Original Research Article

Effect of varicocelelectomy on seminogram in patients with clinical varicocele

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ABSTRACT

Background: Despite various studies published in the recent years, efficacy of varicocelelectomy and its influence on semen parameters, particularly sperm count, motility and morphology has not yet been determined. Conflicting results obtained in different studies, accounts for sparked interest in varicocele management and its effects on seminal parameters. Therefore, present study was designed in an attempt to evaluate the effect of varicocelelectomy on the semen parameters by analyzing reports that included men with varicoceles who had both preoperative and postoperative semen examination done.

Methods: The present prospective study enrolled fifty patients. Varicocele was graded by Dubin grading system by palpation in standing and during Valsalva maneuver under adequate exposure and illumination. Macro and microscopic assessment of semen samples was carried out according to WHO guidelines. The surgical approach used for varicocelelectomy was inguinal (Modified Ivanissevich procedure).

Results: Significant improvement in semen parameters viz sperm counts/ml, sperm counts/ejaculate and sperm motility were observed after varicocelelectomy. We noted no effect of patient's age on the degree of improvement in semen parameters post operatively. Preoperatively, men with Grade III varicoceles had lower sperm counts and sperm motility, but significant improvement was observed post-operatively compared to men with Grades I and II varicoceles.

Conclusions: Our study supports the fact that, varicocele exerts a deleterious effect upon sperm motility, concentration and repair of varicocele leads to improvement in these seminal parameters. The repair of larger varicocele seems to be a predictor for better post-repair semen parameters. Varicocele is a treatable cause of male infertility (primary and secondary), so patients undergoing varicocelelectomy should have a pre-operative and post-operative semen examination done routinely.

Keywords: Ivanissevich procedure, Seminogram, Varicocele, WHO

INTRODUCTION

Varicocele has first been described as early as first century B.C.1 Celsus wrote "when the disease has spread over the testicle and its cord, the testicle sinks a little lower and becomes smaller than its fellow, in as much as its nutrition has become defective". The earliest description of varicocele in the modern literature was in

1885 by Barwell.¹ Varicocele is a very common finding in young men. It is an abnormal enlargement and tortuosity of the pampiniform plexus of veins in the spermatic cord.² The prevalence of varicocele is approximately 15% in general population, 25%-40% among men with primary infertility and 45% to 81% among men with secondary infertility.² Isolated left-sided lesions are seen in 78% to 93% of varicocele patients,

unilateral right-sided lesion has a reported incidence of 1% to 7%, bilateral varicocele is found in 2% to 20% of cases.³ Several studies have focused on determining mechanisms of how varicocele leads to impaired spermatogenesis and infertility. Most of these studies propose mechanism of heat exchange hypothesis. The pampiniform plexus controls the temperature around the testicle by an efficient drainage of the testicle venous blood into the internal spermatic vein.

This mechanism keeps the temperature in the scrotum 1-2°C lower than the core body temperature. Impairment of this countercurrent mechanism, produces an elevation of the testicular temperature. Elevated testicular temperature may cause damage to the deoxyribonucleic acid (DNA) and proteins in the nucleus of the seminiferous tubule cells and/or Leydig cells. Another theory is based on an increased venous pressure in the internal spermatic vein and the pampiniform plexus, which not only limits the arterial inflow at the testicular level but also interferes with the osmotic regulation of the metabolic products exerting detrimental effect on testicular epithelium.⁴

Another postulate suggests that varicoceles cause a disruption of the normal blood-testis barrier with the production of antisperm antibodies. This results in an impairment of sperm penetration into the cervical mucus. Oxidative stress hypothesis is based on an excess production of reactive oxygen species.⁵ Thus, pathogenesis of varicoceles is apparently not explained by one mechanism or theory several hypotheses seem to act synergistically.

