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Research Article

Effect of varicocele surgery on sperm quality

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Abstract

Introduction: A varicocele is a vascular lesion characterised by dilatation and tortuosity of the veins of the pampiniform plexus and is found in approximately one-fifth of the adult male population. It is the most common cause of treatable infertility.

Physical examination may or may not show a varicocele which is mostly diagnosed only when patients present with infertility or adolescents during a physical examination, like testicular hypotrophy, impairment in spermatogenesis mainly in the form of low or absent count, decreased sperm motility, and abnormal sperm morphology.

Treatment for varicocele includes medical therapies, radiological embolization, and surgical techniques. Medical therapy, including antioxidants and anti-inflammatory agents, has been utilized with variable success. Radiological embolization of varicocele is a new technique in the treatment of varicocele, but it is associated with high recurrences and high cost. Varicoceles are surgically treated either by open or laparoscopic approaches the principal aim being occlusion of the dilated veins of the pampiniform plexus.

A definitive conclusion of indication of medical treatment cannot be drawn at present because most published studies have inadequate design and lack controls.

Various studies in the past have concluded significant changes in sperm parameters (total count, motility, morphology) post-varicocele repair. However, few other studies suggest no improvement in sperm parameters following surgical varicocele repair and studies that conclude recommendations against repair of varicocele. Thus, conflicting opinions have opened the scope to establish this fact by this study.

Aim: To evaluate changes in sperm morphology, sperm count, and sperm motility in a patient with varicocele after varicocele surgery.

Materials and methods: The study was conducted in the Department of Surgery, North Delhi Municipal Corporation Medical College & Hindu Rao Hospital, Delhi, India from August 2019 to February 2021. The sample size was calculated to be 50 using Slovin's formula with a confidence level of 95% with a margin error taken as 5% (*p* - value 0.05).

Sperm morphology, sperm count, and sperm motility were the parameters studied before and after 3 months of surgery.

Results: The majority of patients belonged to the age group of 18 to 25 years (42%) followed by 26 to 35 years (40%) (27.78 ± 6.547 years). Left-sided varicocele was more common (54%), followed by bilateral varicocele (42%). Varicocele grade II was most common (58%) followed by grade I (30%) and lastly grade III (12%). Total sperm count improved by 8.88 million per ml after varicocelectomy. Total sperm motility improved by 6.08% after the surgery. Total normal sperm forms improved by 6.44% after varicocele repair.

Conclusion: Based on the findings it was concluded that Varicocelectomy results in significant improvement in total sperm count, total sperm motility, and total normal sperm morphology. The best improvement was seen in sperm count followed by total normal sperm forms and lastly total sperm motility.

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Introduction

A varicocele is a vascular lesion caused by dilatation and tortuosity of the veins of the pampiniform plexus. Varicocele is found in approximately 15% - 20% of the adult male population and is the most common cause of treatable fertility [1]. Varicocele is rarely seen in the pre-adolescent group in which its incidence is 0.92% [2].

Patients with varicocele usually present with scrotal pain; worm-like swelling in the scrotum and male infertility. Physical examination may or may not show a palpable varicocele, most of the time varicoceles are diagnosed only when patients present with infertility or adolescents during a physical examination [3]. Varicoceles are associated with various deleterious effects on testes like testicular hypotrophy, impairment in spermatogenesis mainly in the form of low or absent count, decreased sperm motility, and abnormal sperm morphology [4]. Oxidative stress, scrotal hyperthermia, hormonal disturbances, testicular hypoperfusion, hypoxia, and backflow of toxic metabolites are potential mediators of varicocele-mediated infertility of which oxidative stress has been implicated as the central mediator of varicocele-associated infertility [5].

Colour Doppler Ultrasound study is the primary modality for diagnosing varicocele. Invasive techniques such as spermatic venography to diagnose varicocele have now become obsolete. Thermography has also been used to diagnose varicocele and has a higher sensitivity and specificity but is comparatively costlier.

Treatment for varicocele includes medical therapies, radiological embolization, and surgical techniques. Medical therapy, including antioxidants and anti-inflammatory agents, have been utilized to treat symptomatic men with varicocele and infertility in men with varicocele with variable success [6].

Varicoceles are surgically treated either by open or laparoscopic approaches. The principal aim of surgery is the occlusion of the dilated veins of the pampiniform plexus. Open surgery is performed by the following approaches:

1. Palomo's operation: Supra-inguinal extraperitoneal ligation of the testicular vein.
2. Inguinal approach (Inavissevich approach)
3. The subinguinal approach (Marc-Goldstein) is a subinguinal approach at the superficial inguinal ring outside the external oblique aponeurosis without opening the external oblique aponeurosis and is most commonly performed.
4. Scrotal approach: The chances of leaving behind a few veins are high
5. Laparoscopic approach: Presently accepted, good approach.

Various studies in the past have concluded significant changes in sperm parameters (total count, motility, morphology) post-varicocele repair. Natural pregnancy rates after varicocelectomy when female factors are excluded, are approximately 44.1 % at 1 year follow-up [7]. However, few other studies suggest no improvement in sperm parameters following surgical varicocele repair and studies that conclude recommendations against the repair of varicocele [8,9].

Thus, conflicting opinions have opened the scope to establish this fact, so the aim of this study is to evaluate changes in sperm morphology, sperm count, and sperm motility in a patient with varicocele after varicocele surgery.

Materials and methods

The study was conducted in the Department of Surgery, North Delhi Municipal Corporation Medical College & Hindu Rao Hospital, Delhi, India from August 2019 to February 2021. The study was approved by the Institutional Ethics Committee. The sample size was calculated to be 50 using Slovin's formula with a confidence level of 95% with a margin error taken as 5% (p - value 0.05).

