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Outcome of Laparoscopic High Ligation of Left Sided Varicocele: Our Five Years' Experience

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Abstract **Original Research Article**

***Background*:** Varicocele, characterized by the dilation and tortuosity of the pampiniform plexus veins, predominantly affects the left testis due to unique anatomical factors, including the perpendicular entry of the left testicular vein into the renal vein. Affecting 18% of the male population, varicocele is a common cause of infertility, especially in adolescents and adult men, with left-sided dominance accounting for up to 35% of infertility cases. Diagnosis relies on physical examination and Doppler ultrasound. Management prioritizes alleviating discomfort and addressing infertility, with laparoscopic high ligation emerging as a superior method due to its precision, reduced recurrence, and lower complication rates. ***Aim of the Study*:** This study aims to share our five-year experience with laparoscopic high ligation, specifically for left-sided varicocele, focusing on postoperative complications, recurrence rates, and its effectiveness in relieving symptoms and improving outcomes in affected patients. ***Methods*:** This cross-sectional study was conducted at the Department of Urology, Shahid Sk. Abu Naser Specialized Hospital, Khulna Medical College Hospital and two other private Hospitals in Khulna city, Khulna, Bangladesh from January 2017 to June 2023. It included 32 male patients aged 15–40 years who underwent laparoscopic surgery for grade II or III left-sided varicocele. Inclusion criteria focused on symptoms of testicular pain, visible tortuous veins, and oligospermia. Patients with renal malignancy or recurrent varicocele were excluded. Laparoscopic surgery involved a 10 mm paraumbilical port for pneumoperitoneum creation (12–14 mmHg) and two additional ports for vein dissection and clipping. Data collection included pain assessment, Doppler ultrasonography, and follow-ups at 3 and 6 months. Analysis was performed using SPSS 26, with statistical significance set at $p<0.05$. ***Result*:** This study analyzed outcomes in 32 patients (mean age: 32.19±3.28 years) undergoing surgical intervention. Most were classified as Grade III (78.13%). Pre-operative pain scores were slightly higher in Grade III patients (VAS: 4.91±0.46) compared to Grade II (VAS: 4.79±0.83). The procedure duration averaged 65±3 minutes. Post-operative pain scores significantly decreased at 3 and 6 months ($p < 0.001$), with Grade III patients experiencing a drop from 1.52±0.26 to 0.83±0.08. Common complications included nausea (18.75%) and shoulder pain (9.38%), with recurrence observed in 3.13%. Overall, 87.50% showed significant improvement, affirming the intervention's effectiveness. ***Conclusion*:** Laparoscopic high ligation for left-sided varicocele offers significant symptom relief, reduced pain, and a low recurrence rate, with minimal complications. The procedure's effectiveness and safety profile make it a preferred treatment option, ensuring durable outcomes for patients with Grade II and Grade III varicocele.

Keywords: Outcome, Laparoscopic High Ligation, and Left Sided Varicocele.

INTRODUCTION

Varicocele, defined as an abnormal dilation and tortuosity of the pampiniform plexus veins surrounding the testis, exhibits a marked predominance on the left side, where it frequently contributes to male infertility and testicular dysfunction [1]. This condition affects different age groups, occurring in approximately 6% of children around ten years old, 13% in adolescents aged 11 to 18, and around 5% in adult males over 18 years [2]. In the general population, varicocele affects about 18% of men, with up to 35% of infertile men experiencing this condition, particularly on the left side [1, 3]. This left-sided dominance is linked to anatomical differences,

