACL reconstruction. The small uncontrolled cohort and absence of objective functional assessments and complete one-year complication data limit conclusions regarding comparative superiority, return to sport, and graft survival.

Categories: Sports Medicine, Pain Management, Orthopedics
Keywords: all-inside acl reconstruction, anterior cruciate ligament, cortical suspensory fixation, ikdc subjective score, lysholm knee score, quadrupled hamstring autograft, visual analog scale

Introduction

Anterior cruciate ligament (ACL) injury can result in recurrent instability, impaired knee function, and limitations in occupational and sporting activities. Concomitant meniscal and articular cartilage injuries may further increase the risk of post-traumatic osteoarthritis, which can develop despite ACL reconstruction [1]. Treatment decisions should account for symptoms, functional demands, associated injuries, and patient preferences. Randomized evidence does not support routine immediate reconstruction for every ACL rupture; structured rehabilitation with reconstruction deferred or reserved for patients with persistent symptoms or instability may be an appropriate strategy for some patients [2].

All-inside ACL reconstruction uses closed femoral and tibial sockets, with the graft secured by cortical suspensory fixation at both ends. A quadrupled semitendinosus-based graft requires less tendon length than a graft spanning complete tunnels and may permit preservation of the gracilis tendon when adequate graft

diameter and length are achieved. Bone preservation and reduced surgical exposure are potential advantages of the technique. However, successful reconstruction requires specialized instrumentation and precise coordination of graft preparation, socket diameter and depth, graft passage, seating, and tensioning. These technical features provide a rationale for the procedure but do not independently establish a clinical advantage [3].

Comparative evidence has not consistently established superior functional outcomes with all-inside ACL reconstruction. An early postoperative pain advantage without a sustained functional advantage through two years was observed in a randomized controlled trial [4]. An Indian prospective comparative study similarly demonstrated lower early postoperative pain but comparable later functional outcomes following all-inside tibial socket preparation [5]. A meta-analysis of randomized controlled trials identified modest differences in selected functional outcomes without establishing superior knee stability or graft survival [6]. A more recent randomized trial using comparable adjustable suspensory fixation found no significant advantage in clinical outcomes, graft healing, or tunnel widening at one year [7]. Another systematic review and meta-analysis reported greater measured knee laxity despite a small mid-to-long-term advantage in subjective functional outcomes [8].

The distinction between patient-reported knee function and objectively measured stability is particularly relevant when evaluating postoperative recovery. Improvements in symptoms and daily functional activities do not necessarily indicate restoration of anterior-posterior or rotational knee stability. Consequently, patient-reported outcome measures should be interpreted separately from objective mechanical assessments and structural findings. The International Knee Documentation Committee (IKDC) Subjective Knee Form [9] and Lysholm knee score have established measurement properties in patients with knee injuries, including ACL-related conditions [10]. Together with pain assessment using the visual analog scale (VAS), these instruments provide a means of evaluating changes in symptoms and perceived knee function throughout postoperative rehabilitation.

Serial assessment at clinically relevant postoperative intervals can characterize the trajectory of functional recovery following ACL reconstruction. Early postoperative improvement may not fully represent the functional gains achieved during subsequent rehabilitation. Furthermore, longitudinal assessment allows the magnitude and progression of recovery to be quantified relative to preoperative functional status. Therefore, this prospective observational cohort study aimed to evaluate patient-reported knee function using the IKDC Subjective Knee Form and Lysholm knee score, alongside pain assessment using the VAS, following arthroscopic all-inside ACL reconstruction with a quadrupled hamstring autograft. The principal analytical objective was to quantify within-patient changes in these three measures from the preoperative assessment to 52 weeks postoperatively. An additional objective was to characterize the longitudinal trajectory of functional recovery and pain reduction through serial assessments at four, eight, 12, and 24 weeks.

Materials And Methods

This was a prospective, single-center observational cohort study conducted at St. Theresa's Hospital, Sanathnagar, Hyderabad, India, from August 2019 to July 2020. The study was approved by the Institutional Ethics Committee of St. Theresa's Hospital (approval number: ECR/230/INST/AP/2013/RR-2019). A total of 20 patients who underwent arthroscopic all-inside ACL reconstruction performed by a single surgeon were included in the study and were followed for 52 postoperative weeks. The surgical procedures were undertaken as part of routine clinical care, with prospective assessment of postoperative functional outcomes.

