Time for Improvement in Semen Parameters After Varicocelectomy

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Purpose: While there are a number of studies documenting a positive effect of varicocelectomy on semen parameters, the length of time required following varicocelectomy for semen quality to improve is not well established. Therefore, in this study we identified the changes with time in semen parameters after varicocelectomy.

Materials and Methods: The records and database of 304 patients who underwent varicocele repair for subfertility were reviewed retrospectively. All men had at least 2 preoperative semen analyses as well as semen testing at 3 and 6 months postoperatively.

Results: For the 100 patients who met the study inclusion criteria mean sperm counts increased significantly by 3 and 6 months after varicocelectomy (by 53% and 38% by 3 and 6 months, p = 0.0003 and 0.001, respectively). By 3 and 6 months the combined groups had a mean 2.5 and 1.5-fold higher total motile count compared to the preoperative total motile count, respectively. There was no further improvement in semen parameters in those men followed for more than 6 months. There were no statistically significant differences in the improvement in semen volume, motility, count or total motile count comparing the results at 3, 6 and more than 9 months postoperatively.

Conclusions: Sperm parameters improve by 3 months after varicocele repair and then do not improve further. This finding should allow physicians to decide quickly if varicocelectomy has been effective and, then, if required, plan on the use of other therapies to manage the couples' infertility.

Key Words: varicocele, spermatozoa, time factors

Abbreviations and Acronyms

ART = assisted reproductive technique

IUI = intrauterine insemination

IVF = in vitro fertilization

TMC = total motile count

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A varicocele is the most common correctable cause of male subfertility with an estimated prevalence of 15% in the general male population and up to 40% in infertile men.[1,2] There are several theories regarding the mechanism by which varicocele could affect the fertility potential of affected men. The most commonly proposed theory is that excess heat due to the varicocele reduces spermatogenesis, although some have also speculated that the effect is via reflux of metabolites into the testis.[1,3]

There are many ways to perform a varicocele repair.[4,5] Initially an open surgical technique to ligate the testicular veins was the only technique used, but now there are several options including varicocele embolization, surgical ligation (with or without microscope in the retroperitoneum, inguinal canal or subinguinally) or laparoscopic repair.[6,7] In the literature there is no evidence of a difference in fertility rates among any of the techniques used to repair varicoceles.[8–10]

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The question is what is the role for varicocele repair in infertile men? There has been tremendous controversy regarding the effects of varicocelectomy on spontaneous pregnancy rates.[11] However, spontaneous pregnancy rates are not the only potential benefit of varicocele repair. Many groups are now studying other positive effects of varicocele repair such as improvements in semen parameters (sperm count, morphology and motility), improved sperm quality, improvements in sperm DNA integrity and improvements in the function of the sperm (improvements in the sperm's fertilizing capacity).

While there is debate about the effects of varicocele repair on fertility rates in couples with infertility, there is well documented improvement in semen parameters (including sperm counts, motility and morphology) after the repair of varicoceles.[12,13] In a meta-analysis Agarwal et al reviewed the effects of varicocelectomy on semen parameters, and found that the literature identified a significant improvement in semen parameters in infertile men with palpable varicocele and abnormal semen parameters following varicocelectomy.[12] Sperm improvements following varicocelectomy have been found in 66% to 70% of men.[14]

In addition, there is evidence that varicocelectomy results in improvements in other measures of sperm quality not captured with standard semen testing, such as sperm DNA fragmentation rates. Zini[15] and Smit[16] et al found that varicocele repair results in significant improvements in semen parameters and DNA fragmentation rates in infertile men.

More importantly, the functional parameters of the sperm also improve in men after varicocelectomy. For men who participate in programs involving IUI, pregnancy rates increase following varicocele repair.[17] Even in men participating in an in vitro fertilization program, a prior varicocelectomy was found to increase the pregnancy rates and live birth rates with IVF in couples by 30%.[18–21]

Finally, varicocelectomy may also change the semen parameters to allow couples to avoid the use of IVF. Varicocele repair may upgrade patient semen parameters to a level that may reduce the need for invasive ARTs or sperm retrieval procedures.[22–24] It has become increasingly clear that there are many potential benefits to varicocele repair extending beyond an increase in spontaneous pregnancy rates. While varicocelectomy is a relatively low risk procedure with minimal morbidity, patients have other options to increase the couples' chances of conceiving. Certainly the use of IUI or IVF to treat male infertility is widely used. An advantage of IUI or IVF has always been the speed with which the couple may conceive. A common concern heard in clinical practice is the length of time required for varicocele repair to improve sperm parameters.

The Practice Committee of the American Society for Reproductive Medicine has recommended that after varicocele repair patients wait at least 1 year to assess the changes in semen parameters and the need to proceed to other assisted reproductive techniques.[25] While this has become a common practice, there are no published data to our knowledge to indicate the length of time needed for sperm parameters to improve after varicocelectomy. Obviously waiting a year for the varicocelectomy outcome to become clear is a significant disincentive for most couples interested in conceiving. Because of this timing issue many men are not opting for varicocele repair and couples are instead proceeding directly with IUI or IVF. However, these couples may be missing the benefits of varicocelectomy. The question is how long do men actually need to wait following varicocele repair to assess the changes in semen parameters? To answer this question we assessed the length of time required following varicocele repair to note improvements in semen parameters.

MATERIALS AND METHODS

The records of patients who had undergone varicocele management (surgical or radiological as per patient choice and preference) for subfertility at Mount Sinai Hospital from 2002 to 2010 and who had a minimum of 6 months of followup were reviewed retrospectively. This study was approved by the Research Ethics Board of Mount Sinai Hospital. Men were initially included if they met the criteria of proven male factor subfertility and abnormal semen parameters (by WHO criteria).[26] Men were then included if they met the criteria of 1) a palpable varicocele on examination and confirmed on Doppler scrotal ultrasound, 2) at least 1 preoperative semen analysis plus semen analyses at 3 and 6 months after varicocelectomy, and 3) nonazoospermia.

All semen analyses were done in the same laboratory at Mount Sinai Hospital. In cases in which 2 or more analyses were available before repair we averaged the results of the semen analyses and used this value in our final analysis. Semen parameters (volume, concentration, motility and morphology) were evaluated, and were used to calculate the TMC using the formula, [volume (ml) $\times$ concentration (millions per ml) $\times$ motility (%)]. A paired 2-tailed t test was used to compare semen parameters before and after repair.

In addition, the total population of patients was further divided into 3 groups according to the TMC based on the WHO reference as less than 5×10^6, 5 to 9×10^6, greater than 9×10^6.[26] Then the average change and the average fold increase in each group were calculated to evaluate whether preoperative semen parameters affected the outcome. A small subgroup of 19 patients who had followup for more than 9 months was analyzed to