

Functional Outcome in ACL Reconstruction Using Autograft Hamstring Tendon and Peroneus Longus Tendon: A Meta Analysis

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Abstract: ***Introduction:** Tear of the anterior cruciate ligament (ACL) is the most common ligamentous injury of the knee. The importance of ACL in maintaining knee joint stability, so that if a ACL injury occurs, it can be followed by degenerative changes and future meniscus injuries Anterior cruciate ligament. ACL reconstruction is a common procedure in orthopedic surgery. The aim of surgery is to restore functional stability to the ACL deficient knee. The functional stability provided by the normal ACL is both in resisting anteroposterior translation as well as rotational subluxation. The aim of this study is to compare the functional outcome of ACL reconstruction using autograft Hamstring tendon and peroneus longus tendon. **Material and Method:** We conducted an extensive database search PubMed, Embase, the Cochrane Library, and Google Scholar for literature published. The keywords used were ACL Reconstruction, Hamstring tendon, and Peroneus Longus tendon. The final result yielded a total 18 study, of which only 10 study could be used. The outcome measure used is IKDC Score. **Result:** This study include total 544 patients who underwent ACL reconstruction surgery, with 182 patients from peroneus longus group and 362 patients from Hamstring group. The follow up time was variably from 6 months to 15 years. There is 1 study that not mentioned about the sex of participants, from 9 studies the patients predominantly male with 309 patients and Female with 197 patients. The mean age of the participant is 24,87 years. A Subgroup analysis was performed to test whether the group modified has a better functional outcome of IKDC Score ($p < 0.001$). **Discussion:** The autografts have been time tested and consistently associated with good clinical results. The hamstring and the peroneus longus tendon grafts are the forerunners among the autografts with wide acceptability. Some studies reported the using hamstring as autograft can cause a significant change in hamstring muscle strength, while the use of anterior half of peroneus tendon is a suitable graft and has minimal effect to donor site morbidity accompanied with high functional outcome. **Conclusion:** Both of peroneus longus group and hamstring group have IKDC score more than 80, but the IKDC score in Hamstring group is better than in Peroneus Longus Group. But in term of donor site morbidity and complication we can consider the peroneus longus tendon autograft as an alternative autograft.*

Keywords: ACL, reconstruction, IKDC, Hamstring, Peroneus, functional outcome

1. Introduction

Tear of the anterior cruciate ligament (ACL) is the most common ligamentous injury of the knee² The incidence of ACL rupture in USA is around 80.000 cases per year and cost more than 1 billion dollars to the health care system³The importance of ACL in maintaining knee joint stability, so that if a ACL injury occurs, it can be followed by degenerative changes and future meniscus injuries Anterior cruciate ligament⁴ ACL reconstruction is a common procedure in orthopedic surgery^{5,6}. The aim of surgery is to restore functional stability to the ACL deficient knee. The functional stability provided by the normal ACL is both in resisting anteroposterior translation as well as rotational subluxation.

ACL reconstruction can be performed using a variety of different surgical techniques as well as different graft materials⁷ Nowadays, bone-patellar tendon-bone (BPTB) and four-strand hamstring autografts are the two most common autografts used for ACL reconstruction and each has its advantages and disadvantages⁷⁻⁹. Although the patellar tendon has been a gold standard, 40-60 % patients who have undergone ACL Reconstruction using patellar tendon autograft have anterior knee problem that can jeopardy the activity for the patient, who spend a lot of time on their knee for culture and job^{9,10}. Quadrupled hamstring has become an increasingly popular alternative autograft,

and recent reports indicate less donor morbidity, however the hamstring harvest medially can damage saphenous nerve and could potentially lead to instability of the medial knee joint if ACL rupture accompanied by MCL injury^{10,11} An ideal autograft should have an acceptable amount of strength, size, and be easily and safely harvested¹⁰. Nowadays, autograft using peroneus longus tendon become alternative for ACL reconstruction. The study showed that the peroneus longus tendon that had been taken did not have any effect on walking disorders and did not interfere with ankle stability⁴. Some studies also mentioned that the advantage of using peroneus longus as an autograft is satisfactory cosmetically result and peroneus longus tendon was also expressed material that as strength comparable to semitendinosus tendon^{4,9,10}. Although peroneus longus is the important plantar flexor and evtor of the ankle, some studies conclude that no significant donor site morbidity¹²

The aim of this study is to compare the functional outcome of ACL reconstruction using autograft Hamstring tendon and peroneus longus tendon.