Study population

Eligibility Criteria

Eligible participants were skeletally mature adults aged 20-50 years with symptomatic ACL insufficiency confirmed by clinical examination and magnetic resonance imaging (MRI), no history of previous surgery on the affected knee, and a normal contralateral knee. Exclusion criteria included asymptomatic ACL insufficiency, systemic illness compromising anesthetic fitness, associated posterior cruciate ligament injury, grade III collateral ligament injury, osteoarthritis, associated fracture, and local skin infection. Informed consent was obtained before surgery.

Sampling Method

Patients were enrolled using nonprobability consecutive sampling. Eligible patients who provided informed consent were included in the order in which they presented during the recruitment period.

Sample Size

The sample comprised 20 consecutively enrolled eligible patients treated at the study center. No formal a

priori sample-size calculation or prespecified target effect size was documented. The study size therefore reflects the available clinical cohort. This justification follows STROBE (STrengthening the Reporting of OBservational studies in Epidemiology) guidance to explain how observational study size was determined [11]. Precision was evaluated using 95% confidence intervals (CIs) for within-patient changes. No retrospective power calculation was performed. The small sample limits precision and generalizability, and the findings should be interpreted as exploratory.

Preoperative clinical assessment

Baseline evaluation included patient age, sex, affected side, presenting symptoms, mechanism of injury, time of presentation (TOP), and associated meniscal pathology. TOP was recorded separately and was not considered equivalent to the injury-to-surgery interval. Preoperative knee function was evaluated using the IKDC Subjective Knee Form [9] and Lysholm knee score [10]. Pain severity was assessed using a VAS ranging from 0 to 10, with higher scores indicating greater pain intensity.

Surgical technique

All procedures were performed arthroscopically with the patient positioned supine under spinal or combined epidural anesthesia. Diagnostic arthroscopy was initially performed to evaluate the ACL injury and identify associated intra-articular pathology. The semitendinosus tendon was harvested through a small incision over the pes anserinus and prepared as a short, quadrupled hamstring autograft. Gracilis tendon augmentation was performed when required. The described surgical technique utilized a graft construct approximately 60-70 mm in length, with adjustable-loop cortical suspensory fixation at both the femoral and tibial ends. Individual graft dimensions and tendon composition were unavailable for analysis.

The femoral socket was prepared using the anteromedial portal technique with the knee maintained in hyperflexion. A guidewire was introduced at the selected femoral ACL footprint, followed by drilling to create a socket approximately 25 mm deep. The tibial socket was prepared using a retrograde drilling technique with a FlipCutter® drill (Arthrex, Naples, Florida, United States), creating a socket approximately 30 mm deep. Socket dimensions were adapted according to the prepared graft. The quadrupled hamstring graft was introduced through the anteromedial portal and sequentially seated within the femoral and tibial sockets. Fixation was achieved using adjustable-loop cortical suspensory devices with cortical buttons at both ends. The socket dimensions represent the reported operative technique rather than measured cohort averages. The number of meniscal repairs or resections, individual graft diameters, and calibrated graft-tensioning parameters were not available for analysis.

Postoperative rehabilitation

Postoperative rehabilitation emphasized early pain and swelling control, restoration of knee extension and flexion, quadriceps activation, and progressive weight bearing. Subsequent rehabilitation focused on progressive muscle strengthening, proprioceptive training, and functional recovery. Progression was guided by postoperative clinical assessment and patient tolerance.

Follow-up and outcome assessment

Patients underwent scheduled evaluations preoperatively and at four, eight, 12, 24, and 52 weeks postoperatively. All 20 patients completed the 52-week follow-up assessment, with complete IKDC subjective scores, Lysholm knee scores, and VAS pain scores available at each assessment. No patients were lost to follow-up, and no imputation of missing outcome data was required.

Functional outcomes were evaluated using the IKDC Subjective Knee Form and Lysholm knee score. Pain was assessed using the VAS. Higher IKDC and Lysholm scores indicated better patient-reported knee function, whereas lower VAS scores indicated reduced pain. Early postoperative complications were obtained from the available clinical records. However, the functional outcome dataset did not contain dedicated adverse-event variables, limiting assessment of complications throughout the entire follow-up period.

Statistical analysis

Patient-level data were analyzed using Python version 3.12, NumPy, and SciPy (Python Software Foundation, Wilmington, Delaware, United States). Categorical variables were summarized as frequencies and percentages. Continuous variables were expressed as mean and standard deviation (SD), while TOP was summarized using the median and interquartile range (IQR). The primary analytical emphasis was the change in IKDC, Lysholm, and VAS pain scores between the preoperative assessment and 52-week follow-up. This endpoint emphasis was selected for the analysis and was not prospectively registered.

