

Evaluating the results of an all-inside arthroscopic posterior cruciate ligament reconstruction using hamstring tendon autograft

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Keyword:

PCL reconstruction, Hamstring tendon autograft.

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Received: Sep, 30, 2020

Accepted: Oct, 13, 2020

Published: Oct, 23, 2020

Abstract

Introduction: The posterior cruciate ligament (PCL) and anterior cruciate ligament (ACL) are important to ensure the stability of the knee joint. Both PCL and ACL can be injured, but PCL injuries are much less common than ACL injuries. In order to summarize the experience and improve the quality of treatment, we conducted the research with the aim is to evaluate the results of arthroscopic all-inside posterior cruciate ligament reconstruction using hamstring tendon autograft.

Materials and methods: From June 2018 to December 2019, all patients who had posterior cruciate ligament (PCL) rupture treated with all-inside arthroscopy PCL reconstructions using semitendinous and gracilis autograft at the Joint Surgery Department of 108 Military Central Hospital were enrolled. The results were evaluated according to the Lysholm - Gilquist and IKDC - 2000 score.

Results: 28 patients were enrolled. The mean age was 34,1 years (range: 20 – 55 years old), the mean follow-up time was 15,8 months, good results accounted for 35,7%, fair: 57,1%, average: 7,2%.

Conclusions: In patients with PCL rupture, who were treated with arthroscopy PCL reconstruction by all - inside technique, the results were good prospects. However, it needs to assess more patients and to follow-up for long term.

Introduction

The posterior cruciate ligament (PCL) and anterior cruciate ligament (ACL) are important to ensure the stability of the knee joint. Both PCL and ACL can be injured, but PCL injuries are much less common than ACL injuries [1].

Basically, there are two prevalent techniques exist for PCL reconstruction based on the tibial insertion site: the transtibial and the tibial inlay techniques [2], [3]. There are many variations of PCL reconstruction surgery that were introduced and developed based on two techniques. Recently, arthroscopic all-inside PCL reconstruction surgery was introduced and initially clinical application with the development of

arthroscopic surgical instruments and graft fixation facilities. Besides many advantages, this surgery also has certain challenges.

In order to summarize the experience and improve the quality of treatment, we conducted the research with the aim is to evaluate the results of arthroscopic all-inside posterior cruciate ligament reconstruction using hamstring tendon autograft.

Materials and methods

Subject

All 28 patients (28 knee joints, 26 men and 2 women) diagnosed PCL rupture, indicated for arthroscopic surgery to all-inside reconstruction PCL

with a hamstring tendon graft at 108 Military Central Hospital from June 2018 to the end of December 2019 were enrolled. Average age is 34,1 (from 20 to 55 years old). The average postoperative follow-up time is 15,8 months, with a minimum of 6 months, and the longest 24 months.

Selection criteria

Patients selected for the study were from 18 - 55 years old, diagnosed with PCL rupture with or without damage of meniscus, not accompanied by other ligament injuries of the knee such as ACL, medial collateral ligament (MCL), lateral collateral ligament (LCL) and posterolateral corner (PLC), posteromedial corner. Evaluate the posterior displacement of the tibial plateau compared to the femur by the KT-1000 machine with at least 10mm compared to normal knee (grade III). Painful and / or symptoms affect patients activity. Patients with high demands for physical activity.

Exclusion criteria

All the patients < 18 years of age or older than 55 years were excluded from the study. Patients with other ligament injuries of the knee joint combination as above. Patients are not suitable for surgery: lots of muscle atrophy, limited movement of the knee joint after the injury. The patient did not agree to participate in study, was not followed up properly after surgery.

Methods

Research design

Retrospective cohort study, clinical intervention, no controlled group.

Research process

The research process was performed through the following steps:

- Evaluating patients before surgery: Investigation of cause of injury, time from injury to surgery, the impact of knee injury on patient movement, assess preoperative knee function according to the Lysholm - Gilquist scale and the IKDC-2000 scale. Clinical examination: Evaluation of knee instability by posterior-drawer test, Godfrey test, quadriceps muscle contraction test. Detection of cartilage lesions combined with Mc Murray test, Appley test.

Evaluation of preoperative posterior displacement of the tibial plateau compared to the femur was assessed by KT-1000 machine.

- PCL reconstruction: All-inside technique. The graft is gracilis and semitendinosus.

- Rehabilitation after surgery: After surgery, patients are assisted to practice according to the program. After 9 months, patients can return to normal activities, even playing sports.

