

---

# Laparoscopic staple interruption versus laparoscopic varicocelectomy for the treatment of varicocele value and effect: A comparative study

*Ghada Morshed, MD, MRCS; Hany Habashy, MD*

*Department of Surgery, El-Fayoum University Hospital, Fayoum, Egypt.*

## Abstract

*Background: Varicocele is an abnormal dilation of the pampiniform plexus that constitutes the primary drainage of the testis. It is found approximately in 15% of male adolescents with a left sided predominance. Laparoscopic varicocelectomy has been proposed as an alternative surgical procedure for the repair of varicocele with reported benefits of better convalescence, minimal invasiveness and less analgesic requirement postoperatively.*

*Patients and methods: The study was done in El Fayoum University Hospital from November 2011 till November 2012 and it included twenty cases with varicocele. The patients were divided into two groups: The first group (10 patients) was subjected to laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins in between the clips, the second group (10 patients) was subjected to laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips.*

*Results: All the procedures in the two groups were completed satisfactorily, with no intraoperative complications. No significant difference was found in the operative time between the two groups ( $25.5 \pm 3.12$  minutes and  $26.2 \pm 4.23$  minutes for group I and II respectively) ( $p=0.889$ ). Most patients in the two groups had moderate pain, with no significant difference between the two groups ( $p=0.801$ ). The hospital stay was not significantly different among the patients of the two study groups ( $1.7 \pm 0.82$  days in group I and  $1.5 \pm 0.68$  days in group II) ( $p=0.870$ ). There were no post operative complications, only one patient in the 2<sup>nd</sup> group experienced recurrence symptoms of varicocele.*

*Conclusion: In conclusion, laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips is more superior to traditional laparoscopic staple interruption with cutting the gonadal vein or veins inbetween the clips for treatment of varicocele regarding the lower risk to cut the vas deference or spermatic artery. The spermatic count was the same as well as the spermatic motility and abnormal forms.*

*Key words: Varicocele, laparoscopic varicocelectomy, semen analysis, Palomo's operation.*

---

## Introduction:

Varicoceles have been associated with progressive deterioration of testicular function and testicular hypotrophy.<sup>1,2</sup> Varicocele repair can halt or even reverse this progression.<sup>3</sup> Over recent decades, varicocelectomy has developed with numerous approaches: microsurgical subinguinal (Goldstein), inguinal (Ivanissevich), and abdominal (Palomo, non artery sparing). Advantages of laparoscopic varicocelectomy include:

increased magnification, facilitating more accurate identification of vessels, such as spermatic collateral veins, (i.e. veins running along side the spermatic cord and together entering the internal ring, a possible cause of recurrence if left alone), lymphatics (the ligation of which can lead to hydrocele formation) and the internal spermatic artery.<sup>4,5</sup> Moreover, laparoscopic varicocelectomy is safe even after prior inguinal surgery. The characteristic supra-inguinal access allows

for high ligation of fewer veins vs. the subinguinal approach.

#### **Aim of the study:**

To compare the outcome including operative time, semen analysis, and complications between laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips and only application of the clips without cutting inbetween the clips

#### **Patients and methods:**

The present study involved 20 patients with symptomatic varicocele. These patients presented to Fayoum University Hospital outpatient clinic. They were subjected to clinical examination, pre-operative routine investigations, and pre-operative scrotal duplex. Clinical assessment included age, marital status, and history of having children, special habits of medical importance, complaint, urologic symptoms and local examination findings.

#### **Preoperative assessment included:**

- 1- Routine investigations including semen analysis.
- 2- Duplex study to determine the presence of reflux and the size of the spermatic veins.

These patients were randomly allocated into two groups depending on the procedure to be done:

Group A: 10 patients included post pubertal adolescents to be subjected to laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips. Four of them had bilateral varicoceles.

Group B: 10 patients included postpubertal adolescents to be subjected to laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips. Three of them had bilateral varicoceles.

