

Original Research Article

Improvement in semen parameters after varicocelectomy

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ABSTRACT

Background: Varicoceles are associated with abnormal sperm parameters. The difference is more marked in cases with infertility and higher grades of varicocele. Following ligation of varicocele, there is a significant improvement in the sperm counts.

Methods: The study was conducted in the department of general surgery at Maulana Azad Medical College and associated Lok Nayak Hospital from September 2012 to April 2014. The study was conducted on 40 numbers of patients. These were divided into 2 groups, group 1 (n=20) constituted of patients with varicocele who are symptomatic. Group 2 (n=20) constituted of patients with varicocele who are asymptomatic (infertile). All patients were evaluated by clinical examination and Doppler to grade the varicocele. All patients underwent detailed semen analysis. Patients of both the groups underwent FNAC of bilateral testes. The patients with clinical or Doppler detectable varicocele were taken up for low ligation of varicocele. Patients were followed up and all above parameters were repeated about 3 months after surgery.

Results: The sperm morphology, counts and motility increase significantly in group 2 patients and sperm counts and morphology increased significantly in group 1 while motility not increased significantly.

Conclusions: Most of the patients who presented to us were in the age group of 25-35 years. Longer duration of disease in patient with infertility is also suggestive of the fact that varicocele is a progressive disease and leads to testicular dysfunction over time leading to infertility. Most of the varicoceles were either left sided or bilateral

Keywords: Semen parameters, Varicocelectomy, Sperm count, Sperm morphology, Sperm motility

INTRODUCTION

Varicocele is an abnormal degree of venous dilatation in the pampiniform plexus. It affects approximately 15% of men. Varicocele is considered a major cause of male infertility, with an overall prevalence rate of 40% in men being treated for primary infertility and of 80% in men with secondary infertility.¹ Varicocele is rare below the age of 10 years and its incidence increases with progressive pubertal development reaching upto 15-20% at the age of 14-15 years, a rate similar to what is observed in adults. Although it is accepted that varicocele

exerts a negative feedback on male fertility, the effect of varicocelectomy on restoration of fertility is subject of ongoing debate. There are controversies on what should be the age for treatment of varicocele. Some authors proposed that it should be treated in adolescence in order to prevent future fertility problems based on the fact that one third of the patients evaluated for infertility have varicocele. However, only 15-20% of men with varicocele need treatment for infertility² indirectly indicate that most men with varicocele do not have impaired fertility. It is now believed that varicocele develops from absent or incomplete valves in the internal spermatic vein, accompanied by a retrograde blood flow

down this vein and cremastic vein to the pampiniform plexus. This phenomenon leads to an increase of 2.5°C of the scrotal temperature and several other changes i.e. loss of spermatocyte and spermatid.³

Varicocele can present with scrotal pain, swelling and during the investigation of male infertility. Studies of fertile men with and without varicocele have shown no significant differences between standard semen parameters. However, over the past decade several studies have established an association between the presence of varicocele and abnormal semen parameters such as sperm count, motility, and morphology in infertile patients.⁴ In clinical practice, many shows persistent abnormality of sperm count, motility and morphology. Varicocele also causes elongated, tapered sperm head.⁵

There are no randomized controlled trials comparing treatment modalities; a single case series on microsurgical techniques has shown partial and complete resolution of pain in 20% and 72% of patients, respectively.⁶

The study conducted by us would evaluate the changes in sperm morphology, counts and motility after varicolectomy. Despite a large number of animal and human studies, the exact mechanism whereby varicoceles cause impaired testicular function remains poorly understood. Theories include abnormally high scrotal temperature, hypoxia due to venous stasis, dilution of intratesticular substrates (e.g. testosterone), imbalances of the hypothalamic-pituitary-gonadal axis and reflux of renal and adrenal metabolites down the spermatic vein. Data exist to both support and refute each of these possibilities. In addition, nitric oxide, reactive oxygen species, and regulators of apoptosis have all recently been implicated in the pathophysiology of varicoceles. It appears that cigarette smoking in the presence of varicocele has a greater adverse effect than either factor alone.⁷

It is speculated that secondary infertility is due to the chronic and progressively increased influence of varicocele. Based on these assumptions, some studies suggest the surgical repair of varicocele, in order to avoid any negative effects on testicular function. Nevertheless, those studies have several drawbacks as they fail to mention any possible reduction in semen parameters and choose to concentrate on the increased prevalence of varicocele in older couples. As an exception, progressively decreased sperm concentration was mentioned only in one study.⁸ The most vigorously studied pathophysiologic theory is that of increased testicular temperature.

