

A study of the surgical outcome and impact on semen parameters after laparoscopic varicocele and sub inguinal microscopic varicocele

Kareddy Bhargava Vardhana Reddy¹, Rachamalla Malleswari^{2*}

¹*Urologist, Department of Urology, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh, India*

²*Associate Professor, Department of Anaesthesia, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh, India*

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Abstract

Introduction: Varicocele is defined as a pathological dilation of the testicular pampiniform venous plexus that drains the testes and may be associated with male subfertility, hypogonadism, pain, discomfort, and failure of ipsilateral testicular growth and development. This condition is present in 11.7% of adult men and in 25.4% of men with abnormal semen analysis. Despite a recent meta-analysis showing semen improvement after surgical correction, the exact association between reduced male fertility and varicocele is unknown. **Materials and Methods:** This is prospective interventional study conducted from January 2020 to December 2020 in patients attending the OPD in the department of Urology, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh, India. Patients with abnormal semen parameters and clinical varicocele were selected. Doppler study of the scrotum (presence of varicocele graded using Sarteschi scale) was done for these patients. The patients fulfilling the selection criteria were counselled for varicocele and consent for the study obtained. The patients were randomized into Group A (laparoscopic varicocele) and Group B (sub-inguinal varicocele) by random allocation method. **Results:** Review at immediate post-operative period, follow ups at 3 & 6 months were undertaken. History of conception, clinical examination, semen analysis according to WHO 2010 manual and doppler studies by Sarchetsi scale were performed. Three factors in seminal parameters namely sperm concentration, motility & morphology were assessed. Varicocele recurrence was also assessed. There had been a statistically significant improvement in semen parameters in all the patients who underwent varicocele (p value $p < 0.005$). On comparing the laparoscopic and sub-inguinal surgical techniques, there was no significant variation in increase in sperm concentration, sperm motility and morphology. **Conclusion:** Varicocele improves the semen parameters. No significant variation was observed when the different surgical approaches of varicocele were compared.

Keywords: Varicocele, hypogonadism, Sarchetsi scale, varicocele.

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Introduction

Varicocele is defined as a pathological dilation of the testicular pampiniform venous plexus that drains the testes and may be associated with male subfertility, hypogonadism, pain, discomfort, and failure of ipsilateral testicular growth and development. This condition is present in 11.7% of adult men and in 25.4% of men with abnormal semen analysis[1]. Despite a recent meta-analysis showing semen improvement after surgical correction, the exact association between reduced male fertility and varicocele is unknown[2].

Several hypotheses have attempted to explain the correlation between varicoceles and subfertility, with the most commonly acknowledged mechanisms being acceptably attributed to hypoxia and hemostasis, increased scrotal temperature, adrenal metabolite reflux, autoimmunity, and increased oxidative stress[3,4].

Because the pathophysiology of varicocele-related infertility remains elusive, current challenges in its management lie in determining which patients stand to benefit most from surgical correction, and when surgery should be performed[5].

Effect of varicocele has been a matter of debate, but recent studies give a strong recommendation for varicocele in infertile men. One study had reported a 33% pregnancy rates in patients who underwent surgical varicocele and a 15.5% pregnancy rates in the controls who had no varicocele[6]. Apart from fertility aspect varicocele repair has proved to decrease the amount of oxidative stress. Even in patients opting for assisted reproductive technology, varicocele prior to ART increases the pregnancy rate and is cost-effective[7].

The various techniques of repair are as follows-

- Conventional open retroperitoneal- Palomo procedure.
- Laparoscopic varicocele.
- Sub inguinal varicocele.
- Microsurgical sub inguinal-varicocele.
- Radiological procedures- percutaneous embolization of veins.

With the advances in technology and minimal access techniques, laparoscopy has been the preferred approach due to early recovery and better cosmesis. Sub inguinal procedure offers minimal scar and post-operative complications[8,9,10]. With the aim of choosing a better surgical technique for restoration of fertility, we have analysed and compared the surgical outcome in terms of its impact on semen parameters postsurgery: laparoscopic varicocele and sub inguinal varicocele.

