ORIGINAL ARTICLE

Study of Testicular Geometry and Resistivity Indices Before and After Hydrocelectomy in Unilateral Idiopathic Hydrocele

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Abstract

Background: Idiopathic Hydrocele is the most prevalent cause of benign painless scrotal swelling in adult male, associated discomfort; cosmetic appearance and patients wish are the only designation for surgery. But little is kenned about its effect on testis, intratesticular blood flow and spermatogenesis. *Aim and Objectives:* The purpose of this study was to determine whether hydrocele has any effect on the testicular volume and vascular resistance. *Material and Methods:* In this prospective observational study Twenty-four patient with a mean age of 39.4 years who had a unilateral idiopathic hydrocele and underwent unilateral hydrocelectomy were included. Scrotal gray -scale sonography and colour Doppler scan were done in all patients to determine Testicular size, Resistive (RI) and Pulsatility Indexes (PI) of the intratesticular arteries on the involved and uninvolved sides before and after hydrocelectomy. *Results:* As compared to the normal side ($p = 0.777$), the difference in the Testicular volume before and after surgery on the side of hydrocelectomy was statistically significant (24.69% decrease) ($p < 0.01$). The mean decrease in RI (21.27 %) and PI (41.82 %) values of intratesticular arteries on the affected side after hydrocelectomy were statistically significant ($p < 0.01$), while no statistically significant difference in RI and PI values were detected on the normal side ($p = 0.964$ for RI, $p = 0.499$ for PI). *Conclusion:* Idiopathic hydrocele causes impedance to venous and lymphatic outflow due to increased hydrostatic pressure leading to increased vascular resistance and testicular volume.

Keywords: Testicular Volume, Resistive Index, Pulsatility Index, Idiopathic Hydrocele, colour Doppler scan

Introduction:

Hydrocele, first defined in the 15th century by Ambroise Paré, is an abnormal benign collection of serous fluid between the parietal and visceral layers of the tunica vaginalis [1]. It is the most common abnormal fluid accumulation within the scrotum [2] and most common cause of painless scrotal swelling [3, 4]. The congenital type of hydrocele results from the patency of the processus vaginalis testis, whereas most of the acquired causes of hydrocele are idiopathic [5]. The exact mechanism of idiopathic hydrocele formation is not known. Factors such as increased serous fluid secretion, lack of efferent lymphatics, and inadequate reabsorption of fluid secreted by the mesothelium are possible explanations [5]. The first description of scrotal ultrasonography was published by Musken and Bain in 1874-75 by using static B-mode scanning. Until then examination of scrotal contents was limited to palpation and trans-illumination. The effect of a hydrocele on the gonads has not been studied widely. Only a few studies have suggested that hydrocele may be associated with infertility by interfering with spermatogenesis [6-9]. Hence we

designed a prospective observational study in which patients with a unilateral idiopathic hydrocele were examined on gray-scale, colour, and spectral Doppler sonography before and after hydrocelectomy and the association between the idiopathic hydrocele, testicular size and blood flow analyzed.

Material and Methods:

This was a prospective observational study carried out at Acharya Vinoba Bhave Hospital in which consecutive 24 adult patients with the diagnosis of unilateral idiopathic hydrocele who underwent hydrocelectomy were included in the study from 1st February 2015- 1st September 2015. In this study, group 1 (study group) consisted of the testes of the patients on the side of the hydrocele, whereas the testes on their contra-lateral side were included in group 2 (control group). No underlying cause for the hydrocele was found in any of the patients. Written informed consent was obtained from all patients before the sonographic examinations and surgery. Patients with secondary hydrocele were excluded from the study. The examination protocol included pre- and postoperative evaluations of both testes by scrotal gray-scale sonography and colour Doppler scan. All examinations were performed by the same examiner with a high-resolution sonography system (Aloka Prosound Alfa 7, aloka) using a 7.5-12.5 MHz linear array transducers. Hydro-celes were evaluated for the internal septations and loculations to determine whether it was complicated and length, width, antero-posterior diameter of both testes were measured. Approximate volume for ellipsoid structures was calculated by multiplying these three diameters by 0.523 [10]. The parameters of Colour Doppler sonography were optimized to display low-flow velocities for evaluating intratesticular blood flow and low-velocity diastolic arterial flow on both the normal and the side with hydrocele. Spectral waveforms were obtained from at least three different intratesticular arteries. Resistivity Index (RI) and Pulsatility Index (PI) values were determined from these wave forms. To avoid any effect of early postoperative changes (edema, hyperemia, or inflammation) on Resistive index and Pulsatility index values, we performed the sonographic examinations at least 1 month after the hydrocelectomy.

Statistical Analysis:

The program SPSS (version 19) was used for statistical analysis. Testicular Volumes and RI and PI values for the normal and the side with hydrocele were compared before and after surgery. The Student's *t* test for paired samples was used for statistical analysis. Statistical significance was indicated by a *p* value of less than 0.05.

Results:

In our study mean age of patient was 39.4±10.7 years (21-58year). Left sided testis involved more commonly than right testis (62.5% vs. 37.5%). The mean volume of hydroceles was 147.4 ± 49.9 ml at surgery. The mean values, SDs for the volume, RI and PI values, and percentage of differences in measurements before and after hydrocelectomy are summarized in Table-1. Before surgery, a statistically significant difference was found between the testicular volume, RI and PI values between the normal and the side with hydrocele ($p < 0.001$).

