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Clinical Research

Does Varicocele Affect Testicular Arterial Blood Flow?

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ABSTRACT

Objective: To compare the changes of testicular blood supply in the control group and patient group with varicocele and normal sperm parameters.
Material and Method: 40 patients with left varicocele and 25 healthy controls were enrolled in the study. All participants were performed color Doppler sonography to assess testicular blood flow of the both right and left testes. Blood flow parameters were measured in testicular, capsular and intratesticular arteries. Semen parameters were also assessed in the participants of the patient group. Testicular blood flow parameters were compared between the two groups.
Results: Mean ages of the patients and controls were respectively, 24,92±4,34 and 23,42±4,42(p>0,05). In the left testes; only the resistive index values of testicular artery were significantly lower in the patients (p=0,02). In the right testes; the resistive and pulsatility index values of testicular artery were significantly lower in the patients (p=0,01; p=0,01).
Conclusion: Most of testicular blood flow parameters in the both testes were similar. These may be the result of the normal semen parameters of the patients. We suggest that testicular blood flow in patients with varicocele and normal sperm parameters should be investigated by further studies with long term follow up.

Key Words: *Testicular blood flow, Testicular hemodynamic, Varicocele, Color doppler ultrasound.*

ÖZET

Varikosel Testiküler Arteriyel Kan Akımını Etkiliyor mu?

Amaç: Normal sperm parametrelerine sahip sol varikolselli hastalar ile sağlıklı kontrol grubu arasındaki testiküler kan akımı değerlerini karşılaştırmaktır.
Gereç ve Yöntem: Çalışmaya sol varikoselli 40 hasta ve 25 sağlıklı gönüllü dahil edildi. Tüm katılımcıların her iki testislerindeki kan akımı renkli Doppler ultrason ile değerlendirildi. Testiküler kan akımları testiküler, kapsüler ve intratestiküler arterlerde ölçldü. Hasta grubunda ayrıca semen parametreleri de değerlendirildi. Her iki gruptaki testiküler kan akım değerleri istatistiksel olarak karşılaştırıldı.
Bulgular: Hasta ve kontrol grubunun ortalama yaşları sırası ile 24,92±4,34 ve 23,42±4,42 idi (p>0,05). Sol testiste sadece testiküler arterin rezistans indeksi hasta grubunda anlamlı olarak düşük bulundu (p=0,02). Sağ tetstiste ise testiküler arterin hem rezistans hem de pulsatil indeksleri hasta grubunda anlamlı olarak düşüktü (sırası ile p=0,01; p=0,01).
Sonuç: Her iki testisteki kan akım parametrelerinin çoğunluğunda fark çıkmaması hastaların normal semen parametrelerine sahip hastalar olmasından kaynaklanabilir. Anormal sperm parametrelerine sahip varikoselli hastalarda testiküler kan akımının değerlendirildiği uzun takip süreli ileri çalışmalar yapılmasını önermekteyiz**.**

Anahtar Kelimeler: *Testiküler kan akımı, Testiküler hemodinami, Varikosel, Renkli doppler ultrason.*

Varicocele is an abnormal dilatation of the veins of the pampiniform plexus within the spermatic cord which is popular for its negative impact on male infertility (1). Epidemiologic studies suggest that approximately 15% of all men in the general population have a clinical varicocele. In contrast, between 19-41% of men evaluated for infertility are found to have varicoceles (2). Interestingly, the rate of varicocele is increased in men with secondary infertility to approximately 81%, suggesting that varicoceles may cause a progressive decline in fertility potential (3).

The pathogenetic mechanism through which varicocele causes testicular dysfunction and subsequent alteration in spermatogenesis, is, however, not completely understood (4). Some researchers have hypothesized that impaired venous drainage causes an increase in venous stasis and a decrease in arterial blood flow, thus inducing hypoxia and deficiency in

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testicular microcirculation (5). Previous studies indicate that color Doppler sonography (CDS) is well established to illustrate macromicrovascularity and therefore perfusion of the testis (6). The arterial flow velocities (peak systolic velocity [PSV] and end diastolic velocity [EDV]) and the resistance indices against this flow (resistive index [RI] and pulsatility index [PI]) in the testis can be measured with this technique (7).

