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Comparison of Outcome in Open and Laparoscopic Varicocelectomy in Terms of Operative Time and Wound Infection

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ABSTRACT

Introduction: Male infertility is commonly caused by varicocele, which is frequently treated by an operation like open or laparoscopic varicocelectomy. The significant factors that affect the recovery and success of the surgery include operative time and the occurrence of wound infections during the postoperative period. **Objective:** To compare the results of open and laparoscopic varicocelectomy as regards operative time and wound infection. **Material and Method:** This is a cross-sectional, comparative study conducted at Department of Urology, Armed Forces Institute of Urology from January 03, 2025 and May 15, 2025. Two groups were used: Group A (open varicocelectomy) and Group B (laparoscopic varicocelectomy), each comprising 100 patients. The operating time and wound infection data were captured and assessed with SPSS v25. **Results:** The operating time was less in the open surgery, and the median time of operating was 38.4 in the open group as opposed to 50.6 in the laparoscopic group. However, there were significantly greater incidences of wound infection among the open group, 18 percent, against the laparoscopic group, where four percent was reported. **Conclusion:** Laparoscopic varicocelectomy, although it takes more time, leads to a low incidence of post-surgery wound infections with improved post-surgery results.

INTRODUCTION

Varicocele is a common disease and is defined by considerable twisting of the pampiniform venous plexus in the scrotum, which is a leading cause of male sterility. It affects nearly 15 percent of the entire male population and is commonly seen among teens and young adults. The surgical intervention required for treating varicocele has undergone significant changes, with open varicocelectomy and laparoscopic varicocelectomy being the most popular modalities. Pain relief, better values in semen, and, eventually, better fertility outcomes are the main objectives of varicocelectomy. Minimization of surgical procedure time and postoperative complications, such as wound infections, is a significant feature of surgical treatment (1). The comparison between laparoscopic and open surgery has become increasingly substantial following improvements in the field of less-invasive surgery. Several studies have indicated the association between laparoscopic varicocelectomy and decreased postoperative wound infection and shorter recovery periods. As an example, Farooq et al. have underlined that the laparoscopic approach is characterized by improved cosmetic effects as well as reduced postoperative pain. In contrast, more technical skills and technology are needed (2).

Mohammed and Gamil, on the same scheme, reviewed other ways of carrying out varicocelectomy and concluded that both laparoscopic and sub-inguinal microscopic methods are better in complication rates and recurrence than the open inguinal one (3). Additionally, laparoscopic varicocelectomy also offers the advantage of visualization of the internal spermatic veins, thereby offering the possibility of more precise ligation and less operative trauma (4). The open technique is still optional despite the benefits of laparoscopy, especially where the use of laparoscopy equipment is scarce or where there is a lack of surgical professionals to perform the operations. According to a systematic review and meta-analysis across studies carried out by Warli et al., the efficacy of laparoscopic and microsurgical procedures done on varicocelectomy is similar in regard to achieving recurrence of varicocele, but the complication rate was lower with microsurgery in regard to varicocelectomy (5). In a comparative study of varicocele cases, Awad-Allah et al. found less operative time in open varicocelectomy but a larger number of wound-related complications (6).

Cao et al. further qualified this analogy by exploring how surgery may involve artery preservation, which can both affect surgery duration and results. Their results indicate that in microsurgery, selective arterial preservation does not interfere with the efficacy rate and, in some cases, decreases the surgical time (7). Similarly, Shah and colleagues investigated various anatomical surgical solutions with the help of open surgery. They discovered that the supra inguinal approach was linked to many complications in comparison to the inguinal one, which means that the choice of technique in surgery plays an important role (8). Rehman et al. provided insight into the long-term results of laparoscopic and open Palomo varicocelectomy, indicating that both approaches are, practical laparoscopic surgery causes reduced morbidity and a shorter hospitalization periods (9). Similarly, El-Rahman compared laparoscopic varicocelectomy with foam injection sclerotherapy, depicting that altshowingero therapy is less invasive, the procedure of laparoscopic varicocelectomy produces better results in terms of recurrence and complications rate complication rates varicocelectomy offers several clear benefits, particularly in pediatric and adolescent populations. In the case of minimally invasive approaches, Tandon have al. has carried out a systematic review that shows favorable results in this population group, namely reduced rates of recurrence and complications (11). Similar results were also reflected by Salroo et al., who reported better laparoscopic surgery recovery and patient satisfaction in tertiary care settings (12).

