

ARTHROSCOPIC ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN GHANA: A 2-YEAR OUTCOME ASSESSMENT.

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Abstract

Objective: The goal of this study was to evaluate the treatment outcomes of arthroscopic anterior cruciate ligament reconstruction among patients at the Komfo Anokye Teaching Hospital, (KATH) in Ghana.

Methods: A prospective cohort study. We enrolled consenting patients who underwent arthroscopic anterior cruciate ligament (ACL) reconstruction at the KATH over a 3-year period, from January 1, 2015 to December 31, 2018 and followed up each study participant for 2 years. Post-operative assessments were performed at 2, 6, 12, 24 weeks, 1 year and at 2 years, to record outcome variables such as range of motion, pain, swelling and laxity of the affected knee as well as excessive discharge from the surgical site, suggestive of infection. Tegner Lysholm knee scores were obtained for each patient at 2-years following surgery. The follow-up was concluded in 2020.

Results: Over the 3-year period, 40 primary arthroscopic ACL reconstructions were performed in 40 patients. Most of the patients were young adult males who sustained a tear of the anterior cruciate ligament following a fall from a standing height. Out of this number, 31 had isolated ACL tear, 4 had ACL tear

associated with LCL tear and 3 had ACL tear with associated meniscal tear. Two of the participants had ACL, PCL and LCL tear and a complex medial meniscal tear, with associated posterolateral corner rotatory instability. ACL reconstructions that were performed within 12 months following injury had higher mean Tegner Lysholm score of 7 (range of 5-9), than those carried out later than 12 months after injury. Overall, 37 of the patients (93%) had good to excellent outcome at 2 years post-operatively. Three of the patients who were competitive athletes before injury had returned to competitive sport within 1 year of surgery. There was one case of surgical site infection giving an infection rate of 2.5% and one case of graft rupture that required revision ACL reconstruction.

Conclusion: Arthroscopic ACL reconstruction is feasible at the study site with low complication rate and provides good to excellent outcome in 93% of patients. The procedure is generally safe and effective in restoring knee function following an ACL tear. Patient reported outcomes are superior when reconstruction is performed within 12 months of injury compared to later reconstructions.

Key Words: Anterior Cruciate Ligament (ACL), Lateral Collateral Ligament (LCL), Posterior Cruciate Ligament (PCL), Tegner Activity Scale (TAS).

Introduction

The Anterior Cruciate Ligament (ACL) is a 2-bundle structure - anteromedial and postero-lateral bundles. It provides restraint to anterior displacement of the tibia on the femur and is particularly important in antero-posterior stability when the knee is flexed.¹ Anterior cruciate ligament injuries are the most common ligament injury of the knee and affects predominantly physically active young people.^{1,2,3} A rupture of the ACL is functionally incapacitating and causes joint instability, with associated reduced activity level,

unsatisfactory knee function and an increased risk of knee osteoarthritis, especially when associated with meniscal damage.¹ An ACL tear also predisposes to further injuries.¹ In the USA, the age- and sex-adjusted annual incidence of ACL tears is estimated at 68.6 per 100,000 person-years and approximately 200,000 ACL reconstructions are performed each year.^{4,5} Similarly, in Australia, 52 ACL reconstructions per 100,000 person-years have been reported.^{6,7}

Surgical reconstruction of a torn ACL, which may involve the use of an open or arthroscopic technique, is regarded as critical for a good outcome particularly in those wishing to resume sporting activities.^{8,9} The primary objective of ACL reconstruction is to provide a functionally stable knee and to maintain knee kinematics and proprioception.⁹ In addition, the goal of ACL reconstruction is to reduce the complications associated with graft-harvest. The best choice of graft tissue to use is a subject of controversy. Semitendinosus-gracilis tendon or central third patellar tendon autograft is used in most ACL reconstructions.¹⁰ The use of central-third

