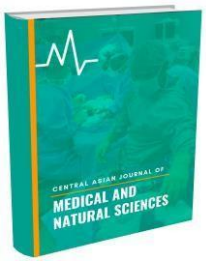

CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.centralasianstudies.org/index.php/CAJMNS
Volume: 06 Issue: 03 | July 2025 ISSN: 2660-4159

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Article

Surgical Evaluation of Open Subinguinal and Microscopic Varicocelectomy for Improvement of Semen Quality and Post-Operative Complication

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Abstract: Varicocelectomy remains one of the most commonly performed surgeries in urological practice to address male infertility, typically caused by dilated spermatic veins. This study presents a prospective comparative analysis of two surgical approaches—microscopic subinguinal and conventional subinguinal varicocelectomy—to evaluate their effectiveness in improving semen quality and minimizing postoperative complications. Over a two-year period, 106 patients with palpable varicoceles and abnormal semen parameters were assigned to two groups: one underwent microsurgical varicocelectomy using a microscope, while the other received conventional subinguinal surgery. Semen analysis and clinical evaluations were conducted preoperatively and during follow-up. Both surgical techniques demonstrated statistically significant improvements in seminal fluid parameters, such as sperm concentration, motility, and morphology, with no notable differences in the magnitude of enhancement between the groups. However, the microsurgical method required more operative time. Postoperative complications in both groups were minimal, with manageable side effects such as scrotal swelling and mild pain. The findings affirm that both methods are safe and effective, with the microsurgical approach offering a slight advantage in precision and fewer complications when equipment and expertise are available. In resource-limited settings, conventional varicocelectomy remains a valid and cost-effective alternative.

Keywords: Varicoceles, Microscopic Varicocelectomy, Subinguinal Varicocelectomy, Seminal fluid analysis.

Citation: Essa, A. A, Al-Azzawi, I. S. H. & Al-Zubaidy, A. H. Surgical Evaluation of Open Subinguinal and Microscopic Varicocelectomy for Improvement of Semen Quality and Post-Operative Complication. Central Asian Journal of Medical and Natural Science 2025, 6(3), 1299-1312.

Received: 08th Mar 2025
Revised: 15th Apr 2025
Accepted: 24th May 2025
Published: 17th June 2025

1. Introduction

The internal spermatic veins within the pampiniform plexus of the spermatic cord experience abnormal dilation and tortuosity to produce a varicocele [1],[2] . This issue frequently accompanies infertility. Its prevalence ranges from 10 to 20% among healthy males, 35 to 40% among men experiencing primary infertility, and secondary infertility occurs among men from 75 to 80%. [3]. Numerous efforts have attempted to understand the causes of varicocele-associated testicular dysfunction. The precise mechanism through which varicocele induces infertility remains incompletely clarified. Hypoxia caused by venous stasis and the obstruction of small vessels is the most probable cause of dysfunctional germinal cells. Additional hypotheses include endocrinological changes, elevated scrotal temperature, and the backflow of adrenal and renal metabolic products via the left internal spermatic vein, all of which contribute to the detrimental impact of

varicocele on fertility. Increased oxidative stress and reduced antioxidant capacity are additional hypotheses regarding the procedures underlying infertility in men with varicoceles. This has occurred with sperm DNA damage, specifically DNA fragmentation, and has been correlated with both normal fertility and the inability of spermatozoa to fertilize oocytes during assisted reproduction techniques [4], [5].

Etiology

As of yet, the exact cause of varicoceles remains unknown. However, the problem is believed to arise due to the accumulation of venous blood flow in the internal spermatic vein, leading to the vein's expansion. This phenomenon may be identified by clinical examination of the scrotum. Varicoceles are significantly more prevalent in the left testicle (80% to 90%). 30% to 40% of the time, a left varicocele indicates the presence of a bilateral condition [6].

As an anatomical cause, three theories have been proposed:

1. If the left internal spermatic vein becomes entangled between the aorta and the superior mesenteric artery, the "Nutcracker" effect is induced. This entrapment results in the constriction of the venous pressure and spermatic vein.
2. There is an angulation observed at the point where the left renal vein and the left internal spermatic vein meet.
3. The occurrence of anti-reflux valve failure at the point of junction between the left renal vein and the internal spermatic vein. This particular malfunction results in the occurrence of reflux and retrograde blood flow inside the testicular vein [7].

Rare varicoceles causes include thrombosis of the pampiniform plexus, renal arteriovenous malformations, deep vein thrombosis, and renal or retroperitoneal malignancies [8], [9].

Classification

Since 1970, the most widely utilized and accepted classification has been proposed by Dubin and Amelar. It is determined according to the clinical features (in the clinical examination) [10].

1. Subclinical: Not visible or palpable during Valsalva or at rest, but ultrasound detectable.
2. Grade 1: Palpable during the Valsalva maneuver (no elsewhere).
3. Grade 2: Invisible but palpable at rest.
4. Grade 3: Visible and Palpable at rest.

