

Benefits of Laparoscopic Varicocelectomy on Sperm Parameters and Pregnancy Rates in Infertile Males with A Varicocele

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ABSTRACT

Background: A varicocele is among the most often reported reasons for male infertility. Malfunctioning of the testicles is a potential consequence. Semen quality and postoperative spontaneous conception can both be enhanced by varicocelectomy. There are a variety of surgical techniques available for varicocelectomy. Decreased analgesic need, quicker rates of return to work, and lower morbidity were all associated with laparoscopic varicocele ligation, as opposed to the conventional open surgical method. **Objective:** The aim of the current study was to determine the impact of laparoscopic varicocelectomy on postoperative sperm parameters and spontaneous pregnancy rates in varicocele-related infertile men. **Patients and methods:** A total of 34 individuals who underwent laparoscopic varicocelectomy for primary varicocele and infertility were included for this retrospective study. We contrasted the concentration and motility of their semen after 3 and 6 months following surgery with the preoperative values along with the spontaneous pregnancy of their partner at >12 months postoperatively. **Results:** The research was done on patients aged between 20-40 years, who underwent laparoscopic varicocelectomy with a mean age of 28.4 years. At the third to sixth months following surgery, semen parameter findings improved, the difference between the semen parameters pre and postoperatively assures that sperm motility and count both significantly increase at 6 months. About 38.2% of the following partners conceived successfully during the first year. **Conclusion:** Despite the results of their semen analysis, a noticeable rise in the success rate of spontaneous conception in infertile males was seen during the observation period. Laparoscopic varicocelectomy is therefore advised as a viable surgical treatment for varicocele.

Keywords: Varicocele, Laparoscope, Semen analysis, Pregnancy rate, Intervention study, Suez Canal University.

INTRODUCTION

When a couple has frequent unprotected sex for a year and is still unable to conceive, it is considered infertility ⁽¹⁾. Men's infertility's most common treatable cause that can harm the testicles, though it may appear to have no negative effects in some males, is varicocele ⁽²⁾.

Varicocele can induce infertility for a number of reasons. Numerous investigations have shown that varicocele can cause spermatic vein hypertension, oxidative stress, death of germ cells, testicular hypoxia, and reflux of hazardous substances from the kidneys and adrenals, and an increase in the patient's testicular temperature ⁽³⁾.

Although the effectiveness of varicocelectomy has been disputed, recent research strongly supports its use in infertile males. According to one study, patients who received surgical varicocelectomy achieved a pregnancy rate of 33% whereas controls who received no varicocelectomy had a pregnancy rate of 15.5% ⁽⁴⁾.

Varicocele is thought to be the main factor contributing to a combination of anomalies in the three essential semen characteristics known as the OAT (oligoasthenoteratozoospermia) syndrome defined by insufficient sperm production ⁽⁵⁾.

Alleviating venous stasis, preserving the spermatic cord's arterial and lymphatic flow, and reducing consequences and recurrence are the objectives

of varicocele treatment. Laparoscopic, microsurgical, or open approaches exist for managing varicocele ⁽⁶⁾.

Finding the most efficient varicocelectomy method is an unfulfilled clinical need in the absence of prognostic markers. Some researchers claim that the microsurgical approach yields the best results, while others lean more toward the laparoscopic approach ⁽⁷⁾.

Because laparoscopic varicocelectomy provides an excellent vision of the spermatic arteries and allows for preservation of the spermatic artery in 89-100% of individuals, it is regarded to be preferable to open varicocelectomy. Additionally, it is less invasive, has less morbidity, and requires less postoperative pain medication ⁽⁸⁾.

The primary benefit of the laparoscopic method is that it eliminates the need for two incisions necessary with an open surgical approach and permits the same incision to be used for a bilateral laparoscopic ligation. Therefore, laparoscopy seems inappropriate for treating a unilateral varicocele due to its greater price and requirement for repeated port insertions, which are its main drawbacks ⁽⁹⁾.

The aim of the current study was to determine the impact of laparoscopic varicocelectomy on postoperative sperm parameters and spontaneous pregnancy rates in varicocele-related infertile men.

PATIENTS AND METHODS

Study Design and Patients:

A retrospective chart review was done on thirty-four individuals who underwent laparoscopic varicocelectomy at the Department of Surgery, Suez Canal University Hospital spanning the months of February 2020 and November 2021. Patients were considered suitable study participants if they:

1. have palpable clinical varicocele, and infertility (primary) over 12 months.
2. completed their 12-month follow-up (about 53 patients had undergone Laparoscopic Varicocelectomy and met the inclusion criteria but only 34 of them completed the 12 monthly follow up and therefore were selected for this study).
3. With no prior history of pelvic surgery.
4. male factor (There is no visible cause for the female partner's infertility on investigation).
5. lacked a serious chronic condition, such as liver or renal impairment

We exclude males who suffered recurrent varicocele, patients who were using any form of contraception, past history of surgery for testicular pathology or inguinal hernia, and patients who had open varicocelectomy from our study. The study's findings were focused on the following: rate of spontaneous conception and semen characteristics improvement following varicocelectomy.

