

# A Comparison between Early and Delayed Arthroscopic Anterior Cruciate Ligament Reconstruction: A Prospective Cohort Study

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## ABSTRACT

**Introduction:** A complete Anterior Cruciate Ligament (ACL) injury can result in a progressively increasing symptomatic knee instability, which can cause recurrent intra articular damage and eventually results in osteoarthritis if not treated on time.

**Aim:** To analyse the effects of delaying ACL reconstruction beyond a period of 12 weeks and compare the results with cases managed before that time period.

**Materials and Methods:** A prospective cohort study was conducted between July 2017 to October 2019 in Government Medical College, Jammu, India on two groups of patients divided into early (<12 weeks) and delayed (>12 weeks) on the basis of interval between the injury and definitive surgery. The ACL reconstruction was done using a quadrupled semitendinosus-gracilis graft. A standard rehabilitation protocol was followed and the results were compared. Patients were followed-up till one year postsurgery. Software used for statistical analysis was

EpilInfo Version 3.0 and Statistical Package for the Social Sciences (SPSS).

**Results:** A total of 72 patients were included in the study. Forty patients were in the early group and 32 in delayed. Male patients outnumbered the females in both the groups and the incidence of injury was more on the right side. Sports injuries were the most common mode of injury, followed by falls and road traffic accidents in both the groups. The incidence of grade 3/4 medial and Lateral Meniscal (LM) tears was more in the delayed group and the association was statistically significant ( $p < 0.05$ ). There was significant thigh wasting in the delayed group ( $p < 0.05$ ). Two patients were lost to follow-up and were not included in the study.

**Conclusion:** Delay in ACL reconstruction surgery predisposes to higher grade meniscal lesions and significant thigh wasting and hence the surgery should be preferably done within the first 12 weeks after injury.

**Keywords:** Arthroscopy, Lateral meniscal, Quadrupled semitendinosus-gracilis graft

## INTRODUCTION

The ACL is one of the two cruciate ligaments which aid stabilisation of knee joint. It is made up of strong band of connective tissue and collagen fibres [1]. The ACL is the most commonly injured ligament in the knee. Most ACL tears occur in athletes by non contact mechanism such as rotational forces [2].

A complete ACL injury can result in a progressively increasing symptomatic knee instability, which inflicts recurrent intra-articular damage and eventually results in osteoarthritis if not treated on time [3,4]. Dunn KL et al., suggested that ACL reconstruction reduces the need for additional operations, especially in younger patients [5].

Even though reconstruction is the most common treatment for ACL rupture, but the optimal timing of surgery is still debatable [6]. Often the ACL injuries have been associated with primary meniscal and cartilage lesions. Therefore, the risk of developing secondary meniscal and cartilage lesions in ACL-deficient knees is greatly increased. Hence, the timing is of paramount importance [7].

The ACL reconstruction leads to improvement in instability, but the associated intra-articular injuries still have been a major cause of concern and important prognostic factor for long term results, as it may lead to osteoarthritis. Delay in ACL reconstruction has been eventually linked to increase in intra-articular injuries but the lack of consensus regarding optimal timing of reconstruction is still evident [8]. Early reconstruction may prevent increased instability of the knee and decrease the risk of meniscal and chondral injury. Higher prevalence of intra-articular injury with delayed reconstruction was seen in patients >22 years, whereas no such differences were seen in younger patients [9]. A prospective study by Tambe AD et al., showed that athletes who underwent surgery after 6 weeks of injury had better clinical outcome [10].

Hence, this study aims to highlight the repercussions of delayed arthroscopic ACL reconstruction and assess the functional outcome of delayed ACL reconstruction as compared to when done early based on Lysholm Tegner Scoring, thigh wasting and degree of associated injuries.

## MATERIALS AND METHODS

A prospective cohort study was done in Government Medical College, Jammu, India between July 2017 to October 2019 after seeking approval from Institutional Ethical Committee (IEC) clearance viz., no IEC/2017/475. The patients were followed-up for a period of one year postsurgery [Table/Fig-1].

