
Surgical outcome of varicocelelectomy

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Abstract:

A prospective study over a period from 2009 to 2013, the 97 patients involved in this study of age group from 16 to 33 years (*the median patients' age was 28.5years*), they were re underwent unilateral or bilateral varicocelelectomy. The approach of surgery depends on deep inguinal ring closing test. Regarding to the results of the test the surgical approach was determined. Indication of surgery (presentation), preoperative clinical examining, semen analysis, early postoperative examination of all cases to exclude technical failure.

Introduction:

Varicoceles are an abnormal dilatation of the veins of the pampiniform plexus. They occur in 6% of children at age 10, 13% of adolescents and 15 percent of males in the general population. Varicoceles has been observed in 35 percent of men with primary infertility and up to 80 percent of men with secondary infertility. Although many men with varicoceles can be a father of children, varicoceles causes a progressive time-dependent decline in semen quality.

ANATOMY

The pampiniform plexus is composed of the veins of the spermatic cord. These veins drain blood from the testes, epididymis, and Vas deferens and eventually become the spermatic veins that drain into the main circulation of the kidneys. The left gonadal vein ends into left renal vein by right angle while right gonadal vein ends by acute angle into inferior vena cava. Two other veins, the cremasteric and the deferential, also drain blood from the testicles; however, they are rarely involved in the varicoceles process.

ETIOLOGY

Palpable unilateral varicoceles occur on the left side from 85% to 90% of cases. Palpable right varicoceles is usually found in cases of bilateral varicoceles and rarely occurs unilaterally.

Theories explaining the etiology of varicoceles

- (1) The left testicular vein is longer than (8-10cm) the right testicular vein; the hydrostatic pressure in the distal region of the left testicular vein is unusually high.

- (2) A lack of valves in the testicular vein would result in increased pressure transmitted to the testicular vein from the renal vein.
- (3) Compression of the left renal vein between the aorta and the superior mesenteric artery, a phenomenon known as the "nutcracker effect."
- (4) No available data support a genetic basis or hereditary transmission for these lesions. Retroperitoneal masses such as sarcomas, lymphomas, and renal tumors have been known to cause varicoceles by obstructing venous outflow from the testicles.

Aim of study:

PATHOPHYSIOLOGY

Despite a large number of animal and human studies, the exact mechanism by which varicoceles cause impaired testicular function remains poorly understood. Several potential mechanisms on how the varicoceles causes testicular defects have been discussed.

1. Hyperthermia

The optimal activity of spermatogenesis is at 33°C. Dilated veins result in increased scrotal and testicular temperature, which alter DNA synthesis within the testicle, leading to morphologic changes in sperm and testicular tissue.

2. Hypoxia

Low oxygen content in the dilated veins may result in local tissue hypoxia. This could impact both testicular architecture and sperm production.

3. Adrenal reflux

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There is a potential effect for exposure of the testes to renal and adrenal metabolites via the testicular vein causing testicular dysfunction. Renal and adrenal metabolites refluxing into dilated spermatic veins may lead to local tissue damage through undefined mechanisms.

4. Altered blood flow

Compared with many other tissues, blood pressure in the testicular capillaries and postcapillary venules is very low. The low pressure of this system makes it very sensitive to increases in pressure on the venous side (This, in turn, could cause degenerative changes in the affected testis). Increased blood flow, known to accompany the varicoceles, would increase the testicular temperature due to inefficient cooling of the incoming blood.

PATHOLOGY

I. Changes in testicular size

The WHO studies reported that varicoceles (most of which were on the left side) was associated with relative left testicular atrophy compared to the contralateral testis (Decrease of testicular volume was associated with increasing varicoceles grade).

II. Changes in testicular histology

The changes in testicular histology associated with varicoceles are varied from normal to Sertoli cell only pattern, so hypospermatogenesis and premature sloughing of germ cells were found to be the most common.

III. Leydig cell dysfunction

Leydig cell dysfunction has been documented in men with varicoceles. It was suggested that hyperplasia of the Leydig cells is the poor prognostic factor for fertility. The mean testosterone concentration of men with varicoceles older than 30 years of age was found to be significantly lower than that of younger patients with varicoceles (time-dependent effect).

