



The impact of diabetes mellitus on penile length in men undergoing inflatable penile prosthesis implantation

Diabetes mellitusun şişirilebilir penil protez uygulanan erkeklerdeki penis boyu üzerine etkisi

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ABSTRACT

Objective: To evaluate the changing cavernosal length of patients with diabetes mellitus (DM) and organic erectile dysfunction (ED) who were treated with inflatable, three-piece penile prostheses, a current surgical treatment option in our clinic, over the course of 12 years.

Materials and methods: Between April 2000 and December 2012, we retrospectively investigated data from patients who were diagnosed with organic ED and performed penile prosthesis implantation (PPI). Of the 239 patients, 235 patients were included in the study. Four patients who were operated on for transsexuals were excluded from the study. All patients were divided into two groups; group 1 included patients with DM, and group 2 included patients without DM. Data, including age, body mass index (BMI) in kg/m², operation history, comorbidities, International Index of Erectile Function (IIEF) questionnaire results, combined intracavernous injection and stimulation (CIS) test results, the measured length of the corpus cavernosum while implanting the penile prosthesis, complications, operation time, mean hospital stay, and the satisfaction of the patient and partner, were recorded. Kruskal-Wallis and Mann-Whitney U tests were used for statistical analysis. A p-value of <0.05 was considered to be statistically significant.

Results: The mean age was 57.9±10.5 years. In the study, 65 patients with DM, 51 patients who underwent radical pelvic surgery, 21 with only additional disease hypertension (HT), 28 with combined DM and HT, 5 with hyperlipidemia, 4 with DM and radical pelvic surgery, and 62 without any additional comorbidity were identified. The mean measured length of the corpus cavernosum was 17.277±0.1509 cm in group 1 and 17.289±0.1598 cm in group 2 (p<0.05). Additionally, the other parameters, including age, operation time, and the satisfaction of the patient and partner, were not different between these groups (p>0.05).

Conclusion: The length of the corpus cavernosum and the destruction of cavernosal tissues do not depend only on DM. We conclude that these features may have multifactorial causes.

Key words: Corpus cavernosum; diabetes mellitus; erectile dysfunction; penile prosthesis; penis.

ÖZET

Amaç: Kliniğimizin 12 yıllık tecrübesinde, diabetes mellitus (DM) ve organik kaynaklı erektil disfonksiyonu (ED) olan, standart cerrahi tedavi olarak; şişirilebilir üç parçalı penil protez uygulanan hastalarda, değişen kavernozaal uzunlukların değerlendirilmesi amaçlanmıştır.

Gereç ve yöntemler: Nisan 2000 ve Aralık 2012 arasında organik kaynaklı ED tanısı konularak penil protez implantasyonu (PPI) yapılan hastalar geriye dönük olarak değerlendirildi. İki yüz otuz dokuz hastadan, 235'i çalışmaya alındı. Cinsiyet değişimi için opere edilen 4 hasta çalışma dışında tutuldu. Hastalar 2 Gruba ayrıldı; DM'li hastalar Grup 1'e dahil edildi, Grup 2'ye ise diğer hastalar alındı. Hastaların yaşı, vücut kitle indeksleri (kg/m²), geçirilmiş operasyon öyküsü, ek hastalıkları, ereksiyon işlevi uluslararası değerlendirme skorları (IIEF), intrakavernozaal stimülasyon test (CIS) sonuçları, operasyon sırasında ölçülen korpus kavernozaal boyları, komplikasyonlar, operasyon süresi, hastanede kalış süresi, hasta ve partner memnuniyeti kaydedildi. Kruskal-Wallis ve Mann-Whitney U istatistik yöntemleri kullanıldı ve istatistik anlamlı p değeri p<0,05 olarak kabul edildi.