Within-patient changes were calculated by subtracting the preoperative score from the corresponding postoperative score. Paired t-tests were used to evaluate changes from baseline, and two-sided 95% CIs were calculated using the paired differences. Paired t statistics are reported with 19 degrees of freedom (df) for the 20 complete pairs. To account for multiple testing, Holm adjustment was applied across 15 baseline comparisons, comprising five postoperative assessments for each of the three outcome measures. Holm

adjustment was applied to P values; the corresponding t statistics were unchanged. The reported confidence intervals were pointwise rather than simultaneous.

Distributions of within-patient changes were examined for departures from normality. Exact Wilcoxon signed-rank tests using sign permutation were conducted as sensitivity analyses, with Holm adjustment applied across the same 15 comparisons. Friedman tests were performed to evaluate changes across all six assessment points without requiring the assumption of sphericity. Corresponding chi-square statistics are reported with five degrees of freedom. Paired comparisons were two-sided, and a Holm-adjusted P value <0.05 was considered statistically significant. Friedman tests were evaluated at P <0.05. No post hoc power calculation or subgroup modeling was performed.

Results

Patient characteristics

The study included 20 patients with a mean age of 32.15 ± 8.76 years and an observed age range of 20-46 years. Nine patients (45%) were aged 20-30 years, seven (35%) were aged 31-40 years, and four (20%) were aged 41-50 years. Fourteen patients (70%) were male, and the left knee was affected in 12 patients (60%). Road traffic accidents and sports-related injuries each accounted for eight cases (40%). Six patients (30%) had associated meniscal tears, including four medial meniscal tears, one lateral meniscal tear, and one involving both menisci. The median recorded TOP was four weeks (IQR, 3-8 weeks; range, 2-52 weeks). The recorded TOP was not considered equivalent to a verified injury-to-surgery interval (Table *1*).

Characteristic		Value
Age (years)	mean ± SD	32.15 ± 8.76
Age range (years), n (%)	20-30	9 (45%)
	31-40	7 (35%)
	41-50	4 (20%)
Sex, n (%)	Male	14 (70%)
	Female	6 (30%)
Affected knee, n (%)	Left knee	12 (60%)
	Right knee	8 (40%)
Cause, n (%)	Road traffic accident	8 (40%)
	Sports injury	8 (40%)
	Fall	3 (15%)
	Dancing	1 (5%)
Type of pain, n (5)	Pain with instability	12 (60%)
	Pain alone	5 (25%)
	Pain with locking	3 (15%)
Tear type, n (%)	Associated meniscal tear	6 (30%)
	Medial meniscal tear	4 (20%)
	Lateral meniscal tear	1 (5%)
	Both medial and lateral meniscal tears	1 (5%)
TOP (weeks)	median (IQR)	4 (3-8)
	TOP range	2-52

TABLE 1: Patient characteristics (N=20)

TOP denotes time of presentation and should not be interpreted as the injury-to-surgery interval.

TOP, time of presentation; IQR, interquartile range; SD, standard deviation

Functional outcomes and pain

Complete functional outcome data were available for all 20 patients at each assessment. The mean Lysholm knee score increased from 51.40 ± 4.25 preoperatively to 80.20 ± 3.04 at 12 weeks and 90.35 ± 2.30 at 52 weeks. Similarly, the mean IKDC subjective score increased from 49.15 ± 8.73 preoperatively to 73.07 ± 3.77 at 12 weeks and 87.50 ± 2.04 at 52 weeks. The mean VAS pain score decreased from 8.17 ± 0.70 preoperatively to 1.68 ± 0.36 at 12 weeks and 0.60 ± 0.31 at 52 weeks (Table *2*).

Assessment time	Lysholm knee score, mean±SD	IKDC Subjective Knee Form, mean±SD	VAS pain, mean±SD
Preoperative	51.40 ± 4.25	49.15 ± 8.73	8.17 ± 0.70
4 weeks	62.10 ± 4.77	61.85 ± 3.77	5.47 ± 0.70
8 weeks	74.10 ± 5.38	68.09 ± 4.08	2.70 ± 0.63
12 weeks	80.20 ± 3.04	73.07 ± 3.77	1.68 ± 0.36
24 weeks	85.75 ± 2.43	82.10 ± 3.13	1.13 ± 0.36
52 weeks	90.35 ± 2.30	87.50 ± 2.04	0.60 ± 0.31

TABLE 2: Recorded outcomes through 52 weeks (N=20)

IKDC, International Knee Documentation Committee; VAS, visual analog scale; SD, standard deviation

The recorded recovery trajectories were consistent with progressive increases in mean patient-reported knee function and reductions in pain across the postoperative assessments. Individual patient trajectories and group means with 95% CIs are presented in Figure *1*.