IV. Changes in sperm characteristics

The adverse effect of varicoceles on spermatogenesis in the subfertile male is manifested by low sperm count, decreased sperm motility and low percentage of normal sperm morphology, which together or in different combinations known as stress pattern. The characteristic stress pattern is not a sensitive marker for varicoceles and is not specific for this pathology.

PRESENTATION

1. Incidental finding: - Varicoceles in adolescents are usually asymptomatic and therefore the diagnosis is typically made at a routine physical examination.

2. Infertility (primary or secondary):- after exclusion of other causes of infertility.

3. Scrotal discomfort or scrotal swelling:- On occasion a patient will present for evaluation of a scrotal mass or testicular discomfort, such as heaviness or a dull ache after standing all day. A careful and thorough history should differentiate men who stand a good chance of pain relief from men with other causes of testicular pain (high ligation).

- Despite numerous technological advancements, the key to diagnosing varicoceles remain a thorough physical examination.

TREATMENT

- There is no medical therapy for varicoceles or their effects on the testes.

- The term varicocelelectomy is a misnomer, the procedure should be termed internal spermatic or gonadal veins ligation, as the dilated veins are actually ligated but not removed.

- The goal of treatment of the varicoceles is to obstruct the refluxing venous drainage to the testis while maintaining arterial inflow and lymphatic drainage.

- Varicocelelectomy is very cost effective in treatment of infertility as compared with ICSI or IVF; however, varicocelelectomy may improve semen quality that increases the success rate of ICSI and IVF.

Aim Of The Study:

Although varicoceles are common in adolescence, the indications for surgery as well as the procedure of choice are controversial which mainly depends on preoperative assessment of the condition; however the strict method for identifying the surgical approach for varicocelelectomy is not confirmed yet.

The aim of our study is to determine the effect of surgical approach of varicocelelectomy on the result of surgery and what's the ideal method for identifying the surgical approach preoperatively.

Materials and Methods:

A prospective study has been done over a period since Jun 2009 till August 2012, where one hundred sixty nine patients of different age groups having unilateral or bilateral primary varicoceles were included.

The patients included in this study were of different ages having primary unilateral or bilateral varicoceles belong to Grade III or IV varicoceles were subclinical and grade II were excluded from the study. The patients with recurrent varicoceles also included in the study.

The cases of bilateral varicoceles considered as a single case if one side is grade III or IV while the other side is subclinical or grade II (i.e. contralateral subclinical or grade II in cases of bilateral varicoceles are not included in the study), however all cases of bilateral

varicoceles which included in study has only unilateral grade III or IV varicoceles.

The study is based on a concept that occlusion test of deep inguinal ring with Valsalva maneuver is important in identifying the best surgical approach of each case of varicoceles,

Presentations

The age groups of patient were between 17 to 46 years and no criteria was done for selection of cases according age of patient and all patient presented to the our department having grade III or IV varicoceles were selected. (Table 1)

Table.1 Shows number of patients and age distribution		
Age	Number	Percentage
<20	27	15.9%
21-30	81	47.9%
31-40	54	31.9%
>40	7	4.1%
Total	169	100%

The presenting symptoms of patient are pain and or swelling, infertility and incidental findings. (Table 2).

Table. 2 Shows the presentation of cases						
Age		<20	21-30	31-40	> 40	Total
SYMPTOMS	Incidental	2	5	1	--	8 (4.7%)
	infertility	--	2	18	2	22 (13.01%)
	swelling	12	34	15	3	64 (37.8%)
	pain	4	2	1	--	7 (4.1%)
	Pain and swelling	7	18	6	--	31 (18.3%)
	Infertility& swelling	--	16	8	2	26 (15.3%)
	Infertility, swelling and pain	--	3	1	--	4 (2.3%)
Recurrence		2	1	4	--	7 (4.1%)

About 8 (4.7%) cases the varicoceles discovered incidentally, 22 case (13.01%) of varicoceles are presented with infertility, 64 cases (37.8%) of varicoceles were presented only by scrotal swelling, 7 cases (4.1%) presented by scrotal pain, 31 cases (18.3%) were presented by swelling and scrotal discomfort, 26 cases (15.3%) were presented Infertility and swelling, and only 4 cases (2.3%) were presented Infertility, swelling and pain.