Bulgular: Hastalarımızın ortalama yaşı 57,9±10,5 olarak saptandı. Diabetes mellitusu olan 65 hasta, radikal pelvik cerrahi geçiren 51 hasta, sadece ek hastalık hipertansiyonu (HT) olan 21 hasta, DM ve HT birlikteliği olan 28 hasta, sadece hiperlipidemi olan 5 hasta, DM ve radikal pelvik cerrahi geçiren 4 hasta, herhangi bir prepsidoze edici ek hastalığı olmayan 62 hasta mevcuttu. Grup 1'de ortalama korpus kavernozaal boyu 17,277±0,1509 ve Grup 2'de 17,289±0,1598 cm idi (p<0,05). Diğer parametreler; yaş, operasyon süresi, hasta ve hastanın partnerinin memnuniyet oranları iki grup arasında farklı değildi (p>0,05).

Sonuç: Korpus kavernozaal uzunluğunu ya da destrüksiyonu, sadece DM'ye bağlı değildir. Multifaktöriyel nedenlere bağlı olabileceğini düşünmekteyiz.

Anahtar sözcükler: Diabetes mellitus; erektil disfonksiyon; korpus kavernozaal; penis; penil protez.

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Introduction

Erectile dysfunction (ED) is sexual dysfunction characterized by the inability to develop or maintain an erection of the penis during sexual performance.^[1]

Although ED was previously accepted as a psychologically based disease, ED has been accepted as a 75% organically based disease in recent years.^[2] By developing technologies for methods of diagnosis, the etiologic factors were accurately determined. Thus, these developments provided us with a choice of treatment options for the cause.^[3] Currently, when patients are diagnosed as ED, medical treatment options are offered as the first step of treatment. When these options are inadequate for treatment, surgical treatment options are considered.^[4] Inflatable, three-piece penile prostheses are the current option for the surgical treatment of ED.^[5] Implanting an inflatable penile prostheses are the gold-standard surgical treatment option for ED. Moreover, research on the etiology of ED is continuing.^[6,7]

There are several proven etiologic factors in ED that are often related to poor health or chronic illnesses, such as atherosclerosis, diabetes mellitus (DM), depression, and hypogonadism.^[8]

Men with DM may have ED at an earlier age and with a significantly higher prevalence, reaching as high as 75%.^[9] However, the etiology of ED in DM is multifactorial. There is a greater incidence of peripheral neuropathy, microangiopathy, and arterial insufficiency in individuals with DM and ED compared with those individuals with normal function. Changes in endocrine function and the central nervous system's control of sexual arousal may also have an important role in the pathogenesis of ED associated with DM. Thus, shortening of the length of the cavernosum is an issue in patients with DM.

In our study, we evaluated the changing cavernosal length of patients with DM and organic ED who were treated with inflatable, three-piece penile prostheses, a current surgical treatment option in our clinic, over the course of 12 years. We hypothesized that DM causes ED and that DM induces the shortening of penile length.

Material and methods

In this retrospective study, we included 235 patients (mean age 57.9 ± 10.5 years) who underwent inflatable, three-piece penile prosthesis implantation (PPI) between April 2000 and March 2012. Signed informed consent was obtained from all patients. The study protocol was approved by the institutional review board.

All patients were divided into two groups; group 1 included patients with DM, and group 2 included patients without DM.

Recorded data for statistical analyses included age, body mass index (BMI) in kg/m^2 , operation history, comorbidities, International Index of Erectile Dysfunction (IIEF) questionnaire results, combined intracavernous injection and stimulation (CIS) test results, the measured length of the corpus cavernosum while implanting the penile prosthesis, complications, operation time, mean hospital stay, and the satisfaction of the patient and partner. Additionally, nocturnal penile tumescence (NPT) tests and color Doppler ultrasonography examination were performed on the patients according to the individuals' clinical conditions.

Moreover, all patients consulted with a psychiatry outpatient clinic. We implanted inflatable, three-piece penile prostheses in all patients, as Montequi et al.^[10] previously described. The surgical approach, such as penoscrotal or infrapubic, was determined by our surgeon (MU) according to the conditions of the patients, such as surgical histories and physical examination results. Four patients who were operated on for transsexuality were excluded from the study.