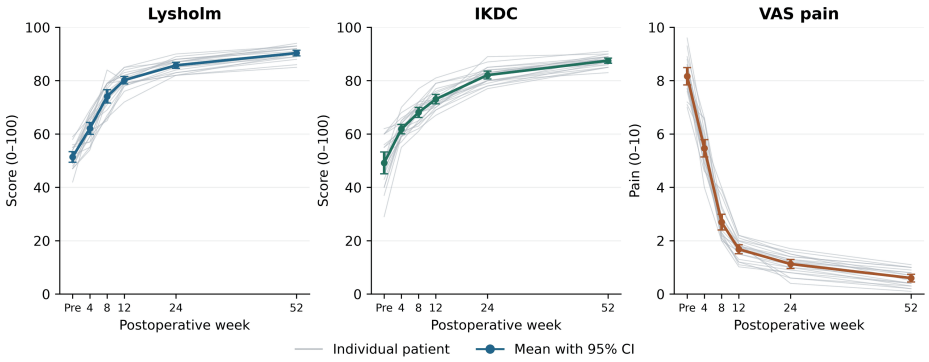


FIGURE 1: Recorded recovery trajectories through 52 weeks (N=20)

Thin gray lines represent individual patients; colored points and bars represent means and pointwise 95% confidence intervals. Pre indicates the preoperative assessment, plotted at zero for display. n = 20 at every visit. Connecting lines display observed visits and do not represent measurements between visits.

IKDC, International Knee Documentation Committee Subjective Knee Form; VAS, visual analog scale; Lyshom, Lysholm knee score

At 52 weeks, the mean improvement from baseline was 38.95 points for the Lysholm score (95% CI, 36.89-41.01) and 38.35 points for the IKDC score (95% CI, 34.54-42.16). The corresponding mean change in VAS pain score was -7.57 points (95% CI, -7.98 to -7.15). All three changes were statistically significant after Holm adjustment (adjusted $P < 0.001$) (Table *3*).

Outcome	Mean change	95% CI	Paired t statistic	df	Adjusted P
Lysholm	38.95	36.89 to 41.01	39.64	19	<0.001
IKDC	38.35	34.54 to 42.16	21.09	19	<0.001
VAS	-7.57	-7.98 to -7.15	-37.79	19	

TABLE 3: Paired changes from baseline to 52 weeks (N=20)

Change = 52-week minus baseline score. Positive functional changes and negative pain changes indicate improvement. CIs are pointwise t-based intervals. P values are Holm-adjusted across all 15 baseline comparisons. The sign of t follows the direction of the paired change.

df, degrees of freedom; IKDC, International Knee Documentation Committee Subjective Knee Form; VAS, visual analog scale

All 15 postoperative comparisons with baseline demonstrated statistically significant improvements following Holm adjustment (all adjusted $P < 0.001$). Exact signed-rank sensitivity analyses supported these findings (all adjusted $P < 0.001$). Friedman tests demonstrated significant differences across the six assessment points for Lysholm ($\chi^2 = 99.46$), IKDC ($\chi^2 = 100.00$), and VAS ($\chi^2 = 100.00$), each with five degrees of freedom (all $P < 0.001$). The magnitude and precision of the paired changes from baseline at each postoperative assessment are illustrated in Figure 2.