Materials and methods

Study design

A prospective interventional study

Study location

Department of Urology, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh, India

*Correspondence

Dr. Rachamalla Malleswari

Associate Professor, Department of Anaesthesia, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh, India.

E-mail: bhargavardhanreddy@gmail.com

Study duration

January 2020 to December 2020 (1 year)

This is prospective interventional study conducted from January 2020 to December 2020 in patients attending the OPD in the department of Urology, Santhiram Medical College and Hospital, Nandyal, Andhra Pradesh, India.

Inclusion Criteria

- Patients with documented infertility.
- Clinically palpable varicocele.
- Patients with abnormal semen parameters.
- No other attributable causes for infertility.
- No factor for infertility in the female partner.

Exclusion Criteria

- Previous surgery for inguinal hernia.
- Previous surgery for testicular pathology.
- Congenital abnormalities.
- Prior surgery for varicocele.

Patient Selection

All the patients attending the infertility clinic in Department of Urology, Sri Ramachandra institute of higher education and research underwent history elicitation, clinical examination, semen analysis (as per WHO manual 2010).

Patients with abnormal semen parameters and clinical varicocele were selected. Doppler study of the scrotum (presence of varicocele graded using Sarteschi scale) was done for these patients. The patients fulfilling the selection criteria were counselled for varicocelectomy and consent for the study obtained. The patients were randomized into Group A (laparoscopic varicocelectomy) and Group B (sub-inguinal varicocelectomy) by random allocation method.

The laparoscopic varicocelectomy was done by routine 3 transperitoneal ports, 1 in the umbilicus for camera and two working ports in right & left iliac fossa lateral to inferior epigastric vessels.

Results

Fifty patients were included in the study after they fulfilled the inclusion and exclusion criteria. The demographic parameters of the patients in both the arms were similar. Most of the patients belonged to age group 31-35 years followed by 26-30 years.

Table 1: Age distribution of patients

Age of patients	Laparoscopic no of cases	Sub Inguinal	Total
21-25 years	0	0	0
26-30 years	12	6	18
31-35 years	10	12	22
36-40 years	2	8	10
41-45 years	0	0	0

Though the prevalence of varicocele is predominant in secondary infertility patients, in our study majority of the patients were with primary infertility (22/25). Three were with secondary infertility.

Grading of Varicocele On clinical examination, all patients had bilateral varicocele.

38 patients had grade II varicocele and 12 patients had grade III varicocele.

Table 2: Doppler Grading as per Sarteschi Grading System

Grading of Varicocele	Laparoscopic cases	Sub Inguinal	Total
Grade 3	12	14	26
Grade 4	8	6	14
Grade 5	4	6	10

There was no significant difference in both the arms when the grading of varicocele was compared both by clinical and by doppler examinations.

Semen Parameters

Semen analysis was done as per WHO (2010) standards pre-operatively. Seventy-two percentage of patients had oligospermia in both arms (18 patients) with a mean sperm concentration of 7.82 million/ml. The rest of them had normal sperm concentration with sub normal motility and morphology. Nine patients had asthenozoospermia in our study. Twenty one of the 25 patients (84%) had morphologic defects. The patients in both arms had similar seminal parameters before undergoing surgery.

Table 3: Distribution of Seminal Parameters in 2 Groups in Preoperative Status

	N	Mean	SD	Std error mean	P
Concentration					
Laparoscopic	24	16.7	12.86	3.457	.610
subinguinal	26	13.48	18.472	5.125	

Peritoneum over the spermatic vessels was incised, veins were identified, ligated with clips and cut, sparing the arteries. Port sites was closed with absorbable sutures and skin with staplers.(8) In subinguinal varicocelectomy, a small transverse incision is made just inferior to the level of the external ring. Scarpa's fascia is split, cord structures identified using blunt and sharp dissection. Cord is brought up to the level of the skin incision and secured with a vessel tape. With the help of surgical loupe, the cord structures were dissected, veins were identified, ligated with 3-0 silk and divided sparing the arteries and lymphatic channels. Cord was replaced and wound closed with absorbable sutures.(9) The duration of hospital stay, postoperative analgesic requirement was noted for the patients.