Out of 169 patients, there were 7 patients (4.1%) presents with recurrent varicoceles, five of them has history inguinal varicocelelectomy in whom occlusion test positive and they underwent high ligation approach, the other two cases had history of high ligation to them occlusion test was done and the result is

negative and they underwent inguinal varicocelelectomy.

Fifty two cases of varicoceles presented with infertility were included in the study, 22 out of them were presented only with infertility, and 26 cases were presented with infertility and obvious scrotal swelling, however only 4 cases presented with infertility and painful swelling.

Out of 52 cases belong to infertility due to varicoceles, there were 37 cases of primary infertility and 15 cases of secondary infertility.

Out of 37 cases of primary infertility, 15 cases were presented with infertility and scrotal swelling and only 4 cases were presented with infertility, pain and scrotal swelling. In cases of secondary infertility 11 out of 15 cases were presented with scrotal swelling. (Table 3).

Table 3 Shows the presentation of primary and secondary infertility					
Infertility	Presentation	Age			
		<20	21-30	31-40	>40
Primary	Only infertility	--	5	13	**
	Infertility and scrotal swelling	--	4	9	2
	Infertility, pain and scrotal swelling	--	--	4	--
Secondary	Only infertility	--	1	1	2
	Infertility and scrotal swelling	--	11	--	--
	Infertility, pain and scrotal swelling	--	--	--	--
Total		--	21 (12.4%)	27 (15.9%)	4 (2.3%)

Physical Examination

Preoperatively, the patients were examined preoperatively and 169 patient's patients with grade III and grade IV were selected to be included in study.

A deep inguinal ring occlusion test (OCT) was done for 129 patients and according to the result of the test the cases (positive i.e. no filling of veins during standing or Negative i.e. the veins becomes palpable despite closing the deep inguinal ring) the cases divided in two groups, however other 40 cases are control group operated without performing occlusion test.

The main concept is that once the occlusion test is positive mean defect above deep inguinal ring and the approach should above the ring (high ligation i.e. through palamo incision), however, if the test is negative, the approach should be inguinal through Ivanissevich techniques. The size of testis at the effected side was evaluated, and most of the patients had average size of testes. Eleven cases having all criteria of study but there testes size were small so they excluded from the study; because we suspected that there was no considerable semen parameters improvement in these cases.

All patients had been subjected to general or spinal anesthesia without selection bias (i.e.

the decision of type of anesthesia was left to the anesthetist); However in all patients underwent laparoscopic varicocelectomy general anesthesia is essential. Most patients were discharged in the 1st postoperative day except who developed post spinal anesthesia headache or who is leaving far away from Benghazi.

All patients were examined at the day 1st of surgery to exclude the technical failure, and all patients were examined between 3 to 6 months after the surgery. The follow up in some cases were extended up to 2 years depending on patients' cooperation.

Investigation

All the cases are thoroughly investigated, i.e. all patients do routine investigations beside ultrasonic examination of scrotum and semen analysis especially for patients presented with infertility.

Results:

Out of 129 patients who underwent deep inguinal ring occlusion, the test was positive in 97 patients (57.3%) and negative in 32 patients (18.9%). The other 40 cases (23.6%) (Control group) underwent surgery without occlusion test and the approach was left to the surgeon preference. (Table 4).

Table 4. Shows Result and distribution of occlusion test				
Age	Number	Occlusion		
		Positive	Negative	Not done
<20	27	14	7	6
21-30	81	43	15	23
31-40	54	36	9	9
40	7	4	1	2
Total	169	97 (57.3%)	32 (18.9%)	40 (23.6%)

A surgical approach was chosen according to the result of occlusion test in 96 patients (56.8%), where the surgical approach was left to preference of the surgeon regardless the result of the test in 33 patients (19.5%).

Out of 96 cases of varicoceles the surgical approach was selected according to the result of the occlusion test, and 76 cases out of them (33.1%) the test is positive and out of them 63 patients (37.2%) underwent high ligation approach and 13 patients (21.97%) underwent laparoscopic surgery; (Laparoscopic varicocelectomy was done for 13 cases, when the varicoceles are bilateral and occlusion test is positive at least in one side and the approach considered as high ligation).

