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**ORIGINAL ARTICLE**

# Laparoscopic Versus Open Inguinal Ligation of Varicocele: A Study of 60 Cases

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## ABSTRACT

**Objective:** To compare the results of trans-peritoneal laparoscopic varicocelectomy with open inguinal technique in terms of operation time, post-operative pain and analgesic requirement, post-operative complications and hospital stay.

**Study design**: Randomized controlled trial.

**Place & Duration of study:** Department of Urology, Jinnah Postgraduate Medical Center (JPMC) Karachi, from January 2017 to December 2020.

**Methodology:** This prospective study composed of 60 patients diagnosed as primary varicocele clinically or as asymptomatic on Doppler U/S. They were divided into two groups on the basis of type of operation by alternate methods. In Group A (n=32), laparoscopic varicocelectomy was performed while in Group B (n=28), open inguinal method was used. Their clinical presentations, operation times, postoperative pain, analgesic requirement, hospital stay and postoperative complications were noted and analyzed.

**Results:** Out of 60 patients included, the age range was from 18-30 years.41.6% patients were asymptomatic and were referred to us because they were declared unfit for recruitment. Left sided varicocele was diagnosed in 81.6% patients, while 16.6% were bilateral. Grade II was most common seen in 60% of patients. Operation time for unilateral laparoscopic varicocelectomy was 17.25±2.1minutes, while open unilateral time was 42.5±3.4 minutes. Post-operative pain and hospital stay were significantly better in laparoscopic group (p value<.001). Postoperative wound related complications and secondary hydrocele was more in open group. In laparoscopic group, subcutaneous emphysema was noted in early postoperative period in 3 patients (9.3%) and portside hernia in one patient (3.1%). Recurrence rate was more in open cases (14.2%), versus 6.2% in laparoscopic group.

**Conclusion:** Laparoscopic varicocelectomy is a simple and safe technique causing minimal morbidity with early recovery and better surgical outcome.

**Keywords:** Varicocele, Laparoscopic Ligation, Open ligation

## INTRODUCTION

A varicocele is dilated veins of pampiniform plexus of testicular veins having reverse blood flow. It is more common in left side (90%) due to its drainage into left renal vein which cross the midline to enter into inferior vena cava [1]. It's a common disease in young adults (15%)[2]. A study conducted in Turkey showed its prevalence 11% in boys aged 11–19 years while it is very low below 11 years [3]. 35% men presenting with primary infertility while 45–81% with secondary infertility[4]

There are various techniques to deal with varicocele includes Open surgical approaches, Laparoscopic repair, microsurgical technique and endovascular approaches. Most common Open surgical approach is inguinal (Ivanissevich) approach[5]. The other approaches are Palomo approach (High ligation in retroperitoneum)[6], Goldstein subinguinal approach [7] and Scrotal approaches (not used nowadays). Laparoscopic repair (Sanchez-de-Badajoz)[8] through trans-abdominal pre peritoneal approach introduced in 1990 has various advantages including bilateral surgery and relatively short operating times. In 1985 Marmar introduced Microsurgical technique [9].Endovascular approach (Tauber approach) in which sclerosing agent directly inject into the pampiniform plexus via a small incision.[10]

Among these various techniques we compare open inguinal versus trans-peritoneal laparoscopic technique commonly performed in our hospital to know which one is superior

## METHODOLOGY

This study was conducted in Urology department of Jinnah Postgraduate Medical Centre, Karachi from January 2017 to December 2020 with minimal 6 months of follow-up. This randomized controlled trial has 60 patients of primary varicocele. All patients with primary varicocele of more than one year duration with clinically demonstrable varicocele (Grade II and III) or asymptomatic Doppler ultrasound proven (Grade I) were included in this study. Patients with recurrent varicocele, secondary varicocele, associated undescended testis or history of orchidopaxy were excluded. Detailed history and examination were performed. Doppler color ultrasound was used to assess the diameter of varicocele (diameter > 2.4mm) and reversal of venous flow. Dublin and Amelar classification was used for grading the varicocele.[11]

Patients were divided into two groups by alternative method. Patients in a group A (n=32) were treated by laparoscopic varicocelectomy and patients of group B (n=28) were treated by open inguinal technique. All patients

were informed about the two techniques and written informed consent was obtained. The surgery in both the groups was performed by a senior consultant having more than 10 years of experience. All bilateral cases were operated by laparoscopic method. Three ports technique with clip ligation of testicular veins after separation was used for trans-peritoneal laparoscopic varicocelectomy while standard inguinal approach with excision of 5 cms of dilated vein after separation and with meticulous preservation of lymphatic was the method for open cases. Post operatively all patients were evaluated for operation time, severity of pain, frequency of analgesia used, hospital stay and post- operative complications. Semen analysis was also performed in all patients, before and six months after surgery for comparison. Operative time was defined as time between skin incision to closure in open cases, while trocar insertion to trocar removal in laparoscopic surgery. Pain was measured by VAS scale (0-10).1 to3 was mild, 4 to 6 was moderate and 7 to 10 was taken as severe pain.