Semen parameters in varicocele

There is still an ongoing debate among researchers as to if and to what extent varicocele affects semen parameters,

which usually vary from normal to mild or moderate asthenospermia, teratospermia or asthenoteratospermia. Initially, sperm concentration is not seriously affected, though later all three sperm parameters can gradually deteriorate, resulting in azoospermia in very few cases.⁹

The gold standard treatment currently accepted for varicocele is surgical repair either by open approach associated or not with magnification, laparoscopy, or through percutaneous embolization of the internal spermatic vein.

METHODS

One group were symptomatic patients with complaints of pain and the other group was asymptomatic (infertile) subjects. Subjects with hypogonadism, recurrent varicocele and with any other systemic illness were excluded from the study. Clinical Grading of varicocele: Dubin and Amelar. Ultrasound and colour Doppler of scrotum was done for confirmation and grading of varicoceles. All patients underwent fine needle aspiration of both testes for grading of spermatogenesis. Cytological analysis was done to identify different stages of spermatogenesis viz. spermatogonia, primary and secondary spermatocyte, early and late spermatids and spermatozoa.

Semen analysis

After 3 days of sexual abstinence, ejaculates obtained by masturbation were examined, Semen analysis was performed according to the guidelines of WHO (2010). The patients were asked to come after at least 3 days abstinence. The parameters studied were: volume, appearance, pH, morphology, counts, motility (%) and liquefaction time.

Determination of the proportion of normal spermatozoa was done. All the variations in head size and shape or the various midpiece and principal piece defects were examined. Morphological evaluation was performed on every assessable spermatozoon in several systematically selected areas of the slide, to prevent biased selection of particular spermatozoa.

Assessment of all spermatozoa in each field, moving from one microscopic field to another was done. At least 200 spermatozoa per slide were examined, in order to achieve an acceptably low sampling error. Repeat assessment of at least 200 spermatozoa was done. A comparison of percentages of normal morphological forms from abnormal morphological forms was done from the two readings.

Intact spermatozoa, defined as having a head, mid piece and a tail. Only intact spermatozoa were counted for sperm concentration. Immature germ(round) cells were not counted. Overlapping spermatozoa and those lying

with the head on edge were not assessed; because these cannot be analysed adequately.

Procedure

Patients of both the groups were taken up for varicocelectomy. The approach was low ligation under local anesthesia and veins were ligated under binocular loupe magnification.

Follow up

First visit after 1 week, stitch removal was done. Patient was asked about other complaints and those were dealt with appropriately. Subsequent visit after 3 months, sample for semen analysis was collected after 3 days of abstinence and semen analysis done. FNAC was done to see the change in the grading of spermatogenesis if the initial spermatogenesis grade was abnormal. USG Doppler was done if the sperm count did not increase to assess for persistent or recurrent varicocele.

Statistical analysis

Quantitative data, difference between the two means was compared by Student’s t-test for paired observations: Wilcoxon paired test was done. Qualitative data, Fisher test was done. Statistical significance was defined by $p < 0.05$.

RESULTS

Amongst 40 patients included in the study maximum number of patients in group 1 were in age group less than 25 years, while in group 2 maximum number of patients were in age group 25-35 years of age group (Table 1).

Table 1: Age wise distribution of varicocele in both fertile and infertile men.

Age (years)	No. of patients in group 1		No. of patients in group 2	
	Frequency	%	Frequency	%
<25	10	50	4	20
25-35	7	35	7	35
35-45	2	10	5	25
>45	1	5	4	20

Table 2: Comparison of changes in FNAC before and after varicocelectomy in group 1 patients.

Frequency (No. of patients)	FNAC Chandley’s grading	
	Pre ligation	Post ligation
11(55%)	N	N
2(10%)	2	N
5(25%)	2	2
2(10%)	3	2

Table 3: FNAC grading pre and post varicocelectomy in group 2.

Frequency (no. of patients)	FNAC Chandley’s grading		Percentage
	Pre ligation	Post ligation	
9	N	N	45
3	2	N	15
7	2	2	35
1	3	3	5

Out of the twenty patients in Group 1, 11 patients had normal spermatogenesis before varicocelectomy. Amongst the remaining 9 patients, 7 had grade 2 spermatogenesis on FNAC. Two patients reverted back to normal grade post varicocelectomy and 5 patients did not improve. Two out of 20 patients had grade 3 spermatogenesis, both improved to grade 2 after varicocelectomy. Thus, amongst total of 9 patients who had hypospermatogenesis at different stages 4 showed improvement in its grade after varicocelectomy (Table 2).

Out of 20 patients 9 patients were with normal spermatogenesis, 3 patients improved from grade 2 to normal, 2 patients improved from grade 3 to grade 2, 5 patients with grade 2 did not improve, 1 patient with grade 3 did not improve (Table 3).