As per this, Liu et al. explained the merits of a sub-sub inguinal circulation during microsurgical varicocelectomy and found that there is definite advantage of vein ligation with few complications (13). Patient satisfaction is becoming a significant indicator of the outcome of surgeons. Porto et al. examined the perspective of the long-term satisfaction of patients who underwent the subinguinal microscopic varicocelectomy and revealed a favorable level of satisfaction after the treatment, which is associated with very little postoperative pain and a significant decrease in the recurrence rates (14). Moreover, the study carried out by Wang et al. once again advocated for a shift towards less invasive approaches, as they demonstrated that introducing stronger recovery protocols for microsurgical varicocelectomy had a significant positive effect on clinical outcomes (15).

Surgery is also becoming increasingly technical. The comparison of the conventional and the pulling methods in subinguinal microsurgery varicocelectomy of Ozervarl et al. dictates that the pulling technique can lead to a smaller duration of operative workload in varicocelectomy without loss of results (16). A population-based study conducted by Aksoy et al. in Germany identified an emerging trend in favor of the use of minimally invasive surgical techniques in varicocele surgery, part of a global shift in surgical preferences (17). Although this study primarily focuses on varicocelectomy, evidence of the benefits of laparoscopic interventions is also appreciated in hernia surgery. The results suggested by Koirala et al. are similar: laparoscopic inguinal hernioplasty had a shorter recovery time and fewer wound complications than open inguinal hernioplasty (18). Pogorelić et al. examined pain management methods during laparoscopic varicocelectomy and reported that the use of local anesthetics in the postoperative period improves patient comfort and accelerates recovery (19).

Such results may be of great importance when it comes to the best postoperative conduct in varicocele surgery. Lastly, Shah et al. have mentioned the advantages of laparoscopic hernioplasty compared with the classical open technique in reducing the occurrence of wound problems (21), which supports the wider possible use of not only laparoscopic but also any minimally invasive techniques in groin operations. Furthermore, these studies underscore the need for a detailed and evidence-based analysis of the open and laparoscopic varicocelectomy procedure, particularly in terms of operative duration and wound infections. Although the two methods have their advantages, newer evidence is accumulating in favor of the laparoscopic approach due to its excellent risk-benefit ratio, especially in younger patients and patients interested in cosmesis and the ability to resume normal life soon.

Objective

The study aims to compare the results of open and laparoscopic varicocelectomy, based on operative time and wound infection, to identify which is the more efficient and safest surgical method.

MATERIALS AND METHODS

Study Design: Comparative Cross-sectional.

Study setting: The research was carried out at the Department of Urology, Armed Forces Institute of Urology, Rawalpindi

Duration of Study: The study was conducted from January 03, 2025 and May 15, 2025**.**

Inclusion Criteria

Clinically diagnosed primary varicocele proved by Doppler ultrasound by patients between the ages of 15 and 45 years was considered. Cases of unilateral and bilateral cases were taken into consideration. Eligible patients were those who were ready to undergo elective administrations of varicocelectomy and general or regional anesthesia. It was obligatory to enroll only those people who agreed to participate in this research and to attend the follow-ups.

Exclusion Criteria

Those patients with secondary varicocele, any history of inguinal or scrotal surgery, hematological disorders, poor systemic health, or ongoing infections are not included. Individuals who were non-compliant with postoperative management and those who were lost to follow-up were also not included such that it would facilitate consistency and reliability of outcome measurement.

