Original Paper

Urologia Internationalis

Urol Int 2002;69:293–296
DOI: 10.1159/000066125

Received: October 22, 2001
Accepted: February 15, 2002

Diagnosis of Pediatric Varicoceles by Physical Examination and Ultrasonography and Measurement of the Testicular Volume

Using the Prader Orchidometer versus Ultrasonography

Selahittin Çayan[a] Erdem Akbay[a] Murat Bozlu[a] Erdal Doruk[a] Altan Yıldız[b] Deniz Acar[a] E. Arzu Kanık[c] Ercüment Ulusoy[a]

Departments of [a]Urology, [b]Radiology, and [c]Biostatistics, University of Mersin School of Medicine, Mersin, Turkey

Key Words
Varicocele, diagnosis · Prader orchidometer · Ultrasonography · Testis volume, varicocele

Abstract

Introduction: The differentiation of unilateral versus bilateral varicoceles and testicular volume measurements are important in determining the need for adolescent varicocele surgery and also in following patients after varicocelectomy. The aim of this study was to prospectively compare the findings of physical examination and color Doppler ultrasonography in the diagnosis of pediatric varicoceles and to compare the findings using the Prader orchidometer and scrotal ultrasonography in the measurement of testicular volumes. ***Patients and Methods:*** This study included 68 boys with varicoceles, ranging in age from 8 to 19 years. Varicoceles were diagnosed using both physical examination and scrotal color Doppler ultrasonography. The testicular volumes of 136 testicles were measured using the Prader orchidometer and scrotal ultrasonography. A difference of more than 10% or 2 ml in each testicular volume was considered significant. ***Results:*** The mean age of the boys was 13.5 ± 2.3 years. On physical examination, a left unilateral varicocele was diagnosed in 46 boys (67.6%). The other 22 boys (32.4%) had bilateral varicoceles. Color Doppler ultrasonography detected bilateral varicoceles in 4 of the 46 boys (8.7%) who were diagnosed by physical examination as having only left unilateral varicoceles (grade 3 in 3 patients and grade 2 in 1 patient). A different of more than 10% or 2 ml in testicular volume using the Prader orchidometer versus scrotal ultrasonography was detected in 3 out of 136 testicles (2.2%). The correlation between ultrasonography and Prader orchidometer results in the measurement of testicular volumes was statistically highly significantly consistent using the intraclass correlation test ($r = 0.997$ and $p < 0.001$ for the left testis; $r = 0.998$ and $p < 0.001$ for the right testis). ***Conclusions:*** Although the management of subclinical varicoceles remains controversial, these data show that color Doppler ultrasonography may be necessary in the diagnosis of bilateral varicoceles, especially in boys with high-grade left varicoceles. In contrast, scrotal ultrasonography, if considered the gold standard, did not show superiority over the Prader orchidometer in measuring testicular volumes.

This study was presented at the 96th Annual Meeting of the American Urological Association, Anaheim, Calif., USA, and at the 16th Congress of the European Association of Urology, Geneva, Switzerland.

KARGER

Fax + 41 61 306 12 34
E-Mail karger@karger.ch
www.karger.com

0042–1138/02/0694–0293$18.50/0

Accessible online at:
www.karger.com/uin

Selahittin Çayan, MD
Department of Urology, University of Mersin School of Medicine
Zeytinlibahçe Caddesi
TR–33070 Mersin (Turkey)
Fax +90 324 337 4332, E-Mail selcayan@mersin.edu.tr

Introduction

Although a varicocele is rarely seen in children, the prevalence is 7.8% at the age of 11–14 years and 14.1% at the age of 15–19 years [1]. Many investigators recommend that varicoceles should be treated early in adolescents, possibly because of the still developing testis [2–6]. A smaller testis volume on the affected side is observed in adolescents with a varicocele. This has been reported to occur in up to 50–75% of the teenagers with varicoceles [7–10]. It has also been reported that subfertile men with varicoceles had significantly smaller testes on the involved side than subfertile patients without varicoceles [11]. Our previous study [1] showed that varicocele-related testicular atrophy was seen in 7.3% of the children aged 11–14 years and in 9.3% of those aged 15–19 years, while this was not found in children under 11 years of age. These findings support that a varicocele is a progressive disease and that the incidence of varicocele and testicular atrophy increases with puberty. Therefore, the finding of unilateral versus bilateral varicoceles and testicular volume measurements are important in determining the need for adolescent varicocele surgery and also in following patients after varicocelectomy.