- Evaluating patients after surgery: In the first week after surgery: check patient's pain from the first day after surgery by VAS scale, knee swelling and effusion, overall condition and at the surgical site note if any postoperative complications. Evaluation at 1 month, 3 months, 6 months, 9 months and 12 months after surgery. Far results are assessed from the 9th month.

Indicator research

- Demographic of subject: age and gender, injury types: trauma cause, time from trauma to surgery, meniscus damage and joint cartilage injuries. Graft size: length and diameter.

- Evaluating the improvement of posterior displacement of the tibial plateau compared to femur, preoperative and postoperative, evaluated by KT-1000, divided the PCL rupture into 3 grades as follows [2]: grade I: from 0 - 5mm, grades II: from 6 - 10mm, grades III: > 10mm.

- Evaluating the function of the knee joint based on the Lysholm - Gilquist scale. The results are divided into 4 levels: Very good: 91 - 100 points, good: 77 - 90 points, medium: 68 - 76 points, bad: < 68 points.

- Evaluating the improvement of knee function according to the IKDC 2000 scale before and after surgery. The results are divided into 4 levels: A: normal, B: almost normal, C: abnormal, D: very abnormal.

Analysis and data processing

Data was processed by medical statistics based on SPSS 20.0 software. The continuous variables were described as mean \pm standard deviation, amplitude of variation, 95% confidence interval. The difference was statistically significant when $p < 0,05$.

Results

All lesions are in the chronic stage (after 3 weeks of injury). The main causes are due to sports injury accounting for 50% (14/28 patients), falling 28,6% (8/28 patients), traffic accidents 21,4% (6/28 patients). The average time from the time of knee injury to surgery was $12,3 \pm 8,5$ months, at the earliest 3 weeks after the injury and 10 years after the injury, of which 64,3% the number of patients were operated after injury less than 3 months and 78,6% of patients were operated after injury less than 6 months.

There are 21,4% of cases accompanied by meniscus injury, 28,5% of cases with cartilage joint damage. The hamstring tendon graft used to reconstruct the PCL in our study had an average diameter of $8,17 \pm 0,94$ mm and a mean length of $82,2 \pm 1,68$ mm.

Evaluating the improvement of posterior displacement of the tibial plateau compared with femoral condyle.

Table 1: Evaluating the improvement of posterior displacement of the tibial plateau compared with femoral condyle preoperative and postoperative at the last follow-up (n = 28)

Deviation (mm)	Before	Last follow - up
Mean \pm deviation	$11,3 \pm 1,65$	$5,4 \pm 2,03$
Amplitude of oscillation	10,5 - 13	2 - 8
Difference before and after surgery	$5,9 \pm 0,49$	
P	< 0,01	

The difference in posterior displacement of the tibial plateau compared with lateral femoral condyle of the PCL rupture compared with the normal knee in our study was $5,4 \pm 2,03$ mm. This showed a statistically significant improvement in the difference between posterior tibial plateau versus femoral condyle postoperative compared with preoperative.

Evaluate knee joint function subjectively

To assess patients knee function, we use the Lysholm - Gilquist scale.

Table 2: Evaluate the change of Lysholm – Gilquist scores before and after surgery at the last follow-up time (n = 28)

Lysholm – Gilquist scores	Before	Last follow-up
Mean \pm deviation	$60,4 \pm 7,51$	$84,2 \pm 8,26$
Amplitude of oscillation	43 - 67	62 - 92
Difference before and after surgery	$23,8 \pm 8,43$	
P	< 0,01	

According to Table 2, there was an obvious improvement in Lysholm - Gilquist scores at the last follow-up time compared with the time before surgery with statistical significance with $p < 0,01$. At the time of last follow-up, there were 35,7% (10/28) of patients with Lysholm - Gilquist scores at good, 57,1% (22/28) at fair and 7,2% (2/28) at on average, there is no patient at a poor level.

Knee joint function assessment

To evaluate knee function, we use the IKDC-2000 score evaluated by physicians based on clinical criteria and X-ray.

Table 3: Evaluating the improvement of knee function objectively according to the IKDC - 2000 scale before and after surgery at the last follow-up (n = 28)

IKDC 2000 classification	Before		After	
	N	Rate %	n	Rate %
A	0	0	11	39,3
B	0	0	12	42,9
C	6	21,4	5	17,8
D	22	78,6	0	0

Discussions

Evaluate posterior displacement of the tibial plateau compared to femoral condyle

None of the PCL reconstructive studies that single-bundle were completely displaced back of the tibial plateau compared to femoral condyle as a normal knee. There is still a certain displacement of the posterior tibial plateau compared to the femoral condyle which some authors call residual

postoperative knee loosening [13]. Therefore, some authors support the hypothesis that single-bundle PCL reconstructive surgery using tendons with large graft size or two-bundle DCCS reconstruction will reduce or lose knee laxity, postoperative residue.

