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Evaluation of Clinical, Laboratory and Doppler Ultrasonography Findings in Patients with Varicocele

Varikosel Hastalarında Klinik, Laboratuvar ve Doppler Ultrasonografi Bulgularının Değerlendirilmesi

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Abstract

Purpose: To evaluate the color Doppler ultrasonography findings, testicular volumes, sperm concentration-motility, hormone levels and resistivity-pulsatility index values of testicular arteries in clinically diagnosed varicocele cases with healthy males. **Materials and Methods:** This study was conducted on 100 case subjects with varicocele diagnosis made by physical examination and a healthy control group of 20 volunteers. After the physical examination of case subjects were done: gray scale-color Doppler ultrasonography, semen analysis and hormone analysis of the subjects were made and the results were evaluated. **Results:** It was found that color Doppler ultrasonography has an important role in detection of subclinical varicocele. For clinically diagnosed cases of varicocele, the results of color Doppler ultrasonography was similar to physical examination. It was detected that testicular volumes and sperm count-motility were decreased in the patient group ($p<0.05$). In majority of varicocele case subjects, the follicle-stimulating hormone and testosterone levels were found normal. No significant change was detected in the values of resistivity-pulsatility index in testicular arteries ($p>0.05$). **Conclusion:** In varicocele diagnosis, physical examination and color Doppler ultrasonography should be performed together. Particularly in subclinical varicocele diagnosis, color Doppler ultrasonography is useful. Adverse effect of varicocele on testicular volumes and spermatogenesis was detected.
Keywords: Varicocele, physical examination, color Doppler ultrasonography, testicular volume, semen analysis.

Özet

Amaç: Klinik olarak varikosel tanısı konulan olgularda ve sağlıklı erkeklerde: renkli Doppler ultrasonografi bulgularının, testis hacimlerinin, sperm yoğunluğu-hareketinin, hormon seviyelerinin ve rezistivite-pulsatilite index'lerinin değerlendirilmesi hedeflendi. **Yöntem:** Bu çalışmaya fizik muayene ile varikosel tanısı konulan 100 olgu ve kontrol grubu olarak 20 sağlıklı kişi dahil edildi. Olguların fizik muayenesi yapıldıktan sonra gri skala-Doppler ultrasonografi, semen ve hormon analizi tetkikleri değerlendirildi. **Bulgular:** Doppler ultrasonografinin, subklinik varikosel tanısında önemli yeri olduğu ve klinik olarak varikosel tanısı alan olgularda fizik muayene ile benzer tanısal etkinliği olduğu saptandı. Hasta grupta testis hacimlerinin ve sperm sayı-hareketinin azaldığı bulundu ($p<0.05$). Varikosel hastalarının çoğunluğunda Folikül-stimüle edici hormon ve Testosteron seviyeleri normal olarak bulundu. Testiküler arter rezistivite-pulsatilite index'lerinde anlamlı değişiklik saptanmadı ($p>0.05$). **Sonuç:** Varikosel tanısında fizik muayene ve renkli Doppler ultrasonografi birlikte uygulanmalıdır. Özellikle subklinik varikosel tanısında renkli Doppler ultrasonografi daha değerli bilgiler vermektedir. Testis hacimlerine ve spermatogeneze varikoselin olumsuz etkisi olmaktadır.
Anahtar Kelimeler: Varikosel, Fizik muayene, Renkli Doppler ultrasonografi, Testis hacmi, Semen analizi.

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Introduction

Varicocele is the dilatation and tortuosity in testicular veins and pampiniform plexus, where retrograde flow is accompanied. Though there is not a common idea about the etiology of varicocele, it is probably because of inadequacy or absence of venous valves and increase of pressure gradient between left renal vein and inferior vena cava. Varicocele is observed 90% at left and 10% bilateral. Clinically, palpable varicocele is observed in about 15% of all male population in the community (1). Varicocele is the most common treatable cause of male infertility (2). Presence of conflicting results related with the studies conducted on subjects of varicocele cases makes this topic worth to investigate.