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patella tendon autograft may be complicated by patellofemoral pain, weakness of the quadriceps muscle, rupture of the patellar tendon and patellar fracture.¹¹ The use of semitendinosus-gracilis tendon autograft may be attended by poor graft incorporation, hamstrings muscle weakness and prominence or pain from the hardware used in the fixation. However, good or excellent outcomes can be expected in over 90% of patients following arthroscopic ACL reconstruction. In ACL reconstructive procedures, the pre-injury anatomy of the ACL is simulated as closely as feasible and early reconstruction of ACL tears offers a higher mean Tegner Lysholm score than late reconstruction.¹²

Arthroscopic reconstruction of a torn ACL is a less invasive and less morbid surgical approach to restore knee stability. In a review of patients who had undergone arthroscopically assisted ACL reconstruction versus those who had had open reconstruction, Buss and colleagues, reported comparable results. However, the frequency of patellofemoral joint pain and the need for knee manipulation on account of stiffness were lower in the arthroscopically assisted group.¹³ Moreover, in a prospective randomized study to compare arthroscopic and open ACL reconstruction, Scott and others found that 1-month post-operative range of motion and 6-month post-operative thigh atrophy were more favourable for the arthroscopic method ($p < 0.05$). Noyes and others in their study, similarly, observed a decreased thigh circumference within the first few weeks of surgery, in spite of a closely supervised inpatient and outpatient rehabilitation programme, in the open ACL reconstruction group compared to the arthroscopic group.¹⁴ Anderson and co-workers in a study to assess the effect of operative technique on ACL reconstruction, concluded that, the initial graft tension does not affect clinical outcome and that bioabsorbable screws and titanium screws produced similar results irrespective of the graft type used.¹⁵

The Tegner Lysholm activity score, first described in 1985, is widely used to assess functional outcomes after treatment for ACL and Meniscal injuries.¹⁶ In a study to test the reliability, validity and responsiveness of the Tegner Lysholm scale for knee anterior cruciate ligament injuries, Briggs and others¹⁷ found this scale to be a reliable measure of outcomes. Its main disadvantage is that it is related to sports more than to functional activities of daily living.⁹ In a retrospective review of 876 arthroscopic procedures that were performed in a community hospital in Baerum, the overall complications rate was found to be 5%.¹⁸ A survey of the American Board of Orthopaedic Surgery database found complications relating to ACL reconstruction to account for 9% of all complications recorded. Overall, infection was the most common complication with a rate of 0.84%. The rate of pulmonary embolism was 0.11% and anaesthetic complication accounted for 0.22%.¹⁷

Methods

In this study, we enrolled consenting patients who underwent arthroscopic ACL reconstruction at the KATH over a 3-year period, from January 1, 2015 to December 31, 2018 and followed up each study participant for 2 years. Post-operative assessments were performed at 2, 6, 12, 24 weeks, 1 year and at 2 years to record outcome variables such as knee range of motion, pain, swelling, knee laxity and excessive fluid discharge from the surgical site. Tegner Lysholm knee scores were obtained at 2-years following surgery for each patient. The follow-up was concluded in 2020.

At the time of enrolment, sociodemographic data of participants, such as age, gender and occupation were recorded as well. The mechanism of the ACL tear, concomitant injuries, type of ACL tear as reported by a radiologist and/or determined at arthroscopy, the time interval between injury and arthroscopic reconstruction were captured.

Surgical procedure

A double bundle ACL reconstruction with interference screw graft fixation to the tibia and endobutton graft fixation to the femur using ipsilateral semitendinosus and gracilis tendon autograft was performed in 39 patients. One patient underwent reconstruction with bone-patella tendon-bone autograft. All surgical reconstructions employed a similar surgical technique by the same surgical team. Patients with Lateral Collateral Ligament (LCL) tear underwent LCL reconstruction with ipsilateral fascia lata autograft with interference screw fixation of the graft to the distal femur, just above the epicondylar ridge and those with ACL tear with concomitant LCL and Posterior Cruciate Ligament (PCL) tear and posterolateral corner rotatory instability underwent, in addition to ACL reconstruction, posterolateral corner reconstruction with fascia lata autograft. All patients underwent a similar structured rehabilitation programme after surgery with increased attention to building quadriceps and hamstrings strength and restoration of optimal range of knee motion. Following isolated ACL reconstruction, the knee was immobilized at 30 degrees of flexion for 7 to 10 days after which braced motion from 20 to 60 degrees was permitted. The operated knee was braced and patients were allowed full weight bearing on post-operative day 1 with a pair of axillary crutches. The crutches were discarded after 2 weeks. In cases of meniscal repair, the affected knee was braced and was non-weightbearing for 4 weeks, and knee motion from 0 to 90 degrees commenced at 5 weeks. All knees were braced for 6 weeks following surgery and progressive resistive exercises began thereafter. Return to light sports was permitted 12 weeks post-operatively and resumption of competitive sports was allowed 6 months after surgery.