Following factors were assessed during follow up In the Immediate Post Op Period

Patients were assessed for pain as per visual analog scale. And examined for complications like hematoma and infection.

3 and 6 Months Post Operatively

1. History including the history of conception or pregnancy.
2. Clinical examination.
3. Investigations.
 - a. Semen analysis.
 - b. Ultrasonography and Doppler study.

Semen Analysis

We compared the improvement in semen parameters in all patients (combining both groups pre and post operatively), to assess the benefit of varicocele repair. Three vital parameters compared were sperm concentration, total motility and sperm morphology.

Statistical Analysis: The SPSS software (Statistical Package for the Social Sciences, version 13.0, SPSS Inc, Chicago, Illinois, USA) was used to analyse the data. Paired T-test and Wilcoxon signed rank test, Mann Whitney test were used to analyse as the data didn't have the normal distribution. A p value <0.005 was considered significant.

Motility					
Laparoscopic	24	46.58	12.80	5.650	.399
subinguinal	26	40.54	15.476	4.350	
Morphology					
Laparoscopic	24	3.33	2.452	0.650	.166
subinguinal	26	2.00	2.237	0.600	

Post-Operative Period

The following findings were noted. Immediate postoperative period. Pain: Pain scale assessment and the analgesic requirements were similar in both groups.

Fever:

One patient in group A had fever in the first post op day which subsided on continuation of antibiotics for 2 days and he was discharged on the 3rd post op day.

Wound Infection

One patient developed wound infection in Group B which was evident on the 3rd post day and it required hospital admission and was treated conservatively. No hematoma was detected in any of the patients. All patients were followed up regularly at the intervals of 3 months post-surgery and 6 months post- surgery. No significant complication occurred in any of the 25 patients. On Doppler study no patient had recurrence of varicocele.

Semen Analysis during 3rd and 6th Month Follow Up

We compared the change in semen parameters in terms of 1) An entire cohort of 25 patient's pre and post-operative status and 2) Compared as cohorts undergoing the two surgical approaches. No significant difference was seen in the macroscopic appearance of the

semen post-operatively. Three vital microscopic parameters compared were sperm concentration, total motility and sperm morphology. As the distribution was not normal, T-test and Wilcoxon signed rank test were used for statistical analysis.

Sperm Concentration

In the preoperative analysis, the mean concentration of sperm in the 50 patients was 15.02 Million/ml. Eighteen patients were oligospermic (concentration levels <15 mil/ml) with a mean sperm concentration of 7.42 million/ ml,

At 3 Months

The sperm concentration improved in all patients and the mean sperm concentration increased from 15.02 million/ml to 18.22 million/ml post-operatively. Among the 18 oligospermic patients, sperm concentration increased in 7 patients (38.8%) and the remaining 11 patients (61.2%) remained oligospermic. Even in this category their mean concentration increased to 9.32 million/ml.

At 6 Months

The sperm concentration further improved in all patients and the mean sperm concentration increased to 22.89 million/ml. Only 7 patients (38.8%) remained oligospermic with an increase in mean to 10.57 million/ml.

Table 4: Sperm Concentration Change in Both Groups

		Mean (million/cells)	N	SD	Sd error mean	P
Concentration						
Pair 1	Pre OP	15.90	50	15.41	3.090	.001
	3 months	18.20	50	14.01		
Pair 2	Pre OP	15.85	50	15.40	3.095	.000
	6 months	22.56	50	14.50		

This table shows the increase in sperm concentration was statistically significant p value: preop- 3 months p = 0.001; pre op – 6 months p = 0.000.

Total Motility

The mean total motility of sperm in the 25 patients was 43.44%. Nine patients (36%) had asthenozoospermia (total motility < 40%) with the mean total motility of this group being 25.2%.