Methods

Patients who met the inclusion criteria were then randomly assigned into two groups: Group A, open varicocelectomy, and Group B, laparoscopic varicocelectomy. The decision to be assigned to either group was dependent on the surgeon's experience and patient preference following elaborate counseling. The surgeries were all done under general or regional anesthesia by highly qualified urologists who followed the

normal surgical measures. The time a surgeon took to operate (taking the initial incision to the last moment of sewing the skin) was noted with the aid of a stopwatch. The clinical assessment of wound infection was evaluated on postoperative days 7 and at follow-ups at 2 and 4 weeks, based on the presence of redness, swelling, discharge, or tenderness in the wound. Standardized antibiotic prophylaxis and post-operative care were given to all patients. The structured proforma was used to collect the data, which was then analyzed with SPSS version 25. Operative time was analyzed using mean and standard deviation, and the wound infection rate was expressed as a percentage. It was analyzed via t-tests and chi-square tests, and to be counted as statistically significant, p was required to be less than 0.05.

RESULTS

These patients, with a diagnosis of primary varicocele, accounted for 100 patients. The fifty patients underwent open varicocelectomy (Group A), and the last fifty patients underwent laparoscopic varicocelectomy (Group B). Patients in Groups A and B had a mean age of 26.8 ± 5.4 and 27.2 ± 6.1 years, respectively. The groups had similar baseline features like age, varicocele side, and grade of varicocele.

Table 1

Demographic and Clinical Characteristics of Patients

Variable	Group A (Open)	Group B (Laparoscopic)	p-value
Number of Patients	50	50	—
Mean Age (years)	26.8 ± 5.4	27.2 ± 6.1	0.64
Left-sided Varicocele	42 (84%)	44 (88%)	0.58
Bilateral Varicocele	8 (16%)	6 (12%)	0.55
Grade II Varicocele	31 (62%)	30 (60%)	0.84
Grade III Varicocele	19 (38%)	20 (40%)	0.85

Operative time and wound infection after or post-operation were the main results to be measured. The operative time in the open group of varicocelectomy was considerably less than that in the laparoscopic group. The postoperative wound infection was, however, higher in the open group.

Table 2

Comparison of Operative Time

Surgical Approach	Mean Operative Time (minutes)	Standard Deviation	p-value
Open Varicocelectomy	38.4	±5.7	
Laparoscopic Varicocelectomy	50.6	±6.2	<0.001

The comparison of operative time between the two groups was also statistically significant ($p < 0.001$), with laparoscopic surgery showing a greater average time. The open surgery group had a higher rate of wound infection. Infection of a wound was established as any redness, swelling, or purulent drainage in the site of incision four weeks after the operation.

Table 3

Postoperative Wound Infection

Wound Infection	Group A (Open)	Group B (Laparoscopic)	p-value
Present	9 (18%)	2 (4%)	0.02
Absent	41 (82%)	48 (96%)	

The rates of wound infection, 18 percent versus 4 percent, respectively, between the open surgery group and the laparoscopic group were statistically significant as the p-value was < 0.05. The complication was further analyzed to reveal that there were no significant intraoperative complications in either group. However, the complications in the open surgery group were more common than in the laparoscopic surgery group, as minor symptoms like scrotal edema and post-operative discomfort were recorded.