Study Site

The study was conducted at the trauma and orthopaedics directorate of the Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana. The KATH is a 1,500-bed hospital and serves as a main referral hospital for the northern two-thirds of Ghana. It is a centre for training doctors, nurses, anaesthetists, radiographers and several other healthcare staff. The hospital is located in the city of Kumasi which has a population of 1,730,249. The KATH serves people across Ghana and some neighbouring countries. It provides Trauma and Orthopaedic care for patients 24 hours a day and seven days a week. The centre provides specialized trauma and orthopaedic services which include arthroscopic ACL reconstruction.

Study design

Prospective cohort study.

Inclusion Criteria:

All patients who underwent arthroscopic anterior cruciate ligament reconstruction at the KATH and who gave participation consent were included in the study.

Exclusion Criteria:

Patients who refused consent to participate in the study as well as polytrauma patients who underwent anterior cruciate ligament reconstruction were excluded. Open or revision anterior cruciate ligament reconstructions, patients with diabetes or underlying immunosuppression and those who underwent ACL reconstruction as part of a complex procedure were not considered for this study.

Statistical analysis

Data were analysed using STATA SE version 16.0. Our primary analysis looked at pain, swelling, stiffness and instability of the affected knee as well as excessive wound discharge suggestive of surgical site infection. Descriptive statistics such as means and standard deviations were used to assess demographics, physical examination and outcome data. Analysis of data was performed with 95% confidence interval. P-values less than 0.05 were considered statistically significant. Fisher's exact test was performed to test an association between treatment method and outcomes as well as demographic data; significance was set at $p < 0.05$.

Ethical approval of the study was obtained from the Institutional Review Board of the Komfo Anokye Teaching Hospital, Kumasi, RD/CR20/141

Results

Over the 3-year recruitment period of the study, 40 primary arthroscopic ACL reconstructions were performed at the KATH, in 40 patients. No patient with bilateral arthroscopic ACL reconstruction was recorded during the time of the study. Out of this number, 31 had isolated ACL tear, 4 had ACL tear associated with LCL tear and 3 had ACL tear with associated meniscal tear. Two of the participants had ACL, PCL and LCL tear and a complex medial meniscal tear, as reported by a

radiologist, with associated posterolateral corner rotatory instability. The medial meniscus was involved in 2 of 3 patients who had meniscal tears associated with an ACL tear. The characteristics of the 40 patients are summarized in Table 1. Most of the patients were young adult males who sustained a tear of the anterior cruciate ligament following a fall from a standing height. The mean age of the participants was 38.1 years with a standard deviation of 11.9 and a male to female ratio of 5:3. Forty percent of the participants of the study had surgery within the first 12 months or less after sustaining a tear of the ACL, whereas the majority of patients (60%) underwent surgery after a time lapse of 12 months. No complication was recorded in 95% of patients. Two patients (5%), had complications- one patient developed septic arthritis of the affected knee on post-operative day 9 and the other patient reported with recurrent knee effusion consistent with osteoarthritis of the knee that was operated on. In the patient who had septic arthritis of the operated knee, E. Coli was isolated and the infection resolved on arthroscopic washout and antibiotics. This participant recorded a fair outcome.

