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TRANSTIBIAL VERSUS TRANSPORTAL TECHNIQUE FOR FEMORAL TUNNEL DRILLING IN ACL RECONSTRUCTION.

Orthopaedics

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ABSTRACT

Background: The superiority of transtibial versus trans-portal techniques for ACL reconstruction has been discussed but there is no clear evidence regarding the same.
Hypothesis: The transportal technique for drilling the femoral tunnel leads to a more anatomically placed graft according to the data which has been published.
Study Design: Prospective observational study.
Methods: A total of 48 patients underwent arthroscopic anterior cruciate ligament reconstruction using both transportal and transtibial techniques. Functional assessment was done on the basis of IKDC Scores, Tegner Lysholm knee scoring scale and Tegner Activity Level Scale postoperatively. Patients were followed up from minimum of 3 months to 14 months.
Results: The functional and clinical outcome of both the groups was satisfactory. There was no significant change in range of motion deficit as compared to preoperative baseline evaluation. The time taken to attain pre-injury level was about one to five months (transportal group 83% and transtibial group 67%). The IKDC subjective score did not show any significant change and results. Lysholm score and Tegner activity level showed significant results on p value analysis.
Conclusion : Both transtibial and transportal approaches for ACL reconstruction result in comparable short term to midterm functional results.

KEYWORDS

Anterior Cruciate Ligament, Arthroscopy, Transportal, Transtibial, Tegner Score.

INTRODUCTION:

The ultimate goal of ACL reconstruction is to restore the normal knee biomechanics and kinematics so as to allow the patients to return to their routine and sports activities and delay the onset of osteoarthritis in the long term with associated injuries to the articular cartilage and loss of meniscal functions[1]. The transtibial technique (TT) was a popular method of ACL reconstruction where in the femoral tunnel was drilled through the tibial tunnel, so both the tunnels were linked. The patients in which the TT technique was used showed minimal antero-posterior translation based on Lachman and arthrometer assessment on follow up but they still had positive pivot shift test and reduced rotational stability. With increase in research we now have a better understanding of ACL anatomy and non-anatomical femoral tunnel placement became recognized as the most common cause of failed ACL reconstruction.

Initially ACL reconstruction by transportal technique began with double bundle reconstruction in which both the bundles were reconstructed to improve rotational stability. Though double bundle ACL reconstruction improved the appearance and rotational stability of ACL, it led to increased operating time and little difficulty in passing and securing both the grafts [2]. Yasuda et al introduced anatomic ACL reconstruction and changed the whole perspective of ACL reconstruction surgery [3]. The anatomic placement of graft resulted in early return of patients to pre-injury levels of activity. Vertical tunnel position caused rotational knee laxity while oblique placements of grafts increased rotational stability with better clinical results[4,5].

Some researchers compared the outcome in patients who underwent ACL reconstruction by transtibial and transportal techniques and they found significant difference in the functional outcomes and those with trans-portal ACL reconstruction having better outcome[6,7,8].

MATERIALS AND METHODS:

The aim of the study was to compare the functional outcome between Trans-tibial and Trans-portal technique of Arthroscopic ACL Reconstruction.

We conducted a prospective observational study of 48 patients with ACL deficient knees treated in a single centre with arthroscopic ACL reconstruction using the transtibial and transportal technique.48 patients were operated between April 2018 and October 2019. They were grouped into transportal (TP) group and transtibial (TT) group. All patients underwent arthroscopic ACL reconstruction using quadrupled hamstring autograft and fixation with Endobutton (Smith and Nephew,Andover,MA) on femoral side and Absorbable screw or Titanium screw on the tibial side.