Materials and Methods

This study was conducted at the Department of Radiology of Faculty of Medicine of Firat University between May 2009 and May 2010. The study covered 100 case subjects with clinically diagnosed varicocele, who were admitted to Urology outpatient clinic with complaints of infertility, scrotal pain and swelling and for whom color Doppler ultrasonography (CDUS) was requested after their clinical and laboratory assessments were done. Also, a healthy control group of 20 volunteers having no varicocele was formed. For the study, approval of the ethical board and signed consent of the case subjects were taken. After the patient group were undergone physical examination, their follicle-stimulating hormone (FSH) – testosterone levels were checked and semen analysis was performed. Dubin grading system was used in clinical diagnosis. Veins are not visible or palpable at rest or under Valsalva maneuver but detectable by Doppler ultrasonography is called subclinical varicocele. Physical examinations of all subjects and their CDUS examinations were made by one Urology specialist and one Radiology specialist, respectively.

CDUS examination was made by using LOGIQ 7 ultrasonography (US) device (General Electric, Yokogawa Medical System, Tokyo-Japan) with multi frequency 7 MHz linear transducer. Examination was made using gray scale, color mode and spectral analysis. The testicular volumes, diameters of their plexus pampiniform veins, intratesticular and capsular artery resistivity index (RI) and pulsatility index (PI) of case subjects were evaluated. Testicular volume measurement was calculated using the formula of AxBxCx0.523 (Figure 1). Pampiniform plexus in the posteroinferior vicinity of testicles were examined when subjects were at supine position. We used our grading system in our study, at least 2 separate tortuous and dilated veins, with a diameter more than 2 mm, were detected in favor of varicocele (Figure 2). It was interpreted as grade 1 varicocele when vein diameter was between 2 and 3 mm, as grade 2 when vein diameter was between 3 and 4 mm, and as grade 3 varicocele when vein diameter was above 4 mm. Spectral wave forms were obtained at the lowest PRF (pulse repetition frequency) causing no aliasing artefact, at the maximum gain causing no noise, at the lowest wall filter and at the smallest possible Doppler window. In spectral analysis, intratesticular and capsular artery (RI) and (PI) were evaluated (Figure 3, 4). For semen analysis of case subjects, spermatozoon count and sperm motility at 1 cc was selected as parameter. In the evaluation, values that are being used by World Health Organization were taken as criteria (for Sperm count >20 million/ml, sperm motility; slow and rapid forward moving sperm total count > 50%). Case subjects with varicocele were compared among themselves and with the control group. FSH and testosterone levels of 84 case subjects were checked. Hormone levels were grouped as low, normal and high according to the values of the central laboratory of Fırat University (normal values for FSH are 0,7-11,1 mIU; normal values for testosterone are 245-1600 ng/dl between the ages of 20-49 and 181-772 ng/dl above the age of 50).

The statistical package program for the Social Sciences was used for statistical evaluation (Statistical Package for the Social Sciences=SPSS 15.0 for Windows). Data was submitted as an average ± standard deviation. Mann-Whitney-U test was used for comparing the groups of two during statistical evaluation. In all analyses, the result $p<0.05$ was accepted statistically significant.

Results

The physical examinations of 100 patients who were admitted to Urology outpatient clinic with complaints of infertility, scrotal pain and swelling were made. All subjects were asked at least two semen analyses and 84 subjects were asked FSH-Testosterone analysis. Then, with gray scale US and CDUS, testicular vein diameter, RI-PI values in capsular and intratesticular artery and testicular volumes were calculated. Moreover, 20 healthy volunteers were examined as control group. A total

of 240 hemiscrotums (patient and control groups) were examined with CDUS and 2 hemiscrotums

