

## Femoral Tunnel Placement: Antero-medial versus Trans-Tibial for Anterior Cruciate Ligament Reconstruction by using Peroneus Longus Graft

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### ABSTRACT

**Objective:** To compare Antero-medial versus Trans-Tibial femoral tunnel placement for anterior cruciate ligament reconstruction by using peroneus longus graft.

**Study Design:** Prospective comparative study.

**Place and Duration of Study:** Orthopedic Department, Combined Military Hospital, Lahore Pakistan, from Jul 2020 to Jun 2023.

**Methodology:** We included all the young patients who underwent anterior cruciate ligament reconstruction via peroneus longus graft. Patients were randomly divided into two groups for comparison. One group had femoral tunnel placement via antero-tibial drilling while other had via trans-tibial route. Both the groups were followed up for three months for comparison of stability, achievement of anatomical position, pain score and muscle strength.

**Results:** A total of 125 patients who had ACL reconstruction surgery were recruited in this study. Mean age of these patients was  $28.25 \pm 6.81$  years. Out of the total study participants, 108(86.4%) were military personals while 17(13.6%) patients were civilian-non entitled. Out of 125 patients, 64(51.2%) had femoral tunnel placement via anteromedial route while 61(48.8%) had via transtibial route. Statistical analysis revealed that at the end of three months' patients in both groups had no statistically significant difference in stability of joint, achievement of anatomical position on x-ray, significant pain and muscle

**Conclusion:** Both the methods used for femoral tunnel placement for reconstruction of anterior cruciate ligament by using peroneus longus graft were equally efficacious in terms of stability, achievement of anatomical position, pain score and muscle strength.

**Keywords:** Anterior Cruciate Ligament Reconstruction, Femoral Tunnel Placement, Trans-Tibial.

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### INTRODUCTION

Anterior cruciate ligament (ACL) is a strong bank of fibrous tissue which plays the role of bridge between two important long bones of the lower limb of human body. It may get ruptured or injured due to pressure, trauma or any other pathological event involving the lower limb. People who play sports or are involved in various athletic events are more at risk of having injuries involving the anterior cruciate ligament.<sup>1,2</sup> Rupture/tearing of this fibrous tissue may cause local symptoms which could be cumbersome for the affected individual causing marked decline in daily life activities.<sup>3</sup> Orthopedics or trauma surgeons diagnose the injury to anterior cruciate ligament incorporating history given by the patient, clinical signs elicited in the clinic and relevant radiological investigations.<sup>4</sup> Conservative treatment is only offered in patients with mild tear and symptoms but most of the patients with extensive damage are offered

surgical treatment.<sup>5</sup> Peroneus longus graft is commonly used for reconstructing the anterior cruciate ligament and studies have shown that if adequate surgical and post-surgical protocols are followed, patients have very good results after the reconstruction.<sup>6</sup>

Femoral tunnel placement is an important step when surgeons are reconstructing the ACL by using peroneus longus graft. Multiple techniques may be used for this purpose. Shekhar *et al.*, in 2022 studied patients of ACL reconstruction who were non-athletes and studied results of antero-medial femoral canal placement. They revealed that this method was effective in achieving clinical and radiological goals in these patients.<sup>7</sup> Trans-tibial and trans-portal techniques were studied by Soo Moon *et al.*, in the same year for purpose of ACL reconstruction. They concluded that trans-portal technique can have a greater effect on the stress increase in the femur compared to that with the modified trans-tibial technique.<sup>8</sup> Similar comparative study was published from Egypt which compared modified transtibial versus anteromedial portal techniques for ACL

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reconstruction. It was found in this study that results were comparable in both groups and use of modified transtibial technique was advocated.<sup>9</sup>

Trauma surgery is generally covered under orthopaedic surgery in our part of the world and it becomes more important in military medical settings. A recent local study revealed that transportal arthroscopic ACL reconstruction had favourable results in young patients of Karachi managed for ACL tears.<sup>10</sup> Limited local data is available regarding efficacy and safety of different techniques for femoral tunnel placement during ACL reconstruction. We therefore planned this study with the rationale to compare Antero-medial versus Trans-Tibial femoral tunnel placement for anterior cruciate ligament reconstruction by using peroneus longus graft among patients managed at Combined Military Hospital Lahore.

