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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

Relationship between varicocele and anthropometric indices in infertile population

İnfertilite olgularında varikosel ve antropometrik index ilişkisi

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ABSTRACT

Objective: To evaluate relationship between varicocele and anthropometric indexes in patients presenting with infertility.

Methods: 600 male patients presenting with infertility were included in this study. The presence and degree of varicocele were evaluated by physical examination. Anthropometric index parameters were compared in terms of presence of varicocele and grade. The anthropometric indexes including body mass index (BMI), waist circumference (WC) and waist-to-hip ratio (WHR) were recorded.

Results: A total of 210 (35%) patients had varicocele. The mean of BMI, WC and WHR of those without varicocele was 30.5 ± 6.4 kg/cm^2, 86.40 ± 9.97 cm and 0.89 ± 0.05, respectively. The mean of BMI, WC and WHR with varicocele was 24.7 ± 5.2 kg/cm^2, 81.19 ± 9.01 cm and 0.82 ± 0.05 respectively (p<0.001). The mean value of each anthropometric index had a significantly statistical correlation with each grade varicocele (p<0.001). In the normal weight group (BMI less than 25) 82 of 180 patients (45%) had varicoceles. In the overweight group (BMI 25 to less than 30) 94 of 266 patients (34%) had varicoceles. In the obese group (BMI 30 or greater) 34 of 154 patients (21%) had varicoceles (p<0.001). Prevalence of varicocele decreased with increasing body mass index for all varicocele grades (p<0.001).

Conclusion: The prevalence of varicocele decreases with increasing body mass index. The present data support the explanation that obesity may result in a decreased nutcracker effect, which accounts for prevention of the renal vein compression.

Key words: İnfertility, obesity, varicocele, anthropometric indexes

ÖZET

Amaç: İnfertilite nedeniyle başvuran hastalarda varikosel ve antropometrik indeks ilişkisini değerlendirmek.

Yöntemler: İnfertilite nedeniyle başvuruda bulunan 600 hasta çalışmaya dahil edildi. Varikosel varlığı ve derecesi fizik muayene ile değerlendirildi. Antropometrik indeks parametreleri varikosel varlığı ve derecesi açısından karşılaştırıldı. Antropometrik indexler; vücut kitle indexi, bel çevresi ve bel-kalça oranı kaydedildi.

Bulgular: Hastaların 210'unda (%35) varikosel saptandı. Ortalama vücut kitle indexi, bel çevresi ve bel-kalça oranı; varikoseli olmayanlarda 30.5 ± 6.4 kg/cm^2, 86.40 ± 9.97 cm ve 0.89 ± 0.05, varikoseli olanlarda 24.7 ± 5.2 kg/cm^2, 81.19 ± 9.01 cm ve 0.82 ± 0.05 idi (p<0.001). Varikosel derecesi ile antropometrik indeks parametreleri arasında istatistiksel anlam mevcuttu (p<0.001). Normal vücut ağırlığı olanların % 45' inde, fazla kilolu olanların % 34'ünde ve obez hastaların % 21'inde varikosel saptandı (p<0.001). Varikosel prevalansı tüm varikosel dereceleri için artan vücut kitle index ile birlikte azalmaktaydı (p<0.001).

Sonuç: Varikosel prevalansı vücüt kitle indeksi arttıkça azalmaktadır. Mevcut veriler obezitesinin nutcracker etkisini azalttığı, adipoz dokunun renal vene baskıyı engellediği yorumunu desteklemektedir.

Anahtar kelimeler: İnfertilite, obezite, varikosel, antropometrik indeks

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INTRODUCTION

Varicoceles are present in approximately 15% of the general population. In contrast 35% of men with primary infertility and up to 70% of men with secondary infertility have been found to have varicoceles [1].

A varicocele is a dilatation of the scrotal portion of the pampiniform plexus/internal spermatic venous system that drains the testicle. Approximately 75% to 90% of varicoceles are left side. The incidence of bilaterality is anywhere from 15% to 50% but isolated right varicoceles are fairly rare. One theory postulates that the length of the left internal spermatic vein and the angle with which it drains into the left renal vein can result in increased hydrostatic pressure. This increased pressure is transmitted to the scrotal pampiniform plexus causing dilatation and tortuosity of the plexus [2].

Increased pressure in the left internal spermatic vein may result from compression of the left renal vein between the aorta and the superior mesenteric artery, a phenomenon known as the nutcracker effect [3]. Another theory describes absent or malfunctioning venous valves as a potential cause of varicocele formation [4]. The mechanism of nutcracker effect is not fully recognized. Retroperitoneal fat and the third segment of the duodenum are important in maintaining a wide aorta-mesenteric angle and a narrow aorta-mesenteric angle or an abnormal branching of the superior mesenteric artery from the aorta causes compression of left renal vein [5,6].