The aim of this prospective study was to compare the findings of physical examination and scrotal color Doppler ultrasonography (SCDU) in the diagnosis of pediatric varicoceles and to compare the orchidometer and SCDU results with respect to the testicular volumes.

Patients and Methods

This study included 68 boys with varicoceles, ranging in age from 8 to 19 years. Varicoceles were diagnosed using both physical examination and SCDU. All patients were examined in a warm room in the supine and upright positions with and without the Valsalva maneuver. Physical examination for varicoceles was performed according to an established grading system [12]. Varicoceles were classified as grade 1 (palpaple only during the Valsalva maneuver), grade 2 (palpable without the Valsalva maneuver), or grade 3 (visible without the need for palpation). The volumes of 136 testicles of 68 patients were measured using an ellipsoid Prader orchidometer (Accurate Surgical and Scientific Instruments, Westbury, N.Y., USA) [13]. If the testicular size discrepancy between the measurements with ultrasonography and Prader orchidometer was more than 2 ml or more than 10%, it was considered significant. Each boy was examined by two specialists, and the findings were confirmed.

Real-time SCDU was used to confirm the presence of a varicocele, to demonstrate a subclinical varicocele on either side, as well as to measure testicular volumes. Briefly, SCDU was performed by a single radiologist in all subjects using a model Sonoline Versa Plus apparatus with a 5-MHz transducer (Siemens, Munich, Germany), and a varicocele was considered to be present, if two or more veins could be identified, with at least 1 vein having a diameter of 2.0 mm or greater [14, 15]. A varicocele was also considered to be present by SCDU, if retrograde flow for at least 2 s was identified within the pampiniform plexus, spontaneously and/or during the Valsalva maneuver [15]. When a varicocele was detected by SCDU, the largest internal spermatic vein size was recorded. The testicular volume on ultrasonography was calculated by the formula: volume = length × width × anteroposterior diameter × 0.53 [16, 17].

Other scrotal pathologies were excluded after performing a detailed history, physical examination, and further diagnostic modalities.

Statistical analysis was performed using the intraclass correlation test to compare testicular volumes measured by ultrasonography and by Prader orchidometer [18]. $p < 0.05$ was considered to be statistically significant. The values are presented as mean ± SD.

Results

The mean age of the boys was 13.5 ± 2.3 years. On physical examiation, a left unilateral varicocele was diagnosed in 46 of the boys (67.6%). Of these, 9 (19.6%) had a grade 1 varicocele, 24 (52.1%) had a grade 2 varicocele, and 13 (28.3%) had a grade 3 varicocele. The other 22 boys (32.4%) had bilateral varicoceles. Of these, 10 (45.5%) were grade 2, and 12 (54.5%) were grade 3 on the left side; 13 (59%) were grade 1, 5 (22.8%) were grade 2, and 4 (18.2%) were grade 3 on the right side. On SCDU, all subjects had reflux into the internal spermatic vein. The mean diameter of the largest internal spermatic vein, detected by SCDU, was 3.21 ± 1.29 (range 2.1–8) mm on the left side and 2.41 ± 0.47 (range 2–3.5) mm on the right side in the patients with bilateral varicoceles and 2.76 ± 1.07 (range 2.1–8) mm on the left side and 1.64 ± 0.48 (range 1.1–2) mm on the right side in those with a left unilateral varicocele.

