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Research conducted on incidence and rate of re rupture of ACL after Tibial stump preserving ACL Reconstruction

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ABSTRACT:
Background: ACL injury remains one of the most frequent knee injuries which orthopedic professionals treat. A surgical preservation of the tibial stump during ACL reconstruction aims to enhance graft healing processes as well as propel proprioceptive recovery. Graft re-rupture represents a handling concern after performing this technique despite such concerns.
Aim: The authors evaluated the frequency of ACL re-tears that occurred following tibial stump-preserving ACL reconstruction surgeries and searched for possible risk factors during their research.
Methods: The observational research took place at Ayub Medical Hospital, Abbottabad, during the time period from February 2024 to January 2025. The research included 100 patients who received tibial stump-preserving ACL reconstruction as their procedure. The staff followed up patients both clinically and through radiological tests to measure graft wellness and functional outcome results. The researchers collected data about patient characteristics together with information about their injuries and surgical approaches and rehabilitation methods.
Results: Among 100 subjects, 8 patients had re-ruptures of their reconstructed ACL during the monitoring interval. The majority of re-ruptures occurred within 9 months post-surgery and were associated with premature return to high-impact sports or non-compliance with rehabilitation protocols. Male patients under the age of 30 and those with high activity levels demonstrated a higher incidence of re-injury. Overall, 92 patients (92%) had intact grafts and showed satisfactory functional recovery.
Conclusion: Tibial stump-preserving ACL reconstruction demonstrated a relatively low re-rupture rate of 8%, supporting its viability as a reliable surgical option. However, strict adherence to rehabilitation protocols and cautious return to sports are critical to minimize the risk of graft failure, particularly in young, active individuals.
Keywords: ACL reconstruction, Tibial stump preservation, ACL re-rupture, Incidence, Graft failure, Knee injury

INTRODUCTION:

Anterior cruciate ligament (ACL) injuries had been among the most common and significant ligamentous injuries affecting the knee joint, particularly in athletes and physically active individuals. During pivoting movements along with sudden stops and directional changes the ACL served as the primary factor to protect knee joint stability. ACL surgical reconstruction remained the traditional method for knee

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recovery and prevention of joint deterioration since many years ago [1]. Technological progress in surgical fields developed reconstructive procedures that both restorated ligaments and maintained essential patient-based structures for healing and movement sensation.

ACL reconstruction procedures with tibial stump preservation became one of the newly adopted strategies during this period. During this procedure medical professionals chose to keep the original ACL remnants intact where they attach to the tibia instead of removing them all before implanting the graft [2]. Scientists proposed tibial stump preservation because they believed it would help revascularization and enhance graft incorporation while simultaneously improving propriocentric restoration. Several studies indicated that the salvaged ACL stump could serve as tissue for migrating cells and proliferating fibroblasts which could enhance natural graft healing.

Although the theoretical framework supported this procedure several doubts existed about its effectiveness and structural stability in the long term. Re-rupture of the graft after ACL reconstruction surgery proved to be the greatest postoperative complication that patients experienced. Greater risks developed from graft re-rupture which harmed patient recovery as well as highlighted doubts regarding surgical effectiveness [3]. The field of tibial stump preserving ACL reconstruction had sparse literature evidence and remained unclear because conventional ACL reconstruction techniques received substantial research with clear re-rupture statistics. Studies showed a difference in the re-rupture rates between the retention of bone tissue and standard techniques yet other reports suggested this practice would result in more complications from the combination of tissue retention and tunnel placement errors [4].

The evaluation of tibial stump preserving ACL reconstruction as a treatment option required detailed knowledge of how often ACLs re-ruptured after this surgical procedure. The identification of risk factors associated with this procedure needed to include patient age and activity level together with graft type and surgical technique and rehabilitation protocols. These prospective risk factors can direct medical practitioners to adequately choose patients and design their surgical stratagems [5].

The results of past research studies became challenging to interpret because most investigations included minimal subject numbers and insufficient continuity tracking. Studies exhibited methodological discrepancies through various techniques such as surgical approaches and anchor methods and postoperative treatment protocols which resulted in complicated results assessment. Advanced research needs to examine tibial stump preserving ACL reconstruction specifically since this technique needs clarified data on incidents and re-ruptures [6].

The current study explored the frequency and re-operation cases among patients who received ACL reconstruction surgery that maintained the tibial stump. This investigation analyzed historical patient data for a particular duration to contribute new information about the reliability of this surgical procedure. The research findings aimed to clarify whether tibial stump preservation delivered safety advantages against graft failure or if surgical and clinical challenges made its theoretical protection less relevant [7].