Inclusion Criteria:

- Age between 18 to 50 years
- ACL deficient knee on the basis of clinical tests
- ACL deficient knee on the basis of MRI

Exclusion Criteria:

- Multiligamentous Injuries
- Associated tibial plateau fractures
- Revision ACL reconstruction
- Gross joint stiffness

Surgical Technique:

After regional anaesthesia, the deranged knee was examined and stability of knee was checked by doing anterior drawer test, posterior drawer test, Lachman test and pivot shift test and was documented. An anterolateral portal was used for diagnostic arthroscopy and an anteromedial portal as working portal. The ACL stump was debrided and the tibial tunnel was then created with the knee at 90 of flexion & using the endoscopic aimer. The entry point of the tibial tunnel was placed using anterior horn of lateral meniscus and the ACL Stump as the landmark. The technique was identical for both (TT and TP) groups. In the TT group, for drilling the femoral tunnel a femoral guide with an appropriate offset (e.g. for 8-mm graft a femoral guide with a 5-mm offset is used) is introduced into the joint through the tibial tunnel and it was placed in the posterior aspect of the notch keeping the knee in 70–90 degrees of flexion. A K-wire is then drilled at the location determined by the femoral guide (usually at approximately the 11 o'clock position for the right knee or at approximately the 1 o'clock position for the left knee). A cannulated reamer corresponding to the size of the graft is used to over drill over the K-wire upto a depth of 30 mm. Graft was fixed with an absorbable screw on tibial side and Endobutton (Smith and Nephew, Andover, MA) on

femoral side with a loop of 10 or 15 mm. In the TP group, the femoral tunnel was drilled through the anteromedial portal. The knee was placed in maximum flexion between 120 and 130 degrees and a offset femoral guide is introduced through the anteromedial portal and a K-wire is drilled into the centre of the anatomic insertion of the ACL (usually at approximately the 10 o'clock position for the right knee or at approximately the 2 o'clock position for the left knee). With the knee in maximum flexion, reaming of the graft size was done upto 45mm. Graft fixation was performed with the endobutton on the femoral side with a loop of 15mm. Graft length of 25-30 mm is maintained in all cases. Tibial fixation was done using absorbable screw.

Follow-Up:
Patients were reviewed at 2 weeks, 1month, 3 months and 6months postoperatively for functional status. The follow ups were continued till 14 months. Evaluation of functional status, knee scoring and activity level was done at the average of 6 months.

Both groups were evaluated & compared for:-
- Time of return to activity (walking without crutches, normal life activity, jogging and exercise).
- Maximum range of passive movements.
- Knee stability (Lachman & Pivot shift test)
- Functional stability (IKDC score, Tegner Lysholm Knee score, Tegner activity level)

RESULTS:
Out of 24 patients in transportal group 15 were male and 9 were female. In transtibial group, 21 patients were male and 3 patients were female. In both the groups, majority of the patients were between the age group of 20 to 50 yrs. In trans-portal group, 25% of patients had sports injury, 33.3% with RTA and 41.7% with domestic injury. Whereas, in transtibial group, majority of patients had RTA (62.5%), about 20.8% patients had sports injury and 16.7% patients had domestic injury. More than 65% of patients in both the groups had about 1-6 months duration between the injury and surgery. In In the transportal group 37.5% had medial meniscus tear & 45.8% had lateral meniscus tear. Whereas, transtibial portal group 54.2% had medial meniscus tear & 33.3% had lateral meniscal tear. Around 70% patients in both group had duration of surgery less than 100 minutes. In both the groups average graft size was 8mm. Around 15 patients transportal group and 14 patients in transtibial group underwent meniscectomy respectively. 2 patients underwent meniscal repair with 1 patient in each group. Around 83.3% patients in trans-portal group and 66.7% patients in trans-tibial group came to their pre-injury level in less than 5 months.

IKDC Score : In Transtibial group, 10 patients (41.7%) scored less than 50 and 10 patients scored 50-75. Postoperatively about 13 patients (54.2%) scored 50-75 and 10 patients (41.7%) scored >75. In anteromedial group, 7 patients (29.2%) scored less than 50 and 13 patients (54.2%) scored 50-75. Postoperatively 8 patients (33.3%) scored 50-75 and 15 patients (62.5%) scored >75. **[Table 1]**