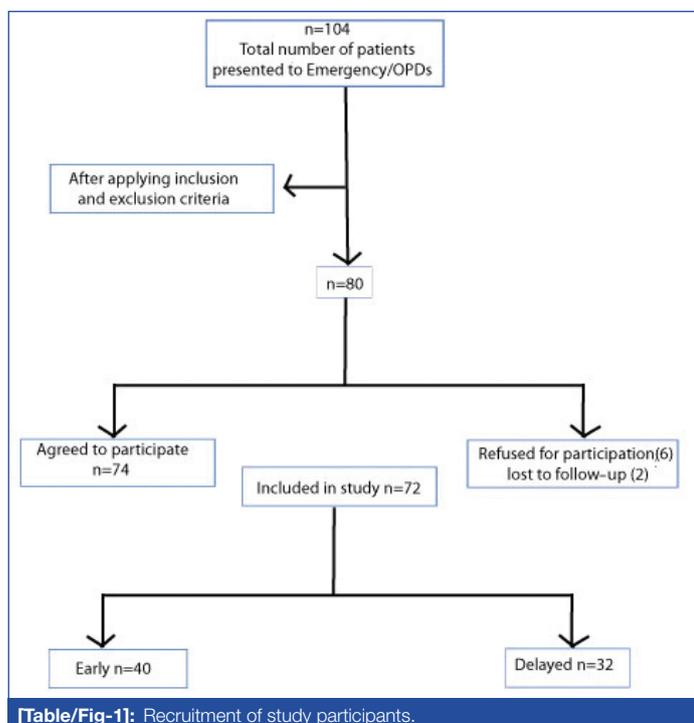
A detailed history and clinical examination was done. Diagnosis was confirmed with standard clinical tests and with the help of Magnetic Resonance Imaging (MRI). Patients were categorised into early <12 weeks and delayed >12 weeks groups depending on the time since injury.

### Inclusion Criteria

- Patients in age group 18-60 with isolated complete ACL tear.
- Patients belonging to the age group of 18-60 years with ACL injury with associated:
  - a. Meniscal injury [Table/Fig-2a]
  - b. Chondral Injuries
  - c. Medial/lateral collateral ligament sprains.

### Exclusion Criteria

- Patients with associated Posterior Cruciate Ligament (PCL) injury.
- Patients with ACL reinjury.
- Patients with associated periarticular fracture.



- Patients with associated ipsilateral lower limb fractures.
- Patients with associated complete tears of medial or lateral collateral ligaments.

Pre-operative assessment was done using Lachman test, anterior drawer test, pivot shift, X-ray knee, MRI knee, and Lysholm-Tegner score. Functional assessment of patients was done post operatively with Lysholm-Tegner score. The scores of both groups were expressed as mean±SD. The groups were also compared on the basis of incidence of associated injuries and the degree of thigh wasting.

### STATISTICAL ANALYSIS

The normality of the data was examined using appropriate tests (Shapiro Wilk test) and the scores were compared between pre and postoperative time points using tests (unpaired t-test and Fisher-exact test). All statistical analysis were considered significant at  $p < 0.05$  level of significance. Software used for statistical analysis was EpiInfo Version 3.0 and SPSS.

