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ORIGINAL ARTICLE

Clinical and demographic features of ACL surgery cases: A retrospective descriptive study at H. Adam Malik General Hospital and Affiliated Hospitals (2017–2022)

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ABSTRACT

Anterior cruciate ligament (ACL) injuries are among the most common knee injuries, particularly in physically active individuals. This retrospective descriptive study analyzed 118 patients who underwent ACL reconstruction at H. Adam Malik General Hospital and its affiliated centers between 2017 and 2022. Most patients were male (83.9%) with a mean age of 33.44 years, and 74.6% were engaged in occupations involving heavy manual labor. Contact injury was the predominant mechanism (75.4%), and complete ACL tears were identified in 65.3% of cases. The majority of surgeries were performed during the chronic phase (62.7%). The hamstring tendon autograft was the most frequently used graft type (78.0%), with graft diameters exceeding 8 mm in 66.1% of cases. Meniscal injuries were present in 41.5% of patients. All patients successfully returned to sport after more than six months of rehabilitation, and no postoperative infections or revision surgeries were reported. These findings characterize the demographic and clinical profile of ACL reconstruction patients in this setting and emphasize the importance of timely surgical intervention and structured rehabilitation to optimize functional outcomes.

Keywords: anterior cruciate ligament, reconstruction, hamstring autograft, contact injury

INTRODUCTION

Physical activity provides numerous health benefits, particularly for cardiovascular, physical, and mental well-being. It is defined as any bodily movement produced by skeletal muscles that requires energy expenditure.[1] In general, physical activity can be classified into three main categories based on intensity and energy expenditure: daily physical activity, exercise, and sports. Daily physical activity includes routine tasks such as walking or performing household chores, whereas exercise and sports refer to structured and planned activities, including jogging, push-ups, soccer, and basketball.[2]

Anterior cruciate ligament (ACL) injury is among the most common knee injuries.[3] The incidence of ACL injury ranges from 38 to 78 cases per 100,000 individuals annually.[4] ACL injuries occur through three primary mechanisms: direct contact, indirect contact, and non-contact.[5] Injury develops when physical activity exceeds the body's physiological threshold or when there is an imbalance between external load and the tissue's ability to withstand it.[6] Causative factors may be external or internal. External factors include impact, collision, or blunt force, while internal factors often involve improper movement patterns, poor posture, or muscle weakness.[7]

Most ACL tears occur in athletes through both direct and indirect contact mechanisms.[8] Direct contact typically involves lateral impacts to the knee, such as collisions with another player or object. Indirect mechanisms are commonly associated with sudden changes in direction or speed, such as zigzag movements, rapid deceleration, or acceleration. The incidence of ACL injury and reinjury in the United States remains high, with approximately 350,000 ACL reconstruction procedures performed each year.[9]

ACL reconstruction is one of the most frequently performed orthopedic procedures worldwide. Surgical intervention is considered the primary treatment option for ACL injuries in physically active patients. The most commonly used autografts for ACL reconstruction include the patellar tendon and

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hamstring tendon.[10] According to Hur et al.[11], early reconstruction, defined as surgery performed within the first three weeks after injury, results in better clinical outcomes and joint stability than delayed reconstruction performed beyond three months. Additionally, patients undergoing early reconstruction exhibit fewer postoperative complications related to knee motion, muscle strength, and postural control, and demonstrate an enhanced potential for meniscal healing.

Previous studies have reported that ACL injuries occur more frequently than other ligamentous injuries of the knee. Therefore, this study aims to describe the characteristics of patients who underwent ACL reconstruction at H. Adam Malik General Hospital and affiliated hospitals of the Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Sumatera Utara (FK USU), between 2017 and 2022.

METHOD

This retrospective descriptive study aimed to characterize patients who underwent anterior cruciate ligament (ACL) reconstruction at H. Adam Malik General Hospital and its affiliated institutions under the Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Sumatera Utara (USU), between 2017 and 2022. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara, and institutional permissions were secured from the directors of all participating hospitals. Written informed consent was obtained from all participants prior to enrollment.

The study population comprised all patients diagnosed with ACL tears or injuries who underwent reconstruction at the Department of Orthopaedics and Traumatology's teaching hospitals: H. Adam Malik General Hospital, Setiabudi Hospital, and Haji Hospital, during the study period. A total sampling method was applied, including all patients who met the inclusion criteria. The inclusion criteria were patients with ACL tears who had undergone reconstruction at least nine months before data collection and who consented to participate. Exclusion criteria included incomplete medical records or inability to contact the patient. From a total of 142 identified patients, 24 were excluded (18 due to incomplete records and 6 due to loss of contact), resulting in 118 patients included in the final analysis.