The second patient who similarly had a fair outcome was a seaman who had a recurrent ACL tear during sea diving 9 months after surgical reconstruction. He was counselled for revision ACL reconstruction but declined surgery. The third patient had recurrent knee effusion involving the operated knee at 2 years, no bacteria was cultured from the effusion. The fair-outcome-patient category, described their knee as abnormal. They reported mild to moderate knee pain with moderate difficulty to run. Engagement in light-level physical activity was not compromised. Patients who had a good outcome, 15 (38%) qualified their knee function as near normal and had mild to moderate limitation of strenuous work or sports. Those whose outcome is reported as excellent, 22 (55%) described the function of their operated knee as normal and had no limitation of activities of daily living, participation in strenuous work or sports. Overall, good to excellent outcome was recorded in 37 out of 40 patients, (93%). Study participants within the age range of 31-40 years in our cohort had the most favourable outcomes. A statistically significant association was observed between age and outcomes, $p=0.015$. No statistically significant association was detected between gender, diagnosis or type of procedure performed and outcomes.

Outcomes Following Arthroscopic ACL Reconstruction

Patients reported their level of function in terms of walking, running, stair climbing, squatting, jumping, level of activities of daily living as well as participation in sports. Three of the study participants who were competitive athletes before injury had returned to competitive sport within 1 year following surgery. It was found that isolated arthroscopic ACL reconstruction and arthroscopic ACL reconstruction with concomitant meniscal repair offered the most favourable functional

outcome with a mean Tegner Lysholm score of 9 (range of 5 to 10), followed by arthroscopic ACL and attendant LCL reconstruction, which had a mean score of 8.5 (range of 7 to 10). Patients (2 in number) who had simultaneous arthroscopic ACL reconstruction, partial meniscectomy and posterolateral corner reconstruction recorded the lowest Tegner Lysholm score of 7.5 (7 and 8). Participants who had arthroscopic reconstruction within 12 months following injury, had superior results, with a mean Tegner score of 7 (range of 5-9), as compared to those who had it later than 12 months after injury. The latter cohort had reduced levels of activity owing to knee pain and stiffness with a mean Tegner Lysholm score of 3.5 (range of 2-5). However, the association between timing of surgery and outcome was not found to be statistically significant ($p= 0.258$). Similarly, no significant association was observed between patient reported outcome and the nature of knee injury (isolated ACL tear, ACL and LCL tear and ACL and meniscal tear) after surgery. There was however, a statistically significant association between patient age and functional outcome after surgery ($p=0.015$).

Table 1: Distribution of the 40 patients by gender, age, mechanism of injury, diagnosis and type of procedure performed, is depicted in the table below.

Variable	Frequency (n=40)	Percentage (%)
Gender		
Female	15	37.5
Male	25	62.5
Age (years)		
≤30	12	30.0
31-40	16	40.0
>40	12	30.0
Diagnosis		
Isolated ACL tear	31	77.5
ACL and LCL tear	4	10.0
ACL and meniscal tear	3	7.5
ACL, PCL and LCL tear and a complex medial meniscal tear	2	5.0
Mechanism of injury		
Fall	26	65.0
RTA	4	10.0
Sports	8	20.0
Other	2	5.0
Type of procedure performed		
ACL reconstruction	31	77.5
ACL and LCL reconstruction	4	10.0
ACL and meniscal repair	1	2.5
ACL and partial meniscectomy	2	5.0
ACL and LCL and partial meniscectomy and posterolateral corner reconstruction	2	5.0
Time lapse from Injury to Surgery (months)		
≤12	16	40.0
>12	24	60.0
Complications		
None	38	95.0
Surgical site infection	1	2.5
Recurrent knee effusion	1	2.5
Outcome		
Fair	3	7.5
Good	15	37.5
Excellent	22	55.0