Obesity is a metabolic disease of pandemic proportion. The World Health Organization estimates that 300 million of adults worldwide are obese and more than 1 billion are overweight [7].

The purpose of this study was to determine relationship between anthropometric indexes and the presence of varicocele and grade.

METHODS

A total of 600 male patients presenting with infertility were included in this study. Patients had complete data, including the anthropometric measures of height, weight, WC, hip circumference (HC), age and physical assessment for varicocele. All subjects underwent history taking and physical examinations to evaluate the presence and severity of varicocele. All patients were evaluated by same investigator. All patients underwent physical examination in a warm environment. Only palpable varicoceles were recorded. If bilateral varicoceles were present, the varicoceles were graded in severity according to the largest varicocele.

Varicoceles were categorized as small (grade I-palpable only with Valsalva), medium (grade II-palpable without Valsalva but not visible) or large (grade III-visible) by physical examination. Varicoceles were examined as presence or absence, and the subjects of presence were divided into three groups by grade.

BMI was calculated from the formula, weight in kilograms divided by height in metres squared. WC was obtained from the mid-point between the iliac crest and costal margin. HC was measured at the widest point around the greater trochanter. Both WC and HC were measured in centimetres. WHR was determined by the WC divided by the HC. Height, weight and all these anthropometric indexes (including BMI, WC and WHR) were recorded according to the various varicocele groups (non-varicocele, grade I, grade II and grade III). Differences in the above indexes among each various varicocele groups were compared using the test of analysis of variance.

The frequencies of varicoceles in each quartile category were compared by chi-square test. Analysis of logistic regression was used to exhibit the trend between varicoceles and obesity in each anthropometric index. The method of logistic regression was used to observe the variance of prevalence in each grade varicocele group with increasing obesity of each anthropometric index.

Anthropometric indexes parameters were compared in terms of presence of varicocele and grade. The anthropometric indexes including body mass index (BMI), waist circumference (WC) and waist-to-hip ratio (WHR) were recorded. All subjects were categorized by quartiles according to each anthropometric index.

Using the National Institutes of Health definition, those patients with a BMI of less than 25 kg/m^2 were categorized as normal weight. Patients with a BMI of 25 kg/m^2 to less than 30 kg/m^2 were considered overweight, those with BMI of greater than 30 kg/m^2 were categorized as obesity [8].

All analyses were conducted using spss statistical software (version 16.0; SPSS Inc, Chicago, IL, USA). Means were compared with the Student's t-test. Severity was compared by analysis of variance testing and frequency was analysed using the chi-square method. Statistical significance was considered at $p < 0.05$.

RESULTS

All subjects were aged between 21 and 38 years and a total of 210 (35%) subjects had varicoceles, and were on the left side in 28.5%, bilateral in 5.8% and on the right side in 0.7% of patients. The means of age without varicoceles was 24.46 ± 2.03 and the means of age with varicoceles was 24.73 ± 1.88 (p=0.422). The means of BMI, WC and WHR of those without varicoceles was 30.5 ± 6.4 kg/cm^2, 86.40 ± 9.97 cm and 0.89 ± 0.05, respectively. The means of BMI, WC and WHR with varicoceles was 24.7 ± 5.2 kg/cm^2, 81.19 ± 9.01 cm and 0.82 ± 0.05 respectively (p<0.001) (Table1).

The mean value of each anthropometric index had a significantly statistical correlation (p<0.001) with each grade varicocele. In other words, these results suggested that more obese men may have less severity of varicocele (Table 2).

In the normal weight group (BMI less than 25) 82 of 180 patients (45%) had varicoceles. In the overweight group (BMI 25 to less than 30) 94 of 266 patients (34%) had varicoceles. In the obese group (BMI 30 or greater) 34 of 154 patients (21%) had varicoceles (p<0.001). Prevalence of varicocele decreased with increasing body mass index (p <0.001) (Table 3).

Table 1. The comparison results of objects between with varicoceles and without varicoceles

Variables	Without varicoceles Mean ± SD (n = 390)	With varicoceles Mean ± SD (n = 210)	p
Age (years)	24.46 ± 2.03	24.73 ± 1.88	0.422
BMI (kg/m^2)	30.5 ± 6.4	24.7 ± 5.2	
WC (cm)	86.40 ± 9.97	81.19 ± 9.01	< 0.001
WHR	0.89 ± 0.05	0.82 ± 0.05	

BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio; SD, standard deviation

Table 2. The mean values of anthropometric indexes according to each varicocele category

Anthropometric index	Non-varicocele (n=390)	Grade I (n = 50)	Grade II (n = 82)	Grade III (n = 78)	p *
BMI (kg/m^2)	30.523	25.826	24.461	23.463	
WC (cm)	86.40	83.56	81.33	77.38	<0.001
WHR	0.892	0.8471	0.8235	0.809	