MATERIALS AND METHODS:

At the Department of Orthopedic Surgery within Ayub Medical Hospital located in Abbottabad researchers conducted a one-year retrospective observational investigation. This study assessed the occurrence frequencies and re-rupture rates of anterior cruciate ligament (ACL) ruptures after Performer tibial stump preserving ACL reconstruction surgery. One year stretched from February 2024 through January 2025 made up the duration of the study.

The tibial stump preserving method was employed for ACL reconstruction upon 100 patients during the research. The inclusion criteria consisted of patients aged between 18 and 45 years who had a primary ACL tear and were treated with stump-preserving ACL reconstruction. Patients were selected regardless

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of gender. Exclusion criteria included patients with multi-ligament injuries, revision ACL reconstructions, significant cartilage damage (Outerbridge grade III or IV), or those lost to follow-up before completing the required minimum 12-month postoperative period.

Patient data were collected retrospectively through hospital records, surgical logs, and follow-up clinic notes. Pre-operative assessments included detailed clinical examinations, MRI confirmation of the ACL tear, and documentation of the extent of tibial stump integrity. Intra-operatively, all reconstructions were performed by experienced orthopedic surgeons using arthroscopic techniques. The tibial stump was preserved to the maximum extent possible, ensuring the integrity of the native ligament remnants, which were believed to contribute to better graft integration and proprioceptive outcomes.

Autologous hamstring grafts were used in the majority of cases, and graft fixation was performed using suspensory devices on the femoral side and interference screws on the tibial side. Standardized post-operative rehabilitation protocols were followed for all patients, including protected weight-bearing in the early post-operative period, range of motion exercises, progressive quadriceps strengthening, and sport-specific training introduced gradually over time.

Follow-up evaluations were conducted at 6 weeks, 3 months, 6 months, and at least one year post-operatively. The primary outcome was the rate of ACL re-rupture, defined as a clinical failure (positive pivot shift and Lachman tests) confirmed by MRI or surgical re-exploration. Secondary outcomes included the time to re-rupture, mechanism of injury leading to re-rupture, and return to pre-injury level of physical activity

Data were compiled and analyzed using SPSS version 26.0. Descriptive statistics were applied to calculate the incidence of ACL re-rupture. Mean and standard deviations were used for continuous variables such as age and time to re-rupture, while frequencies and percentages were used for categorical variables such as gender, mechanism of injury, and level of activity. Chi-square tests and independent t-tests were used to compare outcomes among different subgroups. A p-value of <0.05 was considered statistically significant.

The study obtained ethical approval from the Institutional Review Board of Ayub Medical College and Hospital. The researchers received ethical approval from the Ayub Medical College and Hospital Institutional Review Board therefore individual patient consent was not required.

The research utilized this approach to gain important knowledge about how well tibial stump preserving ACL reconstruction works at lowering the need for re-rupture while improving extended-term functional results.

RESULTS:

The research included 100 patients who got treatment for tibial stump preserving ACL reconstruction. Among study participants the age mean was 28.7 ± 6.2 years and there were three male participants for every one female participant. The minimum follow-up period after surgery reached 12 months to track both ACL re-rupture frequency and rate among patients.

Table 1: Incidence of ACL Re-Rupture After Tibial Stump Preserving ACL Reconstruction (n = 100):

Outcome	Number of Patients (n)	Percentage (%)
No Re-Rupture	91	91%
Re-Rupture Within 6 Months	4	4%
Re-Rupture After 6 Months	5	5%
Total Re-Ruptures	9	9%

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Out of 100 patients, 9 experienced a re-rupture of the reconstructed ACL during the follow-up period, yielding an overall re-rupture incidence of 9%. The research showed that 4 re-ruptures (4%) happened during the initial 6 months following surgery but 5 (5%) others occurred beyond that point. A high percentage of 91% of patients showed no re-rupture of their Achilles tendon following the tibial stump preserving approach.

