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Functional outcome of transtibial VS transportal drilling techniques in anterior cruciate ligament reconstruction

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Abstract

Background: Anterior Cruciate ligament injuries are one of the most common injuries of the knee. The choice of the optimal surgical method in ACL reconstruction is still unclear. A frequent cause for failure after ACL reconstruction has been the incorrect placement of bone tunnels, especially on the femoral side. The most commonly employed trans-tibial technique has been reported not to provide anatomical placement of femoral tunnel and result in rotational instability. Cadaveric and radiographic studies have confirmed that drilling the femoral tunnel through anteromedial portal allows a more anatomical placement of the tunnel and higher rotational stability. However clinical results of trans-tibial and anteromedial portal techniques are still comparable.

Objective: To study the functional outcome in transtibial vs transportal drilling techniques in ACL reconstruction.

Materials and Methods: This is a prospective follow up study of functional outcome in 40 patients who underwent ACL reconstruction by either transtibial or transportal technique. Patients were followed up for at least 24 months and assessed using Lysholm and IKDC scale. Statistical Analysis of the data was done by Mann-Whitney test and chi square test.

Results: In the present study the Trans-portal group of patients showed a marginally better functional outcome with respect to the Lysholm and IKDC scores; however the statistical significance was lacking.

Conclusion: There isn't enough clinical evidence to warrant giving up on transtibial technique which is time tested and simpler.

Keywords: Anterior cruciate ligament, transtibial, transportal

1. Introduction

Anterior cruciate ligament injuries are one of the most common injuries of the knee. Arthroscopic ACL reconstruction has become the gold standard for the treatment of ACL injuries in patients with instability [1]. However the optimal surgical method is still a matter of debate, despite a multitude of surgical techniques and graft and fixation device choices being available to the surgeon.

An ideal surgical technique should restore sagittal, frontal and transverse plane stability and normal knee kinematics in an ACL deficient knee. However the traditionally employed Trans-tibial technique has been shown to provide only anterior stability and no rotational stability due to the relative vertical orientation of the graft obtained by this technique [2]. To address this problem focus was shifted to the Trans-portal technique which is believed to result in a more anatomic orientation of the ACL graft [3-5]. However recent literature reviews have failed to show any difference between the two techniques in terms of actual clinical outcome [6, 7]. Very few other studies are available providing direct comparison between these two techniques.

The study is a randomized prospective clinical study to determine the functional outcome of trans-tibial and anteromedial portal techniques in ACL reconstruction. The contribution of the present study to the literature would be to confirm or refute an actual clinical advantage of the technically difficult anteromedial portal technique over the easier, more popular and well established trans-tibial technique.

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2. Materials and Methods

40 patients who were diagnosed to have complete ACL tear were selected for the study, with the inclusion criteria being Isolated ACL complete tear, with or without meniscal injury, age between 18 to 45 years, duration of injury less than 6 months and at least 24 months follow-up. Patients with associated ligament injuries were excluded from the study. Following the selection, they were assigned to Trans-portal or Trans-tibial surgical groups using Simple Random Sampling method. This study was approved by our institutional ethics committee and informed consent was obtained from all patients.

All the patients underwent arthroscopic ACL reconstruction using quadrupled hamstring tendon graft. All the surgeries were performed by the same surgeon and with same technique except for the difference in the femoral tunnel drilling technique. The tibial tunnel was drilled first using ACL tibial jig set at 55 degree and the guide wire entry away from midline to get as oblique a tunnel as possible. This helped in aiming for an anatomic femoral tunnel even with trans-tibial technique. In the trans-tibial technique femoral tunnel was drilled at 2 or 10 o'clock position for left and right knee respectively. The positioning of the tunnel posterior to the residents ridge was facilitated by keeping the knee in a position of relative extension (around 60-70 degree flexion as against 90 degree). An attempt was made to place the tunnel as low as possible by manipulating the guide wire inside the pre-drilled tibial tunnel. In the trans-portal technique femoral tunnel was drilled at the anatomical site, as evidenced by the

remnant, through the antero-medial portal. The knee was flexed to about 100 degrees during this step. Hyper flexion was avoided as it interfered with visualization and may also lead to very short tunnel lengths.

The patients followed a standard rehab protocol with slight modifications depending on the presence of pain and individual patient response. The patients were followed up at regular intervals with the minimum follow up interval being 24 months. All the patients were evaluated pre and post operatively with respect to IKDC and Lysholm scores. Statistical Analysis of the data was done by Mann-Whitney test and chi square test. A p value < 0.01 was considered statistically significant.

3. Results and Analysis

The average age of TT group was 30.65, and of TP was 30.20, the total average age for the study was 30.43, it was found to be non-significant. The mean duration of injury to surgical intervention for TT group was 151.45 days and for TP group was 129.65 days. The TT group consisted of 4 females and 16 males, whereas the TP group consisted of 5 females and 15 males.

The mean pre and post-operative Lysholm scores for the TT group were 58.70 and 92.40 respectively and those for TP group were 61.75 and 93.50 respectively. Both TT and TP group showed highly significant difference in their values pre and post operatively, however when the post-operative scores were compared the difference was found not significant (Table 1 and 3).