#### **1- Group A (laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips)**

All patients were subjected to general anesthesia with endo-tracheal intubation. They were placed in the Trendlenburg

position. Trans-peritoneal approach was carried out which consisted of induction of pneumo-peritoneum by insufflation of CO<sub>2</sub> through an open technique through a supra-umbilical mini-incision. As the pressure intra-abdominally reached 14mmHg, a safety 10-mm trocar sheath unit was introduced through the same incision. Pressure was then established at 12-14mmHg. Through that port, a 0-degree scope was inserted and the abdominal cavity inspected. Two working ports were further introduced at a level just caudal to the umbilicus and lateral to the rectus muscle of both right and left lower quadrants. One of them was of 5-mm caliber and the other was of 10-mm caliber. This array of trocars was used in either left or bilateral cases.

T-shaped peritoneal incision was made to provide ample exposure for access to the spermatic vascular bundle just cephalad to the internal inguinal ring. Freeing the entire spermatic vascular bundle from the surroundings was done. The spermatic artery was identified and isolated in an attempt for its preservation. The internal spermatic vein was individually clipped and divided using the 10-mm hemoclip applier.

#### **2- Group B (laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips)**

The same previous steps but the internal spermatic vein was individually clipped but not divided using the 10-mm hemoclip applier.

#### **Post-operative Work-up:**

All patients of both groups were given parental antibiotics (cefotaxime 1gm) i.v. 12 hours after the operation, and allowed oral liquid diet 12 hours after the operation. All patients were discharged 24 hours to return after one week to remove the stitches.

Clinical assessment of the patients as regards testicular pain, size of the testis and size of varicocele was done after 1 month.

Color coded duplex was done to all patients to assess the presence or absence of reflux and size of spermatic veins after 1 month.

**Statistical analysis:**

Differences between means and the effects of treatments were determined by one-way ANOVA using Tukey's test,  $P < 0.05$  was considered statistically significant.