At 3 Months

The mean total motility increased to 50.96%. In the asthenozoospermic group, 4 (44.44%) patients had improved motility to normal levels. In the rest of the 5 patients the mean total motility increased to 34.4 %.

At 6 Months

Further increase in total motility was observed with mean increased to 52.96. Only one patient who had decreased motility remained asthenozoospermic.

Table 5: Sperm Motility Change in Both Groups

		Mean total motility %	N	S.D	Std error mean	P
Total Motility %						
Pair 1	Pre OP	43.43%	50	17.37	3.60	.001
	3 months	50.95%	50	11.835	2.35	
Pair 2	Pre OP	43.35%	50	15.365	3.49	.000
	6 months	52.80%	50	14.465	2.54	

This table shows the increase in sperm total motility was statistically significant. p value: preop- 3 months P = 0.001; pre op – 6 months p = 0.000.

Morphology

The mean of morphologically normal sperms in the 50 patients was 2.64 %. Around 42 (84 %) patients had teratozoospermia (morphologically normal sperms <4 %) and the mean of normal sperms in this category was 1.08 %.

At 3 Months

The mean of morphologically normal sperms in the 50 patients at 3 months interval had improved to 5.24 %. Among the 42 patients who had teratozoospermia, in 30 patients the morphology has improved to > 4 % and in the remaining 6 patients the mean percentage of morphology had increased to 3.16%.

At 6 Months

The mean of morphologically normal sperms in the 25 patients improved at 6 months interval to 8.40%. All patients improved the morphology to normal levels in 6 months.

Table 6: Sperm Morphology Change in Both Groups

		Mean	N	S.D	Std error mean	P
Normal Forms						
Pair 1	Pre OP	2.63%	50	2.378	.476	.000
	3 months	5.23%	50	2.166	0.433	
Pair 2	Pre OP	2.64%	50	2.378	0.476	.000
	6 months	52.95%	50	4.542	2.542	

This Table shows the marked increase in morphology and statistically significant p value. Pre-op- 3 months p = 0.000; pre op -6 months p = 0.000.

The observations made in the above study have shown statistically significant improvement in semen parameters in infertile men with varicocele after varicocele repair.

Table 7: Comparison of Sperm Concentration- Group A & Group B

	Group A- Laparoscopic	Group B- Subinguinal	
	Varicocelectomy	Varicocelectomy	
	N=24	N=26	
	Mean SD, Millions/ml	Mean SD, Millions/ml	P
Pre OP	16.70 12.048	13.48 18.473	0.201
3 Months	19.42 10.113	17.12 17.281	0.516
6 Months	23.88 11.021	21.92 17.595	0.32

The increase in sperm concentration between two groups, laparoscopic varicocelectomy & sub inguinal varicocelectomy was not statistically significant in post op period of 3 months and 6 months. Both techniques had a similar enhancement. Pre-op - 3months P value = 0.156; Pre op -6 months p value =0.327.

Table 8: Comparison of Sperm Motility in Group A & Group B

	Group A- Laparoscopic Varicocelectomy N=24	Group B- Subinguinal Varicocelectomy N=26	
	Mean, SD	Mean, SD	P
Pre OP	46.58% 19.40	40.54% 15.634	.399
3 months	52.57% 13.385	49.46% 10.564	.522
6 months	52.33% 12.478	53.54% 13.40	.818

The increase in the mean total motile sperms between laparoscopic varicocelectomy & sub inguinal varicocelectomy was not statistically significant. On statistical analysis between Group A laparoscopic varicocelectomy & Group B sub inguinal varicocelectomy in terms of total motility Preop -3months & preop - 6 months, the P value were 0.522 & 0.818 respectively

Table 9: Comparison of Sperm Morphology in Group A & Group B

	Group A- Laparoscopic Varicocelectomy N=24	Group B- Subinguinal Varicocelectomy N=26	
	Mean, SD	Mean, SD	P
Pre OP	3.33% 2.45	2.00% 2.634	.166
3 months	5.75% 2.09	4.77% 2.204	.267
6 months	8.67% 3.420	8.15% 5.352	.776

The observations made in this study was that varicocele repair has a role in improvement of semen parameters, but no statistically significant difference was observed when the surgical outcome was analysed between the laparoscopic varicocelectomy and sub-inguinal varicocelectomy.