The effect of varicocele on male fertility still remains controversial. Evaluation of the semen is the primary investigative tool in the assessment of male infertility. Through its cellular and chemical components, human semen can provide information on the functional properties of the organs producing this fluid i.e. the testis, epididymis, accessory glands and thus, reflect the deleterious effect of varicocele on spermatogenesis.⁶

In current practice, impairment of semen parameters, particularly sperm count, motility, and morphology, suggest that a varicocele might be present.⁷ Although a large number of reports have shown improvement in the semen parameters after correction of varicocele.^{8,9} Other studies have suggested no benefit.^{10,11}

However, whether semen analysis should be performed at the time of the first visit for varicocele patients who do not complain of infertility is unclear from the existing research.⁷

Therefore, we conducted this study to evaluate the effect of varicolectomy on the semen parameters, by analyzing preoperative and postoperative semen data in patients with varicoceles classified according to Dubin Amler classification, who underwent varicolectomy in our tertiary care hospital.¹²

METHODS

The present prospective study was conducted in the Department of General Surgery in association with the Department of Pathology, at Pt. B. D. Sharma Post Graduate Institute of Medical Sciences, Rohtak. Fifty patients were enrolled in the study who qualified the inclusion criteria. An informed consent was taken from all patients for inclusion in the study.

Inclusion criteria

- Patients with clinically palpable unilateral or bilateral varicoceles (grades I-III).

Exclusion criteria

- Patients with unilateral or bilateral recurrent varicocele.
- Patients with azoospermia or total necrospemia.
- Patients with secondary varicocele e.g Renal cell carcinoma.

For diagnosing varicocele, a detailed history and clinical examination was recorded on pretested proforma. Complete physical examination and local examination of scrotum was done. Varicocele was graded by Dubin grading system by palpation in standing and during Valsalva maneuver under adequate exposure and illumination.¹²

After three to five days of sexual abstinence, semen samples were obtained by masturbation and collected in a sterile plastic container. Macro and microscopic assessment of semen samples was carried out according to WHO guidelines.¹³ Patients fulfilling the inclusion criteria were taken up for varicolectomy.

The surgical approach used was inguinal (Modified Ivanissevich procedure) and was performed under spinal anesthesia. Semen analysis was performed after three months of surgery in the same way as done pre-operatively and both the reports were compared with each other.

Statistical analysis

Data are presented as means $\pm$ standard deviation (SD) for continuous variables and number or percentages for categorical variables. Statistical analysis was performed with SPSS for Windows (v 12.0; SPSS Inc, Chicago, IL) and analyzed statistically by using Student t-test for quantitative analysis. One-way Analysis of Variance (ANOVA) was used. A p-value of <0.05 was considered as significant.

RESULTS

All the patients who were 14 years and above having varicocele were included in the study. The youngest

patient in the present study was 18 years and the eldest patient was 40 years old. The mean age of patients under study was 28.34 years (SD: 5.72, Median: 28 years, Range 18-40years). Age distribution is shown in Table 1.

Table 1: Age distribution of patients.

Age range	No. of patients (n=50)	Percentage
< 20	04	8.00
21-30	29	56.00
31-40	17	34.00
Mean±SD	28.34±5.72	
Range	18-40	
Median	28	

As per clinical history, patients presented with symptoms of either pain/discomfort or scrotal swelling or both. Minimum duration of symptoms was two months and maximum were eight months. Majority of patients i.e. 24

out of 50 (48.00%) presented with chief complaint of scrotal swelling whereas 18 out of 50 (36.00%) presented with complaints of scrotal pain/discomfort. A total of eight out of 50 (16.00%) patients presented with both swelling and pain.

A total of 44 out of 50 (88.00%) patients presented with unilateral (left sided) varicocele whereas 6 out of 50 (12.00%) presented with bilateral varicocele. None of patient presented with isolated right sided varicocele. The severity of varicocele was assessed by the Dubin-Amelar classification.¹² Patients were graded from I to III depending upon severity of varicocele. We observed that most of the patients 30 out of 50 (60.00%) presented as grade II disease. Grade I and Grade III varicocele was observed among 4 (8.00%) and 16 (32.00%) patients respectively. Macro and microscopic assessment of semen samples were carried out according to WHO guidelines.¹³

Table 2: Pre-operative and post-operative comparison of Semen Analysis.

	Pre-operative			Post-operative			p-value
	Mean	*SD	Median	Mean	*SD	Median	
pH	7.78	0.22	7.8	7.85	0.26	08	>0.05
Volume	3.07	0.49	03	3.14	0.47	03	>0.05
Counts/ml	48.96	28.42	45	70.1	28.28	63.5	<0.001
Counts/ejaculate	128.31	66.68	95	171.15	75.01	165	<0.001
Motility %	59.1	15.79	60	67.2	14.43	65	<0.001
Morphology %	27.06	5.69	28	28.82	5.75	33	>0.05

*SD-Standard Deviation

Table 3: Comparison of semen analysis according to different age groups before and after varicocelectomy.

