ÖZGÜN ARAŞTIRMA ORIGINAL RESEARCH

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COMPARISON OF FUNCTIONAL RESULTS OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION IN OBESE PATIENTS WITH NORMAL INDIVIDUALS

ÖN ÇAPRAZ BAĞ REKONSTRÜKSİYONU UYGULANMIŞ NORMAL VE OBEZ BİREYLERİN FONKSİYONEL SONUÇLARININ KARŞILAŞTIRILMASI

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Öz

Amaç
Obezite, ortopedik cerrahide postoperatif klinik sonuçlara etki eden bir klinik antitedir. Literatürdeki birçok çalışma obezitenin ortopedik cerrahi üzerindeki etkilerini ortaya koymuştur. Ön çapraz bağ (ÖÇB) yırtılması genellikle genç ve aktif bireylerde görülür ve genellikle cerrahi olarak tedavi edilir. Bu çalışmada obezitenin ön çapraz bağ rekonstrüksiyonunun klinik sonuçları üzerindeki etkisini araştırmak istedik.

Gereç ve Yöntem
Eylül 2012-Haziran 2016 yılları arasında opere edilen, 180 hasta retrospektif olarak değerlendirildi. Hastalar vücut kitle indekslerine (VKİ) göre 2 gruba ayrıldı. Tüm hastalar tek bir merkezde ve tek bir cerrah tarafından ameliyat edildi. VKİ<25 kg/m² olan hastalar Grup 1'i (n=113), VKİ>30 kg/m² olan hastalar Grup 2'yi (n=67) oluşturdu. Hastaların yaş, cinsiyet, VKİ, ameliyat için bekleme süresi, ameliyat öncesi ve ameliyat sonrası Lysholm ve modifiye Cincinnati skorları bu iki grup arasında karşılaştırıldı.

Bulgular
Gruplar arasında komplikasyon, takip süreleri, ameliyat öncesi bekleme süresi, ameliyat öncesi ve sonrası Lysholm skorları ve ameliyat sonrası modifiye Cincinnati skorları açısından anlamlı fark bulunamadı. Ameliyat öncesi modifiye Cincinnati skorlarında gruplar arasında istatistiksel olarak anlamlı bir fark bulundu. Komplikasyon oranları açısından iki grup arasında istatistiksel olarak anlamlı bir fark saptanmadı.

Sonuç
ÖÇB rekonstrüksiyon cerrahisi normal VKİ'ye sahip popülasyon ve VKİ'ye göre obez olan hastalarda fonksiyonel diz skorları açısından benzer sonuçlara sahiptir. Ancak bu sonuçları doğrulamak için daha fazla klinik çalışmaya ve başka parametrelere ihtiyaç vardır.

Anahtar Kelimeler: Obezite, Ön çapraz bağ, Rekonstrüksiyon

Abstract

Objective
Obesity is one of the most challenging diseases in orthopedic surgery which directly affects the clinical results of the operations. Many studies in the literature demonstrated the effects of obesity on orthopedic surgery. Anterior cruciate ligament (ACL) rupture is commonly seen in young and active individuals and generally treated surgically. In this study, we had the intention to investigate the effect of obesity

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on the clinical results of anterior cruciate ligament reconstruction.

Material and Methods
180 patients were retrospectively evaluated whom operated between September 2012 - June 2016. The patients are divided into 2 groups according to their body mass index (BMI). All patients were operated on in a single center and by a single senior surgeon. BMI<25 kg/m^2 patients formed Group 1 (n=113), BMI>30 kg/m^2 patients formed the Group 2 (n=67). Age, gender, BMI of the patients, waiting time for the operation, preoperative and postoperative Lysholm and modified Cincinnati scores were compared between these two groups.A p-value less than 0.05 (typically ≤ 0.05) is statistically significant.

Results
There was no significant difference between the groups in terms of complication, follow-up periods, waiting time before operation, and pre-op and post-op Lysholm scores, and post-op modified Cincinnati scores. A significant difference has been found between the groups in pre-op modified Cincinnati scores.