All left varicoceles detected by physical examination were confirmed by SCDU. In addition, SCDU detected bilateral varicoceles in 4 of the 46 boys (8.7%) who were diagnosed by physical examination as having only left unilateral varicoceles (grade 3 in 3 patients and grade 2 in 1 patient).

A difference of more than 10% or 2 ml in testicular volume using the Prader orchidometer versus scrotal ultrasonography was detected in 3 out of 136 testicles (2.2%). As shown in figure 1, the testicular volumes measured by SCDU and Prader orchidometry were statistically highly significantly consistent using the intraclass correlation test ($r = 0.997$ and $p < 0.001$ for the left testis; $r = 0.998$ and $p < 0.001$ for the right testis). This correlation remained consistent, regardless of the ages or testicular volumes on both sides of the subjects.

Discussion

While the prevalence of varicoceles is 0–1% in the prepubertal period and 2–20.5% in adolescence [1, 8, 19], it has been shown that the prevalence is 11.7% in the general male population and 25.4% in infertile men [20, 21]. In our previous study [1], the prevalence increased significantly after the age of 13 years. According to the grading system used, varicoceles are grade 1 in the majority of adolescents, while grade 2 or 3 was found in 35% of them [7].

Varicoceles are seen more commonly on the left side than on the right. The incidence of bilateral varicoceles is 0–1% in healthy young men, but this proportion is ranging between 15 and 20% in infertile men [22]. In the present study, there were 22 boys (32.4%) with bilateral palpable varicoceles; this incidence was much higher than that reported in the literature [1, 23]. However, this was the actual finding in this unselected group. In the literature, the incidence of bilateral varicoceles in the pediatric and in the adolescent population has not been reported as yet. Many papers only mention the treatment of left varicoceles or do not mention the percentage of side localization. Today, using venography and SCDU more frequently and with the definition of subclinical varicoceles in the adult population, this proportion has reached $\leq 50\%$ [24, 25]. In the present study, SCDU detected bilateral varicoceles in 8.7% of the boys who had only left varicoceles on physical examination. These boys had high-grade left varicoceles on physical examination. Although studies have addressed the success of subclinical varicocele ligation in infertile men, no consensus has been reached on the need to diagnose or treat these lesions [26]. If boys with high-grade palpable left varicoceles have abnormal semen parameters, SCDU may be necessary in diagnosing bilateral varicoceles to consider bilateral varicocele repair.

The general consensus is that patients with testicular volume loss, a large palpable varicocele, or with symptoms should be treated, but whether otherwise healthy children should undergo surgery when the outcome is not certain is still a very important question.

Lipshultz and Corriere [11] first reported testicular atrophy secondary to varicoceles. These authors showed that the frequency increased with age and that it stopped with early treatment. Later, Lyon et al. [8] reported progressive testicular volume loss in 10% of the adolescents with varicoceles and in 20% of the adult patients. In our previous study [1], at less than 10 years of age, no testicular atrophy secondary to a varicocele was detected, while the incidence was 7.2% at the ages 11–14 years and 9.3% at the ages 15–19 years. All these findings support the concept that the frequency of testicular atrophy increases with age.