Table 1

Parameter: Lysholm %

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		change (%)	
					Lower Bound	Upper Bound		
TT	Pre	20	58.70	16.394	51.03	66.37	57.41	t=8.52, p<0.001, HS
	Post	20	92.40	5.798	89.69	95.11		
TP	Pre	20	61.75	14.610	54.91	68.59	51.42	t=9.45, p<0.001, HS
	Post	20	93.50	4.395	91.44	95.56		

TT: transtibial, TP: transportal, HS: highly significant

All 40 cases fell into 2 categories of the Objective IKDC score; TT group had 9 patients in the "A" group and 11 in the "B" group whereas TP had 10 patients in the "A" group and 10 in the "B" group the results being not significant. The mean pre and post-operative Subjective IKDC scores for the

TT group were 64.66 and 93.76 respectively and for the TP group 68.18 and 94.90 respectively. There was no statistical significance between the post-operative Subjective IKDC scores in the present study (Table 2 and 3).

Table 2

Parameter: Subjective IKDC %

		N	Mean	Std. Deviation	95% Confidence Interval for Mean		change (%)	
					Lower Bound	Upper Bound		
TT	Pre	20	64.66	7.882	60.97	68.35	45.00	t=15.73, p<0.001, HS
	Post	20	93.76	3.439	92.15	95.36		
TP	Pre	20	68.18	6.741	65.02	71.33	39.20	t=18.01, p<0.001, HS
	Post	20	94.90	2.847	93.57	96.23		

Table 3

Parameter		N	Mean change	Std. Deviation	change (%)	
Lysholm %	TT	20	29.095	8.274	57.41	t=0.375, p=0.709, NS
	TP	20	26.725	6.638	51.42	
Subjective IKDC %	TT	20	33.700	17.685	45.00	t=0.999, p=0.324, NS
	TP	20	31.750	15.019	39.20	

NS: not significant

4. Discussion

Arthroscopic ACL reconstruction has become the standard treatment for ACL deficient knees in patients who have or are at risk of developing knee instability. This procedure aims to restore knee stability and kinematics to as near normal as possible. However the complexity of functional anatomy of ACL has been difficult to recreate in the reconstructed ACL. The classically described 'Isometric' ACL reconstruction represented an over-simplified concept for a ligament which shows differential tension behaviour with changing knee position. This led to the development of the concept of Anatomic ACL reconstruction.

Femoral attachment of ACL has been a subject of extensive research since it is close to the centre of axis of knee motion and may significantly influence the behaviour of the reconstructed ACL and consequently the clinical results. The femoral attachment is well posterior to the long axis of femur and lower down on the lateral wall of the notch with none of the fibres attaching at 12 o'clock position. For anatomic reconstruction it is essential to drill the femoral tunnel at the centre of this attachment [8]. However doubts were raised as to whether anatomic femoral tunnel placement could be achieved using the traditional Trans-tibial technique [9, 10].

Some cadaveric studies have revealed that with Trans-tibial technique the femoral tunnel is more anterior and superior to the femoral footprint [11]. Another cadaveric study concluded that even with a correctly placed tibial tunnel it is impossible to drill anatomic femoral tunnel [8]. This means that with Trans-tibial technique the graft is more vertical than a normal ACL. This led to the development of Trans-portal technique, wherein the femoral tunnel is drilled through the antero-medial portal independent of the tibial tunnel. Most of the cadaveric studies have confirmed a more anatomic femoral tunnel placement with this new technique [11, 12]. However to complicate the matter further some of the studies have reported that anatomic tunnel placement can be achieved by Trans-tibial technique with slight modifications [13, 14].

Biomechanical studies confirmed that the more anatomic low femoral tunnel placement provided better restoration of stability and normal knee kinematics [15].

However similar results have not been replicated consistently in clinical trials. Although there is agreement on better rotational stability with Trans-portal technique, its clinical significance has not been established [7, 16-19]. Alerton et al reported better short term results with Trans-portal technique but no difference at mid and long term follow-up [20]. A meta-analysis of 5 RCTs by Chen et al concluded that in terms of postoperative stability and functional recovery of the knee the outcome of single-bundle ACL reconstruction with the AM technique is better than that with the TT technique [21]. However at present there isn't enough clinical evidence to support one technique over the other.

Trans-tibial technique is an easily reproducible, safe and technically less demanding and time tested. Trans-portal

technique may be more time consuming, technically more difficult and may be associated with short femoral tunnel length, graft passage difficulties and complications like posterior blow out and lateral popliteal nerve injury.²² However it is considered more versatile and is compatible with any fixation device. It avoids the problem of screw divergence by allowing for parallel screw placement through the anteromedial portal [23].

Our trans-tibial technique involves modifications of drilling the femoral tunnel with knee in lesser degree of flexion and a more oblique tibial tunnel to achieve a near anatomic femoral tunnel. In the trans-portal technique we avoid hyper flexion to avoid problems like short femoral tunnel and difficulty in visualization caused by fat pad.

In our study we have found no statistically significant difference between the Trans-tibial and Trans-portal groups with respect to the IKDC and Lysholm scores. This could be due to a small sample size and short follow up duration.

5. Conclusion

In conclusion, although results of biomechanical studies are heavily in favour of Trans-portal technique, there isn't enough clinical evidence to warrant giving up on a technique which is time tested, simpler and safe. In the present study the Trans-portal group of patients showed a marginally better functional outcome with respect to the Lysholm and IKDC scores; however the statistical significance was lacking. Further long term studies are required to establish the optimal surgical method ACL reconstruction.

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