### METHODOLOGY

This prospective comparative study was planned and conducted at combined military hospital Lahore between July 2020 and June 2023. Sample size was calculated by using the WHO sample size calculator by using two study groups. Group-I had patients who underwent anteromedial tunnel position 54.5% while group II had patients who underwent transtibial tunnel position 34.1%.<sup>11</sup> Margin of error was kept as 10% as this surgery not performed too often so sample size was expected to be less. Non probability consecutive sampling technique was used to gather the sample.

**Inclusion Criteria:** All patients between the age of 18 and 45 years undergoing arthroscopic ligamentous reconstruction of anterior cruciate ligament via peroneus longus graft were recruited in this study.

**Exclusion Criteria:** Patients who could not follow up after the surgery were not recruited. Those with poly trauma were also not made part of this study. Patients who refused before or after the surgery to undergo physiotherapy plan were excluded as well.

Ethical approval was obtained from the institutional review board committee of CMH Lahore via letter number 488/2023. Patients of ACL tear were recruited after application of criteria set for this study. ACL tear was diagnosed by consultant orthopedic surgeon and decision of surgery was made according to the set guidelines.<sup>12</sup> Patients were divided into two groups for the sake of comparison. One group

underwent antero-medical femoral tunnel placement while second group underwent transtibial femoral tunnel placement via set protocols.<sup>13</sup> After the surgery patients were kept in recovery room for three hours and then shifted to high dependency unit for 24 hours and later shifted to orthopedics ward. Patients who developed any post-operative complications were excluded and all other patients were given a physiotherapy and follow up plan. They were followed up for three months after the surgery to look for outcome. Anterior drawer and Pivot shift tests were used to assess the stability of joint. Anterior-posterior side to side difference of less than 5mm and a negative pivot shift test was used to class the joint as stable.<sup>14</sup> Achievement of anatomical position after reconstruction of joint was assessed by consultant on the basis of X-ray.<sup>15</sup> Significant pain was considered if it was scored more than 6 on visual analogue scale. Muscle strength was considered adequate if limb symmetry index was more than 90%.<sup>16</sup>

Statistical analysis was done by using Statistical Package for Social Sciences (SPSS 23.0). Mean and standard deviation was calculated for age of the patients undergoing ACL repair. Frequency and percentages were calculated for patients who had stable joint at end of three months, adequate muscle strength and achieved anatomical position. Pearson chi-square and Fischer exact tests were applied to compare the variables in both the study groups by keeping the *p*-value less than or equal to 0.05.

### RESULTS

We recruited one hundred and twenty-five patients who had ACL reconstruction surgery in our study in three years of time. Mean age of these patients was  $28.25 \pm 6.81$  years. Characteristics of study individuals have been summarized in Table-I. Out of the total study participants, 108(86.4%) were military personals while 17(13.6%) patients were civilian-non entitled. Out of 125 patients, 64(51.2%) had femoral tunnel placement via anteromedial route while 61(48.8%) had via transtibial route.

Results of detailed statistical analysis have been summarized in table-II. It was revealed that at the end of three months' patients in both groups had no statistically significant difference in stability of joint, achievement of anatomical position on x-ray, significant pain and muscle strength (*p*-value>0.05).

**Table-I: Profile of Study Participants who Underwent Anterior Cruciate Ligament Reconstruction in our study (n=125)**

| Variables                                 | Values           |
|-------------------------------------------|------------------|
| Age (years)<br>Mean±SD                    | 28.25±6.81 years |
| Profession                                |                  |
| Military                                  | 108(86.4%)       |
| Civilians                                 | 17(13.6%)        |
| Route used for femoral tunnel             |                  |
| Antero-medial                             | 64(51.2%)        |
| Trans-tibial                              | 61(48.8%)        |
| Body mass index                           |                  |
| Normal                                    | 102(81.6%)       |
| Overweight                                | 14(11.2%)        |
| Obese                                     | 09(7.2%)         |
| Causes of Anterior Cruciate Ligament tear |                  |
| Injury during assault course              | 55(44%)          |
| Kabaddi                                   | 29(23.2%)        |
| Sports                                    | 18(14.4%)        |
| Trauma                                    | 17(13.6%)        |
| Others                                    | 6(4.8%)          |

