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Original Research Article

Failure rate after primary anterior cruciate ligament reconstructions

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ABSTRACT

Background: One of the most common sport injuries is anterior cruciate ligament injury, making anterior cruciate ligament reconstruction (ACL) a very common orthopaedics procedure. Arthroscopic anterior cruciate ligament reconstruction can be performed using auto-graft from different sources like, bone patellar tendon graft, hamstring tendons (semitendinosus with or without gracilis) or peroneus longus tendon.
Methods: A retrospective study of total 230 patients operated from June 2017 until December 2020. All of then underwent primary arthroscopic anterior cruciate ligament (ACL) reconstructions using hamstring tendons auto-graft. The others underwent revision ACL; their primary surgery was done in other hospital.
Results: Statistically, total rate of complications after primary ACL reconstructions, which was defined as the need for revision surgery, was five patients (2.17%) for home revision was done using contra lateral hamstring graft.
Conclusions: A failure rate of 2.17 percent over the reported period of three years falls within reported rates in literature.

Keywords: Arthroscopy, ACL reconstruction, Failure rate, Audit

INTRODUCTION

Anterior cruciate ligament (ACL) tears and the resulting insufficiency are among the most frequent injuries sustained in sports. Young people who participate in sports and knee revolving physical activities are particularly likely to experience it. The current "gold standard" for ACL reconstruction is arthroscopic surgery. The procedure either removes or avoids any remaining ACL tissue, usually without attempting to repair the ligament, whereas direct repair has a high failure rate.1 Approximately 400,000 ACL repairs are performed annually in the US, according to research conducted overall. As the number of primary surgeries performed annually rises, so does the real number of graft failures following ACL repair.[1]

Revision ACL reconstruction is a viable option for individuals experiencing symptomatic failures after their initial ACL reconstruction. Research indicates that the typical revision rate following revision ACL reconstruction for athletes is approximately 13.7%, in contrast to the average revision rates of 2.9% to 5.8% for primary ACL reconstructions.[2-5]

There is no universally accepted definition for the failure of an ACL reconstruction. While defining ACL reconstruction failure through the lens of instability might be simpler, numerous other factors must also be taken into account. The procedure may be regarded as unsuccessful if objective laxity or the patient's perception of instability occurs in a knee that has been previously reconstructed.[6]

Noyes and Barber-Westin established a definition for failure of ACL reconstruction based on specific criteria which include: a total graft rupture accompanied by more than 6 mm of anterior tibial movement in comparison to the unaffected knee; a positive pivot shift test rated at +2 or +3 when compared to the healthy knee, irrespective of the presence of knee pain, inflammation, or the subjective

feeling of instability or limitations in daily activities and/or sports.[7]

ACL reconstruction is a successful surgical procedure, with 75% to 90% of individuals experiencing good or excellent results. However, a notable fraction of patients (10% to 15%) may need a revision procedure. Traditionally, studies have indicated that failures in ACL reconstruction are mostly attributed to technical errors (estimated to be around 70%), as well as chronic or acute injuries, and biological factors.[8] A group known as the Multicenter ACL Revision Study (MARS) initiated a multivariate, multicenter longitudinal study involving multiple surgeons to analyze various factors and establish predictors of clinical outcomes for revision ACL surgeries.[9] The MARS cohort, consisting of 460 patients, revealed that the causes of failure, as assessed by the surgeon performing the revision, included traumatic (32%), technical (24%), biological (7%), a combination of factors (37%), and infection (1%). The impact of improper tunnel placement on knee stability has been well established.

Karmath et al examined the existing literature on outcomes following revision ACL reconstruction and found that technical mistakes were responsible for 22% to 79% of failure cases, with 70 to 80% of these possibly linked to non-anatomical tunnel placement.[10] This study aims to evaluate the failure rate following primary ACL reconstruction.

METHODS

This is a retrospective analysis of the failure rate after primary ACL reconstruction done between June 2017, and December 2020 in Khoula Hospital, Muscat, Sultanate of Oman. All primary ACL reconstruction done on the same period, as a one-referral centre, single surgeon series were included. With failure defined as instability that needed revision surgery.

All primary ACL reconstructions included were done using same side hamstrings graft, and patients were advised to use extension brace and crutches for two weeks.

We allowed our patients to go back to sport after 9 to 12 months of the primary operation.

Excluded cases were those who did the primary surgery outside Khoula Hospital and came for revision.

All data collected from the patient records on the hospital computer system and clinical record. All data collected in specific data sheet and entered in excel sheet. Data analysis carried out using IBM statistical package for the social sciences (SPSS) statistics 25.0 (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.)

After getting official ethical approval from our local research committee data collections started.