Morphology in head, mid piece and principle piece improved significantly in group 1 with a p value of 0.002, 0.024, 0.003 respectively (Table 4).

Morphology increased significantly in head, mid piece, principle piece in Group 2 with a $p < 0.001$, 0.016, 0.002 respectively (Table 5).

Table 4: Patient wise sperm morphology group 1.

Case number	Head	Head1	Mid	Mid1	Prince	Prince1
1	72	90	92	100	89	90
2	52	68	92	94	88	92
3	96	90	96	100	96	100
4	70	93	92	100	89	100
5	68	70	86	78	84	88
6	83	94	96	95	96	99
7	68	94	75	93	70	88

Continued.

Case number	Head	Head1	Mid	Mid1	Prince	Prince1
8	81	88	98	98	91	94
9	50	82	70	99	74	78
10	86	85	91	94	82	87
11	89	97	97	99	95	100
12	86	88	86	90	97	99
13	89	90	87	86	89	87
14	86	88	87	87	79	97
15	88	90	84	90	95	91
16	76	80	78	80	94	95
17	69	75	77	80	76	80
18	79	80	73	75	78	80
19	59	64	81	83	94	95
20	82	84	84	85	89	90
Mean±SD	76.45±12.7	84.50±9.20	86.10±8.35	90.30±8.14	87.25±8.20	91.50±6.91
P value	p=0.002		p=0.024		p=0.003	

Table 5: Patient wise sperm morphology Group 2.

Case number	Head	Head1	Mid	Mid1	Prince	Prince1
1	68	73	88	86	69	85
2	87	88	89	85	83	88
3	75	81	83	84	81	84
4	69	73	79	81	88	89
5	68	78	75	73	79	76
6	87	88	79	82	78	81
7	73	75	78	80	91	84
8	68	70	86	84	90	88
9	85	86	86	89	87	90
10	89	90	84	96	82	99
11	75	80	75	87	84	88
12	81	84	78	88	85	87
13	84	98	74	99	81	89
14	85	96	89	91	83	87
15	88	94	88	87	79	91
16	76	88	86	85	78	83
17	79	86	84	84	79	81
18	84	84	79	85	80	89
19	87	90	76	85	84	89
20	84	91	78	85	81	88
Mean	79.60±7.46	84.65±7.91	81.70±5.12	85.80±5.49	82.10±4.92	86.80±4.70
P value	p<0.001		P=0.016		P=0.002	

Table 6: Patients wise sperm counts in Group 1 and Group 2.

Cases	Group 1		Group 2	
	Pre op	Post op	Pre op	Post op
1	75	76	36	40
2	99	110	55	60
3	80	86	9	10
4	70	75	1	2
5	50	60	10	15
6	75	80	18	20
7	5	5	20	30
8	60	70	15	20
9	88	90	20	22

Continued.

Cases	Group 1		Group 2	
	Pre op	Post op	Pre op	Post op
10	20	35	2	3
11	10	12	8	10
12	60	65	2	2
13	25	30	1	2
14	70	75	6	15
15	11	13	9	12
16	5	10	13	14
17	10	12	16	16
18	5	7	10	12
19	50	60	10	12
20	65	67	8	12
Mean± SD	46.65±31.885	51.90±33.023	13.45±12.902	16.50±13.99
P value	<0.001		<0.001	

Table 7: Patients wise sperm motility in Group 1 and Group 2.

Cases	Group 1		Group 2	
	Pre op (%)	Post op (%)	Pre op (%)	Post op (%)
1	70.00	72.0	20.00	30.0
2	70.00	70.0	65.00	70.0
3	69.00	70.0	40.00	45.0
4	60.00	60.0	20.00	20.0
5	40.00	45.0	30.00	35.0
6	30.00	30.0	25.00	30.0
7	40.00	45.0	59.00	65.0
8	60.00	63.0	60.00	60.0
9	40.00	40.0	50.00	55.0
10	65.00	70.0	50.00	52.0
11	40.00	45.0	60.00	65.0
12	40.00	40.0	15.00	15.00
13	40.00	50.0	50.00	55.0
14	50.00	55.0	70.00	75.0
15	27.00	34.0	26.00	32.0
16	30.00	32.0	31.00	32.0
17	18.00	21.0	40.00	42.0
18	35.00	36.0	21.00	30.0
19	58.00	36.0	30.00	38.0
20	69.00	74.0	30.00	38.0
Mean±SD	47.55±16.33	49.40±16.28	37.85±20.07	42.45±20.44
P value	P>0.05		P<0.001	

Sperm count post varicocelectomy increased significantly in group 1, group 2 patients with a $p<0.001$.

Sperm motility increased significantly in group 2 with a $p<0.001$ while it was not significant increase in group 1 with $p>0.05$.