TABLE 1: IKDC SCORES

LYSHOLM Score: In anteromedial group, majority of patients about 22 (91.7%) were in 50-70 score pre-operatively. On follow up, about 87.5% patients scored above 70, out of which 2 patients scored above 90, which showed significant improvement. In Transtibial group, majority of patients about 23 (95.8%) were in 50-70 score pre-operatively. On follow up, about 87.5% patients scored above 70 which showed significant improvement. On analysis, P value shows that the result is significant. **[Table 2]**

TABLE 2: LYSHOLM SCORES

IKDC Subject score TRANSPORTAL	PRE-OP	FOLLOW-UP
<50%	29.2%	4.2%
50-75%	54.2%	33.3%
>75%	16.7%	62.5%
Total	100.0%	100.0%
IKDC Subject score TRANSTIBIAL	**PRE-OP**	**FOLLOW-UP**
<50%	41.7%	4.2%
50-75%	41.7%	54.2%
>75%	16.7%	41.7%
Total	100.0%	100.0%
P-value	0.559(NS)	0.49(NS)

LYSHOLM SCORE TRANSPORTAL	PRE-OP	FOLLOW-UP
<50	8.3%	0.0%
50-70	91.7%	12.5%
70-90	0.0%	79.2%
>90	0.0%	8.3%
Total	100.0%	100.0%
LYSHOLM SCORE TRANSTIBIAL	**PRE-OP**	**FOLLOW-UP**
<50	4.2%	0.0%
50-70	95.8%	12.5%
70-90	0.0%	87.5%
>90	0.0%	0.0%
Total	100.0%	100.0%
P-value	0.001(S)	0.001(S)

TEGNER Activity Scale: In anteromedial group, about 75% patients were in Level 3 & 4 preoperatively. About 70.9% patients were in activity scale level of 4 and above on follow up. In transtibial group, about 66.6% patients were in level 3 & 4 pre-operatively. Postoperatively about 75% patients were in activity scale level of 4 and above. **[Table 3]**

TABLE 3: TEGNER ACTIVITY LEVEL

TEGNER ACTIVITY LEVEL Group TRANSPORTAL	PRE-OP	FOLLOW-UP
Level 1	0.0%	0.0%
Level 2	4.2%	0.0%
Level 3	33.3%	29.2%
Level 4	41.7%	37.5%
Level 5	12.5%	16.7%
Level 6	8.3%	4.2%
Level 7	0.0%	4.2%
Level 8	0.0%	8.3%
Total	100.0%	100.0%
TEGNER ACTIVITY LEVEL Group TRANSTIBIAL	**PRE-OP**	**FOLLOW-UP**
Level 1	0.0%	0.0%
Level 2	8.3%	0.0%
Level 3	20.8%	25.0%
Level 4	45.8%	33.3%
Level 5	16.7%	16.7%
Level 6	8.3%	20.8%

PIVOT Shift Grade : Pre-operatively, in anteromedial group 45.8% had grade 1, about 16.7% had grade 2 and 4.2 % patients had grade 3 pivot shift positive. Whereas, in transtibial group 66.7% patients had grade 1, about 16.7% patients had grade 2 pivot shift positive. Postoperatively, in both group 87.5% patients showed negative pivot shift test. **[Table 4]**

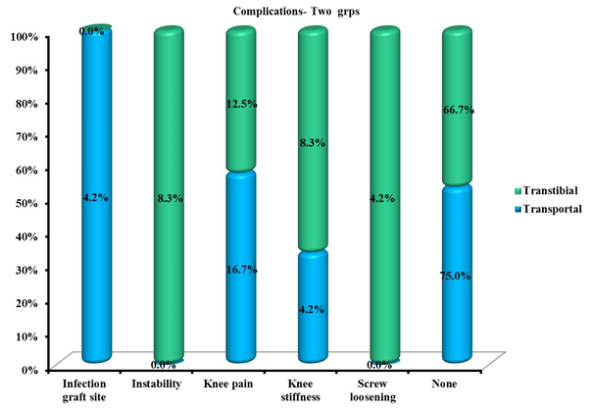
TABLE 4: PIVOT SHIFT TEST

PIVOT SHIFT TEST TRANSPORTAL(grade)	PRE-OP	FOLLOW-UP
0	33.3%	87.5%
1	45.8%	12.5%
2	16.7%	0.0%
3	4.2%	0.0%
Total	100.0%	100.0%
PIVOT SHIFT TEST TRANSTIBIAL(grade)	**PRE-OP**	**FOLLOW UP**
0	16.7%	87.5%
1	66.7%	12.5%
2	16.7%	0.0%
3	0.0%	0.0%
Total	100.0%	100.0%
P-value	0.127(NS)	0.243(NS)

LACHMAN Test: In both the groups, about 95.8% patients had positive lachman's test preoperatively. About 87.5% patients had negative lachman's test postoperatively.