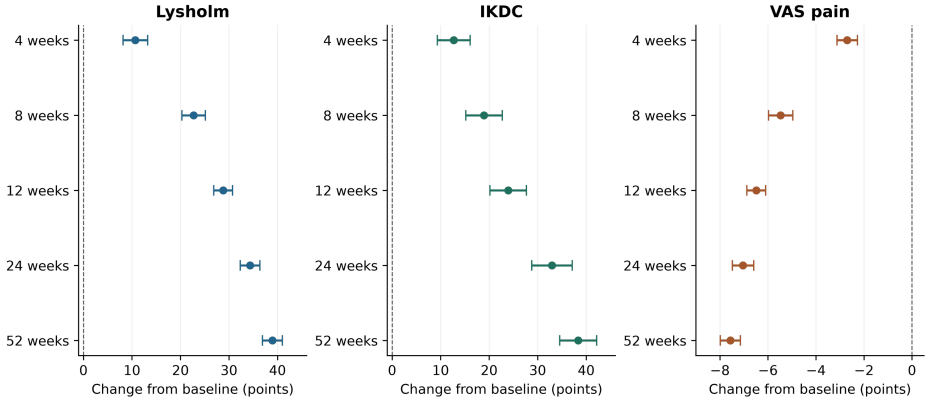


FIGURE 2: Paired mean changes from baseline at each postoperative visit

Points show mean within-patient changes; horizontal bars show pointwise t-based 95% confidence intervals, calculated from the SD of paired differences. n = 20 for every comparison. Positive Lysholm and IKDC changes and negative VAS changes indicate improvement. Panel axes use different scales. The dashed line indicates no change. All 15 baseline comparisons had Holm-adjusted $P < 0.001$; the displayed confidence intervals are not adjusted for multiplicity. These within-cohort changes do not estimate a treatment effect against a comparator.

IKDC, International Knee Documentation Committee Subjective Knee Form; VAS, visual analog scale; Lyshom, Lysholm knee score

Further improvement was observed between 12 and 52 weeks. The mean Lysholm score increased by 10.15 points (95% CI, 8.85-11.45), while the mean IKDC score increased by 14.43 points (95% CI, 12.93-15.93). The mean VAS pain score decreased by an additional 1.08 points (95% CI for the magnitude of reduction, 0.93-1.22). These additional contrasts were descriptive. Although group means improved at each assessment, one patient's Lysholm score decreased from 84 at eight weeks to 80 at 12 weeks.

Complications

Two patients (10%) developed superficial infections at the graft-harvest site during early postoperative follow-up (95% CI, 1.2-31.7%). Both infections resolved following antibiotic treatment. No additional complications were observed in the functional outcomes. There was no graft rerupture, revision surgery, or reoperation throughout the one-year follow-up period.

Discussion

Knee function and pain improved within one year after all-inside ACL reconstruction in this cohort. Mean changes from baseline to 52 weeks were 38.95 points for the Lysholm score, 38.35 for the IKDC score, and -7.57 for pain, with further improvement beyond 12 weeks. These results describe recovery after reconstruction and rehabilitation. Without a comparison group, the contribution of the all-inside technique cannot be separated from the overall treatment course.

The continued improvement after early follow-up is clinically relevant. Mean IKDC score increased from 73.07 at 12 weeks to 87.50 at one year, while Lysholm score increased from 80.20 to 90.35. Assessment confined to the early postoperative period may therefore have underestimated the final improvement in this cohort. However, lower pain and better symptom scores do not establish recovery of strength or rotational stability, and should not be interpreted as evidence of readiness for unrestricted sport. Symptom improvement and biological graft maturation represent different aspects of recovery.

The one-year IKDC mean score was broadly consistent with the value of 86 ± 11 in the all-inside arm of the randomized trial by Okutan et al. [7]. Their trial found no advantage over complete tibial tunnel reconstruction in patient-reported outcomes, measured laxity, graft healing, or tunnel widening, and did not support routine all-inside use given the specialized instrumentation and potentially greater cost. The numerical similarity provides context for the present results but does not demonstrate equivalence. Differences in case selection, baseline function, rehabilitation, and measurement precision limit comparisons across studies. The narrow dispersion of final scores in this cohort also warrants consideration of scoring and ascertainment methods.

Comparative studies have reported mixed findings. Early pain benefits have not consistently translated into sustained functional superiority [4,5]. Pooled randomized evidence has identified modest differences in selected scores without an established rerupture advantage [6]. More recent pooled evidence suggests greater measured laxity with all-inside reconstruction despite a small mid-to-long-term IKDC advantage; the rerupture estimate remained imprecise and did not establish a significant increase [8]. Because instrumented laxity was not measured in the present study, the favorable subjective outcomes cannot address this distinction between perceived function and mechanical stability.

The magnitude of improvement can also be considered against published thresholds for clinical relevance. A systematic review reported approximate minimal clinically important differences of 13.8 points for IKDC and 9.9 for Lysholm scores after knee ligament reconstruction [12]. The mean changes in this cohort exceeded those benchmarks. Thresholds nevertheless depend on the population, assessment interval, and method of estimation. A group mean above a threshold does not identify the proportion of individual responders or establish a patient-acceptable symptom state. These comparisons therefore contextualize the observed improvement rather than constitute a validated responder analysis.

