

# THE EFFECT OF VARICOCELECTOMY ON TESTICULAR VOLUME IN INFERTILE PATIENTS WITH VARICOCELES

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## ABSTRACT

The presence of a varicocele has been associated with decrease in testicular volume both in adult and pediatric patients. However, a study on the effect of varicocelectomy on testicular volume in the adult varicocele patient has never been reported. We determined the testicular volume before and after varicocelectomy in 52 patients with varicocele. A significant increase in testicular volume with the right side showing a greater increase was observed ( $p < 0.05$ ). No greater increase in testicular volume was noted among the patients who achieved a pregnancy with their spouses. In addition, the age of the patient did not correlate with the observed change in testicular volume. These results suggest that varicocele is clearly related to decreased testicular volume and that varicocelectomy can increase bilateral testis volume resulting in improved testicular function.

Key Words: Varicocele, Testis volume, Infertility

## INTRODUCTION

Celsus noted in the 1st century A.D. that in patients with varicoceles, the veins are swollen and twisted over the testicle, which becomes smaller than its fellow. Numerous investigators have supported the concept that the presence of a varicocele can have a detrimental effect on fertility.<sup>1-3)</sup> These claims have been based on the fact that approximately 40% of the patients being evaluated for infertility have a varicocele compared with 15% of the normal population.<sup>4,5)</sup> In the patients with varicoceles, repair of the varicocele has produced significant increases in ipsilateral testicular volumes.<sup>6)</sup> However, to our best knowledge, a study determining the effect of varicocelectomy on the bilateral testicular size has never been reported.

It is generally agreed that testicular volume correlates well with semen quality and fertility, since the seminiferous tubules and germinal cells account for approximately 98% of the testicular mass. The purpose of this study was to determine testicular size in the patients with varicocele and the effect of varicocelectomy on bilateral testicular volume.

## MATERIALS AND METHODS

A total of 52 men with varicoceles who complained of infertility were entered into the study. All patients had clinically palpable varicoceles and semen analyses showing oligozoospermia with reduced sperm motility and increased abnormal morphology. The mean patient age was

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33.5 years (range of 23 to 42 years), and the mean infertility duration was 3.2 years (range of 1 to 8 years).

Testicular volumes in all patients were examined by a single urologist using a punched-out orchimeter. The orchimeter used offers accurate volumes based on previous water displacement studies of testes after orchiectomy.<sup>7)</sup> Measurements were reproducible to within 2 ml.<sup>7)</sup> Varicocelectomy was performed using a high retroperitoneal ligation technique. Approximately one year after varicocelectomy, testicular volumes were again examined by the same urologist without knowledge of the preoperative volumes. Three semen analyses were performed on all patients preoperatively and at 3-month intervals beginning approximately three months postoperatively. A record of all pregnancies was kept. All the values were expressed as Mean  $\pm$  S.D. The data were analyzed by Wilcoxon signed-rank test to compare the pre-operation value with the post-operative value. One-way analysis of variance with linear contrast was used to assess differences between groups where needed.

## RESULTS

After varicocelectomy, total testicular volume increased by 6.8 ml (Table 1). Right testicular volume improved more than left. Right testicular volume significantly improved by 4.1 ml ( $p < 0.05$ ). Left testicular volume also significantly improved by 2.7 ml ( $p < 0.05$ ). During the follow-up period of four years, 16 pregnancies were recorded. Of the 16 patients achieving

Table 1. Testicular Volume Changes in 52 Patients after Varicocelectomy

|       | Before Operation  | After Operation                |
|-------|-------------------|--------------------------------|
| Right | 20.1 $\pm$ 3.1 ml | 24.2 $\pm$ 2.2 ml <sup>a</sup> |
| Left  | 18.2 $\pm$ 2.5 ml | 20.9 $\pm$ 1.8 ml <sup>a</sup> |

<sup>a</sup> shows significant difference ( $p < 0.05$ )