Evaluate knee joint function subjectively

According to Table 2, there was an obvious improvement in Lysholm - Gilquist scores at the last follow-up time compared with the time before surgery with statistical significance with $p < 0,01$. At the time of last follow-up, there were 35,7% (10/28) of patients with Lysholm - Gilquist scores at good, 57,1% (22/28) at fair and 7,2% (2/28) at on average, there is no patient at a poor level.

For comparison with other authors, we present a number of single-bundle surgical PCL reconstruction surgical studies with trans-tibial tunnels for reference to evaluate the effectiveness of the surgical method we perform.

Table 4 : Comparison of average Lysholm - Gilquist scores with some PCL reconstruction studies with single-bundle technical trans-tibial tunnel

Research	(n)	Time of follow	Lysholm - Gilquist score		p
			Before	After	
Chan et al [4]	20	3 - 5 years	63 ± 10	93 ± 9	< 0,005
Chen et al [5]	57	> 4 years	54,3 ± 11,34	91,4 ± 7,43	< 0,01
Seon et al [7]	21	12,1 months	55,5	91,3	< 0,01
Wu et al [12]	22	5 years	67 ± 9	89 ± 10	< 0,009
We	28		60,4 ± 7,51	84,2 ± 8,26	< 0,01

In Table 4, PCL reconstruction surgery significantly improved postoperative knee function of patients assessed on the Lysholm - Gilquist scale, statistically significant. The average postoperative Lysholm - Gilquist score in our study was $84,2 \pm 8,26$. There was a statistically significant improvement in the mean score of Lysholm - Gilquist after surgery

compared to before surgery like other studies.

Table 5: Comparison of postoperative IKDC classification with some studies on PCL reconstruction with single-bundle tibial tunnel

Research	(n)	Time of follow	IKDC classification			
			A	B	C	D
Chan et al [4]	20	3 - 5 years	17 (85,0%)	2	1	
Chen et al [5]	57	> 4 years	42 (73,7%)	8	2	
Mariani et al [11]	24	32 months	19 (79,2%)	3	2	
Wu et al [12]	22	5 years	18 (81,8%)		4	
We	28		23 (82,2%)	5	0	

In Table 5, PCL reconstruction surgery technique of a single-bundle of whether with a semi-tendon and a gracilis tendon graft or other muscle tendon graft brought positive knee function to patients with the proportion of patients with IKDC classification. Postoperative at normal and almost normal levels, ranging from 73 to 90%. In our study, the rate of patients with classification IKDC after surgery at the last follow-up was at the normal and near normal level accounting for 82,2%, similar to other studies.

Table 6: Marked improvement in knee joint function assessed on an objective IKDC-2000 scale at the last follow-up compared to before surgery

Study	(n)	Deviation (mm)		P
		Before	After	
Chan et al [4]	20	12 ± 3,4	3,8 ± 2,5	< 0,007
Chen et al [5]	57	11,69 ± 2,01	3,45 ± 2,04	< 0,001
Norbakhsh [6]	52	12 ± 3,9	3,8 ± 2,3	< 0,005
Wu et al [12]	22	11 ± 2,6	3,5 ± 2,7	< 0,006
We	28	11,3 ± 1,65	5,4 ± 2,03	< 0,01

In Table 6, there was a marked improvement in knee joint function assessed on an objective IKDC-2000 scale at the last follow-up compared to before

surgery, with statistical significance with $p < 0,01$.

Complications

In this study, there were no complications directly related to the surgical procedure. Complications directly related to surgery may include complications from use of tourniquet, damage to blood vessels and nerves, unwanted bone tunnel rupture, and postoperative graft loosening. Agotegaray et al report one case of artery injury during PCL reconstruction [8]. Ahn et al, the above experimental study confirmed that the minimal invasive posterior sheath release will increase the distance between the PCL and the nerve bundle, creating suitable conditions for the drilling of the tibial tunnel [9]. Chen et al, follow-up of 181 cases of PCL reconstruction surgery, recorded that 21,9% of cases appeared deep vein thrombosis and all had no clinical manifestations. Risk factors for deep vein thrombosis after PCL include older age (> 46 years), prolonged tourniquet time (> 80 minutes), postoperative pain (VAS > 4), increased D-dimer postoperative and complicated surgical procedure, the author recommends postoperative anticoagulants for patients with the above risk factors [10].

Conclusions

In patients with PCL rupture, who were treated with arthroscopy PCL reconstruction by all - inside technique, the results were good prospects. However, it needs to assess more patients and to follow-up for long term.

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