Slovins formula for calculation of sample size:

n= 2 1 Ne N +

n= ( ) 2 1 57 0.05 57 + □

n= 1.1425 57

n = 49.9

Where n= Sample Size N= Population size at the centre taken as average in 2 years and e= margin of error taken as 0.05 (at 5%). After the calculation from the above formula sample size was 50.

Inclusion criteria: 1. Patients of varicocelectomy between ages 18 to 50.

Exclusion criteria: 1. Patients who did not give consent for their participation in this study. 2. Secondary varicocele. 3. Varicocele patients having hydrocele 4. Varicocele patients with inguinal hernia.

Sperm morphology, sperm count, and sperm motility were the parameters studied before and after 3 months of surgery. (Tables A and B).

Statistical methods

Testing was conducted with the statistical package for the social science system version IBM SPSS 28.0.0.0. Continuous variables are presented as mean ± SD, and categorical variables are presented as absolute numbers and percentages. The comparison of normally distributed continuous variables between the groups was performed using the Student's t-test. Nominal categorical data between the groups were compared using the Chi-square test or Fisher's exact test as appropriate. The p - value < 0.05 was taken as statistically significant.

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Results

Of the patients, 42% were in the age group of 18 to 35 years with a mean presentation at 27.78 years. Of varicoceles, 96% were either left-sided or bilateral. The majority 58% of varicoceles were of Grade II or Grade I (Table A for grading).

Even though most patients (54%) had a near-normal sperm count between 20 and 35 million per ml, the mean pre-operative total sperm count being 24.16 ± 22.90 million per ml, the quality of sperm was poor in most cases. Preoperative mean motility was 38.18 ± 10.85%. While the mean normal sperm morphology assessed preoperatively was 40.26 ± 7.46%.

Post-surgery the mean total sperm count rose to 33.04 ± 23.34 million per ml while the mean total sperm motility assessed postoperatively was 44.26 ± 10.64%. The mean normal sperm morphology assessed postoperatively rose to 46.7 ± 6.91%. The *p* - value of comparison of pre-operative and postoperative sperm quality calculated with the help of chi-square test is < 0.001 showing significant improvement in overall quality of sperm in cases of varicocele after surgery.

Discussion

This prospective analytical study was done on 50 patients of infertility with varicocele and with abnormal sperm count and quality taken up for varicocelectomy.

The results as compared to other studies are shown in Tables 1-3.

This difference in total count, motility, and morphology after surgery may be attributed to improvement in the pathophysiologic mediators in varicocele that cause reduced sperm count. However, limited follow-up of up to 3 months was a limitation as some patients may show improvements up to 12 months or even more. Also, the outcome in terms of natural pregnancy rates following surgery was not assessed.

Table A

Grades of Varicocele [10].

- **Grade 1**: Detection of prolonged reflux in vessels only during Valsalva's maneuver.
- **Grade 2**: Nondilated veins while supine. When standing dilated veins reach the upper pole of the testicle. Reflux to upper pole veins only while performing a Valsalva maneuver.
- **Grade 3**: Nondilated veins while supine. When standing dilated veins reach the lower pole of the testicle. Reflux to lower pole veins only while performing a Valsalva maneuver.
- **Grade 4**: Dilated veins while supine with reflux while performing a Valsalva maneuver.
- **Grade 5**: Dilated veins that reflux without performing a Valsalva maneuver.

Table B

Semen analysis cut-off reference values published by WHO (2010) [11] are as follows:

- **Volume**: The reference limit is 1.5 ml.
- **Sperm Count**: The reference limit taken was normal above 15 x 106 /ml.
- **Total sperm count**: The reference limit taken was normal above 39 x 106/ml.
- **Total Motility**: Normal reference taken as more than 40%
- **Total progressive motility**: Normal reference taken as more than 32% 12
- **Vitality:** Normal reference taken as 58% alive.
- **Morphology:** Normal reference is 4% of normal forms.
- **Leucocyte count:** Normal reference taken as less than 1.0 x 106 /ml.

Table 1: Sperm Count comparative study.

Study	Year of study	Sample size	Preoperative sperm count (Mean) in millions per ml	Postoperative sperm count (Mean) in millions per ml
Dhabuwala, et al. [12]	1992	38	33.8	58.6
Cayan, et al. [13]	2000	232	30.97	34.57
Kamal, et al. [14]	2001	159	22.50	29.90
Kibar, et al. [15]	2002	90	22.10	38.30
Hseih, et al. [16]	2003	96	26.20	42.78

Table 2: Sperm Motility comparative study.

Study	Year of Study	Sample size	Preoperative sperm motility (Mean)	Postoperative sperm motility (Mean)
Goldstein, et al. [17]	1992	429	39.62%	45.66%
Cayan, et al. [13]	2000	232	29.70%	36.62%
Hseih, et al. [16]	2003	96	31.86%	47.62%
Zini, et al. [18]	2005	37	34.60%	38.40%
Our Study			38.18%	44.26%

Table 3: Sperm Morphology comparative study.

Study	Year of study	Sample size	Preoperative sperm normal morphology (Mean)	Postoperative sperm normal morphology (Mean)
Dhabuwala, et al. [12]	1992	38	36.10%	40.30%
Goldstein, et al. [17]	1992	429	48.42%	52.10%
Zini, et al. [18]	1999	30	46.40%	54.40%
Hseih, et al. [16]	2003	96	62.30%	64.68%
Our Study			40.26%	46.7%

Conclusion

Based on the above findings we conclude that Varicocelectomy results in significant improvement in total sperm count, total sperm motility, and total normal sperm morphology in case of male infertility.

The best improvement was seen in sperm count followed by total normal sperm forms and lastly total sperm motility. The reason why motility showed the least improvement cannot be deduced but even this improvement is clinically significant.

(**Annexure**)

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