2. Method

We conducted an extensive database search PubMed, Embase, the Cochrane Library, and Google Scholar for literature published. The keywords used were ACL Reconstruction, Hamstring tendon, and Peroneus Longus

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tendon. The database search results were subsequently filtered for duplicates and inclusion criteria, which consisted of publications in English, noncadaveric studies, and a

follow-up period of at least 6 months. The final result yielded a total 18 study, of which only 10 study could be used. The outcome measures are IKDC Score.

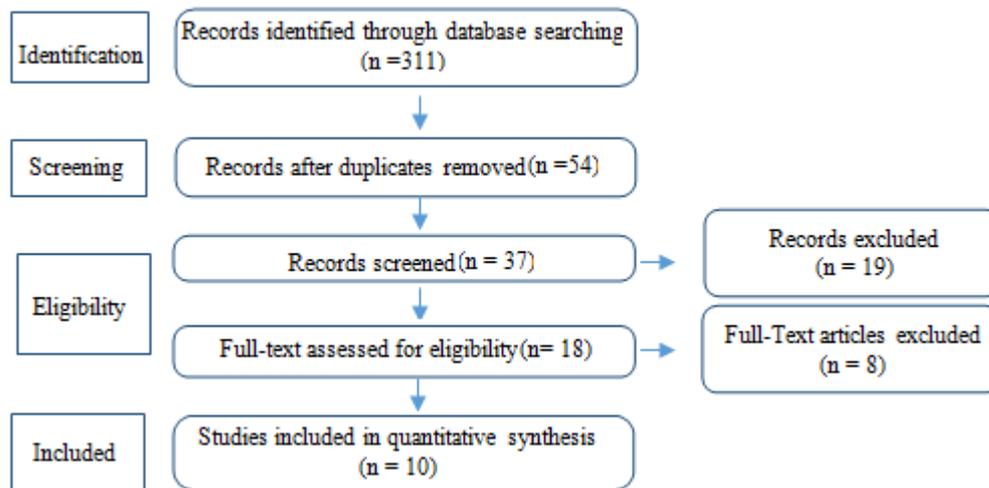


Figure 1: Article Selection Flow Chart

Table 1: PICO Table Describing Inclusion and Exclusion Criteria

Study Component	Inclusion	Exclusion
Population	<ul style="list-style-type: none"> Age >15 years Patient underwent Arthroscopy ACL Reconstruction using autograft of hamstring tendon or peroneus longus tendon Mean follow up at least 6 months 	<ul style="list-style-type: none"> Animal studies Pediatric population Non-ACL Reconstruction study Follow up <6 months Less than 10 patients
Intervention	Arthroscopy ACL Reconstruction using autograft of hamstring tendon or peroneus longus tendon	Other method of treatment ACL rupture
Outcome	IKDC Score	No outcome, different parameter of outcome
Publication	Studies published in English in peer-reviewed journals	<ul style="list-style-type: none"> Abstracts, editorials, letters Duplicate publications of the same study that do not report on different outcomes Single reports from multicenter trials Studies with less than 6 months follow-up Meeting abstracts, presentations, or proceedings
Study Design	All study design except case report and review article	Case report, review article

The presence of publication bias was considered through the preparation of funnel plots, with the absence of bias identified from a symmetrical inverted funnel. As a rule of thumb, one should only perform tests for funnel plot asymmetry when there are at least 10 studies included in the meta-analysis. However, due to the small number of studies, it was not appropriate to consider statistical methods to detect or correct for any biases that were identified. All analyses were conducted using STATA/SE 12.1 (Stata-Corp, College Station, TX), with p values of less than .05 considered statistically significant.

3. Result

In total, 18 studies were identified through our literature research excluding duplicates. Due to discrepancies in the reported data including lack of reported and/or calculated data and application of inclusion and exclusion criteria, only 10 studies could be used in the meta-analysis, it was summarized in table 2.

The studies was stratified into level of evidence based on the guidelines of Journal Bone and Joint Surgery¹³. There were

1 publication with level I of evidence, 1 publication with level II of evidence and level III evidence for the remain publication.

This study Include total 544 patients who underwent ACL reconstruction surgery, with 182 patients from peroneus longus group and 362 patients from Hamstring group. The follow up time was variably from 6 months to 15 years. There is 1 study that not mentioned about the sex of participants, from 9 studies the patients predominantly male with 309 patients and Female with 197 patients. The mean age of the participant is 24,87 years.

