



# Microscopic varicocelectomy as a treatment option for patients with severe oligospermia

Chirag Gupta<sup>1</sup>, Arun Chinchole<sup>1</sup>, Rupin Shah<sup>1</sup>, Hemant Pathak<sup>1</sup>, Deepa Talreja<sup>2</sup>, Ankit Kayal<sup>3</sup>

Departments of <sup>1</sup>Urology and <sup>2</sup>Reproductive Medicine, Lilavati Hospital and Research Centre, Mumbai, <sup>3</sup>Department of Urology, Nil Ratan Sircar Medical College and Hospital, Kolkata, India

**Purpose:** Many studies have shown improved semen parameters after varicocele surgery; however, the benefit in terms of improved pregnancy rates and live births is still disputed in cases of severe oligoasthenozoospermia (OAS). The present study evaluated the outcome of microscopic subinguinal varicocelectomy in terms of the spontaneous pregnancy rate in patients with severe OAS.

**Materials and Methods:** This was a retrospective, observational, analytic study of 56 men with OAS who underwent microscopic varicocelectomy at our center between 2008 and 2015. The subjects were followed for a mean period of 12.4 months. Outcome was compared among groups of men with mild (sperm concentration, 10.2–19 million/mL), moderate (5.7–9.5 million/mL), and severe (<5 million/mL) OAS who were operated on during the same period.

**Results:** A total of 13 of 35 men (37.1%) with severe OAS achieved spontaneous pregnancy. Mean sperm density increased from 2.29 million/mL preoperatively to 14.09 million/mL postoperatively. The mean time to pregnancy from the date of surgery was 8.5 months. The spontaneous pregnancy rate in men with mild and moderate OAS was 62.5% and 46.2%, respectively.

**Conclusions:** Although pregnancy rates after varicocele surgery are lower preoperatively in men with severe OAS than in men with mild or moderate OAS, the spontaneous pregnancy rate of 37.1% still compares very favorably with outcomes after a single attempt at *in vitro* fertilization.

**Keywords:** Microsurgery; Oligospermia; Pregnancy rate; Varicocele

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

Varicocelectomy is a common surgery for infertility. It is reported that 30% to 40% of infertile men have a palpable varicocele, whereas the prevalence of a varicocele in the general population is about 15% [1]. Several theories have been proposed to explain the harmful effects of varicocele on sperm quality, including the possible effects of heat,

pressure, oxygen deprivation, and toxins. Despite many individual studies reporting improvements in sperm count and the natural conception rate after varicocele repair, conflicting opinions remain as to whether a varicocele repair improves fertility in individuals with severe oligospermia (sperm concentration <5 million/mL) [2].

Various surgical approaches have been advocated for varicocelectomy. These include traditional open varicocele-

**Received:** 27 December, 2017 • **Accepted:** 5 March, 2018

**Corresponding Author:** Chirag Gupta

Department of Urology, Lilavati Hospital and Research Centre, A-791, Bandra Reclamation, Bandra west, Mumbai 400050, India

TEL: +91-22-2656-8359, FAX: +91-22-2640-7655, E-mail: drchirag845@gmail.com

ORCID: <http://orcid.org/0000-0001-6343-9211>

tomy, microsurgical varicocelectomy, and laparoscopic varicocelectomy [3,4]. Cayan et al. [4] concluded that the microsurgical varicocelectomy technique results in a higher spontaneous pregnancy rate and lower postoperative recurrence and hydrocele formation than do conventional varicocelectomy techniques in infertile men.

The present study aimed to address the benefits of microsurgical varicocelectomy in men with severe oligospermia (<5 million/mL) and clinically palpable varicocele in terms of the spontaneous pregnancy rate (without assisted reproductive techniques) and improvement in semen analysis parameters (sperm concentration, sperm motility, and sperm morphology).

**MATERIALS AND METHODS**

We retrospectively selected 56 couples who had presented with primary infertility for more than 18 months in our andrology clinic from 2008 to 2015. We included oligospermic men with either unilateral or bilateral clinical varicocele and a healthy female partner. We excluded patients with a history of cryptorchidism, infection, or subclinical varicocele. We assessed the subset of patients with oligospermia (sperm concentration between 0.2 and 20 million/mL). All men had at least two semen analyses performed before and two semen analyses performed after surgery. All semen analyses were done at the same laboratory. Samples were obtained by masturbation after 3 to 5 days of sexual abstinence. After liquefaction of semen, standard variables (volume, density, motility, and morphology) were obtained.

We used the following clinical criteria to grade the varicoceles: grade I, clinically palpable on Valsalva maneuver; grade II, clinically palpable in standing position without Valsalva maneuver; and grade III, visible varicoceles in standing position. In-office Doppler examination for retrograde flow in the dilated veins was also performed.