BMI, body mass index; WC, waist circumference; WHR, waist-to-hip ratio.
* ANOVA test

Table 3. Prevalance of varicocele according to each body mass index group

BMI groups	Without varicoceles n	%	With varicoceles n	%	Total	p
Normal weight	98	55	82	45	180	
Overweight	172	66	94	34	266	<0.001
Obese	120	65	34	35	154	
Total	390	100	210	100	600	

DISCUSSION

Obesity and the related health risks have been noted to be an epidemic problem worldwide, especially in developing countries [9-11]. Within the Eastern Mediterranean Region, an increasing prevalence of overweight has been recorded and has been noted to be at "an alarming level" [12,13]. The factors lead-

ing to this widespread increase in obesity have been suggested to include economic growth, modernization, westernization of lifestyles (including foods higher in fats and decrease in exercise levels], and the globalisation of food markets [14].

A study by Flegal et al demonstrated the prevalence of obesity (BMI 30 or greater) in adults 20 to 74 years old in 1999 to 2000 to be 30.5% [15]. In our study, this ratio was 21%.

A total of 210 patients (35%) had varicoceles. The means of BMI, WC and WHR of those with varicoceles was significantly less than those without varicoceles. Delaney et al performed a retrospective review of 43 adolescent boys with varicocele, and noted that patients with varicocele were taller and heavier than age matched controls [16].

Another group, May et al suggested that the children and adolescents aged 9-19 years with varicoceles were heavier and taller than an age-correlated normal population, but had a distinctly lower BMI [17].

Among the adult population, recent reports of Handel et al emphasized that less nutcracker effect or other biophysical effects of increased adiposity may play a role in prevention of varicoceles. They assert that fat around the left renal vein may provide a cushion protecting against the nutcracker phenomenon in the obese men. Because of not showing direct influence of adiposity on the nutcracker phenomenon [18]. Shin et al investigated an inverse relationship between BMI and the peak velocity (PV) ratios of the left renal vein (aorta-mesenteric PV/ hilar PV, a diagnostic criterion of nutcracker phenomenon) among the male patients; however, they did not examine the presence of varicocele [19].

The visceral obesity has been proven to be involved in the pathogenesis of cardiovascular disease, type 2 diabetes and dyslipidemia and it seems to be more potentially harmful to endothelial function than obesity in general [20,21]. According to our results, not only the general obesity assessed by BMI has statistically inverse relationship with the severity of varicoceles, but also the visceral obesity assessed by WC and WHR were significantly inversely correlated with varicoceles. Our results suggest that increased visceral obesity prevents the nutcracker effect and then results in less severity of varicoceles.

One study by Rigano et al reported a positive correlation between the number of athletes with varicocele and the highest grade of varicocele in the adolescents [22]. Another study by Di Luigi et al also found a high incidence of varicocele in adult athletes. As the subjects of our study received high-volume and intensive physical training, a greater prevalence of varicoceles was observed compared with other study groups [23].

Not only the prevalence but also the severity of varicoceles showed significantly inverse correlation with obesity. The grade III varicoceles appeared in the young men with the least obesity according to all three anthropometric indexes. The explanation of Handel et al supported our results, which excluded the possibility of obesity induced decreased detection of varicoceles because of difficulty in palpation on physical examination. As to the above theory, which would not expect the prevalence of grade III varicoceles to decrease in more obese men on account of being easily detected, and would expect the prevalence of grade I to be less in obese men because it is easily missed [18]. More recently, a total of 1,050 young males attending the Navy Recruit Training Center were evaluated by Tsao et al. from their physical screening examinations to determine the relationship between varicocele and obesity. They also found that the prevalence and severity of varicocele were inversely correlated with obesity [24].

The patients included in this study were males presenting for infertility evaluation. The results of the current study may be interpreted in several ways. In those patients with a higher BMI it is plausible that there is a decreased nutcracker effect or compression of the left vein due to increased adipose tissue between the superior mesenteric artery and aorta. Another possible explanation is decreased detection of varicoceles in the overweight patient population due to difficulty in palpation on physical examination. In addition, obese patients have a lower prevalence of varicoceles detected by ultrasound. The lower prevalence is independent of physical examination and more likely due to another factor [25]. It is likely that large varicoceles would be easily detected even in obese patients and small varicoceles might be missed on physical examination.

The results of this study indicate that there is a decreasing prevalence of varicocele with increasing

BMI in the infertile population. This pattern is present regardless of varicocele grade, supporting the possibility that obesity results in a decreased nutcracker effect in which the adipose tissue prevents compression of the renal vein.

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