Indications for surgery

Regarding fertility indications, the American Society for Reproductive Medicine (ASRM) Practise Committee encourages treating varicocele when the majority, if not all, of the subsequent conditions are fulfilled. The pair are now engaged in efforts to achieve conception. During a physical examination, the presence of a varicocele is detectable. The couple has a registered infertility history. The woman's partner exhibits normal fertility or a possibly remediable factor contributing to infertility. The timeframe for achieving pregnancy is not a pressing issue. Moreover, the male partner has atypical semen characteristics [11], [12].

There are Indications other than fertility, which include: 1) Testicular atrophy in adolescents, 2) Varicoceles-related testicular pain, 3) Cosmetic concerns, especially in grade 3 varicoceles and 4) hypogonadism in the presence of clinical varicoceles [13].

2. Materials and Methods

Approaches to Varicocele Treatment

Inguinal Varicocelectomy

A 5-centimeter incision is made over the inguinal canal, the external oblique aponeurosis is exposed, and the spermatic cord is grasped and delivered as part of the conventional inguinal varicocelectomy procedure. Everything within the spermatic

vessels is ligated following the dissection of the cord. Preservation is observed in the vas deferens and its vessels. Identification and preservation of the lymphatics and testicular artery, if possible, are attempts. Furthermore, Upon raising the spermatic cord, any external spermatic veins that traverse the inguinal canal floor parallel with the cord are identified and, if present, ligated. When compared to retroperitoneal operations, the incidence of varicocele recurrence is reduced with conventional non-magnified inguinal approaches. However, neither hydrocele formation nor testicular artery injury occurs at an altered frequency. Postoperative hydrocele formation is observed with an average incidence of 7%; the incidence rate for conventional inguinal procedures ranges from 3% to 15% .

Microsurgical Subinguinal Varicocelectomy

Here, a transverse skin incision measuring 2 to 3 centimeters is created just below the external ring of the pubic ramus. By employing sharp and imprecise dissection techniques, the cord structures are separated from the adjacent tissues, thereby facilitating their mobilization through the skin incision. Then, we split and divided the external spermatic fascia using a surgical microscope for magnification. Next, we identify and preserve the vas and its perivasal vascular bundle. Then, to facilitate determining the testicular artery, A micro-Doppler probe is utilized. All lymphatic vessels, like any additional testicular arteries, are preserved when possible. 4-0 sutures or surgical clamps are utilized to ligate every spermatic cord vein. In the wound, the spermatic cord is changed; then, the wound is closed. Postoperative complications are fewer with the microsurgical subinguinal approach, particularly varicocele recurrence and hydrocele formation .

Laparoscopic Varicocelectomy

Generally, three transperitoneal incisions are utilized during laparoscopic varicocelectomy. With the Hasson or Veress needle technique, a 5-mm laparoscopic conduit is inserted into the peritoneal space from close to the umbilicus. After that, two further 5-mm ports are positioned subcutaneously: one is positioned laterally to the left epigastric vessels, and the other is positioned between the pubic symphysis and umbilicus. Incising occurs approximately 3 cm superior to the internal inguinal ring in the peritoneum that covers the spermatic vessels. From surrounding tissues, the spermatic vessels are divided by blunt and sharp dissection (With a micro-Doppler probe or a laparoscopic Doppler). Whether the testicular artery is preserved and isolated is a matter of surgical discretion. Then, with clips, the veins are ligated. According to the literature, the artery-preserving approach is linked with higher varicocele recurrence rates.

In contrast, a higher risk of post-varicocelectomy hydrocele formation is associated with the non-sparing approach . The laparoscopic approach is directly associated with a higher rate of hydrocele formation and recurrence than conventional inguinal or subinguinal techniques. According to the literature, hydrocele rates range (from 7 to 43) percent, and postoperative recurrence rates range (from 3 to 6) percent among patients undergoing laparoscopic varicocelectomy . Currently, lymphatic sparing has been included in the laparoscopic technique. Rizkala et al. demonstrated that including lymphatic sparing reduces the rate of hydrocele formation to 4.5%.

Percutaneous Varicocele Embolization

Compared with the standard surgical approaches, Varicocele embolization is defined as a minimally invasive approach associated with reduced hydrocele risk and reduced postoperative pain. Usually, it is accomplished under local anesthesia and intravenous sedation. At this point, venous access is obtained via the bilateral varicoceles, the right common femoral vein for left-sided varicoceles, or the internal jugular vein for right-sided. A venogram is done after advancing the catheter tip to the distal internal spermatic vein and pampiniform plexus. Then, Varicoceles are embolized either with liquid embolic agents (for example, sclerosing tetradecyl sulfate) or occlusive solid agents (for example, vascular plugs and coils). Three to six months later, postoperative ultrasonography is

performed to validate the success of the treatment. Failure to achieve the desired effect is a complication exclusive to embolization. Accessing the spermatic vein and guiding the catheter into the vein is critical for effective embolization. Approximately (8 to 30) percent of patients who undergo attempted embolization fail to do so .