### Surgical Technique

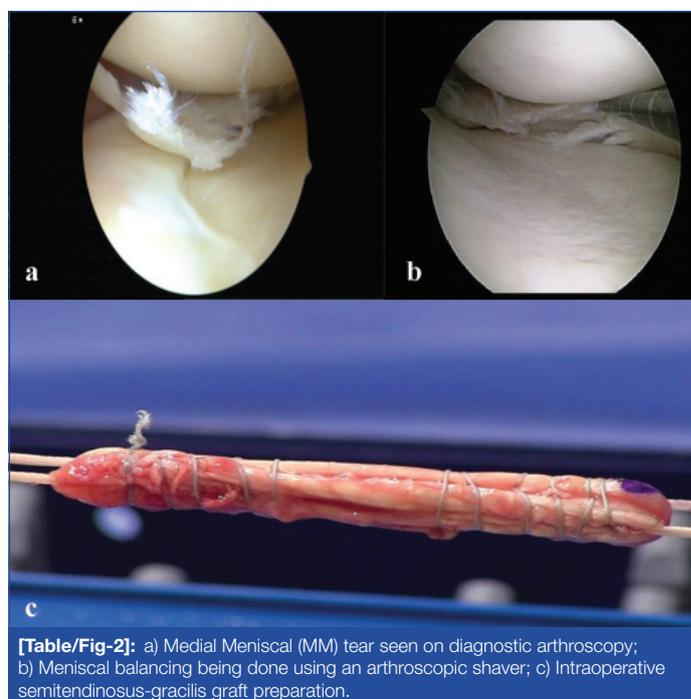
All cases were performed under regional anaesthesia (spinal) with the patient in supine position. Intravenous antibiotic prophylaxis was given. Diagnostic arthroscopy was performed to assess injuries. Meniscal injuries were addressed accordingly [Table/Fig-2b]. Hamstring tendons (semitendinosus and gracilis) were harvested and prepared via a small incision on the anteromedial aspect of tibia over the insertion of pes anserinus using a tendon stripper [Table/Fig-2c]. Tourniquet was used in all the cases.

### Postoperative Rehabilitation

Standard Rehabilitation protocol was followed postsurgery. Gentle knee physiotherapy was started after 1<sup>st</sup> week of surgery and during subsequent weeks range of motion was increased to around 90 degrees at the end of 1<sup>st</sup> month [Table/Fig-3]. Open chain exercises were begun at six weeks followed by wall slides and lunges.

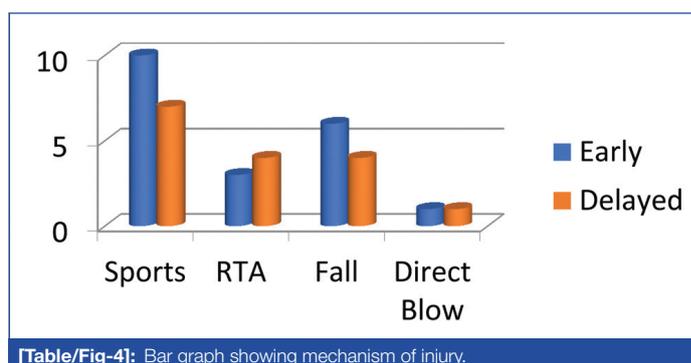
### RESULTS

Total number of patients at the beginning of our study was 74, two patients were lost to follow-up and 72 patients completed the study. A total of 40 (55.56%) were in the early group and 32 (44.44%) were in the delayed group. Patients ranged from 22-48 years in the early group (33.5±3.5 years) and from 20-45 years in the delayed



group (32±3.3 years). Majority of the patients (62%) in the study were males (90% in the early and 81.25% in delayed).

There was higher incidence of injury on the right side in both the groups. Sports injuries were the most common mode of injury, followed by falls and road traffic accidents in both the groups [Table/Fig-4].



Time since injury ranged from 2 to 12 weeks in the early group (2.19±0.585 months) and 12 weeks to 13 months (10.5±0.912 months) in the delayed group. In the early group, 6 (15%) out of the 40 patients had grade 3/4 Medial Meniscal (MM) tears, 14 (35%) patients had grade 1/2 MM tears, 4 (10%) patients had Lateral Meniscus (LM) grade 1/2 tears, 6 (15%) had bone contusions, 4 (10%) had an associated Medial Collateral Ligament (MCL) sprain and 2 (5%) patients had a synovial fistula. Four (10%) patients had no associated injuries. Comparison of MM injuries between the two groups was statistically significant ( $p < 0.05$ ) [Table/Fig-5]. The comparison of combined MM and LM injuries between the two groups was also