Table 2: Summary of Studies Included on Analysis

Graft Type	Author	Year	Journal	Country	Level Evidence	N	Mean Age	Sex		Mean Follow Up	IKDC Score	Lysholm Score
								M	F			
Peroneus Longus tendon	Angthong,et al	2015	Journal Med Assoc Thailand	Thailand	Level 3	24	NA	15	9	12,8 month	58.6± 20.8	NA
	Bi, et al	2018	The Journal of Knee Surgery	China	Level 3	62	29,1 ± 2.0	34	28	29.7 ± 3.7 month	89.3 ± 8.4	NA
	Rhatomy,et al	2018	Journal of Knee Surgery, Sports Traumatology, Arthroscopy	Indonesia	Level 3	24	23.4 ± 8.1	20	4	12 month	92.5 ± 6.2	94.9 ± 5.6
	Shi, et al	2018	Journal of Knee Surgery	China	Level 3	18	42 (19-58)	NA	NA	24 month	90.13 ± 3.01	94 ± 6.81
	Kerimoglu, et al	2008	ActaOrthopaedica et TraumatologicaTurcica	Turkey	Level 3	29	30 (21-39)	27	2	5 years	90	83,7
	Khajotia,et al	2018	International Journal of Research in Orthopedics	India	Level 3	25	26.72 (18-42)	24	1	6 month	83.53	NA
Hamstring tendon	Bi,et al	2018	The Journal of Knee Surgery	China	Level 3	62	27.9 ± 6.7	31	31	30.3 ± 3.5 month	90.4 ± 7.1	NA
	Rhatomy,et al	2018	Journal of Knee Surgery, Sports Traumatology, Arthroscopy	Indonesia	Level 3	28	26.4 ± 8.6	24	4	12 month	88.8 ± 9.7	93.1 ± 7.3
	Shi, et al	2018	Journal of Knee Surgery	China	Level 3	20	40 (21-54)	NA	NA	24 month	89.22 ± 3.83	93± 5.22
	Bourke,et al	2012	Journal of Bone and Joint Surgery	Australia	Level 2	152	25.8 (14-62)	86	66	15 years	90	93
	Iorio , et al	2006	International Orthopedics (SICOT)	Italy	Level 3	25	30 (17-44)	18	7	10 month	86.8	94.6± 1.6
	Sajovic, et al	2006	The American Journal of Sports Medicine	Slovenia	Level 1	64	24 (14-42)	32	32	5 year	89	92 (74-100)
	Charlton,et al	2003	The American Journal of Sports Medicine	USA	Level 3	47	30.2 (24-43)	17	30	2 year	83 (47-100)	91 (45-98)