We referred to the World Health Organization (WHO) guidelines for grading motility, as follows [5]: grade A, rapid, progressive motility; grade B, sluggish, progressive motility; grade C, total progressive motility; grade D, nonprogressive;

grade E; nonmotile. Sperm concentration was also determined according to the WHO guidelines [5]. Patients were divided into three groups: mild (10–19.9 million/mL), moderate (5–9.9 million/mL), and severe (<5 million/mL) oligoasthenozoospermia.

All patients underwent microsurgical subinguinal varicocelectomy under spinal anesthesia performed by a single surgeon using a Karl Zeiss operating microscope with a magnification of from 10× to 20×. The surgical technique included a subinguinal approach, ligation of posterior cremasteric vessels, and preservation of the testicular artery, vasal vein, and lymphatic vessel. Before closure, the cord was scanned for remnant veins. Closure was done with absorbable sutures. Semen analysis was obtained after a minimum of 3 months of surgery and then every 3 months until 12 months. Follow-up was conducted by chart review and telephone calls about 12 months after the last patient treatment. The outcome measures were as follows: (i) changes in semen variables and (ii) spontaneous pregnancy rates. Our Institutional Review Board of Lilavati Kirtilal Mehta Medical Trust (LKMMT) Research Centre approved this study (approval number: 4/18/4).

**Statistical analysis**

Statistical analysis was carried out using IBM SPSS Statistics ver. 20.0 software (IBM Co., Armonk, NY, USA). The results for normally distributed continuous data were presented as the mean±standard deviation (SD), and categorical data were presented as number (n) and percentage (%). The significance between preoperative and postoperative changes in both groups was studied by using Student’s paired t-test. A p-value of less than 0.05 was considered to be statistically significant.

**RESULTS**

Our study included of total 56 men with clinical varicocele and oligoasthenospermia. Patients ranged in age from 23 to 32 years (SD, ±4.4 years). Duration of infertility ranged from 1.5 to 8 years (SD, ±1.44 years; Table 1). Of 56

**Table 1.** Baseline (preoperative) variables of the different groups

Variable	Group 1 (mild)	Group 2 (moderate)	Group 3 (severe)
No. of cases	8	13	35
Age (y)			
Men	30.8±4.1	29.9±3.6	28.2±4.3
Women	27.4±3.1	26.9±2.9	27.3±3.8
Duration of infertility (y)	3.2±1.41	3.13±0.84	3.16±1.52

Values are presented as number only or mean±standard deviation.

men, 48 had clinical varicoceles on both sides, 8 had clinical varicoceles on the left side only, and no patient had a varicocele on the right side. On the right side, 27 patients had grade I, 16 had grade II, 5 had grade III, and 7 had no varicoceles on physical examination; 1 man had a right orchidectomy in the past. On the left side, 2 patients had grade I, 16 had grade II, and 38 had grade III varicoceles.

Other variables that were recorded were preoperative testicular volume, semen volume, sperm density, and sperm motility. Mean preoperative semen volume was  $2.4 \pm 0.55$  mL. Mean testicular volume was  $17 \pm 3.2$  and  $15.5 \pm 4.06$  mL on the right and left side, respectively. Of the 56 men, 47 underwent bilateral microscopic varicocelectomy and 9 underwent left microsurgical varicocelectomy. The spontaneous pregnancy rate in the mild, moderate, and severe oligoasthenospermia groups was 62.5%, 46.2%, and 37.1% (Table 2). The mean duration of spontaneous pregnancy from the date of surgery was  $5.2 \pm 2.01$  months (range, 2–8 months). Sperm density in patients with mild, moderate, and severe oligoasthenospermia increased from 16.23 million/mL preoperatively to 42.42 million/mL postoperatively, from 7.10 million/mL preoperatively to 19.38 million/mL postoperatively, and from 2.26 million/mL preoperatively to 14.09 million/mL postoperatively, respectively, as shown in Table 3. The results of pre- and postoperative sperm motility are shown in Table 4. Overall, morphologically normal sperm improved from  $39.91\% \pm 14.92\%$  to  $44.74\% \pm 15.17\%$

( $p$ -value=0.00026).

## DISCUSSION

Varicoceles affect spermatogenesis in men by means of various pathophysiologic factors that are manifested as abnormal semen parameters such as low sperm density, decreased sperm motility, and a high percentage of abnormal sperm.