Surgical procedure:

Relevant data was gathered from the patient's files and included: age, marriage duration, infertility duration, chronic illness, medication history or smoking. The results of general and local examinations were also documented assessing the existence, grades, and unilaterality or bilaterality of a varicocele. Preoperative Scrotal ultrasound reports for each patient were analyzed. Pre and post-varicocelectomy, the results of the semen analysis were compared. The World Health Organization (WHO) criteria were used to define normozoospermia in 2010⁽¹⁰⁾.

The following are the results of the test's local physical examinations: Only when the patient is upright and performing the Valsalva maneuver is Grade I varicocele visible; even without doing the Valsalva maneuver, Grade II is tactile, and Grade III is visible through the scrotal skin⁽¹¹⁾. The size of the vein implicated in a varicocele could be determined by Doppler ultrasound of the scrotum; a varicocele is typically defined as having a vein with a diameter of 2.5 to 3 mm⁽¹²⁾. Semen samples were acquired through masturbation following three to four days of no sexual activity prior to surgery and Semen analysis though CASA was applied. The intervention in this study was

Laparoscopic varicocelectomy performed under general anesthesia. A 10 mm trocar was used to gain direct access to the abdomen through the umbilicus. Through the umbilical port, a laparoscope was introduced to examine the peritoneal contents.

The best locations for the new operating ports to be inserted were then found. In order for instruments to easily access the interior ring, instrument port locations were chosen in each LOWER quadrant. The posterior peritoneum was then gripped 2 to 3 cm from the deep inguinal ring, lateral to the testicular arteries, and incised to create a window. Identification and isolation of the vascular structures was then achieved (**Figure 1**). An effort was made to keep the testicular lymphatics and arteries intact. Two clips were used on testicular veins (**Figure 2**). The surgery was performed on the other side in event of bilateral varicocele. Both a 3-month and 6-month postoperative semen analysis was performed. Successful conception was followed up for over a year and the main outcome was successful pregnancy even if it did not reach full term.

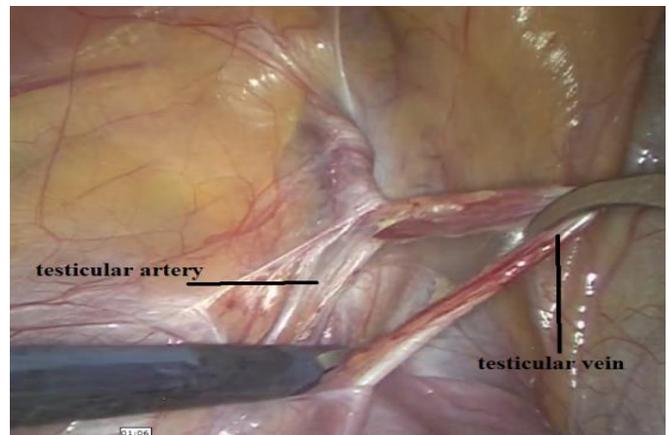


Figure 1: Testicular vessels dissection and isolation.

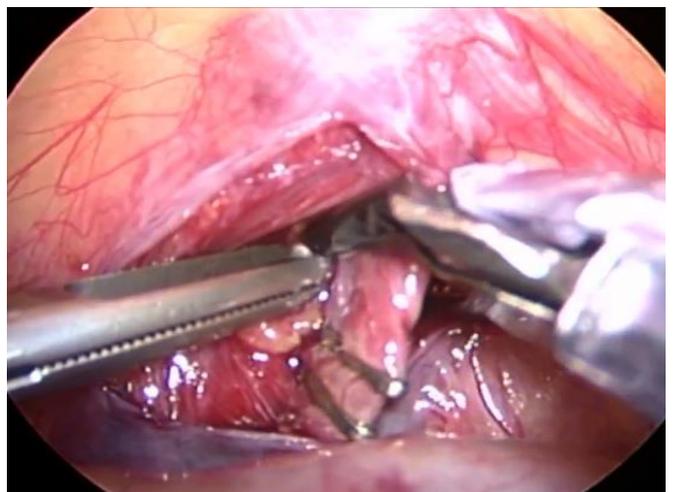


Figure 2: Clips were applied on the testicular vein.