Retroperitoneal approach (Palomo technique) retroperitoneal approach is becoming one of only historical importance. To treat varicocele retroperitoneally, an incision is made at the level of the internal inguinal ring. Usually, commences approximately two fingers medial to the anterior superior iliac spine and involves the division of the internal and external oblique muscle fibers, resulting in the retroperitoneal exposure of the internal spermatic artery and vein close to the ureter.

Proximally, near the discharge site, the internal spermatic veins can be isolated into the left renal vein using this methodology. There are only one or two sizable veins observed. Furthermore, the testicular artery is frequently distinguished from the internal spermatic veins and has not yet undergone branching. With the retroperitoneal approach, minimal vein ligation is needed.

However, a drawback of the retroperitoneal approach is the high incidence of varicocele recurrence, especially in children and adolescents, when the testicular artery is purposefully preserved. After retroperitoneal varicocelectomy, the recurrence rates are in the 15% range. Usually, Failure can occur due to periarterial plexus preservation of venae comitantes (fine veins) along with the artery. It has been demonstrated that these veins connect with larger internal spermatic vessels. They have the potential to dilate and induce recurrence if not ligated. Recurrence due to parallel inguinal or retroperitoneal collaterals occurs with less frequency. These collaterals have the ability to exit the testis and return proximally to the ligation site, bypassing the ligated retroperitoneal veins. Additionally, scrotal collaterals and dilated cremasteric veins are recurrent varicocele causes and cannot be identified retroperitoneally .

Aim of the Study

This paper compares the improvement in fertility status and post-operative complications in two different techniques for varicocele repair: Microscopic versus conventional open subinguinal varicocelectomy.

Patients and methods

The present study is a prospective comparative clinical interventional performed over two years (between October 2019 and October 2021). In this study, one hundred-six patients with clinically significant varicoceles and complaints from infertility (primary or secondary) have participated.

The inclusion criteria were:

1. Adult males with age range 18 to 45 years.
2. History of infertility.
3. Having unilateral or bilateral clinically palpable varicoceles.
4. Impaired SFA results.

The exclusion criteria were:

1. The presence of subclinical varicoceles.
2. The presence of significant medical comorbidities.

All patients were counseled and consented pre-operatively and were willing to be followed up post-operatively. Pre-operative evaluation included a detailed history focusing on the type and duration of infertility, any local symptoms, any medical comorbidities, bleeding tendency and drug history. Physical examination: genital and general examination to assess the degree and laterality of varicocele size of testes and to exclude any genital abnormality that may affect fertility status, like the absence of the proximal hypospadias and vas deferens.

The evaluation also included routine pre-operative lab Investigations, CXR, ECG when indicated and virology, including PCR for Covid-19. Seminal fluid analysis was conducted at least on two occasions, pre-operatively, demonstrating abnormal

parameters. Scrotal ultrasound was also done for some patients. Patients were classified as follows. Group A, containing 44 patients, was treated with Microscopic microsurgical varicocelectomy through a sub-inguinal approach, while Group B patients, containing 62 patients, were treated with conventional subinguinal varicocelectomy. Operative time and all intra and post-operative complications were recorded in both groups.

Follow-up consisted of 1 week post-operatively visit (physical examination) and three months post-operatively visit (physical examination plus SFA to assess change in SFA parameters).

Technique for Microscopic Varicocelectomy

The operation is done under either spinal or general anesthesia, with the patient being put in a supine orientation. The lower abdominal, scrotal and upper thigh areas are prepped and draped using povidone-iodine. An oblique incision measuring 2 cm is made to initiate the operation above the external inguinal ring. The surgical procedure involves the deepening of the incision through Camper's and Scarpa's fascia. Subsequently, the spermatic cord is carefully grasped using a Babcock clamp, extracted, and positioned above a ribbon retractor. We usually search for external spermatic veins below the grasped cord at the base of the wound. If any vein is encountered, it will be isolated and ligated to decrease the recurrence risk post-operatively.

Subsequently, the microscope is introduced into the surgical site, and the chord is examined with a magnification of 10. The incision is made on both the internal and exterior spermatic fascias, allowing for examining the cord structures. In order to determine the testicular artery, Caverject (Alprostadil, a Prostaglandin E1) is sprayed directly on the surface of the cord structures. This step makes the pulsation of the testicular artery more easily visible. Any pulsatile vessel is then encircled with surgical tape to differentiate it from the veins, which are later identified and ligated with vicryl 5/0. Lymphatics are usually dissected away from the veins before ligation.

After ligating all visible veins, a second look is done to identify any missed vessels to eliminate the risk of recurrence. The cord is then placed back into position, and secure hemostasis is ensured. Then, in two layers, the wound is closed. The fascia with vicryl interrupted sutures and the skin with subcuticular prolene suture (usually removed after 7-10 days).