The rest of cases 20 patient (11.8%) who underwent surgical approach according to test

result, in whom the result of occlusion test is negative, they underwent varicocelectomy through inguinal approach.

In 33 cases of varicoceles, the test is done but surgical approach is left to the surgeon preference, out of 21 cases (12.4%) the occlusion test was positive and 15 out of them underwent high ligation while the other 5 cases, the operation was done through inguinal approach, however the other 12 cases (7.1%) in whom the test was negative, the surgical approach was high ligation in 5 cases and inguinal in the other 7 cases.

In the study forty cases (23.6%) underwent surgery without test, where high ligation done in 25 cases and inguinal approach varicocelectomy done in other 15 cases. (Table 5).

Table. 5	Shows surgical approach					
Surgical approach	Surgical approach according to test result		Surgical approach according to preference of surgeon and test is done		Surgical approach according to preference of surgeon and test is not done	Total
	(+)	(-)	(+)	(-)		
Palamo techniques	63	--	15	5	25	108 (60.9%)
Ivanishevich techniques	--	20	6	7	15	48 (28.4%)
Laparoscopic techniques	13	--	--	--	--	13 (7.6%)
Total	76 (33.1 %)	20 (11.8%)	21 (12.4%)	12 (7.1%)	40 (23.6%)	169
	96 (56.8%)		33 (19.5%)			

So the patients were divided according to occlusion test into 8 groups

1. Occlusion test is positive and underwent varicocelectomy through high ligation or laparoscopic approach 76 cases.
2. Occlusion test is negative and underwent varicocelectomy through inguinal approach 20 cases.
3. Occlusion test is positive and underwent varicocelectomy according to preference of surgeon through high ligation approach 15 cases.
4. Occlusion test is positive and underwent varicocelectomy according to preference of surgeon through inguinal approach 6 cases.
5. Occlusion test is negative and underwent varicocelectomy according to preference of surgeon through high ligation approach 5 cases.

6. Occlusion test is negative and underwent varicocelectomy according to preference of surgeon through inguinal approach 7 cases.

7. Occlusion test is not done (control group) and underwent varicocelectomy according to preference of surgeon through high ligation approach 25 cases.

8. Occlusion test is not done (control group) and underwent varicocelectomy according to preference of surgeon through inguinal approach 15 cases.

Postoperative follow up

All personal data was taken from patient including the number of their mobile phone, and full essential information about the study was explained and discussed with the patients to get their cooperation.

At the day 1st all patient underwent physical examination to exclude any cases of technical failure (operation not succeed), and fortunately all patients had no evidence of surgical failure. Every patient scheduled for follow up to 3, 6, 12 months after surgery and sometimes the follow can be extended up to 2 years depending on cooperation of patients, and all of them examined at each visit to evaluate if there any evidence recurrence.

The cases who presented with fertility informed to bring new semen analysis 3 months after surgery.

Out of 52 cases of infertility, 34 patients (65%) get pregnancy whatever the result of test and a surgical procedure had performed, while 18 cases (34%) showed reasonable improvement

in semen analysis parameters but no pregnancy.

All 7 cases of recurrent varicoceles who underwent occlusion test and the operation performed regarding to the result of test shows improvement in semen parameters and they have no evidence of reoccurrence.

Recurrence detected only in 5 cases (2.9%) after 2 years of follow up and 2 (1.1%) of them who underwent inguinal approach despite the occlusion test is positive; while other 3 cases in recurrence occur in cases that underwent surgery without test (two cases (1.1%) of recurrence underwent palamo approach while the other one (0.59%) underwent inguinal approach).(Table 6).

Table.6	Shows Result and distribution of occlusion test				
Result of surgery	Age				Total
	<20	21-30	31-40	>40	
Get pregnancy	--	12	19	3	34 (20.1%)
Improved semen analysis (no pregnancy)	--	9	8	1	18 (10.6%)
Improvement of symptoms	17	49	20	--	86 (50.8%)
Missed	9	11	5	1	26 (15.3%)
Recurrence	1	--	2	2	5 (2.9%)
Total	27	81	54	7	169

7 cases were missed for follow up after the 1st visit to 3 months and other 19 cases missed after the second visit to 6 months due to difficulties in mobile communications at 2011 i.e. 26 cases (15,3%) were missed.