Patient and partner satisfaction were evaluated by meeting face-to-face or by telephone conversations.

Statistical analysis

Kruskal-Wallis and Mann-Whitney U tests were used for statistical analysis. A p-value of <0.05 was considered to be statistically significant.

Results

All of the patients were diagnosed with organic ED. In total, 65 of the patients only had DM, 28 of the patients had DM and hypertension (HT), and 4 of the patients had DM and previous radical pelvic surgery. Therefore, group 1 included 97 patients, and group 2 included 138 patients. In group 2, there were 51 patients who had undergone previous radical pelvic surgery, 62 patients with no predisposing factors for ED, 21 patients with HT, and 4 patients with only hyperlipidemia.

The mean measured length of the corpus cavernosum was 17.277 ± 0.1509 cm in group 1 and 17.289 ± 0.1598 cm in group 2 ($p < 0.05$). Moreover, the mean operation time, satisfaction of the patient and partner, and complications were not significantly different between the two groups (Table 1).

Peyronie's disease was diagnosed in 12 (12%) patients in group 1 and 15 (10%) patients in group 2. Manual remodeling was used in 4 patients in group 1 and 5 patients in group 2. An incision of the plaque was performed in 3 patients in group 1 and 5 patients in group 2. An incision of the plaque and patching of the fascia of the rectus muscle were used in 5 patients in group 1 and 5 patients in group 2.

However, the type of implanted penile prosthesis was not assessed. From a clinical aspect, there was no difference between the groups.

Discussion

Diabetes mellitus is a heterogeneous group of disorders characterized by high blood-glucose levels. The pancreatic beta cell and its secretory product, insulin, are central in the pathophysiology of diabetes.^[11] Type 1, or insulin-dependent, DM (T1DM) results from an absolute deficiency in insulin due to autoimmune beta cell destruction. In type 2, non-insulin-dependent DM (T2DM), liver, muscle, and fat cells are resistant to the actions of insulin. The compensatory attempt by the beta cells to release more insulin is not sufficient to maintain blood glucose levels within a normal physiological range, ultimately leading to the functional exhaustion of the surviving beta cells.^[12] Vickers et al.^[13] demonstrated that patients with DM have high rates of ED, and Vickers and Wright^[13] reported that ED was present in 32% of men with T1DM and 46% with T2DM. Moreover, the Massachusetts Male Aging Study revealed that the prevalence of ED in diabetic men is 50.7 per 1.000 population-years compared with 24.8 in those individuals without diabetes.^[14] Studies in experimental animal models and diabetic patients have indicated several mechanisms responsible for diabetes-associated ED, such as impaired vasodilatory signaling, nonadrenergic-noncholinergic (NANC) dysfunction, endothelial dysfunction, oxidative stress, proinflammatory changes, cavernosal hypercontractility, venoocclusive dysfunction, and hypogonadism.^[15] Notably, endothelial dysfunction caused by independent or concomitant cardiovascular risk factors not only results in atherosclerosis but is also a common denominator among the comorbidities of T2DM. It has also been established that dysfunction in the nitric oxide cascade is the primary link between insulin resistance, coronary artery disease, and ED.^[16] Moreover, the cavernosal tissue is under attack in DM by harmful oxygen free radicals, such as O_2 . This agent reacts with nitric oxide, forming peroxynitrite, which reacts with lipids, proteins, and nucleic acids.^[17,18] However, the mechanism was described for the association of ED and DM. Recently, Cartledge et al.^[19] reported the destruction of cavernosal tissue in patients with DM and ED due to vasculopathy and autonomic neuropathy. In the light of these, we evaluated the changing cavernosal length of patients with DM and organic ED who were treated

with inflatable, three-piece penile prostheses, a current surgical treatment option.