Table 4

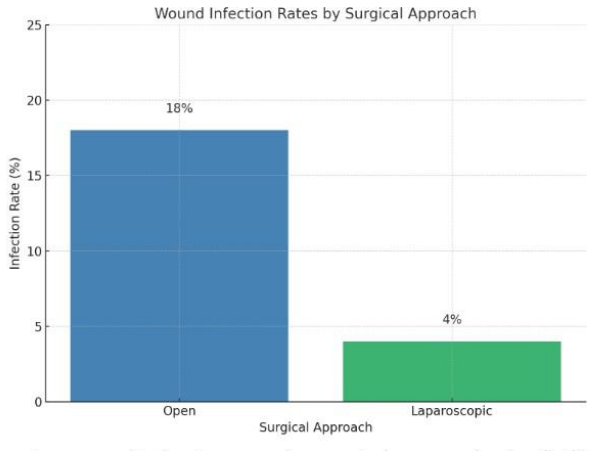
Other Postoperative Complications

Complication	Group A (Open)	Group B (Laparoscopic)
Scrotal Edema	12 (24%)	7 (14%)
Postoperative Pain (VAS >5 at 24hrs)	15 (30%)	9 (18%)
Hydrocele Formation	3 (6%)	2 (4%)
Recurrence at 3 months	2 (4%)	1 (2%)

The bar graph is provided below to show the difference between wound infection of the two groups in a visual manner:

Graph 1

Postoperative Infection Rate of Wound in Open vs. Laparoscopic Varicocelectomy



The graph indicates that the proportion of wound infections is significantly lower in the laparoscopic group than in the open surgery group.

DISCUSSION

Varicocele is ranked as one of the most common reversible causes of male infertility, especially in youths and teenagers. It is still noted that the foundation of surgical correction, both with or without the help of laparoscopy, is the main option in the case of the appearance of such additional indicators as pain, atrophy, or poor semen characteristics. This study aimed to compare the results of open and laparoscopic varicocelectomy procedures based on operative time and postoperative wound infection, two key parameters that determine patient success and satisfaction. The findings revealed that the open varicocelectomy had a very short operative time than that of laparoscopic surgery. The result concurs with that of other past researchers, who indicate that shorter times are required in open procedures due to the straightforward method and decreased preparation of intraoperative

equipment and port placements (5). Similar findings, as reported in comparative studies conducted by Farooq et al. regarding the use of laparoscopic and open varicocelectomy, highlighted the issue of the learning curve and the time spent setting up the laparoscopic technique (2).

Nonetheless, the laparoscopy operative time, which is slightly higher, can still be attributed to its advantages in postoperative recovery and complications. Among the cardinal realizations of this study was the fact that wound infection was significantly lower in the laparoscopic group than that of the open surgical group. This is also in line with the current literature, which indicates that minimally invasive procedures are associated with lower infection rates due to smaller incisions and reduced tissue exposure (3). Shi et al. conducted a study that demonstrated, through multiple procedures in the abdominal region, that laparoscopic surgery resulted in minimal instances of infection and required less time to recover compared to conventional open methods (1). The laparoscopy has less exposure to the tissues and allows the surgery to have less contamination and increased post-surgery outcomes due to the enlarged visual field.