### 1. Spontaneous pregnancy rate and sperm density

Many randomized controlled trials have shown significant improvements in semen parameters after varicocelectomy in infertile men with oligospermia (i.e., having a sperm count below 20 million/mL) [6-8]. Agarwal et al. [7] analyzed 17 studies reporting outcomes of microsurgical varicocelectomy and high-ligation series for varicocele treatment and demonstrated that surgical varicocelectomy significantly improves semen parameters in infertile men with palpable varicoceles and abnormal semen analysis. However, very few randomized controlled studies have shown improvement in the spontaneous pregnancy rate in patients with severe oligoasthenospermia who undergo microsurgical varicocelectomy. Enatsu et al. [2] evaluated infertile men with severe oligoasthenozoospermia, and of 102 patients, mean sperm concentration increased from 2.4 to 11.6 million/mL ( $p < 0.001$ ) and mean sperm motility

**Table 2.** Impregnation rate in the different groups

	No. of total cases	No. of spontaneous pregnancies	Success rate (%)
Group 1 (mild)	8	5	62.5
Group 2 (moderate)	13	6	46.2
Group 3 (severe)	35	13	37.1

**Table 3.** Preoperative and postoperative sperm density in the different groups

Variable	Group 1 (mild)	Group 2 (moderate)	Group 3 (severe)
Density ( $10^6$ /mL)			
Pre	$16.23 \pm 2.79$	$7.10 \pm 1.31$	$2.26 \pm 1.56$
Post	$42.42 \pm 19.08$	$19.38 \pm 15.24$	$14.09 \pm 16.81$
p-value	0.028	0.049	0.026

Values are presented as mean  $\pm$  standard deviation.

**Table 4.** Preoperative and postoperative motility in the different groups

Motility	Preoperative (%)	Postoperative (%)	p-value
Grade 1	$6.07 \pm 8.95$	$10.60 \pm 11.68$	0.0018
Grade 2	$16.39 \pm 10.44$	$22.59 \pm 12.49$	0.0038
Grade 3	$22.44 \pm 15.23$	$32.16 \pm 21.64$	0.00027

Values are presented as mean  $\pm$  standard deviation.

improved from 32.8% to 42.2% ( $p=0.0024$ ), but the wives of only 17 men (16.7%) conceived naturally. In a uncontrolled study, Ishikawa et al. [9] evaluated infertile men with severe oligospermia (mean sperm density of 2.3 million/mL) and reported mean improvement in postoperative sperm density of 9.2 million/mL. They also reported that 7% of men with severe oligoasthenozoospermia achieved paternity through unassisted pregnancies [9]. In our study of 56 men, we placed the men into groups with mild, moderate, and severe oligospermia. In the mild oligospermia group, mean preoperative sperm density was 16.23 million/mL and postoperative mean sperm density was 42.42 million/mL ( $p$ -value=0.028). In the moderate oligospermia group, mean preoperative sperm density was 7.10 million/mL and postoperative mean sperm density was 19.38 million/mL ( $p$ -value=0.049). In the severe oligospermia group, mean preoperative sperm density was 2.29 million/mL and postoperative mean sperm density was 14.09 million/mL ( $p$ -value=0.026). The above findings suggest that there were statistically significant improvements in all three oligospermic groups. Our data showed spontaneous pregnancy rates of 62.5%, 46.2%, and 37.1% in the mild, moderate, and severe oligospermia groups, respectively (Table 2). Intracytoplasmic sperm injection provides fertilization rates of 45% to 75% per injected oocyte when surgically retrieved epididymal or testicular spermatozoa are used. Clinical pregnancy rates reported in the recent literature range from 26% to 57% and delivery rates from 18% to 75% [10-16]. These findings suggest that there is a role for microsurgical subinguinal varicocelectomy even in severe oligospermia for treating infertile couples and that spontaneous, natural pregnancy can be achieved. These findings should be considered before subjecting these couples to assisted reproductive techniques.

## 2. Motility and morphology

Richardson et al. [3] reviewed 21 studies that evaluated the impact of varicocelectomy on sperm motility in 3,676 patients. Six of these studies did not demonstrate a significant improvement in sperm motility, although in each there was a trend toward improvement. Two studies had mixed results. Hussein [17] reported significant improvement in motility from a preoperative mean of  $24 \pm 13.9$  million/mL to a postoperative mean of  $28.6 \pm 17.6$  million/mL ( $p$ -value<0.0001), whereas Orhan et al. [18] were unable to show significant improvement in sperm motility in 147 patients. In our study, we evaluated motility, and mean the percentages of sperm with grade A, grade B, and grade C motility preoperatively were 3.9%, 16.66%, and

20.52%, respectively. These percentages improved to 10.6%, 22.59%, and 32.16%, postoperatively, respectively (Table 4). In Richardson's review, of 14 studies reporting data for 2,166 patients, 6 showed a significant improvement in morphology, 7 did not, and 1 had mixed results [3]. In our study, the percentage of sperm with normal morphology improved from a preoperative mean of 39.91% to a postoperative mean of 44.74%.