The distribution of missed cases regarding occlusion test (OCT). Table 7

1. The missed cases in group of OCT (+) and underwent varicocelectomy through laparoscopic approach are 5 cases (2.9%).
2. OCT (-) and underwent varicocelectomy through inguinal approach 3 cases (1.7%).
3. OCT (+) and underwent varicocelectomy according to preference of surgeon through high ligation approach 5 cases (2.9%).

Table 7.	Shows the distribution of missed cases					
Surgical approach	According to test result		According to preference of surgeon and test is done		According to preference of surgeon and test is not done	Total
	(+)	(-)	(+)	(-)		
Palamo	0/63	--	5/15	1/5	6/25	12/108 (11.1%)
Inguinal	--	3/20	2/6	0/7	4/15	9/48 (18.7%)
Laparoscopic	5/13	--	--	--	--	5 /13 (38.4%)
Total	5/76 (6.5 %)	3/20 (15%)	7/21 (33.3%)	1/12 (8.3%)	10/40 (25%)	26 (15.3%)
	8/96 (8.3%)		8/33 (24.2%)			

4. OCT (+) and underwent varicocelectomy according to preference of surgeon through inguinal approach 2 cases (1.1%).
5. OCT (-) and underwent varicocelectomy according to preference of surgeon through high ligation approach 1 cases.
6. Occlusion test is not done (control group) and underwent varicocelectomy according to preference of surgeon through high ligation approach 6 cases (3-5%).
7. Occlusion test is not done (control group) and underwent varicocelectomy according to preference of surgeon through inguinal approach 4 cases (2.3%).

The distribution of missed cases regarding surgical approach are as following

1. Out of 108 cases underwent high ligation approach there are 12 cases (11.1%) were missed, out of them in 5 cases (4.6%) with OCT (+) 1 case (0.9%) with OCT(-) and 6 cases (5.5%) in whom the test is not done.
2. Out of 48 cases underwent inguinal approach, there are nine cases (18.7%) were missed, out of them 3 cases (6.25%) with OCT (-), 2 cases (4.1%) with OCT (+), and 4 (8.3%) cases in whom the test is not known.
3. Out of 13 cases underwent laparoscopic approach there are 5 cases (38.4%) were missed with OCT (+).

Discussion:

- It is widely accepted that patients with testicular growth retardation ipsilateral to the varicocele may represent an 'at-risk' group for late infertility.^{16,17} Moreover, it was stated that patients with grade III and IV varicoceles had a significantly smaller left testis than other grades of varicoceles, and these patients are also at risk of bilateral volume loss for them early surgical varicocelectomy is recommended.¹⁸
- Thomas and Elder¹⁹ reported, in a series of 124 boys aged 7–18 years, testicular growth arrest in 13 of 33 (39%) of those with grade II and 47 of 84 (56%) with grade III varicoceles ($P < 0.01$). Cozzolino and Lipshultz¹⁷ stated that many adolescents with varicoceles will be needed to treat because there is convincing evidence that a varicocele might have a progressive toxic effect on the testes that may ultimately result in irreversible infertility if left untreated.
- Various therapeutic strategies show that no single approach can be adopted as the best.^{1,9} Some authors prefer percutaneous

embolization or sclerosis; others prefer retroperitoneal, inguinal or subinguinal open surgery; only a few surgeons approach the varicocele using a microsurgical venous bypass. The laparoscopic or retroperitoneoscopic treatment of varicocele has recently been advocated as a simple, safe and effective technique, and its results in terms of recurrence and complication rates are comparable with those from the other procedures.