Complications:
About 18 patients (75%) in Transportal group and 16 patients (66.7%) in Transtibial group had NO complications. In one patient of Trans-tibial group screw loosening was noticed and one patient in trans-

portal group had skin grafting site infection. Around 2 patients in Trans-tibial group had instability and 3 patients in same group noticed anterior knee pain. Whereas, in trans-portal group, no patient had any instability and 4 patient noticed anterior knee pain. **[Figure 1]**



DISCUSSION:

Riboh JC et al did a meta-analysis on transtibial versus independent drilling techniques for ACL reconstruction and concluded that while there are biomechanical data favouring independent drilling technique with regards to knee stability and anatomic graft placement, and found no significant differences between the two groups [9]. Similar studies reported comparable functional and clinical outcomes on most measures after ACL reconstruction with transtibial versus transportal techniques [10,11,12]. The variability in the Lysholm score and lateral movement functional tests may suggest a quicker return of function and performance for transportal group. Tudisco et al in their cadaveric study on the effect of femoral tunnel placement while using transtibial or transportal techniques concluded that femoral tunnel driling by transportal technique led to a superior placement of the tunnel in both coronal and sagittal planes [5]. The stability of the knee improved in both the groups but transportal technique had better results in terms of rotational stability which was evaluated using the pivot shift test. The results in ACL reconstruction surgery are mainly determined by similarities between the graft structure, tension and placement compared to native ACL. An anteriorly placed graft results in anterioposterior instability of the knee; where as a vertically oriented graft in the coronal plane results in an increase internal rotation and positive pivot shift sign.The transtibial technique placed the femoral tunnel anteriorly and higher in the intercondylar notch compared to the native ACL insertion site.On the contrary transportal technique resulted in a graft position which was more posterior and closer to the anatomical position than the transtibial technique. This lead to higher antero-posterior knee stability values in the transportal group owing to more posteriorly palced femoral tunnel.The transtibial is technically simple, requires less time but has a higher incidence of non-anatomic location of the femoral tunnel can lead to rotational instability due to a more vertical femoral tunnel [13].Transportal technique has more chances of achieving a anatomical femoral tunnel which is more oblique thus reducing the chances of rotational instability[14]. Transportal technique has certain disadvantages in terms of a shorter femoral tunnel which might be an issue with fixation modality and graft healing but none were reported in our study. There is a possibility of posterior blow out,femoral condyle cartilage damage, nerve and soft tissue damagewhich were not reported in our study. The limitations of our study was the short follow-up, because long-term studies illustrated that some variables (including Range of Motion and joint stability rate) reach an approximately similar rate in both groups over time in which the TT group did as well as the TP group[15]. Another limitation was non-availability of KT-2000 arthrometer, which made our analysis only qualitative and not quantitative . But an important strength of our study was that it was done in a single centre using same type of graft and identical rehabilitation program. The observed population in most previous studies was cadavers or special populations like athletes unlike our study which had appropriate number of samples in all age and occupations.

CONCLUSION :

Both transtibial and transportal approaches for ACL reconstruction result in comparable short term to midterm functional results. From current study, by using hamstring graft for ACL reconstruction with both transtibial and transportal technique, we were consistently able to reproduce preinjury level status of knee. A good functional outcome can be achieved with a good technique, accurate tibial and femoral tunnel positioning, graft fixation and rehabilitation. Further studies with reference to long term follow up, radiological parameters including MRI, randomized control trials comparing outcomes of transtibial and transportal approaches are however required to.

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