Data collection involved both secondary and primary sources. Secondary data were retrieved from hospital medical records, while primary data were obtained from postoperative assessments and patient interviews. Collected information included demographic characteristics (age, sex, education level, and occupation), clinical findings, surgical details, and postoperative outcomes. Age was recorded in years from birth to the date of reconstruction as a continuous variable. Sex was categorized as male or female. Education level was classified as elementary, junior high, senior high, undergraduate, master's, or doctoral. Occupation was grouped according to physical activity demands, either as heavy manual work or low-impact work.

Trauma and injury characteristics were extracted from medical records. The mechanism of injury was categorized as contact or non-contact. The affected knee was identified as right or left, and the tear type was recorded as total or partial. Associated injuries, including meniscal tears, posterior cruciate ligament (PCL) injury, collateral ligament injuries, cartilage damage, and other concomitant conditions, were documented. Surgical data included the interval from injury to surgery, categorized as acute (≤3 months) or chronic (>3 months); the graft type used (hamstring tendon, quadriceps tendon, bone–patellar tendon–bone [BPTB], allograft, or other); and graft diameter (<8 mm or ≥8 mm).

Postoperative outcomes and patient histories were assessed through chart review and interviews. Return to sports (RTS) was defined as the self-reported time required for patients to resume their usual physical activities, including sports and heavy manual labor, categorized as less than 6 months or 6 months and above. Postoperative infection and revision reconstruction were noted as present or absent.

All data were processed and analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Data handling included editing, coding, entry, and cleaning to ensure validity and reliability. Descriptive statistics were applied, and findings were presented in narrative, tabular, and graphical forms. Continuous variables were reported as means ± standard deviation (SD), and categorical variables were expressed as frequencies and percentages.

RESULTS

This study analyzed data from 118 patients who underwent anterior cruciate ligament (ACL) reconstruction at H. Adam Malik General Hospital and its affiliated network hospitals between 2017 and 2022. The mean age at the time of surgery was 33.44 ± 12.71 years. Patient demographic characteristics are summarized in Table 1. The majority of patients were male (n = 99, 83.9%). In terms of occupational cate-

gory, most patients (n = 88, 74.6%) were classified as having heavy manual occupations. The most common education level was high school (n = 65, 55.1%), followed by a bachelor's degree (n = 39, 33.1%).

Clinical characteristics, including injury profiles and postoperative outcomes, are presented in Table 2. The most frequent mechanism of injury was contact-related (n = 89, 75.4%), and the right knee was the most commonly affected side (n = 66, 55.9%). Complete ACL tears were observed in 65.3% (n = 77) of cases. Most patients (n = 74, 62.7%) underwent surgery during the chronic phase of injury. Concomitant meniscal injuries were identified in 41.5% (n = 49) of patients, while isolated ACL tears were reported in 52.5% (n = 62).

All patients (100%) achieved return to sport (RTS) at more than 6 months postoperatively. No postoperative infections or revision cases (patients with a history of previous ACL reconstruction) were recorded.

Operative characteristics are summarized in Table 3. The hamstring tendon was the most frequently used graft (n = 92, 78.0%), followed by the quadriceps tendon (n = 22, 18.6%). A graft diameter greater than 8 mm was used in 66.1% (n = 78) of procedures.

Table 1. Patient demographic characteristics (n=118)

Characteristics	n	%
Age (years) Mean±SD	33.44 ± 12.71	
Gender		
Male	99	83.9
Female	19	16.1
Employment status		
Heavy manual occupation	88	74.6
Low impact occupation	30	25.4
Education level		
Junior high school	9	7.6
High school	65	55.1
Bachelor's degree	39	33.1
Master's degree	5	4.2

Table 2. Patient clinical characteristics (n=118)

Characteristic	n	%
Mechanism of injury		
Contact injury	89	75.4
Non-contact injury	29	24.6
Laterality (affected side)		
Right	66	55.9
Left	51	43.2
Bilateral	1	0.8
Tear type		
Complete	77	65.3
Partial	41	34.7
Timing of surgery		
Chronic	74	62.7
Acute	44	37.3
Associated pathologies		
None	62	52.5
Meniscal injury	49	41.5
PCL injury	7	5.9
Time to return to sport		
> 6 months	118	100
< 6 months	0	0
Postoperative infection		
No	118	100
Yes	0	0
History of ACL reconstruction		
Primary (None)	118	100
Revision (Previous)	0	0

DISCUSSION

This study analyzed the demographic, clinical, and operative characteristics of 118 patients who underwent anterior cruciate ligament (ACL) reconstruction at H. Adam Malik General Hospital and its affiliated centers. The findings indicate that the typical patient profile predominantly consisted of males (83.9%) in the productive age group (mean age 33.44 years) who sustained injuries through contact mechanisms (75.4%) and underwent surgery during the chronic phase (62.7%) using hamstring tendon autografts (78.0%).