Table 2: Factors that determine outcome of surgery

Variable	Outcome of surgery			P-value
	Fair n (%)	Good n (%)	Excellent n (%)	
Gender				0.287
Female	1 (12.5)	6 (40.0)	8 (47.1)	
Male	7 (87.5)	9 (60.0)	9 (52.94)	
Age (years)				0.015*
≤30	-	7 (46.7)	5 (29.4)	
31-40	7 (87.5)	2 (13.3)	7 (41.2)	
>40	1 (12.5)	6 (40.0)	5 (29.4)	
Diagnosis				0.836
Isolated ACL tear	7 (87.5)	12 (80.0)	12 (70.6)	
ACL and LCL tear	-	2 (13.3)	2 (11.76)	
ACL and meniscal tear	-	1 (6.7)	2 (11.76)	
ACL, PCL and LCL tear and a complex medial meniscal tear	1 (5.9)	-	1 (5.9)	
Type of procedure performed				0.678
ACL reconstruction	7 (87.5)	12 (80.0)	12 (70.6)	
ACL and LCL reconstruction	-	2 (13.3)	2 (11.8)	
ACL and meniscal repair	-	1 (6.7)	-	
ACL and partial meniscectomy	-	-	2 (11.76)	
ACL and LCL and posterolateral reconstruction and partial meniscectomy	1 (12.5)	-	1 (5.88)	
Time lapse from Injury to Surgery (months)				0.258
≤12	5 (62.5)	4 (26.7)	7 (41.2)	
>12	3 (37.5)	11 (73.3)	10 (58.8)	

Table 3 Distribution of procedure by range and mean Tegner Score

ACL reconstruction	9 (5-10)
ACL and LCL reconstruction	8.5 (7-10)
ACL and meniscal repair	9
ACL and partial meniscectomy	8.5 (9,8)
ACL and posterolateral corner reconstruction and partial meniscectomy	7.5 (7,8)

Appendix: Tegner Lysholm Activity Scale.

Please grade each symptom that you experience currently during your highest level of activity.

	Left Knee				Right Knee			
	NONE ○ 1	MILD ○ 2	MODERATE ○ 3	SEVERE ○ 4	NONE ○ 1	MILD ○ 2	MODERATE ○ 3	SEVERE ○ 4
Pain								

How does your knee affect your ability to:

	Not Difficult ○ 1	Minimally Difficult ○ 2	Moderately Difficult ○ 3	Extremely Difficult ○ 4	Unable to Do ○ 5
Run					

Currently, how does your knee function:

○ Normal ○ Nearly Normal ○ Abnormal ○ Severely Abnormal

What is the highest level of activity you can participate in on a regular basis?

○ Very Strenuous ○ Strenuous ○ Moderate ○ Light ○ Unable

Rate your current ability to perform

	NO LIMITATION	UNABLE TO PERFORM								
Activities of Daily Living	○ 10	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1
Strenuous Work	○ 10	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1
Sports	○ 10	○ 9	○ 8	○ 7	○ 6	○ 5	○ 4	○ 3	○ 2	○ 1

Discussion

A cardinal finding of this study was that enrolled patients had significant improvement in knee function after arthroscopic ACL reconstruction. In the prospective evaluation of the 40 study subjects, 37 (93%) of them had good to excellent outcome 2 years after surgery. A similar finding was reported by Corry and others⁷ who after a study on patient outcomes following arthroscopic ACL reconstruction concluded that good or excellent outcomes can be expected in over 90% of patients following this procedure. Furthermore, the benefits of arthroscopic reconstruction after ACL tear has been demonstrated in several studies. Kowalk and his colleagues²⁰ reported in their study that following this procedure, antero-posterior knee laxity reduced significantly from 7.9 mm to 5.8 mm and knee score increased from 70.4 to 88.5 with improved restoration of antero-posterior knee stability and subjective knee function. In a study in South Africa²⁰ of non-operative treatment of ACL tears, one third of the cohort of patients studied, despite rehabilitation, had worsening knee instability. The authors concluded that some patients were unable to develop compensatory adaptations to knee instability and their continued participation in strenuous activity would lead to radiographic changes of knee osteoarthritis and recommended ACL reconstruction for patients with a torn ACL.²⁰