Table 2. Total Testicular Volume Changes Relative to Improvement in Semen Parameters

| Semen parameter   | Testicular volume before varicocelectomy | Testicular volume after varicocelectomy |
|---|--|---|
| Patients showing improvement in sperm concentration       | 32 $\pm$ 3.1                             | 39 $\pm$ 1.6 <sup>a</sup>               |
| Patients not showing improvement in sperm concentration   | 35 $\pm$ 4.2                             | 37 $\pm$ 3.2                            |
| Patients showing improvement in sperm motility            | 35 $\pm$ 2.8                             | 45 $\pm$ 2.8 <sup>a</sup>               |
| Patients not showing improvement in sperm motility        | 36 $\pm$ 3.5                             | 34 $\pm$ 4.2                            |
| Patients showing improvement in normal forms of sperm     | 31 $\pm$ 1.2                             | 46 $\pm$ 3.1 <sup>a</sup>               |
| Patients not showing improvement in normal forms of sperm | 39 $\pm$ 3.8                             | 42 $\pm$ 2.9                            |

<sup>a</sup> shows significant difference ( $p < 0.05$ )

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pregnancies with their spouses, an average testicular volume increase of 5.1 ml was observed. Of the 36 patients who did not achieve a pregnancy, average testicular volume increased by 3.8 ml. The volume change differences between these two groups did not reach statistical significance.

Testis volume improvements correlated with improvements in semen parameters. With respect to sperm concentration, motility and percent of normal forms, statistically significant differences in testis volume changes between the groups showing improvement and those showing no improvement could be identified ( $p < 0.05$ ) (Table 2).

No correlation existed between the age of the patient at the time of varicocele repair and changes in testicular volume (Table 3). Similarly, age did not adversely affect fertility. The average age of those achieving pregnancy was 28.9 years, whereas the average age of those failing to achieve a pregnancy was 30.2 years.

Table 3. Testicular Volume Changes Relative to Patient Age

| Patient age (years) | Postoperative left  | Postoperative right  | Totals    |
|---------------------|---------------------|----------------------|-----------|
|                     | – preoperative left | – preoperative right |           |
|                     | mL                  | mL                   | mL        |
| 23–25 (n=10)        | 2.5 ± 0.8           | 3.2 ± 0.9            | 5.7 ± 1.2 |
| 26–30 (n=24)        | 3.4 ± 0.9           | 3.8 ± 0.7            | 7.2 ± 0.8 |
| 31–35 (n=15)        | 2.7 ± 1.2           | 3.0 ± 1.3            | 5.7 ± 1.4 |
| 36–40 (n=1)         | 2.1 ± 1.1           | 2.6 ± 1.2            | 4.7 ± 1.3 |
| 41–42 (n=2)         | 2.2 ± 0.9           | 2.8 ± 1.2            | 5.0 ± 0.4 |

## DISCUSSION

The loss of testicular volume in the presence of a varicocele is related to the loss of seminiferous tubule elements and decrease in tubular diameter, which may lead to the higher incidence of subfertility and abnormal seminal parameters.<sup>8,9)</sup> Kass and Belman<sup>6)</sup> showed that unilateral testicular atrophy induced by varicoceles could be reversed by repair of the varicocele. Their report involved 20 patients 11 to 19 years of age.<sup>6)</sup> The effect of varicocelectomy on the adult testicular volume has never been reported. In our study of 52 infertile men with varicoceles, significant testicular volume improvement occurred after varicocelectomy. Right testicular volume improved more than left to a statistically significant degree. Furthermore, testis volume improvements significantly correlated with improvements in semen parameters. Explanation for the improved right-sided testicular volume after left varicocelectomy may be the crossover venous circulations between the left and right sides. The varicocele communicates with two venous plexi, the pampiniform plexus and the cremasteric plexus. Although early work focused on cross-circulation between the left pampiniform plexus and the right testis, more recently attention has been devoted to the cremasteric plexus which surrounds the tunica albuginea.<sup>10)</sup> It is presumed that either plexus functions as the conduit through which a countercurrent heat exchange system conveys an elevated peritesticular temperature to both testes. All patients in our series underwent high ligation of the internal spermatic vein(s) above the level of such crossover vessels.