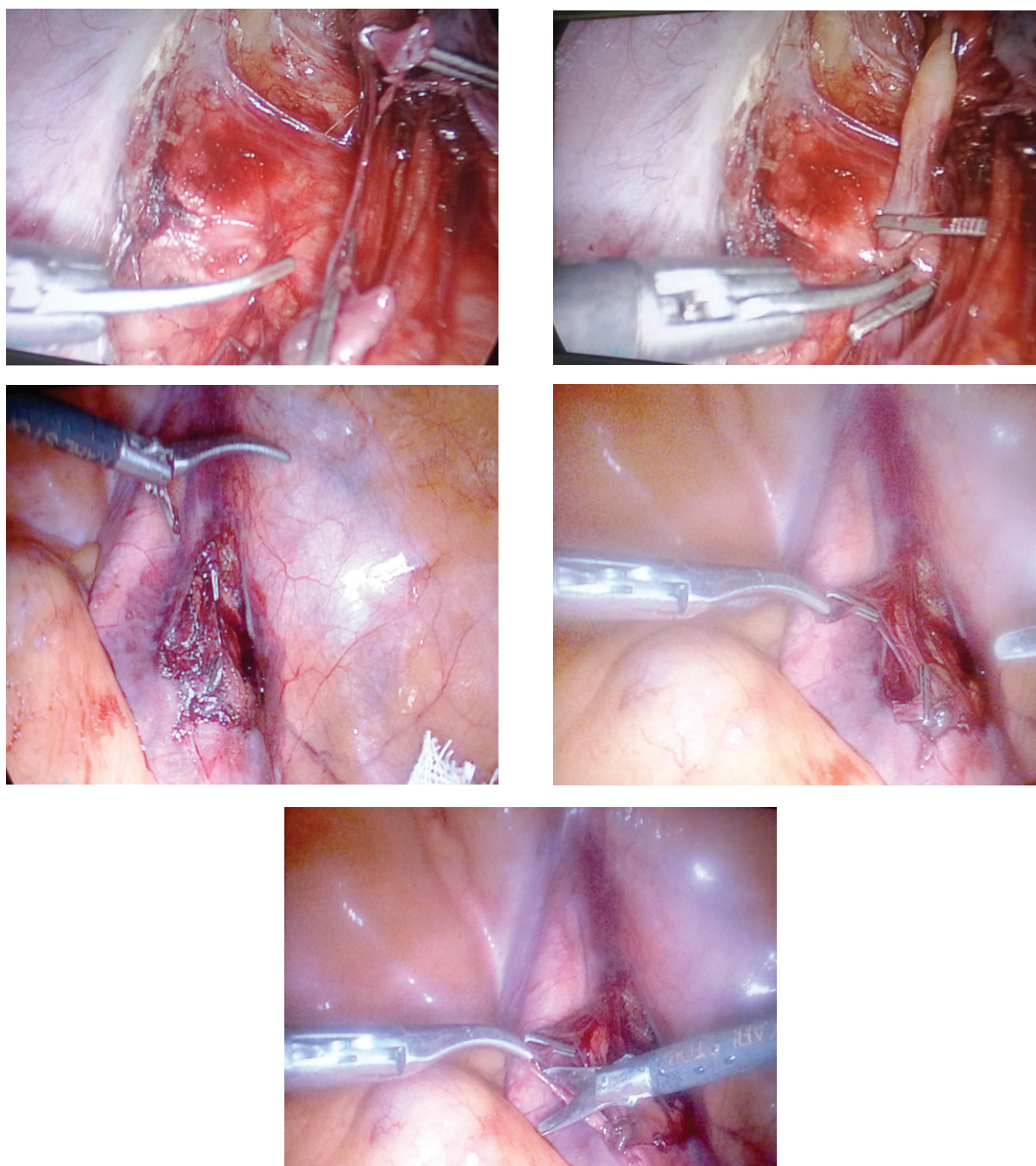
**Results:**

The study included twenty cases with varicocele. They ranged in age from 19 to 42 years (mean = 25.5 years). **Table(1&2).**

The study included twenty cases with

varicocele. They ranged in age from 19 to 42 years (mean = 25.5 years). **Table(1&2).**

The patients were divided into two groups according to the operative procedure done. The first group (10 patients) was subjected to laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips **Figure(1)**. The second group (10 patients) was subjected to laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips **Figure(2)**.



*Figure (1 a,b,c,d&e): Laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips.*



Figure (2 a,b,c,d): Laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips.

Table (1): Clinical data in group I with u/s side.

Case No.	Age (year)	Presentation (the most distressing)	Duration of disease (months)	Side (clinical)	Side (u/s)
1	30	Swelling	15	Left	Bilateral
2	24	Pain	12	Left	Left
3	19	Infertility	10	Left	Bilateral
4	22	Pain	12	Left	Left
5	27	Swelling	14	Left	Bilateral
6	21	Swelling	20	Left	Bilateral
7	23	Infertility	6	Left	Bilateral
8	33	Infertility	30	Bilateral	Bilateral
9	20	Pain	15	Bilateral	Bilateral
10	28	Pain	22	Left	Bilateral
<b>Mean</b>	24.7±8.3 years	-	15.6±14.4 Months		

*Table (2): Clinical data in group II with u/s side.*

Case No.	Age (year)	Presentation (the most distressing)	Duration of disease (months)	Side (clinical)	Side (u/s)
11	26	Pain	14	Left	Left
12	21	Swelling	30	Left	Bilateral
13	30	Pain	8	Left	Left
14	22	Swelling	20	Left	Bilateral
15	26	Infertility	16	Left	Left
16	24	Swelling	20	Left	Left
17	28	Swelling	8	Left	Bilateral
18	24	Pain	6	Left	Left
19	42	Infertility	30	Bilateral	Bilateral
20	20	Swelling	12	Bilateral	Bilateral
<b>Mean</b>	26.3±15.7 Years	-	16.4±13.6 months		

*Table (3): Comparison between the two groups regarding clinical features.*

		Group I	Group II	P value
<b>Number</b>		10	10	-
<b>Mean age</b>		24.7±8.3	26.3±15.7	0.689
<b>Mode of presentation</b>	<b>Infertility</b>	3	2	-
	<b>Pain</b>	4	3	
	<b>Swelling</b>	3	5	
<b>Bilaterality (clinically)</b>		2	2	-

Table (4): Results of pre and postoperative u/s examination.