Technique for Conventional Subinguinal Varicocelectomy

Under spinal or general anesthesia, the operation is performed with the patient being put in a supine position. The lower abdominal, scrotal and upper thigh areas are prepped and draped using povidone-iodine. Surgery is started with an oblique (4-5) cm incision positioned over the external inguinal ring. The procedure involves deepening the incision by dissecting through Camper's and Scarpa's fascia. Subsequently, utilizing a Babcock clamp, the spermatic cord is carefully grasped, extracted, and positioned atop a ribbon retractor. As with the microscopic varicocelectomy, we usually search for external spermatic veins below the grasped cord at the base of the wound. If any vein is encountered, it will be isolated and ligated to decrease the recurrence risk post-operatively. The cord layers are then dissected layer by layer, isolating any visible vein and trying to skeletonize it from nearby fatty tissue and lymphatics to reduce the likelihood of hydrocele formation post-operatively. All isolated veins are then ligated with vicryl 3/0 suture and divided.The microscopic procedure was performed using a high-resolution surgical microscope, as shown in Figure 1.The specialized microsurgical instruments used differ notably from conventional tools, as illustrated in Figure 2.Alprostadil (Prostaglandin E1) was applied to the cord to aid artery identification (Figure 3). After ensuring secure hemostasis, the cord is returned to the wound, and closure is done with two layers, the fascia with vicryl interrupted sutures and the skin either with prolene subcuticular suture or with silk mattress sutures, which are usually removed after 7-10 days.A clear visual distinction in the surgical field when viewed through the microscope is presented in Figure 4.

Figure 1: The surgical microscope used for microscopic varicocelectomy.

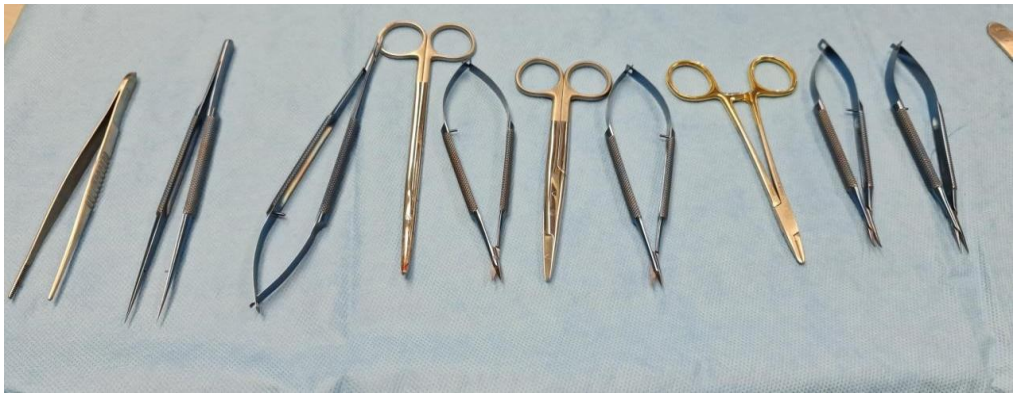


Figure 2: The microsurgical instruments compared with the conventional surgical instruments (blue instruments are microsurgical while silver and golden instruments are conventional surgical instruments).

Figure 3: Alprostadil used to facilitate identifying testicular artery.

(a) (b)

Figure 4: The surgical field: A) Seen by the microscope; B) Seen by the microscope

statistical analysis.

The statistical software toll (SPSS-version 27) has been utilized in data analysis. The data were presented using basic statistical measures, including standard deviation, mean, percentage frequency, and range (represented by the lowest and maximum numbers). The test of the difference significance of qualitative data (different percentages) was performed using the Pearson Chi-square test (t^2-test), applying Yate's correction or Fisher Exact test whenever applicable. On the other hand, the test of difference significance of quantitative data (i.e., means) was performed using the paired-t-test and the students-t-test for the difference between two dependent and two independent means, respectively. The statistical significance was considered whenever ($P \leq 0.05$).

3. Results

Here, Although there were four instances of right-sided varicocele in the microscopic group and none in the conventional group, laterality was the only significant difference between the two groups regarding the patient's demographic information. Other than that, the left side dominated in both groups [14], [15]. In addition, there was some difference between the two groups regarding grade of varicocele as only the microscopic group included three patients with grade 1 varicocele, while the majority of varicocele included in both groups were of grades 2 and 3 (Table 1).

Table 1: Patients' demographic data.

		Conventional varicocelectomy		Microscopic varicocelectomy		P-value
		number	percent	number	percent	
Age (years)	<20years	2	3.2	1	2.3	0.326
	20---29	28	45.2	13	29.5	
	30---39	25	40.3	21	47.7	
	=>40years	7	11.3	9	20.5	
	Mean±SD (Range)	30.6±7.3 (18-44)		33.4±7.2 (19-45)		0.053
Laterality	Bilateral	15	24.2	8	18.2	0.047*
	Right	-	-	4	9.1	
	Left	47	75.8	32	72.7	
Grade	I	-	-	3	6.8	0.045*
	II	34	54.8	28	63.6	
	III	28	45.2	13	29.5	
Type of infertility	Primary	50	80.6	31	70.5	0.223
	Secondary	12	19.4	13	29.5	

#Significant difference between two independent means using Students-t-test at 0.05 level.