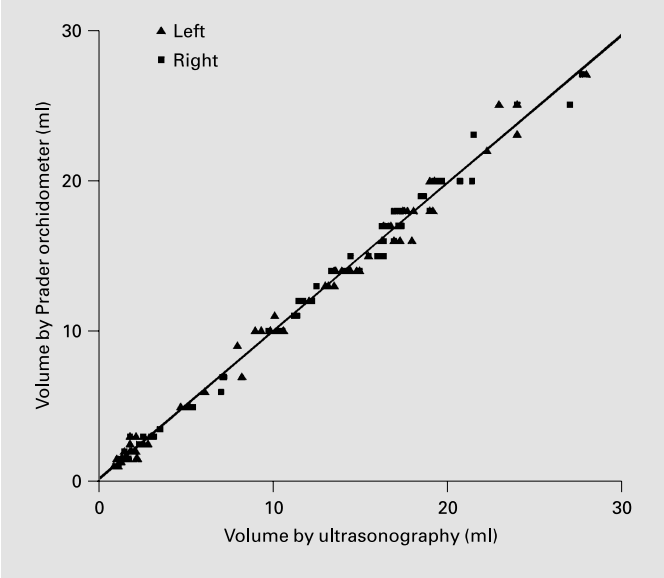

Fig. 1. Testicular volume measurements using SCDU and the Prader orchidometer. Note that the correlation was statistically highly significantly consistent using the intraclass correlation test ($r = 0.997$ and $p < 0.001$ for the left testes; $r = 0.998$ and $p < 0.001$ for the right testes).

Following varicocelectomy, a testicular volume increase has been reported in adolescents who have a testicular volume difference or atrophy [5, 6]. Therefore, in addition to semen analysis and determination of serum reproductive hormones, testicular volume measurement is important to assess the clinical significance of a varicocele and the need for varicocele surgery. Testicular volumes have traditionally been clinically determined using orchidometers [13, 27]. More recently, scrotal ultrasonography has been used in testicular measurement [28–30]. In the literature, there are some discrepancies between orchidometer and ultrasonography results reported with regard to testicular volumes. Rivkees et al. [28] concluded that the measurement of the testicular volume was not accurate and reproducible. Diamond et al. [29] reported a strong linear relationship between volume measurements using orchidometer and ultrasonography. To detect a defined volume differential as determined by ultrasonography, the orchidometer sensitivity was weak, whereas its specificity was better. In their study, there was also a strong correlation with regard to the orchidometer results between urology nurse and attending urologist. However,

these authors concluded that although the orchidometer remains valuable in assessing the size of the individual testis, it was too insensitive to volume differentials relative to ultrasound to be used routinely to determine growth impairment. Chipkevitch et al. [30] reported a comparison between the Prader and Rochester orchidometers and ultrasonography to measure testicular volumes. Using ultrasonography as the gold standard, they found each orchidometer to be equally reliable. Sayfan et al. [4] suggested that a 20–25% volume differential is significant in children with a varicocele. In the present study, a difference of more than 10% or 2 ml in testicular volume using the Prader orchidometer versus scrotal ultrasonography was detected in 3 out of 136 testicles (2.2%). The testicular volumes measured using ultrasonography and Prader orchidometry were statistically highly significantly consistent. This correlation remained consistent regardless of the ages or testicular volumes on both sides of the subjects.

Although the management of subclinical varicoceles remains controversial, these data show that SCDU may be necessary in the diagnosis of bilateral varicoceles, especially in boys with high-grade left-sided varicoceles. This information may also be helpful in counseling patients and their families who consider varicocele treatment. In contrast, SCDU, if considered the gold standard, did not show superiority over the Prader orchidometer in measuring testicular volumes.