No.	Preoperative				Postoperative			
	Left side		Right side		Left side		Right side	
	Grade	Testis (cm)	Grade	Testis (cm)	Grade	Testis (cm)	Grade	Testis (cm)
1	III	4.5X3X2	II	4X3X2		4X3X2	I	4X2.5X2
2	II	4X3X2	I	4X2X2.5		4X3X2		4X2X2.5
3	II	3.7X2.5X2		3.8X2.5X2		4X2.5X2		4X3X2
4	II	4.2X3X2	II	4X2.3X2		4.1X3X2	I	4X2.2X2
5	III	4.2X2.8X2		4X2.7X2		4.2X2.6X2		4X2.7X2
6	III	4.2X2.6X2	I	4X2.6X2	I	4X2.5X2		4.1X2.5X2
7	II	3.6X2X2	II	3.5X2.6X2		3X2X2	I	3.5X2.5X2
8	I	4X2X2	I	4X2X2		4X2X2	I	4X2X2
9	II	4.3X2.5X2	I	4.2X2X2		4.2X2.3X2		4.1X2X2
10	III	3.8X2X2	I	3.8X2X2	I	3.5X2X2	I	3.5X2X2
11	II	3X2X1.5	II	3X2X2		3X2X1.5	I	3X2X2
12	II	3X2X1.5		3X2X1.5		3X2X1.5		3X2X1.5
13	III	4.2X2.5X2	II	4X2.5X2		4X2.5X2	I	4X2.5X2
14	II	4X2.3X2	I	4X2.1X2		4X2.1X2		4X2.1X2
15	I	4.1X2X2		4.1X2X2		4X2X2		4.1X2X2
16	III	4X2.7X2	I	4X2.3X2		4X2.5X2		4X2.2X2
17	I	4.2X2X2		4.2X2X2		4.1X2X2		4X2X2
18	II	4.2X2.5X2		4.1X2.5X2		4.1X2.3X2		4X2.4X2
19	III	4.4X2X2		4.4X2X2	II	4.2X2X2	I	4.3X2X2
20	I	4X2.2X2		4X2.1X2		4X2.1X2		4X2.1X2

Table (5): A comparison between the two groups of patients preoperatively as regards their results of Duplex findings.

	Group I	Group II	P value
<b>Bilaterality</b>	8	5	-
<b>Mean Grade (left)</b>	2.3±1.3	2±1	0.832
<b>Mean Grade (right)</b>	1.1±0.9	0.6±1.4	0.0000005

**Table (6): Results of pre and postoperative semen analysis.**

No.	Preoperative					Postoperative				
	Count X 10 <sup>6</sup> /ml	Motility% (hours)			Abnormal Forms %	Count X 10 <sup>6</sup> /ml	Motility % (hours)			Abnormal Forms %
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>			1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	
1	51	40	34	20	44	50	45	37	16	41
2	29	22	16	10	38	48	30	19	14	35
3	20	59	42	18	51	42	50	34	20	33
4	25	33	23	14	49	40	39	30	20	47
5	33	50	41	29	50	62	51	57	30	28
6	21	20	11	6	44	35	26	21	11	36
7	6	21	9	17	75	9	31	20	14	65
8	43	51	44	29	14	51	66	43	28	43
9	50	51	30	15	20	46	44	28	12	29
10	15	50	39	35	40	12	54	45	36	31
11	13	32	22	9	60	13	30	21	22	59
12	6	39	32	20	55	16	44	36	30	66
13	11	33	20	26	17	19	39	20	37	25
14	22	55	38	18	45	30	66	44	14	43
15	31	55	38	40	63	30	50	36	20	49
16	60	43	33	25	25	60	66	41	26	20
17	41	66	30	40	25	60	70	54	43	20
18	16	30	9	6	66	26	33	14	8	63
19	11	54	44	30	50	31	55	40	22	61
20	17	62	39	19	30	41	65	39	38	24