With increasing age, the improvement in testicular volume postoperatively did not decrease. This result suggests that advancing age does not appear to have a negative impact on the patient's fertility after varicocelectomy. However, Foresta et al.<sup>11)</sup> identified two groups of men: those who had and those who had not initiated a pregnancy following varicocelectomy. Men

who impregnated their wives had a mean age of  $26.7 \pm 3.9$  years, while those who were unsuccessful had a mean age of  $30.4 \pm 4.6$  years. Tinga *et al.*<sup>12)</sup> used the age of 30 years as a cutoff point. In their series, pregnancies occurred almost twice as frequently in men under the age of 30 following varicocelectomy. Thus, 45% (17/38) of the men under the age of 30 initiated a pregnancy, while only 12 out of 50 (24%) aged more than 30 years were able to father children following varicocele surgery. In contrast, Comhaire and Kunnen<sup>13)</sup> found that the age of the man did not influence the fertility prognosis after treatment. However, only young men were studied; the mean age for postvaricocelectomy fertile versus infertile men was 27.8 and 28.7 years, respectively. If age is to be considered a factor, then the available data and our present result indicate that varicocelectomy is likely to be effective when surgery is performed before the age of 30.

In conclusion, a significant increase in testicular volume was observed in patients with clinically recognized varicoceles after varicocele repair. Varicoceles are clearly associated with decreased testicular volume and subsequent impairment of testicular function. Varicocelectomy will have a positive effect on bilateral testis volume.

## REFERENCES

- 1) Charny, CW.: Effects of varicocele on fertility: Results of varicocelectomy. *Fertil. Steril.*, 13, 47–51 (1962).
- 2) Scott, L.S. and Young, D.: Varicocele: A study of its effect on human spermatogenesis and the results produced by spermatic vein ligation. *Fertil. Steril.*, 13, 325–34 (1962).
- 3) MacLeod, J.: Further observations on the role of varicocele in human male fertility. *Fertil. Steril.*, 20, 545–63 (1969).
- 4) World Health Organization: Comparison among different methods for the diagnosis of varicocele. *Fertil. Steril.*, 43, 575–580 (1985).
- 5) Cockett, A.T.K., Takihara, H. and Cosentino, M.J.: The varicocele. *Fertil. Steril.*, 41, 5–11 (1984).
- 6) Kass, E.J. and Belman, A.B.: Reversal of testicular growth failure by varicocele ligation. *J. Urol.*, 137, 475–476 (1987).
- 7) Takihara, H., Sakatoku, J., Fujii, M., Nasu, T., Cosentino, M. and Cockett, A.T.K.: Significance of testicular size measurement in andrology: A new orchimeter and its clinical application. *Fertil. Steril.* 39, 836–40 (1983).
- 8) Lipshultz, L.I. and Corriere, J.N., Jr.: Progressive testicular atrophy in the varicocele patient. *J. Urol.*, 117, 175–180 (1977).
- 9) Hadziselimovic, F., Leibundgut, B., Da Rugna, D. and Buser, M.W.: The value of testicular biopsy in patients with varicocele. *J. Urol.*, 135, 707–712 (1986).
- 10) Sayfan, J., Adam, Y.G. and Soffer, Y.: A new entity in varicocele subfertility: The “cremasteric reflux.” *Fertil. Steril.*, 33, 88–90 (1980).
- 11) Foresta, C., Ruzza, G., Rizzotti, A., Lembo, A., Valente, M.L. and Mastrogiacomo, I.: Varicocele and infertility. Preoperative prognostic elements. *J. Androl.*, 5, 135–137 (1984).
- 12) Tinga, D.J., Jager, S., Bruijnen, C.L., Kremer, J. and Mensink, H.J.: Factors related to semen improvement and fertility after varicocele operation. *Fertil. Steril.*, 41, 404–410 (1984).
- 13) Comhaire, F.H. and Kunnen, M.: Factors affecting the probability of conception after treatment of subfertile men with varicocele by transcatheter embolization with bucrylate. *Fertil. Steril.*, 43, 781–786 (1985).