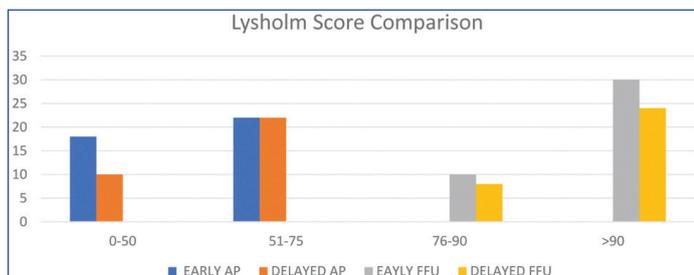
statistically significant ( $p=0.01$ ). There was no statistical association when comparing the other associated injuries between the two groups.

Associated injury	Early n (%)	Delayed n (%)	p-value
MM Grade 3/4	6 (15)	14 (43.75)	0.006
MM Grade 1/2	14 (35)	2 (6.25)	0.003
Combined ML	0	6 (18.75)	0.01
LM Grade 3/4	0	4 (12.5)	0.07
LM Grade 1/2	4 (10)	2 (6.5)	0.5
Bone contusions	6 (15)	4 (12.5)	0.7
MCL sprain	6 (15)	0	0.06
Nil	4 (10)	0	0.1
Total	40 (100)	32 (100)	

**[Table/Fig-5]:** Associated injuries.

$p < 0.05$  calculated by Chi-square test;  $p$ -value  $> 0.05$  was considered as statistically significant; MM: Medial meniscal; MCL: Medial collateral ligament; LM: Lateral meniscus

When comparing the pivot shift tests, Lachman tests, Lysholm-Tegner activity levels and single leg hop scores there was no significant statistical association at presentation or at final follow-up ( $p > 0.05$ ) [Table/Fig-6]. The mean thigh wasting at presentation in the early group was  $1.65 \pm 0.57$  cm and in the delayed group was  $2.40 \pm 0.36$  cm and the association between the two groups was statistically significant ( $p < 0.05$ ) [Table/Fig-7]. In comparison the mean thigh wasting at the final follow-up in the early group was  $0.98 \pm 0.46$  cm and at final follow-up was  $1.21 \pm 0.30$  cm and the association between the two groups was found to be statistically significant ( $p < 0.05$ ). In the early group, 16 patients complained of numbness, two of effusion and six had swelling while the remaining 16 did not have any complications whereas in the delayed group six patients had numbness, six had effusion, two each had swelling, pain and synovial fistula and the remaining 14 did not have any complications [Table/Fig-8]. The complications were compared between the two groups and did not have any statistical association. Mean time between injury and surgery in the early group was  $2.19 \pm 0.585$  months and in the delayed group was  $10.5 \pm 0.912$  months.



**[Table/Fig-6]:** Bar graph showing the pattern of Lysholm scores At Presentation (AP) and at Final Follow-up (FFU) between the early and delayed group

Thigh wasting (Average) (in cm)	Early	Delayed	p-value
At presentation	1.65	2.40	0.009
Final follow-up	0.98	1.21	0.01

**[Table/Fig-7]:** Comparison of mean thigh wasting.

Complication	Early n (%)	Delayed n (%)	p-value
Numbness	16 (40)	6 (18.75)	0.05
Effusion	2 (5)	6 (18.75)	0.06
Swelling	6 (15)	2 (6.25)	0.2
Persistent pain	0	2 (6.25)	0.3
Synovial fistula	0	2 (6.25)	0.3
Nil	16 (40)	14 (43.75)	0.9
Total	40 (100)	32 (100)	

**[Table/Fig-8]:** Complications.

The complications were compared between the two groups and did not have any statistical association