such as the angle at which the left testicular vein enters the renal vein, leading to greater venous pressure and predisposition to varicocele formation on that side [4]. Clinically, left-sided varicocele may manifest as a "Bag of Worms" appearance in the scrotum and can lead to testicular asymmetry, where the affected testis appears smaller than the contralateral side [3]. Patients may present with scrotal discomfort, inguinal aching, or a dragging pain on the affected side, often exacerbated by standing or physical exertion. Diagnosis is typically established by physical examination, supplemented by Doppler ultrasound to detect venous dilation and assess reflux under a Valsalva maneuver, particularly in left-sided cases [5]. Management of left-sided varicocele focuses on addressing symptoms like discomfort and infertility, with various surgical interventions designed to prevent venous reflux. While conservative measures like scrotal support may offer temporary relief, surgical intervention is often preferred for long-term resolution [6]. The treatment options include open retroperitoneal high ligation (Palomo), inguinal and subinguinal low ligation approaches, and more advanced methods like percutaneous embolization and laparoscopic high ligation [7]. Among these, laparoscopic high ligation is particularly beneficial for left-sided varicoceles, where it allows for targeted occlusion of the refluxing veins with reduced risk of missing collateral veins. The laparoscopic high ligation approach offers several advantages in left-sided varicocele management. This method allows for better visualization and precise ligation of the testicular vein at a higher anatomical level, close to the renal vein, where the reflux is most prominent. High ligation techniques such as this focus on ligating the pampiniform plexus at a level where it consolidates into fewer vessels, which is especially effective for the left-sided varicocele due to the structural venous flow patterns on this side. Laparoscopic high ligation enables access to the left testicular vein within the abdominal cavity, bypassing the complexity of lower ligation approaches that carry higher recurrence rates due to incomplete vein occlusion or collateral formation [8]. Although laparoscopic high ligation is associated with fewer complications compared to inguinal and subinguinal techniques, some risks remain. Complications of left-sided varicocelectomy include testicular atrophy, recurrence, and hydrocele formation, with high ligation approaches showing generally lower rates of these issues [6]. Hydrocele formation, for instance, is more commonly associated with lower ligation techniques due to the difficulty in isolating lymphatic vessels from the pampiniform plexus in the scrotal region. In laparoscopic approaches, precise dissection of the lymphatic vessels from the spermatic cord is feasible, reducing the likelihood of visualization formation [9]. The blood supply to the left testis is maintained through three primary sources: the testicular artery, cremasteric artery, and internal spermatic artery. During laparoscopic high ligation, careful preservation of the testicular artery is prioritized, reducing the risk of testicular atrophy and ischemia by maintaining adequate blood flow from the collateral arteries [10]. This focus on arterial preservation is particularly relevant in left-sided varicocelectomies, as the left testicular artery may be more prone to inadvertent damage due to its proximity to the ligation site [11]. The aim of this study is to share our five-year experience with laparoscopic high ligation specifically for left-sided varicocele, focusing on postoperative complications, recurrence rates, and its effectiveness in relieving symptoms and improving outcomes in affected patients.

METHODOLOGY & MATERIALS

This cross-sectional study was conducted at the Department of Urology, Shahid Sk. Abu Naser Specialized Hospital, Khulna Medical College Hospital and two other private Hospitals in Khulna city, Khulna, Bangladesh, targeting male patients aged 15 to 40 years who underwent laparoscopic surgery for grade II and III left-sided varicocele. The study spanned five years, from January 2017 to June 2023, and included 32 participants who met the inclusion criteria, consented to participate, and provided relevant data. Strict inclusion and exclusion criteria were followed.

Inclusion Criteria:

- Male patients aged 15 to 40 years
- Presenting with symptoms of dragging pain in the testis
- Visible tortuous veins in the scrotum
- All grade II and grade III varicocele with pain and Oligospermia

Exclusion Criteria:

- Patients with renal malignancy
- Patients with recurrent varicocele

Surgical Procedure

Laparoscopic surgery was performed under general anesthesia. Peritoneal access was achieved via a 10 mm paraumbilical port, establishing a pneumoperitoneum at 12–14 mmHg pressure. A second 10 mm port was inserted 2 cm below the umbilical line on the right mid-clavicular plane, while a 5 mm port was placed on the left mid-clavicular line, aligned with the umbilical port. The peritoneum was incised 1–2 cm above the internal inguinal ring, and the internal spermatic vein was carefully dissected. The vein was clipped 2 cm apart and divided between the clips, ensuring the preservation of the internal spermatic artery.