Conclusion
ACL reconstruction surgery has similar results in the obese population compared to the normal weight population in terms of functional further studies and other parameters are needed to verify these results.

Keywords: Obesity, Anterior cruciate ligament, Reconstruction

Introduction

The anterior cruciate ligament (ACL) is the primary stabilizer ligament of the knee. The ACL forces the tibia to internally rotate during anterior tibial translation, indicating that the ACL primarily restrains internal rotational moments during antero-posterior translation (1).

This ligament is the most commonly injured as a result of knee traumas and sports injuries (2). Although ACL injury can be observed in all age groups, this injury is most commonly seen between the ages of 15 and 45 and related to the higher participation in sports (3). An untreated ACL may lead to knee instability which triggers osteoarthritis (4). Up to the study Costa-Paz et al., ACL does not spontaneously heal after a complete rupture (5). Therefore, surgical treatment must be considered in younger age groups to prevent future complications of the ACL rupture such as early osteoarthritis of the knee.

Obesity is one of the major health problems threatening public health nowadays. It seriously affects the quality of life and its rate is increasing in adults over the world. Obesity is an independent risk factor for musculoskeletal injuries, while increased body mass index may be a predisposing factor for ACL injury (6). Besides its side effects in metabolic pathways, obesity in orthopedic surgery is a challenging problem for both the surgeon and the patient. There are not many studies in the literature concerning obese patients who underwent ACL surgery and their functional results. Our hypothesis was to show that this negative effect of obesity does not apply to anterior cruciate ligament surgery.

In this study, we had the intention to compare obese patients who underwent ACL reconstruction surgery to the normal weight population with the same injury and to assess the clinical differences between these two groups.

Material and Methods

Patients' retrospective data was retrieved from the local computer system of the hospital. The study consists of a total of 180 patients who were operated on due to an injury which is defined as a complete rupture of the ACL. ACL rupture diagnosis was confirmed both clinically and radiologically, via physical examination and magnetic resonance imaging respectively. Patients who were followed up regularly from September 2012 to June 2016 were included in this study. All the patients had surgical indication due to complete ACL injury and all the operations were performed by the senior surgeon (LK).

The patients were divided into two groups as a normal-weight group with Body Mass Index (BMI) 20-25 kg/m^2 (113 patients, Group 1) and obesity group with BMI of 30 kg/m^2 (67 patients, Group 2). Age, gender, waiting time for operation after injury, follow-up duration and functional knee scores are listed in Table 1.

Age, gender, BMI of the patients, waiting time for the operation, were compared between these two groups. Clinically, preoperative and postoperative Lysholm and Modified Cincinnati scores and complication rates between the groups were analyzed and compared (7, 8).

Patients who couldn't started rehabilitation early due to concomitant cartilage and meniscus damage, those with bilateral anterior cruciate ligament injury, pediatric patients, those who underwent gastric by-pass surgery after the operation, and patients with inflammatory joint disorders were not included in the study. ACL revision surgeries were excluded from the study. Patients with a changed body mass index interval with at least one range, have been excluded from the study.

Surgical Technique

Primary arthroscopic anterior cruciate ligament reconstruction was applied to all patients. All operations were performed arthroscopically with a single bundle technique. An autologous hamstring graft was harvested from the appropriate donor site. The femoral tunnel is anatomically built with the proper surgical materials and bioabsorbable screw and staple were used on the tibial side to plug the tibial tunnel, while an endobutton was used for the femoral tunnel.

Physical Therapy and Rehabilitation

All patients in the study were included in a standard postoperative physical therapy protocol for the anterior cruciate ligament reconstruction. It was taken into account that regular controls (1st month, 3rd month, 6th month, 12th month postoperatively) were done and the follow-up periods were at least 18 months.

