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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA

The effect of varicocele on the right testicular blood flow in patients with left varicocele

Sol varikoselli hastalarda varikoselin sağ testiküler kan akımı üzerine etkisi

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ABSTRACT

Objective: There are many theories about the mechanism how varicocele causes infertility. One of these theories is about the negative effect of varicocele on testicular blood flow. We aimed to compare the measurements of testicular blood flow in right and left testes in patients with left varicocele and normal right testes.

Methods: Forty-one patients with left varicocele were enrolled in the study. All participants were performed color Doppler sonography to assess testicular blood flow of the both testes. Blood flow parameters such as peak systolic velocity (PSV), end diastolic velocity (EDV), resistive index (RI), pulsatility index (PI) were measured in testicular, capsular and intratesticular arteries. Semen parameters were also assessed in the participants. Testicular blood flow parameters were compared between the two testes.

Results: Mean age of the patients was 25,95±5,27(16-37). The mean semen parameters of the patients; sperm count (million/ml) was 31.56±19.05, motility (%) was 51.21±22.27, normal morphology (%) was 12.75±2.97 and total motile sperm count (million/ml) was 54.92±47.46. There were no statistically significant differences between the testicular blood flow parameters of both testes which are PSV, EDV, RI and PI values in the testicular artery and its branches (capsular and intratesticular arteries) (p>0.05).

Conclusion: The fact that there were no differences between the blood flows in both testes may depend on the study group who had normal sperm parameters. We suggest that testicular blood flow may be evaluated in patients with left varicocele and impaired sperm parameters.

Key words; testicular blood flow, color Doppler ultrasound, varicocele

ÖZET

Amaç: Varikosel hastalarında görülen sperm parametre bozukluğu hakkında çok sayıda teori ileri sürülmüştür. Bu teorilerden biri de, testisin arteriyel kan akımındaki değişikliklerdir. Biz çalışmamızda; sol varikoseli ve normal sağ testisi olan hastaların sağ ve sol testislerindeki arteriyel kan akım değerlerini karşılaştırmayı amaçladık.

Yöntemler: Üroloji polikliniğine başvuran ve fizik muayenesinde sol varikosel saptanan 41 erkek çalışmaya alındı. Sağ ve sol testislerindeki kan akımını değerlendirmek için tüm hastalara renkli doopler ultrason yapıldı.Her iki testisteki testiküler, kapsüler ve intratestiküler arterlerdeki pik sistolik hız, end diyastolik hız, resisitive ve pulsatilite indeksleri ölçüldü. Semen parametreleri de ayrıca değerlendirildi. Her iki testisin kan akım değerleri karşılaştırıldı.

Bulgular: Çalışmaya katılan hastaların yaş ortalaması 25,95±5,27(16-37) idi. Tüm hastaların sperm parametre ortalamaları; ml'deki sayı(milyon) 31,56±19,05, hareket(%) 51,21±22,27, morfoloji(%) 12,75±2,97 ve total motil sperm sayısı 54,92±47,46 olarak belirlendi. Testiküler arter ile bu arterin testis içindeki dalları olan kapsüler ve parankimal arterlerin pik sistolik hızları, diastol sonu hızları, direnç ve pulsatilite indeksleri arasında her iki testis karşılaştırıldığında istatistiksel olarak anlamlı fark saptanmadı(p>0,05).

Sonuç: Sağ ve sol testiküler akım değerlerinde anlamlı bir farklılık saptanmaması, çalışmanın sperm parametreleri normal sınırlarda olan bir grupla yapılmasına bağlanabilir. Sperm parametreleri etkilenmiş başka bir sol varikoselli hasta grubuyla karşılaştırmalı olarak yapılacak yeni çalışmalara gereksinim duyulmaktadır.

Anahtar kelimeler: testiküler kan akımı, renkli Doppler ultrason, varikosel

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INTRODUCTION

The term varicocele was originally coined by British surgeon T.B. Curling in 1843 to describe the pathologic dilation of veins of the spermatic cord [1]. Although the incidence of varicocele in the general male population is approximately 15%, it is implicated as a factor in about one-third of infertile males [2]. The rate of varicocele is increased in men with secondary infertility to approximately 70%, suggesting that varicoceles may cause a progressive decline in fertility potential [3].