References

1 Akbay E, Cayan S, Doruk E, et al: The prevalence of varicocele and varicocele-related testicular atrophy in Turkish children and adolescents. BJU Int 2000;86:490–493.
2 Lenzi A, Gandini L, Bagolan P, et al: Sperm parameters after early left varicocele treatment. Fertil Steril 1998;69:347–349.
3 Lund L, Tang YC, Roebuck D, et al: Testicular catch-up growth after varicocele correction in adolescents. Pediatr Surg Int 1999;15:234–237.
4 Sayfan J, Siplovich L, Koltun L, et al: Varicocele treatment in pubertal boys prevents testicular growth arrest. J Urol 1997;157:1456–1457.
5 Laven JS, Haans LC, Mali WP, et al: Effects of varicocele treatment in adolescents: A randomized study. Fertil Steril 1992;58:756–762.
6 Lemack GE, Uzzo RG, Schlegel PN, et al: Microsurgical repair of the adolescent varicocele. J Urol 1998;160:179–181.
7 Steeno O, Knops J, Declerck L, et al: Prevention of fertility disorders by detection and treatment of varicocele at school and college age. Andrologia 1976;8:47–53.
8 Lyon RP, Marshall S, Scott MP: Varicocele in childhood and adolescence: Implication in adulthood infertility? Urology 1982;19:641–644.
9 Pozza D, Gregori A, Ossanna P, et al: Is it useful to operate on adolescent patients affected by left varicocele? J Androl 1994;15(suppl):43–46.
10 Okuyama A, Nakamura M, Namiki M, et al: Surgical repair of varicocele at puberty: Preventive treatment for fertility improvement. J Urol 1988;139:562–564.
11 Lipshultz LI, Corriere JN Jr: Progressive testicular atrophy in the varicocele patient. J Urol 1977;117:175–176.
12 Dubin L, Amelar RD: Varicocele size and results of varicocelectomy in selected subfertile men with varicocele. Fertil Steril 1970;21:606–619.
13 Prader A: Testicular size: Assessment and clinical importance. Triangle 1966;7:240–243.
14 Jarow JP, Ogle SR, Eskew LA: Seminal improvement following repair of ultrasound detected subclinical varicoceles. J Urol 1996;155:1287–1290.
15 Meacham RB, Townsend RR, Rademacher D, et al: The incidence of varicoceles in the general population when evaluated by physical examination, gray scale sonography and color Doppler sonography. J Urol 1994;151:1535–1538.
16 Behre HM, Nashan D, Nieschlag E: Objective measurement of testicular volume by ultrasonography: Evaluation of the technique and comparison with orchidometer estimates. Int J Androl 1989;12:395–403.
17 Fuse H, Takahara M, Ishii H, et al: Measurement of testicular volume by ultrasonography. Int J Androl 1990;13:267–272.
18 Zar JH: Simple linear correlation; in Zar JH (ed): Biostatistical Analysis, ed 4. Englewood Cliffs, Prentice-Hall, 1999, p 404.
19 Oster J: Varicocele in children and adolescents: An investigation of the incidence among Danish school children. Scand J Urol Nephrol 1971;5:27–32.
20 Madgar I, Weissenberg R, Lunenfeld B, et al: Controlled trial of high spermatic vein ligation for varicocele in infertile men. Fertil Steril 1995;63:120–124.
21 Nieschlag E, Hertle L, Fischedick A, et al: Treatment of varicocele: Counselling as effective as occlusion of the vena spermatica. Hum Reprod 1995;10:347–353.
22 Greenberg SH, Lipshultz LI, Wein AJ: Experience with 425 subfertile male patients. J Urol 1978;119:507–510.
23 Dubin L, Amelar D: Varicocele. Urol Clin North Am 1978;5:563–572.
24 World Health Organization: Comparison among different methods for the diagnosis of varicocele. Fertil Steril 1985;43:575–579.
25 Eskew LA, Watson NE, Wolfman N, et al: Ultrasonographic diagnosis of varicoceles. Fertil Steril 1993;60:693–697.
26 Marsman JW, Schats R: The subclinical varicocele debate. Hum Reprod 1994;9:1–8.
27 Takihara H, Sakatoku J, Fujii M, et al: Significance of testicular size measurements in andrology. I. A new orchidometer and its clinical application. Fertil Steril 1983;39:836–840.
28 Rivkees SA, Hall DA, Boepple PA, et al: Accuracy and reproducibility of clinical measures of testicular volume. J Pediatr 1987;110:914–917.
29 Diamond DA, Paltiel HJ, Dicanzio J, et al: Comparative assessment of pediatric testicular volume: Orchidometer versus ultrasound. J Urol 2000;164:1111–1114.
30 Chipkevitch E, Nishimura RT, Tu DG, et al: Clinical measurement of testicular volume in adolescents: Comparison of the reliability of 5 methods. J Urol 1996;156:2050–2053.