## DISCUSSION

This study was done on two groups, early  $< 12$  weeks and delayed  $> 12$  weeks and results were compared. A total of 74 patients were included at the beginning of the study, 2 patients were lost to follow-up and finally 72 patients completed the study. Forty (55.55%) patients were in the early group and 32 (44.44%) in the delayed group. Mean time between injury and surgery in the early group was  $2.19 \pm 0.585$  months and in the delayed group was  $10.5 \pm 0.912$  months. Different authors had different results on the time between injury and surgery and on the definition of early and delayed/late. In a study by Brambilla L et al., 80.16 % patients came to the hospital at less than 12 months after injury [11]. Gupta R et al., came to the conclusion that delay in ACL reconstruction lead to an increase in the incidence of associated meniscal and chondral injuries. The mean delay in surgery in their study was 78.91 weeks (range 1 week-18 years) [8]. Mansson O et al., observed associated intra-articular injuries in the long term follow-up of delayed ACL reconstruction [12]. Mean delay was eight months (range 4-9).

Comparison of MM and combined MM & LM injuries was statistically significant ( $p < 0.05$ ). There was no statistical association on comparing the other associated injuries. In the study by Mansson O et al., 18 (62.07%) out of the 29 patients had associated meniscal (medial+lateral) injuries, 2 (6.9%) patients had meniscal injuries along with chondral injuries, 1 (3.5%) patient had lateral collateral ligament sprain, 1 (3.5%) an associated fracture, 1 (3.5%) synovitis, 1 (3.5%) pure chondral lesion, 1 (3.5%) contralateral ACL injury and 4 (13.53%) had no associated injuries [12]. Kruttsch W et al., concluded that associated MM tears (40.3%) were seen more frequently [7]. The MM tears were seen in 39.5% in the early group and in 46.9% patients of the delayed group. The LM tears were seen in 28.4% in the early group and 25% in the late group. Severe cartilage lesions i.e., grade 3/4 were seen in 39.9% in early and 31.3% in the late group. Gupta R et al., inferred that surgical delay beyond six months was associated with significant medial meniscus injuries ( $p = 0.0001$ ) [8]. Bernstein J et al., reached a conclusion that 23% in the early group and 35% in the delayed group required a meniscectomy [13]. In the study by Magnussen RA et al., the delay in surgery beyond 12 weeks resulted in more medial compartment injuries {meniscal ( $p = 0.013$ ) and chondral ( $p < 0.0005$ )}. However, there was no relation to LM injuries [9].

The mean thigh wasting at presentation in the early group was 1.65 cm and in the delayed group was 2.40 cm ( $p < 0.05$ ) [Table/Fig-7]. In comparison the mean thigh wasting at the final follow-up in the early group was 0.98 cm and at final follow-up was 1.21 cm ( $p < 0.05$ ). Fowler PJ et al., did a retrospective analysis of 49 ACL deficient knees [14]. The data was analysed by retrieving thigh girth measurements at follow-up visits and significant thigh wasting was seen in 40 patients. Jarvinen M et al., in their study found out that there was significant thigh wasting in 30% of their patients who underwent reconstruction for chronic ACL injuries [15]. The mean thigh wasting at final follow-up for early and delayed intervention, as reported in the previous studies and the present study has been compared in [Table/Fig-9].

Parameter	Our study	Fowler PJ and Regan WD, [14]	Jarvinen M et al., [15]	Brambilla L et al., [11]	Gupta R et al., [8]	Mansson O et al., [12]
Mean thigh wasting at final follow-up (in cm)	Early-0.98 Delayed-1.21	1.4 cm in Chronic ACL Insufficiency.	1.29 cm in the delayed group			
Time between surgery and injury (in months)	Early- $2.19 \pm 0.585$ Delayed- $10.5 \pm 0.912$			80% of patients came less than 12 months post injury.	The mean delay in surgery was 19.7 months.	Mean Delay-8 months.

**[Table/Fig-9]:** Comparison of various studies.

## Limitation(s)

Sample size taken for study was small and a future study with a larger sample size is desired. Most of the patients in the study were males so groups were not comparable on basis of gender. Most of the patients were army personnel so the results may not be generalisable.

## CONCLUSION(S)

Delay in ACL reconstruction surgery predisposes to higher grade meniscal lesions and significant thigh wasting and hence the patients should be explained about these complications and counselled for surgical intervention.

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