The predominance of male patients is consistent with numerous reports in the orthopedic literature. In a large cohort study of 18,780 orthopedic patients, males accounted for 39.6% of the cases.[12] Orthopedic research increasingly recognizes the need for gender-based analyses, with studies showing that only 34% of orthopedic publications in 2016 included gender as a statistical variable.[13] Among these, 39% revealed significant differences in outcomes between males and females, suggesting that sex-based patterns in orthopedic conditions are complex rather than uniform. The mean patient age of 33.44 years in this study aligns with the most physically active life stage. Notably, 74.6% of the participants worked in heavy manual labor, further supporting the association between physical activity level and ACL injury risk. This finding corresponds with the results of Aguero et al.[14], who observed higher ACL rupture susceptibility among lower-ranking soldiers engaged in physically demanding tasks. Most patients (55.1%) had completed high school education.

Regarding injury mechanisms, sports-related contact trauma was the predominant cause (75.4%), consistent with the findings of Utoyo and Marsahala.[15] Right-sided injuries were more frequent (55.9%), aligning with Rajesh and Kumar[16], who also documented a predominance of right-sided tears. In terms of rupture pattern, a majority (65.3%) had complete ACL tears, corroborating Utoyo and Marsahala.[15] However, the proportion of partial ruptures (34.7%) in this study was higher than previously reported. Carulli et al.[17] suggested that partial ACL injuries are often underdiagnosed, representing only 10–12% of all ACL lesions.

Most patients (62.7%) underwent surgery during the chronic phase, a finding related to the high rate of concomitant comorbidities. Meniscal injuries were observed in 41.5% of the cohort, a rate higher than the 16% reported by Hagmeijer et al.[18], but consistent with Hagino et al.[19], who emphasized the frequent coexistence of meniscal tears with ACL ruptures. The high prevalence of chronic-phase reconstruction and associated meniscal pathology highlights the importance of early diagnosis and prompt surgical management

to minimize secondary intra-articular damage. Hamstring tendon autografts were the preferred graft material in 78.0% of cases, similar to practices at other institutions, including Sanglah Hospital[20], which commonly utilized semitendinosus grafts. Graft diameter selection also played an important clinical role, with most patients (66.1%) receiving grafts greater than 8 mm. This practice is well supported in the literature; Alkhalaf et al.[21] reported a 7.2-fold increased risk of graft failure when the diameter was less than 8 mm.

All patients (100%) successfully returned to sports (RTS) more than six months after surgery, demonstrating excellent postoperative outcomes in line with current rehabilitation protocols. Return-to-sport decisions after ACL reconstruction are traditionally based on time since surgery, with 85% of studies recommending activity resumption before nine months postoperatively, although functional assessments remain underutilized.[22] Although Joshua et al.[23] noted that some patients safely return to pivoting sports after six months; however, the absence of early RTS (<6 months) in our cohort reflects adherence to a conservative rehabilitation approach designed to reduce re-injury risk.

No postoperative infections occurred (0%), indicating excellent surgical and perioperative care. Although Alberto et al.[24] described postoperative infections as rare complications, their complete absence in this study underscores the effectiveness of infection prevention protocols. Furthermore, all cases (100%) involved primary ACL ruptures rather than revision surgeries, consistent with epidemiological data from McMurray et al.[25], who reported that 86–93% of ACL ruptures are primary injuries.

CONCLUSION

This retrospective descriptive study characterized 118 patients undergoing anterior cruciate ligament (ACL) reconstruction at H. Adam Malik General Hospital and affiliated centers from 2017 to 2022. The cohort predominantly comprised males (83.9%) aged 33.44 ± 12.71 years, engaged in heavy manual labor (74.6%), with contact-related injuries (75.4%) affecting the right knee (55.9%) and resulting in complete tears (65.3%). Chronic-phase surgery (>3 months post-injury) was common (62.7%), often with meniscal comorbidities (41.5%), using hamstring tendon autografts (78.0%) of ≥8 mm diameter (66.1%). All patients achieved return to sport >6 months postoperatively, with no infections or revisions.

These findings align with global patterns of ACL injuries in active populations, emphasizing the role of contact mechanisms and delayed intervention. Hamstring grafts and conservative RTS timelines contributed to favorable outcomes. Future prospective studies should incorporate functional assessments and long-term reinjury tracking to refine rehabilitation protocols and address underdiagnosed partial tears. Early diagnosis and gender-specific analyses may further mitigate risks in high-demand occupations.

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