Ethical Considerations:

The Suez Canal University Hospital’s Local Ethics Committee gave its approval to the study's protocol. Due to the retrospective nature of the study, the requirement for written informed consent was waived. Every procedure is carried out in accordance with the Helsinki Declaration's guidelines ⁽²⁵⁾. According to STROBE principles, we created the following manuscript ⁽²⁶⁾.

Statistical analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 20 for windows. Qualitative data were defined as numbers and percentages. Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation (SD), and Paired t-test was used for comparison between variable before and after intervention. P value ≤0.05 was considered to be statistically significant.

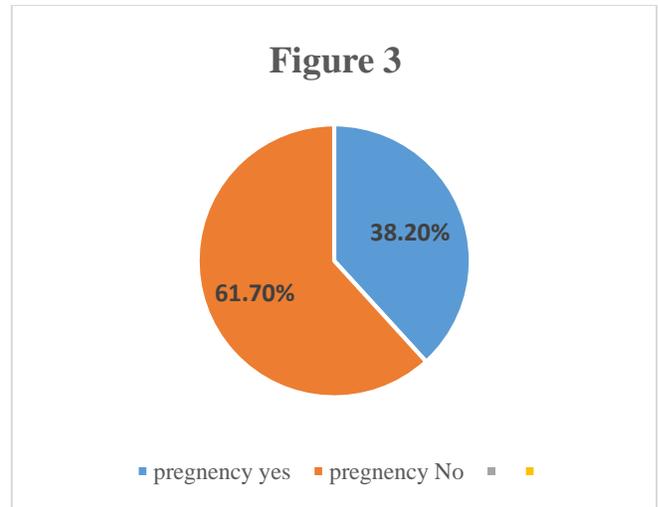
RESULTS

A total of 34 adult male patients with a clinical varicocele were legible to participate in this study. The average patient age ranged from 20 to 40 years old (Table 1), with all of them being married. Grade 2 and 3 varicocele were identified during the preoperative physical examination in 4 (11.8%) and 30 (88.2%) of the patients, respectively (Table 1).

Table 1. Demographic and clinical data of studied patients.

Demographic Data	No (%)
Age	
<25	8 (23.6%)
25-40	13 (38.2%)
>40	13 (38.2%)
Min-Max	20-45
Mean/SD	28.41 ± 6.13
Marital status	
Married	34 (100%)
Single	0 (0%)
Pregnancy	
Yes	13 (38.2%)
No	21 (61.7%)
Varicocele Grade	
Grade2	4 (11.8%)
Grade 3	30 (88.2%)
Radiological bilaterality	
Unilateral (left side)	14(41.1%)
Bilateral	20 (58.8%)

Under general anesthesia, patients received laparoscopic varicocelectomy procedures. There were no postoperative problems induced by anesthesia for any of the patients. Preoperatively and three to six months after surgery, semen parameters (motility, concentration, and aberrant forms) and values were compared. A statistically significant increase in sperm parameters was observed postoperatively in the third to sixth month when compared to the result before surgery (P ≤0.05). Only 13 (38.2%) couples experienced spontaneous pregnancies during the first year of follow-up (Figure 3).



Despite the fact that 20 patients were bilaterally afflicted based on the radiological assessment, only patients were clinically diagnosed as having bilateral disease whereas 27 patients exhibited left-sided affection. Infertility was the presenting symptom in 40% of the patients (Table 1). About 60% of the patients experienced testicular pain with a mean age of 27 years old (Table 2).

Table 2. The complaint of the studied patients.

Complaint	Percentage	Mean age
Testicular pain	60%	27 ± 4.88
Testicular swelling	21%	22.4 ± 3.3
Infertility	40%	30.4 ± 4.18

Each patient's sperm concentration increased in the semen assay, with the mean sperm concentration rising from 15.9 million/ml to 19.22 million/ml at three months to 22.8 million/ml at 6 months after surgery. This rise was found to be statistically significant (Table 3). At 6 months postoperatively, the mean total motility rose from 42.3% preoperatively to 51.8% (Table 4). Changes in the concentration abnormal sperm forms are shown postoperatively (Table 5).

Table 3. Sperm concentration changes pre and postoperative.

Sperm concentration	Mean (million/ml)	SD	P-value
Preoperative	15.9	14.4	
3 months post-op	19.2	16.4	0.001
6 months post-op	22.8	14.5	0.00

Table 4. Sperm motility changes pre and postoperative.

Total motility	Mean (%)	SD	P-value
Pre-op	42.3%	17.4	
3 month post-op	49.8%	11.8	0.001
6 month post-op	51.8%	14.5	0.00

Table 5. Comparison between pre and post-varicocelectomy sperm morphology.