*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.

As listed in Table 2, Patients' age and type of infertility were comparable in both groups, as the mean age for conventional varicocelectomy was (30.6±7.3) while the mean age for microscopic varicocelectomy was (33.4±7.2), with primary infertility being the major type in both groups. Regarding operative time, there was an obvious significant difference between the two groups in both unilateral and bilateral varicocelectomy, as the mean time for unilateral surgery was (18±1.7) minutes in the conventional group and (26.4±3.2) minutes in the microscopic group. In contrast, the mean time for Bilateral surgery was (38.5±1.9) minutes for the conventional group and (50.9±4.3) minutes for the microscopic group.

Table 2: Operative time of both groups.

		Conventional varicocelectomy		Microscopic varicocelectomy		P-value
		number	percent	number	percent	
Operative time (min) for unilateral	15---19	37	78.7	-	-	0.0001*
	20---29	10	21.3	30	83.3	
	30---33	-	-	6	16.7	
	Mean±SD (Range)	18.0±1.7 (15-22)		26.4±3.2 (20-33)		0.0001#
Operative time (min) for bilateral	37---39	15	24.2	8	18.2	0.047*
	40---49	-	-	4	9.1	
	50---56	47	75.8	32	72.7	
	Mean±SD (Range)	38.5±1.9 (33-40)		50.9±4.3 (45-56)		0.0001#

#Significant difference between two independent means using Students-t-test at 0.05 level.

*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.

After varicocelectomy using both methodologies, a statistically significant improvement was observed in seminal fluid parameters, including concentration, normal morphology, progressive motility, and total motility. However, between the two groups, this improvement did not differ significantly. (see Table 3 and Figure 5). Postoperative complications in both groups were simple & manageable, with transient scrotal swelling being the commonest in both groups, followed by post-operative pain/ numbness & wound infection [15], [16]. There were 2 cases of mild hematoma & 1 case of hydrocele only in the conventional group (see Table 4 and Figure 6).

Patients in both groups received almost the same postoperative analgesia and left the hospital on the same day of the operation after full recovery. Table 5, designed to study the possible correlations between different parameters, shows a correlation between operative time & complication rate in a way that the more the operative time, the more complications occurred. Another correlation was found between postoperative complications and the postoperative improvement in SFA parameters, as there was less improvement in progressive motility in cases with complications.

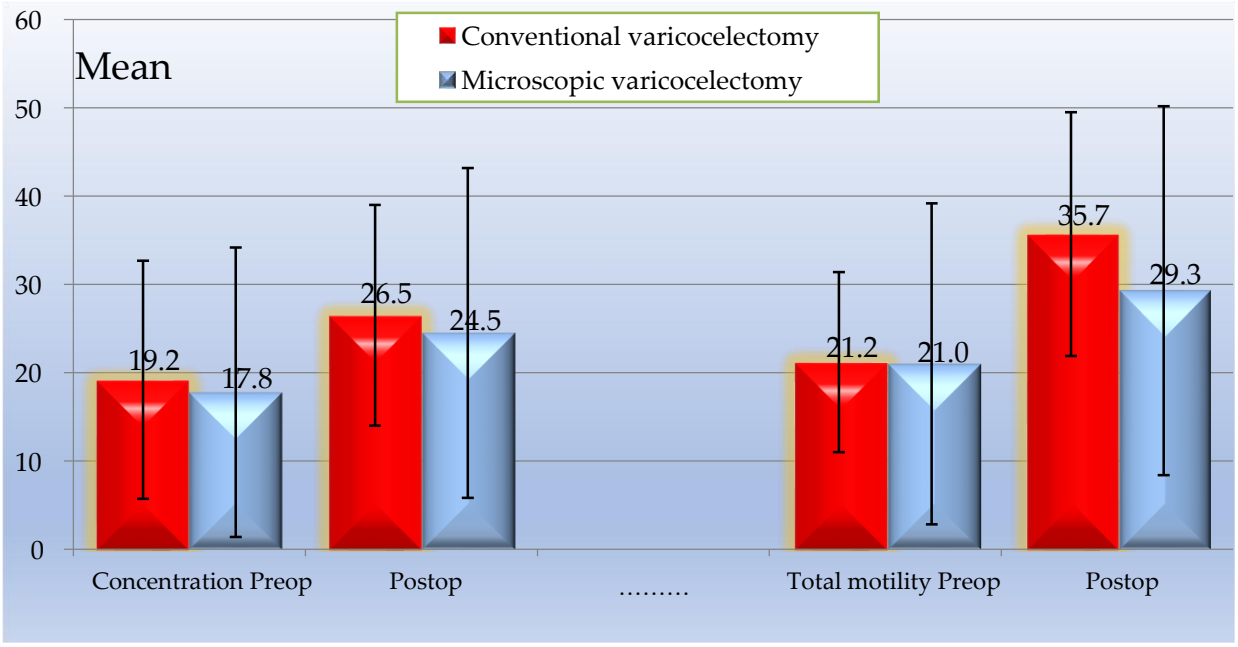
Table 3: SFA parameters of both groups.