Age (in years)	< 20 years	21-30 years	31-40 years	P value*
Semen Analysis	(N=4)	(N=29)	(N=17)	
pH				
Pre-operative	7.62±0.25	7.77±0.22	7.82±0.22	0.274
Post-operative	7.82±0.23	7.80±0.28	7.93±0.22	0.261
Counts/ml				
Pre-operative	43±36.17	52.96±30.27	44.05±24.13	0.546
Post-operative	65.5±27.28	68.42±29.93	73.72±26.96	0.792
Counts/ejaculate				
Pre-operative	157.5±101.03	131.35±65.39	117.08±62.23	0.530
Post-operative	185±109.16	165.62±69.61	176.66±79.32	0.830
Motility				
Pre-operative	57±19.78	58.28±15.74	60.83±15.83	0.844
Post-operative	71.25±17.5	63.39±13.94	72.22±13.52	0.110
Morphology				
Pre-operative	27.5±6.24	28.5±5.56	24.72±5.32	0.092
Post-operative	30.75±6.84	29.17±6.14	27.83±4.99	0.600

*Among various age groups, for multi-group comparison, One-way Analysis of Variance (ANOVA) was used and all the p values found to be statistically insignificant (p >0.05).

Mean value of sperm count/ml among pre-operative patients and post-operative patients were 48.96±28.42 (Range 16-105 million/ml) and 70.1±28.28 (range 20-120 million/ml). Sperm counts/ejaculate were obtained by multiplying counts with semen volume. All screened

patients had count >40 million/ejaculate. The mean value of sperm count/ejaculate among pre-operative patients and post-operative patients were 128.31 (S.D 66.68, Median 95) and 171.15 (S.D 75.01, Median 165). Sperm motility was graded a, b, c or d as per WHO guidelines.

Mean percentage motility observed among pre-operative patients was 59.1(S.D. 15.79, Median 60), whereas among post-operative patients mean percentage motility observed was 67.2 (S.D 14.43, Median 65).

Significant improvement in sperm counts/ml, sperm counts/ejaculate and sperm motility (post operatively) after varicocelectomy was observed. Results of both semen parameters pre-operatively and post- operatively are depicted in Table 2. Further, Authors compared pre-operative and post-operative semen parameters with respect to age of patients.

Authors observed that varicocelectomy lead to improvement in semen parameters among all age groups

and there was no statistically significant difference with respect to patient's age among pre-operative and post-operative patients. Results are shown in Table 3. Authors also compared pre-operative and post-operative semen parameters with respect to grade of varicocele.

Preoperatively, men with Grade III varicoceles had lower sperm counts and sperm motility compared to men with Grades I and II varicoceles.

Statistically significant improvement was observed post-varicocele repair in semen parameters in men with Grade III varicoceles compared to men with grade I and grade II varicoceles. Results are depicted in Table 4.

Table 4: Comparison of semen analysis according to different grades of varicocele before and after treatment.

Semen Parameters	Grade of Varicocele	Pre-operative (n=50)	Post-operative (n=50)	P value
pH	Grade I	7.9±0.2	8±0.4	0.117
	Grade II	7.73±0.23	7.8±0.30	0.193
	Grade III	7.83±0.21	7.87±0.18	0.377
Volume (ml)	Grade I	2.87±0.25	2.92±0.15	0.228
	Grade II	3.08±0.52	3.18±0.49	0.324
	Grade III	3.09±0.49	3.06±0.47	0.755
Sperm Counts/ml (million/ml)	Grade I	51.75±37.25	64±40.47	0.118
	Grade II	43.45±26.02	49±40.47	0.419
	Grade III	40.62±31.97	68.56±32.35	<0.001
Sperm counts/ejaculate	Grade I	133±86.71	156±119.75	0.274
	Grade II	121.51±63.02	140.63±75.32	0.171
	Grade III	101.37±72.11	147.15±59.88	<0.01
Motility	Grade I	60.25±18.08	65.75±20.15	0.154
	Grade II	50.83±16.24	65.5±14.99	<0.001
	Grade III	48.06±14.52	66.5±14.89	<0.001
Morphology	Grade I	22.5±4.35	24±6.48	0.177
	Grade II	28.43±5.78	29.3±5.45	0.440
	Grade III	25.62±5.09	27.37±6.36	0.132