Discussion

This significant benefit of varicocelectomy even extends to men with nonobstructive azoospermia. In one meta-analysis of azoospermic patients with varicoceles, Esteves et al. found that varicocelectomy led to return of sperm to the ejaculate in 43.9% of patients and was associated with a 13.6% natural spontaneous pregnancy rate. In addition, they found that correction of varicocelectomy in this group was associated with improved sperm retrieval rates (odds ratio [OR] 2.65, 95% confidence interval [CI] 1.69–4.14; $p < 0.001$) [11].

There are various methods for varicocelectomy, but none has been superior in efficacy in relation to treatment of infertility in patients with varicocele. Shamsa et al compared 3 varicocelectomy methods on 3 groups comprising 30 patients each [12]. In this study all had the same response in increasing the semen parameters. When comparing the post-operative complications like hydrocele, recurrence and operative time, sub-inguinal varicocelectomy under LA was found to preferred method. Dr. Haluk So'ylemez et al in his claims that laparoscopic varicocelectomy is better in terms of patient comfort and

early return to activity and advises laparoscopic to be gold standard [13].

Armand Zini et al showed that though technically challenging, microsurgical sub inguinal varicocelectomy has less complications and early return to work when compared to other modalities of varicocele repair. A recent metanalysis provides evidence for improvement of semen parameters following varicocelectomy, but all techniques have similar improvement in semen parameters, except for the advantages in reducing complications post-surgery, with microsurgical approach having least complications. In a recent study, Abdul Mageed compared laparoscopic and sub inguinal varicocelectomy and concluded that both groups had similar impact on semen parameters and complications [14].

In a meta-analysis of 33 studies, conducted in over 5000 patients, various current varicocelectomy techniques were analysed. The surgical outcome and improvement in semen parameters were calculated. They calculated that the overall pregnancy rate was 38.37% (954/2486). The incidence of recurrence of varicocele were

more in radiological procedure when compared with surgical methods (12% Vs 9.6%). The increase in seminal parameters varied from 50 to 80% in operated patients with results more in favour of microsurgical inguinal surgery. In a case series, varicocelectomy using loupe-assisted inguinal technique could improve semen parameters and pregnancy rate with a low postoperative complication rate. In a review article varicocelectomy before assisted reproduction helps in improving the outcomes, irrespective of the technique of varicocelectomy[15].

In our study of 50 patients, post operatively there was improvement in semen parameters in both groups with mean sperm concentration increase from 15.02 million/ml to 22.89 million/ml. Among the 36 patients in entire cohort who were oligospermic, 22 patients improved their sperm count to normal. The mean total sperm motility increased from 43.44 % to 52.96 %. The mean sperm morphology also improved from 2.64% to 8.4%. When the semen parameters were compared in the two surgical methods, no statistically significant difference was observed, the improvements were similar in both groups.

Conclusion

There is a definite improvement in semen parameters with statistically significant increase in sperm concentration, sperm total motility & sperm morphology following varicocele repair with both laparoscopic varicocelectomy & sub-inguinal varicocelectomy. There was no difference between laparoscopic varicocelectomy and subinguinal varicocelectomy when surgical outcome and sperm parameters were compared. Post-operative complications by both techniques were minimal and insignificant. Laparoscopic varicocelectomy does provide better cosmesis but sub-inguinal varicocelectomy is cost effective in low resource setting. There was no statistically significant difference observed when the sperm parameters were compared between both the arms.

So, both laparoscopic and sub-inguinal varicocelectomy have same efficacy in terms of improvement in semen parameters post varicocele repair in infertile men with clinically detected varicocele.

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