Data Collection and Follow-up

Grade II varicocele was defined as palpable at rest and standing, while grade III varicocele presented as visible, dilated, and tortuous veins through the scrotal skin. The diagnosis of varicocele was confirmed by Doppler ultrasonography. Each patient underwent a physical examination, pain assessment using the visual analog scale (VAS), and ultrasound at 3 months and 6 months post-surgery. The VAS is a numerical scale

ranging from 0 to 10, with each number representing a different pain intensity [12]. Comprehensive briefings were provided to participants, informed consent was obtained, and baseline demographic and clinical data were handled with confidentiality in line with institutional policies. Ethical approval was granted by the institutional review committee.

Statistical Analysis

Data were compiled into detailed tables and figure for clarity. SPSS (version 26) was used for statistical analysis on Windows. Continuous data were reported as means ± standard deviations (SD), and categorical data were shown as frequencies and percentages. An unpaired t-test was used for continuous data comparison, and the chi-square test was employed for categorical variables. A p-value of <0.05 was considered statistically significant, ensuring robust findings.

RESULT

A total of 32 patients participated in this study, with the majority falling within the 26-35 years age range (53.13%), followed by those in the 15-25 years range (12.50%). The mean age of the patients was 32.19±3.28 years. In terms of grade classification, most patients were in Grade III (78.13%), while 21.88% were classified as Grade II. Pre-operative pain levels, assessed using the Visual Analogue Scale (VAS), revealed that Grade II patients had a mean score of 4.79±0.83 and Grade III patients had a slightly higher mean score of 4.91±0.46. The mean operation time for the procedure was 65±3 minutes, with a range from 50 to 90 minutes (Table 1). Post-operative pain scores were significantly reduced at both 3 months and 6 months following surgery. In Grade II patients, the mean VAS score dropped from 1.36±0.25 at 3 months to 0.66±0.13 at 6 months. Similarly, Grade III patients showed a decrease in their VAS scores from 1.52±0.26 at 3 months to 0.83±0.08 at 6 months. Both changes were statistically significant (p-value < 0.001) (Table 2). The post-operative complications were diverse. Nausea and vomiting were the most common, reported by 18.75% of participants. Shoulder tip pain occurred in 9.38%, while headache and urinary retention were each observed in 6.25% of patients. Recurrence was the least frequent complication, seen in only 3.13% of patients (Table 3). Outcomes of the intervention showed a positive trend, with 87.50% of patients experiencing significant improvement after the procedure. Mild improvement was reported by 9.38% of patients, and 3.13% showed no change. This suggests that the intervention was largely effective for the majority of patients (Table 4).

Table 1: Demographic and clinical profiles of patients (N=32)

Variables	Frequency (n)	Percentage (%)
	Mean±SD	
Age (years)		
15-25	4	12.50
26-35	17	53.13
≥ 36	5	15.63
Mean±SD	32.19±3.28	
Grade		
Grade II	7	21.88
Grade III	25	78.13
VAS pain score (Pre-operative)		
Grade II	4.79±0.83	
Grade III	4.91±0.46	
Operation time (min)		
Mean±SD	65±3	
Range	(50-90)	

Table 2: Post-operative visual analogue scale assessment (N=32)

VAS pain score	3 Months	6 Months	P-value
	Mean±SD		
Grade II	1.36±0.25	0.66±0.13	<0.001
Grade III	1.52±0.26	0.83±0.08	<0.001

Table 3: Post-operative complications among study participants (N=32)

Complications	Frequency (n)	Percentage (%)
Nausea and vomitting	6	18.75
Shoulder tip pain	3	9.38
Headache	2	6.25
Urinary retention	2	6.25
Recurrence	1	3.13

Table 4: Comprehensive analysis of study outcomes (N=32)

Outcome	Frequency (n)	Percentage (%)
Significant improvement	28	87.50
Mild improvement	3	9.38
Unchanged	1	3.13