**Table (7): A comparison between the two groups of patients preoperatively as regards their results of semen analysis.**

	Group I	Group II	P value
Mean spermatic count x10 <sup>6</sup>	29.3	22.8	0.136
Mean motility (1 <sup>st</sup> hour) %	39.7	46.9	0.263
Mean motility (2 <sup>nd</sup> hour) %	28.9	30.5	0.708
Mean Motility (3 <sup>rd</sup> hour) %	19.3	23.3	0.359
Abnormal forms %	42.5	43.6	0.879

**Table (8): Comparison between group I and II pre and postoperatively regarding semen analysis findings.**

		Group I	Group II	P value	
<b>Mean spermatic count x10<sup>6</sup></b>	<b>preoperative</b>	29.3	22.8	0.136	
	<b>postoperative</b>	39.5	32.6	0.220	
	<b>P value</b>	0.063	0.0338	-	
<b>Mean motility percentage %</b>	<b>1<sup>st</sup> hour</b>	<b>Preop.</b>	39.7	46.9	0.263
		<b>Postop.</b>	43.6	51.8	0.236
		<b>P value</b>	0.521	0.462	-
	<b>2<sup>nd</sup> hour</b>	<b>Preop.</b>	28.9	30.5	0.708
		<b>Postop.</b>	33.4	34.5	0.862
		<b>P value</b>	0.345	0.466	-
	<b>3<sup>rd</sup> hour</b>	<b>Preop.</b>	19.3	23.3	0.358
		<b>Postop.</b>	20.1	26	0.179
		<b>P value</b>	0.823	0.531	-
<b>Abnormal forms %</b>	<b>Preop.</b>	42.5	43.6	0.887	
	<b>Postop.</b>	39	43	0.521	
	<b>P value</b>	0.631	0.928	-	

**Table (9): Comparison between the two groups regarding operative time, postoperative pain and hospital stay**

	Group I	Group II	P value
<b>Mean operative time (minute)</b>	25.5±3.12	26.2±4.23	0.889
<b>Mean postoperative pain (scale)</b>	5.7±2.22	6.3±3.05	0.801
<b>Mean hospital stay (days)</b>	1.7±0.82	1.5±0.68	0.870

All the procedures in the two groups were completed satisfactorily, with no intraoperative complications. No significant difference was found in the operative time between the two groups (25.5±3.12 minutes and 26.2±4.23 minutes for group I and II respectively) (p=0.889) **Table(9)**.

Most patients in the two groups had moderate pain. According to the visual scale, the mean of group I was 5.7±2.22 and of group II was 6.3±3.05 with no significant

difference between the two groups (p=0.801) **Table(9)**.

The patients in the two groups were not different regarding the frequency and dosage of postoperative analgesics. The hospital stay was not significantly different among the patients of the two study groups (1.7±0.82 days in group I and 1.5±0.68 days in group II) (p=0.870) **Table(9)**.

At follow-up, none of the patients in the two groups had developed a postoperative



hydrocele. Only one patient in the 2nd group experienced recurrent symptoms of varicocele.