Statistical Analysis

Statistical analysis was carried out using Statistical Package for the Social Sciences for Windows 21.0 (SPSS Inc. Chicago, IL). Descriptive statistics were given as mean (±) standard deviation, median (minimum-maximum), frequency distribution, and percentage. The compliance of the variables to normal distribution was examined using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov / Shapiro-Wilk Tests). Student's t-test and chi-square test were used for normally distributed data and Mann-Whitney U test was used for non-normally distributed data. Values of $p<0.05$ were considered statistically significant.

Ethical Approval

Ondokuz Mayıs University Clinical Research Ethics Committee approval was obtained for the study (No: 2021/50, Date: 29.01.2021). The study was conducted in line with the principles of the Helsinki Declaration.

Results

Table 1 shows the clinical and sociodemographic characteristics of the patients. A total of 180 patients were included in this study. 161 of patients were male (%89.4) and 19 patients were female (%10.6). The mean age of the patients was found 30.5± 8.1(19-54). There was no statistically significant difference between the two groups in terms of age, gender,

Table 1 The clinical and sociodemographic characteristics of the patients

Study Parameters	Mean± SD (min-max)
Gender	%89.4 male (n:161), %10.6 female (19)
Age (years)	30.5± 8.1(19-54)
BMI (kg/m^2)	27.0±6.1 (19-43)
Waiting time before operation (month)	6.0±2.1 (1-130)
Pre-op modified Cincinnati score	60.6±11.0 (35-70)
Post-op modified Cincinnati score	90.8±9.8 (52-100)
Pre-op Lysholm score	65.7±11.5 (35-76)
Post-op Lysholm score	94.1±8.9 (56-100)
Follow-up duration (month)	70.5±9.3 (46-91)
Complication	%3.8 (n:7)

Table 2 The comparison of the normal weight group (Group 1) and obesity group (Group 2)

Study Parameters	Group 1 Normal (n: 113)	Group 2 Obese (n: 67)	Statistical analysis	P-value
BMI	20-25	>30		<0.05
Gender (Male-Female)	103-10	60-7	χ^2:0.179	0.41
Age (years)	29.2±7.9	30.9±8.9	t: 0.733	0.37
Waiting time before operation (months)	5 (1-12)	6 (1-36)	Z:3.535	0.09
Pre-op modified Cincinnati score	61.4±11.4	57.3±12.3	T: 2.374	**0.02***
Post-op modified Cincinnati score	92.2±9.3	90.7±10.3	T: 1.222	0.22
Pre-op Lysholm score	76.3±12.1	74.6±10.5	T:0.960	0.33
Post-op Lysholm score	94.6±16.2	93.1±14.4	t:1.733	0.08
Follow-up duration (month)	70.2±17.4	71.5±17.7	t:0.590	0.39
Complication	%2.2 (n:4)	%1.6 (n:3)	χ^2:0.133	0.62

*:p value < 0.05 is considered significant

waiting time for operation after injury (6 ± 2.1 months), and follow-up duration (mean 70.5 months) (p>0.05). The mean clinical follow-up period was 70.2 ± 17.4 months for the patients with normal BMI, and 71.5 ± 17.7 months for obese patients (Table 2). The mean postoperative follow-up duration was similar for both groups, and there was no significant difference between the two groups in terms of complications.

According to the long-term follow-up results (average 61 months), we found that the postoperative Lysholm and modified Cincinnati scores of the Group 1 and 2 were similar and there was no statistically significant difference (p>0.05).

The total complication rate was 3.8%. Two deep vein thrombosis (DVT) and 1 superficial infection occurred in Group 2 while 1 DVT and 3 superficial infections occurred in patients in Group 1.There was no significant difference between the groups in terms of complications (p>0.05) (Table 2).

Discussion

The incidence of obesity is increasing all around the world and orthopedic surgeons have to encounter these patients more with the increasing rate of obesity. There are many different opinions in the literature regarding the effect of BMI on the clinical results of orthopedic surgeries. In addition, very few studies in the literature are comparing the results of anterior cruciate ligament reconstruction in obese patients and patients with normal BMI.