According to Mohammed and Gamil, both laparoscopic and sub-inguinal microscopic varicocelectomy were more advantageous than open inguinal techniques in the case of infection and recurrence (3). Laparoscopic procedures may have a lower rate of infection because there is minimal exposure of surgical equipment to the outside skin and less exposure to internal organs. Moreover, Mohammed et al. indicated that the sublingual approach, unlike the inguinal approach, is not practical and requires more surgical skills, as well as additional operative time (4). This concern is also equally identified with laparoscopic surgery. Although these benefits have been observed, the increased operative time has been a concern regarding the laparoscopy exercise, particularly in resource-limited environments. A meta-analysis conducted by Warli et al. acknowledged that although laparoscopy provides superior cosmetic results and less postoperative discomfort, the process of laparoscopy takes a long duration, primarily due to the requirement of setup and technical requirements (5). Nevertheless, as surgeons gain more expertise and laparoscopic training improves, the operation time becomes shorter over time. As noted by Awad-Allah et al., the experience of a surgeon is a significant factor in determining how laparoscopic surgery can be performed more effectively, thereby optimizing outcomes and shortening operation time (6). Surgical technique is another factor that influences the duration of an operation. They established that retaining one of the arteries in subinguinal microsurgical varicocelectomy could minimize the amount of time taken in operation without jeopardizing surgical outcomes (7), implying that technical changes, though slight, could result in surgeries with shorter durations. On the same note, various anatomies also produce differences in results. Shah et al. contrasted suprainguinal and inguinal procedures and concluded the latter to be better regarding complication rates, suggesting once more the value of technique over simple classification of the procedure regarding complication rates (8). In our research, the open procedure demonstrated a shorter procedure time than the laparoscopic ones; however, a larger proportion of postoperative complications was observed. Similar results were also achieved by Rehman et al., who reported a higher complication rate in the open group as compared to laparoscopic Palomo varicocelectomy (9). Such complications as scrotal edema and infection of the wounds tend to occur due to enlarged incisions, more handling or manipulation of tissues, and a more extended hospitalization period. The study led by El-Rahman et al. shows that laparoscopic varicocelectomy is even more effective than other non-surgical treatments, such as sclerotherapy, in terms of long-term patient outcomes (10). Laparoscopy is especially beneficial among children and young adults. Tandon et al. noted an increase in recovery and a reduction in complications in this case, a trend also observed in children who have undergone laparoscopic varicocelectomy, which is why it has become the preferred choice for younger patients (11). Concentrated lines in the same innovation were noted by Salroo et al., who highlighted the effectiveness and safety of the laparoscopic approach in tertiary care hospital settings (12). Another dimension of minimally invasive surgery is the sub-sublingual method elaborated by Liu et al., who have demonstrated promising results with minimal complications (13). Satisfaction plays a significant role in evaluating the outcome of surgery, particularly in the context of a patient-centered approach. According to the study by Porto et al., the satisfaction rates were high after subinguinal microscopic varicocelectomy due to minimal scarring, lower postoperative pain, and low rates of recurrence (14).

Wang et al. also confirmed this fact by applying an enforced recovery program, with patients being released more quickly and having better experiences (15). The trend toward minimally invasive surgery is observed worldwide. In a German population-based population-based study, Aksoy et al. reported a rising trend in laparoscopic procedures over the last decade, attributed to shifting surgical preferences due to improved outcomes outcomes and patient expectations (17). These are corroborated even by hernia surgery evidence. Shah et al. compared laparoscopic with open hernioplasty and noticed fewer wound complications and a faster recovery, indicating that the use of laparoscopy in groin operations should be expanded (21). Koirala et al. also found fewer wound complications with laparoscopy and speedy recovery as compared to open hernioplasty (18). Lastly, as evident in the research by Pogoreli Bosko et al., the administration of local anesthetics after laparoscopic surgery significantly benefits the ease of postoperative pain and contributes to early mobility and recovery (19). It is this dimension that we have as a central point of our study, which highlights the holistic advantages of minimally invasive surgery.

CONCLUSION

This study was conducted to compare the differences between open and laparoscopic varicocelectomy in terms of procedure duration and postoperative wound infection. The results show that open varicocelectomy has a shorter operative time. It is a time-efficient method, especially in

resource-poor settings. Nevertheless, the laparoscopic approach is very much superior to the open method as far as lower rates of wound infection and postoperative morbidity are concerned. These effects align with the existing literature, which supports the benefits of minimally invasive surgery, including superior cosmetic outcomes, reduced postoperative pain, and shorter recovery times. Laparoscopic surgery requires increased technical skills and a longer surgical time, its benefits to patients in terms of safety and satisfaction are convincing. Hence, laparoscopic varicocelectomy must be regarded as the method of choice, particularly in areas that are rich in resources and surgical skills. Nevertheless, open surgery can also be a suitable option in case laparoscopic facilities are not as rich. These findings should be reinforced with additional research that includes large sample sizes and studies with sustained follow-ups.

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