**Table-II: Comparison of various outcome parameters in two study groups (n=125)**

| Outcome parameters                          | Antero-medial (n=64) | Trans-tibial (n=51) | p-value |
|---------------------------------------------|----------------------|---------------------|---------|
| Stability at the end of three months        |                      |                     |         |
| No                                          | 17(26.5%)            | 25(40.9%)           | 0.087   |
| Yes                                         | 47(73.5%)            | 26(59.1%)           |         |
| Achievement of anatomical position          |                      |                     |         |
| No                                          | 16(25.0%)            | 16(26.2%)           | 0.875   |
| Yes                                         | 48(75.0%)            | 45(73.8%)           |         |
| Significant pain at the end of three months |                      |                     |         |
| No                                          | 61(95.3%)            | 55(90.1%)           | 0.262   |
| Yes                                         | 03(4.7%)             | 06(9.9%)            |         |
| Adequate Muscle Strength                    |                      |                     |         |
| No                                          | 09(14.1%)            | 12(19.6%)           | 0.401   |
| Yes                                         | 55(85.9%)            | 49(80.4%)           |         |

## DISCUSSION

Knee injuries involving ACL tears are common in all parts of the world especially among young adults, sportsmen and athletes.<sup>13,14</sup> Orthopedics surgeons are well equipped to deal with these tears in number of ways depending upon type and extent of tear. Surgical procedure is offered to huge number of patients who can't be managed conservatively.<sup>15</sup> Placement of femoral tunnel is an integral part of ACL reconstruction and could be done in more than one ways depending upon choice and expertise of the treating surgeon.<sup>16</sup> We targeted young adults to conduct this study with an aim to compare Antero-medial versus Trans-Tibial femoral tunnel placement for anterior cruciate ligament reconstruction by using peroneus longus graft at our orthopaedic unit of a tertiary care military hospital at Lahore.

Wen *et al.*, studied Chinese population in 2020 regarding use of two different techniques for femoral tunnel placement in patients managed for ACL reconstruction. They revealed that femoral oval tunnel technique was better than round tunnel technique for tunnel placement.<sup>17</sup> We studied antero-medial and transtibial techniques and at the end of three months did not find any significant difference on clinical outcome in both groups. A systematic review was published by Loucas *et al.*, in 2021 regarding clinical and radiological outcome of anteromedial vs transtibial femoral tunnel placement during ACL reconstruction. They concluded that anteromedial technique was superior to transtibial technique both in terms of clinical and radiological parameters.<sup>18</sup> Our results were slightly different as in our study participants both clinical and radiological outcome parameters were not statistically significantly different in two study groups.

Gabr *et al.*, in 2022 published a study from UK after two year follow up of patients undergoing ACL repair. They compared anteromedial and transtibial drilling for femoral tunnel placement and concluded that anteromedial technique was done more and also had more graft failure rate but otherwise all postoperative outcome parameter were not different in both the groups.<sup>19</sup> We followed up our patients for three months only and our results showed that both the methods used for femoral tunnel placement for reconstruction of anterior cruciate ligament by using peroneus longus graft were equally efficacious in terms of stability, achievement of anatomical position, pain score and muscle strength.

MRI based model was used Dimitriou *et al.*, to compare femoral tunnel length via anteromedial and transtibial technique in patients undergoing ACL reconstruction. They revealed that technique had no impact on length of tunnel.<sup>20</sup> We compared stability, anatomical position achievement and muscle strength and concluded that type of technique used for femoral tunnel placement had no impact on these post-operative parameters.

## LIMITATION OF STUDY

Comparison was made at the end of three months. Usually longer follow ups required to ascertain exact positioning and functioning of the graft after ACL reconstruction. Single consultant operated these patients at one center. Variation in expertise of the surgeon may affect the type of route used for femoral tunnel placement and may affect the results.

## CONCLUSION

Both the methods used for femoral tunnel placement for reconstruction of anterior cruciate ligament by using peroneus longus graft were equally efficacious in terms of stability, achievement of anatomical position, pain score and muscle strength.

**Conflict of Interest:** None.

**Funding Source:** None.

**Authors' Contribution**

Following authors have made substantial contributions to the manuscript as under:

SM & WM: Data acquisition, data analysis, critical review, approval of the final version to be published.

HR & ARC: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SW & ATM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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