#### **Discussion:**

A varicocele is an abnormal dilation of the pampiniform plexus that constitutes the primary drainage of the testis. It is found approximately in 15% of male adolescents. The majority of which is due to retrograde flow of blood in the internal spermatic vein.<sup>6</sup>

Several treatment options are available and include spermatic vein sclerotherapy or embolisation and open surgical ligation of the varix through a retroperitoneal, inguinal or a subinguinal approach. Laparoscopic varicocelectomy has been proposed as an alternative surgical procedure for the repair of varicocele with reported benefits of better convalescence, minimal invasiveness and less analgesic requirement post-operatively. It was reported as one of the most commonly performed laparoscopic procedures in surgery.<sup>7</sup>

The major advantage of the laparoscopic approach is that it provides a direct and magnified view of the structures allowing precise identification and dissection. It likewise allows a bilateral laparoscopic ligation to be done through the same incisions, instead of the two incisions required in an open surgical approach. However the main disadvantages of laparoscopy are the higher cost and the need for multiple port placements, which make it quite inappropriate in treating a unilateral varicocele.<sup>8</sup>

Varicoceles are most frequently diagnosed when a patient is 15-25 years of age, and rarely develop after the age of 40.<sup>9</sup>

Our study included twenty cases with varicocele. They ranged in age from 19 to 42 years (mean =25.5 years). The patients were divided into two groups according to the operative procedure done. The first group (10 patients) was subjected to laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips. The second group (10 patients) was subjected to laparoscopic staple interruption for treatment of varicocele without cutting

inbetween the clips. The patients were randomly distributed between the two groups.

Comparing the mean age of both groups, it was found that there was no significant difference between them (24.7 years and 26.3 years for group I and II respectively) ( $p=0.689$ ), denoting good matching of patients.

The mean duration of the disease in group I was 15.6 months and 16.4 months in group II with no statistically significant difference ( $p=0.847$ ). In an experimental study<sup>10</sup> it was found that there was significant increase in apoptosis at the end of the first month in the varicocele cases and that this apoptosis continued with time. Because the histopathologic injury, which is parallel to apoptosis, increased, they believe that treatment in the early phase of varicocele is important for prevention of probable injury.

Varicoceles are implicated in 70% to 80% of men with secondary infertility.<sup>11</sup> It was found in our study that infertility represented the most common presentation in our patients (40%) (30% in group I and 50% in group II), followed by pain (35%) and swelling which represented (25%).

It was noticed that the mean age of the infertility cases (28.38 years) was larger than that of the pain cases (25.71 years) and that of the swelling cases (24.4 years).

Physical examination in a warm room is the mainstay of diagnosis of varicocele, but this is affected by a low sensibility and specificity, especially in cases of low grade varicocele. The sensitivity and specificity of varicocele detection approaches 100% with color Doppler ultrasound.<sup>12</sup> Color Doppler ultrasound will certainly become the gold standard in the investigation of varicocele.<sup>13,14</sup>

In this work, color Doppler study revealed additional nine cases with bilateral disease that were not detected clinically.

Primary varicocele, by far is more common on the left side in approximately 90% of cases, it is bilateral in 8 to 9 % and is right sided in 1 to 2%.<sup>15</sup> Abnormality apparently has a high bilateral prevalence (80.7%). This may suggest that we should consider varicocele as a bilateral disease. This result coincided with

our study.

In a study it was found that varicocele repair in adults with a clinical left varicocele increased left testicular volume and improved semen profiles.<sup>16</sup> In contrary, in our study, no changes have been detected regarding testicular volume following varicocelectomy.

Varicocele is a very common pathology in infertile men, but it is unclear whether only one common pathway or whether multiple mechanisms negatively affect spermatogenesis. Therefore, varicocele may be associated with a variety of spermatogenic conditions, ranging from completely normal seminal parameters to moderate oligo spermia or azoospermia. Different researchers have focused upon the effect of varicocele in the function and number of human sperm cells and sperm characteristics.<sup>17,18,19</sup> Varicocele causes damage to sperm DNA and changes sperm motility.<sup>20</sup>

Comparing the preoperative semen parameters of patients in both groups, there were no statistically significant difference regarding the mean spermatic count (29.3 x10<sup>6</sup>/ml and 22.8 x10<sup>6</sup>/ml in group I and II respectively) (p=0.136), the mean spermatic motility after one hour (39.7% and 46.9% in group I and II respectively) (p= 0.263), the mean spermatic motility after two hours (28.9% and 30.5% in group I and II respectively) (p= 0.708), the mean spermatic motility after three hours (19.3% and 23.3% in group I and II respectively) (p= 0.359) and the mean of the abnormal forms (42.5% and 43.6% in group I and II respectively) (p= 0.879).