SFA parameters	Conventional varicocelectomy	Microscopic varicocelectomy	P-value
Concentration Preop	19.2±13.5 (0-60)	17.8±16.4 (0-58)	0.621
Postop	26.5±12.5 (3-60)	24.5±18.7 (0-65)	0.506
P value	0.0001#	0.0001#	
Total motility Preop	21.2±10.2 (0-40)	21.0±18.2 (0-80)	0.967
Postop	35.7±13.8 (10-65)	29.3±20.9 (0-82)	0.059
P value	0.0001#	0.0001#	

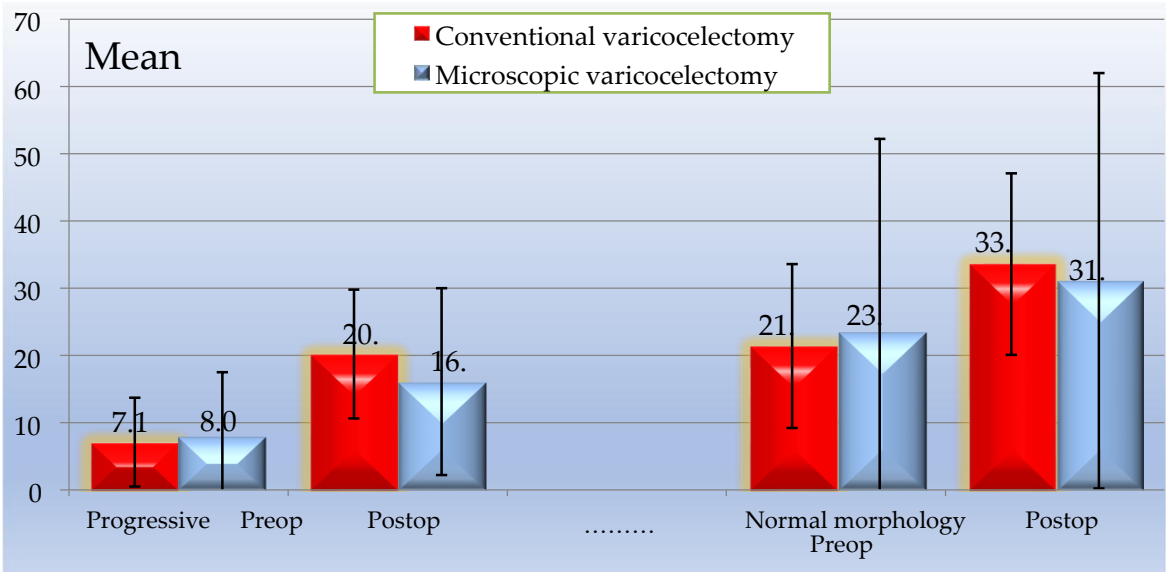
Progressive Preop	7.1±6.6 (0-20)	8.0±9.5 (0-40)	0.588
Postop	20.2±9.6 (2-45)	16.1±13.9 (0-61)	0.072
P value	0.0001#	0.0001#	
Normal morphology Preop	21.4±12.2 (0-55)	23.5±28.7 (0-90)	0.612
Postop	33.6±13.5 (10-60)	31.1±30.9 (0-80)	0.572
P value	0.0001#	0.012#	

#Significant difference between two dependent means using Paired-t-test at 0.05 level.

#Significant difference between two independent means using Students-t-test at 0.05 level.



(a) Concentration and total motility.



(a) Progressive motility and morphology.

Figure 5: SFA parameters.

Table 4: Complications of both groups.

Complications		Conventional varicocelectomy		Microscopic varicocelectomy		P-value
		number	percent	number	percent	
Complications	Yes	23	37.1	13	29.5	0.419
	No	39	62.9	31	70.5	
Scrotal swelling	Yes	12	19.4	6	13.6	0.440
	No	50	80.6	38	86.4	
Wound infection	Yes	4	6.5	3	6.8	0.940
	No	58	93.5	41	93.2	
Hematoma	Yes	2	3.2	-	-	0.229
	No	60	96.8	44	100.0	
Hydrocele	Yes	1	1.6	-	-	0.397
	No	61	98.4	44	100.0	
Pain / Numbness	Yes	9	14.5	5	11.4	0.637
	No	53	85.5	39	88.6	

*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.

