

Body Profile and Arthroscopic Anterior Cruciate Ligament Reconstruction Using Autograft Hamstring Tendon

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Abstract

The incidence of obesity in Indonesia has increased from 14.8% in 2013 to approximately 21.8% in 2018. There is no published data regarding assessments on functional outcomes and complication after Anterior Cruciate Ligament (ACL) reconstruction in patients with different Body Mass Index (BMI) in Indonesia. The aim of this study was to describe the distribution of ACL injury and compare the functional outcomes after ACL reconstruction using hamstring tendon autograft in patients with different BMI categories. This was a retrospective study in 2 groups of patients with different BMI categories: normal BMI group (18.5 to 24.99) and high BMI group (≥ 25), who had undergone surgeries for ACL injury in Dr. Hasan Sadikin General Hospital Bandung, Indonesia, during the period of 2017 to 2018. Data were collected from medical records and direct examination on functional outcome measurement using Lysholm score. This study comprised of 71 patients who were followed for a minimum of 6 months. Of 71 patients, 43 were in the normal BMI group and 28 were in the high BMI group. No significant differences in postoperative functional outcome between the groups when assessed using Lysholm score. In normal BMI group 95% were graded as excellent to good while 5% were in the fair functional category. Meanwhile, in the high BMI group, 86% were graded as excellent to good and 14% were graded as having fair functional results. ACL reconstruction with Hamstring tendon autograft results in a good functional score and a high success rate in both BMI groups. High BMI does not adversely affect functional outcomes as both BMI groups gain equal benefits.

Key words: Anterior cruciate ligament reconstruction, body mass index, functional outcome

Profil Tubuh dan Rekonstruksi Anterior Cruciate Ligament Arthroscopic Menggunakan Autograft Tendon Hamstring

Abstrak

Insiden obesitas di Indonesia telah meningkat dari 14,8% pada tahun 2013 menjadi sekitar 21,8% pada tahun 2018. Tidak ada data yang diterbitkan mengenai penilaian pada hasil akhir fungsional dan komplikasi setelah rekonstruksi *anterior cruciate ligament* (ACL) pada pasien dengan indeks massa tubuh (IMT) yang berbeda. di Indonesia. Tujuan dari penelitian ini membandingkan hasil akhir fungsional menggunakan skor Lysholm setelah rekonstruksi ACL pada pasien dengan IMT yang berbeda. Penelitian ini bersifat retrospektif pada 2 kelompok pasien dengan kategori IMT yang berbeda: kelompok IMT normal (18,5–24,99) dan kelompok IMT tinggi (≥ 25), yang telah menjalani operasi untuk cedera ACL di Rumah Sakit Dr. Hasan Sadikin Bandung, Indonesia, periode 2017 hingga 2018. Data dikumpulkan dari catatan medis dan pemeriksaan langsung pada pengukuran hasil fungsional menggunakan skor Lysholm. Penelitian ini terdiri atas 71 pasien yang dilakukan pengamatan selama 6 bulan. Terdapat 43 pasien pada kelompok IMT normal dan 28 pasien pada kelompok IMT tinggi. Tidak ada perbedaan signifikan dalam hasil fungsional pasca operasi antara kelompok ketika dinilai menggunakan skor Lysholm. Kelompok IMT normal 95% dinilai sebagai sangat baik sampai baik sedangkan 5% berada dalam kategori fungsional yang adil. Sementara itu, dalam kelompok BMI tinggi, 86% dinilai sebagai sangat baik sampai baik dan 14% dinilai memiliki hasil fungsional yang adil. Simpulan, rekonstruksi ACL dengan *autograft* tendon *hamstring* menghasilkan skor fungsional yang baik dan tingkat keberhasilan yang tinggi pada kedua kelompok BMI. BMI tinggi tidak memengaruhi hasil fungsional karena kedua kelompok IMT mendapatkan manfaat yang sama.

Kata kunci: Hasil akhir fungsional, indeks masa tubuh, rekonstruksi *anterior cruciate ligament*

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Introduction

The incidence of obesity in Indonesia has increased from 14.8% in 2013 to approximately 21.8% in 2018. The World Health Organization (WHO) has classified a body mass index (BMI) of 18.5–24.99 kg/m² as normoweight, a BMI of greater than 25 kg/m² as overweight, and a BMI of more than 30 kg/m². Anterior cruciate ligament (ACL) is the major stabilizing ligament of the knee which is frequently injured, leading to instability. ACL injuries frequently result from sports injuries that involve deceleration movement (sudden stop, pivoting, jumping, and sudden change of direction). The treatment of choice for ACL injuries is ACL reconstruction, ACL replacement with bone patella tendon bone (BPTB) graft, or semitendinosus–gracilis tendon (SGT) graft. Some studies have reported that ACL reconstruction with BPTB or SGT graft has a good functional rate and is highly successful.^{1,2}

Some studies report increasing complication rate and length of hospital stay after orthopedic surgery in obese patients, whereas other studies have not found any increased risk of surgery or complication. There are very few published data that assess the functional outcomes and complication after ACL reconstruction in patients with different BMI.^{3,4}

In the present study, functional outcomes after ACL reconstruction using hamstring tendon autograft in patients with different BMI classes in Bandung were compared.