## CONCLUSIONS

To conclude, we found that microsurgical subinguinal varicocelectomy significantly improves the spontaneous pregnancy rate and sperm density in patients with severe oligospermia (sperm count <5 million/mL) and thus provides a good option for such patients to achieve natural pregnancy before trying assisted reproductive techniques.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

## REFERENCES

- Schlesinger MH, Wilets IF, Nagler HM. Treatment outcome after varicocelectomy. A critical analysis. *Urol Clin North Am* 1994;21:517-29.
- Enatsu N, Yamaguchi K, Chiba K, Miyake H, Fujisawa M. Clinical outcome of microsurgical varicocelectomy in infertile men with severe oligozoospermia. *Urology* 2014;83:1071-4.
- Richardson I, Grotas AB, Nagler HM. Outcomes of varicocelectomy treatment: an updated critical analysis. *Urol Clin North Am* 2008;35:191-209, viii.
- Cayan S, Shavakhabov S, Kadioğlu A. Treatment of palpable varicocele in infertile men: a meta-analysis to define the best technique. *J Androl* 2009;30:33-40.
- World Health Organization (WHO). WHO laboratory manual for the examination of human semen and sperm-cervical mucus interaction. 4th ed. Cambridge: Cambridge University Press; 1999; 128.
- Ficarra V, Novara G, Artibani W, Cestari A, Galfano A, Graefen M, et al. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies. *Eur Urol* 2009;55:1037-63.
- Agarwal A, Deepinder F, Cocuzza M, Agarwal R, Short RA, Sabanegh E, et al. Efficacy of varicocelectomy in improving semen parameters: new meta-analytical approach. *Urology* 2007;70:532-8.
- Kim KH, Lee JY, Kang DH, Lee H, Seo JT, Cho KS. Impact of

- surgical varicocele repair on pregnancy rate in subfertile men with clinical varicocele and impaired semen quality: a meta-analysis of randomized clinical trials. *Korean J Urol* 2013;54:703-9.
9. Ishikawa T, Kondo Y, Yamaguchi K, Sakamoto Y, Fujisawa M. Effect of varicocelectomy on patients with unobstructive azoospermia and severe oligospermia. *BJU Int* 2008;101:216-8.
  10. Tournaye H, Merdad T, Silber S, Joris H, Verheyen G, Devroey P, et al. No difference in outcome after intracytoplasmic sperm injection with fresh or with frozen-thawed epididymal spermatozoa. *Hum Reprod* 1999;14:90-5.
  11. Palermo GD, Schlegel PN, Hariprashad JJ, Ergün B, Mielnik A, Zaninovic N, et al. Fertilization and pregnancy outcome with intracytoplasmic sperm injection for azoospermic men. *Hum Reprod* 1999;14:741-8.
  12. Kupker W, Schlegel PN, Al-Hasani S, Fornara P, Johannisson R, Sandmann J, et al. Use of frozen-thawed testicular sperm for intracytoplasmic sperm injection. *Fertil Steril* 2000;73:453-8.
  13. Habermann H, Seo R, Cieslak J, Niederberger C, Prins GS, Ross L. In vitro fertilization outcomes after intracytoplasmic sperm injection with fresh or frozen-thawed testicular spermatozoa. *Fertil Steril* 2000;73:955-60.
  14. Mercan R, Urman B, Alatas C, Aksoy S, Nuhoglu A, Isiklar A, et al. Outcome of testicular sperm retrieval procedures in non-obstructive azoospermia: percutaneous aspiration versus open biopsy. *Hum Reprod* 2000;15:1548-51.
  15. Nagy Z, Liu J, Cecile J, Silber S, Devroey P, Van Steirteghem A. Using ejaculated, fresh, and frozen-thawed epididymal and testicular spermatozoa gives rise to comparable results after intracytoplasmic sperm injection. *Fertil Steril* 1995;63:808-15.
  16. Gil-Salom M, Mínguez Y, Rubio C, De los Santos MJ, Remohí J, Pellicer A. Efficacy of intracytoplasmic sperm injection using testicular spermatozoa. *Hum Reprod* 1995;10:3166-70.
  17. Hussein AF. The role of color Doppler ultrasound in prediction of the outcome of microsurgical subinguinal varicocelectomy. *J Urol* 2006;176:2141-5.
  18. Orhan I, Onur R, Semerciöz A, Firdolas F, Ardicoglu A, Köksal IT. Comparison of two different microsurgical methods in the treatment of varicocele. *Arch Androl* 2005;51:213-20.