The database was developed on SPSS version 23. For the quantitative variables like age, total sperm concentration and sperm motility were represented by their Mean ± S.D values and were tested by student`s t-test. For the association of two qualitative variables, the Chi-Square test of independence was employed where it is valid; else Fischer exact test was used. The significant results were considered at $p < 0.05$.

## RESULTS

A total of 60 patients were included in the study. The mean age in Group A was 24.44 ± 3.50 years, while 25.32 ± 4.10 years in Group B. Patients were selected between age ranges 18 to 30 years. Twenty five out of 60 patients (41.6%) were asymptomatic and were referred to our outpatient department (OPD) because they were declared unfit for recruitment in armed forces and police department and hence, they represent the majority of our patients. Other common presentations were dragging scrotal pain (50 %), visible scrotal swelling (56.6%), and infertility (35%). Left sided varicocele was noted in 49/60 (81.66%) patients, bilateral cases were 10/60 (16.6%) while only one patient (1.6%) was a case of right sided isolated Primary Varicocele. Grading of Varicocele was made after clinical examination and Doppler Ultrasound. Grade II was the most common type, seen in 26/60 (43.33%) patients, followed by Grade III in 17/60 (28.3%) and Grade I was found in 7/60 (11.6%) patients. The comparison in these parameters in both groups are shown in Table 1.

Operative duration in Laparoscopic Varicocelectomy was 17.25 ± 2.1 minutes in unilateral cases while 29.32 ± 2.8 minutes in bilateral presentations. In Open Varicocelectomy, the mean duration of surgery for unilateral cases was 42.5 ± 3.4 minutes. This difference was statistically significant ($p < 0.001$). Only one case had to be converted into open surgery because of presence of dense inflammatory adhesions in left iliac fossa due to previous abdominal surgery.

Post operatively, pain was assessed by using the VAS scale. After Laparoscopic Varicocelectomy, 78.1% patients experienced mild pain while 21.8% patients had moderate pain and no patient was noted to complain of severe pain. In Open group, 71.4% patients complained of moderate pain and 7.1% patients experienced severe pain. Patients operated through open procedures required injectable opioid analgesics (Tramol) for more than 3 days with an average of 4-8 doses; whereas patients operated through Laparoscopic procedures were controlled with non-steroidal analgesics (Diclofenac Sodium) for 1-2 days with an average of 2-3 doses only. Hospital stay was also significantly lower in patients who underwent laparoscopic surgeries ($p < 0.001$) as compared with patients who were operated through open procedures.

Table-1: Clinical Presentation (Comparison Of Two Groups)

| | LAPAROSCOPIC (A) | OPEN INGUINAL (B) | p-value | Test- value |
|---|---|---|---|---|
| NUMBER OF PATIENTS | 32 | 28 | | |
| MEAN AGE (years) | 24.44+3.5 | 25.32+4.1 | 0.37 | 0.89 |
| SYMPTOMS | | | | Fisher's Exact test |
| • DRAGGING PAIN | 16 (50%) | 14 (50%) | 0.60 | 0.99 |
| • VISIBLE SCROTAL SWELLING | 18 (56.2%) | 16 (57.1%) | 0.47 | 0.99 |
| • INFERTILITY | 9 (28.0%) | 12 (42.8%) | 0.17 | 0.35 |
| • FITNESS FORRECRUITMENT (Asymptomatic) | 14 (43.7%) | 11 (39.2%) | 0.46 | 0.93 |
| LATERALITY | | | | Chi-square test |
| • LEFT | 22 (68.7%) | 27 (96.5%) | | |
| • RIGHT | 0 (0%) | 1 (3.5%) | 0.003 | 11.29 |
| • BILATERAL | 10 (31.2%) | 0 (0%) | | |
| GRADE | | | | Chi-square test |
| I | 4 (12.5%) | 3 (10.7%) | | |
| II | 19 (59.3%) | 17 (60.7%) | 0.04 | 0.97 |
| III | 9 (28.1%) | 8 (28.5%) | | |

In Group B, 2 (7.2%) patients developed mild reactionary bleeding on next day post operatively, needed partial wound opening and pressure dressing for management, which was followed by a good recovery. Wound infection was seen in 5 (17.8%) patients, requiring opening of stitches, pus drainage and regular dressing. Secondary hydrocele was observed in 6 patients (21.4%), four of them resolved gradually but two needed hydrocelectomy. In Group A, mild surgical emphysema was noted around umbilical port in 9.3% cases which was managed conservatively while port site wound infection was seen in 6.2% patients. Mild secondary hydrocele prevailed in only 6.2% patients which resolved spontaneously. Recurrence was also noted in 6.2% cases

in laparoscopic group but it was much higher in open group (14.2%). These parameters are mentioned in Table 2. The changes in Semen Parameters, before and 6 months after surgery were also noted. Both groups showed almost equal improvement in sperm concentration, morphology and motility with minimal change in semen volume as shown in Table 3.