DISCUSSION

Varicocele is among the most common causes of male infertility. It is also one of the most controversial issues, especially regarding why, when and to whom varicocelectomy offered. Though large number of reports have shown a significant attenuation of oxidative stress markers occurs after varicocelectomy and also significant improvements in sperm DNA integrity has been demonstrated in men after varicocele repair.^{8,9} On the other hand many authors have suggested no improvement in the semen parameters after correction of varicocele.^{10,11} Conflicting results obtained from different studies attempting to answer the question of whether or not varicocelectomy improves seminal parameters, accounts for the sparked interest in varicocele management. Thus, present study was conducted to evaluate the effect of varicocelectomy on the semen

parameters, by analyzing preoperative and postoperative semen data. Varicoceles first appear during adolescent age group. Studies have proved that varicocele is a progressive disease and it causes increasing testicular dysfunction over time. Therefore, age of presentation is important to indicate the degree of dysfunction caused by varicocele.¹⁴ The youngest patient in the present study was 18 years and the eldest patient was 40 years old. The mean age of patients under study was 28.34 years (SD: 5.72, Median: 28, Range: 18-40 years) as shown in table I. A total of 29 out of 50 (56.00%) patients were in the age group 21-30 years, followed by 17 out of 50 (34.00%) in the age group 31-40 years and only four out of 50 (8.00%) of the enrolled patients were younger than 20 years of age. Thus, in the present study majority of patients who presented with varicocele were in their young age. Similarly mean age observed among study group by Shabana et al was 28.3 ± 7.4 years.² Whereas,

mean patient age observed by Sampalski et al was 35.8 years (Range 23-62 years).¹⁵ Evaluation of the semen is the primary investigative tool in the assessment of male infertility. Through its cellular and chemical components, human semen can provide information on the functional properties of the organs producing this fluid i.e. the testis, epididymis, accessory glands and thus, reflect the deleterious effect of varicocele on spermatogenesis.⁶

On comparing, pre-operative and post-operative results of semen analysis, Authors observed a beneficiary effect of varicocelectomy on semen parameters in terms of sperm count/ml, sperm count/ejaculate and sperm motility (Table III). Similar to our study, Belzile and colleagues recorded mean increase of sperm concentration.¹⁶ Also, Shabana et al observed a statistically significant increase in sperm density and progressive motility.² Other authors also reported improvement in post-repair sperm concentration and total sperm motility.¹⁵

Huang et al found that preoperative sperm density had a favorable association with the likelihood of successful varicocelectomy, and that a preoperative sperm density of 12×10^6 /ml or greater was able to predict successful varicocelectomy with a sensitivity of 77.6% and specificity of 77.4%.¹⁷

Authors compared pre-operative and post-operative semen parameters with respect to age of patients. Mean sperm counts/ml (million/ml) improved from 43, 52.96 and 44.05 (pre-operatively) to 65.5, 68.42 and 73.72 (post-operatively) among age groups <20 years, 21-30 years and 31-40 years respectively as shown in table III. Mean counts/ejaculate (million/ml) also improved from 157.5, 131.35 and 117.08 (pre-operatively) to 185, 165.62 and 176.66 (post-operatively) among age groups <20 years, 21-30 years and 31-40 years respectively. Mean sperm motility percentage also improved from 57, 58.28 and 60.83 (pre-operatively) to 71.25, 63.39 and 72.22 (post-operatively) among age groups <20 years, 21-30 years and 31-40 years respectively. Though varicocelectomy improved the semen profile of all participants in terms of sperm counts and motility. However, Authors noted no effect of patient age on the degree of improvement in postoperative semen parameters in the present study.