- By reviewing of published reports shows that little attention has been paid to the different types of venous reflux (renal-internal spermatic and/or iliac-deferential reflux) in selecting the best surgical procedure, so the right approach to treating a varicoceles should be based only on a correct understanding that concept.
- With accepting a concept that the surgical treatment is interruption of all venous networks potentially causing reflux is sufficient, so the only effective technique should be subinguinal ligation, which clearly exposes the vessels, thus allowing the sectioning of all networks (internal spermatic vein, cremasteric vein, and deferential vein). However, the high ligation, either by open surgery through palamo incision or laparoscopically or retroperitoneoscopically, can only be used to treat renal-internal spermatic refluxing varicoceles. Therefore, many varicoceles due to venous reflux involving not only the internal spermatic vein remain untreated, thus causing variable varicocele recurrence rates.
- We think that the right approach to a varicoceles should not be 'how to treat' but 'how to diagnose and then to treat' the different types of varicoceles.
- Varicocele is a well-established cause of male infertility,¹ giving rise to a progressive and time-dependent impairment of spermatogenesis² and a significant volume loss of the ipsilateral gonad,³ For this reason, the repair of varicocele at the time of presentation is widely advocated, as it can prevent testicular damage, as indicated by improvement in semen variables.⁵
- The younger the patient when the varicocele is repaired the more likely the testis will recovery from varicocele-induced injury.⁶ However, the ideal method for treating a varicocele remains controversial; the standard technique should provide for a low incidence of recurrences and complications

after surgery, optimum testicular function, and should be cost-effective.

- Several studies have been examined different techniques to ascertain differences in efficacy and outcome. Although the short-term results are similar, the open microsurgical methods seem to cause fewer long-term complications, e.g. recurrences and hydrocele.^{7,8} More recently, the transperitoneal laparoscopic and the retroperitoneoscopic approach to varicocele were described as feasible techniques, and their results were comparable to those of open surgery or radiological treatment.⁹

Conclusion:

- Although varicoceles are common in adolescence, and despite varicocelelectomy of the most common and easiest surgery done in urology, the decision of surgical approach is not clear yet and still controversial, however every surgeon preferred single approach without an obvious explanation.
- Whatever the surgical approach chosen for varicocelelectomy, most of patient should considerable improvement of symptoms and most of infertile men due to varicoceles show improvement of semen analysis parameters and a majority of them get pregnancy within few months after surgery.
- Postoperative recurrences are due to wrong approach and are not due to technical failure.
- However, little attention has so far been paid to the different aetiopathogenetic types of varicocele to outline the different surgical techniques. Using the laparoscopic or retroperitoneoscopic approach, or sclero-embolization of the internal spermatic vein, the varicoceles is treated according to the rationale of the Palamo technique; treatment is therefore successful only in occlusion test positive varicoceles (i.e. having renal-internal spermatic reflux), The other patients may have persistent or recurrent varicoceles, due to other components of the venous reflux, e.g. iliac-deferential reflux i.e. those patients in whom occlusion test positive varicoceles .
- The aim of the present study was therefore to investigate whether internal ring occlusion

test is a reliable diagnostic tool to assess cases of varicoceles and thus select patients based on the result of test, consequently choosing the appropriate surgical approach

- The occlusion test positive varicoceles can be treated through palamo approach or laparoscopically, whereas occlusion test negative varicoceles should be treated by through inguinal or subinguinal approach.
- Another concept arises during collection and analysis of data of the study that may help in choosing appropriate surgical approach and this concept is performing occlusion test at deep and superficial inguinal rings (double occlusion test) consequently.
- The double occlusion test is performed as following, at first let the patient lying on bed and occlude the deep inguinal ring as the patient to stand, if the test is positive (i.e. no filling of veins during standing because of blocking of renal- internal spermatic reflux), the surgical approach should be above deep ring though open or laparoscopic procedure, however if the test is negative (i.e. filling of veins during standing due to iliac-deferential reflux), let the patient lies down and perform the occlusion test at the superficial inguinal ring and then ask him to stand again, if the test becomes positive (i.e. no filling of veins during standing because of blocking of iliac-deferential or internal spermatic reflux), the approach is inguinal by using Ivanissevich techniques, and if the test becomes negative (i.e. filling of veins during standing) the approach should be microsurgical subinguinal ligature.
- To make occlusion test is more reliable especially for subclinical and grade II varicoceles a color Doppler ultrasound (CDUS) is advised as objective tool in the assessment the reflux for determination of varicocele size, venous flow patterns, testicular volume, and resistance index as well as make the occlusion test is more reliable.
- We hope the incidence of recurrence was significantly reduced following the introduction of this maneuver.

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