Methods

A retrospective chart review on ACL reconstruction with hamstring tendon autograft was conducted in Bandung from January 1, 2017 to December 31, 2018. This study was approved by the Ethics Committee of dr. Hasan Sadikin General Hospital Bandung, Indonesia, in November 2017 through the issuance of the ethical clearance number LB.04.01/A05/EC/337/XI/2017). Patient records were canvassed for demographic, as well as details regarding age, BMI groups, nature of injury, complication, pain assessment using visual analog scale (VAS), postoperative knee range of motion (ROM), and the outcome of ACL reconstruction as measured by Lysholm score.⁵

To avoid selection bias, this study set the inclusion criteria as follows: patients have undergone unilateral primary ACL reconstruction using hamstring tendon autograft

with no previous ligamentous or bony injuries or procedures in the knee and were classified as normal (BMI 18.5–24.99) or high (BMI ≥25). The exclusion criteria included the presence of grafts other than hamstring (BPTB, quadriceps tendon grafts), allograft ligament, previous ACL procedures in either knee, collateral ligament procedures during ACL reconstruction, previous bony procedures, and other ligament reconstruction in the past or during the procedure.

Between January 1, 2017 and December 3, 2018, a total of 71 patients had undergone a unilateral primary ACL reconstruction using Hamstring tendon. Patients were diagnosed as suffering from an ACL rupture based on clinical findings, a positive anterior drawer test, a positive Lachman test, and a positive pivot shift test as assessed by a senior orthopedic surgeon and/or on magnetic resonance imaging. All ACL reconstructions were performed by three senior orthopedic surgeons through anteromedial and anterolateral portals with a tourniquet. All grafts were harvested from the ipsilateral leg. The gracilis and semitendinosus tendon were secured as a single bundle reconstruction. Tibial fixation was performed using a biodegradable screw and femoral fixation was achieved through the use of endobutton. All patients underwent a rehabilitation period of a minimum of 4 months after the operation.

Patients were classified into 2 BMI groups according to the WHO classification: normal-BMI group (BMI 18.5 to 24.9) and high-BMI group (BMI ≥25). Functional outcomes were measured using the Lysholm score after at least 6 months after the surgery.

The Kolmogorov Smirnov test was used to see the normality of the postoperative outcome scores in both groups. Comparison between the two groups (normal weight and high weight) and a categorical variable (functional outcome: excellent, good, fair) was performed using the Kolmogorov Smirnov test to obtain the p-value. A p-value of <0.05 was considered statistically significant. IBM SPSS statistics version 25 was used for statistical analysis.

Results

Of the 71 patients studied 43 patients belonged to the normal BMI group while 28 were in the high BMI group. When patients were compared based on the mechanism of injury, it was identified that the most common mechanism of

Table Patient Demographics

Variable	Normal BMI (n=43)	High BMI (n=28)	p-value
Age (years)	27.8 (17-51)	33.4 (15-58)	
Sex			
Male	35 (81.3%)	23 (82.1%)	
Female	8 (18.7%)	5 (17.9%)	
Side			
Right	30	13	
Left	17	11	
BMI (kg/m ²)	21.9 (19-24.99)	30.4 (25.1-37.8)	
Mechanism of injury			
Sport injury	32 (74%)	18 (64%)	
Road traffic accident	4 (10%)	2 (8%)	
Fall/trivial injury	7 (16%)	8 (28%)	
VAS (postoperatively)			
1 month	2.9 (1 to 4)	3.4 (1 to 5)	0.032
3 months	0.9 (0 to 3)	1.5 (0 to 4)	0.024
ROM of knee			
Extension	-2° (-8° to 4°)	4° (0° to 10°)	
Flexion	141° (135° to 155°)	132° (125° to 150°)	
Lysholm score			
Excellent (>95)	30 (70%)	15 (54%)	
Good (84-94)	11 (25%)	9 (32%)	
Fair (65-83)	2 (5%)	4 (14%)	
Normality test (p-value)	0.061	0.057	0.021
Complication			
Graft failure	1 (New Injury)	2 (No injury recalled)	
Infection	0	1 (Superficial)	

injury was associated with sports injuries.

All patients were followed up for pain assessment using VAS at 1 month and 3 months after surgery. Some patients complained of anterior knee pain after the ACL reconstruction. In the normal BMI group, the mean VAS after 1 month ACL reconstruction was 2.9 while the mean VAS after 3 months was 0.9. Whereas in high BMI group, the mean VAS after 1 month ACL reconstruction was 3.4 while the mean VAS after 3 months was 1.5. Statistically, the VAS scores in 1 month and 3 months after ACL reconstruction were significantly different.