Table No 2: Operative And Post Operative Parameters

| | LAPAROSCOPIC (n=32) | OPEN(INGUINAL) (n=28) | P-VALUE | Test –VALUE |
|---|---|---|---|---|
| OPERATIVE TIME (Mints)<br>• UNILATERAL<br>• BILATERAL | <br>17.25 ±- 2.1<br>29.32 ± 2.8 | <br>42.5 ± -3.4<br>0 ± (0) | <br>0.001<br>-- | t-VALUE<br>35.04<br>-- |
| POST OPERATIVE PAIN<br>• MILD<br>• MODERTE<br>• SEVERE | <br>25 (78.1%)<br>7 (21.8%)<br>0 (0) | <br>6 (21.4%)<br>20 (71.4%)<br>2 (7.1%) | <br><br>0.001 | Chi-square test<br><br>19.73 |
| DURATION OF ANALGESIA | 1.4+1.0 days<br>(2-3 DOSES) | 3.8+ 1.7 days<br>(4-8 DOSES) | | |
| POST OPERATIVE COMPLICATIONS<br>EARLY:<br>• HEMORRHAGE<br>• SUBCUTANEOUS EMPHYSEMA<br>• WOUND INFECTION<br>• HYDROCELE<br>LATE:<br>• POST OPERATIVE PORT HERNIA<br>• RECCURENCE | <br><br><br>0 (0)<br>3 (9.3%)<br><br>2 (6.2%)<br>2 (6.2%)<br><br><br>1 (3.1%)<br>2 (6.2%) | <br><br><br>2 (7.1%)<br>0 (0)<br><br>5 (17.8%)<br>6 (21.4%)<br><br><br>0 (0)<br>4 (14.2%) | <br><br><br>--<br>--<br><br>--<br>0.08<br><br><br>--<br>0.08 | Fisher's Exact test<br><br><br><br><br><br><br>0.17<br><br><br><br>0.17 |
| HOSPITAL STAY (DAYS) | 1.5 ± 0.4 | 4.2 ± 0.9 | 0.001 | t-value<br>15.3 |

Table No 3: Changes in semen parameter before and sixth month after surgery

| Parameters | Laparoscopic varicocelectomy (n=32) | | | Open Varicocelectomy (n=28) | | |
|---|---|---|---|---|---|---|
| | Before surgery | Six months after surgery | P value<br>t-value | Before surgery | Six month after surgery | P-value<br>t-value |
| Sperm volume (ml) | 3.6+ 1.13 | 3.86+0.78 | 0.28<br>1.07 | 3.5+1.3 | 3.75+1.5 | 0.50<br>0.66 |
| Total sperm concentration(millions/ml) | 24.21+6.19 | 38.7+14.76 | 0.001<br>5.12 | 25.1+5.9 | 37.56+15.2 | 0.001<br>4.04 |
| Normal sperm morphology (%) | 16.96+7.75 | 20.89+10.59 | 0.09<br>1.69 | 16.3+6.93 | 21.1+11.2 | 0.05<br>1.92 |
| Sperm motility (%) | 12.84+4.62 | 24.23+9.35 | 0.001<br>6.17 | 12.9+5.0 | 23.9+10.1 | 0.001<br>5.16 |

## DISCUSSION

Varicocele is a common problem in the practice of reproductive medicine. It is identified in 15% of healthy men population maybe an evolutionary effect of men's upright posture. Many theories proposed to explain its pathophysiology. Scrotal hyperthermia is the main mechanism which affects the spermatogenesis and testicular function [12]. The reflex of adrenal metabolites from the left adrenal vein into left spermatic vein is another explanation [13]. Increased hydrostatic pressure in internal spermatic vein from renal vein reflux maybe another factor [14].

Age group in our study was comparatively younger than other studies. This maybe because 41.6% of our patients were asymptomatic, younger group, aged between 18-25 years were declared unfit for recruitment in police, armed forces and other government jobs. Surprisingly, they were not Grade I but most of them were Grades II and III. Similar results were also shown by another study where 55% of the patients with primary varicocele were asymptomatic, young and were rejected by medical board for entry in armed forces [15].