Some authors noticed that significant improvements occurred in testicular blood supply and sperm parameters after subinguinal (5) or microsurgical inguinal varicocelectomy (6). These improvements in both testicular blood supply and sperm parameters confirm the hypothesis that the association between varicocele and abnormal sperm parameters may depend on decreasing in testicular microcirculation. On the other hand, some authors showed that testicular blood flow decreased in infertile males with varicocele (8). These findings may be due to damage on testicular blood supply of varicocele, it occurs impaired sperm parameters in infertility. Testicular blood flow may not change in males with varicocele who have normal sperm parameters. The aim of this study was to compare the changes of testicular blood supply in the control group and patient group with varicocele and normal sperm parameters.

MATERIAL AND METHOD

Patients

The study comprised 40 consecutive males with clinical left varicocele who had presented the Urology clinic as outpatients, and 25 healthy controls. Among the patients, 10 (25.0%) had scrotal pain, 19 (47.5%) had infertility, and 11 (27.5%) had a mass in the scrotum. The mean ages of the varicocele and control group were respectively, 24.92±4.34 (range; 17-36) and 23.42±4.42 (range; 20-37) years ($p>0.05$). Examination for varicocele was performed in a warm room with the patient in the upright position with the aid of a Valsalva maneuver (9) by the same urologist (OU). Only patients with clinical left varicocele were included in the study. Bilateral varicocele, any scrotal pathology other than varicocele, history of varicocelectomy, and recurrent varicocele were exclusion criteria. Informed consent was obtained from all patients, and the study protocol was approved by the ethics committee of our institution.

Semen Analysis

Semen analysis was performed according to the standards of the World Health Organization (WHO 1999) in the patient group (10). For each patient 2 semen analyses were conducted at 15-day intervals (collected via masturbation following 3-day sexual abstinence); sperm count (number of sperm in milliliters), motile percentage, morphology percentage, and total motile sperm count (sperm count x ejaculate volume x motile percentage) were measured and their means were taken into evaluation.

Radiological Assessment

Blood flows of right and left testicular arterials and their capsular and intratesticular branches in all patients and controls were measured with CDS (GE Logic 3 Expert, Kyunggi- Do, Korea) by the same radiologist (S.T.). CDS measurements of the testicular arteries and their branches of the first 20 patients were performed twice in the same day, at 08:00–10:00am and 16:00–18:00pm. As no significant difference was found between the morning and afternoon measurements, the other CDS measurements in the patients and controls were performed at 16:00–18:00pm. CDS was performed using a 5–10-MHz multifrequency linear transducer before and after the Valsalva maneuver when the participants were in a supine position. The testicular artery was analyzed at the proximal end of the testis where it enters the testis; the capsular branch, at the periphery of the testis; and the intratesticular branch, in the parenchyma. PSV, EDV, RI, and PI were measured electronically in all 3 arteries using CDS.

Statistical Methods

Statistical analysis was performed with SPSS 16.0 (SPSS, Chicago, Illinois). The CDS parameters of testicular, capsular and intratesticular arteries in the patient and control group were compared using Independent Samples T test. A p value of <0.05 was considered statistically significant.

RESULTS

Among the patients, 23 (57.5%) had grade 2, and 17 (42.5%) had grade 3 varicocele. The mean semen parameters of the patients; sperm count (million/ml) was 32.23±18.32, motility (%) was 53.26±21.18, normal morphology (%) was 14.24±2.76 and total motile sperm count (million) was 56.12±46.29. The mean left internal spermatic vein diameter before and after Valsalva maneuverwere 3.32±0.71mm and 3.96±1.12mm, respectively. Among the left testicular blood flow parameters, only the mean of RI was significantly lower in the patient group ($p=0.02$). Among the right testicular blood flow parameters, the mean of RI and PI were significantly lower in the patient group (respectively, $p=0.01$; $p=0.01$). The values of testicular blood flow parameters are given in Table 1.

Table 1. Comparison of testicular blood flow parameters in the patient and control group.