Measurement of the ROM of the knee in the 6 months minimum follow-up showed that the knee extension in the normal BMI group and the high BMI group were -2° (range, -8° to 4°) and 4° (range, 0° to 10°), respectively. The knee flexion in the normal BMI group was 141° (range, 135° to 155°) whereas the high BMI group had a knee flexion of 132° (range, 125° to 150°).

When analyzing the Lysholm score, no

difference in outcomes was observed between both BMI groups at postoperative follow-up assessment with a minimum interval of 6 months with both groups presented a significant result with a p-value of <0,05. In the normal BMI group, 70% of patients were reported to have an excellent outcome with a score of above 95. In addition, 25% of patients were reported to obtain a good outcome with a score of between 84-94, and 5% of the patients scored 65-83, which was considered to reflect a fair outcome. Whereas in the high BMI group, 54% of patients had an excellent outcome, 32% achieved a good outcome, and 14% has a fair outcome. Both groups showed comparable clinical improvements in the postoperative functional outcome as evident from the Lysholm scores.

Complication in the normal BMI group was seen in 1 patient who experienced graft failure due to a new injury 1 year after the original procedure. The graft in this patient was then fixed. In the high BMI group, 3 patients experienced

complications consisting of 2 patients with a graft failure without recalled trauma and 1 patient who experienced a superficial wound infection and underwent debridement. All patients with graft failure received another procedure using hamstring tendon from the contralateral side.

Discussion

The incidence of obesity is increasing in Indonesia as the obesity rate surpassed 21.8% in this country. Some authors conclude that obesity impact postoperative functional outcomes after ACL reconstruction, but other authors do not see any impact. Kowalchuck et al. reported that self-reported poorer ACL reconstruction outcome was strongly associated with obesity, smoking, and severe chondrosis at the time of surgery. Maletis et al. suggested that the risk factors for ACL reconstruction corrections include graft type, sex, race, and BMI which may vary in strength and significance along a patient's life lifetime, especially in young patients. Ballal et al. stated that being in the high BMI group does not adversely affect the functional outcomes after ACL reconstruction using Hamstring tendon. Almeida et al. observed no significant difference in the outcome of returning to sports activity between groups of high and normal BMI after ACL reconstruction.^{6,7,8,9}

There was a significant decrease in postoperative pain between 1 month and 3 months after surgery. Anterior knee pain is commonly seen after ACL reconstruction with quadriceps weakness as the risk factor for anterior knee pain that will hinder the recovery. Strengthening the quadriceps is associated with pain regression, thus promoting recovery. The use of immediate weight-bearing after ACL reconstruction results in a lower incidence of anterior knee pain. In this study, all patients received immediate weight-bearing with restricted ROM of the knee using a knee brace and underwent rehabilitation after reconstruction with a physical therapist to reduce pain.^{10,11}

Knee ROM after reconstruction in normal BMI was slightly better than that of the high BMI group. Almost all patients achieve full ROM of the knee joint after ACL reconstruction. Full ROM of knee motion can be achieved by strictly adhering to an aggressive physical therapy rehabilitation program without the need for an accelerated rehabilitation program.¹²

This study shows that the postoperative outcome in high BMI patients is similar to the

outcome in normal BMI patients when measured using the Lysholm score. Interestingly, having an elevated BMI is associated with good functional outcome for all patients and a decreased risk of ACL reconstruction correction. Maletis et al. suggested that patients with an elevated BMI may be less active after having an ACL reconstruction and, therefore, less likely to need a revision. Furthermore, all patients also received routine postoperative rehabilitation.⁷

The main complications found in both groups relate to graft failure and infection. There were 3 patients with graft failure during the period of the study. The causes of ACL reconstruction graft failure can be divided into three categories: technical errors, biological failure, and traumatic injury. The most commonly cited technical error in ACL reconstruction has been non-anatomic tunnel placement with an improperly placed femoral tunnel as the root cause of failure. Biological causes for failure include lack of graft incorporation, infection, allograft rejection, and a failure in the ligamentization process. During this study, 2 patients in the high BMI group experienced a graft failure without a new injury and 1 patient in the normal BMI group experienced a graft failure due to new injury.¹³

There was 1 case with superficial infection, which was treated using open surgical wound irrigation and debridement combined with intravenous antibiotics for about 4 weeks. Multiple factors could cause infection after arthroscopy ACL reconstruction including a previous knee surgery, contamination during graft preparation, incomplete sterilization of surgical instruments, and environmental contamination of surgical equipment or hospital material.¹⁴

It is concluded that the ACL reconstruction using hamstring tendon autograft has a good functional outcome score and a high success rate in both BMI groups. Patients with high BMI do not experience adverse effects on the functional outcomes as measured by Lysholm score after a minimum of 6 months after surgery and that both groups have benefitted equally.

This study was a retrospective analysis of prospectively collected data with a small sample size and short term follow up and only analyze two BMI groups, hence the results should be interpreted carefully. A longer-term follow up is suggested for future studies to investigate functional recovery after ACL reconstruction for both groups and to consider 3 categories of weight (normal, overweight, and obese) in the analysis.

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