In our study, 82% of our cases were left sided primary varicocele and 16.6% patients presented with bilateral disease which were operated laparoscopically in one sitting. This was very cost effective for patients and for health providers. Only one right sided primary varicocele was found in the study which was operated through open inguinal approach. Isolated non reducible right sided varicocele should always be taken seriously and proper investigations should be performed, especially for right renal or retroperitoneal mass.

After adequate training, the laparoscopic varicocelectomy is a time-saving procedure. Our mean operation time for unilateral cases was 17.25 ± 2.1 minutes whereas the open unilateral cases lasted for an average of 42.50 ± 3.4 minutes. Similar results were reported in another study with duration of unilateral laparoscopic varicocelectomy was 13.8+1.2 minutes, while bilateral cases was 17.3±1.7 minutes, while the time duration in unilateral open varicocelectomy was 27.55±2.05 minutes and bilateral cases took 49.7±3.50 minutes. These differences were statistically significant (p value <0.001)[15] .Another study revealed 24 minutes (15-65 minutes) for unilateral laparoscopic varicocelectomy and 40 minutes(25-85 minutes) for bilateral varicocelectomy[16] .One study from Pakistan showed operative time for unilateral laparoscopic varicocelectomy was 27.44±3.31 minutes while inguinal

surgery took around 36.5±3.56 minutes, which is very much close to our study[17] .

Intraoperative, no major complication was noted in our study. Only one case had to be converted into open surgery because of presence of dense inflammatory adhesions in left iliac fossa due to previous abdominal surgery. There are two techniques of varicocele ligation in laparoscopic surgery: mass ligation and artery and lymphatic sparing technique. We try to follow the artery and lymphatic sparing technique in both open and laparoscopic surgeries to preserve lymphatic and genital branch of genito-femoral nerve, so minimizing the chances of lymphocele (hydrocele) and post-operative pain. Our study shows hydrocele formation in 6.2% patients in laparoscopic group, compared with 21.4% in open group respectively. This is a reflection of the advantages of laparoscopic magnification, which led to better lymphatic preservation. Mass ligation is a safe procedure with better success rate and lower recurrence rate (2.2% versus 3.5%) but higher rate of hydrocele formation of about 3-25%[18]. Build-in magnification of laparoscopy allows the identification of spermatic vessels and lymphatics, minimizing the chances of formation of a post-operative hydrocele[19]. Kocvera R et. al reported 17.9% hydrocele formation with mass ligation and 1.9% after lymph vessel preservation[20].

The degree of pain on the VAS Scale, duration and type of analgesia for the pain relief in our study showed much better results in laparoscopic group. Open procedures group required an average of 4-8 doses for the pain relief including initial few injectable opioid analgesics (Tramol), whereas patients operated through Laparoscopic procedures were controlled with non-steroidal analgesics (Diclofenac Sodium) for 2-3 doses only. Similar results were also observed by other author reporting that laparoscopic group needed only 2.5 doses, whereas open group required an average of 4.5 doses including 2 opioid doses[15]. In our study there was significant difference in hospital stay between laparoscopic and open groups i.e. 1.5± 0.4 days versus 4.2 ± 0.9 days (P value <0.001). Another study revealed hospital stay of 1.2 days in laparoscopic group and 4.3 days in open group[21]. Another study showed average hospital stay after laparoscopic varicocelectomy between 24 to 36 hours[22].

Recurrence rate in our study was 6.2% in laparoscopic group and 14.2 in open group. Similar rate of recurrence was noted by one study showing 5.6% recurrence rate after laparoscopic surgery[22]. Another study showed 4.65% recurrence in laparoscopic group and 18.6% in inguinal group[17]. But few studies revealed higher recurrence rate in laparoscopic group than open[23]. This better result in open method may be due to extensive ligation of the vessels including retro-inguinal and cremasteric veins during surgery. Regarding semen parameters equal improvements were seen in semen concentration, motility and morphology six months after varicocelectomy but there was minimal change in semen volume. This observation was also noted in other studies[24]. One meta- analysis revealed that improvement in sperm density and motility are better in microsurgical than open method and there were insignificant differences between microsurgical and laparoscopic groups[25]. This reflect that microsurgical and laparoscopic are the best methods of varicocelectomy in patients with abnormal sperm parameters.

## CONCLUSIONS

Laparoscopic varicocelectomy is a safe and simple surgical technique with minimal morbidity. Less postoperative pain and hospital stay with fewer postoperative complications as compare to open procedure make it the procedure of choice.

**Conflict of Interest**: The authors declare that they have no conflict of interest.

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**Ethical approval**: This study was approved by the institutional Ethics committee

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