			Patient group		Control group		P value
			Mean	SD	Mean	SD	
Left	Testicular artery	PSV	9,31	5,05	9,84	4,37	0,61
		EDV	3,01	1,60	2,82	1,23	0,57
		PI	1,34	0,42	1,50	0,37	0,19
		RI	**0,65**	**0,09**	**0,71**	**0,07**	**0,02***
	Capsular artery	PSV	11,56	5,50	10,25	2,57	0,29
		EDV	4,54	2,22	4,15	1,12	0,30
		PI	1,05	0,25	1,02	0,21	0,53
		RI	0,59	0,08	0,57	0,05	0,97
	Intra-testicular artery	PSV	6,38	2,63	7,32	3,39	0,22
		EDV	2,94	1,04	3,24	1,39	0,25
		PI	0,81	0,19	0,83	0,19	0,47
		RI	0,51	0,07	0,52	0,07	0,23
Right	Testicular artery	PSV	8,88	3,65	8,71	3,65	0,88
		EDV	2,86	1,08	2,39	0,94	0,12
		PI	**1,29**	**0,40**	**1,57**	**0,44**	**0,01***
		RI	**0,66**	**0,07**	**0,71**	**0,05**	**0,01***
	Capsular artery	PSV	10,28	4,37	10,52	4,25	0,77
		EDV	3,81	1,77	4,22	1,57	0,36
		PI	1,17	0,40	1,02	0,18	0,09
		RI	0,61	0,08	0,59	0,05	0,31
	Intra-testicular artery	PSV	7,36	2,94	5,94	1,89	0,05
		EDV	3,24	0,99	2,86	0,99	0,05
		PI	0,86	0,20	0,77	0,12	0,12
		RI	0,53	0,07	0,50	0,05	0,24

Abbreviations: EDV, end diastolic velocity; PI, pulsatility index; PSV, peak systolic velocity; RI, resistive index.
**p>0.05 was considered statistically significant.*

DISCUSSION

Functional analysis of testes contains the illustration of macrovascularity and microvascularity, which are indicators of tissue perfusion. The correlation with testicular function was proven by a considerable number of trials, and established the CDS's sensitivity. The RI of testicular artery varies at this level between 0.75 and 0.88. The RI of intratesticular artery varies between 0.45 and 0.67. Some authors suggest that a threshold of intratesticular RI of 0.6 should be considered because the RI is usually below this threshold in normal tissue (11). In our study, the RI values of testicular arteries in the left and right testis were significantly lower in the patients with varicocele than the controls. However, these RI values of testicular arteries in both testes of the patient and control group are below the recommended threshold for testicular artery. Also, although PSV and EDV are reliable indicators for testicular artery, RI and PI are not recommended for this artery (6). We also found that there were no statistically significant differences between the groups according to the other parameters. Consequently, the testicular blood supplies were found similar in the groups. These results may depend on our study group because the patients in the study had normal semen parameters.

Unsal et al. (12) published that the RI was an indicator of testicular microcirculation and was increased in case of clinical varicocele. They evaluated capsular and intratesticular branches of testicular artery in the patients with varicocele (n=15) and controls (n=34). The deficiencies of their study are absence of semen analysis and low number of patients in the study group. Although we measured the same parameters in these branches of testicular artery, none of these parameters were found different between the patient (n=40) and control (n=23) group. Previously, testicular artery blood flow was compared between the control group and varicocele group who had impaired sperm parameters. Tarhan et al. (7) published that testicular blood flow was found to be significantly decreased in men with varicocele, which may be a reflection of impaired microcirculation. Hassan et al. (8). similarly compared testicular blood supplies in the healthy and infertile males, but they did not evaluate semen analysis in the participants. Although these two studies showed that varicocele poorly effects testicular perfusion in infertile males, we found that varicocele does not have a decreasing effect on testicular blood supply in males who have normal sperm parameters. We think that when varicocele effects testicular blood flow, it may cause impaired sperm parameters or infertility. Low testicular blood flow in varicocele may be a predictive indicator for infertility.

Some researcher assessed effect on testicular blood flow of varicocelectomy. While Balci et al. (5) measured PSV, EDV, RI and PI in intratesticular artery Tarhan et al. (6) measured these parameters in testicular artery and its branches (capsular and intratesticular). Both studies noticed that testicular blood supply and sperm parameters significantly

increased in six months after varicocelectomy. They also found that there were some correlations between sperm and testicular blood flow parameters.

Previous studies showed that both testicular blood flow and sperm parameters decreased in infertile patients with varicocele and these parameters recovered after treatment of varicocele. We found that testicular blood flow did not impair in the patients with varicocele who had normal sperm parameters. We suggest that testicular blood flow parameters may be a predictive indicator for infertility. These parameters may use to decide therapy or follow up male with varicocele and normal sperm parameters. We suggest that testicular blood flow in patients with varicocele and normal sperm parameters should be investigated by further studies with long term follow up.

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