Comparing the postoperative semen parameters of patients in both groups, there was significant increase in the mean spermatic count in group I (from 29.3 x 10<sup>6</sup>/ml to 39.5 x 10<sup>6</sup>/ml) (p= 0.063) and (from 22.8 x 10<sup>6</sup>/ml to 32.6 x 10<sup>6</sup>/ml) (p=0.033) in group II p<0.05, thus the improvement in spermatic count shows significant difference between the two groups.

In a study it was found that the improvement in spermatic motility after one hour was from 28.42%±23.22% to 39.92%±22.06% in their patients post-varicocelectomy.<sup>21</sup>

In our study, it was observed that the spermatic motility improved in both groups postoperatively after 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> hours; although, the improvement was statistically insignificant.

In our study, it was observed that there was no significant improvement regarding abnormal forms in group I (p= 0.631), or in group II (p=0.928).

In this work the procedures in the two groups were completed satisfactorily, with no intra-operative complications. No significant difference was found in the operative time between the first and second groups (25.5 minutes and 26.2 minutes for group I and II respectively) (p=0.889).

Most of patients in the two groups had moderate postoperative pain. According to the visual scale, the mean of group I was 5.7 and of group II was 6.3 with no significant difference between the two groups (p=0.801).

The patients in the two groups showed no difference regarding the frequency and dosage of postoperative analgesics.

The hospital stay was not significantly different among the patients of the two study groups (1.7 days in group I and 1.5 days in group II) (p=0.870).

The most frequent complication of varicocelectomy was hydrocele formation, occurring in as many as 30% of the patients. The etiology is likely that of lymphatic obstruction, evidenced by the high average protein content of post varicocelectomy hydroceles compared to that of edematous fluid produced by venous obstruction.<sup>22</sup> However, none of our patients developed a postoperative hydrocele.

In our study in all cases, identification of the testicular artery was done successfully. In a study aiming to determine if laparoscopic varicocelectomy with preservation of the testicular artery is a satisfactory alternative to standard open surgical techniques in adolescents it was found that the laparoscopic technique with preservation of the testicular artery is an acceptable alternative to open surgical treatment of varicoceles. Further, it eliminates the risk of testicular atrophy and it is the technique of choice when previous

inguinal surgery has been performed.<sup>23</sup>

#### Conclusion:

Laparoscopic staple interruption for treatment of varicocele without cutting inbetween the clips is more superior to traditional laparoscopic staple interruption for treatment of varicocele with cutting the gonadal vein or veins inbetween the clips especially regarding the lower risk to cut the vas deference or spermatic artery, and spermatic count with the same results regarding spermatic motility and abnormal forms.

A limitation of the present study was the absence of a control group of observation or no treatment to add to the debate on the real value of varicoelectomy in treating male infertility.