Similar to our study, Comhaire and Kunnen found that the age of the man did not influence the fertility prognosis after treatment.¹⁸ Also, Reşorlu et al and Liguori et al reported no significant alterations in sperm concentration and motility rates after ligation between the different age groups.^{19,20} Whereas contrary to our study, Lipshultz and Corriere suggested that varicoceles were associated with testicular atrophy that was progressive with age.²¹ In addition, Zini et al., found similar sperm parameters and spontaneous pregnancy rates following varicocelectomy in couples with advanced paternal age (>40 years) compared with younger couples.²²

This indicates that varicoceles cause progressive impairment of testicular function and hence fertility over time. So, in patients presenting early in life with varicocele, option of treatment should be considered even if patient is having normal semen parameters.²⁴ Though findings of our study are comparable to some other studies available on this subject in literature, but the effect of varicocelectomy on improvement in semen parameters among elderly cannot be truly commented upon because none of the participants of our study were above 40 years of age.

Authors analyzed, based on the clinical grade, sperm motility and sperm concentration parameters in men with varicocele and evaluated the changes and its correlation among pre-operative and post-operative patients as discussed in table IV. Mean Sperm counts (million/ml) were 51.75, 43.45 and 40.62 in patients with Grade I, II and III varicocele (pre-operatively) and were 64, 49 and 68.56 among patients with Grade I, II and III (post-operatively) respectively. Mean counts/ejaculate (million/ejaculate) was 133, 121.51, 101.37 among patients with Grade I, II and III varicocele (pre-operatively) and 156, 140.63, 147.15 among patients with Grade I, II, and III varicocele (post-operatively) respectively. The mean percentage of motile sperms was 60.25, 50.83 and 48.06 in patients with Grade I, Grade II, and Grade III varicocele (pre-operatively) and 65.75, 65.5 and 66.5 among patients with Grade I, II, III varicocele (post-operatively) respectively. Thus, preoperatively, men with Grade III varicoceles had lower sperm counts and sperm motility compared to men with Grades I and II varicoceles. Statistically significant improvement was observed post-varicocele repair in semen parameters in men with Grade III varicoceles compared to men with Grade I and Grade II varicoceles.

Similarly, Steckel et al grouped 86 men by varicocele size. Preoperatively, men with Grade III varicoceles had lower sperm counts and total motile count (TMC) compared to men with Grades I and II varicoceles. Post varicocele repair, a comparison of percent change in TMC among the groups revealed that men with Grade III varicoceles improved to a greater degree (128%) than men with Grade I (27%) or Grade II (21%) varicoceles. Repair of larger varicoceles resulted in greater improvements in semen parameters than repair of small or medium sized varicoceles.²³ Another study found that greater improvements in sperm density were seen in the patients with a Grade III varicocele, as compared with Grades I or II.²⁴ Similarly, Ishikawa and Fujisawa found that improvements in semen parameters were greater after repair of Grade II (7.47×10^6 /ml pre to 11.04×10^6 /ml post repair) or III (7.87×10^6 /ml pre to 12.23×10^6 /ml post repair), as compared with Grade I.²⁵ While there were some early studies that demonstrated that there was no association between varicocele grade and degree of improvement in semen parameters after repair, more recent data seems to support an association.^{12,15}

Thus, the present study supports the finding, that pre-operative varicocele grade impacted post varicocelectomy semen parameters, with the improvements in semen parameters being directly related to the grade of the varicocele. Varicocele is one of the most debatable issues in the field of male infertility mainly with regard to surgical intervention. Many scholars believe that the surgical repair of varicocele should include a very narrow group of infertile men. Nevertheless, there are no widely accepted criteria regarding the selection of this group of men. The fact that some men with varicoceles are fertile should not minimize the potentially detrimental role of this abnormality. It would be reasonable to claim that varicocele is uniformly detrimental. Taken together, these findings suggest that varicocelectomy improves seminogram.

CONCLUSION

Present study supports the fact that, varicocele exerts a deleterious effect upon sperm motility, concentration and morphology and repair of varicocele leads to improvement in all these seminal parameters. The repair of larger varicocele seems to be a predictor for better post-repair semen parameters. Varicocele is a treatable cause of male infertility (primary and secondary), so patients undergoing varicocelectomy should have a pre-operative and post-operative semen examination done routinely. Thus, based on the available evidence, it is clear that there is a benefit in treating men with a varicocele.

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