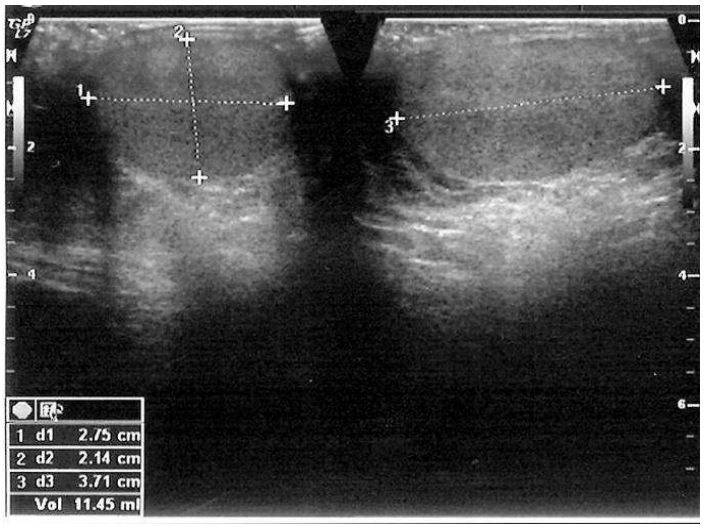

Figure 1. Sagittal and transverse gray scale ultrasound images demonstrate testicular volume measurement in a 44 year-old patient.

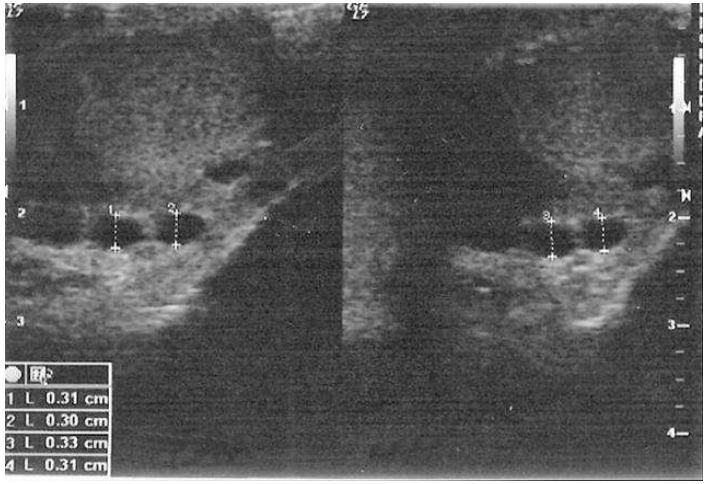

Figure 2. Grade 2 varicocele in a 45 year-old man. Transverse gray scale ultrasound image shows varicose pampiniform plexus veins in neutral position (left). No significant increase in diameter is monitored during the Valsalva maneuver (right).

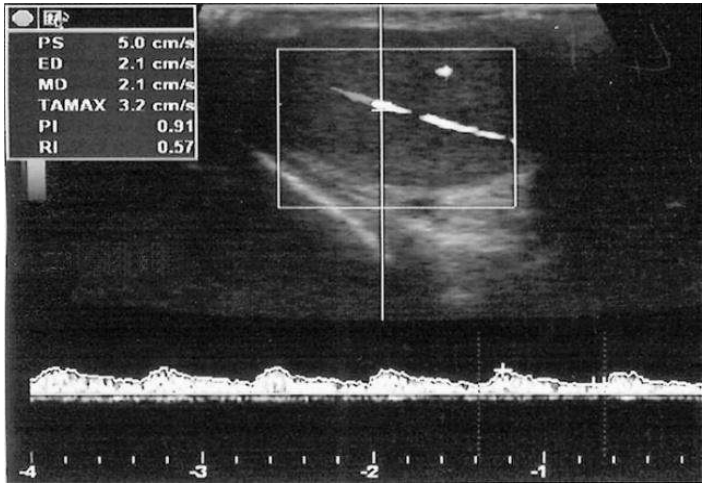

Figure 3. Transverse Doppler ultrasound image shows RI and PI measurement in intratesticular artery in a 32 year-old patient.