The paired estimates describe the precision of these changes. At the one-year follow-up, the IKDC change had a wider CI than the Lysholm change despite similar mean gains. These intervals quantify uncertainty in the cohort mean, but they do not predict an individual patient's result or account for the limitations of an uncontrolled design. The individual trajectories and paired-change plots serve complementary purposes by showing variation in recovery and the magnitude and precision of the average change.

Interpretation also depends on the clinical composition of the cohort. Both sports-related and nonsport injuries were represented, and 30% of patients had meniscal pathology. Functional goals and recovery may differ across these presentations. Without details of meniscal treatment or rehabilitation adherence, their contributions cannot be separated. Likewise, gracilis preservation cannot be assumed for every patient, and the absence of strength testing prevents assessment of a donor-site benefit. Rehabilitation recommendations emphasize functional testing and movement quality when assessing return to sport [13]. These domains were not captured by the three outcome scores used here.

The two early superficial infections temper the favorable functional findings. The 10% proportion has a wide CI, and resolution with antibiotics does not remove its clinical relevance. A systematic review estimated an overall infection incidence of 0.60% across 316,214 primary ACL reconstructions [14]; however, variation in infection definitions limits comparison with superficial harvest-site infections. European Society for Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA)/European Bone and Joint Infection Society (EBJIS) recommendations address infection prevention and management, including graft handling and vancomycin presoaking [15]. Vancomycin use was not documented in this cohort. The available early complication records also do not establish safety through one year.

Strengths, limitations, and future recommendations

Strengths include repeated within-patient assessment, complete recorded outcomes for all 20 patients at final follow-up, and a single-surgeon technique. Analysis of patient-level data allowed paired estimates with CIs, using revised scores checked against the questionnaires. Sensitivity analyses supported the direction of change, although agreement between statistical methods does not independently validate the measurements.

The study is limited by its small sample, single-center setting, lack of a control group, and absence of a documented a priori sample-size calculation. Assessor blinding was not documented. Although follow-up was prospective through one year, exact calendar dates of the assessments were unavailable for verification. Functional scores were checked against the questionnaires, but item-level forms were unavailable for independent scoring verification. TOP cannot be interpreted as injury-to-surgery delay. Instrumented laxity, objective strength, hop testing, psychological readiness, activity exposure, postoperative imaging, and complete one-year complication data were unavailable. One year is insufficient to assess long-term graft durability or osteoarthritis, which may develop despite reconstruction [1]. For the two cases with postoperative infections, while both resolved following antibiotic treatment, the clinical records differed regarding oral versus combined intravenous and oral antibiotic administration.

Further studies should define recruitment and follow-up periods prospectively, retain item-level questionnaires, standardize graft and meniscal documentation, and include a comparison group. Future studies should also prospectively and consistently document postoperative complications, including their type, severity, management, and resolution, throughout the follow-up period. Follow-up beyond two years, with objective functional testing, return-to-sport exposure, complications, and revision outcomes, would help determine whether proposed technical advantages produce durable clinical benefit.

Conclusions

IKDC, Lysholm, and VAS pain scores improved through 52 weeks after all-inside ACL reconstruction in this 20-patient prospective cohort. These findings describe recovery but do not establish comparative superiority, return-to-sport readiness, or one-year graft safety. Future investigations with larger, multicenter cohorts may help to further characterize these clinical results and address the limitations regarding objective stability and long-term surgical outcomes.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Adinarayana Kashyap Tadikonda, Sai Vishwanath Mudigonda, Divakar Reddy K., Jayanth S.N.

Acquisition, analysis, or interpretation of data: Adinarayana Kashyap Tadikonda, Sai Vishwanath Mudigonda, Divakar Reddy K., Jayanth S.N., Praveen Sodavarapu

Drafting of the manuscript: Adinarayana Kashyap Tadikonda, Sai Vishwanath Mudigonda, Jayanth S.N., Praveen Sodavarapu

Critical review of the manuscript for important intellectual content: Adinarayana Kashyap Tadikonda, Sai Vishwanath Mudigonda, Divakar Reddy K.

Supervision: Divakar Reddy K.

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Ethics Committee, St. Theresa's Hospital, Hyderabad, India issued approval ECR/230/INST/AP/2013/RR-2019. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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