Three of the 40 patients studied developed complications following surgery giving a complication rate of 7.5%. Our rate of complication approximates those of similar studies. In the USA, Salzler and others¹⁹ in a review of the American Board of Orthopaedic Surgery Database reported that arthroscopic ACL reconstruction accounted for 9% of all complications recorded. A community study of 876 arthroscopic procedures in Baerum reported an overall complication rate 5% and concluded that simple arthroscopy is safe and has few serious complications.¹⁸ Sazler and colleagues¹⁹ also found that, subjects younger than 40 years had higher complication rate than those above 40 years of age owing to higher injury complexity in this age group and reported infection as the most common complication of arthroscopic procedures with an overall rate of 0.84%. In our study, however, age below 40 years was not significantly associated with a higher complication rate and an overall infection rate of 2.5% was recorded. Participants aged between 31 and 40 years had the most favourable outcomes. The variance between our findings and those of Sazler and co-workers, was probably due to a lower injury complexity observed in our cohort of patients.

In our prospective assessment, patients who underwent arthroscopic ACL reconstruction within 12 months of injury had higher Tegner scores 9 (5-10) than those who underwent the procedure after 12 months of injury with a mean Tegner score of 4.4 (1-7). This finding is supported by several studies. In a similar study by Chhadia and others²⁰, it was shown that following a

tear of the ACL, the associated knee instability may cause a secondary damage to the articular cartilage and the medial meniscus. They reported that with increasing time to surgery after a tear of the ACL, there is a greater risk for medial meniscal and cartilage damage and stated that arthroscopic ACL reconstructions that delay longer than 12 months tend to have a poorer outcome than those performed in less than 12 months after injury.^{20,21} The authors concluded that to reduce the risk of meniscal tears and degenerative knee changes, reconstruction of ACL tears should be performed within 12 months of injury.^{20,21}

Kowalchuk and colleagues²² reported that concomitant ligamentous and meniscal injuries as well as the time from injury to surgical reconstruction were not material predictors of patient-reported outcome. Similarly, in this study, it was found that isolated ACL tears and ACL tears with associated ligamentous and meniscal tears, after arthroscopic surgical treatment, did not make a significant difference in patient reported outcomes such as muscle strength, knee laxity and overall function. However, contrary to the findings of Kowalchuk and others, time to surgery was found to be significant in terms of patient-reported outcome, being more favourable in arthroscopic ACL reconstructions performed within 12 months of injury. A longer time from injury to surgical reconstruction as a predictor of poor outcome has been reported by Laxdal and co-workers.²³ In a study of 948 subjects, the authors, Laxdal and others, observed a slower return to sports in subjects who had surgery after 12 months of injury. This finding supports the finding of our study where arthroscopic ACL reconstructions performed after 12 months had a less-favourable patient reported outcome.

Conclusions

We have provided a report on our initial experience with arthroscopic ACL reconstruction in a third world country on 40 patients after a 2-year post-operative follow up period. Arthroscopic ACL reconstruction is feasible at the study site with low complication rate and provides good to excellent outcome in 93% of patients. The procedure is generally safe and effective in restoring knee function following an ACL tear and patient reported outcomes are superior when reconstruction is performed within 12 months of injury. Concomitant ligamentous and meniscal injuries were not material predictors of patient-reported outcome. Isolated ACL tears and ACL tears with associated ligamentous and meniscal tears, after arthroscopic reconstruction or repair (for meniscal tears), did not make a significant difference in patient reported outcomes in terms of muscle strength, knee laxity and overall function. Analysis of potential predictors of outcome such as tunnel positioning, patient self-efficacy, motivation, compliance, and expectations are recommended in future studies. In addition, studies involving larger sample sizes and spanning longer periods are recommended to enable stronger

associations between injury type, surgical treatment and outcomes to be established.

Limitations

Our study involved a prospective review of 40 patients. A larger sample size could have allowed the determination of stronger associations as well as the drawing of stronger conclusions between arthroscopic ACL reconstruction and outcomes. In addition, psychological factors of patients have been shown to be an important predictor of time to return to pre-injury activity level, in patients undergoing ACL reconstruction. If psychological profile of patients' expectations and motivations had been measured in this study, the estimate of time to return to pre-injury level of activity could have been more accurate.

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Conflict of interest

The authors have no conflict of interests.

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