Table 1: Volume, Resistive Index, and Pulsatility Index Values Preoperative and Postoperative and Percentage of Difference

Normal			Hydrocele			Percent of Difference Preoperatively
Pre Operative	Post Operative	Percent Change	Pre Operative	Post Operative	Percent Change	
Volume						
15.29± 3.98	14.98 ± 3.61	-2.027 %	21.95± 5.15	16.53 ±4.18	-24.69 % *	43.558 % *
Resistive Index						
0.553 ± 0.1	0.552 ± 0.09	-0.181 %	0.738 ± 0.74	0.581 ± 0.11	-21.27 % *	33.454 %*
Pulsatility Index						
1.177 ± 0.4	1.105 ± 0.32	-6.117 %	1.657 ± 0.53	0.964 ± 0.15	-41.82 %*	40.782 %*

**Indicate Statistical Significance ($p < 0.01$)*

After hydrocelectomy as compared to normal side ($p = 0.777$), the difference in the testicular volumes before and after surgery on the side of hydrocele was statistically significant ($p < 0.01$). The side with the hydrocele showed a statistically significant decrease in RI and PI values of intratesticular arteries after hydrocelectomy ($p < 0.01$). Similar statistically significant difference in RI and PI values were not detected on the normal side ($p = 0.964$ for RI, $p = 0.499$ for PI)

Discussion:

Hydrocele is regarded as the most common cause of non acute painless scrotum swelling [4]and also a cause of physical, psychosocial and economic distress. Large hydroceles cause pulling and dragging sensation [11] and interfere with daily activity and can even cause difficulty in sexual intercourse [12]. As many of the hydroceles can readily be diagnosed by history and clinical examination, sonography can only do to rule out testicular malignancy [13] rather than to show any impact on testicular parenchymal integrity. A few studies reported that hydrocele is connected with diminished or capture of spermatogenesis [6-9, 14]. The most plausible pathophysiologic mechanism may be direct pressure effect of fluid over parenchyma hampering vascular supply as hydrostatic pressure associated with hydrocele, which has been shown to surpass the pressure of blood vessels within the scrotum, has a key role in the ischemia secondary to the vascular impairment and malfunction of spermatogenesis [8, 15]. Other conceivable system could be the response of testicular cells to the profoundly proteinaceous liquid, interstitial fibrosis, thickening of the basement membrane, and disorganization of spermatogenic cells [6-9].

In our study we analyzed effect of hydrocele on testicular geometry using sonography; there was a statistically significant increase in testicular volume on the affected side compared with that on the uninvolved side (43.55%, $p<0.01$). After hydrocelectomy, the mean volume of the testis on the side with hydrocele was measured as 16.53±4.18 mL. When compared with preoperative values, the postoperative measurements showed a statistically significant decrease ($p < 0.001$) of approximately 24.69 %. Similarly in the study by Mihmanli *et al* [16], it has been reported that testicular volume values on the involved side are significantly higher than those on the uninvolved side. Furthermore, they have noted that the postoperative values are significantly lower than the preoperative values. On the contrary Turgut *et al* [17] have shown no change in testicular volume on involved and normal side which could be explained due to small size of hydrocele in their study supporting the hypothesis that testicular changes depend on duration, and size of hydrocele [8,14]. The distinction in volume can be clarified by the same pathophysiological systems that were specified before [6-8, 15]. We believe that the pressure of the hydrocele fluid imposes a resistance in the testicular vessels, in this manner making stasis in the venous and lymphatic outflow. This stasis is thus reflected as swelling and an increment in the testis' measurements. One of the objectives of our study was to illustrate the impact of hydrocele on testicular blood flow by the determination of testicular RIs during spectral Doppler analysis. The spectral wave form of the intratesticular arteries characteristically has a low-resistance pattern, with a mean RI value of 0.62 (range, 0.48–0.75) [18]. In our study, a low resistance flow inside intratesticular arteries has been seen pre- and postoperatively on the normal side (percentage of change, 0.18%). As opposed to that finding, a high-resistance flow is present preoperatively in the testis with the hydrocele; however the postoperative flow demonstrates a low resistance after the elimination of the pressure effect. The mean percentages of postoperative decrease in the RI and PI values have been approximately 33.45% and 40.78%, respectively. In parallel to the theories proposed by Mihmanli *et al* [16] and Nye and Prati [2], we believe that the increment could be clarified by two conceivable components. One could be the obstruction of the venous or lymphatic outflow tract caused by the pressure effect of the hydrocele, which in turn may increase the vascular resistance. The other conceivable mechanism could be histopathologic changes in the testes such as interstitial fibrosis, thickening of the basement membrane, might cause an increase in vascular resistance by decreasing the compliance as a result of fibrosis. The present indications for treating a hydrocele were the cosmetic appearance, difficulties in daily activity or emotional discomfort due to the size of the hydrocele, and patients' wish [12, 13, 19].

In conclusion, an idiopathic hydrocele is associated with an incremented testicular volume and vascular resistance and there is desideratum for development of grading system predicated on alterations in the testicular size, morphologic characteristics, and parenchymal integrity on the affected size. Ultrasonographic evaluation of the amount of the hydrocele before surgery, and quantification of the incremented testicular vascular resistance due to hydrocele, should be developed to enable opportune decisions about therapeutic options.

Limitation of study:

1. It is important to note that, as sample size is small and the study is not powered enough to detect statistically significant differences and therefore the possibility of Type II errors (i.e. not detecting important differences) exists.
2. Additionally, the flow within the intra-testicular arteries is technically difficult to measure because they often had very little flow, and are more prone to artifact, addition of measurement of flow within subcapsular artery would be more appropriate to examine as a measure of testicular vascularization.

Conclusion:

There is positive association between hydrocele and increase in testicular volume and vascular resistance. The decrease in testicular volume, RI and PI indices after surgery in our study is due to elimination of pressure effect of fluid leading to improved vascular flow.

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