RESULTS

Total number of patients was 230, (229 males and 1 female). Maximum age was 51 and minimum age was 19. The average age was about 32 years. Table 1 shows the demographic data of the patients.

Of the total patients, five (2.17%) had symptomatic instability that needed revision ACL during the study period. Table 2 shows the clinical and percentage of the complications.

Table 1: Demographic data of the patients.

Gender			Age (years)			
Male	**Female**	**Percentage**	**Mean**	**Medium**	**Minimum**	**Maximum**
248	1	99.6	31.91	32	19	51

Table 2: The clinical outcome and percentage of the complications.

Clinical diagnosis	Number	Percentage
ACL re-rupture	5	2.17
Arthritic	2	0.86
Infection	1	0.43
Meniscus injury	3	1.30
Stiffness	2	0.86

DISCUSSION

An inadequate rehabilitation program following surgery can lead to ACL-graft failure, even when the initial surgery is performed correctly. Moreover, an ACL reconstruction may be deemed a relative failure if the results, as reflected in patient-reported outcome measures, do not align with the patient's expectations, even if no specific cause can be identified.[11]

Despite recommendations to refrain from playing football for a minimum of 1-2 years, many patients who experience graft failure and undergo revision surgery end up sustaining a second football-related injury. This phenomenon is observed in an estimated 5% to 10% of cases.[11] Some researchers have found that as much as 43% of ACL reconstruction failures are linked to an acute traumatic incident. The improper replication of the anatomical footprints of the native ACL, whether at the femoral, tibial, or both tunnels, can elevate graft stress and lead to changes in graft length and tension.[11] One of the most frequent technical errors associated with bone

drilling that can result in ACL reconstruction failure is the positioning of the femoral tunnel too far anteriorly in the sagittal plane. Certain authors have suggested that the trans-tibial drilling method may result in non-anatomical placement of the femoral tunnel, as the tibial tunnel often directs the surgeon toward a more anterior region of the femoral ACL footprint.[12,13]

An anterior femoral tunnel that is improperly positioned can occur due to inadequate visualization of the posterior wall or mistaking it for the "resident's ridge," which divides the two fascicles of the original ACL. If the femoral tunnel is positioned too far posteriorly, the graft can become tight during knee extension and exhibit looseness during flexion, potentially leading to eventual instability.[12,13]

Regarding the coronal plane, a femoral tunnel that is both centered and vertical (located closer to 12 o'clock rather than at the 10 or 1 o'clock positions) might provide stability in the antero-posterior direction but can result in rotational instability, as indicated by a positive pivot shift test.[13]

If the tibial tunnel is positioned too medially, it can lead to graft impingement against the medial femoral condyle and the posterior cruciate ligament.

Conversely, if the tibial tunnel is placed too laterally, it may cause graft impingement with the inner side of the lateral femoral condyle, resulting in rotational instability. Both situations can lead to damage to the cartilage of the tibial plateau during the drilling process.[13]

Table 3, summarizes the most common mistakes in the placement of both femoral and tibial tunnels and the consequences on the ACL graft.

Patient's compliance to rehabilitation, and giving enough time before returning to football or other contact sports is crucial. Upon returning to sport there could be an important role to the way subjects get their engagement back into the filed with appropriate warm-ups, the appropriate shoe wear, dress, and playing in well desalinated fields.

Table 3: Summary of common tunnel malposition and consequences.

Tunnel	Position	Consequences on graft
Femoral	Anterior	Excessive tension in flexion or stiffness in extension
	Posterior	Excessive tension in extension or laxity in flexion
	Central/vertical	Rotational instability
Tibial	Anterior	Excessive tension in flexion or impingement against intercondylar notch in extension.
	Posterior	Excessive tension in extension or impingement against PCL
	Medial	Impingement against medial femoral condyle or PCL
	Lateral	Impingement against lateral femoral condyle

PCL: Posterior cruciate ligament

CONCLUSION

Previous reports have presented a revision rate of 5.9 in non-athletes and between 2.9 to 5.8 percent in athletics (Raghu). This case series has reported a failure rate of 2.17 percent, which represents the patients who presented with re-instability and were addressed with revision ACL reconstruction. Anterior femoral tunnel placement was the main technical issue addressed in the revised cases, as these cases had their primary tunnel positioning done free hand. After those five revisions, all ACL cases were performed using the femoral guide, and the technique of free hand spade wire positioning in the femoral tunnel was completely abandoned.

Although our revision rate is falls within a good margin of those reported in literature, further reports needed to address the patient's compliance, adherence to the rehabilitation protocol, and how long they refrained from pivoting sports after the operation. A future study is needed to see the failure rate over a longer follow up period. Furthermore, associate the failure rate with the level of sport activity of each subject.

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