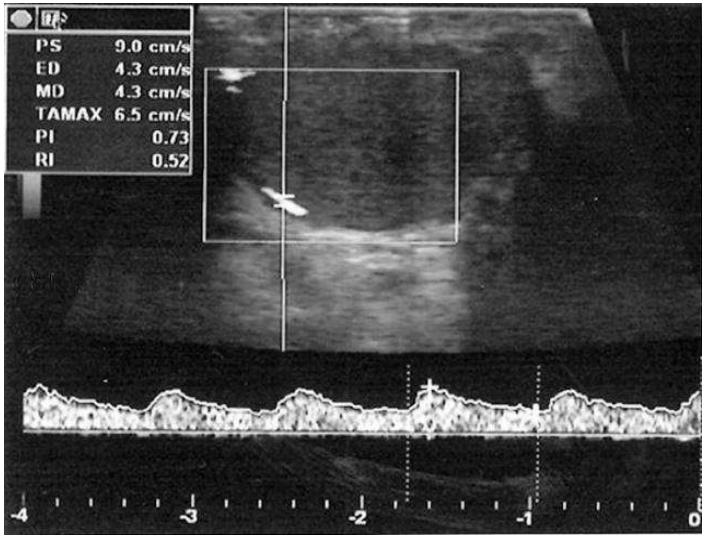

Figure 4. Transverse Doppler ultrasound image reveals RI and PI measurement in capsular artery in a 34 year-old patient.

Table 1. Comparison of testicular volumes

Case status	Right testicular volume (ml)	Left testicular volume (ml)
Grade 1 Varicocele	13 ± 5	11 ± 4
Grade 2 Varicocele	15 ± 3	14 ± 2
Control group	16 ± 4	14 ± 4

P<0.05 for Grade 1 Varicocele, p>0.05 for Grade 2 Varicocele

Table 2. Comparison of RI and PI values

Case status	Capsular artery		Intratesticular artery	
	RI	**PI**	**RI**	**PI**
Grade 1 Varicocele	0.59± 0.07	0.95± 0.19	0.58± 0.07	0.89± 0.17
Grade 2 Varicocele	0.58± 0.06	0.93± 0.19	0.59± 0.09	0.87± 0.14
Control group	0.59± 0.11	0.98± 0.29	0.61± 0.09	0.91± 0.26

RI: Resistivity Index, PI:Pulsatility Index, p>0.05 for Grade 1 and 2 Varicocele

were excluded due to traumatic atrophy. Among the control group, 40 hemiscrotums were evaluated as normal.

Physical examinations of 102 hemiscrotums were normal and CDUS were found normal in 31 of them. Thus subclinical varicocele was diagnosed in 71 hemiscrotums with CDUS. During the physical examination of 84 hemiscrotums, grade 1 varicocele was found. Through CDUS, grade 1 varicocele was found in 62 subjects, grade 2 varicocele was found in 18 subjects and grade 3 varicocele was found in 1 subject. During the physical examination of 12 hemiscrotums, grade 2 varicocele was found. During the CDUS, grade 2 varicocele was found in 10 subjects, and grade 1 varicocele was found in 2 subjects. According to these results, it was found that CDUS has an important role in diagnosis of subclinical varicocele. It was also revealed that both methods showed similar results. Additionally, the similarty of results were increased as the varicocele degree increased.

According to the statistical analysis between groups, a decrease in bilateral testicular volumes of the subjects with grade 1 varicocele was noted when compared with control group and a statistically significant difference was detected. Though decrease in bilateral testicular volumes of the subjects with grade 2 varicocele was noted when compared with control group, no statistically significant difference was detected (Table 1).

No significant difference was observed in intratesticular-capsular artery RI and PI values (Table 2).

A statistically significant decrease was noted in the sperm count – motility of the subjects with varicocele when compared with the control group and World Health Organization values. Evaluation of hormone values according to laboratory reference levels showed, FSH levels were found normal in 66 of 84 subjects and found high in 18. Testosterone levels were found normal in 78 of 84 subjects and found low in 6.