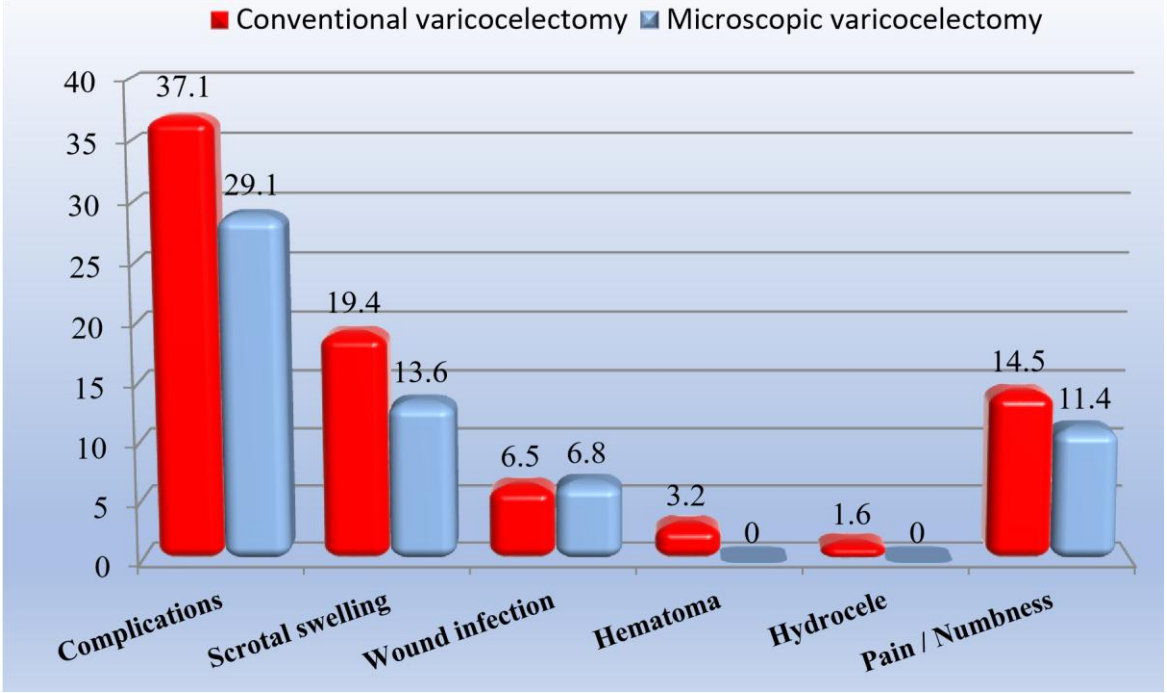


Figure 6: Complications of both groups.

Table 5: Correlations between operative time with SFA parameters and complications.

	Conventional varicocelectomy			Microscopic varicocelectomy			CxM	
	Comp.	No	P value	Comp.	No	P value	Comp.	No
Operative time (min)/Bi	38.7±2.1	38.0±	0.610	51.8±4.4	48.0±2.8	0.308	0.0001#	0.007#
Operative time (min)/Uni	18.0±2.1	18.0±1.5	0.962	26.3±3.1	26.4±3.2	0.925	0.0001#	0.0001#
P value	-	-		-	-			
Concentration Pre-op	18.9±12.9	19.4±14.0	0.900	13.7±13.9	19.5±17.3	0.292	0.264	0.980
Concentration Post-op	24.7±12.2	27.5±12.8	0.400	19.3±16.9	26.7±19.3	0.239	0.273	0.829
P value	0.0001#	0.0001#		0.004#	0.004#			
Total motility Pre-op	20.6±10.8	21.5±10.0	0.728	17.1±16.2	22.7±18.9	0.354	0.444	0.735

Total motility Post-op	32.0±12.6	37.9±14.2	0.106	28.0±19.7	29.8±21.7	0.794	0.457	0.065
P value	0.0001#	0.0001#		0.001#	0.008#			
Progressive Pre-op	8.0±6.4	6.6±6.7	0.452	5.5±5.8	9.0±10.6	0.261	0.256	0.254
Progressive Post-op	19.9±9.7	20.4±9.7	0.832	12.8±8.5	17.5±15.5	0.321	0.034#	0.332
P value	0.0001#	0.0001#		0.001#	0.0001#			
Normal morpho. Pre-op	22.0±11.5	21.0±12.7	0.754	30.5±34.4	20.5±26.0	0.296	0.283	0.915
Normal morpho. Post-op	30.5±10.4	35.4±14.9	0.171	37.8±34.6	28.3±29.4	0.360	0.353	0.193
P value	0.0001#	0.0001#		0.254	0.027#			
*Significant difference between percentages using Pearson Chi-square test (χ^2-test) at 0.05 level.								
^Significant difference among more than two independent means using ANOVA-test at 0.05 level.								
#Significant difference between two dependent means using Paired-t-test at 0.05 level.								
#Significant difference between two independent means using Students-t-test at 0.05 level.								