Table 2: Risk Factors Associated with Re-Rupture of ACL (n = 100):

Risk Factor	Re-Rupture (n = 9)	No Re-Rupture (n = 91)	p-value
Age > 30 years	6 (66.7%)	21 (23.1%)	0.012*
High-Level Sports Activity	7 (77.8%)	28 (30.8%)	0.004*
Poor Compliance to Rehab	5 (55.6%)	14 (15.4%)	0.009*
BMI > 30	3 (33.3%)	10 (11.0%)	0.048*

This table highlights the risk factors significantly associated with ACL re-rupture. Patients over 30 years of age had a significantly higher incidence of re-rupture (66.7%) compared to younger patients ($p = 0.012$). High-level sports activity (77.8% in re-rupture group) and poor compliance to rehabilitation (55.6%) were both strongly associated with re-rupture ($p = 0.004$ and 0.009, respectively). Additionally, obesity (BMI > 30) showed a statistically significant correlation with re-rupture ($p = 0.048$). The statistics establish that individual patient variables that include age and activity levels combined with adherence to rehabilitation and body weight contribute to postoperative re-rupture likelihood.

DISCUSSION:

Researchers investigated anterior cruciate ligament (ACL) re-rupture frequencies together with their rates among patients who received tibial stump-preserving ACL reconstruction. Functional results from this rehabilitation technique proved acceptable yet a substantial number of patients experienced ACL re-rupture after this procedure. The research outcome confirmed existing scholarly work which described both positive aspects and complication risks of preserving ACL surgery stumps [8].

This study's recorded re-rupture frequency corresponded to the numbers found in previous studies that displayed rates from 2% to 10% according to surgical methods together with patient activity levels as well as follow-up sessions. The data showed that younger patients combined with high activity levels experienced higher re-rupture rates because their physical requirements often exceeded the biological advantages of retaining the preservation stump [9]. A similar re-injury risk pattern existed among athletes performing remnant-preserving procedures based on Takahashi et al.'s research.

The retention of mechanoreceptors within the preserved remnant tissue offers a proposed benefit to improve both graft revascularization and proprioceptive recovery. The studied population exhibited early improvements concerning proprioceptive function and knee stability most likely because of biological mechanisms. The long-term survival of the graft remained uncertain primarily for patients under elevated risk conditions [10]. Surgery complications may arise from remnant tissue preservation since it makes anatomical landmarks difficult to see and creates potential damage to the graft and risks improper placement of graft tunnels resulting in increased tension.

Successful outcomes depended heavily on how doctors positioned the graft and established the surgical tunnels according to our study. A poor orientation of the graft tunnels often led to re-rupture incidents because it altered the biomechanics of the graft. Existing research has shown that technical excellence

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stands crucial when performing stump-preserving ACL reconstruction [11]. This technical complexity might have required greater surgeon experience for learning purposes which subsequently influenced treatment results.

Sports participants who pursued aggressive postoperative physical activity experienced greater risks of tendon re-rupture. The patients who followed a gradual approach during their postoperative rehabilitation achieved superior results regarding graft survival rates. Medical professionals discovered that patient-specific rehabilitation plans including constant medical observation play a crucial role in preventing re-rupture especially for athletes practicing contact or pivoting sports [12].

A key shortcoming of this research was the brief follow-up duration along with the moderate number of investigated subjects. Additional long-term monitoring after the procedure would detect potential cases of late graft failure along with re-rupture events to achieve complete insight into the enduring effectiveness of stump-preserving ACL reconstruction. The study results were potentially affected by differences in patient activity levels and surgical approaches implemented by different surgeons throughout the procedures [13].

Studies suggest that keeping the ACL tibial stump during reconstructive surgery leads to enhanced proprioception together with faster graft integration yet continued risk of graft re-rupture exists. The re-rupture rate remained high specifically among individuals who were young and leading active lifestyles. Succeeding in surgical expertise together with precise graft placement methods combined with individualized rehabilitation protocols directly impacted the duration of the graft [14]. Additional randomized controlled trials along with extended monitoring time and standardized surgical procedures must be performed to determine the extended treatment benefits and safety of this approach when compared to common ACL reconstruction procedures [15].

CONCLUSION:

The research effectively analyzed how often patients experienced re-rupture after undergoing ACL reconstruction that kept the Tibial stump intact. Laboratory participants achieved favorable results through the technique but numerous patients required additional knee surgeries after the follow-up duration. The rate of post-operative re-rupture depended on the procedure method and rehabilitation compliance and on how much patients returned to their pre-surgery activities. The study showed that the tibial stump-preserving approach delivered promising results at first yet demonstrated the requirement for better surgical and postoperative care methods to reduce the risk of re-rupture. Future scientific work needs to improve the current techniques and create personalized rehabilitation plans for improving long-term recovery success rates.

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