DISCUSSION

Some authors proposed that it should be treated in adolescence in order to prevent future fertility problems based on the fact that one third of the patients evaluated for infertility have varicocele, however only 15-20% of

men with varicocele need treatment for infertility. Varicocele is found in 15% of the general population and 35% of men with primary infertility and in men with secondary infertility it is 50-80%. The significantly higher incidence of varicocele in men with secondary infertility coupled with the observation that varicocele develops at the time of puberty suggest that presence of varicocele cause a progressive decline in fertility.

Patients mostly have unilateral or bilateral varicocele and very rarely right sided varicocele. In our Study which had total 40 patients majority of patients had either left sided or bilateral varicocele only one patient had isolated right

sided varicocele for which ultrasound abdomen was done to rule out abdominal mass. The presumable cause for the high proportion of unilateral left sided varicocele is that the left spermatic vein runs vertically in an upright man and inserted at right angle into the left renal vein whereas right renal vein runs tangentially to insert into inferior vena cava. Allen et al performed a retrospective chart review on 61 patients who underwent varicocele repair by a single surgeon for infertility of suspected male etiology. All patients who underwent varicocelectomy had abnormal preoperative semen parameters and abnormal sperm morphology. Out of 30 patients 19 had abnormal sperm density, and 26 had abnormal sperm motility, sperm density ($p < 0.0001$) and motility ($p < 0.0004$) improved significantly after varicocelectomy but morphology did not change ($p > 0.05$). There was no change in postoperative morphology, concentration or motility ($p > 0.05$, $p > 0.05$ and $p > 0.05$, respectively) in the subclinical varicocele group. Postoperative improvement was noted in the clinical varicocele group, with respect to sperm concentration and motility ($p < 0.004$ and $p < 0.002$, respectively) but not in morphology ($p > 0.05$). Further segregation revealed that morphology, concentration and motility in the clinical unilateral varicocelectomy group were not changed ($p > 0.05$, $p > 0.05$ and $p > 0.05$, respectively). Varicocelectomy is known to improve sperm count and appears to have variable effect on motility and morphology.¹⁰ In our study same findings were observed in which one group showed improvement in two or more parameters each.

In 1955, Tulloch reported that ligation of the spermatic vessels cured a 27-year-old azoospermic male with bilateral varicoceles.¹¹ Within 3 months of the surgery, spermatozoa had returned to the seminal fluid, and within 9 months the patient's wife became pregnant. In our study although spermatozoa improved in quantity but pregnancy was not reported. Varicocelectomy is advocated in azoospermic men with normal sized testis and palpable varicocele since successful paternity is common after varicocelectomy. When artificial reproductive technology is available it is recommended in patients with varicocele to undergo varicocelectomy for better results and likelihood of successful pregnancy post operatively. Iranian study showed following results mean sperm count before and after surgery 59.04 and 66.07 respectively with $p < 0.001$ sperm motility before and after surgery 38.29 and 41.10 with a $p < 0.001$ and sperm morphology before and after surgery 54.50 and 56.51 respectively. In our study group 1 showed mean sperm count increased from 46.65 to 51.90 with a $p < 0.05$, mean motility 47.55 pre varicocelectomy and 49.40 post varicocelectomy with a $p > 0.05$. Mean morphology in group 1 and it was also significant. Mean morphology was also significant in group 2 along with sperm count and sperm motility. No single diagnostic tool available today provides exceptional sensitivity and specificity in cases of clinically undetected varicocele.

Varicocele first appears during adolescent age group.¹¹ In our study average age of presentation was 25-35 years of age. Several studies have proved that it being a progressive disease, it causes increasing testicular dysfunction over time. Age of presentation is important to indicate degree of dysfunction caused by varicocele. In 1977, Lipshultz and Corriere suggested that varicoceles were associated with testicular atrophy that was progressive with age. They also observed that testicular biopsies in prepubertal boys with varicoceles already demonstrated histologic abnormalities. Kass and Belman were the first to demonstrate a significant increase in testicular volume after varicocele repair in adolescents.

CONCLUSION

The present study highlights the important role played by varicocele in causing detrimental effect on spermatogenesis, semen parameters and resulting in primary infertility thus proving varicocele as an important curable cause of male infertility. All parameters seem to improve after varicocele ligation, thus improving fertility. We believe that, even in the patients where the sperm counts are not increasing, improvement in semen quality, spermatogenesis will improve fertility. The period of this study was too short to show whether fertility improves or not. This study goes a long way in establishing that the possibility of conception will improve markedly after varicocele ligation, provided the female partner is normal. Thus we advocate treatment of all grades of varicocele in symptomatic and primarily infertile patients.

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