High BMI is generally associated with high-fat mass. However, muscle mass, like fat mass, can cause high BMI. In our study, we compared patients with BMI> 30 kg/m^2 and those with normal BMI to exclude patients with high BMI due to muscle mass. When we analyzed the demographic data, we found that there was no significant difference between age and gender in both groups. In the literature, it is observed that anterior cruciate ligament injuries generally occur in male individuals (9). In our study, this data was consistent with the literature.

Lysholm activity level scale is a graduated list of activities of daily living, recreation, and competitive sports. The patients were asked to select the level of participation that best describes their current level of activity and that before the injury. There are studies in the literature showing that obese patients have lower activity levels in daily life (11). In this study, our observation was that obese patients were significantly less active before the injury, therefore Lysholm activity scales were lower in this group.

The Lysholm index is one of the evaluation scales mostly used in the follow-up of patients who underwent knee surgery. In the study conducted by Almeida et al., no significant difference was found between obese and normal BMI patients in terms of Lysholm

scores (13). In our data, we observed that there were no significant differences in post-op Lysholm and modified Cincinnati scores when we compared the obese patient group to the normal group. This result suggests that this technique may be especially used in obese patients who already have additional stress on the knee joint due to excessive weight. Preoperative Cincinnati scores were found to be significantly higher in patients with normal BMI compared to the obese patient group.

Complications encountered in both groups were the same, superficial wound site infection was observed the most. All the infections are treated with the appropriate antibiotherapy, and no patient needed surgical debridement. To our knowledge, DVT is mostly expected more frequently in the obese patient group. The literature lacks recommendations on thromboprophylaxis in patients undergoing elective arthroscopic ACL reconstruction (14). We routinely use DVT prophylaxis on all arthroscopic procedures.

Despite the appropriate thromboembolic disease prophylaxis of all patients starting immediately on the postoperative period, 1 patient in Group 1, and 2 patients in Group 2 have been diagnosed with DVT. The diagnosis is set via the doppler ultrasonography and the results are interpreted by the senior radiologist. No progress of DVT is observed on these patients and patients have fully recovered with the medical treatment. A study with 4933 patients conducted by Cvetanovich et al. demonstrated us the most common complication was symptomatic venous thromboembolic disease followed by return to the operating room and infections. Their overall complication rate was 1.34% and it's lower when compared to our study (15).

Some treatment modalities dictate the preoperative weight loss in the obese patient group for better functional outcomes. We think that this practice puts the patients in an unnecessary vicious circle. Although BMI is used as a measure of body fat to determine the level of obesity in patients, it is a measure of body weight. Since athletes with a high mass of muscle may have higher body weight, it seems incorrect to classify these individuals as overweight or obese according to BMI (16). For this reason, since the patient group was classified as overweight according to WHO with a BMI between 25-30 kg/m^2 and this group was mostly formed by the athletes, this group was not included in our study. The exclusion of this group can be accepted as a limitation for the study. In other words, the use of BMI as a measure of obesity can introduce misclassification problems that may result in important bias in estimating the effects related to obesity.

Our study has also some other limitations. First, only the funcional knee scores (Lysholm and modified Cincinnati) were used to evaluate the patients. Second, returning to sport activities and preop sporting activity levels should be questionned because these parameters may directly influence the functional results. Its retrospective nature is another limitation of the study.

Conclusion

The anterior cruciate ligament reconstruction surgery performed after ACL rupture in obese patients showed similar results in terms of functional knee results and complications compared to individuals with normal BMI. This study proves a need of further and comprehensive verifications to better analyze the obese patients group who underwent ACL surgery.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Ethical Approval

Ondokuz Mayıs University Clinical Research Ethics Committee approval was obtained for the study (No: 2021/50, Date: 29.01.2021). The study was conducted in line with the principles of the Helsinki Declaration.

Consent to Participate and Publish

Written informed consent to participate and publish was obtained from all individual participants included in the study.

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