Numerous clinical studies have demonstrated an association between varicocele and testicular dysfunction; however, the pathophysiology of varicocele remains poorly understood [4]. Elevated testicular temperature caused by increased testicular blood flow, venous stasis secondary to increased venous pressure, reflux of adrenal/ renal metabolites, and hormonal imbalance have been proposed as factors, which may partly explain the impaired spermatogenesis[5]. There are three main anatomic explanations for the origins of varicoceles. The first theory emphasizes the fact that the drainage of the testicular veins differs between the right and left. While the right enters directly into the inferior vena cava at an oblique angle, the left joins the left renal vein at a right angle. This difference is thought to result in increased hydrostatic pressure on the left resulting in dilation of the pampiniform plexus. The second theory postulates that an absence of competent valves leads to varicoceles. The final theory suggests that compression of the renal vein between the aorta and superior mesenteric artery increases the hydrostatic pressure in the testicular vein via a "nutcracker" effect [6]. High hydrostatic pressure is exerted on the pampiniform plexus. When venous pressures exceed the arteriolar pressures in the testicular microcirculatory system, the same hypoxic effect on the testicular tissue occurs on both sides. This adverse effect is due to hydrostatic pressure and lack of proper drainage. The blood becomes stagnated and, as a consequence, oxygenated arteriolar blood cannot flow normally into the testis [7].

Clinically, varicoceles are graded as follows: grade 0, subclinical (nonpalpable); grade 1, palpable during Valsalva's maneuver; grade 2, palpable without Valsalva's maneuver; and grade 3, visible[8]. While physical examination is the gold standard for the diagnosis of clinical varicoceles, venography is the gold standard for the subclinical form; however, venography invasive, requires specialized equipment, and carries a risk of morbidity [9]. Color Doppler sonography (CDS) is a noninvasive diagnostic method for evaluating varicocele, measuring the size of the pampiniform plexus and blood flow parameters of the spermatic veins [10]. It was shown that if venous pressure alone increases as in varicocele condition, a reflex increase occurred in pre-capillary resistance with diminished testicular blood flow comprising the nutrient supply of the affected organ [11]. Our study aims to compare testicular arterial blood flows of normal right testes and left testes with varicocele using CDS.

METHODS

A total of 41 patients with clinical left varicocele who applied to the urology clinic with various scrotal complaints were included in the study. Among the patients, 7 (17%) had scrotal pain, 26 (63.5%) had infertility, and 8 (19.5%) had a mass in the scrotum. Patient ages ranged from 16 to 37 years (mean ± SD, 25.95 ± 5.27 years). Examination for varicocele was performed in a warm room with the patient in the upright position with the aid of a Valsalva maneuver [12] by one (OU) of the authors. Only patients with clinical unilateral left varicocele were included in the study. Bilateral varicocele, any scrotal pathology other than varicocele, history of varicocelectomy, and recurrent varicocele were exclusion criteria.

Two 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. Semen analysis was performed according to the standards of the World Health Organization [13]. Blood flows of right and left testicular arterials and right and left testicular volumes in all patients were measured with a Hewlett Packard Image Point ultrasound unit with a 5–10 MHz multifrequency linear transducer (GE Logic 3 Expert, Kyunggi- Do, Korea) by the same radiologist (S.T.). CDS measurements of the testicular arteries 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 CDS measurements in the remaining patients 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 patients 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 peak systolic velocity (PSV), end diastolic velocity (EDV), resistive index (RI) and pulsatility index (PI) were measured electronically in all 3 arteries using CDS. Informed consent was obtained from all patients, and the study protocol was approved by the ethics committee of our institution.

Statistical analysis was performed with SPSS 16.0 (SPSS, Chicago, Illinois). Student's t test was used for comparison between testicular arterial blood flows in both testes of the patients. A P value of <0.05 was considered statistically significant.

RESULTS

The mean age of all the patients was 25.95±5.27 (range; 16-37). Among the patients, 1 (2.4%) had grade 1, 21 (51.2%) had grade 2, and 19 (46.3%) had grade 3 varicocele. The mean semen parameters of the patients; sperm count (million/ml) was 31.56±19.05, motility (%) was 51.21±22.27, normal morphology (%) was 12.75±2.97 and total motile sperm count (million/ml) was 54.92±47.46.