Abnormal forms	Pre-op %	Post-no at 3 months %	Post-no at 6 months %
	35.2 ± 18.04	31.7 ± 14.6	26.4 ± 10.65

The average length of the hospital stays and operating times were 1.65 (SD 0.26) days and 30.13 (SD 4.03) minutes, respectively. The operation time was calculated from trocar insertion to trocar extraction and skin closure. Two patients developed postoperative hydrocele, one patient experienced recurrence of varicocele, 3 patients had scrotal edema resolved spontaneously and none of the remaining patients showed testicular atrophy, scrotal hematoma or any other postoperative consequences.

DISCUSSION

Varicocele can harm the testicles, which can lead to spermatogenic dysfunction, sperm DNA damage, loss of testicular volume, and other problems. Testicular hypo perfusion, elevated oxidative stress, regional hormonal imbalances, blood stasis (toxin buildup), and heat stress have all been implicated as the pathologic mechanisms underlying testicular dysfunction owing to varicocele.

It is still unclear exactly how varicocele surgery can increase male fertility in affected males. In the majority of patients, varicocelectomy has been shown to dramatically enhance the semen profile ⁽¹³⁾. Several studies have shown that surgery has a good impact on morphology, motility, and concentration of sperm ⁽¹⁴⁾. The studies, however, examine distinct approaches and diverse patient populations, necessitating additional research before a laparoscopic varicocelectomy for male infertility can be recommended on the basis of evidence. After varicocelectomy, the likelihood of spontaneous pregnancies in couples where the male partner has both a varicocele and defective sperm is also greatly raised

⁽¹⁵⁾. In the current study, there is a statistically significant increase in sperm count and motility following laparoscopic varicocelectomy. In this research, the mean age at which varicocele first appeared was 28.7 years, which was similar to what was reported by **Eje et al.** from their study they reported an average age of 35 years same as the age that was reported by **Sadiq et al.** ⁽¹⁶⁾. **Osifo et al.** in Benin, reported a mean age of 37 years ⁽¹⁷⁾. The age range for participants was 20 to 40, close to our data, patients' ages ranged from 25 to 48 years old in the open group, and from 23 to 49 years old in the laparoscopic group, according to **Lynch et al.** ⁽¹⁸⁾.

Semen parameters are improved with varicocelectomy. Improvements in pregnancy rates, sperm morphology, motility, and concentration were observed, according to research by **Leung et al.** on the effects of laparoscopic varicocelectomy on pregnancy outcomes and semen indices ⁽¹⁹⁾. In their investigation into the effects of varicocelectomy on sperm morphology, **Cakan et al.** discovered that the condition of the sperm improved after the procedure ⁽²⁰⁾. Additionally, **Senbanjo et al.** demonstrated that varicocelectomy enhances the quality of the patient's semen in roughly 53% of cases ⁽²¹⁾. In our work, the average sperm concentration was raised after surgery, going from 15.9 million/ml to 19.22 million/ml at 3 months and 22.8 million/ml at 6 months. This rise was found to be statistically significant. Only 13 of the 34 patients in this trial had infertility and/or a low sperm count, which may account for the study's lower improvement percentage. Postoperatively, there was a statistically significant improvement in spermatid motility. Regarding abnormal forms, the overall improvement was approximately 8.8%. Likewise, **Gouda El-laban** ⁽²⁹⁾ found a notable improvement in semen parameters in both the open and laparoscopic groups. According to research by **Al-Kandari et al.**, equivalent improvements in sperm motility and/or concentration were seen in 65%, 67%, and 76% of the open, laparoscopic, and microsurgical groups, respectively ⁽⁹⁾.

Furthermore, Each Surgery was successfully conducted without any intraoperative issues. The average operation lasted 30.13 (SD 4.03) minutes. In comparison to other studies, **Watanabe and collaborators'** investigation found that the average operating duration was 28.4 (SD 3.86) minutes ⁽²³⁾. The fact that 20% of the patients in the laparoscopic group had bilateral varicocele and required bilateral operation may account for the longer recovery time. The hospital stay was 1.65 (SD 0.26) days. According to **Behars et al.**, the patient spent 31.3 days in the hospital ⁽²⁴⁾. The majority of patients had moderate postoperative pain, which has been satisfactorily relieved with nonsteroidal anti-inflammatory drugs or paracetamol.

CONCLUSION

The current investigation demonstrated infertile men with palpable varicocele and abnormal semen parameters to benefit greatly from varicocelectomy in terms of sperm motility and concentration. When performed by skilled hands, it offers great postoperative outcomes with low complication rates and can increase the conception rate in men who first arrive with reproductive issues caused by male factors as a result of varicocele. To assess the reproductive rate after open and laparoscopic varicocelectomy, more research with longer follow-up periods is required.

- **Conflict of interest: The authors declare that their interests do not conflict.**
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