Jevtich et al.^[20] described fibrous proliferation in 90% of penile arteries. Moreover, Ruzbarsky and Michal^[21] reported intimal proliferation, medial fibrosis and calcification, and thrombosis in the cavernosal arteries. However, our study did not include a histopathology step. From a clinical aspect, there was macroscopic fibrosis and insufficient blood supply in the cavernosal tissues. Additionally, it was difficult to dilate the cavernosal tissues with spark plugs in the operations on DM patients. Although DM damages the microcirculation, nerves, and smooth muscle in the penis, the measured length cavernosal length was similar between the two groups. The damage to the cavernosal tissues might occur at the micro level but not at the macro level in this series.

Our findings on operation time and patient and partner satisfaction paralleled the results of Mulcahy and Carlson.^[22] However, there was over 90% patient and partner satisfaction in their series, and we observed 98% in two groups. Lotan et al.^[23] reported that decreased infection rates could be obtained during PPI by experienced hands. We agree with this finding. Our surgeon (MU) participated in a long fellowship program and over 12 years of experience in PPI. Therefore, a lower infection rate could be achieved in our series than in the literature.^[24]

There are several reports that indicated that DM increases or does not increase infections in PPI.^[25,26] In our series, there were three mechanical defects in Group 1 and 2 mechanical defects in Group 2. There was no statistically significant difference between two groups for mechanical defects. Our findings paralleled the results of Montague et al.^[26] In a recent large series, it was reported that the use of an antibiotic-impregnated penile prosthesis could decrease revisions due to infection in DM patients.^[22] Although we had limited numbers of DM patients, our findings were not similar to the results of Mulcahy and Carson.^[22] In the future, the risk of infection caused by DM in PPI patients can be shown in a large population series. Clinicians should closely follow up with all patients after PPI, regardless of the patients' comorbidities for infection and mechanical defects.

In our series, we aimed to compare the cavernosal length of DM and non-DM patients in order to investigate macro-level

Table 1. Comparisons of data for the groups

Parameter	Group 1 (n=97)	Group 2 (n=138)	p-value
Mean age (years)	63.165±0.67	62.906±0.56	0.392
Mean diameter of corpus cavernosum (centimeters)	17.277±0.1509	17.289±0.1598	0.994
Mean operation time (minutes)	63.113±0.97	62.804±0.63	0.461
Mean patient and partner satisfaction	0.979±0.014	0.978±0.146	0.478
Mean number of complications (n)	0.051±0.022 (5)	0.028±0.014 (4)	0.188

damage by DM. There are certain limitations, such as being retrospective and the lack of histopathology and biochemical analyses of the cavernosal tissues. These deficiencies may be addressed in another study in the future.

In conclusion, the gold-standard surgical treatment option for ED is inflatable PPI. The damage to cavernosal length does not only depend on DM. Given our findings, this damage may be related to multifactorial causes. More detailed, large-population and multidisciplinary studies are needed on this topic.

Conflict of Interest

No conflict of interest was declared by the authors.

Peer-review: Externally peer-reviewed.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Author Contributions

Concept - M.U.; Design - Y.A., İ.Ş.; Supervision - M.U., Y.A.; Materials - M.U., İ.Ş., Y.A.; Data Collection and/or Processing - Y.A., İ.Ş.; Analysis and/or Interpretation - Y.A.; Literature Review - İ.Ş.; Writer - Y.A.; Critical Review - Y.A., M.U.

Çıkar Çatışması

Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir.

Hakem değerlendirmesi: Dış bağımsız.

Hasta Onamı: Yazılı hasta onamı bu çalışmaya katılan hastalardan alınmıştır.

Yazar Katkıları

Fikir - M.U.; Tasarım - Y.A., İ.Ş.; Denetleme - M.U., Y.A.; Malzemeler - M.U., İ.Ş., Y.A.; Veri toplanması ve/veya işlemesi - Y.A., İ.Ş.; Analiz ve/veya yorum - Y.A.; Literatür taraması - İ.Ş.; Yazıyı yazan - Y.A.; Eleştirel İnceleme - Y.A., M.U.

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