#### References:

- 1- Canutes BK, Nakib N, Lavers A, et al: Male varicoceles, in male reproductive dysfunction: Pathophysiology and treatment. Kandeel FR, Swerdloff RS, Pryor JL (Editors); Jay & Francis (Publishers); chapter 15, 1<sup>st</sup> edn.; 2007; p. 183-196.
- 2- Casale P: Report on varicocele and infertility. *Fertility Sterility Journal* 2006; 86(4): 93-95.
- 3- Cayan S, Lee D, Black ID, et al: Response to varicoelectomy in oligospermic men with and without defined genetic infertility. *Urology Journal* 2001; 57(3): 530-555.
- 4- Beck, Goldstein: Varicocele anatomy: A macro and microscopic study. *American Urological Association Annual Meeting, Toronto* 1991; (5): 16.
- 5- Amelar RD: Early and late complications of inguinal varicoelectomy. *Urology Journal* 2003; 170 (2Pt 1): 366-369.
- 6- Schneck FX, Bellinger MF: Abnormalities of the testes and scrotum and their surgical management. In: Campbell's urology. Walsh PC, Retik AB (Editors); Elsevier (Publisher); volume 3, 8<sup>th</sup> edn.; 2002; p. 3695-3697.
- 7- Kass EJ, Stork BR, Steinert BW: Varicocele in adolescence induces left and right testicular volume loss. *International British Journal of Urology* 2001; 87: 499-501.
- 8- Sihoe D, Magsanoc N, Sreedhar B, et al: Laparoscopy in pediatric urology. Recent advances. *Hong Kong Journal of Pediatrics* 2004; 9: 65-73.
- 9- Rudloff U, Holmes RJ, Prem JT, et al: Meso-aortic compression of the left renal vein (nutcracker syndrome): Case reports and review of the literature. *Annals of Vascular Surgery* 2006; 20 (1): 120-129.
- 10- Gtirdal M, Kireti S, Him E et al: Correlation between duration of varicocele and apoptosis in testicular tissue in an experimental model. *IC Surg Urology Journal* 2008; 175 (2): 33.
- 11- Fretz PC, Sandlow JI: Current concepts in pathophysiology, diagnosis and treatment. *Urologic Clinical Journal of North America* 2002; 29: 921-937.
- 12- Penson DF, Paltiel AD, Krumholz HM, et al: The cost-effectiveness of treatment for varicocele related infertility. *Urology Journal* 2002; (168): 2490-2494.
- 13- Dogra V, Gottlieb R, Oka M, et al: Sonography of the scrotum. *Radiology Journal* 2003; 227:18-36.
- 14- Liguori G, Trombetta C, Garaffa G, et al: Color Doppler ultrasound investigation of varicocele. *World Journal of Urology* 2004; 22(5): 378-381.
- 15- Bakal CW, Silberzweig J, Cynamon J: Vascular and interventional radiology: Principles and practice. Bakal CW, Silberzweig J, Cynamon J (Editors); Thieme (Publisher); 1<sup>st</sup> edn.; 2002; p. 318.
- 16- Sakamoto H, Saito K, Ogawa Y, et al: Effects of varicocele repair in adults on ultrasonographically determined testicular volume and on semen profile. *Urology Journal* 2008; 71(3): 485-489.
- 17- Zini A, Defreitas G, Freeman M, et al: Varicocele is associated with abnormal retention of cytoplasmic droplets by human spermatozoa. *Fertility Sterility Journal* 2000; (74): 461- 464.
- 18- Hauser R, Paz G, Botchan L, et al: Varicocele: Effect on sperm functions. *Human Reproduction Update* 2001; (7):

- 
- 482- 485.
- 19-Ziamba H, Bialy LP, Fracki S, et al: Proteasome localization and ultrastructure of spermatozoa from patients with varicocele-immunoelectron microscopic study. *Folia Histochemetability Cytobiology Journal* 2002; (40): 169-170.
- 20-Tang J, Yan SW, Zhang N, et al: Influence of varicocele on sperm chromatin structure and sperm motility. *Zhonghua Nan Ke Xue Journal* 2007; 13(8): 690-692.
- 21-Ishikawa T, Fujisawa M: Effect of age and grade on surgery for patients with varicocele. *Urology Journal* 2005; 65(4): 768-772.
- 22-Cayan S, Kadioglu TC, Tefekli A et al: Comparison of results and complications of high ligation surgery and microsurgical high inguinal varicocelectomy in the treatment of varicocele. *Urology Journal* 2000; 55(5): 750-754.
- 23-Cohen R: Laparoscopic varicocelectomy with preservation of the testicular artery in adolescents. *Pediatr Journal* 2001; 36(2): 394-396.