Discussion

Varicocele is defined as the abnormal tortuous and dilated pampiniform plexus veins (3). Although etiopathogenesis was not precisely understood, it is thought that it is due to multifactorial reasons (4). Pathology of venous valve system and the situations causing hydrostatic pressure increases are the most common reasons. After varicocele affects spermatogenesis, morphological disorder emerges with a decrease in count and motility. Varicocele is the most common treatable cause of infertility. It was observed in the patients, to whom varicocelectomy is applied, that semen quality was improved and pregnancy rates of their spouses

raised. Physical examination is the first diagnostic method for varicocele (2, 5). Physical examination with the patient standing in a warm room is currently the preferred method for varicocele diagnosis and has a sensitivity and specificity of around 70% compared with other diagnostic tools. The term clinical varicocele refers to those detectable by either visual inspection or palpation. The most widely used classification is the Dubin grading system: grade 1 varicocele is referred to palpable veins during Valsalva maneuver, grade 2 is palpable veins at rest and grade 3 is visible or palpable at rest. Varicocele cases which cannot be diagnosed by physical examination but can only be diagnosed with radiological methods is called subclinical varicocele. Detection of low degree varicocele is diffucult by physical examination. Subclinical varicocele has an important role in infertility and improvement in spermatogenesis was attained through treatment. Therefore, diagnosis of subclinical varicocele is as important as clinical varicocele (4-6).

The most valuable diagnostic method in varicocele diagnosis is venography. But, it is not being used as a routine technique because it is expensive and invasive, requires special equipment and increases morbidity. In addition, CDUS, Thermography, Scintigraphy and Magnetic Resonance Imaging (MRI) methods can be used in the diagnosis of varicocele. Among them CDUS is the easiest method, which is non-invasive, reliable and easy to apply (7). In the literature, there are different diagnostic criteria have been reported for US. Furthermore, during the studies conducted on the subjects with varicocele, conflicting results were obtained for testicular volume, FSH-Testosterone levels, sperm parameters and testicular artery RI-PI values.

The most widely used criterion for vein diameter in varicocele diagnosis is 2 mm. Gonda et al. reported 95% sensitivity for 2 mm limit value (8). In our study, at least 2 separate tortuous veins, with a diameter larger than 2 mm. were evaluated in favor of varicocele. Cina et al. showed that a reflux time up to 3 seconds and a reflux speed up to 10 cm/sec. could be observed in healthy males. They also found that there was no significant correlation between vein diameter and reflux. Therefore, they suggested not to use reflux speed and time as a precise varicocele criterion (9). In our study, we used vein diameter which is the most general criterion.

It was reported in the subjects with varicocele that abnormality in testicular arterial blood flow would be effective in the disorder of testicular functions. Tarhan et al. reported that testicular arterial blood volume decreased in subjects with varicocele, which could adversely affect spermatogenesis (10). Unsal et al. indicated that RI and PI values in capsular artery of subjects with varicocele increased when compared with healthy males, which would show the disorder of microcirculation in testicle. No difference was noted in their study at RI and PI values of intratesticular artery when compared with the control group (11). No significant difference was noted in our study at the RI and PI values of capsular and intratesticular artery between the patient and the control group.

Zini et al. reported that clinical and subclinical varicocele caused ipsilateral testicle hypotrophy (12). Kervancioglu et al. indicated that varicocele had no significant effect on bilateral testicular volumes (13). We found in our study that testicular volumes of subjects with varicocele decreased, compared with healthy people.

It was reported that spermatogenesis could be negatively affected in subjects with varicocele. It was also reported that varicocele increased infertility rate by 2-3 times. Different suggestions were made about the negative effect of varicocele on spermatogenesis. The most accepted mechanism is that varicocele increases blood flow and temperature in testicles, and this causes the disorder in spermatogenesis. It was found that all sperm parameters or only one parameter could be affected. In addition, it was found that sperm parameters could also be normal for subjects with varicocele. Different results were obtained at hormonal parameters, as well. There are studies showing that testosterone level is normal and low. Also, there are studies indicating that FSH level is high and normal (14, 15). In our study, decrease was noted in the sperm count of subjects with varicocele, when compared with the control group and World Health Organization values. FSH and Testosterone levels were found normal in majority of patients.

Consequently, detection of conflicting results during the studies conducted on subjects with varicocele makes this topic worth to investigate. CDUS is practical and low cost, thus it can be reliably used in the diagnosis of varicocele. Although different results were obtained during the studies conducted with CDUS, important progress was attained in the diagnosis of varicocele. Progress can be made in diagnosis and treatment of clinical and subclinical varicocele with the determination of standard criteria during the studies that will be conducted with larger series in the future.

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