Table 1. Semen parameters of the patients and comparison of testicular arterial blood flow parameters in both testes.

			n	Mean	SD	p
Age			41	25.95	5.27	-
Sperm parameters	Sperm count(million/ml)		41	31.56	19.05	-
	Motility (%)		41	51.21	22.27	-
	Normal Morphology (%)		41	12.75	2.97	-
	Total motile sperm count		41	54.92	47.46	-
Internal spermatic vein diameters	Before Valsalva maneuver		41	3.39	0.75	-
	After Valsalva maneuver		41	3.92	1.01	-
Testicular artery	PSV	Right	41	8.94	3.63	0.183
		Left	41	9.28	4.99	
	EDV	Right	41	2.88	1.07	0.400
		Left	41	3.00	1.59	
	PI	Right	41	1.29	0.40	0.930
		Left	41	1.34	0.42	
	RI	Right	41	0.66	0.11	0.274
		Left	41	0.65	0.12	
Parenchymal (Intratesticular) artery	PSV	Right	41	10.24	4.32	0.508
		Left	41	11.53	5.43	
	EDV	Right	41	3.80	1.75	0.228
		Left	41	4.54	2.20	
	PI	Right	41	1.17	0.40	0.069
		Left	41	1.05	0.25	
	RI	Right	41	0.61	0.11	0.824
		Left	41	0.59	0.13	
Capsular artery	PSV	Right	41	7.29	2.94	0.767
		Left	41	6.35	2.61	
	EDV	Right	41	3.21	1.00	0.531
		Left	41	2.93	1.03	
	PI	Right	41	0.86	0.19	0.412
		Left	41	0.81	0.20	
	RI	Right	41	0.53	0.11	0.937
		Left	41	0.51	0.12	

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

The mean left internal spermatic vein diameter before and after valsalva maneuver, were 3.39±0.75 and 3.92±1.01 respectively. Left and right testicular blood flow values are given in the Table 1. There were no statistically significant differences between the testicular blood flow parameters of both testes which are PSV, EDV, RI and PI values in the testicular artery and its branches (capsular and intratesticular arteries) ($p>0.05$).

DISCUSSION

The mainstay for diagnosis of varicocele is physical examination in a warm room. Ultrasonography, nuclear scintigraphy, thermography and venography have been used to confirm the presence of varicocele [4]. CDS is not invasive, does not take much time, and as demonstrated by a recent study its sensitivity (97%) and specificity (94%) are very close to those of venography [14]. Definitely, CDS becomes a method of first choice after clinical investigation in varicocele detection before and after the treatment [15]. The arterial flow velocities; PSV and EDV, and the resistance indices against this flow; RI and PI in the testis can be measured with this technique [16]. McClure et al[17] have defined a varicocele as being present if veins are present, with one of them being ≥ 3 mm in diameter at rest, or if there is an increase in venous diameter with the Valsalva maneuver. In our study similarly, the patients with left varicocele were diagnosed with physical examination and the diagnosis of varicocele was confirmed by demonstrating the dilatation in the internal spermatic veins using CDS (Table).

There are a few studies about testicular hemodynamic changes in varicocele in literature. However there were some differences between methods in these studies. Tarhan et al [4] evaluated only the left testicular artery in the patients with left varicocele and compared with healthy volunteers. They measured PSV, EDV, PI, RI values of testicular artery, and testicular artery blood flow. Testicular arterial blood flow was calculated from the equation

TABF = Vm x A where Vm is the mean velocity over the cardiac cycle and A is the cross-sectional area of the artery. They found that testicular arterial blood flow was significantly decreased in men with varicocele. We evaluated the same parameters in testicular artery except TABF as well. However, we found that there were no differences between left testes with varicocele and normal right testes according to PSV, EDV, PI, RI values of the testicular arteries. The results in our study depend on study group with normal sperm parameters. Negative effect on right testes of left testes with varicocele may be responsible for the results.

Unsal et al[18] measured PSV, EDV, PI and RI values of intratesticular and capsular arteries which are branches of testicular artery to assess testicular microcirculation. They found no statistically significant difference between the Doppler parameters obtained from the intratesticular branches of both testes and the capsular branches of the right testis. On the other hand, in left-sided clinical varicocele cases (n=15), the average RI and PI of capsular branches of the left testes were found significantly greater than in the control group. In our study, similarly, there were no differences between intratesticular arterial parameters in right and left testes. We also found that there were no differences between capsular arteries. This difference between the findings of the capsular arteries in two studies may be related to two causes. The first cause is the difference between the numbers of the patients with left varicocele in the studies. Although there were 41 patients in our study, there were only 15 patients in their study. The second cause is that there was no control group in our study. We compared left and right testes in the patients with left varicocele. The second cause seems to be the most important deficit in our study.

In conclusion, we found that there were no differences between testicular blood flows in normal right testes and left testes in the patients with left varicocele. We suggest that testicular blood flow in varicocele should be investigated by further studies which involve patient group with impaired sperm parameters and control group.

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