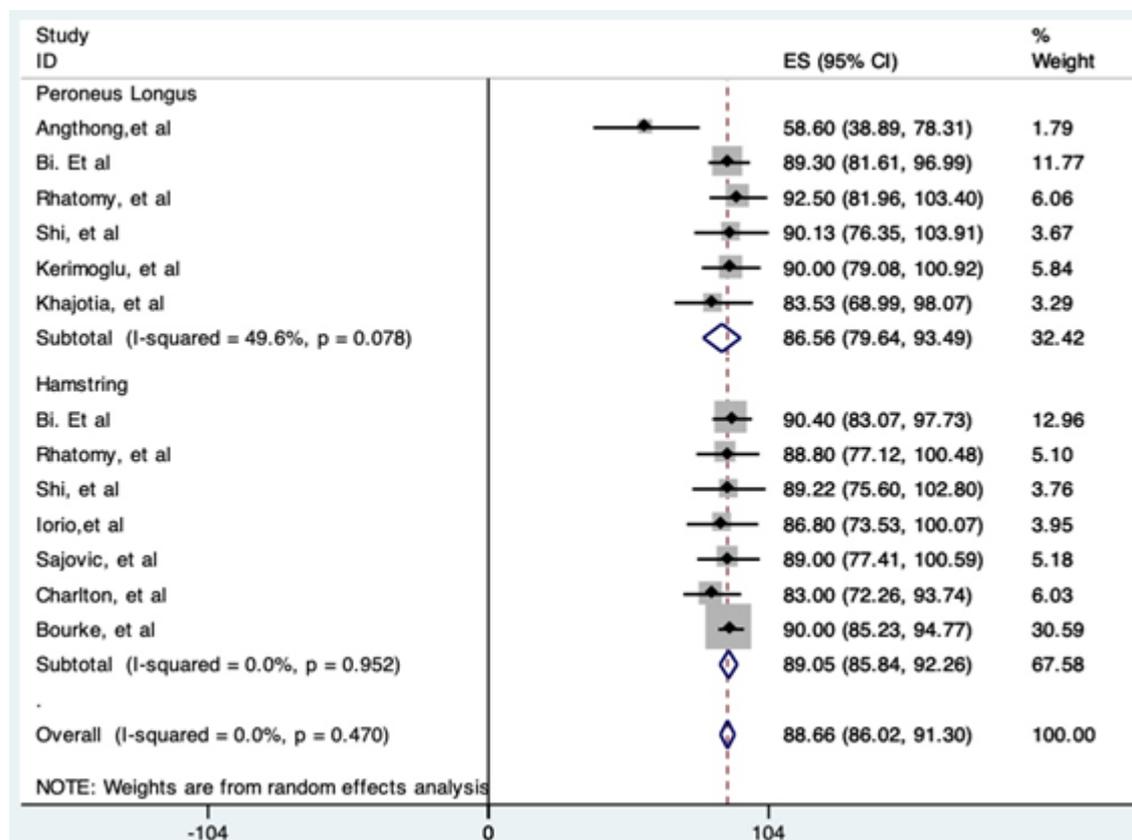


Figure 2: Forest Plot of IKDC Score for All Group

A Subgroup analysis was performed to test whether the group modified has a better functional outcome of IKDC Score ($p < 0.001$)

4. Discussion

ACL injury is the most common serious injury in knee¹⁴. The increasing number of participant in sport has resulted in an increase incidence of ACL injury^{15, 16}. The aim of ACL reconstruction is to achieve good functional outcome and stabilize the knee, so the patient can return to the normal activity. There are several autograft choice for ACL reconstruction, but each autograft has some advantages and disadvantages, especially in complication. Currently we cannot find which the autograft that can give a best functional outcome.

The autografts have been time tested and consistently associated with good clinical results. The hamstring and the bone patella bone tendon grafts are the forerunners among the autografts with wide acceptability¹⁷. The other autografts are quadriceps and fascia lata. Using peroneus longus autograft (PLT) is a recent development in the field of ACL reconstruction. Bone Patellar Tendon Bone Graft is considered a gold standard of autograft in ACL reconstruction because of its strength and consistency in size of graft, but the Complications of bone patella tendon bone graft include patellar tendon rupture, patellar/tibial fracture, quadriceps weakness, loss of full extension, anterior knee pain, difficulty in kneeling and numbness due to injury to the infrapatellar branch of saphenous nerve^{8, 11, 17, 18}. It will become the problem in Indonesia if using BPTP as a graft because of its complication, as we know majority Indonesia people were need kneeling while praying, so in Indonesia the most autograft that used in ACL reconstruction are Hamstring tendon and Peroneus Longus tendon. We need to know how is the functional outcome between these 2 autograft.

Some studies reported the using hamstring as autograft can cause a significant change in hamstring muscle strength. Hamstring function is very important after ACL reconstruction in order to protect the reconstructed ACL from anterior drawer force, which is exerted by quadriceps contraction.^{10, 17, 19}. There are some complication to the donor site after using hamstring autograft such as anterior knee pain, kneeling pain, extension deficit and flexion deficit²⁰. Harvesting hamstring tendon could potentially lead to instability of the medial knee joint, though more definitive data should be collected to prove this assertion. Lastly, such a high-energy injury to the medial side of the knee to cause grade III MCL²¹

The peroneus longus tendon has important function in plantar flexion and eversion the sole of the foot, segmental removal of peroneus longus tendon may result in functional loss of peroneus longus muscle. Zhao, et al reported the use of anterior half of peroneus tendon is a suitable graft and has minimal effect to donor site morbidity¹. Anghong, et al reported that they find a donor site that meets demand of kneeling, but with enough strength and minimal donor site morbidity. They used peroneus longus tendon autograft in ACL reconstruction and evaluated the donor site morbidity

with AOFAS Score. Mean pre-and postoperative AOFAS scores were 100.0 ± 0.0 and 96.0 ± 9.6 respectively at 4-month follow-up ($p = 0.06$). Mean pre- and postoperative VAS-FA scores(8) were 99.7 ± 1.1 and 95.4 ± 12.0 , respectively at around 13-month follow-up ($p = 0.09$)⁹

Kremoglu, et al reported study in using peroneus longus tendon as autograft in 29 patients, the patients were evaluated on outcome, donor site morbidity and complication. They reported that from the examination of ligament stability using a Lachman test, the result is 12 patients were normal, 9 patients +1, 5 patients +2, and 3 patients had +3. In evaluating donor site morbidity with result 27 (93.1 %) patients reported no complaints in the region of the transplant harvest site, although 2 (6.9 %) patients experienced light to moderate pressure pain and dysesthesias and paresthesias in the region of the extracted PLT²².

Present study shows there is no heterogeneity in peroneus longus group with ($I^2 49.6\%$, $p = 0.078$) with total size effect size (IKDC score) was 86.46. There is no heterogeneity in Hamstring group with ($I^2 0\%$, $p = 0.952$)

5. Conclusion

Both of peroneus longus group and hamstring group have IKDC score more than 80, but the IKDC score in Hamstring group is better than in Peroneus Longus Group. But in term of donor site morbidity and complication we can consider the peroneus longus tendon autograft as an alternative autograft.

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