DISCUSSION

Varicocele is characterized by the pathological enlargement of the pampiniform plexus (PP), typically resulting from a defect in the venous renospermatic system. In advanced cases, it may be accompanied by the formation of subcutaneous or testicular varicosities [13]. This condition can contribute to subfertility or infertility, as well as testicular discomfort, often manifesting as a sensation of heaviness in the scrotum. Surgical management of varicocele involves ligation of the affected testicular vein, which can be performed via an inguinal/subinguinal (low) or retroperitoneal (high/Palomo) approach. The laparoscopic technique, offering superior visualization of the testicular vein, is believed to reduce the recurrence rate of varicocele. Some studies have reported a success rate of 100% for the laparoscopic approach [14]. In the present study, the mean age of patients was 32.19±3.28 years, with the majority (53.13%) falling between the ages of 26 and 35. This age distribution is consistent with findings in the literature, which also report similar age patterns among patients undergoing varicocele repair [15, 16]. Regarding varicocele severity, the majority of patients (78.13%) presented with Grade III varicocele, while 21.88% had Grade II varicocele. This distribution aligns with other studies, which frequently observe Grade III varicocele in surgical cohorts [17]. Preoperative pain scores, assessed using the Visual Analog Scale (VAS), were notably elevated, with Grade II patients reporting a mean score of 4.79±0.83 and Grade III patients reporting 4.91 ± 0.46. In our study, post-operative VAS scores showed significant reductions in pain over time. At 3 months, the mean VAS score for Grade II patients was 1.36±0.25, and for Grade III patients, it was 1.52±0.26. By 6 months, pain scores continued to decrease to 0.66±0.13 in Grade II patients and 0.83±0.08 in Grade III patients. This aligns with findings from other studies where laparoscopic varicocelectomy resulted in marked pain relief, with reported improvement rates ranging from 80% to over 90% in similar cohorts [19, 20]. While pain reduction was significant, the incidence of post-operative complications in our study was relatively low. Nausea and vomiting were the most common complications, affecting 18.75% of patients, followed by shoulder tip pain (9.38%), headache (6.25%), urinary retention (6.25%), and recurrence (3.13%). These complications are typical for laparoscopic procedures and have been documented in other studies examining varicocele surgery [21]. However, the recurrence rate in our study (3.13%) was lower than that observed in some previous reports, where recurrence rates have ranged from 5% to 20% [20]. This suggests that our approach to laparoscopic high ligation may offer a lower recurrence risk, although further studies with larger sample sizes are needed for definitive conclusions. The overall clinical outcomes in our study were favorable, with 87.5% of patients reporting significant improvement in their symptoms, 9.38% showing mild improvement, and only 3.13% remaining unchanged. This outcome is in line with other studies that report high rates of patient satisfaction and symptomatic relief following laparoscopic varicocele surgery [17]. The high success rate observed in our study can be attributed to the precise surgical technique of high ligation, which is known to provide optimal outcomes in terms of varicocele embolization and subsequent symptom relief.

Limitations of the Study:

This study, despite its promising outcomes, has several limitations. The small sample size of 32 participants limits the generalizability of the findings. Furthermore, the study focuses solely on Grade II and III left-sided varicoceles, excluding other grades and bilateral conditions. The single-center nature of the study restricts its applicability to diverse populations or healthcare settings. Follow-up duration was relatively short at 6 months, potentially underestimating long-term recurrence rates and complications. Additionally, patient-reported pain and satisfaction measures, though useful, could be influenced by subjective bias. Future research with larger, multicenter cohorts and extended follow-up is necessary for more comprehensive insights.

CONCLUSION AND RECOMMENDATIONS

The five-year study highlights the effectiveness of laparoscopic high ligation for left-sided varicocele, demonstrating significant improvements in symptom relief and pain reduction. The majority of patients (87.5%) reported substantial symptomatic improvement with minimal complications. Postoperative pain scores decreased significantly at 3 and 6 months across both Grade II and Grade III varicocele cases ($p < 0.001$). The recurrence rate (3.13%) was notably lower than in other approaches, underscoring the precision and efficacy of laparoscopic high ligation. These findings support its role as a preferred treatment option for left-sided varicocele, providing durable outcomes with a favorable safety profile.

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