4. Discussion

Varicocele is the most prevalent surgically treatable cause of male infertility. It is shown to be palpable in (30 to 40) % of infertile men, whereas its prevalence in the general population is approximately 15% [17].

All the patients in this study have a clinically palpable varicocele with abnormal SFA (Tables 1 and 3), the first indication for performing varicocelectomy in most guidelines [18]. The three patients with grade A varicocele were existed in this work as they were presented with infertility having abnormal SFA, which was not corrected by conservative treatment. In comparison, patients with subclinical varicocele were excluded as it was found in many studies that subclinical varicocele doesn't cause a significant impairment in SFA [19].

Varicocelectomy stands as the primary treatment option for varicocele [20]. Currently, numerous techniques are available for conducting varicocelectomy, including laparoscopic repair and retroperitoneal, inguinal, and subinguinal varicocele repair without or with magnification [21]. This study adopted the subinguinal approach as it is simple, fast and with the least dissection needed to deliver the spermatic veins [22]. The advantages of the microsurgical technique for subinguinal varicocele repair (explained firstly in 1992 by Goldstein et al.) are the reliable preservation and identification of the vascular structures, hoping to decrease the complications [23].

As we mentioned, this work aims to compare the outcome of two commonly used procedures, the conventional subinguinal varicocelectomy and the microscopic varicocelectomy (recently introduced to Iraq). We compared mainly the improvement in SFA parameters and complications post-operatively in both procedures with the intent to elicit the operative approach with the best outcome, least complications and as much cost-effective as possible.

In our study, the microscopic varicocelectomy was more time-consuming than the conventional one. The difference in operative time was statistically significant both for unilateral & bilateral repair ($P = 0.0001$) as in Table 2, which can be explained by taking into consideration the time needed to bring the surgical microscope into the operative field, focusing the vision on the spermatic cord till best image resolution achieved, also the time consumed for the alprostadil local injection to identify the testicular artery and the meticulous dissection of lymphatics of the veins. This time difference was also noticed in other studies [24].

It has been mentioned in many studies before that a significant improvement in SFA parameters is expected when doing varicocelectomy, whatever surgical approach was used [25].

This was the same outcome in our study, as both operative techniques achieved a statistically significant improvement in seminal fluid analysis parameters, as shown in Tables 3 to 5, which is logically explained by the fact that ligation of these abnormal spermatic veins will abolish the deleterious conditions on spermatogenesis . There is no operation without complications, whatever simple and common it is considered, and this applies to varicocelectomy. The well-known possible complications of varicocelectomy are broadly divided into early, which include testicular oedema/swelling, hematoma, pain and wound infection. In contrast, late complications include recurrence, hydrocele formation and testicular atrophy [26], [27].

In our study, as listed in Table 4, early complications were slightly higher in the conventional method, but it didn't reach a statistically significant difference from the microscopic group. This could be explained as the advantage of using the operative microscope for better identification of vascular structures & avoidance of wrong ligation of testicular artery and lymphatics . Nevertheless, even conventional varicocelectomy, if performed meticulously, sparing the lymphatics and meticulous hemostasis as much as possible, will lead to much fewer complications, as proved in our study. In fact, all the complications reported in both groups were mild, transient and manageable, especially with the use of scrotal support in the first week post-operatively, which had a significant impact on the resolution of the scrotal swelling in most of the patients, meaning that both procedures could be considered safe and without significant morbidity. This is also proved by Li, Hu et al. [28].

Such as testicular atrophy and varicocele recurrence, late complications couldn't be assessed because of the short follow-up period in this research. Considering the cost of treatment, apart from the need for post-operative analgesics, the hospitalization duration and the time to return to work, which was almost similar in both groups, microscopic varicocelectomy was more costly because of the added cost of operative microscope & alprostadil injection. It is worth mentioning that performing microscopic varicocelectomy needs special requisites, such as the need to use a special microscope, which is not available in every hospital, while conventional varicocelectomy can be done at any general hospital or even surgical day clinic by just a basic surgical set. Furthermore, Managing micro-instruments and getting to operating without direct hand visibility are both demanding abilities that necessitate refinement by the surgeon to reduce the duration of the operation [29].

Regarding correlations between the different parameters, the correlation between operative time and complications is merely incidental, as there is no logical explanation for such correlation. In contrast, the one between complications & improvement in seminal progressive motility may be explained by the fact that any prolonged scrotal swelling, as in hematoma, edema, or hydrocele, could induce a negative impact on spermatogenesis, which also found in other studies [30].

5. Conclusion

Both conventional subinguinal and microscopic subinguinal techniques of varicocelectomy are reasonably safe & effective in improving spermatogenesis. In hospitals where an operative microscope is available, it is preferable to perform the microscopic technique to decrease the complications. Otherwise, conventional varicocelectomy is still a valid, cost-effective technique and could be done in any hospital.

Recommendation

One of our primary focuses in the future is as follows:

1. Conduct research with an extended follow-up period and a larger sample of patients.
2. Evaluate other techniques of varicocelectomy.

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